

**Feasibility Study on Watershed Management in Mantasoa  
and Tsiazompaniry in Madagascar**

**Report of the Participatory Study II**

December, 2000

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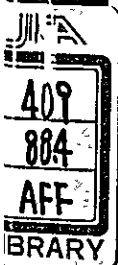


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Consortium of Study on Watershed Management in Mantasoa  
and Tsiazompaniry in Madagascar

Representative: Japan Overseas Forestry Consultants Association (JOFCA)





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## Introduction

A pilot study as part of research for undertaking a participatory watershed management plan in Madagascar was carried out in two stages consisting of planning and implementation. Planning in the first stage has already been summarized as the Report of the Participatory Study. After completion of a participatory watershed management plan, the pilot study was extended in order to demonstrate participatory watershed management models. This report summarizes how the devised plan was implemented in the second stage of the study. It explains details of the pilot projects implemented, including methods and procedures as well as approaches to the local people. The report precisely and concretely describes the experiences of the contracted NGO (GOAIKA) and the study team, including problems in project implementation, countermeasures taken and responses by the local people. It aims to compile useful information on participatory studies to build on achievements in the planning stage.

This report has two major parts. The first part summarizes procedures for pilot project implementation, describing the main aspects of the participatory watershed management pilot projects in order of implementation. The first part of the report thus provides an overview of project implementation. The organization of implementation groups is also summarized.

The second part is devoted to the specific procedures of each pilot project in agriculture, agro-forestry, forestry, improvement of charcoal making, paddy-field fish farming and small-scale hydroelectric plant, which are based actual experience. This part also describes three aspects of each project: work procedures, points to be considered, and problems and countermeasures .

At the end of each are notes on the conclusions of pilot project implementation — including lessons learned and comments for future improvement — for clarification of the issues to be considered when implementing a participatory watershed management plan.



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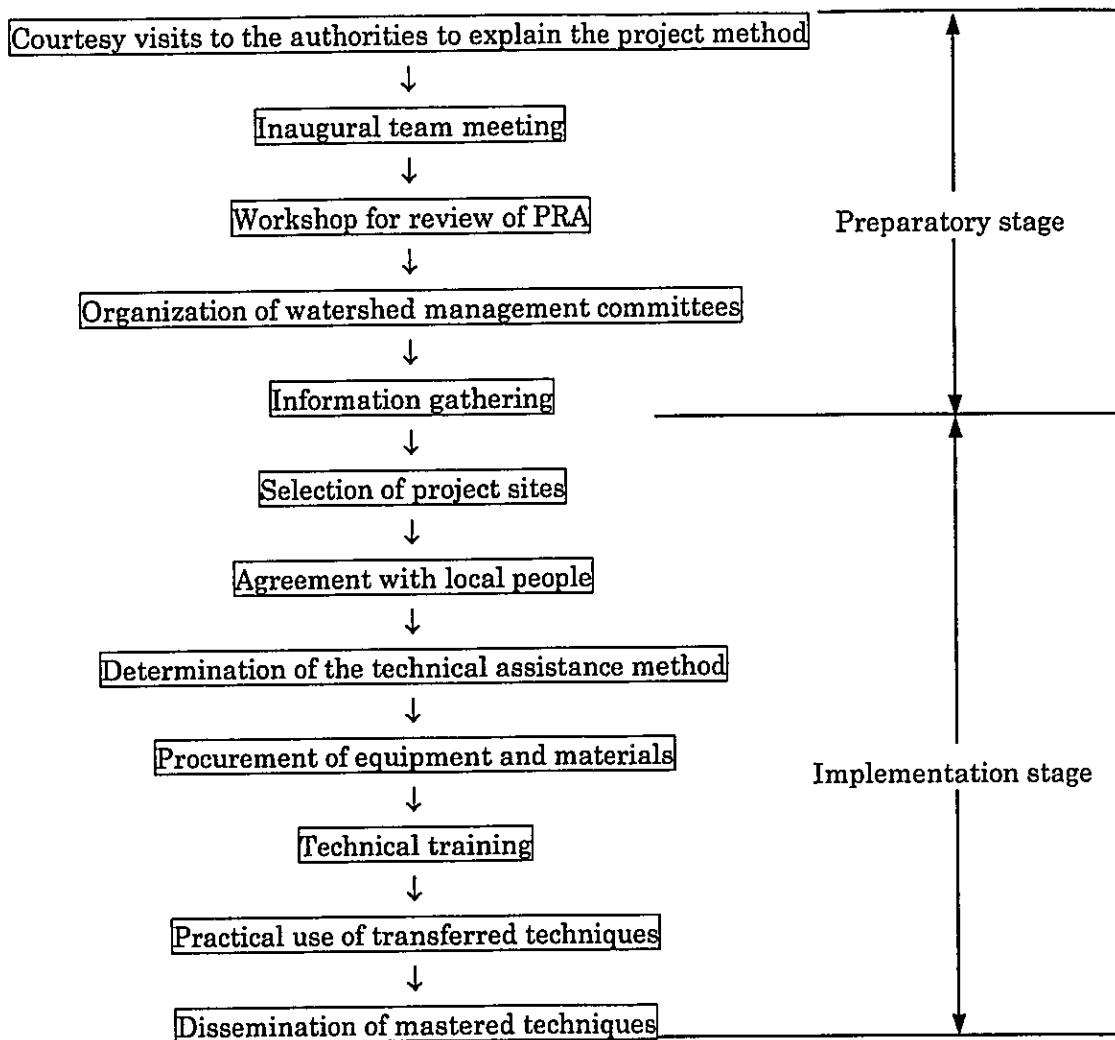
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## 1 Flow of pilot project implementation

The participatory watershed management plan was implemented as follows:



## 2 Outline of pilot project implementation

### 2.1 Courtesy visits to the authorities to explain the project method

Local administrative bodies have closer relations with local people than any other authorities concerned. Before implementing pilot projects, the JICA study team and the NGO paid courtesy calls on the prefectural and rural community offices, and the NGO team manager visited each rural community office to explain to rural community heads the purpose and activities of the projects to be implemented in PS villages. In addition, the manager asked the heads to make it known that the project is being implemented with assistance from Japan. To the rural community of Tankafatora, which was selected as the ZODAFARB area, the manager explained the project procedures as well as the role expected of the rural community, with a request for their cooperation.

For Mantasoa, where local units of the Ministry of Fisheries and other bodies are located, NGO members in charge of field activities visited the authorities to explain project activities. They also filed applications without delay and obtained approval for matters that required permission of the authorities. For example, they never failed to get permission to use boats in the closed season for fishing, when the use of boats is prohibited, before visiting areas not accessible without boats.

### 2.2 Inaugural team meeting

As some NGO members were replaced before the implementation stage, the NGO held a meeting to have the new members fully understand activities in the earlier planning stage so as to ensure a smooth takeover from their predecessors. At the inaugural meeting, team members unified their views on the project and confirmed project activities. When the newly organized team visited villages, new team members were introduced to villagers and it was explained that they were well experienced and fully competent in project management.

## 2.3 Workshop for review of PRA

### 2.3.1 Confirmation of the pilot project purpose and activities

There was an interval of nearly five months between the preparation of a plan based on PRA techniques and their implementation. To cope with the long interval, the NGO held PRA review workshops in every village to ensure a smooth launch of project implementation. The workshops were intended to help local people recall the project, which they might have forgotten during the interval, and to motivate them anew to implement the project for watershed management under their own responsibility.

At the review workshops, local people were again asked why watershed management was necessary. Some people first had difficulty recalling the project objectives, but memories gradually came back to them by the end of the day as to what had been discussed in the planning stage. The meetings thus helped motivate local people for project implementation. Every time the NGO visited the villages, some eager villagers asked the members when the plan would go into effect or whether Japanese member would come again.

### 2.3.2 Project procedure, schedule making, establishment of the project management system

As in the planning stage, local people took the initiative in determining specific schedules of the project through consultations with the NGO, giving top priority to ensuring convenience in relation to their everyday needs. The people first made medium-term schedules for each three month period, and then adjusted the details with the NGO on each of its visits to the project villages.

Project schedules were made in this way, and each pilot project was implemented under a management system established in cooperation with the NGO and the watershed management committee (as described later) which represented the local people. Effective distribution of the appropriate information is the key to smooth implementation of a project. In the light of this, members of the watershed management committee were selected according to the following two criteria. The selection standards, which were clearly explained to the local people, were that the members should be 1) opinion leaders of the village and 2) ready to take responsibility in conveying decisions to other villagers. Another

important opportunity for communication was the market, a traditional venue of information exchange for villagers, where people who had been absent from meetings or events of the watershed management committee could be informed of the date of the next gathering.

The projects were implemented by the watershed management committee, which was a new system for the local people. In addition to the committee, elders also played an important role in establishing a management system, in villages that have the traditional value of respecting the elderly. For example, the elders addressed the people at the beginning and end of each project, which helped them realize anew that what they were doing was not just ordinary chores but had the significant purpose of watershed management. Their words also strengthened the NGO's motivation to make the project a success, together with the people.

Another important factor in establishing a project management system was support from the Ministry of Water and Forestry and the study team for the NGO. Their support and cooperation helped the NGO recognize technical and management problems in its review of project progress and find solutions based on successes in the past.

#### 2.4 Organization of watershed management committee

The watershed management committee was organized with the local people before implementing the project. Its secretariat, the central part of the committee, consisted of a committee chairman, vice chairman, accountant, secretary, and equipment and materials manager. The secretariat had the important role of liaising between the local people and outside organizations including the NGO, the Ministry of Water and Forestry, other authorities concerned, and the study team. Some villages took time to organize the committee due to intervention by leaders of the conventional social hierarchy, resignation of committee members, and a lack of experience in committee management. In these villages, the NGO held workshops for committee members about the roles and duties of the committee to ensure that they understood what they needed to do as committee members and realized the role of the committee.

#### 2.5 Implementation of the pilot project

### 2.5.1 Information gathering

Implementation of each component of the pilot project was preceded by gathering of basic information on relevant matters, such as confirmation of locally used conventional (or traditional) techniques, their current problems and possible solutions, and the local people's requests for future improvements. Such information was useful in studying how to improve the conventional techniques and introduce new ones, when the NGO extended technical assistance on its own or entrusted such assistance to experts.

### 2.5.2 Selection of project sites

Demonstration sites under each project component were selected according to the following criteria:

- (1) Selection of sites suitable for each project component in terms of geographical and other natural conditions.
- (2) Clarification of land ownership and usage rights of the candidate sites.
- (3) Examination of whether the candidate sites were suitable for technical dissemination.

The NGO asked the local people to propose candidate sites based on these three points and decided on the sites after on-the-spot examination with the local people.

### 2.5.3 Agreement with local people

NGOs in Madagascar usually conclude written agreement with local people in implementing participatory projects. The practice was followed in this project, as a result of consultations among the NGO, the Ministry of Water and Forestry and the JICA study team. The agreement mainly provided for:

- (1) Dissemination of mastered techniques.
- (2) Joint use and management of equipment and materials provided.

- (3) Free distribution, on request, of seeds obtained from trees planted under the project.

The agreement was drafted by the NGO and finalized through consultations with the Ministry of Water and Forestry and the JICA study team. The NGO translated the agreement into Malagasy and had the local people examine it. With their consent, it was signed by the head of the administrative village concerned, who represented the local people, and the chief of the Antananarivo district forest office of the Ministry of Water and Forestry, the NGO and the JICA study team.

#### 2.5.4 Determination of the technical assistance method

Technical assistance was carried out mainly through improvement of conventional techniques prevalent in the project areas or the introduction of new techniques. The assistance was provided by NGO technicians, or outside experts as necessary. Among the fields covered by the latest project, assistance by NGO technicians alone was considered to be insufficient in fruit production, fish farming in paddy fields, and the improvement of charcoal making. For assistance in these fields, lecturers were selected from among eligible experts at experimental and research institutes, administrative bodies and private-sector consulting firms. The NGO, when asked to join the project team, provided it with basic information on the project areas (such as whether there were viable techniques in the areas and whether they were prevalent or not, in addition to features of the techniques). The NGO consulted with the candidate lecturers based on such information and also explained the situation of each PS village to them. When the candidates agreed to join the team, they and the NGO inspected the PS villages to study, through talks with watershed management committee members and the local people, what techniques were to be applied there.

This procedure for determining assistance methods was also followed in the assistance provided by the NGO. As most outside experts did not have enough time for long term technical assistance in the PS villages, continued follow-up was provided by NGO members. In some project areas, assistance in paddy-field fish farming was provided by experts at an affiliate of the Ministry of Water and Forestry of the Malagasy government, while continued assistance was provided in fruit production from officer in charge of agriculture propagation program

(PNVA) in the Ministry of Agriculture. In this way, outside experts took part in short- and long-term technical assistance under arrangements made by the NGO.

#### 2.5.5 Procurement of equipment and materials

Before technical training, the necessary equipment and materials were procured by the NGO. The required quantity of equipment and materials was estimated by the watershed management committee beforehand, based on consultations with the local people. The estimate for equipment and materials to be purchased was examined by the JICA study team and the NGO as to the necessity of each item. The purchase was made by the NGO manager and project members who worked as assistants. Other members in charge of on-site activities could thus concentrate on these activities.

#### 2.5.6 Technical training

Seminars and demonstrations were held for each project with assistance as mentioned above. Teaching materials usually used in these seminars were illustrations drawn on craft paper with simple explanations. Features of techniques being transferred were illustrated for instant understanding, and the explanations, written in Malagasy, were easily grasped by the local people. After the seminars, the illustrations were kept by the local people so that the point of the techniques could be confirmed anytime. Another merit of the local people keeping the illustrations was that they could be used by to explain the techniques to other villagers who had not taken part in the seminars or to people in other areas who were interested in the techniques.

Seminars held with these teaching materials always drew active questions from participants. NGO members carefully answered each of the questions, including simple ones, and when the same questions were repeated, they tried to paraphrase answers until the local people could understand. The seminars shifted to demonstrations only after the local people finished their questions and fully understood what was explained. In some projects, the local people were asked before seminars to prepare materials for demonstrations (e.g. biomass materials for compost making). There was no case in such projects where demonstrations could not be carried out because of insufficient preparation of materials on the part of the local people. As in the seminars, when questions

were raised during demonstrations, NGO members and experts responded to every one of them to ensure the understanding of local people.

#### 2.5.7 Practical use of the transferred techniques

The local people who took part in technical training tried to put what they had learned into practice. The extent of application of transferred techniques depended on the local people, and a few of them applied the techniques immediately after the seminars. Some of the local people actively exchanged opinions with NGO members after their attempt to put the techniques into practice.

However, the transferred techniques were not applied in some cases where the training participants did not fully understand the benefits of what was taught. The pot transplanting of seedlings, for example, was not accepted by some people who stuck to their conventional method of bare-root transplanting. In other cases, the technical transfer failed to achieve satisfactory results due to a lack of follow-through assistance to help the local people solve problems in the practical application of the techniques.

In any case, NGO members repeatedly visited the project areas even after the technical training and talked with the local people to see how the transferred techniques were being used and if there were any problems. In some cases of compost production, fermentation was insufficient due to problems in the handling of materials and watering, which the NGO dealt with at the site by repeating explanations to local people. At a plantation nursery, mulching after seeding was left undone for a long time, hampering seedling growth after germination. In this case, the timing of mulching was explained again.

#### 2.5.8 Dissemination of the mastered techniques

Illustrations with explanations in Malagasy, used in technical training, were kept by the local people, with the aim of helping them to go over the transferred techniques and transfer them to other villagers who had not taken part in the technical training and to interested people in surrounding villages.

These teaching tools were of great help in transferring techniques, but a more important means of technical transfer was the spread of mastered techniques by



the local people themselves through explanation of their successful experience to other villagers.

### 3 Progress of Pilot Project Implementation

#### 3.1 Agriculture

##### 3.1.1 Fruit Production

###### (1) Work procedures

The fruit production project is designed to spread high-quality fruit production by planting newer, superior species and providing cuttings of planted trees, with the aim of improving the nutrition of local people and expanding their sources of cash income.

Experts surveyed the local areas and selected sites suitable for fruit tree planting. They taught local people the requirements for tree planting and advised them on the selection of appropriate species, preparation of planting holes and other relevant matters. The holes, measuring one meter each in length, width and depth, were arranged on a grid. The space between saplings varied according to the species. In digging the holes, attention was given to avoiding mixture of the top and lower soils and to keeping them separate. After digging, the holes were left as they were for about a month to destroy harmful insects and bacteria in the soil. The holes were filled back in after about a month with a mixture of the original soil and manure (compost and cattle manure), which was mixed well at a ratio of two to one. The surface of the filled holes was made flat enough to ensure that pools of rainwater could not form. The appropriate timing of planting depended on the fruit trees. It is said, for example, that persimmons should be planted in the rainy season (December to March), while peaches and pears around August. All saplings, however, were planted at the same time as their procurement and delivery came at the same time in the rainy season.

Fruit trees were usually planted within residential sites or in adjacent areas, but in some villages, orchards were set up for collective planting. Species for planting were selected basically in line with the request of project participants, but some were avoided because of the apparent difficulty of cultivation due to climatic constraints. Among the main species selected were persimmons, peaches, pears,

apples, and oranges (planted experimentally since the project areas are at an altitude higher than their growable limit).

Some villages plan to grow vegetables (sweet potatoes, cassava, green beans, etc.) in agro-forestry projects by utilizing the space between the planted fruit trees.

## (2) Points to be considered

Species favored by local people and the environment of the planted areas.

Careful consideration should be given as to whether species favored by local people are suitable in terms of the natural environment of the planted areas, including conditions of soil, sunlight and irrigation. To avoid future complaints from local people when their expectant species are not delivered, the relationship between species characteristics and the planting environment should be explained to local people to gain their understanding.

## (3) Problems and countermeasures

### • Digging of holes

As the digging of one cubic meter holes requires hard work, the result was often smaller holes. It was advised that the top and lower level soil of a dug hole should not be mixed, but few participants separated the two. Experts and NGO members toured the project areas and asked the participants to enlarge the holes.

### • Cultivation soil

As soil for fruit cultivation requires organic fertilizer, project participants were advised to use cattle manure and straw. In cases where there was insufficient manure, participants were requested to use the remains of household meals.

### 3.1.2 Compost making

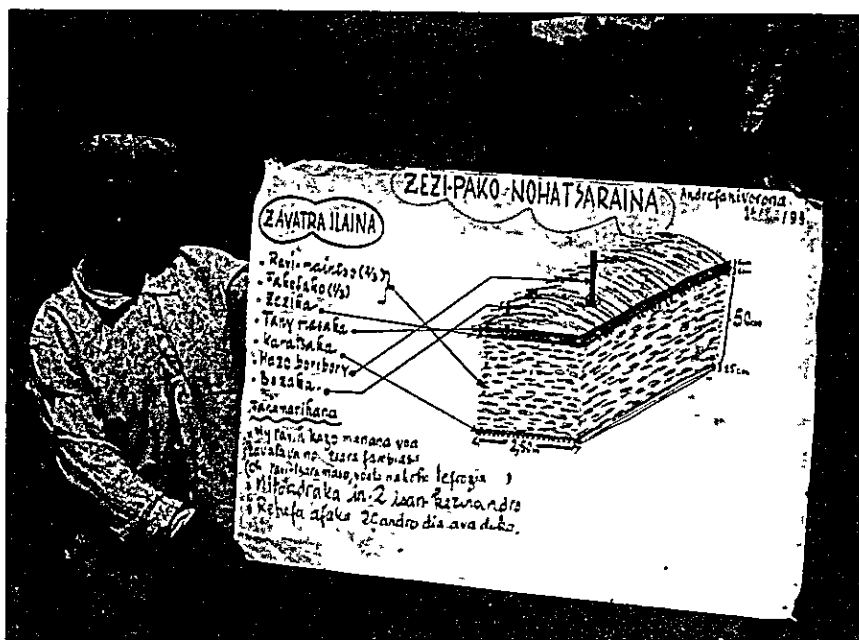
#### (1) Work procedures

Technical assistance for manure treatment consisted of showing the manure and other organic materials and the preparation procedure, including how to layer the materials, using illustrations on craft paper followed by demonstrations. Project participants from among local people prepared plant materials (about 10 kinds) for making compost, straw bedding used in cattle barns, plant materials for covering the manure, a log set up in the center of the compost heap and twigs laid at the bottom. The compost making materials were treated as follows:

- 1) Local people cut plant materials prepared in the village into pieces of some 10 centimeters in length;
- 2) Straw bedding (a mixture of straw and cattle manure) used in cattle barns was prepared;
- 3) Twigs were placed as the base of the compost heap;
- 4) 1) was put on the bottom of the compost heap;
- 5) 2) was put on 4);
- 6) Fertile soil under the cattle barn straw bedding was spread on after sprinkling salt on 5) to facilitate organic decomposition;
- 7) The layers were watered enough so that the water dripped off the materials when they were picked up;
- 8) The processes of 1), 2) and 6) were repeated two or three times, with each layer being watered;
- 9) A log was set up in the center and through the layers. (It was turned every morning to provide ventilation);
- 10) Finally, the layers were covered with dry grass.

The manure and organic materials were stacked as above. They were watered twice a week, and the temperature rise was checked. The layers were turned over once every two weeks. They become usable as compost after two months.

The demonstration was carried out at a site in each village. People who watched the demonstration tried the preparation process by themselves, and spread the process by teaching it to other villagers who had not been present at the demonstration.



Compost making (1)

An illustration prepared for seminar of the technical guidance  
(Ambohimannjaka village)



Compost making (2)

A demonstration for the compost making  
(Ambohimannjaka village)

## (2) Points to be considered

Villagers usually use chemical fertilizers. It was thus necessary to advise them to use compost together with chemical fertilizers and have them understand that such use of compost would help reduce the purchase of chemical fertilizers. It was also necessary to instill in the local people the recognition that the use of compost would help maintain and improve the fertility of the soil. The project team was helped by active cooperation from some villagers who had known, in their own way, how to prepare manure and who had been using cattle manure. They prepared compost materials for the project team and took part in demonstrations.

## (3) Problems and countermeasures

### · Compost materials

Biomass and cattle manure available in the project areas were used as compost materials, but they were not sufficient in quantity. Some villagers willing to participate in the demonstration but unable to procure enough straw bought it from other villagers with a surplus. To secure a sufficient volume of biomass in manure preparation in future, it is hoped that *Tephrosia* spp. (*Tephrosia vogelii*, *Tephrosia candida*) promoted under the agro-forestry project could be used as compost materials.

### · Combined use of chemical fertilizers and compost

Villagers had often been using chemical fertilizers. The project team explained to the villagers that compost, without the immediate effects of chemical fertilizers, would eventually enrich the soil and provide long-term improvements in the land and agricultural sustainable productivity. It was not easy, however, to gain the understanding of the villagers, who expectant immediate results. Under these circumstances, NGO members persuaded the villagers to start using compost together with chemical fertilizers for comparison, rather than to stop using chemicals altogether. It was also explained to them that, while chemicals had to be bought, manure and compost materials would remain available in the future through free use of such abundant materials as *Tephrosia* spp. grown under the agro-forestry project. The project team tried to gain the villagers' understanding by repeating such explanations.

## 3.2 Agro-forestry

### (1) Work procedures

#### 1) Prevention of land erosion

A demonstration of the formation of hedges to prevent land erosion was carried out at a project participant's "Tanety" (farm land on a slope) with the assistance of NGO members.

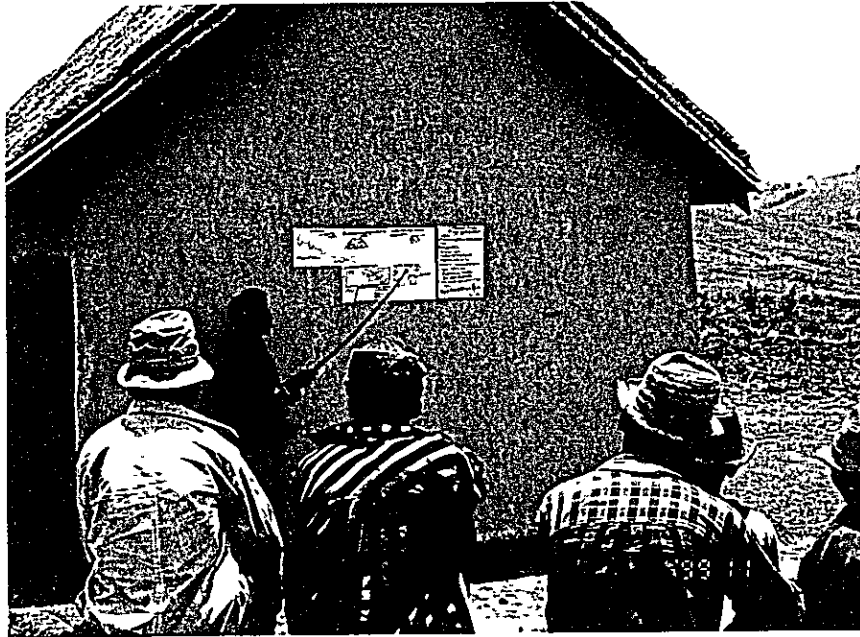
The plants used for hedges were *Tephrosia spp.* and *Crotalaria gralamiana*.

The important factor in forming hedges to control land erosion is the method of setting the hedges so that they follow the contour lines of the slope. The NGO advisers laid out the planting lines for *Tephrosia spp.* hedges using easily available tools such as a Angady, a scoop-like farming tool used for plowing fields, in addition to a notebook and string.

With the line layout procedure, a person with a Angady was positioned on the lower part of the slope. With one end tied to the Angady, the string was stretched up the slope at right angles to the contour line. The string was set at a right angle to the contour using a corner of the notebook. Three or more points were identified in this manner along the same contour line to determine the hedge line, which was then plowed for planting the *Tephrosia spp.* seeds spaced at equal intervals. The work was started shortly before the rainy season as rainwater was relied on for irrigation.

#### 2) Improvement of land productivity: by planting *Tephrosia spp.* on farmland in fallow

The plantation of *Tephrosia spp.* on farmland in fallow is expected to help enrich the land through the nitrogen fixation. It was also explained first that *Tephrosia spp.* trimmings, cut at knee-height, could be used as a fertilizer when mixed into the soil as organic material. The explanation was followed by demonstrations with the seeding *Tephrosia spp.* at intervals of 5 centimeters and a contour line space of 50 centimeters.



Agroforestry (1)  
A seminar of the technical guidance  
(Analamihoatra village)



Agroforestry (2)  
A demonstration for the Tephrosia sowing  
(Ambohimannjaka village)

## (2) Points to be considered

- Introduction of a new species: *Tephrosia spp.*

*Tephrosia spp.* was a new species unfamiliar to local people. When introducing such a new species, it is necessary to fully explain the characteristics of the species and carefully answer every question put by local people. Questions raised, among others, concerned the size of the seed, edibility, how to trim it when it has grown too high, whether it becomes a nesting site for rats when it has spread too much, and whether it has adverse effects on other plants.

- Clarification of objectives

When local people grow *Tephrosia spp.*, it is important for them to clearly understand the purpose, as the choice of cultivation and propagation methods depends on whether the plant is intended to prevent land erosion or fertilize the soil. NGO members repeatedly emphasized the need for local people to clarify the purpose of *Tephrosia spp.* planting.

## (3) Problems and countermeasures

- Ownership of demonstration sites

Demonstrations of *Tephrosia spp.* planting with the objective of preventing land erosion were made on the Tanety of a local farmer. The demonstrations were carried out smoothly, and local people actively took part to learn the techniques involved. The owner of the Tanety, however, came to claim that the use of the Tanety would not be allowed in the future although the demonstrations were acceptable. The work was suspended as a result, and NGO members had private talks with the owner to ask him why he made such a claim. The owner was concerned, it was learned, that land offered for demonstration purposes might be taken away by the government in the future. It was then explained to the owner that the land used for demonstrations would not be transferred to government control and that the landowner was entitled to utilize the *Tephrosia spp.* and other plants grown on the land.



### 3.3 Forestry

#### 3.3.1 Planting of eucalyptus

##### (1) Work procedures

Work procedures from nursery establishment to planting were as follows:

- a) Nursery preparation.
- b) Seeding and seedling management.
- c) Training of pot transplanting.
- d) Training of planting methods.
- e) Land preparation of plantation sites.
- f) Planting of seedlings.

##### 1) Nursery preparation

NGO members explained the conditions required for nursery preparation to local people who took part in the project for planting eucalyptus and other trees. They asked the participants to select nursery sites under the following conditions:

- a) Easy availability of irrigation water.
- b) Proximity to the village.
- c) Flat land.

The participants selected nursery sites that met the above conditions. Sites were selected after the candidate sites were surveyed by NGO members and the participants. Basically, one nursery was set up in each village.

The preparation of nurseries was carried out after specific procedures were explained to the participants in lectures given by NGO members with the use of illustrations. The sites, some materials required (timber for nursery frames and materials for sun shading) and labor were offered by the participants themselves.

Nurseries were prepared as follows:

- a) Weed removal and land leveling.
  - b) Setting up of nursery frames on the leveled land.
  - c) Soil improvement for seeding. The soil was prepared with a 1:1:1 mixture of sand, fertilizer, and earth.
- 2) Seeding and seedling management

Seeds for propagation, watering cans and plastic pots for transplanting were supplied by the JICA study team through the NGO.

The seeds were sown, mixed either in sand with a different color from the seeding bed or in ash. As the seeds were very small, this mixture was necessary in order to distinguish new seeding from the areas already seeded. The seeding bed was covered with straw for sun shading, and the participants were advised to water it twice a day (before 9 a.m. and after 4 p.m.). After seeding, the bed was mulched with straw to maintain soil moisture and prevent high temperatures. The straw was removed after full germination was confirmed, and the sunshade was then set up.

The participants took care of the nursery in rotation for watering, weed removal, sunshade adjustment and other work.

3) Training of pot transplanting

Training of pot transplanting were held as necessary for each village when transplanting became possible after germination (about one month after seeding).

4) Training of planting

The NGO held training of planting techniques in and after August, mainly for project participants. At the seminars, color illustrations on A3-sized boards were used to accompany a step-by-step explanation of the required procedures and points to be considered, starting with nursery management just before planting. The explanation was followed by question and answer sessions. Grassy areas above paddy fields and Tanety were chosen as planting sites. NGO members explained the merits of planting on such ridges above paddy fields and Tanety, referring to the positive effects on agriculture

and people's life with the use of story illustration boards. The merits explained were as follows:

- a) The planted areas will improve the function for conservation of water supply and help regulate water for the paddy fields.
- b) It will help prevent the surface soil erosion of farmland (especially Tanety), and maintain soil fertility.
- c) As a result, there will be improved agricultural output.

#### 5) Land preparation for planting

Land preparation for planting was demonstrated at sites above the participants' Tanety. The demonstrations provide an explanation of how to determine the appropriate location of planting holes, the method of digging these holes, and the measures required to prevent forest fires. The holes were dug at intervals of 2.5-3.0 meters. The rows were also separated by the same interval to form a grid. The holes, 0.4 meter each in length, width and depth, were dug in the same manner as in plowing paddy fields. As measures to prevent forest fires, the participants were advised to keep removing weeds around the holes, and to heap earth around the holes to stop fires spreading over the ground.

#### 6) Planting of seedlings

Planting was carried out from January after the start of the rainy season. The participants pointed out the difference in convenience of transplantation between bare-root and pot seedlings. For the participants, it was easier and more convenient to transplant bare-root seedlings.

#### (2) Points to be considered

The raising of good seedlings requires special care in nursery management, but the participants, accustomed to the planting of forest seedlings, first tended to neglect nursery management, unaware of the importance of nursery care. After experiencing better post-planting growth of nursery seedlings, they came to realize the significance of nursery management. It is noteworthy here that project participants tended not to believe in new techniques until they actually experienced good results from the techniques.

### (3) Problems and countermeasures

- New nursery techniques

Some local people accustomed to eucalyptus planting with forest seedlings or to conventional methods of seedling management were unwilling to take part in nursery preparation and pot transplanting. In such cases, NGO members frequently talked with them and asked them to try the new techniques by suggesting that both bare-root and pot seedlings be used to compare yields and post-planting growth.

- Nursery management system

The quality of nursery management largely depended on the motivation of participants, and nurseries were poorly managed in areas where there was less motivation for planting based on nursery care. NGO members and the JICA study team tried to correct technical problems, but the advice was not heeded well. The important factors in ensuring proper nursery management was the manager's leadership and the community's unity.

- Decrease of participants in nursery care

People's willingness and attitude greatly differed between villages in Administrative Village A in Mantasoa. A particular problem was a decrease in the number of participants in nursery management in a leading village in Administrative Village A, which led to the neglect of nursery management there. There were two direct reasons for the situation. One was the village head's failure to convey dates and other information about the PS project to all villagers. The other was competition for labor in the area. Influential landlords in the village employ farmhands for wages, and they came to have a negative attitude towards the PS project as local people's participation in the project would limit their labour supply for farming. Local people, meanwhile, were also hesitant to participate in nursery management out of concern that the landlords might resent this and stop hiring them for farming. Behind the problem was the social hierarchy in the village, which consisted of four groups with different views about the PS project. At the highest level were the rich who had little interest in the PS project. They were influential in the area and not favorable toward the



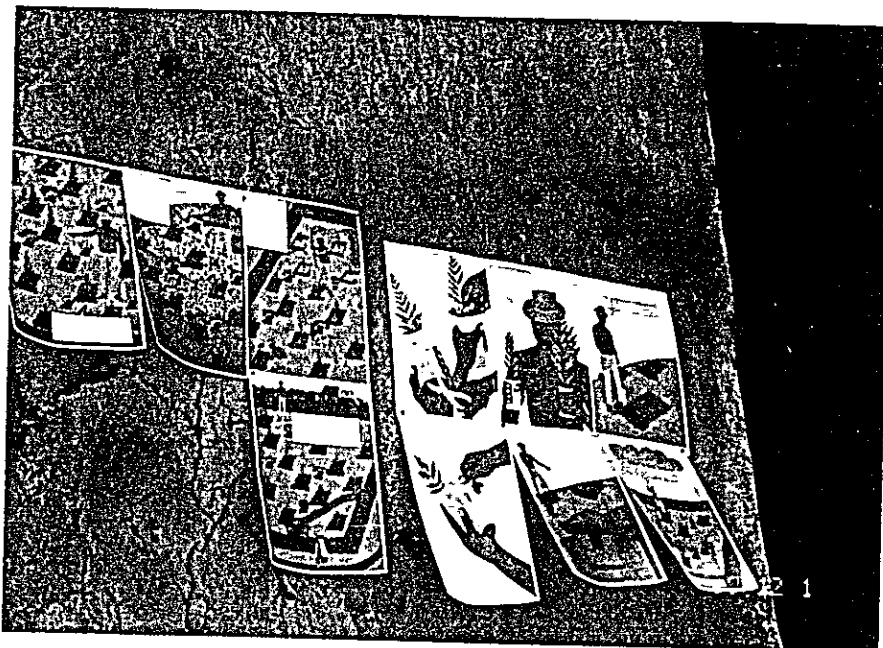
Planting of eucalyptus (1)  
Developing work of a land for tree nursery  
(Analamihoatra village)



Planting of eucalyptus (2)  
Sowing work of seed in the nursery  
(Analamihoatra village)



Planting of eucalyptus (3)  
A seminar of the technical guidance  
(Analamihoatra village)



Planting of eucalyptus (4)  
An illustration prepared for the seminar of the technical guidance  
(Analamihoatra village)

project as participation by local people would result in competition for labor. The second group, mainly belonging to the lower middle class of the hierarchy, showed great interest in the project, were ready to take an active part. The second group included, for example, farmers who owned land but not cattle. The third group had mixed feelings toward the project, standing between the first and second groups. People in the third group were interested in the project, but not so willing to take part. The last group of people were afraid of the project, due to unfavorable rumors about the project and the negative attitude of the rich. The measures taken to improve the situation were as follows.

For better communication on project information, it was advised to ensure the maximum dissemination of correct information. The problem of competition for labor was dealt with by meetings between the watershed management committee officials and the landlords to gain his understanding of the project. These meetings were voluntarily proposed by the committee, which can be seen as a step forward towards strengthening the committee functions and expanding its sustainable activities, although the meetings failed to help increase the number of project participants.

- Failure to correct misunderstandings

In a leading village of Administrative Village A in Tsiacompaniry, the number of participants in nursery management decreased due to a misunderstanding that the Japanese would provide them with chemical fertilizer (NPK). Many of those who had joined the nursery management with such a misunderstanding left the project later, disappointed because the fertilizer was not supplied and they were not paid for the management work. To correct such misunderstandings (supply of chemical fertilizers and payment of wages), the Ministry of Water and Forestry, the JICA study team and the NGO jointly repeated explanations about the pilot project to watershed management committee members, as well as directly to the local people. The misunderstandings, however, were not eliminated as many of the local people still had a passive view about assistance from abroad in that they thought all they needed to do was to receive goods.

### 3.3.2 Application of ZODAFARB

#### (1) Work Procedures

The procedures for ZODAFARB demonstrated in administrative villages in Analamihoatra were as follows:

- 1) Meetings on ZODAFARB procedures.
- 2) Information gathering in villages selected for demonstration purposes.
- 3) Boundary confirmation in ZODAFARB areas (between national and private land).
- 4) Preparation of maps of ZODAFARB areas in cooperation with the JICA team.
- 5) Setting of rules for ZODAFARB participants.
- 6) Preparation of the required drawings and documents.
- 7) General meetings of villagers.
- 8) Preparation of application documents.
- 9) Submission of application documents to the Office of Rural Communities.
- 10) Submission of application documents and drawings to the Andramasina forestry office of the Ministry of Water and Forestry.

#### (2) Points to be considered

ZODAFARB areas should be selected to ensure a balance between the villages and their surrounding areas, so that planting could achieve its intended goal of improving reservoir functions and preventing soil erosion. Specifically, it is advisable to select grassy ridge areas above Tanety (publicly owned and more preferably under the jurisdiction of the Ministry of Water and Forestry). If planting is implemented in areas below Tanety or near paddy fields just because these areas are idle, the function for conservation of water supply of planting cannot be ensured.

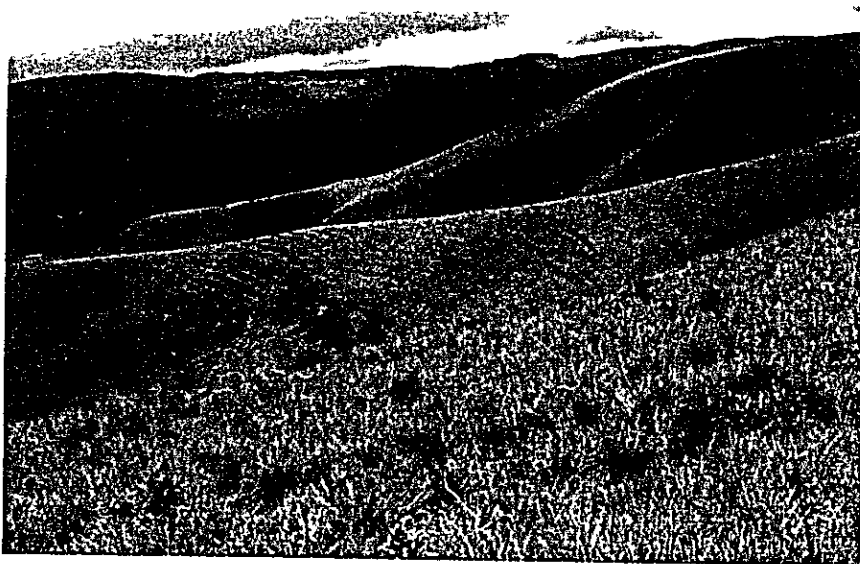
It is also important to confirm the boundaries between public land and private land (including land virtually in private ownership) by making inquiries to the officer in charge of land development, so as to preclude a conflict of land boundaries.





ZODAFARB (1)

A meeting among the residence for the procedure of ZODAFARB  
(Analamihoatra village)



ZODAFARB (2)

A plantation area of ZODAFARB (center of photo)  
(Analamihoatra village)

### (3) Problems and countermeasures

As national and private land was clearly distinguished and project areas were selected based on agreement among the local people, land tenure problems did not occur in application of ZODAFARB.

### 3.4 Improvement of charcoal making techniques

#### (1) Work procedures

In implementing technical assistance for charcoal making, the NGO visited villages that asked for assistance and surveyed charcoal making methods used there and their problems. Based on the survey results, the NGO consulted with experts on charcoal making and discussed possible improvements and the methods required.

The experts carried out demonstrations of charcoal making, using improved and conventional kilns with the same amount and kind of charcoal-making material, to make comparisons.

The demonstrations with the improved kiln were carried out through the following process:

- a) Selection of a site for charcoal making.
- b) Determination of the arrangement of the timber for charcoal-making within the kiln.
- c) Adjustment of the heating levels.
- d) Determination of stack ventilation.
- e) Consideration of the ignition method.

#### (2) Points to be considered

- 1) Demonstrations were set up in spacious areas near villages so that many people could assemble there. It was made sure that local people could frequently visit the site anytime during the demonstrations (requiring 7-14 days before completion) to help propagate the method used.

- 2) Effective technical transfer requires that the demonstrations involve local people who can easily master charcoal making with the improved kiln and teach it to others.
- 3) Mantasoa has a long history of establishing eucalyptus plantations, with some villages having started such plantations more than 70 years ago. Accordingly, charcoal making has also been long established. Charcoal making, a traditional and viable industry in the area, is one of most important sources of cash income for local people. Conventional production methods in Mantasoa have long been prevalent among charcoal makers. The charcoal makers are accustomed to these conventional methods, which they have mastered and have applied in everyday operations. It is thus difficult to influence them to quickly adopt changes to these conventional methods, and the introduction of any new method in these areas must be accompanied by an improvement in output that is clear and persuasive enough for local charcoal makers.

### (3) Problems and countermeasures

As mentioned above, conventional charcoal making methods had already been used widely in Mantasoa, which led to the failure of the attempt to introduce new techniques as they did not have clear benefits to the local people. The demonstrations found that 1) the charcoal output increase with the new method was limited to around 12%, which was not satisfactory for project participants, although the improved method did raise both output yield and product quality, 2) the improved method took twice as long as the conventional methods to make charcoal, and 3) the improved method required earthen stacks. In full consideration of the above, it had to be concluded that the new method was not so easy to adopt for all charcoal makers and local people. Another point worth mentioning was that charcoal, however good the quality was, could not be sold at a premium, making the improved kiln less attractive for charcoal makers. A key to the future introduction of the new method is the reaction of the market to the higher quality products made with the method. The project thus ended without finding an effective measure to improving the local charcoal making industry.

### 3.5 Paddy field fish farming

#### (1) Work procedures

The project was implemented in two stages consisting of hatchery development to obtain fry from adult fish and then the raising of the fry in paddy field farms.

Before starting hatchery development, experts surveyed the project areas together with local people and the NGO to select sites suitable for hatchery ponds. The hatchery sites required easily available water but without the risk of overflowing into the ponds in case of flooding.

Hatchery development to obtain fry from adult fish was entrusted to a person selected to take charge full-time. It was not organized as a joint activity by local people because many of them were busy with agriculture and other work without time to spare for hatchery and hatchery management, which involves difficult technical work not suited to rotational management by local people. A contract was concluded between the designated fry producer and the local community for the distribution of the hatched fry among local people at a low price.

For fry production through spawning and hatching, purpose-built ponds were constructed as follows, utilizing paddy fields.

- Ponds for adult fish (separately for males and females)
- Ponds for spawning and hatching
- Ponds for fry

Adult male and female fish were first kept in separate ponds. Feeding was done mainly by the designated producer's family at the same time and place every day. The feed was prepared using boiled corn, cassava, etc. The males and females were then moved into the same pond for spawning and algae were put into the pond to facilitate spawning. Spawning was attempted in two villages, but was mostly unsuccessful, with only a small number of eggs obtained in one village. Even these eggs, however, did not grow after hatching, being eaten by adult fish due to poor management after spawning.

#### (2) Points to be considered



Paddy field fish farming (1)  
A pond for the fish farm  
(Ambohimanjaka village)



Paddy field fish farming (2)  
Sharing of fry among the residence  
(Ambohimanjaka village)

- 1) Hatchery sites and fish farm should be selected to ensure easy availability of water and an absence of flood risks.
- 2) The culture of adult fish is not technically easy for the local people, and should be entrusted to a designated person with some relevant knowledge.

(3) Problems and countermeasures

- Difficulty of fry production

In a village in Mantasoa, cultured adult carp failed to spawn, which experts traced to stress accompanying the environmental change for the fish, problems with the feed, and an inadequate spawning environment, among other factors. Because of the failure of fry production, a spawning raft was set up in Lake Mantasoa, and after eggs were laid on it, these were moved to a hatchery pond. Some fry were obtained later from the hatched eggs. In a village in Tsiazompaniry, a small number of eggs were hatched and were not sufficient to share among the local people. As a result, some 2,000 fry were obtained separately and were distributed among the local people.

### 3.6 Small-scale hydroelectric plant

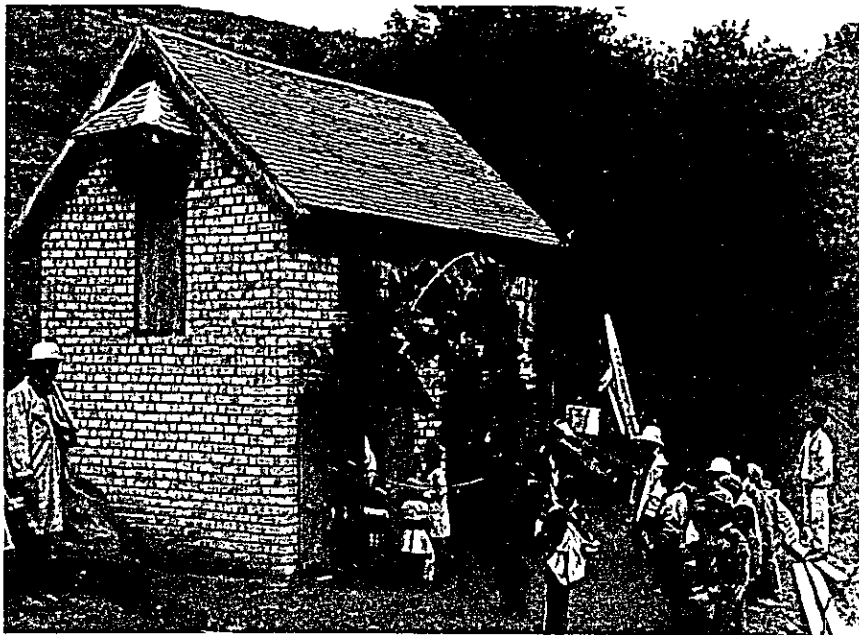
(1) Work procedures

The project for small-scale hydroelectric plant in Administrative Village Analamihoatra was implemented as follows, with those who implemented each procedure shown in parentheses.

- 1) Implementation of a simple feasibility study (experts)
- 2) Organization of participants (NGO, watershed management committee)
- 3) Preparation of bricks, earth, timber and other materials (watershed management committee, local people)
- 4) Construction of waterway, reservoir, etc. (experts, watershed management committee, local people)
- 5) Construction of a cabin for generator installation (experts, watershed management committee, local people)
- 6) Installation of conduits (experts, watershed management committee, local people)



Small- scale hydroelectric plant (1)  
Constructing work for the small- scale hydroelectric power station  
(Analamihoatra village)



Small- scale hydroelectric plant (2)  
The whole view of the small- scale hydroelectric power station  
(Analamihoatra village)

- 7) Design and assembly of the turbine (experts)
- 8) Installation of the turbine (experts, watershed management committee, local people)
- 9) Adjustment of the turbine blade (experts)
- 10) Installation of the generator (experts)
- 11) Technical checkup of the equipment (experts)
- 12) Completion ceremony

(2) Points to be considered

The small-scale hydroelectric plant project, besides its symbolic objective of improving people's life through power supply to villages without electricity, had the secondary objectives of 1) strengthening people's cooperation through their participation in various stages of the project, 2) the organization of local people by entrusting generator maintenance to the watershed management committee, and 3) promoting people's motivation and willingness to take part in other PS projects. The following should be assured when implementing a large-scale project like this.

- 1) Timetables should be prepared in advance, with sufficient time leeway, for procedures that can be carried out by local people. Such preparations require cooperation from the watershed management committee and the NGO, as well as from experts in some cases.
- 2) The work that can be handled by local people without imposing an excessive burden on them should be determined in the early stages, according to their organizational and operational capabilities.

(3) Problems and countermeasures

- Shortage of construction materials

In constructing a cabin for the installation of a turbine and generator, there was a shortage of materials such as timber, nails and tin sheets after the original design was changed to meet requests from the local people. The shortage was traced to inadequate material estimation by the NGO, which should have been made more carefully through frequent consultations with the local people.



- Turbine trouble during the test run

After the generator was installed, part of the turbine's welding failed during a test run. The unexpected trouble occurred apparently because this was the first time in Madagascar that a small-capacity turbine and generator had been assembled. As the trouble was purely technical, the experts in charge of the turbine assembly were asked to solve the problem.

#### 4 Points to be considered in the implementation of participatory watershed management plan

##### (1) Flexible implementation of project schedules

The implementation plan worked out in the PRA survey had frequent additions and changes during the implementation process. Specific timetables in the PRA plan, in particular, were constantly delayed, because the needs of people's life took priority, and this made it necessary for the implementation plan to remain open to flexible changes.

The implementation plan should therefore be prepared with sufficient leeway both in the implementation schedule and work volume. It is also necessary for the watershed management committee to regularly check the implementation schedule.

##### (2) Conventional and new techniques

In implementing the planned project, it is important to harmonize traditional or conventional techniques with the new ones being introduced. In view of this, the conventional techniques, if any, used by the local people were investigated. After the survey, applicable new techniques were explained to the local people, followed by Q&A sessions. The degree of acceptance of new techniques differed between villages, because the advisability of their introduction was judged by the local people, without forcing the new techniques on them.

It should be kept in mind in participatory projects that new techniques cannot be forced on local people and that the judgment as to whether to introduce such techniques should be made by local people through trial applications. The NGOs

role should not go further than the provision of advice and technical assistance to local people to make it easier for them to accept new techniques.

(3) Roles of the Ministry of Water and Forestry, the JICA study team and the NGO in project implementation

The roles played by the Ministry of Water and Forestry, the JICA study team and the NGO in project implementation were as follows:

1) Ministry of Water and Forestry

- Major policy decisions
- Promotion of the project among the general public through radio broadcasts and other media
- Guidance and advice to the NGO to help solve problems in PS villages

2) JICA study team

- Major policy decisions
- Guidance, advice and support to the NGO on overall project management
- Advice to the NGO to help solve problems in PS villages

3) NGO

- Overall coordination of project implementation
- Technical support to the local people in project implementation
- Enhancement of people's motivation to take part in the project (it is important to gain the trust of local people)
- Solution of problems in PS villages

(4) Implementation of technical training

It is effective to hold technical seminars for each project and later carry out relevant demonstrations.

(5) Management of implementation organizations

Each project must be managed, through the organization of local people, by watershed management committee members and village leaders (elders, village heads and elementary school teachers). NGOs are expected to extend support to the committee members as well as elders and other village leaders to help them improve project management on their own. For example, the committee was advised on the management of project meetings by being presented with possible scenarios.

The watershed management committee consisted of the chairman, vice chairman, secretary, accountant, and equipment and materials manager. Relatively young persons were usually selected as the chairman, and in these cases, elders supported the chairman to contribute to smooth organizational management.

#### (6) Dissemination of techniques

The following should be taken note of in the dissemination of techniques:

##### 1) Confirmation of conventional techniques

Conventional techniques prevalent in PS areas should be confirmed to present the local people with options for techniques that are suitable for solving local problems. Improved or new techniques being introduced must be shown to the local people in demonstrations. It is up to the participating local people to decide whether to introduce the techniques presented.

##### 2) Dissemination of techniques with explanatory illustrations

Illustrations used to explain techniques in PS demonstrations should be kept by the watershed management committee so that they can be available again for the dissemination of technical knowledge over a wider area.

##### 3) Dissemination of techniques through verbal communication among local people

There were cases in which local people who took part in demonstrations taught the demonstrated techniques to other villagers who were not present at the demonstrations. The demonstration participants also told others about

their experience of practicing the demonstrated techniques or showed the techniques to others in order to exchange opinions.

Quite a few local people who did not take part in the PS project, including demonstrations, were actually eager to know about the project, waiting to see whether project participants would succeed or not in applying the new techniques. These people were bystanders at least for a time, although they were apparently ready to participate and try the techniques themselves if the project proved to be successful. Dissemination of techniques through verbal communication among local people is effective in prompting such passive people in rural farming villages to take part in the project.

- 4) Exchange of information and opinions among local people through inspection tours in advanced areas

As a complementary activity to the PS project, watershed management committee members and key farmers toured advanced management areas to learn about the situation in agro-forestry and the utilization of biomass there, as well as about small-scale watershed management with field farming and other techniques. The tour was also intended to help improve future implementation of watershed management plans through information exchange among farmers. The tour helped the participants 1) obtain new knowledge and 2) have greater motivation for project participation. Inspection tours in advanced areas are considered to be very effective in the promotion of techniques, as they enabled participants to confirm the project results and directly exchange opinions with farmers in the advanced areas.



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