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Ministry of Water and Forests  
Madagascar

No. 2

**Feasibility Study  
on  
the Watershed Management  
in  
Mantaoa and Tsiazompaniry  
in  
Madagascar**

**Final Report**

**Part II Pilot Study And Annexes**

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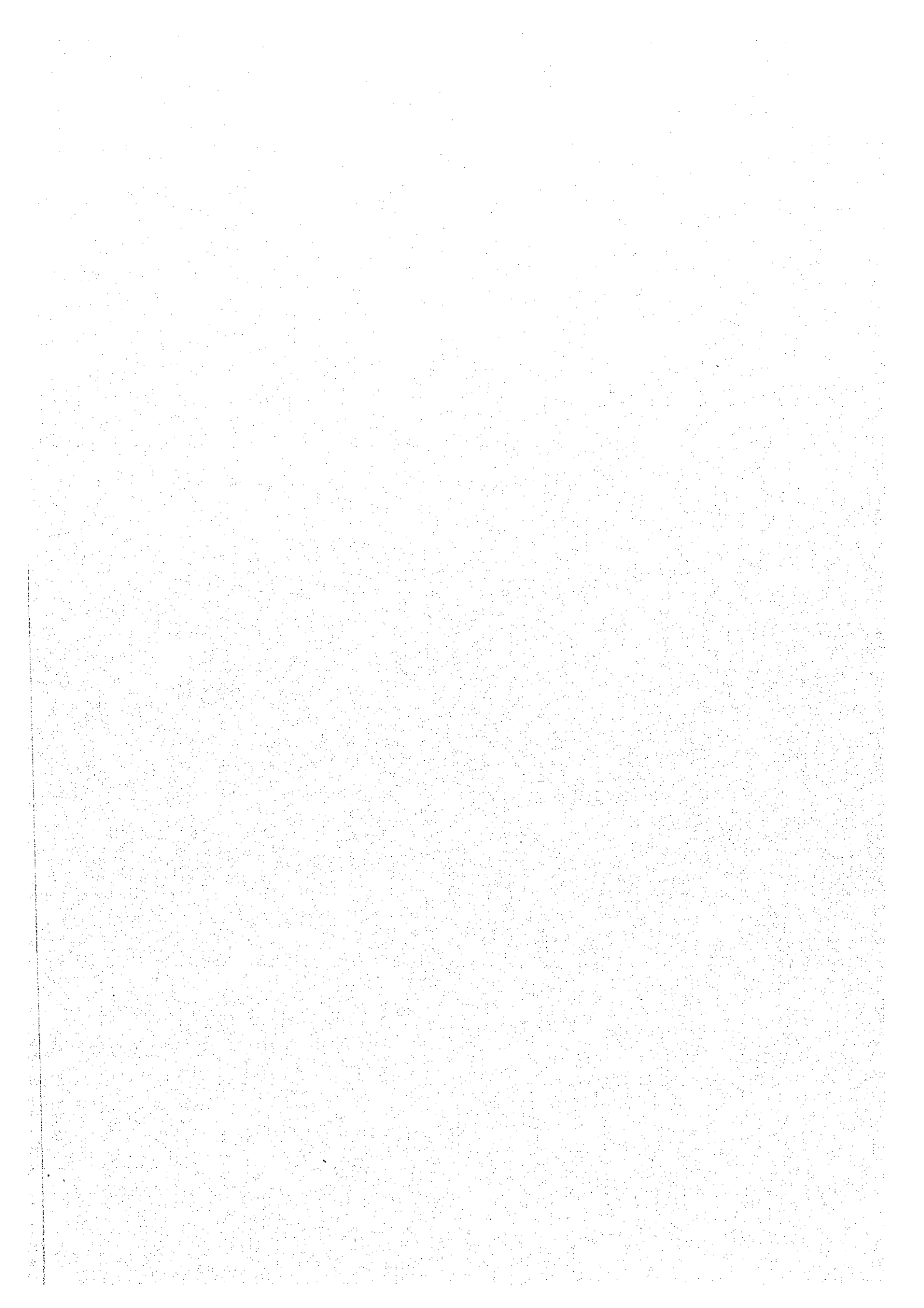
December 2000

**Consortium for the Feasibility Study on the Watershed Management in  
Mantaoa and Tsiazompaniry in Madagascar  
Representative : Japan Overseas Forestry Consultants Association**

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## **Chapter I Pilot Study**

### **1 Objectives**

The objective of this study is to formulate a participatory watershed management plan from the villagers in a target zone. In principle, it consists of re-establishing and protecting the watersheds destroyed by improper land use. The water and soil must be safeguarded through the proper use of the land, coordinated with the environment surrounding the watershed, and with the participation of the villagers in the zone concerned. The natural and socioeconomic environments in the watershed have their particular characteristics according to the areas where the villagers live. Watershed management projects carried out by the villagers themselves must be adapted to these particular conditions (zoning). A pilot study (PS) will be conducted under the present study in order to verify the possibilities of establishing the project and making the villagers implement it by themselves. Under the PS, model villages will be selected in the different zones. The formulation, implementation and evaluation of the project by the villagers will be carried out under the present study. Results will be compiled in the guide for the participation of communities and villagers.

### **2 Study method**

#### **2-1 Zoning**

To ensure effectiveness and feasibility, the watershed management plan must be adapted to the particular conditions of the zone concerned. As such, the target zone was divided based on the particular natural and socioeconomic conditions. In concrete terms, (1) the particular conditions of the areas were updated based on the results of the study on natural conditions and socioeconomic conditions, and (2) we have applied zoning for identical use the objectives and strategies for the watershed management and measures adapted to these local conditions.

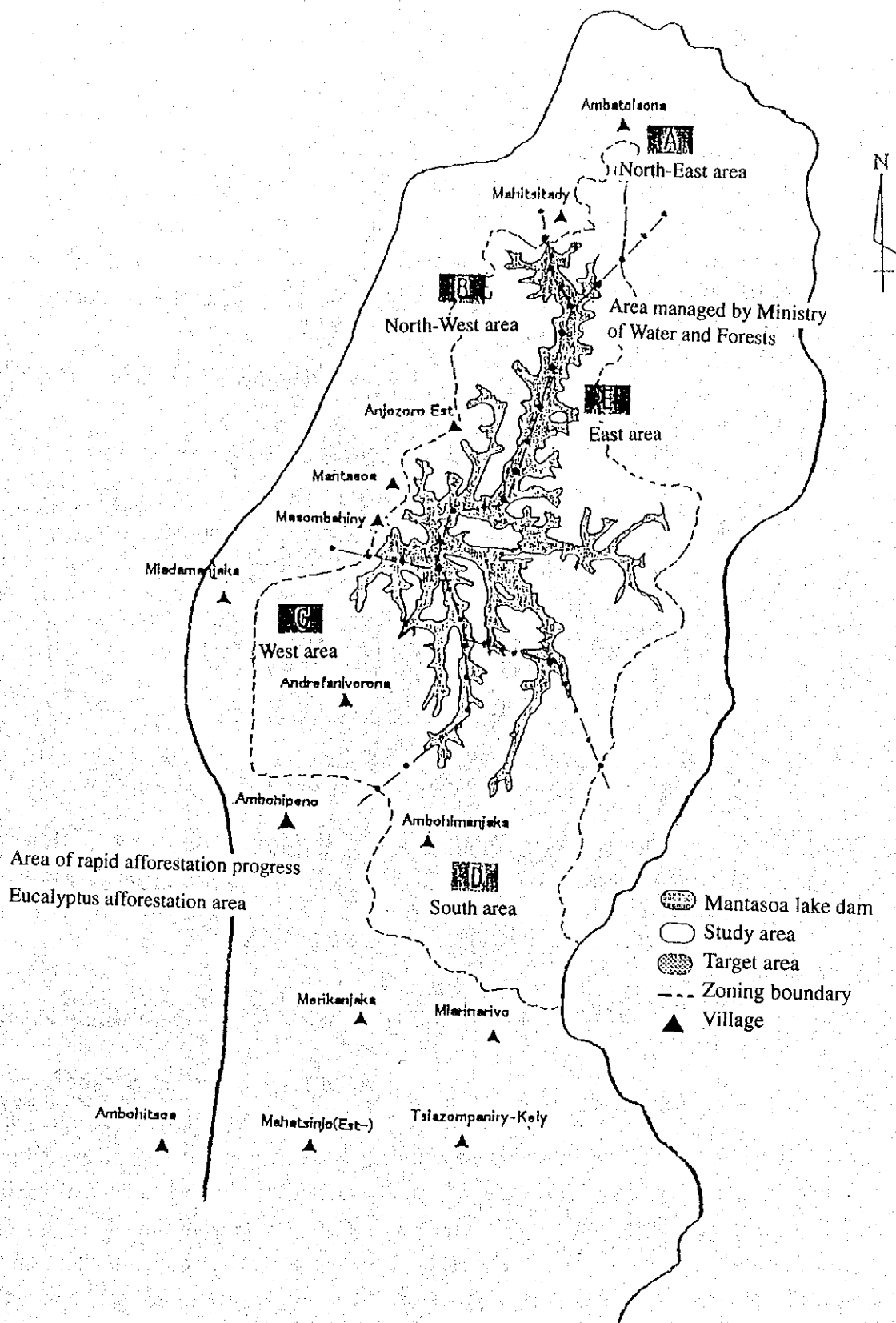
We have divided the target area into two: Mantasoa zone and Tsiazompaniry zone, then further subdivided them based on the forest vegetation, use of the forest, use of the land, safeguarding of the watersheds, the type of hamlets and the socioeconomic conditions. The Mantasoa zone was therefore divided into 5, and the Tsiazompaniry into 4 zones (see annexes 32 and 33). Per zone, similar areas based on watershed management objectives, were grouped as indicated in Table I-1 and Figure I-1.

Table I-1 Objectives and strategy for zoning and the watershed management

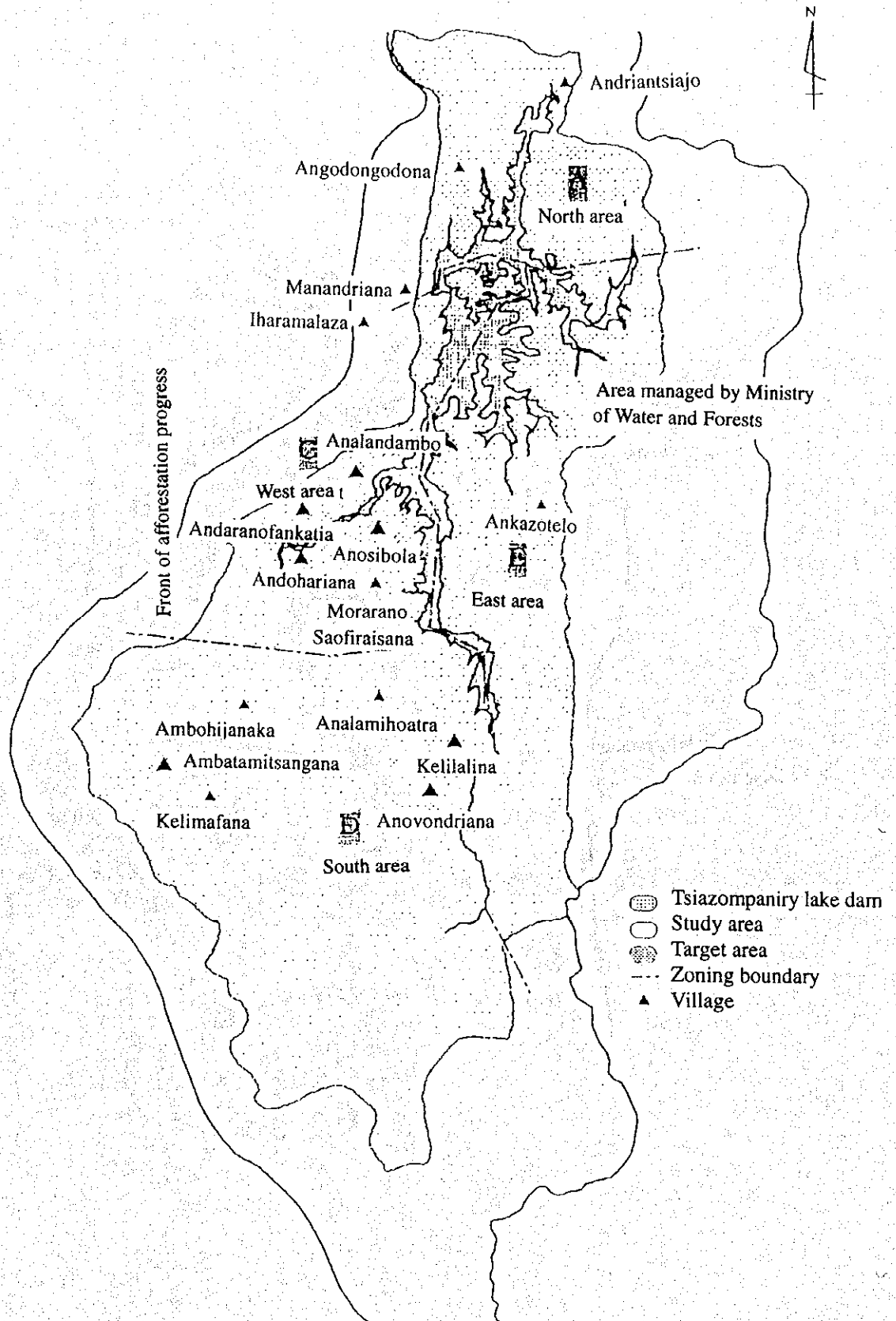
	A	B	C	D	E
Zone	North-east part	North-west part	Western part	Southern part	Eastern part
Mansoura	North part		Western part	Southern part	Eastern part
Tsazompanary					
Objectives	Establishment of a plan adapted to use of the land	Creation of a natural rich environment	Maintenance and increase of soil productivity	Establishment of a plan adapted to use of the land and management of meadows	Improvement of management in the forest safeguarded zones
Ultimate objective	Safeguarding of water and soil, including clean watersheds	Safeguarding of rich watersheds from the environmental viewpoint	Development per type of the zone (reduction of migration and farming away from home)	Safeguarding of water and soil, including clean watersheds	Future assurance of forests for water resources
Watershed management methods	1. Establishment of a plan for use of the land by the villagers themselves	Recommendation for planting trees, flowers and food trees	Maintenance and improvement of land productivity	Establishment of a plan for land use and determination of land to be managed by the villagers	Establishment of a forest management plan and determination of land to be managed by the villagers
Basic components	(Components to be implemented) 1. Establishment of an overall plan for land use by the villagers themselves 2. Land use system adapted to topographical conditions 3. Afforestation plan	1. Establishment of an environmental improvement plan by the community	1. Improvement of land use methods 2. Measures to increase the production capacity of the land 3. Afforestation plan	1. Determination of land to be managed by the villagers 2. Establishment of land use and management by the villagers themselves 3. Afforestation plan 4. Management of meadows	1. Determination of land to be used by the villagers 2. Establishment of land use and management by the villagers themselves 3. Afforestation plan 4. Management of meadows
	(Report components) 1. Systematic guarantee of the use/ownership of lands 2. Overall support by the organization for agricultural development 3. Training of farmer leaders	Support from the Ministry of Water and Forests	1. Overall support by the organization for agricultural development 2. Training of farmer leaders	1. Systematic guarantee of the use/ownership of lands 2. Overall support by the organization for agricultural development 3. Training of farmer leaders	1. Systematic guarantee of the use/ownership of lands 2. Overall support by the organization for agricultural development 3. Training of farmer leaders

Figure I-1 Zoning map

- Mantasoa -



- Tsiacompaniry -



Particular conditions per zone are as follows:

- Zone A: Zone with few hamlets and many low/unused areas, with increasing afforestation.
- B: Zone with State housing sites, mainly occupied by hotels and secondary residences.
- C: Zone with intensive and increasing use of the land, and active afforestation.
- D: Zone under the control of the Ministry of Land Management, where land is used by the villagers and presently being privatized; zone with few hamlets and where use of the land is extensive.
- E: Forest sanctuary zone under the control of the Ministry of Water and Forests, with immigration and establishment of farms from the western part of the lake.

## 2-2 Procedure of the participatory approach

The procedure for formulating a participatory watershed management plan from the villagers is as follows:

- ① Organization of explanatory meetings
- ② Study of the situation in villages by the RRA
- ③ Selection of participants to workshops
- ④ Preparation of a resource map (Understanding of present situation)
- ⑤ Analyzing problems and measures
- ⑥ Preparation of action map (Preparation of action plan)
- ⑦ Preparation of participatory watershed management plan (PS project)

This procedure will be carried out as follows.

### (1) Organization of explanatory meetings

The orientation, objectives, methods and implementation of the pilot study project were explained including the need for participation. Measures to ensure the comprehension and collaboration of the villagers were largely ensured. Explanatory meetings were organized with the collaboration of the counterpart of the Ministry of Water and Forests, forestry employees of the Ministry of Water and Forests, administrative employees of the prefecture and the rural commune, and the heads of each fokontany. During these explanatory meetings, it was clarified that the pilot study project will be formulated and conducted under the initiative of the villagers themselves. Explanatory meetings start with an explanation to the

head of the fokontany, followed by the committee of fokontany representatives (including representatives of hamlets, teachers, etc.), then to the villagers. We have asked them to frankly express their doubts and suggestions, and have tried to answer these concerns. We also ensured them that their doubts during the formulation of the pilot study project will be resolved on a case-by-case basis.

(2) Study of the situation in villages by the RRA

An actual situation study in the villages was conducted by the RRA during meetings, such as the PRA explanatory meeting, meetings called to confirm the willingness of the villagers to conduct the pilot study, and through individual interviews.

(3) Selection of participants to workshops

Selection was made through the method indicated below (2-4 Selection of participants).

(4) Workshops

Workshops were conducted according to procedure (4) to (6) above. Researchers from a NGO (GOAIKA) conducted the study to facilitate the PRA method. Situations mentioned during the workshops were noted, then analyzed after the workshop. Questions such as partial tendencies and the particular content of the interventions were evaluated. On this basis and on the occasion of the subsequent workshop, correction was made or questions were resolved through individual interviews. This is necessary to conduct a workshop with the collaboration and agreement of all the participants. Concrete operations carried out during the workshops were as follows:

- ① Explanation to participants about the PRA.
- ② Preparation of resource map to allow the participants and villagers of the zone to commonly understand the present state of the natural resources and social capital of the area.
- ③ The participants analyzed the problems and proposed solutions for the watershed management. These are compiled in the Table on the analysis - solution of problems.
- ④ To establish the action list, a plan for future use of the land in villages, and an action plan, to reinforce the willingness of the villagers to participate in the watershed management plan.
- ⑤ A diagram of the daily life and agricultural work was established, and a diagram of activities for the watershed management plan in coordination with the former.

(5) Formulation of the participatory watershed management plan by the villagers

A watershed management plan was formulated per fokontany based on information obtained during the workshops. This operation was headed by the NGO with discussions held with members of the study team.



(6) Support plan

Visits to farmers and exchange of information on similar projects were implemented during the second part of the pilot study to support the implementation of projects established by the villagers themselves.

2-3 Selection of villages covered by the pilot study

The following 4 points were taken into account for the selection of villages covered by the pilot study per zone.

- ① Existence of leaders in the zone and willingness of the villagers to autonomously participate in the activities
- ② Existence of a cooperative system among villagers (traditional farmer associations, etc.)
- ③ The fokontanys with a hamlet with many households, or a group of several hamlets, given that the actual project is implemented on that basis
- ④ A hamlet with topographical conditions advantageous for efficient dissemination

The following 4 fokontanys were selected based on the 4 items mentioned above and the natural and socioeconomic conditions.

Table I-2 Characteristics of village zones (fokontanys) covered by the PS

Village covered by PS	Zone	Division	Natural conditions	Socioeconomic conditions
Andrefanivorona	Mantaoa	C	<ul style="list-style-type: none"> <li>- Intensive use of land</li> <li>- Long practice of eucalyptus afforestation</li> </ul>	<ul style="list-style-type: none"> <li>- Combination of charcoal production and wage earning</li> <li>- Small hamlets</li> <li>- Functions of traditional organizations hardly developed</li> </ul>
Ambohimanjaka	Mantaoa	D	<ul style="list-style-type: none"> <li>- Extensive use of land</li> <li>- Flourishing eucalyptus tree-planting</li> <li>- Large grasslands</li> </ul>	<ul style="list-style-type: none"> <li>- Combination of livestock breeding, fishing and wage earning</li> <li>- Functions of traditional organizations hardly developed</li> </ul>
Angodongodona	Tsiazompaniry	A	<ul style="list-style-type: none"> <li>- Extensive use of land</li> <li>- Vast grasslands along the lake shore</li> <li>- Developed eucalyptus tree-planting</li> </ul>	<ul style="list-style-type: none"> <li>- Principally agriculture, fishing and livestock breeding</li> <li>- Hamlets composed of villagers who migrated due to the construction of the dam</li> <li>- Big hamlets</li> <li>- Establishment of new external farms on the eastern shore of the lake</li> <li>- Highly developed traditional organizational functions</li> </ul>
Analamihoatra	Tsiazompaniry	D	<ul style="list-style-type: none"> <li>- Extensive use of land</li> <li>- Vast grasslands in the center</li> </ul>	<ul style="list-style-type: none"> <li>- Principally agriculture and livestock breeding</li> <li>- Problem of migration to the eastern shore of the lake</li> <li>- Highly developed traditional organizational functions</li> </ul>

## 2-4 Selection of participants to the PRA

### 2-4-1 Selection method

Participants to workshops were selected based on discussions with the villagers and the NGO. For the selection, several participants from each hamlet were chosen since the fokontany are divided into several hamlets. The participants of each hamlet were selected after discussion with the NGO, the village chief, the teacher, the hamlet committee and the elderly, etc., in order to avoid any bias based on the socioeconomic position of the participants. In principle, there was one participant per household.

### 2-4-2 Analysis of participants

There is a risk that results of the analysis of PRA problems and the established watershed management plan will be used for the benefit of particular persons or groups according to the social position of the participants. This analysis of the participants was conducted to confirm the absence of social class bias on the part of the participants, by analyzing the objectives of the participants to the PRA, in order to avoid this type of risk and to ensure that the plan will benefit the majority of villagers. Selected participants to the PRA were analyzed based on their age, sex, occupation, social class (area of rice field, artificial forests and field owned, and number of cattle). The result of this analysis is as follows:

#### (1) Number of participants

Table I-3 indicates the number of participants from each village covered by the PS.

In Andrefanivorona and Ambohimanjaka, more than 30% of the estimated number of households participate.

In Angodongodona, the percentage of participation was low, with only an estimated 22% of the households.

In Analamihoatra, an estimated 27% of the households participate.

Table I-3 Number of participants to PRA per village covered by the PS

Village covered by the PS	Number of participants (persons)		
	Total	Men	Women
Andrefanivorona	22	11	11
Ambohimanjaka	45	29	16
Angodongodona	60	55	5
Analamihoatra	61	47	14

#### (2) Age brackets

Table I-4 shows the composition of participants to PRA per village covered by the PS per age bracket.

Table I-4 Composition of participants to PRA per village covered by the PS, per age bracket

Village covered by the PS	Age brackets (%)		
	20-40 years	41-60 years	More than 61 years
Andrefanivorona	64	32	4
Ambohimanjaka	50	38	12
Angodongodona	43	47	10
Analamihoatra	33	49	18

A common point for all villages covered by the PS is that the number of participants aged 61 years or more is low.

In Andrefanivorona, 20-40 year old participants represent more than half of the total.

In Ambohimanjaka, 20-40 year old participants represent half, followed by those from 41-60 years old.

In Angodongodona, the number of participants from 20-40 and from 41-60 years of age is practically the same.

In Analamihoatra, participants from 41-60 years of age represent almost half; those from 20-40 years represent 33%, and those more than 61 years of age, 18%. The percentage of elderly persons is relatively high.

### (3) Composition per sex

Table I-3 indicates the composition per sex of participants to PRA in the villages covered by the PS.

Aside from Andrefanivorona, the number of men exceeds the number of women. In Angodongodona in particular, more than 90% are men.

Percentages of women participants in the villages were as follows: 50% in Andrefanivorona, 36% in Ambohimanjaka, 8% in Angodongodona and 23% in Analamihoatra. The result shows that there is more female participation in Mantasoa zone than in Tsiazompaniry zone.

### (4) Composition per occupation

Table I-5 indicates the composition per occupation of the participants to PRA of the villages covered by the PS.

Table I-5 Composition per occupation of participants to the PRA in villages covered by the PS

Villages covered by the PS	Andrefanivorona (%)	Ambohimanjaka (%)	Angodongodona (%)	Analamihoatra (%)
Farming only	32	20	64	70
Farming + charcoal production	45	9	0	0
Farming + fishing	5	36	17	0
Farming + wage employment	9	13	2	8
Farming + forestry employment	0	7	5	10
Charcoal production + farming	0	4	3	0
Teachers	0	4	6	2
Others	9	4	3	10
Total	100	100	100	100

In Andrefanivorona, those exercising farming + charcoal production represent the largest number, followed by full-time farmers.

In Ambohimanjaka, those exercising farming + fishing represent the largest number, followed by full-time farmers (20%) and farming + wage employment (13%).

In Angodongodona, full-time farmers represent by far the largest number, followed by those exercising farming + fishing (17%). Four teachers are included.

In Analamihoatra, full-time farmers represent by far the largest number, with 70%.

#### (5) Social classes

The ownership of social capital was used as a criterion for the division of social classes as shown in Table I-6. In addition, different criteria were presented for the Mantasoa and Tsiazompaniry zones, due to the difference in use of lands. Classification was made by totaling the number of points per household of the participant on this basis.

Upper class: 4 points or more

Middle class: from 2 to 3 points

Lower class: less than 2 points

On this basis, the social classes of the households participating in the PRA of each fokontany were distributed as indicated in Table I-7. The characteristics per social class are as follows:

- ① In the Mantasoa zone, in Andrefanivorona and Ambohimanjaka, the percentage of medium class households is high. In Andrefanivorona, the lower class constitutes majority. In Ambohimanjaka, there is a mixture of rich and poor classes. This shows that in the Mantasoa zone, the selection of participants was based on a relatively equal percentage of representatives from the different classes.
- ② In the Tsiazompaniry zone, in Angodongodona, the lower class constitutes a half. In Analamihoatra however, participants from different classes were selected. The middle class has lower participation, but the number of representatives from the upper and lower classes are identical. We may say that the participants were selected more equally than in the Mantasoa zone.
- ③ If we consider occupations, participants to the PRA reflect the working structure of the zone for each village concerned.
- ④ The relatively low participation of women and the elderly leaves a small problem in the selection of participants to the PRA.

Table I-6 Criteria for selection based on division in social classes

Criterion	Mantasoia zone	Tsiazompaniry zone	Points
Rice fields	Less than 50 a	Less than 50 a	0
	From 50 a to 1 ha	From 50 a to 1 ha	1
	1 ha or more	1 ha or more	2
Fields	Less than 1 a	Less than 50 a	0
	From 1 a to 2 ha	From 50 a to 1 ha	1
	2 ha or more	1 ha or more	2
Artificial forest	Less than 1 a	Less than 50 a	0
	From 1 a to 5 ha	From 50 a to 1 ha	1
	5 ha or more	1 ha or more	2
Cattle	0	0	0
	1	1 to 2	1
	2 or more	3 or more	2

Table I-7 Composition per social class

	Upper class	Middle class	Lower class
Andrefanivorona	13%	47%	40%
Ambohimanjaka	29%	44%	27%
Angodongodona	20%	30%	50%
Analamihoatra	36%	28%	36%

## Chapter II Present situation in villages covered by the PS

### 1 Location and structure

#### (1) Andrefanivorona

Andrefanivorona is located west of the Lake Mantasoa and administratively belongs to the Mantasoa rural commune. This village is located at around 30 minutes drive from the rural commune county town, by a 4x4 vehicle. Its geographical location is ideal for selling farm products and charcoal. The Andrefanivorona village is subdivided into 4 districts and 9 hamlets.

#### (2) Ambohimanjaka

Ambohimanjaka is located south of the Lake Mantasoa and administratively belongs to the Miadanandriana rural commune. Among the villages in the Mantasoa zone, this one is difficult to reach and it requires more than one-hour in drive by a 4x4 vehicle to reach the rural commune county town. Since the hamlets are widely spread over several hills, access between the hamlets itself is not easy. However, since the eastern shore of the Lake Mantasoa is near the location, it is practical to set up farms on the eastern shore of the lake. Ambohimanjaka is composed of 5 districts and 20 hamlets.

#### (3) Angodongodona

Angodongodona is located north-west of the Lake Tsiacompaniry and administratively belongs to the rural commune of Anosibe Trimoloharano. This village was formed in 1956 by villagers expelled due to the construction of the Lake Tsiacompaniry dam. Since it is far from the county town, the purchase of products for daily life and the sale of farm products is generally carried out in the county town of the rural commune near Ambohimiadana, which is easy to reach. Angodongodona has 6 districts and 7 hamlets.

#### (4) Analamihoatra

Analamihoatra is located south of the Lake Tsiacompaniry and administratively belongs to the Tankafatora rural commune, a new commune created during the administrative reform of 1996. Access conditions to this village is the worst in the Tsiacompaniry zone. Since it is located at the southern end of the Tankafatora rural commune, information and instructions from the county town are not transmitted rapidly. Analamihoatra is composed of 3 districts and 12 hamlets. The re-organization of the Analamihoatra fokontany in November 1998 led to its division into 3 fokontany: Analamihoatra, Anovondriana and Kelilalina.

## **2 Natural conditions**

### **(1) Andrefanivorona**

Andrefanivorona is crossed in the north-south direction by a small watercourse from the valley whose source is in the Antanifotsy hamlet. It is an area where there are few natural forests left, traditionally used as places of worship. Use of the land is intensive and it is divided into 3 zones: rice fields, the tanety and eucalyptus forest. Since conditions for access to the market are good, the planting of eucalyptus has been carried out since 1928, more than 70 years ago. It is still a region where eucalyptus afforestation prospers.

### **(2) Ambohimanjaka**

Ambohimanjaka is crossed by 3 small water courses, one of which has formed its banks from landslides on the spot called "Labaka". Near the rice fields, soil erosion and minor destruction can be seen on the slopes.

Many natural forests have disappeared after aggressive clearing, and they only remain at the east of Fanjaravina (east of the fokontany).

The creation of artificial forests started in 1947 with the planting of pines, eucalyptus, etc. From 1950, only eucalyptus trees have been planted. Today, planting is still encouraged as a source of cash revenue.

### **(3) Angodongodona**

The Andriamanoa river crossing the village is used to irrigate the rice fields. There are hardly any natural forests and the surroundings of the lake shore are covered by grasslands.

Eucalyptus, pine and acacia forests have existed since 1956, the establishment date of the village. At present, eucalyptus afforestation is being continued.

### **(4) Analamihoatra**

Two relatively big rivers cross the Analamihoatra village. There are several waterfalls of nearly 10 m in the center of the village. Natural forests remain only near the eastern limit of the fokontany. Grasslands are extensive. Eucalyptus afforestation, not well developed, occupies less than 10% of the land surface area in the fokontany.

## **3 Socioeconomic conditions**

### **3-1 Population and number of households**

#### **(1) Andrefanivorona**

Andrefanivorona has 319 villagers, with 53% male and 47% female. There are 67 households

with an average of 5 persons each. Since the average population per fokontany is 1,091 in the Mantasoa zone, Andrefanivorona is a small village, populated only one third of the average.

(2) Ambohimanjaka

Ambohimanjaka has 750 villagers, 47% males and 53% females. The females are higher in number. There are 132 households with an average of 6 persons each. Its population is larger than Andrefanivorona, but it is still a small village in the Mantasoa zone.

(3) Angodongodona

Angodongodona has 2,250 villagers, 48% males and 52% females. It is the most populated among the villages covered by the PS. There are 276 households with an average of 8 persons each, the highest number of family members among the villages covered by the PS.

(4) Analamihoatra

Analamihoatra has 1,206 villagers, 51% males and 49% females. The village is of medium size as compared to other villages covered by the PS. There are 232 households with an average of 5 persons each, a relatively small number for a village whose principal activity is agriculture.

### 3-2 School education

(1) Andrefanivorona

Andrefanivorona has one public primary school with 55 pupils but no classes have been given since the only teacher was on maternity leave. She resumed work in 1999. At that time, the school building was under repair and school materials such as desks were not in good condition. The educational environment in this school was the poorest among all the villages covered by the PS.

(2) Ambohimanjaka

There is one public primary school with 2 teachers and 156 pupils in Ambohimanjaka. Classes were conducted actively. The relatively big school building has a library, and furniture such as tables and chairs are sufficient. The teachers in this village enjoy the absolute confidence of the villagers of the region and play the role of councilors.

(3) Angodongodona

Angodongodona has one public primary school and one private primary school run by a Christian foundation. Three teachers are assigned to the public school with 65 pupils. The Christian school has 260 pupils, 4 times more than in the public school. Ordinarily, the



Christian school costs 1,000 FMG/month/student. The fact that many children attend this school shows that the teachers and the quality of education in this school are better. This may also be due to the fact that many families in this village are relatively well off and the Christian faith is firmly rooted.

#### (4) Analamihoatra

Analamihoatra has one public primary school and one private primary school run by a Christian foundation. The public school has 23 pupils and the Christian school has 216 pupils. As in Angodongodona, the number of students in the Christian school is much larger than in the public school, for the same reasons. Furthermore, in higher grades (from the 1st to the 6th grade) the number of pupils tends to decrease since older children are required to work in the farms.

### **3-3 Public hygiene**

Hygienic conditions improve with the standard of living. Consequently, the actual hygiene conditions partially show the standard of living in the region. Except for Angodongodona, the 3 other villages have no medical establishment such as a hospital.

#### (1) Andrefanivorona

The principal diseases present in Andrefanivorona are malaria and influenza. Since there is no medical establishment in the village, patients go to the medical center in Mantasoa or Ambohipeno. Around 2% of pregnant women give birth in the Mantasoa maternity clinic, and 98% give birth in Ambohipeno with the aid of a traditional midwife.

#### (2) Ambohimanjaka

The principal diseases in Ambohimanjaka are malaria, diarrhea, hepatitis and influenza. Since there is no medical establishment in the village, patients go to the Ambohipeno medical center (1 and 1/2 hours on foot). Fish from the lake constitutes the principal source of protein in the village. Around 500 g of fish per week is consumed by the village people.

#### (3) Angodongodona

The principal diseases in Angodongodona are influenza and malaria. There is a medical center with advisers in the village who ensure part of the medical care, but serious diseases are treated in the Ambohimiadana medical facility. 98% of pregnant women give birth in their households with the aid of a midwife.

#### (4) Analamihoatra

The principal diseases in Analamihoatra are malaria, diarrhea and influenza. Malaria often occurs between April and July. Many villagers have dental caries or other dental diseases. Since there is no medical establishment in the village, the villagers seek treatment in Morarano (2 hours on foot). The main reasons for these diseases are malnutrition due to the lack of protein and the accumulation of fatigue from heavy labor such as farming.

### 3-4 Sources of cash revenue

The principal activity in the villages covered by the PS is farming. In particular, going towards south from the Mantasoa zone to the Tsiazompaniry zone, dependence on farming as the source of cash revenue tends to increase. This tendency also applies to livestock breeding. For cattle, an average of 3 heads per farm is raised in the 2 villages covered by the PS in the Tsiazompaniry zone, while only 2 in the Mantasoa zone. Charcoal production and wage earnings are important sources of cash revenue in the Mantasoa zone, but not in Tsiazompaniry.

The characteristics of the principal sources of cash revenue in the villages covered by the PS are as follows.

#### (1) Andrefanivorona

Farming is a source of cash revenue for almost all the households. Close to half of these households produce charcoal with a high percentage on cash revenue from its sale. Some households only live on charcoal production. This is the village where the production of charcoal is the most highly developed among the villages covered by the PS. Livestock breeding (30%) and employment for wages (23%) also represent a high percentage.

#### (2) Ambohimanjaka

Farming is a source of cash revenue for almost all the households, but many practice other activities to earn money such as livestock breeding (53%), fishing (36%), employment for wages (32%), charcoal production (18%) and construction wood production (11%). Some households only practice fishing since in this village, fishing in the continental waters of the Lake Mantasoa is a prosperous activity. Fish are attracted by hitting the water, and are then captured with a net. Fishing is an important source of cash revenue in Ambohimanjaka.

#### (3) Angodongodona

Farming is a source of cash revenue in many households, but many are able to earn cash from such activities as fishing (36%), and livestock breeding (29%). As for farming, the combined planting of potatoes and rice and the planting of fruit trees are common. Many villagers of

this village have built farms on the eastern shore of the Lake Tsiazompaniry where rice cultivation is practiced. A study of the socioeconomic conditions (survey) showed that one out of 3 households plant rice on the eastern shore of the Lake Tsiazompaniry. Charcoal production is not an important activity and the percentage of households in this sector is as low as 5%.

#### (4) Analamihoatra

Farming is a source of cash revenue for many households, but more than half (60%) also earn their living from livestock breeding. For farming, rice and potatoes are cultivated in a very typical manner in the villages covered by the PS. Livestock breeding is principally cattle grazing in the vast grasslands. In this zone, cattle breeding are practiced on a small scale, with 10 to 20 cows at the most. This is in a village where the handicraft industry is well developed, and 90% of women in the farms buy pieces of inexpensive cloth which they tear and reweave into big scarves and sell at the markets in the region, thus providing cash revenue. As in Angodongodona, the development of eucalyptus tree planting is slow. Only 4% of the households produce charcoal, therefore it is not an important source of income.

### **3-5 Traditional organizations of the local society**

In the villages covered by the PS, there are traditional local social organizations called Dina, Faritanana, Indorana and Fanafonda Karena. These traditional organizations are more and more functional going towards the south from the Mantasoa zone to the Tsiazompaniry zone. This is because the Mantasoa zone is in transition from farming to other work possibilities such as employment with wages, while the Tsiazompaniry zone remains centered on farming. In other words, the form and degree of development of the village defines the power of the traditional organizations. Their organizations and their status in the villages under the PS are as follows.

- ① Dina: A village organization created to handle special situations such as brush fires, robbery, defense, etc.
- ② Faritanana: Mutual aid for farming activities or farm work such as rice cultivation and harvests, carried out through territorial and family relations.
- ③ Indorana: Organization of villages in which the local people provide mutual help in case of a problem.
- ④ Fanafonda Karena: Organization with common funds which purchases dead cattle in the hamlet to provide part of the money for the purchase of new cattle.

#### (1) Andrefanivorona

The Dina subsists formally but no longer operates efficiently. The Fanafonda Karena is

operational.

(2) Ambohimanjaka

The Dina subsists formally but no longer operates efficiently. The Fanafonda Karena is operational. Faritanana and Indorana operate to some extent.

(3) Angodongodona

Dina, Faritanana and Indorana exist. In particular, the Faritanana is very active and half of the villagers use it. At present, some participants in Faritanana may received a salary.

(4) Analamihoatra

Dina, Faritanana and Indorana are operating in may cases.

### 3-6 Village organizations of the local society

Aside from the traditional organizations, there are modern village organizations formed on the basis of social necessity.

Associations of students' parents (abbreviated as FRAM), fishing cooperatives and farming cooperatives are representative examples. The FRAM is formed in each of the villages covered by the PS. Their particular characteristics and activities per village are as follows.

(1) Andrefanivorona

The FRAM formed in Andrefanivorona has some constant activities, such as the raising of contributions to repair the school.

(2) Ambohimanjaka

The fishing cooperative called Miara-Miavo-Tena, with 72 members, controls fishing during the fishing prohibition period.

(3) Angodongodona

A farm cooperative called Kintana was founded in 1960. Up to the present, it has signed a contract with a flour mill called Kobama for wheat planting.

A fishing cooperative was created in 1978 and presently has 150 members.

(4) Analamihoatra

With the aid of the Protestant congregation, the FRAM is working to improve schooling conditions.

### 3-7 Commuting farming and migration

As explained in the section of socioeconomic conditions, there are problems of diminishing forests and, private and disordered use of land in the eastern shore of the two lakes due to the commuting farming and migration to the study area. This is a summary of the situation concerning these problems in the villages selected for the PS.

#### (1) Andrefanivorona

The study of the socioeconomic conditions (survey) showed that there are relatively few farms established from other villages, and that a single household use the land as artificial forest in the eastern shore of the Lake Mantasoa. There are a few villagers who migrated in the past to extend their agricultural lands and settled in the eastern river of the Lake Mantasoa. They have married members of the Benzanozano ethnic group and are living in the eastern part.

#### (2) Ambohimanjaka

Ambohimanjaka is located in the southern part of the Lake Mantasoa. It is a relatively vast fokontany which includes hamlets located relatively close to the eastern shore of the Lake Mantasoa, with a geographically advantageous location for the establishment of farms, etc. In the Aminanosy hamlet located south of the village and in the Andranofody hamlet located south-east of the village, 40% of the households have set up farms in the eastern river of the Lake Mantasoa where they cultivate rice and legumes.

#### (3) Angodongodona

The socioeconomic study showed that one out of 3 households in Angodongodona practices rice cultivation on the eastern shore of the Lake Tsiazompaniry. External farming is numerous in this region. The interviews showed that villagers of the Angodongodona and Ambatotsara hamlets cultivate potatoes and rice on the eastern shore of the Lake Tsiazompaniry and that they sell most of their potato production. There are conflicts concerning the right to use the land at the border of the land used by the farmers and livestock breeders. Villagers of the Ankadilandalalina hamlet produce construction wood in the zone inhabited by the Benzanozano ethnic group, on the upper reach of the eastern shore of the Lake Tsiazompaniry. Individual interviews (4 households) of villagers practicing external farming showed that 2 households had set up their farms in the 70s, one in the 80s and that they have been planting for around 30 years.

The reasons for setting up farms outside their own village is the insufficiency of farmlands in the village, the reduction of the farmland surface due to equal division between many brothers and sisters at the time of inheritance. External farming consists of rice cultivation and tanety planting.

#### (4) Analamihoatra

Relatively few farms were set up outside Analamihoatra, but many villagers migrated in the past to the eastern shore of the Lake Tsiacompaniry. Interviews of the villagers showed that since 1951, around 20 households (100 persons) have settled there because the farmlands in the village were insufficient. Recently, a family from Andasimafana moved to the eastern shore of the Lake Tsiacompaniry in search of farmlands.

### 4 Present use of land

#### 4-1 Approach to understand present situation

The villagers have full knowledge of the present use of lands in the hamlets and the use of natural resources. However, they are not familiar with the representation and view of the overall use of lands in the hamlets through a map. The shared work of the villagers to compile this information in a map allowed them to understand the information per hamlet in the form of a map of the hamlet resources. The strict role of the NGO is to assist the villagers in the establishment of this hamlet resources map. In concrete terms, the NGO will carry out the PRA for a group of three persons, with an organizer to ensure progress of the PRA, a moderator to supervise the entire workshop, and a secretary to note the state of progress, point by point. According to participation conditions, the moderator may ask the organizer to encourage a quiet participant to speak out more, and to note participants who limit the interventions of the quieter members. This provided an understanding of the present use of the lands and to make everyone understand that the participants must discuss the matter and take all the time they need according to their own rhythm, until everyone is convinced about the establishment of the hamlet resources map. Importance is given not only to the resource map, but also to its process of establishment. The procedure for the drawing up of the hamlet resources map required one week of work.

- ① The NGO prepares a simple map by marking the lakes, rivers, roads, etc. on kraft paper, based on references such as existing maps, aerial photos, etc.
- ② The villagers add the missing elements such as lakes, rivers, roads, etc on the map.
- ③ The villagers are asked to indicate their present location in the map of resources.
- ④ The villagers are asked to mark with drawings on the map with respect to the present location in concentric circles, the hamlets, public establishments such as the town hall, the medical center, the church, the cemetery, the school, bridges, houses, the market, etc..
- ⑤ Villagers are asked to indicate on the map through drawings, the natural resources such as water sources, rice fields, the tany, natural forests, artificial forests, fishing zones, etc.

## 4-2 Particular conditions for use of the lands

The classification for use of the lands based on the target zone was divided into 3 sections: Low lands, terraces and slopes, using the level differences as a classification index. Ordinarily, low lands are used as rice fields, terraces for planting potatoes, cassava, legumes, etc., the bottom of slopes for planting cassava and corn, and the top of slopes for eucalyptus trees and grazing land. However, in the villages covered by the PS, there are differences in the names of sections for land use and for slopes. The sections are divided in a different manner, and instead of 3 sections, there are 5. Table II-1 indicates the land use sections in the villages under the PS, as well as the particular conditions for use by the village.

### (1) Andrefanivorona

Andrefanivorona is divided into 3 sections: Tanimbary (rice fields), Vodin tanety (cassava fields) and Tanety Avo Toerana (eucalyptus forest and grazing land, etc.).

Table II-1 Sections per land use in the villages under the PS and their designation

Ordinary division	Land use form	Andrefanivorona	Ambohimanjaka	Angodongodona	Analamihoatra
Low lands	Rice fields	Tanimbary	Tanimbary	Tanimbary	Tanimbary
Terraces	Potato, cassava, vegetable, etc. fields	Vodin-Tanety	Tanintsaha	Vodin-Tanety	Vodin-Tanety
Slopes	Bottom: cassava fields, etc.		Tanety	Teheza-Tanety	Tanimboly
	Top: eucalyptus trees, grazing land	Tanety Avo Toerana	Tampon-tanety	Tampon-tanety	Lavabozaka Tampon-tanety

### (2) Ambohimanjaka

Ambohimanjaka is divided into 4 sections. The terrace part is called Tanintsaha. The bottom of cultivated slopes is called tanety, and the top is called Tampon-tanety. These 2 sections are both used for eucalyptus forest and grazing land.

### (3) Angodongodona

Angodongodona is divided into 4 sections. The terrace part is Vodin-Tanety where potatoes and pineapples are the principal crops. The bottom of the slopes is called Teheza-Tanety, the top is called Tampon-Tanety. The bottom is used as a cassava field and/or for grazing, and the top is used for eucalyptus forest.

### (4) Analamihoatra

Analamihoatra is divided into 5 sections. The top of the slopes is divided into 2 parts, which is a particular characteristic. The terrace is called Vodin-Tanety. As in Angodongodona, potatoes and legumes are the principal crops. The bottom of the slopes called Tanimboly, is

used as cassava and corn fields and for eucalyptus forest. The top of the slopes is subdivided into Lavabozaka and Tampon-Tanety. The Lavabozaka part is used as grazing land and the planting of eucalyptus trees. The Tampon-Tanety part is used as eucalyptus forest.

#### 4-3 Surfaces per type of land use

Table II-2 indicates the surfaces per type of land use in the villages under the PS, obtained on the basis of aerial photos. The characteristics of surfaces per type of land use per village under the PS are as follows.

##### (1) Andrefanivorona

In Andrefanivorona, the eucalyptus forest occupies the largest surface area (48%), followed by grasslands (22%). The farmland only represents 4%, and rice fields, 3.7%.

##### (2) Ambohimanjaka

In Ambohimanjaka, grasslands occupy the largest surface area (39.5%), followed by shrub thistles and eucalyptus afforestation (22% each). Rice fields occupy 6%, and cropland, 3%.

##### (3) Angodongodona

In Angodongodona, grasslands occupy the largest part of the surface area (more than 40%), followed by crop fields (15.8%) and rice land (12.3%). The percentage of farmland is high. Eucalyptus forests represent almost 20%.

##### (4) Analamihoatra

In Analamihoatra, grasslands by far occupy the largest surface area, close to 70%. This is followed by farmlands: 9.2% for rice fields and 11.5% for cropland. This places Analamihoatra in second place after Angodongodona for cultivated surfaces. Eucalyptus afforestation occupies 4.3%, which shows their slow development.



Table II-2 Surfaces per type of land use in the villages covered by the PS

Vegetation used on land	Andrefanivorona		Ambohimanjaka		Angodongodona		Analamihotra	
	Surface (ha)	Percentage %	Surface (ha)	Percentage %	Surface (ha)	Percentage %	Surface (ha)	Percentage %
Natural forest	2.9	0.2	11.6	0.5	0.0	0.0	5.0	0.3
Natural forest (scarce)	0.0	0.0	1.3	0.1	0.0	0.0	3.1	0.2
Pine trees	20.2	1.4	13.6	0.6	87.9	4.0	16.2	0.9
Pine tree (scarce)	13.8	1.0	26.4	1.2	29.5	1.3	1.0	0.1
Eucalyptus trees	599.7	41.8	364.8	16.5	346.8	15.8	61.5	3.3
Eucalyptus trees (scarce)	85.2	5.9	129.4	5.8	87.4	4.0	19.2	1.0
Other afforestation *1	1.3	0.1	2.0	0.1	6.1	0.3	2.0	0.1
Land preparation for afforestation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0
Shrub thickets	85.3	5.9	496.7	22.4	34.5	1.6	12.2	0.7
Grasslands	316.2	22.1	875.0	39.5	88.7	40.5	1,284.0	68.8
Wet land, flood plain *2	9.1	0.6	8.1	0.4	0.6	0.0	65.5	3.5
Rice fields *3	53.6	3.7	129.9	5.9	271.1	12.3	170.9	9.2
Cropland *4	56.9	4.0	65.7	3.0	346.9	15.8	215.1	11.5
Bare land, rock outcrops	3.3	0.2	1.6	0.1	7.1	0.3	0.8	0.0
Houses	3.3	0.2	4.9	0.2	15.5	0.7	10.7	0.6
Lake surface	183.1	12.8	82.2	3.7	74.6	3.4	0.0	0.0
Total radius of activity	1,434.0	100.0	2,213.2	100.0	2,196.7	100.0	1,867.1	100.0

Notes: These values were measured separately from the numerical calculation for the entire study zone.

\*1 Orchards such as banana, loquat fields, etc., near houses including gardens.

\*2 The flood plain is a discharge flow area with strong influence from the rivers, for example, traces of meanders.

\*3 Includes fallow land.

#### 4-4 Ownership of lands

The state of ownership of lands is as indicated in the section of socioeconomic environment, but small additions must be made according to the villages covered by the PS.

##### (1) Andrefanivorona

In Andrefanivorona, ownership of all the rice fields, have been confirmed. Lands whose ownership was confirmed such as rice fields, are actually traded between the villagers.

##### (2) Ambohimanjaka

In Ambohimanjaka, as in Andrefanivorona, the owners of all rice fields have been actually confirmed.

(3) Angodongodona

According to the customary rules of the village, the use and limits of the lands are determined by mutual agreement between the villagers. Land ownership is thus confirmed. These lands are referred to as traditional lands. There is no shared land in the village, with ownership held by an individual or a family. According to the village chief, 10 land properties were registered after 1980.

(4) Analamihoatra

As in Angodongodona, the use and limits of the land properties are determined by mutual agreement between the villagers according to the customary rules of the village. Land ownership is thus confirmed. For the major part of wild land such as grassland, ownership has not been confirmed. Such land is not used by mutual consent of villagers.