

CHAPTER III-2 WATERSHED CONSERVATION PLAN FOR THE INTENSIVE AREA

III-2.1 Need of Watershed Conservation

III-2.1.1 Forestry Viewpoint

In general, forests play a very important role in a watershed in terms of soil conservation and water resources circulation. Moreover the forest products are directly utilized for domestic or commercial purposes to improve the livelihood and welfare of local residents. Even in the Intensive Area forests cover steep slopes to prevent intensive soil erosion from the areas and possibly play an important roll for stabilizing water flow. Local residents in the area rely on forest resources for certain parts of their lives, for example fuel woods and timber supply. In addition, forests are one of very important core areas for maintaining bio-diversity in the Intensive Area.

Some factors indicating the degradation of forest function have been observed in the Intensive Area during this study period. Illegal logging and encroachment in the protection forests are good examples. If these devastating forest usage are continuously made, important forest functions mentioned above might be easily lost in near future.

Both government and local residents are aware of the importance of forest function. It seems that local residents are also aware to some extent that the careless usage of the forest resources affects their life in future. But their subsistence level of life sometimes makes it difficult for them to think long term usage of resources. The government side also has not put effective and integrated countermeasures into practice to meet with these situations for several reasons, for example lack of human resources.

Then, to keep the forest function for proper watershed conservation in the Intensive Area, it is essential to establish effective and integrated watershed conservation plan putting emphasis on forest function.

III-2.1.2 Agriculture and Agroforestry Viewpoint

About 80 % of the Intensive Area is presently used for agricultural activities. Of this, about 80 % is located on undulated and sloped area of more than 8 % slope. Such topographic conditions require the more careful land use to keep sound soil conservation and soil fertility. In fact, the interviews with farmers concerned, revealed that improper farming practice on clove cultivation caused tremendous surface soil

erosion in 1980s.

A well-designed agroforestry system is one of the most effective system for soil conservation and increase of soil fertility, which farmers could participate in. In the Intensive Area, some 80 % of agricultural upland is already covered with agroforestry system. But it is mostly at primitive level judging from its random plant of trees, and thus it is essential to improve the present agricultural system, to realize the watershed conservation functions mentioned above.

On the other hand, the fuel wood consumption is significant in the Intensive Area. About 40 kg /household of fuel woods would be consumed in a week on an average. Farmers get it from their fields and bush and/or purchase it from other farmers at present. Agroforestry including hedgerow cropping also highly contributes to supply of fuel woods without disturbing environment.

Dissemination of well-designed agroforestry system needs intensive extension services. However, there is no extension system for agroforestry development in the Intensive Area. It is urgently necessary to establish the extension system for agroforestry development. Since agroforestry has been only recently recognized as an important field for soil fertility increase in the tropics, education and training in agroforestry lag far behind other agricultural disciplines leaving a definite shortage of experienced and qualified trainers. Therefore, training for specialist, extension workers and farmers is urgently required.

III-2.1.3 Physio-graphical Viewpoint

In the Intensive Area, there has been found sheet erosion in some farmland, where plants are still small and no or insufficient conservation practice has been applied. Soil loss calculation by USLE has indicated that average soil loss for the whole Intensive Area came to 19.1 t/ha/year, consisting of 12.5 t/ha/year in the West Area, 20.4 t/ha/year in the East Area, and 27.6 t/ha/year in the South Area. These average values are not apparently so high. But 25 % of the East Area, 23 % of the South Area, and 4 % of the West Area would be largely over tolerable levels, that is 15.6 t/ha/year for the most part of the East Area and 32.5 t/ha/year for other area. Thus, it is required to provide areas suffering from more than tolerable soil loss, with proper measures, to mitigate such soil loss, and eventually to prevent severe sedimentation in Lake Tondano.

Slope failures have been observed at 5 sites only in the East Area. However, their scales in volume are less than 600 m³ except one at Mt. Maimbeng. Four sites have already been re-vegetated naturally. Slope failure at Mt. Maimbeng seems to be

ceaselessly eroded on the weathered rocky exposure. Minor scale roadside slope failures have also occurred on the cut slopes along the Eris-Watulaney road. These slope failures require corrective measures to avoid further deterioration in near future.

There have been 4 torrents under critical situation such as high flooding possibility, eroded banks, and bed degradation. These were due to aggressive land use in addition to inherent weakness. All of them would have high possibility of affecting the productive paddy field and residential areas in the future.

Lake Tondano has a very important role in the regional economy. However, it has been found during field study that the scientific data precisely showing present condition are so limited. For example, there are no data on inflow discharge to Lake Tondano despite the fact that inflow is closely related to sedimentation in Lake Tondano. Even for sedimentation in Lake Tondano, systematic observation has not been made so far. Water quality of Lake Tondano is classified as 'eutrophic'. But, possible causes such as domestic waste water, fish culturing, pesticide and fertilizer, eroded organic soil, etc., have not been clarified. Judging from the present limited data, it is difficult, or rather impossible, to specify the major cause for eutrophication.

Scientific data is essential to analyze and evaluate the status of rainfall distribution, flow rate of inflow rivers, erosion rate, sedimentation, and water quality, and eventually to execute proper management of the lake and its watershed.

III-2.1.4 Institutional Viewpoint

A watershed is a complex ecological unit, and general conservation requires expert and technological inputs that individual small communities are unable to sustain. Good management of the watershed therefore, involves a collective coordinated approach to monitor the overall conditions and ensure that the resource is maintained in good condition. Requirements for institutional capacity to manage the soil and forest resources of a watershed are therefore a) a well informed public and a well trained group of support personnel in the form of professionals and technicians, b) efficient mechanisms for the coordination, and implementation of forest and soil conservation policies and programs, and c) the open exchange of conservation data and information about management experiences among managers and the public.

The Tondano watershed consists of around 57 villages, 11 Sub-districts and 2 Districts (Manado and Minahasa), coordination of government programs, and general public administration is therefore a complex process that requires good planning and management skills, accurate and timely data and information and strong links to the community.

Recent centralized government practices have proved ineffective in establishing countermeasures to address the current conservation related problems in a manner adequate to ensure sustainability and development of the watershed.

A number of institutions that are involved directly in conservation of the watershed need to be improved and integrated to ensure that they provide appropriate services to the community of the watershed while at the same time increasing the role of the community through a partnership process to improve efficiency and the participatory decision making process. Institutional development for government will therefore need to include the strengthening of the coordination, and overall planning and management function of the Provincial Forestry Services Office, strengthening of the general project management, monitoring and evaluation, data gathering and supervisory function of the District Forestry Services Office, improvement of the village mapping capacity in the Office of Sub-district Head, and development of the Forestry Services Branch Offices as data gathering points, and forest boundary management and patrol centers. From the community perspective institutional development will need development of a village cadre extension worker system, development of a training capacity for cadres, strengthening of NGOs, and shifting the project identification, planning and implementation function from government to community level. From the technical perspective a local agroforestry research and development capacity, and watershed conservation research and development capacity will be established in local universities. All developments should be integrated through strengthening the legal and regulatory framework by establishing a joint decree about the role of provinces, districts, sub districts and villages in watershed conservation, and updating of relevant local regulations. Further integration would be effected through establishment of a watershed conservation committee attended by all stakeholders, and a technical services coordination forum to reduce overlap in government activities.

III-2.1.5 Community Viewpoint

(1) Inappropriate Awareness and Knowledge on Conservation

After the socio-economic survey, the JICA Study Team found out that many people in the community possesses a certain level of awareness and knowledge about environmental problems and conservation, but their awareness tends to be excessively simplified and biased. For example, even though local people talk about deforestation in the protection forest, many of them, especially women, do not know the location and boundary of the protection forest. Also, the survey revealed that people in the community have an inappropriate attitude towards lake water conservation. Local

people emit solid and liquid domestic wastes to the lake without thinking about the consequences. The water hyacinth habitat has been increasing at the lake due to the deteriorated water quality.

Those findings imply the lack of campaign on the restrictions and importance of natural resource conservation as well as environmental education about proper conservation practices. Therefore, community empowerment through awareness raising and environmental education is needed.

(2) Absence of Long-Term Conservation Perspectives

Despite of the steep-sloped topography in certain areas, many farmers continue to use improper soil conservation methods, especially for clove cultivation. When the price of cloves is high, clove farmers tend to clear the land under the clove trees to maximize their economic benefit through picking up the fallen fruits. The land clearing would cause soil erosion.

Many clove farmers in the area share a shortsighted investor's mind due to the "high risk, high return" nature of clove production. Long-term investment for conservation is an unfamiliar idea for many clove farmers. Long-term conservation perspectives at a community level are difficult to emerge when the prospect of local economy is uncertain. Therefore, the formulation of micro planing for watershed conservation led by local people should be included in the watershed conservation plan.

(3) Inappropriate Socio-Economic Environment to Support Community-Based Groups

In the Intensive Area, community-based organizations and groups commonly lack financial and human resources for management. It is because of the lack of both internal and external supports for the capacity building of organizations and groups. The survey has found out that even though the sense of cohesiveness within a community is strong, the thrust to organize the community and create solid community-based institutions for collective solutions is missing. It is derived from many factors, including inappropriate awareness and knowledge on conservation, lack of socio-economic resources in the community and external inputs. Therefore, an action to organize local people through maximizing external inputs should be strengthened as a result of the implementation of watershed conservation plan.

(4) Pessimism towards Government

During the survey, respondents illustrated the reforestation activities that were initiated by the government as "top-down." According to their explanations, the reforestation

activities in the area did not include local people during planning, and there was no socialization components attached to reforestation. As a consequence, local people do not possess appropriate information about the rationale, expectation and purpose of the activities. Many local people stated that they are afraid of government officials from the forestry services because they are too formal. Therefore, the re-orientation of government officials and institutions as a whole ought to be a dispensable part of conservation plan.

(5) Improper Collective Initiatives for Conservation

There are no explicit community-based natural resource management mechanisms or rules in the Intensive Area. The absence of management mechanisms and rules at the community level is attributed from the weakened customary laws for conservation, inappropriate sense of natural resources as their common good and lack of strategic inputs as funding for regulative undertakings or leadership training. Therefore, the collective initiatives of local people must be strengthened through the strategic and comprehensive community empowerment.

(6) Economic Instability and Inadequate Social Safety Net

A problem in the Intensive Area is the instability of local economy, mainly caused by the instability of prices of agricultural products. The relationship between the unsteady economy and natural resource degradation in the area is still inconclusive, but it is reasonable to think that local people have difficulty in making a long-term conservation plan when the economic prospect is uncertain. In addition, a socio-economic survey targeted on illegal cultivators in the protection forest from Ampreng village, which were conducted separately from RRA, revealed that some farmers became illegal cultivators because they lost their land due to some emergency expense, which could be dealt with social welfare. The lack of social safety net and job security forced them to become landless and cultivate inside the protection forest. Thus, a measure to strengthen the social safety net is necessary.

(7) Insufficient Farming Capital

Traditional farming technologies, inefficient market mechanisms and rudimentary production arrangement hinder the improvement of agricultural productivity in the area. Based on the socio-economic survey, insufficient farming capital is the root cause of these outcomes. The low productivity eventually drives local people to excessively exploit forest and other natural resources in order to support their livelihood, and the exploitation increasingly becomes unsustainable. Insufficient

farming capital is the sign of lacking inputs for agriculture in the area. Therefore, the provision of capital, possibly through a micro credit program, should be an important part of watershed conservation plan.

(8) Lack of Women's Empowerment

One of the constraints for the degradation of woody land is the lack of women's participation in natural conservation activities in this area. Even though women are the main consumers of some natural resources as fuel wood and spring water, the survey revealed that women in general have restricted interactions with natural resources and improper awareness, knowledge and attitudes for conservation. Therefore, a plan to empower women is critical for watershed conservation.

III-2.1.6 Regional Economic Viewpoint

In Tondano watershed, there are some 60 natural rivers/streams, 154 springs and Lake Tondano. These water sources play an important role for economic activities and inhabitant life not only in the Tondano watershed area, but also in the North Sulawesi Province. The Tondano river generates electric power of 50 MW in total, and provides water source for clean water supply to Manado, the capital of North Sulawesi Province. Also, the Tondano river and other rivers/streams serve as water sources for irrigation. Springs supply not only irrigation water, but also domestic water for inhabitants, and contribute to good living circumstances. Lake Tondano bears various public benefits such as peak-cut of floods, inland fish cultivation, and tourism implication.

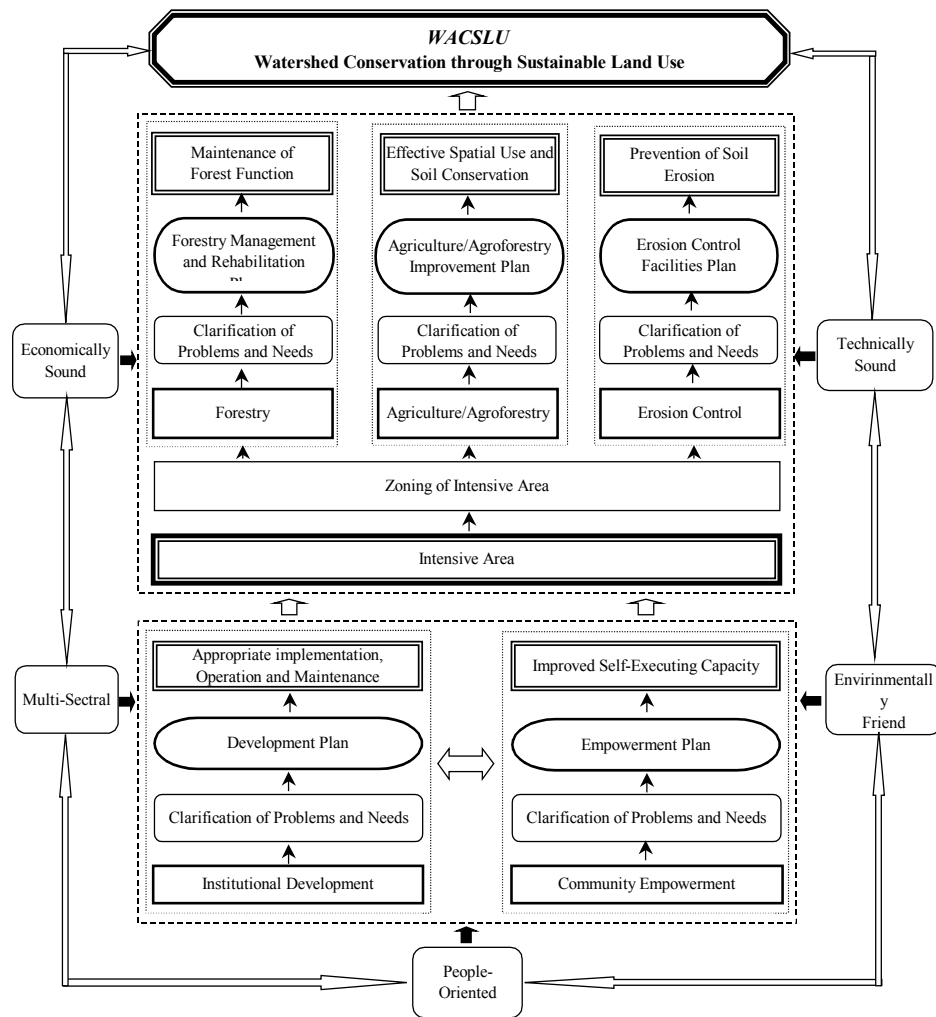
There is a development plan for the *KABIMA* (Kauditan-Bitung-Kema) industrial zone in North Sulawesi Province, which has been identified through the National Spatial Planning (*RTRWN*). A large part of the province's future industrial activity is expected to focus on the zone, near the urban centers of Manado and Bitung. In this development plan, the Tondano watershed, including Lake Tondano, is highly expected as hinterland area functioning water supply to the zone.

To keep such present economic activities and inhabitant life, and to realize the development plan, it is indispensable to maintain sound water sources in the Tondano watershed including Lake Tondano, by means of sustainable land use.

III-2.2 Basic Approach to Watershed Conservation Plan for the Intensive Area

The watershed conservation plan for the Intensive Area should be worked out in the framework of WACSLU supported by 5 elements of "Economically Sound", "Technically Sound", "Environmentally Friendly", "People-Oriented", and "Multi-

Sectoral” which were determined in the Master Plan Study. To implement WACSLU, 5 strategies have been elaborated. These are “Conservation and Rehabilitation of Protection Forest”, “Conservation of Riversides and Lakeshores”, “Reduction of Potential Critical Land”, “Institutional Development”, and “Community Empowerment”. Taking into due consideration these elements and strategies, the basic approach for watershed conservation plan for the Intensive Area is prepared as shown below:



Basic Approach to Watershed Conservation Plan

In this basic approach, an important point is that the physical conservation measures for forestry, agriculture, agroforestry and soil erosion will not be fulfilled without the support of institutional development and community empowerment, to reach WACSLU. Therefore, the institutional development and community empowerment. Plans should be prepared for all the Intensive Area, not for respective zones.

III-2.3 Zoning of the Intensive Area

III-2.3.1 Zoning Guideline and Method

In the zoning for the Intensive Area detailed data of slope gradient, rainfall, soil and geology, and present land cover have been utilized as indicators of each criterion. After the selection of sensitive area for sustainable land use, present boundary of protection forest and distance from the lakeshore have been considered to draw the boundary of each zone for effectiveness of the plan (Figure III-2.3.1 and III-2.3.2). Continuity and extent (about 10 to 15 ha in one patch) has been also considered to avoid complicated zoning distribution for further implementation program (Figure III-2.3.3).

The government regulation for protected area (riverbanks) has been also taken into account, but it has been concluded that special zone is not necessary for riverbanks in the Intensive Area because all the rivers in the area are so small and countermeasure should be united with that of mountain slope areas.

On the other hand, in the feasibility study of the Intensive Area, areas for second priority for conservation measure are further divided into three zones (Bm1, Bm2, and Bm3) mainly based on slope gradient which is the most important factor for soil conservation when land conservation measure is planned.

III-2.3.2 Zoning of the Intensive Area

As a result of the works mentioned above, zoning map of the Intensive Area has been produced as shown in Figure III-2.3.4. The Intensive Area has been classified into 7 zones; P Zone, Bm1 Zone, Bm2 Zone, Bm3 Zone, Bw Zone, F Zone, and S Zone. P,

Bm1, Bm2, Bm3, and Bw Zones have been selected on the basis of the evaluation map and other factors mentioned above. On the other hand, rest of the Intensive Area has been designated for F Zone and S Zone. Demarcation of F Zone and S Zone has been on the basis of present land use.

The area of each zone is shown in the right table. P Zone occupies 1,464 ha (12.3%) of the Intensive Area. It is mainly distributed on the highest parts on the fringe of the Intensive area. The biggest P Zone is located in southern part below Mt. Soputan and

| Area of Each Zone | | | |
|-------------------|-----------|-----------|-----------------------------|
| Zone | Area (ha) | Ratio (%) | Zoning in Master Plan Study |
| P Zone | 1,460 | 12.3 | P Zone |
| Bm1 Zone | 1,985 | 16.7 | Bm Sub-Zone |
| Bm2 Zone | 4,305 | 36.1 | Bm Sub-Zone |
| Bm3 Zone | 1,696 | 14.3 | Bm Sub-Zone |
| Bw Zone | 94 | 0.8 | Bw Sub-Zone |
| F Zone | 2,075 | 17.5 | F Zone |
| S Zone | 270 | 2.3 | S Zone |
| Total | 11,885 | 100.0 | |

Mt. Manimporok. Bm1 Zone occupies 1,993 ha (16.7%). It is mainly located in middle slopes of the East Area. 4,305 ha (36.1%), the largest area is shared for Bm2 Zone. The main location is the West Area, middle slopes of the South Area, and lower slopes of the East Area. Bm3 Zone occupies 1,696 ha (14.3%) and mainly located on gentle plateaus of the West Area and middle slopes of the South Area.

Bw Zone has only 94 ha (0.8%) of the Intensive Area. It is located along the shore areas of Lake Tondano in the East and West Areas. Areas between shorelines and main road along the lake are dedicated for the zone. F Zone and S Zone are located in lower and flat parts occupying 2,075 ha (17.5%) and 270 ha (2.3%) respectively.

Characteristics of zoning for each area are summarized as follows.

(1) East Area

Bm1 Zone is widely arranged in the East Area mainly because of its steep topographic feature. P Zone is located on top of mountains sporadically. Masses of Bm2 Zone occupy lower slopes. Bw Zone is arranged along the shore areas of Lake Tondano.

(2) South Area

The belts of the zones are formed in the South Area. Western part (the highest part) is occupied by P Zone and eastern part is occupied by F Zone. Bm2 Zone and Bm3 Zone are arranged between them. Bm1 Zone is located in 2 parts below P Zone.

(3) West Area

In the West Area, Bm2 Zone is arranged widely and Bm3 Zone is sporadic among Bm2 Zone. Three small patches of P Zone are located on top of mountains. Bm1 Zone is arranged in northern part of this area where slope gradient is rather steep and density of valley is comparatively high. Bw Zone is arranged along the shore areas of Lake Tondano.

Evaluation of respective zones is as follows.

(1) P Zone

Most of this zone is on steep slopes (more than 40%). All the existing protection forests are included in this zone. The first priority of this zone is to maintain well-stocked forest stand. Enforcement of law, reforestation, and planting with people's participant such as Community Forestry (*Hutan Kemasyarakatan*) are possible strategies.

(2) Bm1 Zone

Bm1 Zone mainly distributes on rather steep slopes and most of the area is covered with non-forest vegetation at present. Areas with slope gradient over 40% is often included. Tree dominant agroforestry, reforestation, and planting with people's participation such as Private Forestry (*Hutan Rakyat*) are possible strategies.

(3) Bm2 Zone

Bm2 Zone is mainly located on slightly steep slopes (between 15 and 40% in principle). Agroforestry, proper farming practice, planting with people's participation such as Private Forestry (*Hutan Rakyat*) are possible strategies.

(4) Bm3 Zone

Bm3 Zone is mainly on rather gentle slopes (less than 15%). Sometimes include areas of slope gradient more than 15% with non-rugged topographic features. Most of this area is used as dry upland. Intensive farming with care such as contour farming and planting trees in hedge is acceptable.

(5) Bw Zone

Bw Zone is distributed along shore of Lake Tondano. Most of the area has rather steep slopes. Green belt, planting with people's participation such as Private Forest (*Hutan Rakyat*) are possible strategies.

(6) F Zone

Intensive farming is acceptable, which introducing tree species in the area is recommendable measure for supply of fuel woods.

(7) S Zone

Maintenance of social condition such as sewerage system in good level should be done for preserving water resources.

III-2.4 Physical Watershed Conservation Measures Plan

III-2.4.1 Critical and Potential Critical Land

There are minimal critical lands in the Intensive Area at present. In addition to the encroached area (30 ha) in the protection forest, potential critical lands, which are defined as the area of high possibility of occurring severe erosion in future but no severe erosion at present, have been found as shown in the following table, and its

location is given in Figure III-2.4.1.

Summary of Identified Critical and Potential Critical Land

| Type of Erosion | Critical Land | | Potential Critical Land |
|------------------------------|--------------------|---------------|-------------------------|
| | Number of the Site | Area / Length | Area / Length |
| Soil Erosion | 16 sites | 21 ha | 6,290 ha |
| Slope Failure along the Road | 2 sites | 0.01 ha | 500 m |
| On-farm Road Surface Erosion | 0 | 0.00 m | 3,500 m |
| Hillside Slope Failure | 1 site | 0.30 ha | 0.46 ha |
| Landslide | 0 | 0.00 ha | 5.10 ha |
| River Bed Erosion | 2 rivers | 6,000 m | - |
| River Bank Erosion | 1 river | 900 m | 2,000 m |
| Debris Flow | 1 river | 800 m | 2,600 m |

Note : SW = Sub-watershed

III-2.4.2 Forestry Management and Rehabilitation

(1) Basic Considerations

From a viewpoint of forestry, there are two approaches in the Intensive Area. One is an approach to the protection forest in P Zone. P Zone includes all protection forest areas and forested areas on steep slopes. Therefore the main strategy is how to maintain present forest and how to improve forest condition if degraded. In consideration of the exist of encroachment and illegal cutting in the protection forests, the encroached area should be rehabilitated by appropriate measures like Community Forest in accordance with relevant laws and regulations, to recover forest functions and also to keep people's welfare. As well, illegal cutting areas should be re-planted using the rehabilitation program.

The other is an approach to the forestry areas in the remaining zones. Bm1 Zone, Bm2 Zone, and Bm3 Zone is mainly used for cultivation with various farming activities. Supporting activities for land conservation is necessary. The supporting activities have two sides. One is direct contribution for land conservation by planting trees in these zones, which is mainly considered within the agroforestry scheme. The other is indirect contribution for decreasing deforestation in present forest areas by supplying new resources outside of the forest. Forest conservation program in private lands is mainly considered from the latter point of view. Since Bw Zone has special characteristics as a waterfront close to dwelling areas, careful conservation measure of land use is required.

(2) Each Component of Forestry Management and Rehabilitation Plan

The forestry management and rehabilitation plan consists of 7 components such as a) boundary survey for protection forests, b) community forestry, c) reforestation, d)

forest patrol, e) research for non-wood forest products, f) fuel wood planting and g) timber tree planting. The details of each component are mentioned below.

1) Boundary Survey for Protection Forests

Since the information of protection forest boundary is not well maintained, confirmation of the present boundary of six protection forests is required as a basic information for any conservation activity. The boundary is re-surveyed on a basis of survey data maintained by forestry office such as *BIPHUT*. The total length of the boundary in the Intensive Area is estimated as about 29.8 km. Field survey (confirmation of present boundary in a field), mapping, and reconstruction of boundary monuments are main items. At first, working committee should be organized for managing the whole procedure. Both the forestry office and local residents should be presented during the field survey to get a consensus on the location of the boundary. Boundary monuments made of concrete are constructed about 100 m in intervals and the boundary is drawn on latest topographic maps. A surveyor and assistants are temporarily employed and all the works are completed within two years at the beginning of the project.

2) Community Forestry Plan

Some countermeasure on encroached areas for about 30 ha in the Soputan Protection Forest is required for recovering the function of forest. There are several alternatives to tackle the situation as follows.

a) Alternative1: Drive out all farmers

Under the agreement between the District Forestry Services Office and encroachers, all encroached farmers are driven out from the protection forest. Some compensation for their livelihood should be provided.

b) Alternative2: Restructuring of the boundary

The District Forestry Services Office restructures the boundary of the protection forest to meet the present land use. The new boundary will be established between present cultivating area and forested area. Field survey and mapping are required under the agreement between the government side and encroacher side.

c) Alternative3: Community Forestry in encroached area

To maintain forest function, the Community Forestry (*Hutan Kemasyarakatan*) is to be established. The land use plan is planned considering both land rehabilitation and livelihood of cultivators.

Considering forest function and encroacher's condition examined through a socio-economic survey, Alternative 3 is proposed as a good compromise. Procedure for the establishment of community forest is shown in Figure III-2.4.2. After receiving recommendation from the governor, the area for community forest should be assigned by the minister. Although the establishment of community forest requires long process of legal approvals, it is deemed that this program is the best way to solve the problem with the minimum conflict between all the stakeholders.

Component of the program is as follows.

a) Formulation of community and incentives

Before starting the plan, all encroachers should be requested for quitting individual farming activities and agreeing to follow the plan. With a cooperation of the government, farmer's group of encroachers should be organized as a community. The District Forestry Services Office must perform a leading part with a cooperation of village leaders in this stage.

As a result of an informal meeting with the encroached farmers, it is found that those farmers are eager to be involved in this program because they feel uneasy about their present "illegal" status. During the process of formulating the community, their rights of activity in the protection forest should be guaranteed. In addition to the assurance of their rights, other direct economic benefits are also presented to the farmers to promote their incentive for the participation to the program.

b) Socio-economic approach

According to the socio-economic survey, it is revealed that most of the encroachers are subsistence farmers and there are few other means to acquire income. Therefore an income-generating approach is required in accordance with the planting activity. It is also revealed that the encroached farmers are strongly interested in planting trees and perennial crops in the encroached areas as long as they can benefit from the trees.

Both long term and short term approaches are considered to benefit their economic situation and obtain their support on the program. In the short run, working place as manual laborers is provided in surveying, nursery construction, and other preparatory works. In the long run, trees and perennial crops are allowed to be planted in the encroached areas for their income generation in exchange for their voluntary participation for conserving the areas.

c) Boundary survey

Besides the survey of the protection forest boundary, the encroached area must be decided for common recognition of the extent of the areas. It is estimated that the total area of the encroachment is about 30 ha.

d) Arrangement of lands

After the boundary is confirmed, the target lands will be classified along with planting programme, which considers both land conservation and the income generation of the encroached farmers. It would be possibly divided into three areas of Upper part, Middle part and Lower part, according to their topographic feature and intensity of usage. Each area would be estimated to be about 10 ha (see Figure III-2.4.3).

Upper part

In the upper part, more than 70% of the area is remained as rotational fallow land. It is therefore recommended that the upper part should be provided with tree plantation consisting of pine and multipurpose trees including fruit trees such as Albizia, Gliricidia, Callianders, durian mangostin, mango, etc. Since the land utilization of this area is very extensive, there is not much problem if farmers discontinue cultivation of annual crops. Therefore, it is proposed to start planting trees immediately after agreement between Bupati and community.

Middle part

In the middle part, land is presently utilized more effectively than upper part. It is recommended that the middle part should be provided with fruit tree dominant agroforestry system. The proposed species are durian, mangostin, mango, avocado, langsat, jackfruit, Albizia, Gliricidia and Calliandra. A larger part of the area is now under cultivated land. Planting of these trees would be completed during 20 years.

Lower part

In the lower part, intensive agriculture is concentrated at present. Thus, there would be big problem for encroachers, if they would be forced to discontinue annual crop cultivation. It is recommended that the land use of lower part should be gradually changed by application of "Tumpansary" system within 20 years considering encroachers livings. The application rate of "Tumpansary" system could be proposed at 0.5 ha per year. Fruit trees such as durian, mangostin, mango, avocado, langsat, jackfruit and cempaka and mahogani are proposed in

this system. Tree density at production stage would be 150-200 plants/ha. During the younger stage of trees some food crops and vegetables could be cultivated under trees. Maize, pulses, tomato chili and cucumber are recommended as annual crops, and taro/talas (*Colocasia esculenta*) and ginger are recommended as annual crops during later stage. In order to attain the final shape, it would take about 20 years considering living cost of encroachers and possible full products from trees.

e) Planting and treating activities

Budget and technical assistance for the initiation should be provided. Labor forces are arranged from the community using this budget for supplementing a part of their living costs. The community is requested to plant trees and to treat them along the plan. Seeds and other materials will also be supplied. Considering a lack of human resources in the District Forestry Services Office, the Regional and Provincial Forestry Services Offices are expected to provide a technical support for them.

An informal meeting was held on 11th January 2001 and these idea mentioned above was basically approved by encroached farmers. In the program, the District Forestry Services Office should play a leading roll in organizing those farmers and forming a consensus about this program. On the other hand, the Provincial Forestry Services Office is expected to have a roll for technical support and supervising. In the current situation of decentralization, it is rather difficult to say which organization can prepare a monetary support for this program.

3) Reforestation Plan

Reforestation (enrichment planting) is required in the protection forests to recover illegally logged spots for about 130 ha in the Soputan Protection Forest and about 70 ha in the Lembean Protection Forest. The enrichment planting is also executed in other four protection forests for about 140 ha because the resources of those forests have been declined.

Field survey for a planting plan, construction and maintenance of five nurseries, planting activities, tending of planted trees, and monitoring are the main items of reforestation. Each nursery is constructed with local materials and manual labors. The required number of seedlings to be produced at the 5 nurseries would be about 100,000 in 4 years which corresponds to about 300 seedlings per ha. Nantu (*Palaquium oblongitilium*), Pine (*Pinus spp.*) are suitable for planting in the

protection forest. Other indigenous tree species are also recommended to enhance bio-diversity. Local residents are temporarily employed for nursery construction and maintenance, planting of trees, and tending of planted trees.

Field survey is executed in the 1st year. Five nurseries are constructed in 2nd year and they are maintained for 4 years. Planting activities from 2nd year to 5th year for 25,000 trees each year. Tending planted trees from 3rd year to 10th year, and monitoring for all periods for 10 years.

4) Strengthening Plan of Forest Patrol

Six teams of forest patrol are located for the six protection forests. As the Soputan Protection Forest has the largest area and the longest boundary in these protection forests, two teams are located at northern part and southern part respectively. On the other hand, the Tampusu Protection Forest and the Lengkoan Protection Forest is controlled by one team because of their comparatively small area and their vicinity. Each team consists of two forest guards. They have responsibility for maintaining protection forest boundary and monitoring activities of local residents in the forests inside and outside of protection forest in P Zone. Fire protection with educating local people is also a responsibility of the forest guards.

Six small stations for the teams are constructed at convenient location between protection forests and villages on foot of the protection forests at the beginning of the program. A motor cycle is also provided for each team to move around.

5) Research Plan for Non-wood Forest Products

According to the District Forestry Services Office, although they have an intention to develop some non-wood forest products in this area, the potency of development of non-wood forest products such as nature silk cultivation and apiculture in the area has not been assessed yet.

Some research is required to promote non-wood forest products. Possibility of apiculture, sericulture, and other usage could be identified. Researchers team of three experts, those are an expert of vegetative products, animal products, and non-biological products respectively, are assigned for 2 years.

6) Fuel Wood Planting Plan

Fuel wood planting is planned to prevent over usage of present resources. Construction of seven delivery stations and replenishment of extension services are main items of this plan.

Fast growing legume species such as kaliandra (*Calliandra calothyrsus*) and gamar (*Gliricidia sepium*) are used for the purpose, because it takes only 2 or 3 years for harvest and those species can fertilize soil. Scions of those species can be easily collected from the existing plantation around villages and those can be stored at delivery stations. About 10,000 scions/ha are necessary for planting.

Fuel wood plantation of 150 ha (50 ha for each area) could be established in less utilized lots of private lands. The location of the plantations is selected in accordance with the approval of landowners. Planting activity itself is executed by landowners or local residents with technical support of extension workers. It is expected that those plantations are established over 10 years (15 ha per year).

7) Timber Tree Planting Plan

Timber tree planting as the same as multi purpose trees planting will be carried out in private lands within agroforestry system. Construction of 9 nurseries and dissemination of extension services are main items of this plan.

The nurseries are located near villages for ease of local residents access. Their construction is executed from the 1st to 3rd year (three nurseries per year). The construction work is executed by temporarily employed workers under the supervision of the District Forestry Services Office, and those are maintained until 10th year. Each nursery should have a capacity for producing 10,000 seedlings a year.

Seedlings are planted in agricultural lands within agroforestry system. Planting activity itself is executed by landowners or local residents with technical support of extension workers. The same extension workers with fuel wood plantation are to be stationed (ten workers for each area). The role of extension workers is to encourage local farmers to plant trees in their agricultural lands and teach them how to treat those planted trees. This program can be executed with tight relation to fuel wood planting mentioned above.

(3) Application of Each Component to Zones

Out of 7 components, a) boundary survey for protection forests, b) community forestry, c) reforestation, d) forest patrol, e) research for non-wood forest products, f) fuel wood planting and g) timber tree planting, are applied for P Zone, and the remaining f) fuel wood planting and g) timber tree planting components for Bm1 and Bm2 Zones.

III-2.4.3 Agriculture and Agroforestry Improvement

(1) Basic Consideration

Based on the principles and objective of WACSLU, Strategy 3, 'Reduction of potential critical land', is applied for agricultural improvement. A well-designed agroforestry system is a very effective farming system for soil conservation and increase of soil fertility and productivity. In the improvement plan of the existing agroforestry systems, the following basic considerations are employed:

- 1) Make no drastic change in present agricultural land use system and farming practices.
- 2) Apply the agroforestry system focusing on higher resistance against soil erosion for sloped area, and more production for gentle-sloped area.
- 3) Select suitable farming category and agroforestry system for each zone considering physical and social condition.
- 4) Select suitable tree species and crops considering present cropping pattern, requirement of solar radiation, marketing and demand-supply balance, transportation of commodities, price of commodities and requirement of farmers.
- 5) Determine spacing of trees and tree crops by requirement of solar radiation for crops, crop management and crop yield.
- 6) Employ multipurpose trees in consideration of soil conservation and demand of fuel wood.
- 7) Introduce fruit trees, rapid growth multipurpose trees and some estate crops for water front green belt.

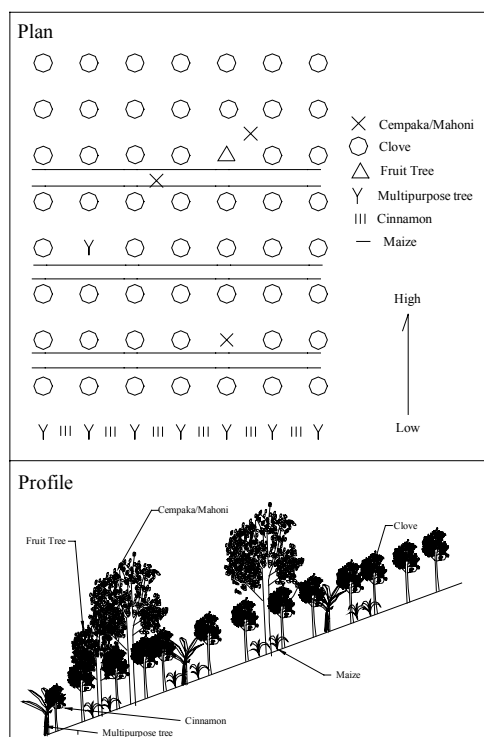
(2) Improvement of Agroforestry System and Cultural Practices

Improvement plan of each type of present agroforestry system is explained below:

1) AGF-I (Type I-2)/IM

This type consists of a large number of clove and small number of fruit trees and timber trees, and herbaceous crops, which are cultivated under trees.

AGF-I(Type I-2)/IM



Clove should be regularly planted by replanting and removing activities, and be gradually reformed into the proper spacing between cloves. The completion of reformation of plant spacing would require 5 years.

The plant density of clove is 200 - 300 plants/ha (6 m x 6 m to 7 m x 7 m), and that of fruit trees and timber trees 20 plants/ha on an average. Hedgerow trees (*Gliricidia*, *Calliandra* and *Cinnamon*) are proposed to be at the spacing of one m.

Maize or pulses are row-cultivated under trees, with the soil conservation technique such as contour ridge cultivation, mulching and no-tillage methods, to avoid soil erosion. The row intervals are proposed at 70 cm for maize and 90 cm or 150 cm for pulses as shown in Figure III-2.4.4.

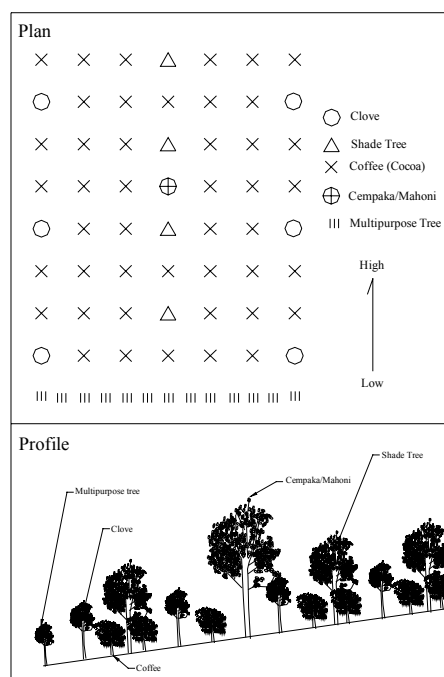
2) AGF-I (Type I-4)/IM

This type is applied only for the steep slope area. The present land use should be mostly left as it is from the viewpoint of well maintenance of bio-diversity and prevention of soil erosion. In this connection, it is recommended that the existing indigenous species such as *Kayu Sirih* (*Piper aduncum*) and *Ficus spp.* should be kept as much as possible.

3) AGF-I (Type I-5)/IM

The proposed tree combination in this type consists of clove and coffee or cocoa with the shade trees, fruit trees (durian, mango, langsung, avocado, banana), timber trees (*cempaka* and mahogany) and hedge trees (*Gliricidia* and *Calliandra*) as shown in Figure III-2.4.5. The plant density of clove and coffee (cocoa) in the clove-coffee garden is proposed at 100 trees/ha and 800 (400) trees/ha respectively, and that of fruit trees and timber at less than 20 trees/ha. The distance between hedgerows should be 50 m at minimum.

AGF-I (Type I-5)/IM



4) AGF-I (Type I-6)/IM

It is necessary to pay attention to prevention of soil erosion for home garden situated at the waterfront of Lake Tondano. It is proposed to plant hedge trees on the border of the field.

5) AGF-II (Type II-2)/IM

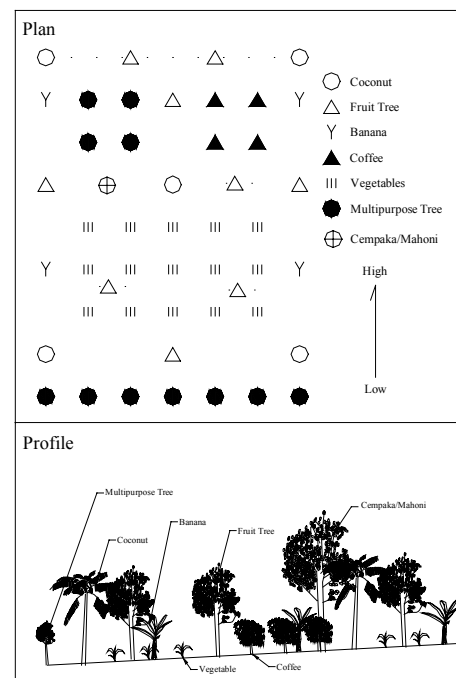
Clove should be planted near the border of field at a low density, namely 30-50 plants/ha, and other trees such as fruit trees, coconut, and *Cempaka* should be planted at the border of field (Figure III-2.4.6).

All the trees/tree crops, which are randomly planted within fields, should be removed, because these trees interfere farmers' activities, and make uneven distribution of solar radiation.

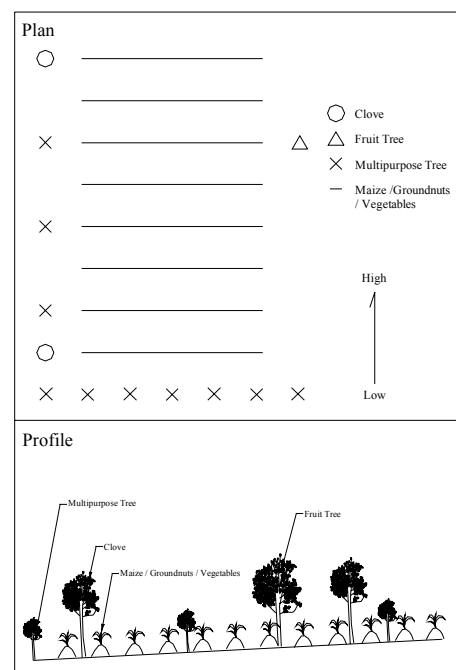
Since the present plant density of trees is low, leguminosae hedge trees such as *Gliricidia* and *Calliandra* are effective for organic matter supply and increase of soil fertility by atmospheric nitrogen fixation. These will also contribute to fuel wood supply.

Considering the soil conservation and the increase of soil fertility, it is proposed to employ the crop rotation system such as cereals- pulses-vegetables-cereals. An area ratio of these crops could be recommended at 80% for cereals, 15% for pulses and 5% for vegetables from the viewpoint of the present farming.

AGF-I (Type I-6)/IM



AGF-II (Type II-2)/IM



6) AGFIII (Type III-2)/IM

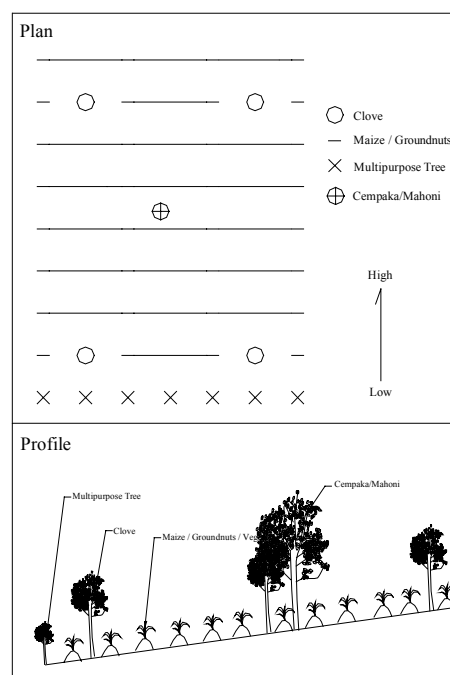
Clove should be regularly planted at wide row and narrow distance (15 m x 5 m) considering the effective utilization of solar radiation and efficient crop husbandry of herbaceous crop. Herbaceous crops (maize and pulses) should be cultivated between clove rows. In this system, total production value would become 130%-150% of mono-culture of clove. Fruit trees (durian, mango, langsung, avocado and banana), timber trees (cempaka and mahogani) are proposed to be planted in the field at low plant density (less than 20 plants/ha).

As there is still some soil erosion potential even in this system, it is required to provide the herbaceous crop cultivation with the soil conservation technique such as hedgerow cultivation, mulching, contour ridge cultivation, no-tillage cultivation (Figure III-2.4.7).

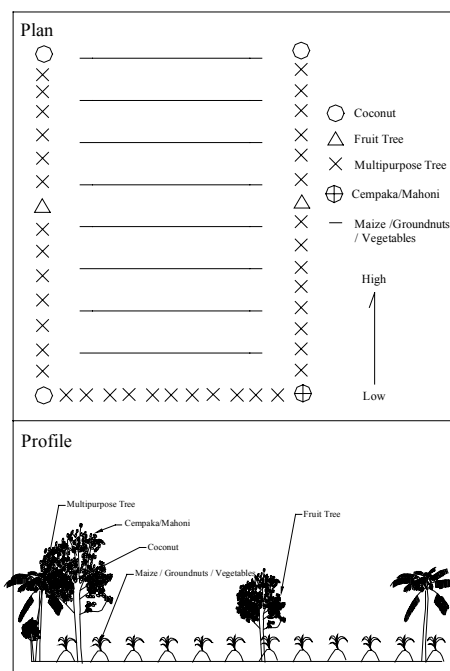
7) UF/IM

This type aims at the increase of hedgerow cultivation area and multipurpose tree density in the hedgerow. Because the hedgerow cultivation would heighten the organic matter supply to soil and the soil fertility by atmospheric nitrogen fixation, and also increase the fuel woods supply to farmers. In UF/IM in F zone, it is proposed to introduce leguminisae trees such as Gliricidia and Calliandra as a hedge tree, for soil conservation and keeping soil fertility, to supplement low organic matter supply (Figure III-2.4.8).

AGF-III (Type III-2)/IM



UF/IM



Considering soil conservation and increase of soil fertility, it is also proposed to employ the crop rotation system such as cereals- pulses-vegetables-cereals in UF/IM. The area ratio of these crops is recommended to be 70% for cereals, 20% for pulses and 10% for vegetables from the viewpoint of present farming and farmers' intention confirmed by socio-economic survey. The proposed major vegetables are tomato, leaf onion, ginger, chili, long beans, pumpkins and cucumber. The cropping intensity of these crops is recommended at 1.5 to 1.6, considering 1.3 to 1.5 of the present cropping intensity.

(3) Selection of Suitable Agroforestry System by Area.

The suitable agroforestry system for each zone has been selected through evaluation of each component as shown in Table II-3.4.1 and -2. The summary of suitable type of agroforestry system for each zone is given in the right table, and the details are shown in Table III-2.4.1.

| Suitable Agroforestry System Type for Each Zone | | |
|---|-----------|---------------------------|
| Proposed Type | Area (ha) | Applied Zone |
| AGF-I (Type I-2)/IM | 1,910 | Bm1 and Bm2 Zones |
| AGF-I (Type I-4)/IM | 860 | Bm1 and Bw Zones |
| AGF-I (Type I-5)/IM | 100 | Bm1, Bm2 and Bm3 Zones |
| AGF-I (Type I-6) | 10 | Bm1, Bm2 Bm3 and Bw Zones |
| AGF-II (Type II-2)/IM | 1,760 | Bm2, Bm3 and F Zones |
| AGF-III (Type III-2)/IM | 1,970 | Bm2 and Bm3 Zones |
| UF/IM | 1,760 | Bm3 and F Zones |
| Total | 8,370 | |

Note: Total area in this table excluded 640 ha of paddy

(4) Anticipated Crop Production

The yields of major crops under the “with project condition” are estimated on the basis of the present technology level, research outcomes on the yield potential, strengthening of agricultural extension service. The anticipated crop yields thus estimated for the “without project” and “with project” conditions are shown below.

Anticipated Yield and Production

| Crop | Area (ha) | | Yield (kg/ha) | | Production (ton) | |
|------------|-----------|-------|---------------|-------|------------------|--------|
| | without | with | without | with | without | with |
| Paddy | 1,020 | 1,020 | 4,800 | 5,040 | 4,896 | 5,141 |
| Maize | 5,343 | 4,955 | 2,900 | 3,050 | 15,495 | 15,113 |
| Ground nut | 323 | 600 | 1,080 | 1,130 | 349 | 678 |
| Cowpea | 129 | 360 | 900 | 950 | 116 | 342 |
| Vegetables | 341 | 485 | 7,000 | 7,350 | 2,387 | 3,565 |
| Clove | 1,466 | 2,571 | 200 | 215 | 292 | 553 |
| Coffee | 140 | 270 | 950 | 1,000 | 134 | 270 |
| Coconut | 186 | 82 | 1,200 | 1,250 | 222 | 103 |

III-2.4.4 Erosion Control Facilities

(1) Basic Consideration

Considering geophysical condition and current development trend, erosion hazard could occur in the Intensive Area. These might be minor scale, however, could extend over a considerably wide area. Erosion control measures shall be provided to minimize the erosion hazard.

Soil loss computation by USLE shows that parts of the Intensive Area produce remarkable soil loss beyond tolerable level. These are 25% of the East Area, 23% of the South Area, and 4% of the West Area. The areas, which require erosion control, are mostly used for agricultural purpose and each farmer owns small area on the steep lands. In such circumstances, simple and more productive vegetation measures, especially agroforestry, fit the situation and might fulfill the demands of the farmers. In addition, slope failures, and torrent erosion have been observed in places in the Intensive Area. Even they are minor scale, but the corrective or protective measures will be structures which are rather large scale and local people could not afford financially and technically. Therefore, the erosion control measures in the torrents or slopes shall be established by GOI.

Such erosion hazard should be mitigated or solved by proper measures to attain the objectives of WACSLU. Taking into account the WACSLU elements, especially focusing on Economically sound, Technically sound, and People-oriented, erosion control should be planned based on the following basic approach:

- Decrease the higher soil loss to tolerable level,
- Put priority on vegetation measures like agroforestry and hedgerow cropping for soil loss reduction,
- Apply simple erosion control measures which could be made by farmers themselves, especially considering maintenance work,
- Use construction materials locally available, and
- Design corrective measures against slope failures and torrent erosion that directly affect Lake Tondano and/or inhabitant's life, e.g. by blocking of roads.

(2) Estimate of Soil Loss by Agroforestry with Traditional Terrace

Soil loss will be reduced by implementing proposed measures of agroforestry with traditional terrace. Soil loss after implementation is estimated 1.9 t/ha/year from the present amount 19.1 t/ha/year as shown in following table:

Estimated Erosion after completion of the Project

| (t/ha/year) | | | | | |
|-------------|------------|---------|---------------|------------|---------|
| Area | Condition | Average | Sub-Area | Condition | Average |
| All Area | w/ Project | 1.9 | | | |
| | Present | 19.1 | | | |
| West Area | w/ Project | 1.2 | | | |
| | Present | 12.5 | | | |
| East Area | w/ Project | 2.8 | Eris (E-N) | w/ Project | 3.1 |
| | Present | 20.4 | | Present | 23.3 |
| | | | Kakas (E-S) | w/ Project | 1.7 |
| | | | | Present | 9.6 |
| South Area | w/ Project | 2.3 | Soputan (S-W) | w/ Project | 1.8 |
| | Present | 27.6 | | Present | 5.8 |
| | | | Kawatak (S-E) | w/ Project | 4.8 |
| | | | | Present | 37.4 |

(3) Erosion Control using Facilities

There are 2 approaches to the plan of erosion control facilities. One is the erosion control facilities for critical land, and the other for potential critical land.

1) Erosion control facilities for critical land

These facilities are divided into 5 types of the facility plan, such as a) slope protection works for hillside, b) slope protection works for road, c) torrent and river bed protection works, d) torrent and river side slope protection works, e) check dam for debris flow control. Basic considerations for plan of these facilities are given below:

Slope protection works for hillside

Five sites of slope failure have been identified in the Intensive Area through the field survey. These are the Makalonsow site in the East Area, the Touliang Oki site in the East Area, the Mt.Kamintong site in the East Area, the Kaayuran Atas site in the South Area, and the Mt.Mainberg site in the South Area. These sites have been studied from viewpoints of size of slope failure, extent of re-vegetation, possibility of further deterioration, and impact to human activities. As a result, it is proposed to repair Mt.Mainberg site in the South Area only.

Slope protection works for road

There are 4 major roadside cut slope failures in the Intensive Area. These are the Paleloan site in the West Area, the Eris-1 site in the East Area, the Eris-2 site in the East Area, and the Eris-3 in the East Area. Out of them, the Paleloan site in the West Area and the Eris-3 site in the East Area have been selected taking into account the importance of road, possibility of expansion of slope failure, and the low possibility of natural re-vegetation. Type of protection works for the

selected sites have been also determined considering possibility of stable slope by re-shaping and shallow surface soil depth.

Torrent and river bed/side slope protection work

Through the site inspection, it has been found that the middle and lower reaches of Panasen river flowing in the South Area, have been severely damaged by floods. Eroded soils would enter Lake Tondano. To avoid further damage, it is proposed to construct the torrent, river bed and river bank protection works. Gabion type for these structures is recommended considering locally available construction materials and easy maintenance as could be made by community.

Check dam for debris flow control

In the Intensive Area, there is a risk of debris flow hazard at Tataaran site in the West Area. To avoid such debris flow hazard, it is essential to construct the new check dam.

2) Erosion control facilities for potential critical land

There are 2 types of erosion control facilities plan for potential critical land in the Intensive Area. One is rehabilitation of the existing damaged check dams and the other is construction of new check dams.

Rehabilitation of existing damaged check dams

Out of 17 existing check dams in the Intensive Area, 3 check dams require the rehabilitation works judging from the estimated volume of soil erosion and site inspection. These are the Leleko check dam, and the Kasuratan check dam in the West Area, and the Tountimomor check dam in the South Area.

Construction of new check dams

In addition to rehabilitation of the existing check dams, it is necessary to construct new check dams in the Intensive Area, to avoid the harmful sediment inflow to Lake Tondano.

First, the locations of new check dams were determined through sediment yield analysis. Three major sources of the erosion were considered in the analysis. These are a) soil erosion, b) slope failure on hillside, and c) land slide. Secondly, sediment yield is calculated using the following equation on a sub-watershed basis. The locations of sub-watersheds used for the study are presented in Figure III-2.4.9.

$$SY = (VSE + VSFH + VLS) \times SDR$$

where,

- SY : Sediment yield (m³),
VSE : Volume of soil erosion (m³),
VSFH : Volume of slope failure on hillside (m³),
VLS : Volume of landslide (m³), and
SDR : Sediment delivery ratio (-).

The figures of sediment delivery ratio used for the estimation are tabulated below (See Sub-Section III-1.8.1 for the survey).

Sediment Delivery Ratio for the Study

| Catchment Area (ha) | 0≤A<20 | 20≤A<30 | 30≤A<50 | 50≤A<100 | 100≤A |
|-----------------------------|--------|---------|---------|----------|-------|
| Sediment Delivery Ratio (%) | 90 | 80 | 65 | 50 | 20 |

After the calculation of the sediment yield, sub-watersheds, which receive more than 500 m³ of sediment, were selected as the candidate sites of the new check dams. Moreover, on-going construction plan of check dams and risk of downstream river bed erosion, which will be caused by the check dam construction on the upstream were also taken into consideration. As the results of such analysis, the required sites are Tandengan, Ranomerut and Tounipus in the East Area.

For the above-mentioned candidate sites, three alternative types of the check dam were compared. These are: a) wet masonry type, b) gabion type, and c) earth fill type. Among the three alternatives, the wet masonry type was selected for all the three sites, considering its stability, sustainability and economic aspect.

(4) Erosion Control Facilities for each Zone

The erosion control facilities to be applied for each zone are summarized as follows, and are detailed in III-2.4.5.

Applied Erosion Control Facilities for Each Zone (1/2)

| Erosion Control Facility | Location | Area | Zone |
|--|---------------|-------|------|
| (1) Facilities on Critical Land | | | |
| a) Slope protection works for hillside | Mt.Maimberg | South | P |
| b) Slope protection works for road | Eris-3 | East | Bm1 |
| | Paleloan | West | Bm2 |
| c) River bed protection works | Panasen river | South | F |
| d) River bank protection works | Panasen river | South | F |
| e) Check dams | Tataaran | West | Bm2 |

Applied Erosion Control Facilities for Each Zone (2/2)

| Erosion Control Facility | Location | Area | Zone |
|---|-------------|-------|------|
| (2) Facilities on Potential Critical Land | | | |
| a) Rehabilitation of existing check dams | Leleko | West | Bm2 |
| | Kasuratan | West | Bm3 |
| | Tountimomor | South | F |
| b) New check dams | Tandengan | East | Bm1 |
| | Ranomerut | East | Bm1 |
| | Tounipus | East | F |

III-2.4.5 Physical Watershed Conservation Measures for each Zone

The forestry management and rehabilitation plan, agriculture and agroforestry improvement plan and watershed conservation facilities development plan to be applied for respective zones are as follows:

(1) P Zone

1) Forestry management and rehabilitation plan

Forestry management and rehabilitation plan in P Zone consists of 5 plans: a) Boundary survey of protection forests, b) Community forestry, c) Reforestation, d) Forest patrol, and e) Research for non-wood forest products. These plans are explained for respective areas as follows:

East Area

There are two protection forests in this area. These are the Lembean Protection Forest and the Kaweng Protection Forest. Forest boundary survey for 9.9 km is required for them.

Reforestation (enrichment planting) is required in illegally logged spots and degraded areas of the Lembean Protection Forest for 70 ha and the Kaweng Protection Forest for 50 ha. The required number of seedlings would be estimated at 21,000 and 15,000 respectively. Two nurseries are placed near forest guard station mentioned below.

Two teams of forest patrol are located for the two protection forests. Two small stations for the teams are located to the east of Makalonsow and the south to Kawen below the protection forests. For fire protection, forest patrol with educating local people is necessary. Some research is executed to promote non-wood forest products.

South Area

The Soputan Protection Forest and the Kawatek Protection Forest are located in

this area. Forest boundary survey for 16.9 km will be needed for them.

There is encroached area of about 30 ha in the Soputan Protection Forest. This encroached area is recommended to serve as a community forestry, to recover forest function. For the community forestry, the detailed plan is given in Sub-Section III-2.4.2.

Reforestation (enrichment planting) is required in illegally logged spots and degraded areas of Soputan Protection Forest for 130 ha and the Kawatek Protection Forest for 50 ha. The required number of seedlings would be estimated at 37,000 and 15,000 respectively. Two nurseries are placed near forest guard station at Noongan and Tumaratas.

Three teams of forest patrol are located for the two protection forests. Three small stations for the teams are constructed at the south and west to Noongan and west to Tumaratas below the protection forests. Some research is executed to promote non-wood forest products.

West Area

Two small protection forests, i.e. the Tampusu Protection Forest and the Lengkoan Protection Forest, are located in this area. Forest boundary survey for 30 km will be needed for them.

Reforestation (enrichment planting) is required in degraded areas of the Tampusu Protection Forest and the Lengkoan Protection Forest for 25 ha and 15 ha respectively. The required number of seedlings would be estimated at 12,000. One nursery is placed near forest guard station at Tampusu.

One team of forest patrol is located at Tampusu village where approach to both protection forests is easy. Some research is executed to promote non-wood forest products.

2) Agriculture and agroforestry improvement plan

The community forestry in the Soputan Protection Forest in the South Area, will be provided with the agroforestry system as mentioned in Sub-Section III-2.4.2.

3) Erosion control facilities development plan

It is proposed to rehabilitate the slope failure on hillside at Mt. Maimberg in the South Area, since it has comparatively large area (0.3 ha) and low possibility of natural re-vegetation. (see Figure III-2.4.10 for the location). Taking into account of the site condition, combination of gabion box slope protection works

and bamboo terrace works is recommended for this site.

(2) Bm1 Zone

1) Forestry management and rehabilitation plan

In Bm1 Zone, fuel wood planting and timber tree planting are planned for forest resources conservation. Details of those plans are mentioned in Sub-Section III-2.4.2. Those plans are applied for three areas respectively.

East Area

Three delivery stations of scions are located near villages at Makalonsow in north, Eris in middle, and Kawen in south respectively. Three nurseries are also established at the same places of delivery stations. Ten extension workers are responsible for the extension works in East Area. Those delivery stations, nurseries, and extension workers are stationed to supply materials and services for both Bm1 Zone and Bm2 Zone. Fifty ha of fuel wood plantation (1 ha x 50 locations) could be established mainly in less productive lots in this zone. 20 locations of them are established in Touliambot Sub-district and Eris Sub-district respectively as Bm1 Zone is larger in these two Sub-districts. Lest of them (10 locations) are distributed in Bm1 Zone of Kakas Sub-district. Seedlings of timber trees and multi purpose trees are planted in this zone in accordance with agroforestry program. Those seedlings are planted in agricultural lands intermittently.

South Area

Three delivery stations of scions are located near the settlement of Noongan, Tumaratas, and Tonsewer respectively. Three nurseries are also established at the same places of delivery stations. Ten extension workers are responsible for the extension services in South Area. Fifteen ha of fuel wood plantation (1.0 ha x 15 locations) could be established in this zone. (As distribution of Bm1 Zone is limited in South Area, 70% of the fuel wood plantations in South Area are established in Bm2 Zone.) 10 locations of them are established in Langowan Sub-district and 5 in Tompaso Sub-district. Seedlings of timber trees and multi purpose trees are planted in this zone in accordance with agroforestry program. Those seedlings are planted in agricultural lands intermittently.

West Area

Three nurseries are placed beside the villages of Tataaran, Pulutan, and Tondegasan. One delivery station of scions is located at the same place of the

nursery in Pulutan. Ten extension workers are responsible for the extension works in West Area. Seedlings of timber trees and multi purpose trees are planted in this zone in accordance with agroforestry program. Those seedlings are planted in agricultural lands intermittently.

2) Agriculture and agroforestry improvement plan

The total agricultural area of Bm1 Zone is estimated at 1,850 ha, out of which 1,650 ha are distributed in the East Area. Bm1 Zone is largely divided into the steep slope area and the slope area in terms of steep gradient.

a) Steep-sloped area (more than or equal 40% in slope gradient: 720 ha)

In this area, AGF-I (Type I-4)/IM is proposed. For the limited area of 20 ha, where the improper farming practice are presently conducted, it is proposed to apply corrective measures such as ridge cultivation, no-tillage cultivation, mulching, terracing and hedgerow, to avoid further deterioration.

b) Sloped area (less than 40% in slope gradient: 1,130 ha)

AGF-I (Type I-2)/IM and AGF-I (Type I-5)/IM are proposed in this area from a viewpoint of soil conservation and production. AGF-I (Type I-2)/IM would be applied for larger part of this area (950 ha in total; 770 ha for the East Area and 180 ha for the West and South Areas). AGF-I (Type I-5) could be proposed for about 100 ha in this zone.

3) Erosion control facilities development plan

In this zone, the slope protection works for road is proposed at the Eris-3 site. The required works are grading and sod facing.

New construction of two check dams are also proposed at the Tandengan site and the Ranomerut site in the East Area. Their dimensions are given below:

Proposed New Check Dams for Sediment Control

| Location | Zone | Sub-watershed No. | Crest Height (m) | Crest Thickness (m) | Crest Length (m) | Capacity (m ³) |
|-----------|------|----------------------|---------------------|------------------------|---------------------|-------------------------------|
| Tandengan | Bm1 | 20 | 5.5 | 1.5 | 45.0 | 1,300 |
| Ranomerut | Bm1 | 22 | 6.0 | 1.5 | 59.0 | 1,000 |

(3) Bm2 Zone

1) Forestry management and rehabilitation plan

In Bm2 Zone, fuel wood planting and timber tree planting are planned for forest

resources conservation. Details of those plans are mentioned in Sub-Section III-2.4.2. The delivery stations, nurseries, and extension workers are common with Bm1 Zone.

East Area

Seedlings of timber trees and multi purpose trees are planted in this zone in accordance with agroforestry program. Those seedlings are planted in agricultural lands intermittently.

South Area

Thirty five ha of fuel wood plantation (0.5 ha x 70 locations) could be established in less utilized lots of Bm2 Zone such as fringe of farming lands. Fifty locations of them are established in Langowan Sub-district and 20 in Tompaso Sub-district. The size of each plantation is smaller than those planned in Bm1 Zone, because it is more difficult to find vacant lots for fuel wood plantation in Bm2 Zone, which is rather intensively used for agriculture. Seedlings of timber trees and multi purpose trees are planted in this zone in accordance with agroforestry program. Those seedlings are planted in agricultural lands intermittently.

West Area

Fifty ha of fuel wood plantation (0.5 ha x 100 locations) is established in less utilized lots around Pulutan village where demand for fuel wood for pottery making is rather high.

Seedlings of timber trees and multi purpose trees are planted in this zone in accordance with agroforestry program. Those seedlings are planted in agricultural lands intermittently.

2) Agriculture and agroforestry improvement plan

The total agricultural area of Bm2 Zone is 3,630 ha, out of which 2600 ha are distributed in the West Area followed by the East Area (520 ha) and the South Area (770 ha). The proposed agroforestry systems are as follows:

- a) AGF-III (Type III-2)/IM is basically proposed for 1,700 ha of the relatively low potential of soil erosion area
- b) AGF-I (Type I-2)/IM and AGF-I (Type I-4)/IM are proposed for 1,080 ha and 90 ha of relatively high potential of soil erosion, respectively.
- c) AGF-II (Type II-2)/IM is proposed for 690 ha of the low potential of soil erosion area.
- d) UF/IM is proposed for 70 ha of the low potential of soil erosion area.

3) Erosion control facilities development plan

In this zone, the slope protection works for road are needed at the Paleloan site in the East Area. The gabion slope protection work with 3.0 m height is proposed.

It is required to provide the debris flow control facility at site Tataaran in the West Area, to prevent disaster of debris flow (see Figure III-2.4.10 for the location). To control the debris flow, wet masonry gravity check dam with 6 m height, 3 m thickness, 70.0 m crest lengths and 800 m³ capacity is proposed.

The existing check dam at Leleko in the West Area is damaged presently, therefore it is proposed to be rehabilitated. The required rehabilitation work is re-embankment and sod-facing of the downstream slope of the dam body.

(4) Bm3 Zone

1) Forestry management and rehabilitation plan

Bm3 Zone has low priority for tree planting because of its gentle topographic feature. Fuel wood planting and timber tree planting could be used for increasing soil fertility and fuel wood supply for farmers' home consumption. In this zone, such increase of soil fertility and fuel wood supply for farmers' home consumption will be made only using hedgerow cultivation in agroforestry system. This concept will be applied for the East, South and West Areas.

2) Agriculture and agroforestry improvement plan

The total agricultural area of Bm3 Zone is about 1,500 ha consist of 1,110 ha in the West Area and 390 ha in the South Area. UF/IM, AGF-II (Type II-2)/IM and AGF-III (Type III-2)/IM are proposed in this zone, and occupy 770 ha, 640 ha and 90 ha, respectively.

3) Erosion control facilities development plan

In this zone, there is one damaged existing check dam at Kasuratan site in the East Area. It is proposed to rehabilitate it for the proper erosion control purpose. The required rehabilitation work is riprap works on the downstream part of spillway.

(5) Bw Zone

1) Forestry management and rehabilitation plan

Most of Bw Zone is dedicated for green belt. As most of slope parts of the zone

is now mostly covered with trees, tree planting at open lots are planned. Extension services are required for educating local residents to conserve sloping parts of the zone with planting or protecting trees. This concept will be applied for both the East and West Areas.

2) Agriculture and agroforestry improvement plan

The total area of Bw Zone is 94 ha. It distributes in the east and west sides of Lake Tondano. Fifty percent of the area are dwelling area, which are surrounded by the home garden, and 40% are lowland where the paddy plant is cultivated throughout the year. The remaining 10% are upland covered with the tree dominant agroforestry system and the grass fallow.

For keeping the waterfront in good condition, it is proposed to make the green belt along the lakeshore as described below.

- a) AGF-I (Type I-4)/IM is proposed for the steep to steep-sloped area along the road. High tree density should be kept to mitigate soil erosion.
- b) AGF-III (Type III-2)/IM for foot of the steep slope area. In the area, the herbaceous crop cultivation should be applied as the soil conservation technique such as ridge row cultivation, mulching and hedgerow etc.
- c) Upland of grass fallow could be proposed to be changed into the lowland field (flat and lower area) or into the fruit tree dominant tree complex (undulated area).
- d) In AGF-I (Type I-6)/IM (home garden), it is necessary to pay attention to soil erosion. Planting hedge trees on the border is one possible measure.
- e) Since the area is close to the lake, the ground water level would be high, therefore, the proposed trees should be resistant to high ground water level. Bamboo, *Ficus spp.*, *Albizia*, *Gliricidia*, durian, avocado langsat, coconut sugar palm and sago palm, which are observed, are proposed to plant in the water front.

3) Erosion control facilities development plan

No erosion control facilities are required.

(6) F Zone

1) Forestry management and rehabilitation plan

This zone is mainly used for the intensive farming. No plan of forestry management and rehabilitation is proposed in this zone.

2) Agriculture and agroforestry improvement plan

The total agricultural area of F Zone is 1,940 ha consisting of 620 ha of lowland and 1,320 ha of upland, out of which 1,000 ha or 50% of upland is distributed in the South Area.

UF/IM and AGF-II (Type II-2)/IM are proposed for this zone and occupy 910 ha and 410 ha, respectively. The average weekly consumption of fuel wood per household is some 40 kg. Farmers collect fuel woods from their field or bush. As F Zone is close to the dwelling area, farmers can save labour, if they can get fuel wood from the neighbouring area. Considering the fuel wood consumption and maintaining soil fertility, the application of Leguminisae hedgerow is useful.

3) Erosion control facilities development plan

Torrent erosion sites should be provided with proper protection measures such as river bed and river bank protection works. These erosion sites are located on the Panasen river in this zone in the South Area. The required number of them would be 6 river bed protections and 900 m river bank protection works.

There is a damaged existing check dam at Tountimomor site in the South Area. It is essential to rehabilitate it from the erosion control point of view. The required rehabilitation work is additional gabion works to strengthen structural stability.

In addition, one check dam is required to be newly constructed at Tounipus in the East Area for sand trap purpose. The required dimension of the check dam is 2.5 m crest height, 1.5 m crest width and 85.0 m crest lengths with 800 m³ capacity.

III-2.4.6 Watershed Conservation Plan Map

Based on the sector-wise development plan mentioned above, an appropriate watershed conservation map has been prepared as shown in Volume IV. In addition, the illustrated watershed conservation plan is given in Figure III-2.4.11.

III-2.4.7 Strengthening of Extension Services

(1) Forestry

Thirty extension workers (10 workers for each area) are required for executing forestry conservation program. In order to strengthen the extension services for forestry, it is essential to enhance ability of the workers. It is expected that the training program is repeatedly held for 5 years.

1) Extension worker training

Extension workers need training to meet farmer's needs and problems. Five training topics for extension worker are suggested as follows.

- Review of current policies, forest laws and regulations which might limit the practice in planting activity,
- Proper knowledge for ecology, pedology, and hydrology of tropical area,
- Tree growing technique (selection of species for particular purposes, planting and treating),
- Knowledge of organizing a farmer's group for collective works such as nursery management, and
- Understanding marketing.

Besides lecturing, participatory methods such as group discussion, workshops, field visits and exercises are recommended to improve ability of trainees.

One-week training course for extension workers is proposed to open once a year for 5 years. The combination of participatory training and traditional method are proposed as training measure for extension workers. Teaching staff are invited from universities, research institutes, specialists of the Forestry Services Offices, and NGOs.

2) Training of Farmers

The objective of training farmers is to make them realize the direct and indirect benefit of tree planting. Proposed training topics are as follows.

- Basic ecology and hydrology,
- Private nursery development,
- Selection of tree species for different purposes
- Treatment of planted trees,
- Market system for wood products

Training for farmers is practiced in two different ways. The first one is on the job training through tree growing practices and verbal communication. Second one is one-week training course, which is held for key farmers once a year for 5 years. Specialists of the District Forestry Services Office, extension workers, expert of university and NGO staff are proposed as trainer.

(2) Agriculture

As mentioned previously, there are enough extension workers for agriculture, but their field works are inactive mainly due to lack of transportation facility. In fact, the

detailed socio-economic survey relates the complaints of farmers on less visiting of extension workers. It is therefore to recommend in this Study that 30 motorcycles and 50 bicycles be provided for strengthening of agricultural extension activities.

(3) Agroforestry

1) Extension system

At present, there is no agroforestry specialist and limited number of extension worker (*PPL*) in both the District Forestry Services Office and BIPP. It is urgently required to establish the extension service system for agroforestry under the District Forestry Services Office. For intensive extension of agroforestry, 3 agroforestry specialist (soil conservation and soil fertility, crop management and forestry) and 60 extension workers (one to 2 extension workers per village) would be required as a special program. This special program would be employed at least 5 years. In this program, the District Forestry Services Office, which handles agroforestry extension work, should closely cooperate with *BIPP*. The following are examples of effective agricultural extension service;

- Collaborate with other related institutions such as universities and NGOs.
- Adopt group guidance method by organizing farmers group and establishing demonstration plot.
- Provide the chance of farmers training program.

2) Training program

The training program varies with each category of group. It could be proposed training program on agroforestry under the special program which continues for 5 years. The following plan could be proposed.

a) Training for policy planners and specialist

The training of planners and specialists aims to:

- Strengthen their capabilities to develop policies and plans to increase production of commodities from agroforestry,
- Enable them to better support research and extension programs for improving agroforestry systems to produce more commodities,
- Understand the market needs of farmers, processors and end users, and
- Organize training programs in agroforestry within their own organizations.

One week training course for planner and specialist would be held three times per five years. Proposed trainer would be teaching staff of universities, researchers

of research institute, government officers and NGO staff.

b) Extension worker training

The training course for extension workers could be proposed to open once a year with one week duration. The combination of participatory training and traditional method are proposed as training measure for extension workers. Teaching staff of universities, researchers of research institutes, specialists of the Provincial and District Forestry Services Offices, government officers and NGO staff would be proposed as trainers.

c) Training for farmers

The training for farmers is proposed by two steps. At first step, key farmer (200 farmers, who are head of farmers group or leaders of village) would be trained and at second step they would work as farmer trainer. It is proposed that one week training course for key farmers would be open once a year. Specialists of the District Forestry Services Office, extension workers and NGO staff would be proposed as trainer.

III-2.5 Institutional Development Plan

III-2.5.1 Basic Consideration on Institutional Development Plan

The institutional development plan will involve 28 institutional entities. In case the organizational structures are not finalized, or the final organizational structures for the government offices are different from the current draft structures, a temporary office should be established in both the province and district level forestry offices, for management, supervision and technical assistance purposes to the implementation of the development plan.

The development plan consists of 7 components for scheduling purposes. These are a) community institutional development, b) technical institutional development, c) institutional development of forestry services, d) accurate village boundary mapping, e) institutional integration and strengthening of legal and regulatory framework, f) strengthening of watershed conservation capacity at University of Manado, and g) strengthening of local NGO. Out of them, community institutional development will be executed for six villages selected as a pilot group in the first instance until the village proposal process is consolidated, after which, the consolidated framework will be implemented in all villages. All components would be integrated as mutually supporting elements of a comprehensive institutional development process.

The institutional development plan will take place, initially over a 3-year period. In the first year the preparations would be made to set the foundations for the remainder of the development period. All activities would be shared and integrated by cooperative arrangements including open sharing of data and resources. Ultimately all institutions will support each other for attainment of conservation objectives.

It is important to realize, at the outset, that a major portion of institutional development is applied through endogenous human capital development processes, in which counterpart arrangements and informal on the job training play an important role. Successful implementation of the project could not be realized without consideration of institutional development. This is particularly relevant to the development of capacity in forestry services. A key role will be played by both international and national consultants in this respect.

The institutional development consultant would have an important role, not only in the supervision of institutional development, but also in overall project monitoring and coordination. In order to ensure project success from the perspective of institutional development, longer-term technical assistance appointments will be required to ensure that schedules are maintained and constant attention is given to progress and achievement.

III-2.5.2 Community Institutional Development

(1) Background

Community institutional development is required because the communities within the proposed area are at different levels of development and the institutions within each village are also at different levels of development. The communications linkage between the government and community is weak, and the government lacks the quantity of human resources needed to effectively apply extension services to the community.

(2) Objective

The community institutional development aims:

- To establish a village based facilitation capacity to enhance the dissemination of extension services to the community through training a group of village cadres.
- To establish a village community group proposal and project tendering process to facilitate community involvement in identification, planning, management and implementation of conservation projects.
- To strengthen local NGOs by training members for extension services and

facilitation also.

- To work with village secretariat and relevant sections to establish a proposal invitation and selection process in cooperation with District Forestry Services Office.

(3) Activities

The required activities are shown in Table III-2.5.1.

(4) Scope

All villages in watershed, and the Minahasa District Forestry Services Office (initially a pilot project involving 6 villages to develop the proposal process, it is expected that the proposal process will be consolidated by the end of the second year). The basic cadre training program will include at least the forestry extension services (regreening, physical measures, and social forestry), basic project management, preparation of proposals, agroforestry for Tondano, and conservation of Tondano watershed.

The objective in the first year will be to establish a base capacity through development of a basic training program, for all extension workers, and implementation of the program. The objective in the following years will be to apply the basic training program to new recruits who will replace those who drop out of the process, and to develop an advanced module to upgrade the skills of cadres on an annual basis. The program will be developed through a linkage with agroforestry and watershed conservation research institutions such as Sam Ratulangi University and University of Manado.

It is envisaged that in the first year around 100 participants will be trained (60 originating from farmers regreening groups, 25 from NGOs, and around 15 government extension workers). Even after the first year, 100 participants would be required to attend a skill-upgrading program continuously.

(5) Major Inputs

- Institutional Development and Information Systems Consultant (International)
- Human Resources Management Consultant (National)
- Project Management consultant/Project Officer (National)
- Financial Management Consultant (National)
- Equipment

III-2.5.3 Technical Institutional Development

(1) Background

At present there is low capacity for applied technical research in agroforestry, or technical watershed management (pure sciences) in North Sulawesi. An agroforestry research capacity is required to find appropriate agroforestry systems to apply to the local environment, and a watershed management (pure science) capacity is required to research the technical aspects of erosion, water quality etc.

The technical institutional development program will consist of establishment of the cadre training programs at the Makassar Forestry Training Center, and agroforestry research and development programs, as well as building the linkage between research and development programs and training.

The development of the technical watershed management (pure sciences) institution in North Sulawesi will take place through equipment installation and technical assistance.

(2) Objective

The objectives of technical institutional development are:

- To establish an applied agroforestry research and development capacity in Sam Ratulangi University and
- To strengthen technical watershed management (pure sciences) capacity in Sam Ratulangi University through development of Watershed Information System and applied research.
- To create a linkage between universities and forestry training center to encourage constant updating of training programs.
- To create a linkage between universities and forestry training centers to encourage constant updating of training programs.

(3) Activities

Table III-2.5.1 shows the required activities.

(4) Scope

Sam Ratulangi University and Makassar Training Center

(5) Major Inputs

- Agro forestry specialists (International-short term)
- Agro forestry specialists (National)

- Erosion and sedimentation specialist (National)
- Hydrologist (National)
- Water quality specialist (National)
- Assistant (Hydrology)
- Helper (Erosion and sedimentation observation)
- Equipment

III-2.5.4 Institutional Development of Forestry Services

(1) Background

The decentralized forestry services offices will have a more prominent role in management, monitoring and evaluation of forestry programs, while the community will be more prominent in identification, planning, and implementation of projects. This implies an increased role for the community in financial management, project management, general administration and information management. The establishment of the village cadre group also means that the district office will require human resource development and management skills, as well as development of the longer-term planning and management perspective. They will need to manage the new forest patrols, and the re-greening fund, as well as the relationship and communications with the community. The development of forestry services will need to maximize the services role and minimize the project implementation role.

The effectiveness of the current forestry services offices for planning and management of forestry are limited by underdeveloped information systems, and general lack of skills among the staff. The management, administration, and leadership of the district office needs to be improved through technical assistance, development of a more efficient managerial structure, and a strengthened capacity for project management monitoring and evaluation.

(2) Objectives

The institutional development of forestry services aims :

- To strengthen the capacity of North Sulawesi Forestry Services Offices, to gather, process, manage, and analyze data, produce reports, and disseminate information to the community, and
- To strengthen the capacity of Forestry Services Office at Minahasa for leadership, management of finance, administration, project management and supervision, and monitoring and evaluation.

(3) Activities

The required activities are given in Table III-2.5.1.

(4) Scope

Province and District Offices of Forestry including Branch Offices

(5) Major Inputs

- Institutional Development and Information Systems Consultant (International)
- Database and Computer Communications Specialist (National)
- Project Management Specialist (National)
- Financial Management Specialist (National)
- Office Administration Specialist (National)
- Equipment

III-2.5.5 Accurate Village Boundary Mapping

(1) Background

There is a need for accurate village boundaries. In general, the study has produced 7 zones for development purposes. In order to accurately apply the master plan each village needs to be informed of the recommendations that apply to their area, and which areas to apply certain strategies. At present there are no accurate boundaries, and the mapping agency is unable to supply anything more than estimations. The Sub-district Offices within the watershed need to be coordinated, and the boundary setting methods standardized, to produce a coordinated approach to the mapping of village boundaries, and sustainable updates.

A set of boundaries is to be developed digitally for use in GIS, both for watershed management purposes, and to assist with communicating the master plan to village communities.

(2) Objective

The objective of accurate village boundary mapping is to standardize the village boundary mapping process, and develop an accurate set of digital village boundaries.

(3) Activities

The required activities are given in Table III-2.5.1.

(4) Scope

All sub district offices with villages in the watershed (11)

(5) Major Inputs

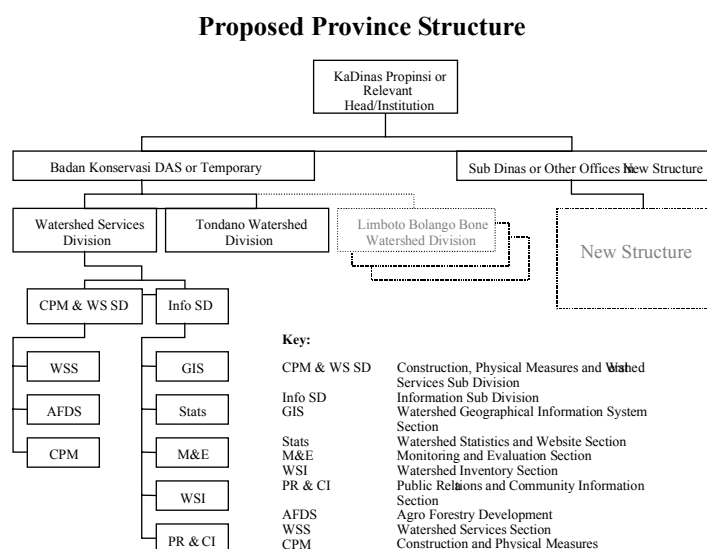
- Institutional Development and Information Systems Consultant (International)
- Mapping and GIS Expert (National)
- Mapping and GIS Assistant (National)
- Equipment Needs: GPS at University of Manado and the existing topographic maps, aerial photos etc.

III-2.5.6 Institutional Integration and Strengthening of Legal and Regulatory Framework

(1) Background

The recent move to decentralization has created a power vacuum, which causes a situation in which regional authorities have no strong foundation or adequate delegation of duties and responsibilities between the different levels of government. The legal and regulatory framework for forestry needs to be strengthened by revising the local laws and regulations to bring them into line with the current laws, and local conditions i.e. Law No. 41 of 1999 about Forestry, Law No. 22 of 1999 about the Regional Administration and Government Regulation No. 25 of 1999 about the Authority of the Central Government and the Authority of the Provinces as Autonomous Regions, and Decree No. 677/Kpts-II/1998 about Social Forestry. There is also a need to develop an agreement between the provincial, and district government about coordination of forestry activities.

One of the foundations of WACSLU concept is a multi-sectoral approach that includes all stakeholders in the basin. However, multi-sectoral approach is not established at present, since Tondano watershed is in the unique socio-economic condition and people's understanding on watershed conservation is low. Therefore, there is a need to integrate all conservation and economic activities in the watershed to provide long-



term direction and strategic management. Efforts from all quarters need to be coordinated to make conservation more efficient, and involve all stakeholders in the conservation process. This process should maximize watershed conservation interests and minimize sectoral interests in watershed management.

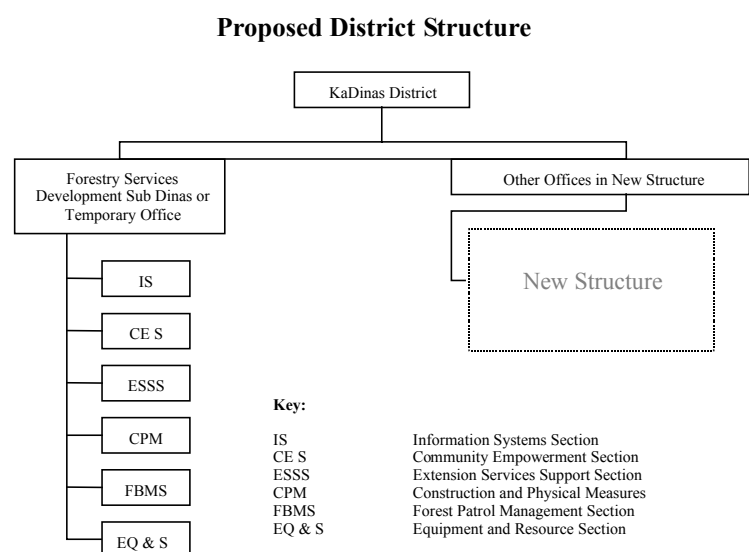
The Institutional Integration and Strengthening of Legal and Regulatory Framework would necessarily involve also significant “structural organizational” changes to ensure that the appropriate organizational homes were in place to support the modified roles of each formal office.

The institutionalization of new structure is important, for two reasons, a) the watershed management/conservation role needs to be housed within an institution with enough “power” to guarantee prominence and leadership within the watershed management process, in this respect a “Badan” is considered to be the appropriate administrative entity to assume this role, and b) the “Badan” and district forestry services office, need a number of new “organizational homes” to ensure that the minimum requirements are satisfied for project implementation and sustainable development in the post project form. It is recommended that these offices be established under a temporary project structure in the first instance, and integrated gradually into the regional government structures during the project. In the case that the new regional structures are, project implementation will integrate roles into the most appropriate units. Any units considered vital to sustainability at the end of the development period that are not in existence in the structures will be established at that time.

(2) Objective

The objectives of institutional integration and strengthening of legal and regulatory framework are:

- To adapt national laws and regulations to local conditions, formulate and establish regional regulations about forestry in line with national rules and regulations,
- To establish a joint decree between the Governor of North



Sulawesi, the Bupati of Minahasa, and the Walikota of Manado about the specific conservation management responsibilities of each with regard to forestry,

- To establish and formalize a series of watershed conservation committee meetings
- To establish a forum for integration of government activities, and
- To make organizational structural changes to support post project sustainability and development of a sustainable holistic watershed management process.

(3) Activities

Table III-2.5.1 presents the required activities.

(4) Scope

Targets of this institutional integration and strengthening of legal and regulatory framework are 50 watershed stakeholders and 50 government activity project leaders/staff to attend and present at regular meetings.

(5) Major Inputs

- Institutional Development and Information Systems Consultant (International)
- Legal Expert (National)

III-2.5.7 Strengthening of Watershed Conservation Capacity at University of Manado

(1) Background

One of the most important inputs to watershed conservation that is based on a multi-sectoral approach, is good policy research. To adequately manage the watershed and forests within the watershed, in the interests of sustainable development, innovative development strategies need to be developed, new rules and regulations researched, and local issues about water resources management need to be clarified. In order to do this a strong social research capacity is required locally. Ideally this role needs to be delegated to an existing institution with a social geography research faculty and some biotechnology background. At present, there is only one university in the watershed that is actively developing this capacity. This institution should be strengthened to amalgamate the pure watershed sciences with the social development needs and provide valuable policy input for government development and conservation planning.

(2) Objective

Strengthening of watershed conservation capacity at University of Manado has the objective to strengthen a social geography research institution for improvement of environmental education, development of environmental laws and regulations, and

build general prominence in social geographical research.

(3) Activities

The activities mentioned in Table III-2.5.1, will be applied through a repetitive cycle. The cycle will run through 6 revolutions, each time on a different but relevant current watershed management issue or topic. The activities will also include studies on water regulation, eutrophication of the lake, conservation funding and incentives for upstream water users. Results will be presented at watershed conservation committee meetings.

(4) Scope

University of Manado (Geography Faculty)

(5) Major Inputs

- International Consultant (Watershed Conservation)
- Social Geography Experts (National)
- Institutional Development and Information Systems Consultant (International)

This effort will begin in the second year of the schedule, and continue to the fifth year, along with a effort on holistic watershed conservation research from the social perspective, to integrate all findings.

III-2.5.8 Strengthening of local NGO

(1) Background

The capacity of local NGOs to effectively participate in the forest conservation process is very low. This is for a number of reasons including lack of management and administration skills, lack of equipment to support administration, and lack of mobility.

(2) Objective

This component aims to strengthen NGOs who will work closely with the District Forestry Office for project facilitation in the field, and implementation, monitoring and evaluation of activities.

(3) Activities

Local NGOs will be strengthened with technical assistance, training for members (same training as cadres) as field workers, and training for administrative staff (on the

job) to produce reports and manage internal administration. A vehicle, computers and incentives are to be provided to active local NGOs.

(4) Scope

Twenty five members to attend cadre training, 4 members to receive administration training. Included in general computer training programs and on the job training with institutional development consultants.

(5) Major Inputs

NGOs will work closely with institutional development consultants in a counterpart/on the job training arrangement.

III-2.6 Community Empowerment Plan

III-2.6.1 Basic Consideration on Community Empowerment Plan

The ultimate goal of watershed conservation is to ensure the long-term welfare of communities. It implies, on one hand, the importance of the community members to contribute to the watershed conservation as beneficiaries. On the other hand, as a driving force, the community members are called for active participation in community-based natural resource management and problem solving. The detailed socio-economic survey has found out the various constraints faced by the community to become a contributor and executor of watershed conservation, as explained previously. To overcome the constraints, community needs to be empowered.

For that reason, the JICA Study Team formulated a community empowerment plan as a part of WACSLU. From the outset, it is important to note that external stimulus, not only physical inputs but also technologies and incentives, are necessary to empower the community in the watershed, given the fact that community exists in the significantly constrained environment. For this, government institutions and civil servants must play key roles for the provision of the stimulus. Government agencies, however, have their own limitations. At present, they do not particularly have an effective mechanism and means for approaching communities directly. To reach local people and empower them, NGOs, academics, consultants and international supporters need to be mobilized. The involvement of those private parties and individuals is crucial as a catalyst between the government and community. This section outlines the proposed community empowerment plan.

The objective of community empowerment plan as a whole is to develop the capability of community to be able to improve its sustainable land use and community-based

natural resource management. The plan consists of five components: a) micro planning for sustainable land use, b) awareness raising and environmental education, c) organizing local people and reorientation of officials, d) strengthening of social safety net, and e) gender and conservation.

As a scheme to implement the community empowerment plan, the JICA Study Team proposes a pilot project. The duration of the implementation of proposed pilot project is four years with an estimated total cost for four years of Rp. 9.8 billion. Six villages should be the selected as pilot sites for the implementation. The rationale for the length and scale of the pilot project, including the number of target villages can be explained from the technical point of view. The pilot project with the proposed length and scale has its advantage for the development of methodology, approach and most importantly, human resources, all of which are inadequate in the context at present. A four-year, six-village with approximately ten billion Rupiah project is a manageable and practical one to maximize the advantage of a pilot project.

Two villages from the East, South and West Areas respectively should be the appropriate arrangement for the target villages. The recommended selection criteria for pilot villages are:

- 1) The access to/size of forest areas,
- 2) The existence of other related implementations, such as Community Forestry (*hutan kemasyarakatan*) in Ampreg village,
- 3) The consumption level of fuel wood, such as the one in Pulutan village,
- 4) The level of village leader's interest in the implementation. For this, a public meeting with village leaders should be organized.

The selection of target villages can be politically sensitive; thus requires consultations with appropriate personnel from related governments and local communities.

The number of target population depends on the populations in the target villages, but a typical village in the Intensive Area is composed of approximately 1,500 people with 450 households. Based on this, the target beneficiaries of implementation are expected to be approximately 9,000 or 2,700 households.

In order to provide local people with incentives to participate the community empowerment plan, the plan includes the provision of materials and equipment for the initiation of people-led micro realization and initial capital for a micro credit program. Also as a key external input, one full-time international consultant will be assigned as a community empowerment specialist to oversee the implementation. For other specialists, experts from academics, NGOs and governmental institutions should be considered. Research institutions, NGOs and governmental organizations can be

involved in the implementation not only as a provider of specialists but also an implementing entity per se. For example, those institutions can subcontract with the project team and carry out some of the activities in the plan, such as conducting training sessions for village cadres, organizing public meetings, facilitating community-based groups and providing technical support for micro realization and awareness raising activities, all of which are described later in this section.

The approach and learning of pilot project ought to be applied to other villages in the future, and the impact of pilot project shall be eventually extended to the whole community within the Study Area and beyond. Therefore, it is important to consider information exchange activities with the population in other villages during the pilot project. Site visits, the creation of manuals and technical papers, campaign programs and training sessions are the possible activities for this.

III-2.6.2 Micro Planning for Sustainable Land Use

(1) Background

As was pointed out in the previous section, the detailed socio-economic survey has found that one of the present problems at a community level is the absence of strategic natural resource management led by local population. Without strategic management at a grassroots level, the conditions of watershed is further deterioration is inevitable. Micro planning is an advantageous venue to strengthen the capability of community for local appraisal and strategic management at a community level.

(2) Objective

To strengthen the capability of community to assess their environmental conditions and formulate a community-based plan for watershed conservation, and to establish the network with external donors/supporters to whom the plan will be presented.

(3) Scope

- Formulate a village committee for micro planning.
- Select and train village cadres who will prepare a community-based conservation plan.
- Conduct a simple and participatory local appraisal in each target village, using a method as Rapid Rural Appraisal (RRA) or Participatory Rural Appraisal (PRA).
- Prepare the plan using a participatory planning method as ZOPP, Project Cycle Management (PCM) or Action Planning.
- Mobilize NGOs, universities and government agencies to establish a network with

external donors and supporters and present the plan to them.

(4) Major Input

1) Community Empowerment Specialist, 2) Community Organizer, 3) Participatory Planning Specialist, 4) Gender Specialist, 5) Forestry Specialist, 6) Agriculture/Agroforestry Specialist, and 7) Operation Cost

III-2.6.3 Awareness Raising and Environmental Education

(1) Background

The detailed socio-economic survey revealed that one of the major constraints in promoting sustainable land use in the Tondano watershed is the inappropriate awareness, knowledge and attitudes of local population towards conservation. For the voluntary actions and discipline towards conservation to emerge from the people, painstaking and continuous awareness raising and environmental education are needed. Awareness raising and environmental education must also be a field-oriented process, and the learning from the activities should be compiled for the future extension of the project. Therefore, NGOs and religious groups who are effective in reaching local people must be actively involved and mobilized. Schools in the area are continuously seeking special programs and external funds for their extra curriculum, thus have potential to have a key role in the implementation. Media, such as local newspapers and radio/TV broadcasters are also looking for sources of special programs and funds. It is an opportunity to maximize media's ability for the campaign of WACSLU.

(2) Objective

To nurture among target population the adequate awareness and knowledge about environmental issues in the watershed, and to develop people's enthusiasm and willingness for the advancement of WACSLU.

(3) Scope

- Develop environmental education materials, or select existing materials when available.
- Prepare a plan for campaign program.
- Establish a network with mass media, schools, churches, NGOs, indigenous organizations and governmental institutions for campaign and mobilize them.
- Train village cadres who will organize environmental events, group discussions, art caravans and environmental contests supported by the parties above.
- Ensure the environmental education to be a part of school curriculum.

(4) Major Input

1) Community Empowerment Specialist, 2) Community Organizer, 3) Environmental Education Specialist, and 4) Operation Cost

III-2.6.4 Organizing of Local People and Reorienting of Officials

(1) Background

The detailed socio-economic survey points out that the sense of natural resources as common goods has been fading away as the society becomes modernized. The modernization process weakened customary laws and traditional cohesiveness of communities, and no other norms for conservation replaced the old ones. Revitalization of collective actions should have a positive impact on conservation; for example, clove farmers organize themselves to lessen the instability of clove cultivation, which in turn would provide a long-term perspective for soil conservation.

The detailed socio-economic survey also revealed an inadequate relationship between the Forestry Services Office and local people. Personnel from the Office and the organization as a whole must be reoriented to be a part of community solutions. The forestry service with local governments should be involved in the process of creation/strengthening of community groups to be able to promote social forestry more effectively.

(2) Objective

To strengthen collective actions for the community-based promotion of sustainable land use, and to transform the frame of mind of related officials to be able to communicate and negotiate strategically with local people for alliance building.

(3) Scope

- Train the selected village cadres on organizational behavior and intercultural communication.
- Organize a series of village-level public meetings facilitated by the village cadres to discuss with officials about local issues related to watershed conservation.
- Establish/revitalize both formal and informal groups/organizations for natural resource management. The responsibility, accountability, beneficiaries and benefactors of the community-based conservation should be clearly identified and understood by local people.
- Prepare an action plan based on the WACSLU micro plan.
- Prepare sufficient resources for the implementation of action plan .

- Implement the micro realization proposed in action plan.

(4) Major Input

1) Community Empowerment Specialist, 2) Community Organizers, 3) Gender Specialist, 4) Training of Trainer Specialist, 5) Community Forestry Specialist, 6) Cost for Micro Realization and 6) Operation Cost

III-2.6.5 Strengthening of Social Safety Net

(1) Background

Based on the detailed socio-economic survey, the weak social safety net in communities creates socially and economically disadvantaged people whose agricultural and economic activities produce a reverse effect on the watershed conservation. For example, some of the illegal cultivators in the protection forest located at the South Area lost their original agricultural land due to emergency medical expenses. Another example is that many farmers use rudimentary contour ridging because they lack capital for the soil conservation measures, which is partly derived from the inadequate social safety net at the community level. Although there are some governmental attempts to improve social safety net at a community level, the attempts have been inadequate in terms of quality and quantity. Therefore, it is necessary to strengthen the economic and social security of local people for the sake of watershed conservation.

(2) Objective

To alleviate social and economic vulnerability of individual villagers to be able to practice community-based watershed conservation.

(3) Scope

- Assess the social and economic risks of communities and liability of villagers.
- Formulate a micro credit program and other forms of community-based insurance programs that will ensure the promotion to sustainable land use.
- Implement the programs.

(4) Major Input

1) Community Empowerment Specialist, 2) Community Organizer, 3) Micro Credit Specialist, 4) Gender Specialist, 5) Seed Money for Micro Credit and 6) Operation Cost

III-2.6.6 Gender and Conservation

(1) Background

Because women in the Intensive Area in general consume and benefit from particular natural resources such as fuel wood or herbs, women should have an important responsibility as a key manager of the resources. However, women's participation in conservation activities in the area is generally restricted. It is thus critical to empower women for watershed conservation so that the community-based natural resource management will be more effective.

(2) Objective

To provide men and women equal opportunities and responsibilities for watershed conservation.

(3) Scope

- Implement simple gender analysis.
- Conduct awareness raising and environmental education specifically targeting women.
- Establish mechanisms to facilitate women's access to benefits from natural conservation.
- Allocate sufficient resources to ensure that women are involved equally in watershed conservation activities.

(4) Major Input

1) Community Empowerment Specialist, 2) Community Organizer, 3) Gender Specialist, 4) Community Forestry Specialist and 5) Operation Cost

III-2.7 Monitoring and Evaluation System Development Plan

III-2.7.1 Basic Consideration on Monitoring and Evaluation System

Monitoring and evaluation are effective management method to understand the level of progress and constraints on a regular basis. The results of monitoring and evaluation will give useful information for operation and management of ongoing or future projects to be improved.

Lake Tondano has been given a very important role as the biggest water source in the region, however, scientific data are limited to explain current physical condition. Regarding erosion, monitoring makes it possible to compare actual measurements with calculated estimates and improve accuracy of the calculations. Regular

monitoring of sedimentation indicates the effect of the erosion control works. Monitoring is effective for evaluation of the conservation works and improvement of accuracy of the computation.

As well, it is indispensable to execute the monitoring and evaluation works for community empowerment, since community activities will largely affect the sustainability of watershed conservation. The problems and constraints occurred at community empowerment should be grasped on time, and these be settled and reflected upon fulfillment of the proper community empowerment.

III-2.7.2 Engineering Items

(1) Erosion and Sedimentation

For measurement of soil erosion, establishment of three monitoring stations is proposed in the West, East, and South Areas since there are different soil types, different slope, and different type of farming. Measurement will be rainfall, rainfall intensity, and amount of soil loss. Monitoring building and several plots for soil erosion measurement will be prepared for the measuring stations. Soil loss measuring plots with sediment traps should be equipped. Duration of monitoring will be 5 years.

Continuous data gathering on sedimentation is important to monitor the watershed condition. Considering the expected annual amount of sedimentation, measurement would be recommended once in 5 years in the lake. For observation of the sediment, regular survey at the existing check dams and the lake is recommended.

(2) Water Quality

Regular monitoring on the water quality is required in Lake Tondano, since water of Lake Tondano is used for fishery, drinking, etc. Frequency of water quality measurement is recommended 4 times a year. Eight sites are recommended for monitoring of water quality including cage fish culturing areas. Water samples will be taken from 4 different depths, i.e. near water surface, near lake bottom and 2 intermediate depths since the depth of the lake is different by the location in the lake. Recommended measuring items are DO, pH, EC, N, P, BOD, suspended solids, plankton, and clearness.

There are many possible pollutants, such as farm chemicals (fertilizer, pesticide, insecticide, etc.), domestic waste from the residential areas around the lake, feed from cage aquaculture, accumulated organic soils, hot spring water from the volcanoes, etc. To specify and reduce the major pollutants, continuous monitoring is not required. Analysis of the bottom materials will be done every 5 years. Sampling points should

be determined considering distribution of paddy fields, residential areas, cage aquaculture. Eight monitoring sites are recommended as same as that of water quality.

(3) Water Balance

Lake Tondano is the major water source of the region and every sector, such as hydro power, irrigation, fishery, domestic and industrial use, etc., expects to use the water. For reasonable water allocation for these water users, it is important to collect data on water balance of the lake, such as rainfall, discharge of inflow and outflow, and water surface level of the lake. The data shall be collected at least on a daily basis. Recommended number is 21 rainfall gauge stations for every 10 km² considering stretch of rainy area, 12 flow rate gauge stations mostly in-flowing rivers, and 2 water surface gauge stations in the lake. Recording rainfall gauge or recording water level gauge will be equipped for every measuring stations.

(4) Watershed Information System

Total watershed information system is proposed to collect and analyze the data on erosion and sediment, water quality and hydrology. In addition, slope failure, and landslide observation and river erosion observation shall be done by this system. To store and analyze the above records, the existing computer and GIS system in *BRLKT* office will be used.

(5) Necessary Data and Equipment

The necessary data and equipment for monitoring and evaluation system are given in Appendix H. And also, locations of measurement sites and equipment installation sites are given in the Watershed Conservation Plan Map and Appendix-H.

III-2.7.3 Socio-Economic Items

(1) Background

Indicators to be monitored and evaluated should be identified in accordance with the objectives and expected outcomes of the implementation. The indicators must be objectively verifiable, and data and information for the verification must be retainable. The monitoring and evaluation process should be participatory as suggested in the scope below, and the results must be disclosed to the public as to a transparency purpose.

(2) Objectives

- To provide relevant information and data to implementers and supporting agencies to be able to facilitate decision making for community empowerment.
- To develop socio-economic assessment techniques necessary for the comprehensive environmental monitoring and evaluation.

(3) Scope

- Train village cadres who will execute appraisal and information collection at a village level.
- Select participatory monitoring and evaluation methods, such as ZOPP, Project Cycle Management (PCM) or logical framework.
- Identify indicators to be monitored and evaluated, and prepare a monitoring and evaluation plan and schedule.
- Gather basic data and information necessary to monitor and evaluate the implementation of community empowerment using community appraisal methods as Rapid Rural Appraisal (RRA) or Participatory Rural Appraisal (PRA).
- Implement the regular monitoring and evaluation with the leadership of village cadres.
- Make the monitoring and evaluation results public and compose recommendations for community empowerment.

(4) Major Input

1) Community Empowerment Specialist, 2) Community Organizer, 3) Monitoring and Evaluation Specialist, 4) Gender Specialist and 5) Operation Cost