

Tables

Table II-1.4.1 General Overview of Spatial Plan (*Rencana Tata Ruang Wilayah, RTRW*)

| No. | S P A T I A L P L A N (<i>RENCANA TATA RUANG WILAYAH, RTRW</i>) | | |
|------------------------|--|--|---|
| | NATIONAL LEVEL | PROVINCIAL LEVEL | DISTRICT LEVEL |
| COVERAGE | Strategic and recommended policy of the national spatial utilization that consist of: a. national objectives of spatial utilization for improving community welfare and security defense. b. Structure and pattern of national spatial utilization c. Criteria and pattern of the management of protected zone, cultivation zone and specific zone. | Spelling out of the strategic and recommended policy of the national spatial utilization into structure and strategy of provincial spatial utilization that consist of: a. Provincial objectives of spatial utilization for improving community welfare and security defense. b. Structure and pattern of provincial spatial utilization c. Guidance for provincial spatial utilization control | Spelling out of the provincial spatial utilization into the implementation strategy of provincial spatial utilization that consist of: a. District objectives of spatial utilization for improving community welfare and security defense. b. Structure and pattern of district spatial utilization plan c. General plan and spatial plan of district d. Guidance for controlling district spatial utilization |
| CONTENT | a. National protection zone, cultivation zone, and specific zone b. Condition and criteria of spatial utilization c. Guidance for spatial utilization control | a. Recommendation of the management of protection and cultivation zone, b. Recommendation of the management of rural zone, urban zone, and specific zone. e. Recommendation of zone development for settlements, forestry, agriculture, mining, industry, tourism and others. f. Recommendation of central system development for rural and urban settlements g. Recommendation of regional infrastructure systems: transportation, telecommunication, energy water resources, and environment management, h. Recommendation of the priority zone, i. Recommendation policies of land use plan, water use plan, space use plan, other natural resources use plan, and pay attention for the integrity of human and artificial resources. | a. The management of protection zone and cultivation zone b. The management of rural zone, urban zone, and specific zone, c. Systems of development activities and rural and urban settlements d. Infrastructure systems of transportation, telecommunication, energy, water resources, and environment management e. Land use plan, water use plan, space use plan, other natural resources use plan, and pay attention for the integrity of human and artificial resources. |
| GUIDELINES FOR | a. Formulation of integrity, interrelatedness, and balance of inter-region development and inter-sector harmony b. Creating integrity, interrelatedness, and balance of inter-region development and inter-sector harmony c. Recommendation of investment place d. Provincial and district planning | a. formulation of main provincial spatial plan policies b. Creating integrity, interrelatedness, and balance of inter-provincial development and inter-sector harmony c. Recommendation of investment place d. District spatial planning which is a basis for controlling the permission of development location | a. formulation of main district spatial plan policies b. Creating integrity, interrelatedness, and balance of inter-district development and inter-sector harmony c. Determining location of investment d. Formulating detailed district spatial plan e. Using land/space for development activities |
| PERIOD | 25 years | 15 years | 10 years |
| REGULATION | Government regulation (<i>peraturan pemerintah</i>) | Regional regulation (<i>peraturan daerah</i>) | Regional regulation (<i>peraturan daerah</i>) |
| SCALE/INTENSITY | Minimum 1 : 1.000.000 | Minimum 1 : 250.000 | Minimum 1 : 100.000 |

Table II-1.4.2 Planning and Zoning of Spatial Utilization in Tondano Watershed (1/2)

| No | ZONES | Location according to | | |
|----------|--|---|--|--|
| | | Provincial Spatial Plan (<i>RTRW Propinsi</i>) by <i>BAPPEDA PROPINSI</i> | District Spatial Plan (<i>RTRW Kabupaten</i>) by <i>BAPPEDA Minahasa</i> | Zonation of TWS by <i>PU Pengairan</i> |
| A | RECOMMENDATION OF STABILIZING PROTECTED ZONE | | | |
| A.1 | ZONE FOR PROTECTING ITS LOWER AREA 1. PROTECTED FOREST ZONE 2. WATER ABSORPTION ZONE | Mt.Klabat, Mt.Manimporok Protected forest and Tondano watershed | Mt. Klabat, Mt. Lembean, Mt. Mahawu, Mt. Masarang, Mt. Tampusu, Mt. Lengkoan, Mt. Kawatak, Mt. Soputan Protected forest and Mt. Manimporok | Districts of Tompaso, Langowan, Kakas, Remboken, Eris, Tondano, Tomohon, Pineleng, Kauditan, Airmadidi -----same as above----- ----- |
| A.2 | IN-SITU PROTECTION ZONE 1. RIVER BANK ZONE 2. SURROUNDING LAKE ZONE 3. SURROUNDING WATER SPRING ZONE | River Tondano Lake Tondano Not yet indicated | River Tondano (100 m of left-right side), River Tikala (50m of left-right side) Lake Tondano (50 – 100 m surrounding lake), Lake Sendow (50 m surrounding lake) Not yet indicated | River Tondano and River Tikala Lake Tondano All water spring in the catchment (in radius of 200 m) |
| A.3. | NATURAL AND CULTURAL RESERVE ZONE 1. NATURAL RESERVE ZONE 2. CULTURE RESERVE ZONE | Not indicated Not indicated | Not indicated Ancient Tomb in Sawangan-Airmadidi | Tomohon and around the lake (ecotourism park) Not indicated |
| A.4. | SENSITIVE NATURAL DISASTER ZONE 1. VOLCANOES ERUPTION 2. MASS MOVEMENT/LANDSLIDE 3. FLOODING | Mt.Mahawu, Mt.Soputan Not indicated Not indicated | Mt. Mahawu, Mt.Soputan Telap – Tasuka Not indicated | Not indicated Not indicated Cities of Manado and Tondano |
| B | RECOMMENDATION OF DEVELOPMENT OF CULTIVATION ZONE | | | |
| B.1 | PRODUCTION FOREST ZONE | - | - | |
| B.2 | AGRICULTURE ZONE 1. WETLAND CEREAL CROPS ZONE 2. ESTATE AND CEREAL DRYLAND FARMING ZONE 3. ANIMAL HUSBANDRY ZONE 4. FISHERY ZONE | | Tondano, Kakas, Remboken, Langowan Clove cultivation: Kombi, Eris, Kakas, Tomohon, Tondano, Pineleng; Coconut cultivation: Airmadidi, Pineleng, Dimembe; Coffee cultivation: Tomohon, Langowan, Tompaso, Kakas, Kawangkoan; Nutmeg cultivation: Kauditan, Airmadidi; Cinnamon cultivation: Langowan Fruit trees: Dimembe (<i>Nephelium</i> , <i>Durian</i>); Vegetables: Tomohon, Remboken, Kawangkoan; Floriculture: Remboken Poultry commodity (Ducks): Remboken, Kakas, Tondano Livestock: Langowan (Goat) Animal Husbandry: Langowan, Tomp[aso, Tondano (Sapi, Kuda) Freshwater fish: Kakas, Eris, Tondano (around lake Tondano) | Tompaso, Kakas, Tondano, Eris, Airmadidi, Langowan <u>Cereal dryland farming</u> : Tompaso, Langowan, Eris, Remboken, Tondano, Airmadidi <u>Estates Crops</u> : Langowan, Eris, Remboken, Tondano, Airmadidi, Mapanget, Kauditan, Tomohon, Pineleng <u>Animal Husbandary</u> : Tondano, Langowan, Remboken, and Tomohon Lake Tondano, Airmadidi, River Tondano |
| B.3 | ZONE OF MINING | Not indicated | Digging (<i>Galian C</i>): Maumbi, Noongan, Districts of Langowan, Dimembe (Klabat) have to be monitored periodically | - |

Table II-1.4.2 Planning and Zoning of Spatial Utilization in Tondano Watershed (2/2)

| No | ZONES | Location according to | | |
|-----------|--|---|--|---|
| | | Provincial Spatial Plan (<i>RTRW Propinsi</i>) by <i>BAPPEDA PROPINSI</i> | District Spatial Plan (<i>RTRW Kabupaten</i>) by <i>BAPPEDA Minahasa</i> | Zonation of TWS by <i>PU Pengairan</i> |
| B.4. | ZONE OF INDUSTRY | Not indicated | Tourism industry (mountain, lake tourism) and agroindustry: Districts of Tomohon, Langowan, Kakas, Eris, Tondano, and Remboken | |
| B.5. | ZONE OF TOURISM | | Main tourism zone of Tomohon – Tondano and its surrounding: Water tourism, ecotourism (agritourism) | Langowan, Tompas, Remboken, Tondano, Tomohon, Airmadidi, Manado |
| B.6. | ZONE OF SETTLEMENTS | | Development of planned housing: Airmadidi, Pineleng, Tondano, Kauditan, Remboken, Langowan, Kawangkoan; Resting places: Tondano, Remboken, Kakas; Labor housing: Kauditan, Airmadidi | All kecamatan |
| C. | RECOMMENDATION OF DEVELOPING RURAL ZONE | | | |
| D. | RECOMMENDATION OF DEVELOPING URBAN ZONE | | | |
| E. | RECOMMENDATION OF SPECIFIC ZONE | | | |
| E.1. | INTEGRATED ECONOMIC DEVELOPMENT ZONE (<i>KAPET</i>) MANADO - BITUNG | | Manado – Bitung corridor (core zone of <i>KAPET</i> industry) | |
| F. | RECOMMENDATION OF DEVELOPING AND MANAGING PRIORITY ZONE | | | |
| F.1. | DEVELOPING STRATEGIC ZONE 1. WATER TOURISM: LAKE TONDANO | | Integrated with other tourism activities as like <i>FESBUDATON</i> (in Paleloan village), Pottery handicraft industry (Pulutan village) | |
| F.2. | DEVELOPING GROWTH REGIONAL TRIGGER ZONE | | - | |
| F.3. | DEVELOPING FAST GROWTH AREA 1. CORRIDOR OF MANADO – BITUNG 2. CORRIDOR OF MANADO – TOMOHON | | Along corridor Manado – Bitung Along corridor Manado – Tomohon | |
| G. | DEVELOPING SPECIAL ZONE 1. MANADO – BITUNG HIGHWAY 2. TONDANO RIVER DAM | | Along the planned highway Not yet indicated | |

Sources :

1. Review of Spatial/Land Use Plan of North Sulawesi (Review *Rencana Tata Ruang Wilayah Propinsi Sulawesi Utara*). 2000. Regional Government of Province of North Sulawesi. Manado.
2. Review of Spatial/Land Use Plan of District of Minahasa (Review *Rencana Tata Ruang Wilayah Kabupaten Minahasa*). 1997. Regional Government of District of Minahasa. Tondano
3. Zonation of Tondano Watershed (*Pekerjaan Penataan Kawasan DAS Tondano*). 1997. Dinas Pekerjaan Umum Propinsi Sulawesi Utara. Manado.

Table II-1.4.3 Scores for Determining Recommended Land Use**1. Classification of Intensity of Daily Rainfall and its Score**

| No | Intensity of daily rainfall (mm/day) | Class | Score |
|----|--------------------------------------|-----------|-------|
| 1. | < 13.60 | very low | 10 |
| 2. | 13.6 – 20.7 | low | 20 |
| 3. | 20.7 – 27.7 | moderate | 30 |
| 4. | 27.7 – 34.8 | high | 40 |
| 5. | > 34.8 | very high | 50 |

2. Classification Soil Type and its Score

| No | Soil Type (Center for Soil Research, Bogor) | Classification | Score |
|----|--|----------------------|-------|
| 1. | Aluvial, Gley Planosol, Hidromorf Kelabu, Laterik Air | Not sensitive | 15 |
| 2. | Tanah | Low sensitive | 30 |
| 3. | Latosol | Moderately sensitive | 45 |
| 4. | Brown Forest Soil, Non Calcic Brown, Mediteran | Sensitive | 60 |
| 5. | Andosol, Laterit, Grumusol, Podsol, Podsolik Regosol, Litosol, Organosol, Renzina | Very sensitive | 75 |

3. Classification of Slope and its Score

| No | Slope gradient (%) | Classification | Score |
|----|----------------------|----------------|-------|
| 1. | 00 - 08 | Flat | 20 |
| 2. | 08 – 15 | Gentle | 40 |
| 3. | 15 – 25 | Moderate | 60 |
| 4. | 25 – 40 | Steep | 80 |
| 5. | > 40 | very steep | 100 |

Table II-1.4.4 Concept of Action Plan of Tondano Watershed Conservation

| No. | Main activities | Description | Executing agency |
|-----|--|---|---|
| 1. | Protecting sedimentation | Reforestation/Planting: 1. Nursery/sedling: a. Reforestation b. Planting 2. Rearing 3. Construction of check dam 4. Maintaining of the dam | Kanwil Forestry & Estates Crops Dinas Kehutanan Propinsi Dinas Kehutanan Kabupaten Dinas PU (Pengairan) |
| 2. | Water Use | Water use retribution | Reg. Govn. Propinsi & Kabupaten, Dipenda, DPRD |
| 3. | Water lake polution | 1. Garbage management and weeds control 2. Hadycraft industry (Eceng gondok) 3. Controlling of Liquid garbage, fertilizer, pesticide, detergent, etc (extension service for floating net fishery) | Dinas PU (pengairan) Kanwil industry and commerce BAPEDALDA Dinas Perikanan Propinsi |
| 4. | Sempadan Danau dan sungai (surrounding lake and river bank zone) | 1. delimiting boundary of zone 2. Extension and sosialisasi | BAPPEDA Minahasa BAPPEDA Minahasa |
| 5. | Spatial Plan of the Watershed | 1. Detailed spatial plan Second year: legalization and sosialisasi 2. Defining forest boundary | UNSRAT, BAPPEDA, PU (cipta karya) Dinas Kehutanan Propinsi |
| 6. | Demography/ pressure on the watershed | 1. Resettlement 2. application of appropriate technology for conserving land (training) 3. Diversification and supplement livelihood (seeds assistance) 4. Research in demography and ecosystem. The activities: 1 st year : preliminary study on community perception 2 nd year experimental study (pilot project) 3 rd – 4 th year : implementation 5. improving community awareness and attitude changing 1 st year: extension/training 2 nd year:developing environmental human resources 3 rd year: improving capability and participation of NGOs 4 th year: giving appreciation 5 th year: evaluation 6. Training on environmental aspects 7. Funds assistance for farmers | Regional government (Prop. & Kab.) Politeknik, Kanwil Pertanian Kanwil industry & commerce UNSRAT BAPEDALDA BAPEDALDA BAPEDALDA |
| 7. | Watershed Management Institution | 1. Formulating the Management Board 2. Formulating and revising the regulation 3. Extension services for stakeholders 4. Formulating integrated watershed management 5. Obtaining environmental geology data/information 6. Supervising/ law enforcement 7. Evaluation | BAPPEDA, LAW BUREAU OF REGIONAL GOVNT. NGOs Related agency Kanwil Pertambangan (mining office) Police Department BAPPEDA |

**Table II-1.5.1 Distribution of Reforestation in and around Tondano Watershed
during 1976 – 1999**

| Fiscal Year | Location | Area (ha) | Failure | | | | Success | Grown species |
|-------------|----------------------------|-----------|---------|-------|-----------------|-------|---------|----------------|
| | | | Fired | Fail | Cleared Away | Total | | |
| 1976/1977 | Mt. Potong Noongan | 71 | 71 | 0 | 0 | 0 | 0 | Pine, etc |
| | | 529 | 0 | 297 | 0 | 297 | 232 | Pine, etc |
| 1977/1978 | Mt. Soputan Kayuwatu | 2.400 | 0 | 1.786 | 614 | 2.400 | 0 | Pine, etc |
| | | 200 | 0 | 0 | 200 | 200 | 0 | Pine, etc |
| 1980/1981 | Mt. Masarang Mt. Mahawu | 175 | 175 | 0 | 0 | 175 | 0 | Pine, etc |
| | | 200 | 65 | 135 | 0 | 200 | 0 | Pine, etc |
| 1981/1982 | Mt. Mahawu | 170 | 78 | 92 | 0 | 170 | 0 | Pine, etc |
| 1983/1984 | Mt. Soputan | 100 | 100 | 0 | 0 | 100 | 0 | Pine, etc |
| 1984/1985 | Mt. Soputan | 500 | 115 | 0 | 0 | 115 | 385 | Pine, Nantu |
| | Mt. Kawatak | 100 | 0 | 0 | 35 | 35 | 65 | Pine, Nantu |
| | Tumaratas | 100 | 0 | 25 | 0 | 25 | 75 | Pine, Nantu |
| 1985/1986 | Makalonsow Mt. Lembean | 200 | 0 | 30 | 0 | 30 | 170 | Pine, Nantu |
| | | 100 | 100 | 0 | 0 | 100 | 0 | Pine, Nantu |
| 1986/1987 | Mt. Lembean | 300 | 0 | 0 | 0 | 0 | 300 | Pine, Nantu |
| 1988/1989 | Makalonsow | 100 | 0 | 0 | 0 | 0 | 100 | Nantu, etc |
| 1991/1992 | Ranolambot | 150 | 0 | 50 | 0 | 50 | 100 | Nantu, etc. |
| 1992/1993 | Mt. Soputan | 150 | 0 | 0 | 0 | 0 | 150 | Nantu, etc. |
| 1993/1994 | Ranolambot | 100 | 0 | 0 | 0 | 0 | 100 | Nantu, etc. |
| | Noongan | 200 | 0 | 0 | 0 | 0 | 200 | Nantu, etc. |
| 1994/1995 | Makalonsow | 200 | 200 | 0 | 0 | 200 | 0 | Gmelina, Nantu |
| 1995/1996 | Makalonsow | 400 | 0 | 0 | 0 | 0 | 400 | Gmelina, Nantu |
| 1996/1997 | Makalonsow | 600 | 0 | 0 | 0 | 0 | 600 | Gmelina, Nantu |
| 1998/1999 | Rerer | 100 | 0 | 0 | 0 | 0 | 100 | Gmelina, MPTS |

Source: Statistics of Dinas Kehutanan Dati I Sulawesi Utara, 1999.

Personal communication with Katuuk, 2000

Table II-1.5.2 Regreening Activities in Tondano Watershed in FY 1999/2000

| No. | Location | Activities | Area/Unit |
|-------------------------------------|-------------------------|-------------------------|-----------|
| I. Tondano Sub-district | | | |
| 1 | Kelurahan' Rinegetan | Private Forest / Estate | 50 ha |
| 2 | Kelurahan' Sumalangka | Private Forest / Estate | 50 ha |
| 3 | Kelurahan' Wewelen | Private Forest / Estate | 25 ha |
| 4 | "Kelurahan' Tataaran II | Private Forest / Estate | 25 ha |
| 5 | Kelurahan' Tataaran II | Private Forest / Estate | 50 ha |
| 6 | Kelurahan' Paleloan | Private Forest / Estate | 25 ha |
| 7 | Kelurahan' Tuutu | Private Forest / Estate | 50 ha |
| | | KBD | 0,5 ha |
| 8 | Kelurahan' Wawalintowan | Private Forest / Estate | 50 ha |
| II. Toulimambot Sub-district | | | |
| 1 | Kelurahan' Kiniar | Private Forest / Estate | 50 ha |
| | | UP-UPSA' | 1 unit |
| 2 | Kelurahan' Taler | Private Forest / Estate | 50 ha |
| III. Eris Sub-district | | | |
| 1 | Desa' Touliang Oki | Private Forest / Estate | 50 ha |
| | | UP-UPSA | 1 unit |
| 2 | Desa' Tandengan | Private Forest / Estate | 50 ha |
| 3 | Desa' Eris | Private Forest / Estate | 50 ha |
| IV. Kakas Sub-district | | | |
| 1 | Desa' Simbel | Private Forest / Estate | 50 ha |
| 2 | Desa' Toulimambe | Private Forest / Estate | 50 ha |
| 3 | Desa' Tounumomei | Private Forest / Estate | 50 ha |
| 4 | Desa' Kaweng | UP-UPSA | 1 unit |
| V. Remboken Sub-district | | | |
| 1 | "Desa' Talikuran | Private Forest / Estate | 50 ha |
| 2 | Desa' Paslaten | Private Forest / Estate | 50 ha |
| 3 | "Desa' Sionia | Private Forest / Estate | 50 ha |
| 4 | Desa' Kaima | Private Forest / Estate | 50 ha |
| VI. Tomohon Sub-district | | | |
| 1 | "Desa' Rurukan | Preventor / Check Dam | 1 unit |
| VII. Langowan Sub-district | | | |
| 1 | Desa' Teep | Private Forest / Estate | 50 ha |
| 2 | Desa' Touneiei | Private Forest / Estate | 50 ha |
| 3 | Desa' Manembo | Private Forest / Estate | 50 ha |
| 4 | Desa' Winebetan | Private Forest / Estate | 50 ha |
| 5 | Desa' Kaayuran Atas | Private Forest / Estate | 50 ha |
| | | KBD | 1 unit |
| 6 | Desa' Waleure | KBD | 0,5 unit |
| 7 | Desa' Temboan | Private Forest / Estate | 25 ha |
| 8 | Desa' Noongan | KBD | 0,5 ha |
| VIII. Tompaso Sub-district | | | |
| 1 | Desa' Toure | Private Forest / Estate | 50 ha |
| 2 | Desa' Tonsewer | Private Forest / Estate | 50 ha |
| IX. Pineleng Sub-district | | | |
| 1 | Desa' Sawangan | Private Forest / Estate | 50 ha |
| | | Preventor / Check Dam | 1 unit |
| 2 | Desa' Ramangia | Private Forest / Estate | 50 ha |
| | | KBD | 1 unit |
| 3 | Desa' Tombuluan | Private Forest / Estate | 50 ha |
| 4 | Desa' Kembes | Private Forest / Estate | 50 ha |
| 5 | Desa' Koka | Private Forest / Estate | 25 ha |
| X. Airmadidi Sub-district | | | |
| 1 | Kelurahan' Sukur | Private Forest / Estate | 50 ha |
| 2 | Kelurahan' Sarongsong I | Preventor / Check Dam | 1 unit |
| 3 | Desa' Tanggari | Private Forest / Estate | 50 ha |
| | | KBD | 1 unit |
| 4 | Desa' Rumengkor | Private Forest / Estate | 25 ha |
| 5 | Desa' Kembuan | Private Forest / Estate | 50 ha |
| 6 | Desa' Kolongan | Private Forest / Estate | 50 ha |
| XI. Dimembe Sub-district | | | |
| 1 | Desa' Paniki Atas | Private Forest / Estate | 50 ha |
| | | Preventor / Check Dam | 1 unit |
| 2 | Desa' Matungkas | Private Forest / Estate | 50 ha |
| | | Preventor / Check Dam | 1 unit |

Notes: * KBD = Kebun Bibit Desa (Village Nursery)

** UP-UPSA (Unit Percontohan Usaha Pelestarian Sumber Daya Alam) = Demonstration Plot for Conservation of Natural Resources

Table II-1.6.1 Production of Major Crops

| (1) Harvested Area of Food Crops in the Study Area (1998) | | | | | | | | | | unit: ha |
|--|---------------|--------------|---------------|-----------|---------------|-------------|-------------|-----------|---------------|----------|
| Sub-district | Lowland paddy | Upland paddy | Maize | Cassava | Swee potatoes | Ground nuts | Green grams | Soybeans | Total | |
| Longowan | 1,400 | 0 | 870 | 2 | 3 | 12 | 0 | 0 | 2,287 | |
| Kakas | 2,070 | 40 | 874 | 0 | 12 | 0 | 0 | 0 | 2,996 | |
| Tompaso | 1,028 | 0 | 2,201 | 2 | 4 | 21 | 0 | 0 | 3,256 | |
| Remboken | 604 | 0 | 1,483 | 39 | 13 | 62 | 0 | 0 | 2,201 | |
| Eris | 344 | 0 | 282 | 3 | 0 | 0 | 0 | 0 | 629 | |
| Tondano | 1,926 | 0 | 2,764 | 8 | 6 | 55 | 0 | 0 | 4,759 | |
| Toul imambot | 2,310 | 0 | 2,787 | 3 | 0 | 36 | 0 | 5 | 5,141 | |
| Tomohon | 49 | 0 | 89 | 6 | 6 | 7 | 0 | 0 | 157 | |
| Kauditan | 454 | 0 | 245 | 19 | 0 | 4 | 0 | 0 | 722 | |
| Airmadidi | 329 | 35 | 1,080 | 0 | 0 | 20 | 0 | 8 | 1,472 | |
| Pineleng | 56 | 18 | 958 | 6 | 8 | 4 | 0 | 0 | 1,050 | |
| Study Area | 10,514 | 75 | 12,675 | 82 | 44 | 217 | 0 | 13 | 23,620 | |

| (2) Production of Food Crops in the Study Area (1998) | | | | | | | | | | unit: tons |
|--|---------------|--------------|---------------|--------------|---------------|-------------|-------------|-----------|--|------------|
| Sub-district | Lowland paddy | Upland paddy | Maize | Cassava | Swee potatoes | Ground nuts | Green grams | Soybeans | | |
| Longowan | 7,840 | 0 | 2,696 | 54 | 30 | 15 | 0 | 0 | | |
| Kakas | 9,936 | 84 | 2,526 | 0 | 0 | 1 | 0 | 0 | | |
| Tompaso | 6,029 | 0 | 6,709 | 26 | 100 | 24 | 0 | 0 | | |
| Remboken | 2,947 | 0 | 5,339 | 585 | 65 | 59 | 0 | 0 | | |
| Eris | 1,664 | 0 | 1,008 | 39 | 0 | 0 | 0 | 0 | | |
| Tondano | 8,628 | 0 | 9,508 | 134 | 23 | 65 | 0 | 0 | | |
| Toul imambot | 9,471 | 0 | 5,379 | 49 | 0 | 39 | 0 | 5 | | |
| Tomohon | 239 | 0 | 196 | 66 | 83 | 8 | 0 | 0 | | |
| Kauditan | 2,146 | 0 | 649 | 273 | 0 | 4 | 1 | 0 | | |
| Airmadidi | 1,582 | 74 | 2,268 | 0 | 0 | 20 | 0 | 8 | | |
| Pineleng | 224 | 33 | 3,399 | 71 | 37 | 5 | 0 | 0 | | |
| Study Area | 50,482 | 158 | 36,278 | 1,226 | 301 | 235 | 1 | 13 | | |

| (3) Yield of Food Crops in the Study Area (1998) | | | | | | | | | | unit: kg/ha |
|---|---------------|--------------|--------------|---------------|---------------|--------------|--------------|--------------|-------|-------------|
| Sub-district | Lowland paddy | Upland paddy | Maize | Cassava | Swee potatoes | Ground nuts | Green grams | Soybeans | | |
| Longowan | 5.600 | | 3.099 | 27.000 | 10.000 | 1.250 | | | | |
| Kakas | 4.800 | 2.100 | 2.890 | | 0.000 | | | | | |
| Tompaso | 5.865 | | 3.048 | 13.000 | 25.000 | 1.143 | | | | |
| Remboken | 4.879 | | 3.600 | 15.000 | 5.000 | 0.952 | | | | |
| Eris | 4.837 | | 3.574 | 13.000 | | | | | | |
| Tondano | 4.480 | | 3.440 | 16.750 | 3.833 | 1.182 | | | | |
| Toul imambot | 4.100 | | 1.930 | 16.333 | | 1.083 | | | 1.000 | |
| Tomohon | 4.878 | | 2.202 | 11.000 | 13.833 | 1.143 | | | | |
| Kauditan | 4.727 | | 2.649 | 14.368 | | 1.000 | | | | |
| Airmadidi | 4.809 | 2.114 | 2.100 | | | 1.000 | | | 1.000 | |
| Pineleng | 4.000 | 1.833 | 3.548 | 11.833 | 4.625 | 1.250 | | | | |
| Study Area | 4.801 | 2.107 | 2.862 | 14.951 | 6.841 | 1.083 | 1,824 | 1,058 | | |

Source: Laporan Tahunan, Dinas Pertanian Tanaman Pangan Kab. Minahasa

Table II-1.6.2 Production of Major Estate Crops

| (1) Area of Estate Crops in the Study Area (1998) | | | | | | | Unit:ha |
|--|----------------|---------------|--------------|--------------|------------|--------------|----------------|
| Sub-District | Coconut | Clove | Coffee | Vanilla | Nutmeg | Cocoa | Total |
| Langowan | 256 | 265 | 8 | 44 | 2 | 6 | 581 |
| Kakas | 215 | 609 | 18 | 29 | 2 | 17 | 890 |
| Tompaso | 78 | 72 | 52 | 4 | 5 | 0 | 211 |
| Remboken | 20 | 80 | 118 | 15 | 0 | 2 | 235 |
| Eris | 13 | 342 | 13 | 10 | 0 | 4 | 382 |
| Tondano | 12 | 60 | 266 | 55 | 0 | 0 | 393 |
| Toulimambc | 14 | 605 | 36 | 19 | 0 | 0 | 674 |
| Tomohon | 25 | 56 | 8 | 5 | 0 | 0 | 94 |
| Kauditan | 1,760 | 195 | 12 | 28 | 122 | 21 | 2,138 |
| Airmaditi | 8,698 | 998 | 38 | 76 | 24 | 49 | 9,883 |
| Pineleng | 3,179 | 899 | 7 | 37 | 3 | 8 | 4,133 |
| Study total | 11,091 | 3,282 | 569 | 285 | 155 | 99 | 15,481 |
| Minahasa | 130,755 | 35,540 | 2,378 | 2,936 | 885 | 2,451 | 174,945 |

| (2) Number of Trees of Estate Crops in the Study Area (1998) | | | | | | |
|---|-------------------|------------------|------------------|------------------|----------------|------------------|
| Sub-District | Coconut | Clove | Coffee | Vanilla | Nutmeg | Cocoa |
| Langowan | 28,813 | 66,454 | 9,176 | 105,874 | 494 | 5,717 |
| Kakas | 26,313 | 189,908 | 18,494 | 71,531 | 3,536 | 17,094 |
| Tompaso | 5,401 | 5,906 | 52,429 | 11,644 | 431 | 0 |
| Remboken | 2,200 | 16,010 | 117,988 | 37,250 | 0 | 2,000 |
| Eris | 1,083 | 65,529 | 12,960 | 21,242 | 0 | 4,050 |
| Tondano | 1,232 | 12,137 | 265,000 | 72,670 | 0 | 0 |
| Toulimambc | 1,584 | 121,800 | 39,142 | 47,000 | 0 | 0 |
| Tomohon | 3,026 | 13,010 | 8,219 | 4,866 | 58 | 627 |
| Kauditan | 244,267 | 38,922 | 7,966 | 51,189 | 22,650 | 21,173 |
| Airmaditi | 1,128,947 | 199,600 | 43,699 | 150,000 | 4,800 | 50,430 |
| Pineleng | 476,567 | 127,719 | 7,112 | 76,930 | 0 | 8,292 |
| Study Area | 1,442,866 | 729,276 | 575,073 | 573,266 | 31,969 | 101,091 |
| Minahasa | 16,348,456 | 7,766,672 | 2,399,458 | 6,486,902 | 162,244 | 2,322,235 |

| (3) Number of Productive Trees of Estate Crops in the Study Area (1998) | | | | | | |
|--|-------------------|------------------|------------------|------------------|----------------|------------------|
| Sub-District | Coconut | Clove | Coffee | Vanilla | Nutmeg | Cocoa |
| Langowan | 22,637 | 66,454 | 8,117 | 105,873 | 494 | 5,717 |
| Kakas | 26,313 | 185,136 | 16,862 | 68,811 | 0 | 16,999 |
| Tompaso | 4,855 | 4,519 | 44,100 | 10,306 | 991 | 0 |
| Remboken | 2,200 | 16,000 | 113,002 | 37,250 | 0 | 2,000 |
| Eris | 357 | 64,800 | 12,234 | 21,121 | 243 | 4,050 |
| Tondano | 931 | 10,230 | 250,000 | 59,970 | 400 | 0 |
| Toulimambc | 1,213 | 118,427 | 35,000 | 29,600 | 0 | 0 |
| Tomohon | 2,970 | 10,400 | 7,888 | 3,373 | 58 | 406 |
| Kauditan | 232,408 | 37,147 | 7,036 | 51,189 | 21,345 | 17,549 |
| Airmaditi | 1,119,955 | 199,600 | 27,699 | 150,000 | 3,200 | 30,630 |
| Pineleng | 468,221 | 126,900 | 3,515 | 47,263 | 409 | 4,576 |
| Study Area | 1,413,839 | 712,713 | 521,938 | 537,493 | 26,731 | 77,351 |
| Minahasa | 14,848,794 | 7,379,128 | 2,149,944 | 5,691,897 | 150,188 | 2,004,462 |

| (4) Production of Estate Crops in the Study Area (1998) | | | | | | | Unit:tons |
|--|----------------|--------------|--------------|------------|-----------|------------|-----------|
| Sub-District | Coconut | Clove | Coffee | Vanilla | Nutmeg | Cocoa | |
| Langowan | 198 | 46 | 9 | 17 | na | 2 | |
| Kakas | 231 | 131 | 15 | 11 | na | 5 | |
| Tompaso | 42 | 3 | 48 | 2 | na | 0 | |
| Remboken | 19 | 11 | 125 | 5 | na | 0 | |
| Eris | 3 | 49 | 15 | 4 | na | 2 | |
| Tondano | 8 | 6 | 255 | 63 | na | 0 | |
| Toulimambc | 10 | 82 | 37 | 3 | na | 0 | |
| Tomohon | 26 | 7 | 5 | 3 | na | 0 | |
| Kauditan | 2,220 | 26 | 7 | 9 | na | 5 | |
| Airmaditi | 9,823 | 139 | 28 | 26 | na | 10 | |
| Pineleng | 4,107 | 92 | 4 | 23 | na | 1 | |
| Study Area | 12,580 | 500 | 544 | 143 | na | 24 | |
| Minahasa | 130,246 | 5,132 | 2,200 | 456 | na | 624 | |

Source: Laporan Tahunan, Dinas Perkebunan Kab. Minahasa

Table II-1.6.3 Animal Population

(1) Animal Population in Minahasa District

| | 1994 | 1995 | 1996 | 1997 | 1998 | Average |
|-------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Cattle | 44,171 | 44,877 | 45,397 | 46,986 | 47,409 | 46,167 |
| Horse | 9,697 | 9,289 | 9,391 | 9,532 | 9,837 | 9,512 |
| Goat | 8,456 | 8,315 | 8,666 | 9,446 | 7,434 | 8,465 |
| Pig* | 397,075 | 357,246 | 82,945 | 102,851 | 119,307 | 165,587 |
| Local chicken | 1,271,697 | 1,275,507 | 1,328,877 | 1,354,126 | 1,150,736 | 1,277,312 |
| Duck | 151,818 | 169,257 | 163,546 | 141,141 | 42,634 | 129,145 |
| Chicken for egg | 349,300 | 197,488 | 238,072 | 232,800 | 204,438 | 218,200 |
| Chicken for meat [§] | 145,175 | 145,175 | 194,785 | 217,359 | 232,987 | 197,577 |

*: Pig population 1996 is decreased by pig cholera

**.: Production per month

Source: Laporan Tahunan, Dinas Peternakan, Tondano 1999

(2) Animal Population in Related Sub-district (1999)

| Sub-district | Cattle | Horse | Pig | Goat | Chicken | Duck |
|-------------------------|---------------|--------------|---------------|--------------|----------------|---------------|
| Longowan | 1,548 | 794 | 3,649 | 901 | 82,965 | 8,703 |
| Kakas | 1,706 | 433 | 4,761 | 116 | 46,229 | 1,922 |
| Tompaso | 2,766 | 772 | 2,286 | 0 | 18,823 | 2,860 |
| Remboken | 1,014 | 404 | 637 | 39 | 16,283 | 951 |
| Eris | 133 | 85 | 927 | 24 | 15,380 | 2,013 |
| Tondano | 2,392 | 1,225 | 1,264 | 151 | 54,304 | 4,296 |
| Toul imambot | 2,861 | 1,201 | 726 | 391 | 38,455 | 3,375 |
| Tomohon | 3,162 | 1,464 | 11,733 | 129 | 87,353 | 1,969 |
| Kauditan | 1,885 | 211 | 7,311 | 231 | 92,818 | 1,592 |
| Airmadidi | 2,120 | 327 | 10,502 | 861 | 55,039 | 129 |
| Pineleng | 1,374 | 154 | 13,109 | 488 | 63,638 | 1,281 |
| Study Area total | 20,961 | 7,070 | 56,905 | 3,331 | 571,287 | 29,091 |

Source: Laporan Tahunan, Dinas Peternakan, Tondano 1999

TableII-1.7.1 Types of Agroforestry System in the Study Area

| Type | Woody perennials | | | | | Herbaceous crops | | Major Area |
|-------|------------------|--------------|-------|---------|-------------|------------------|--|------------|
| | Woody trees | Estate crops | | | Fruit trees | | | |
| | | Coconut | Clove | Others+ | | | | |
| I-1 | △ | ⊙ | △ | X | △ | △ | Northern part of Airmadidi and Pineleng | |
| I-2 | △ | △ | ⊙ | X | △ | △ | Tondano, Tompasso, Remboken, Touliambot,and southernpart of Airmadidi and Pineleng | |
| I-3 | ○ | ⊙ | ○ | X | ○ | △ | Relatively steep slope area of Langowan, Kakas, Eris, Airmadidi and Pineleng | |
| I-4 | ○ | ○ | ⊙ | X | X | △ | Relatively steep slope area of Langowan, Kakas, Eris, Airmadidi and Pineleng | |
| I-5 | ○ | ○ | X | ⊙ | X | X | Tondano, Tompasso, Remboken, Airmadidi and Pineleng | |
| I-6 | ○ | ○ | ○ | ○ | ○ | ○ | Housing area of all the Study Area and Airmadidi (along Bitung road) | |
| II-1 | △ | ○ | △ | X | △ | ⊙ | Southern and western part of the study area | |
| II-2 | △ | △ | ○ | X | △ | ⊙ | Southern and western part of the study area | |
| III-1 | △ | ⊙ | X | X | △ | ⊙ | Flat area of Airmadidi, Pineleng, Tompasso and Remboken | |
| III-2 | △ | X | ⊙ | X | X | ⊙ | Flat area of Airmadidi, Pineleng, Tompasso, Remboken, Tondanoand Toulimumbot | |

Note: * : Others include coffee, cocoa and vanilla.
 ⊙ : Pre-dominant ○ : Dominant △ : Frequent X: Negligible
 ▲ : shows the limited area.

Table II-1.7.2 Agroforestry Systems in the Study Area

| Sub-District | Location | Flat (Less than 8%) | | Slope I (8% to 25%) | | Slope II (More than 25%) | |
|---------------|---------------------------|---------------------|-----------------|---------------------|----------|--------------------------|----------|
| | | Majority | Minority | Majority | Minority | Majority | Minority |
| 1 Langowan | Tumaratas-Rarinis | II-1 | III-2 | III-1 | III-2 | I-11 | |
| | Noogan | I-1, II-1 | III-2 | I-1 | | | |
| 2 Kakas | Kawang | | | III-1 | | I-4 | |
| | Totolan-Panasen-Kalawiran | II-2 | | II-2 | | I-4 | |
| 3 Tompaso | Tempot | II-2 | I-2, -5, III-2 | III-1, -2 | | | |
| | Tonsewer-Touure | III-1 | III-1 | III-1, -2 | | | |
| 4 Remboken | Palestan-Tampusu | III-2 | III-2 | III-2 | I-3 | | |
| | Tampusu-Kasuratan | III-1,2 | | | | I-3 | |
| | Kasuratan | I-2, II-2 | I-5, III-2 | | | | |
| | Kasuratan-Parepei | I-2, II-2 | I-6, III-1 | III-2 | III-1 | I-4 | |
| | Parepei | III-1,2 | | III-2 | III-1 | I-4 | |
| | Parepei-Pulatan | II-2 | I-2, II-1 | | | I-4 | |
| | Pulutan | III-1,2 | | | | | |
| 5 Tomohon | Rurukan-Temboan | II-1, -2 | | II-1 | | II-1 | I-4 |
| | Kumelembau | II-1, -2 | | II-1 | | II-1 | |
| 6 Tondano | Ruaukan-Sumalangka | III-2 | I-2, II-2 | II-2 | I-2 | II-2 | |
| | Sumalangka-sasaran-Suluan | I-2, III-2 | I-6 | I-2, III-2 | | I-3 | |
| | Tataaran | 8, 11 | | III-1,2 | | I-3 | |
| | Tataaran-Palesten | III-1, -2 | | II-2 | I-1, -5 | I-3 | |
| 7 Toulimambot | Papakalan-Makalonsouw | III-2 | III-1 | I-2, III-2 | III-2 | I-4 | |
| 8 Eris | | | | I-4 | | I-4 | |
| 9 Kauditan | | III-1 | I-1 | I-3 | | I-4 | |
| 10 Airmadidi | Suluan-Kembuan | I-1, -2, I-5 | III-1, -2 | III-1, -2 | I-3 | I-3 | |
| | Suluan-Rumengkor | I-2, I-5 | I-1, II-1, -2 | I-1,2 | III-1 | I-3 | I-4 |
| | Rumenkor | I-1, I-3 | III-1, -2 | III-1, -2 | I-1 | I-4 | I-1 |
| | Airmadidi Atas-Maunbi | I-1,I-6 | I-5, III-1 | I-1 | | I-4 | |
| | Airmadidi Bawah-Tanggari | I-1 | I-6, II-2 | I-1, -3 | | I-4 | |
| | Tanggari-Tonsealama | I-2 | II-2, III-2 | I-4 | | I-4 | |
| 11 Pineleng | Rumengkor-Kembes | I-1 | I-2, III-1, -2 | I-3, III-1 | | I-4 | |
| | Kembes-Tombuluan | I-1, III-1 | II-1, -2, III-2 | I-3 | I-1, -2 | I-4 | |
| | Tombuluan-Kumangata | I-1, III-1 | | I-3 | I-1, -2 | I-4 | |
| | Kumangata-Sawangan | I-1 | I-5, -6, II-1 | I-1 | III-1 | I-4 | |
| | Kembes-Koka | I-1, II-1 | III-1 | I-3 | I-1, -2 | I-4 | |

Source: Field reconnaissance by JICA Study Team

Note : Gothic letter shows predominant system in the Study Area.

Table II-1.11.1 Duties and Functions of Government Agencies Concerned

| Agencies | Duties | Functions |
|---|--|--|
| 1. Directorate General of Land Rehabilitation and Social Forestry | To implement the duties of the MOFEC (Ministry of Forestry and Estate Crops) in the sector of land rehabilitation and social forestry according to the policy as stipulated by MOFEC and based on the existing legislative regulation (Article 87 of the Decree of Ministry of Forestry and Estate Crops no.:002/Kpts-II/2000, dated on January 7,2000). | (a). Formulation of technical policy in land rehabilitation and social forestry sector; (b). Plan and program, as well as technical control, social forestry, forest product diversification development, and forest crops seedling; and; (c). Development, which covers the training guidance, and standard preparation in the sector of land rehabilitation and conservation, social forestry, forest product diversification development and forest crops seedling. |
| 2. Regional Office of Ministry of Forestry and Estate Crops | To make and coordinate various plans on forestry activities. | - |
| 3. Office of Land Rehabilitation and Soil Conservation (BRLKT) | Implement the compositions of micro-planning, monitoring, evaluation of watershed management, successful land rehabilitation and soil conservation; | (a). Prepare the long term plan (pattern of land rehabilitation and soil conservation) and the medium term plan (field technical plan of land rehabilitation and soil conservation); (b). Execute the monitoring and evaluation on watershed management; (c). Execute the monitoring and evaluation on successful land rehabilitation and soil conservation; (d). Examine the technical arrangement of land rehabilitation and soil conservation; (e). Examine the technical plan of greening and reforestation; and (f). Perform the administration matters. |
| 4. Forestry Service Office of North Sulawesi Province | (a). Lead and coordinate all forestry activities at provincial level; (b). Execute the technical policies in forestry affairs in accordance with the guidelines and / or technical policies prepared by the central government; (c). Prepare the plans on forestry affairs at provincial level in accordance with the national forestry development plan; (d). Control the forest use including its protection and maintenance; and (e). Perform other duties given by the central government, as the provincial leader. | To fulfil the whole exertions and activities for: (a). Planning, preparing, processing, analyzing; (b). Implementing the duties of Forestry Service Office in accordance with the applicable laws; (c). General administration, civil service, and logistic and financial matters; (d). Arranging and establishing some cooperations, integrating and synchronizing whole organizational activities of the Forestry Service Office, including the implementation of technical coordination with other relevant agencies for smooth execution of the Office duties; and (e). Implementing the technical security. |
| 5. Estate Crops Office of North Sulawesi | Execute the household affairs at provincial level in the estate crops section; | (a). Implement the general establishment in accordance with the policies prepared by the Ministry of Home Affairs; (b). Execute the technical program in the estate crops; (c). Provide the permission enterprise establishment; (d). Execute the extension and enlightenment services; (e). Execute the research ; (f). Execute the technology examination in the framework of establishment of recommended technology; (g). Perform the office administration matters; (h). Carry out the management of Technical Implementation Unit. |
| 6. Forestry Service Office of Minahasa District | To support the Governor for the household matters at district level on the forestry affairs, about ways of: (a). Sale and distribution of forest products; (b). Forest protection; (c). Greening and conservation of soil and water; (d). Sericulture; (e). Apiculture; (f). Community forest and private forest; (g). Enlightenment of importance of forestry, which are supported by the central and regional governments. | (a). Control the distribution and sale of forest products; (b). Protect the forest damage; (c). Prepare the program on monitoring, evaluation, and other administration matters; (d). Support the communities and Self-Supporting Community Institutions in planting, and protection / maintenance of community forest and private forest; (e). Execute the implementation and improvement of apiculture and sericulture; (f). Implement the greening, soil, and water conservation; (g). Execute the enlightenment activities and train the extension workers; (h). Support the community and community organization in recovering and maintaining function of forest, soil, and water; and (i). Provide technical guidance for Technical Implementation Unit. |
| 7. Estate Crops Office of Minahasa District | (a). Examination and application of technology; (b). Land resources utilization; (c). Seedling preparation; (d). Fertilizer supply; (e). Pesticides supply; (f). Establishment of Method of use for machinery equipment; (g). Establishment of farm enterprise management; (h). Products management; (i). Establishment of marketing. | (a). Perform the development by the approach to the natural resources, human resources, agri-business, and integrity concept of inter sector / sub sector; (b). Implement the development pattern consisting of various patterns such as self-supporting / partial establishment, economic enterprise, and investor; (c). Partnership / joint venture of economic enterprise and joint venture; (d). Partnership / joint venture of investor and economic enterprise; (e). BOT (built, operate, transfer); (f). BTN (the estate is made / constructed by the investor / entrepreneur, which the payment is made by the farmers in installments; (g). Execute the main cultivation activities consisting of intensification, extensification, rehabilitation / replanting, diversification, and land conservation; (h). Implement agriculture commodity development; and (i). Application of the commodity policies on various estate crops such as cocoa, clove, nutmeg, coffee, cacao, vanilla, cashew, cassia vera, candlenut, cardamom, and ginger. |

Table II-3.4.1 The Components for Determination of Recommendable Agroforestry System

| Slope | Access | Soil erodibility | Herbaceous cultivation* | Erosion | Required Resistact to erosion | Applicable system | Required Hedge crops* | Required Ridge* | Application of new practice* | Inter cropping* | Recommendable system |
|--------|--------|------------------|-------------------------|--------------------|-------------------------------|----------------------------------|-----------------------|-----------------|------------------------------|-----------------|--------------------------|
| 0--8 | good | low | easy | strongly resistant | medium | All the system | slightly | slightly | easy | easy | I-5,6, II-1,2, III-1,2 |
| | | medium | easy | strongly resistant | medium | All the system | slightly | slightly | easy | easy | I-5,6, II-1,2, III-1,2 |
| | poor | low | easy | strongly resistant | medium | All the system | slightly | slightly | easy | easy | I-5,6, II-1,2, III-1,2 |
| | | medium | easy | strongly resistant | medium | All the system | slightly | slightly | easy | easy | I-5,6, II-1,2, III-1,2 |
| 8--15 | good | low | easy | resistant | medium | All the system | slightly | medium | easy | easy | I-5,6, II-1,2, III-1,2 |
| | | medium | easy | medium | medium-resistant | I-1,2,3,4,5,6, (II-1,2), III-1,2 | slightly | medium | easy | easy | I-5,6, (II-1,2), III-1,2 |
| | poor | low | easy | resistant | medium | All the system | slightly | medium | easy | easy | I-5,6, II-1,2,3, III-1,2 |
| | | medium | easy | medium | medium-resistant | I-1,2,3,4,5,6, (II-1,2), III-1,2 | slightly | medium | easy | easy | I-5,6, (II-1,2), III-1,2 |
| 15--25 | good | low | medium | medium | resistant | I-1,2,3,4, III-1,2 | medium | strongly | medium | medium | I-1,2, I-5, (III-1,2) |
| | | medium | medium | susceptible | Strongly resistant | I-1,2,3,4, (III-1,2) | medium | strongly | medium | medium | I-1,2,3,4, (III-3) |
| | poor | low | medium | medium | resistant | I-1,2,3,4, III-1,2 | medium | strongly | medium | medium | I-1,2, (II-3), (III-1,2) |
| | | medium | medium | susceptible | Strongly resistant | I-1,2,3,4, (III-1,2) | medium | strongly | medium | medium | I-1,2,3,4, (III-1,2) |
| 25--40 | good | low | difficult | susceptible | Strongly resistant | I-1,2,3,4 | strongly | strongly | difficult | difficult | I-1,2,3,4 |
| | | medium | difficult | susceptible | Very strongly resistant | I-3,4, (I-1,2) | strongly | strongly | difficult | difficult | I-3,4, (I-1,2) |
| | poor | low | difficult | susceptible | Strongly resistant | I-1,2,3,4 | strongly | strongly | difficult | difficult | I-1,2,3,4 |
| | | medium | difficult | susceptible | Very strongly resistant | I-3,4, (I-1,2) | strongly | strongly | difficult | difficult | I-3,4, (I-1,2) |
| 40< | good | low | very difficult | very susceptible | | Permanent tree complex | strongly | strongly | very difficult | very difficult | Permanent tree complex |
| | | medium | very difficult | very susceptible | | Permanent tree complex | strongly | strongly | very difficult | very difficult | Permanent tree complex |
| | poor | low | very difficult | very susceptible | | Permanent tree complex | strongly | strongly | very difficult | very difficult | Permanent tree complex |
| | | medium | very difficult | very susceptible | | Permanent tree complex | strongly | strongly | very difficult | very difficult | Permanent tree complex |

Numerals in parenthesis shows optionally applicable or recommendable.

Soil: Andsols; medium, Other soil; less

Access: Distance from the village. Good : less than 1 km. Poor; more than 1km

In case that farming activities are excuted at more than 40% sloped area, it is proposed to employ hedgerow cropping by considering soil erosion.

For recommendation of agroforestry system, it is necessary to pay regard to farmers opinion and requirement.

Erosion: Relative value

* : Determined by field inspection.

| Type | Woody perennials | | | | | Herbaceous crops | |
|-------|------------------|---------|--------------|--------|-------------|------------------|---|
| | Woody trees | | Estate crops | | Fruit trees | | |
| | | Coconut | Clove | Others | | | |
| I-1 | △ | ⊙ | △ | X | △ | | △ |
| I-2 | △ | △ | ⊙ | X | △ | | △ |
| I-3 | ○ | ⊙ | ○ | X | ○ | | △ |
| I-4 | ○ | ○ | ⊙ | X | X | | △ |
| I-5 | ○ | ○ | X | ⊙ | X | | X |
| I-6 | ○ | ○ | ○ | ○ | ○ | | ○ |
| II-1 | △ | ○ | △ | X | △ | | ⊙ |
| II-2 | △ | △ | ○ | X | △ | | ⊙ |
| III-1 | △ | ⊙ | X | X | △ | | ⊙ |
| III-2 | △ | X | ⊙ | X | X | | ⊙ |

Note: * : Others include coffee, cocoa and vanilla.

⊙ : Pre-dominant ○ : Dominant △ : Frequent X: Neglesible

Category I is tree crop dominant, Category II is herbaceous crop dominant, Category III is non dominant.

II-3: Hedge cropping applied to type II-1 and II-2

Table II-3.4.2 Characteristics of Each Type of Agroforestry System

| Type | Productivity | | | | | Resistance to Soil erosion | Application of new practice |
|-------|--------------|----------|------------|------------|------------|-------------------------------|--------------------------------|
| | Trees | Estate C | Fruit | Herbaceous | Evaluation | | |
| I-1 | neglesible | high | neglesible | neglesible | medium | resistant | relatively difficult |
| I-2 | | high | neglesible | neglesible | medium | resistant | relatively difficult |
| I-3 | Low | medium | neglesible | neglesible | Low | very resistant | difficult |
| I-4 | Low | medium | neglesible | neglesible | Low | very resistant | difficult |
| I-5 | medium | high | | | high | very resistant | easy |
| I-6 | medium | medium | medium | medium | high | very resistant | relatively easy |
| II-1 | neglesible | low | neglesible | high | high | resistant | easy |
| II-2 | neglesible | low | neglesible | high | high | resistant | easy |
| III-1 | neglesible | high | neglesible | medium | high | resistant | easy |
| III-2 | neglesible | high | neglesible | medium | high | resistant | easy |

Table II-3.4.3 Recommendable Type of Agroforestry System in the Study Area

| Type | Woody perennials | | | | | Fruit trees | Herbaceous crops | Recommended area |
|-------|------------------|--------------|-------|--------|---|-------------|------------------|---|
| | Woody trees | Estate crops | | | | | | |
| | | Coconut | Clove | Others | | | | |
| I-1 | △ | ⊙ | △ | | X | △ | △ | Gentle to relatively steep slope area of northern part of the Study Area |
| I-2 | △ | △ | ⊙ | | X | △ | △ | Gentle to relatively steep slope area of southern part of the Study Area |
| I-3 | ○ | ⊙ | ○ | | X | ○ | △ | Relative steep to steep slope area |
| I-4 | ○ | ○ | ⊙ | | X | X | △ | Relatively steep to steep slope area |
| I-5 | ○ | ○ | X | ⊙ | | X | X | Gentle slope area where it located not far from settlement area |
| I-6 | ○ | ○ | ○ | ○ | | ○ | ○ | Home garden, and fruit production area |
| II-1 | △ | ○ | △ | | X | △ | ⊙ | Flat to gentle slope area of northern part of the Study Area, close to the housing area |
| II-2 | △ | △ | ○ | | X | △ | ⊙ | Flat to gentle slope area, close to the housing area |
| II-3 | ○ | △ | ○ | | X | △ | ⊙ | Slopy area, close to the settlement area, trees used as hedgerow |
| III-1 | △ | ⊙ | X | | X | △ | ⊙ | Flat to gentle slope area of northern part of the Study Area |
| III-2 | △ | X | ⊙ | | X | X | ⊙ | Flat to gentle slope area of southern part of the Study Area |

Note: *: Others include coffee, cocoa and vanilla.

⊙: Pre-dominant ○: Dominant △: Frequent X: Negligible

Category I is tree crop dominant, Category II is herbaceous crop dominant, Category III is non dominant.

Table II-3.4.4 Watershed Conservation Plan

| Zones | Land Use | Slope Gradient (%) | Area (ha) | Recommended Conservation Measures | | |
|---------|----------------------------|--------------------|-----------|--|---|---|
| | | | | Forest | Agroforestry | Protection Works |
| P Zone | Forest | > 40 | 4,361 | ◎ Reforestation ◎ Prevention of reforestation ◎ Community forest | - | - |
| Bw Zone | Farmlands, forest, wetland | — | 3,266 | ○ Green belt | ○ Tree dominate type ○ Multistory tree garden | ○ Control of fishing in the lake, ○ Erosion control measures (Vegetative measures, riverbed revetment, check dam) |
| Bm Zone | Estate | 25-40 | 4,030 | ◎ Expansion of private forest | ◎ Tree dominate type ◎ Multistory tree garden | ◎ Erosion control measures (terracing, contour dikes, diversion ditches) ○ Road improvement ○ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | | 15-25 | 7,734 | ◎ Expansion of private forest | ◎ Tree dominate type ◎ Multistory tree garden | ◎ Erosion control measures (diversion ditches, contour dikes, infiltration trenches) ○ Road improvement ○ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | Arable upland | 25-40 | 443 | ◎ Expansion of private forest | ◎ Tree dominate type ◎ Multistory tree garden | ◎ Erosion control measures (terracing, contour dikes, diversion ditches) ○ Road improvement ○ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | | 15-25 | 3,825 | ◎ Expansion of private forest | ○ Tree dominate type ○ Multistory tree garden | ◎ Erosion control measures (diversion ditches, contour dikes, infiltration trenches) ○ Road improvement ○ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | | 8-15 | 3,447 | ◎ Expansion of private forest | ○ Non dominant crop type ○ Multistory tree garden ○ Multi-purpose tree ○ Hedgerow cropping w/ leguminous trees | ◎ Erosion control measures (infiltration trenches, contour dikes, drains) ○ Road improvement ◎ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | | 8-15 | 4,747 | ◎ Expansion of private forest | Δ Non dominant crop type Δ Multistory tree garden Δ Multi-purpose tree Δ Hedgerow cropping w/leguminous trees | ○ Erosion control measures (infiltration trenches, contour dikes, drains) ○ Road improvement ◎ Erosion control farming (contour ridge cultivation, hedge cropping) |
| F Zone | Estate | <8 | 5,647 | ◎ Expansion of private forest | Δ Non dominant crop type Δ Herbaceous dominant type | Δ Erosion control measures (drains) Δ Road improvement ◎ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | | <8 | 3,782 | ◎ Expansion of private forest | Δ Non dominant crop type Δ Herbaceous dominant type | Δ Erosion control measures (drains) Δ Road improvement ◎ Erosion control farming (contour ridge cultivation, hedge cropping) |
| | Arable upland | <8 | 3,782 | ◎ Expansion of private forest | Δ Non dominant crop type Δ Herbaceous dominant type | Δ Erosion control measures (drains) Δ Road improvement ◎ Erosion control farming (contour ridge cultivation, hedge cropping) |

Note : Priority in implementation ◎ : High ○ : Medium Δ : Low
 Paddy field (6,007 ha) under F Zone is not included in the table.

Table III-1.1.1 Typical Soil Profile (South Group) (1/3)

| Horizon/Layer | Depth (cm) | Explanation |
|---------------|------------|---|
| A | 0-30 | Color: black (7.5yr 2/1), Structure: Crumb, Size: very fine to medium, Texture: sandy loam, Consistency: very friable to friable, Root condition: dense |
| C | 30-49 | Buried horizon; Sandy fraction |
| I | 49-82 | Color: brownish black (10yr 2/2), Structure: Crumb, Size: very fine to fine, Texture: sandy loam, Consistency: friable, Root condition: lacked |
| II | 82-97 | Color: black (10yr 2/1), Structure: crumb, Size: very fine to fine, Consistency: friable |
| III | 97-100 | Color: black (10yr 2/1), Structure: Crumb to blocky, Size: fine to medium, Texture: sandy loam, Consistency: friable |

Table III-1.1.1 Typical Soil Profile (East Group)(2/3)

| Horizon/Layer | Depth (cm) | Explanation |
|---------------|------------|--|
| A | 0-15 | Color: very dark brown (7.5YR 2/3), Structure: blocky Size: fine to medium, Texture: clay, Consistency: friable to firm, Root condition: dense |
| B | 15-77 | Color: brownish black (75YR 4/3-4/6), Structure: blocky Size: medium-coarse, Texture: clay, Consistency: friable to firm, Root condition: lacked |
| BC | 77-115 | Color: brown (75YR 4/4-4/6), Structure: crumb to blocky Size: fine to medium, Texture: clay, Consistency: friable to firm, sticky, Root condition: lacked |

Table III-1.1.1 Typical Soil Profile (West Group) (3/3)

| Horizon/Layer | Depth (cm) | Explanation |
|---------------|------------|---|
| Ap | 0-10 | Color: brownish black (7.5YR 3/2), Structure: Crumb to blocky, Size: fine to medium, Texture: clay loam, Consistency: friable, Root condition: dense |
| BA | 10-31 | Color: dark brown (7.5YR 3/3), Structure: crumb to blocky, Size: medium, Texture: clay, Consistency: friable to firm, sticky, Root condition: lack |
| B | 31-86 | Color: brownish black to dark brown (10YR 3/2), Structure: crumb to blocky, Size: medium to coarse, Texture: clay, Consistency: friable to firm, Root condition: lack |
| BC | 86-102 | Color: dark brown (7.5YR 3/4), Structure: blocky, Size: fine to medium, Consistency: firm and sticky, Root condition: lack |

Table III-1.3.1 Area of Each Land Use by Three Areas

| Upper: Area (ha) Lower: Ratio (%) | | | | | |
|--------------------------------------|-------------------------------------|-----------|------------|-----------|----------------|
| No. | Legend | East Area | South Area | West Area | Intensive Area |
| 1 | Natural/Semi/natural forest | 327 | 735 | 66 | 1,128 |
| | | 9.8 | 21.6 | 1.3 | 9.5 |
| 2 | Secondary forest | 70 | 478 | 52 | 600 |
| | | 2.1 | 14.1 | 1.0 | 5.0 |
| 3 | Planted forest (Timber) | 11 | 12 | 1 | 24 |
| | | 0.3 | 0.4 | 0.0 | 0.2 |
| 4 | Planted forest (Firewood) | 83 | 6 | 359 | 448 |
| | | 2.5 | 0.2 | 7.0 | 3.8 |
| 5 | Bush | 120 | 48 | 74 | 242 |
| | | 3.6 | 1.4 | 1.4 | 2.0 |
| 6 | Estate (Clove) | 731 | 19 | 200 | 950 |
| | | 22.0 | 0.6 | 3.9 | 8.0 |
| 7 | Estate (Others) | 684 | 269 | 1,491 | 2,444 |
| | | 20.5 | 7.9 | 29.0 | 20.6 |
| 8 | Mixture of estate and arable upland | 461 | 742 | 618 | 1,821 |
| | | 13.8 | 21.7 | 12.0 | 15.3 |
| 9 | Arable upland | 368 | 859 | 1,895 | 3,122 |
| | | 11.0 | 25.2 | 36.8 | 26.3 |
| 10 | Pasture | 0 | 0 | 36 | 36 |
| | | 0.0 | 0.0 | 0.7 | 0.3 |
| 11 | Paddy field | 388 | 125 | 125 | 638 |
| | | 11.6 | 3.7 | 2.4 | 5.4 |
| 12 | Swamp | 10 | 2 | 8 | 20 |
| | | 0.3 | 0.1 | 0.2 | 0.2 |
| 13 | Water body | 1 | 0 | 5 | 6 |
| | | 0 | 0 | 0.1 | 0.0 |
| 14 | Settlement and others | 85 | 105 | 216 | 406 |
| | | 2.5 | 3.1 | 4.2 | 3.4 |
| | Total (ha) | 3,339 | 3,400 | 5,146 | 11,885 |
| | Total (%) | 100.0 | 100.0 | 100.0 | 100.0 |

Table III-1.4.1 Protection Forest Boundaries in the Study Area including Intensive Area

| No. | Registration. No. | Location | Decrees (No., Date) | Area (ha) | Structuring | | Year of Restructuring | Map Scale |
|-----|----------------------|----------------------------|--|--------------|-------------|----------------------|--------------------------|--------------|
| | | | | | Year | Boundary code | | |
| 1 | 42 | Mt. Sopotan | GB.No.8; July 5, 1930 | 13,440 | 1932 | G.1 - G.333 | - | 1:20,000 |
| 2 | 46 | Mt. Lengkoan | GB.No.3; Nov. 22, 1932 | 56 | 1935 | G.1 - G.11 | - | 1:5,000 |
| 3 | 47 | Mt. Tampusu | GB.No.17; July 15, 1933 | 29 | 1938 | B.1 - B.29, G.1-G.10 | 1985/1986 | 1:2,500 |
| 4 | 48 | Mt. Kawatak | GB.No.3; July 5, 1930 | 980 | 1934 | G.1-G.12 | - | 1:20,000 |
| 5 | 50 | Mt. Mahawu | GB.No.17; July 15, 1933 | 550 | 1939 | G.1-G86 | 1986/1987 | 1:10,000 |
| 6 | 52 | Mt. Lembean | GB.No.3; Jan. 5, 1932 | 2,700 | Not Clear | B.1-B.130 | 1977/1978 | 1:20,000 |
| 7 | 54 | Mt. Klabat Mt. Masarang | GB.No.38; April 2, 1932 | 5,670 | Not Clear | B.1-B.183 | 1996/1997 | 1:20,000 |
| 8 | | Mt. Kaweng | Decision of Forestry Minister, No.250/Kpts-II/UM/1984; Feb. 20, 1984 | 146.97 | 1996 | Not Clear | - | 1:50,000 |
| 9 | | | Decision of Forestry Minister, No.250/Kpts-II/UM/1984; Feb. 20, 1984 | 417.86 | 1996 | Not Clear | - | 1:25,000 |

GB: Gouvernementsbesluit (Governer's decision)

Source: Bub BIPHUT Manado, 2000

Table III-1.4.2 Price of Timber Woods

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Linggua (<i>Pterocarpus indicus</i>) | 1.750,000 | 2.250,000 | Plank |
| Cempaka (<i>Elmerillia sp.</i>) | 700,000 | 950,000 | Plank |
| | | 850,000 | Beam |
| Nantu (<i>Palaquium obtusifolium</i>) | 450,000 | 600,000 | Plank/Beam |
| Pulutan (<i>Palaquium obovatum</i>) | 450,000 | 600,000 | Beam |
| Mahoni (<i>Swietenia macrophylla</i>) | 450,000 | 600,000 | Beam |
| Durian (<i>Durio zibetinus</i>) | 400,000 | 550,000 | Plank/Beam |
| Wusel (<i>Pometia tomentosa</i>) | 400,000 | 550,000 | Plank/Beam |
| Wolo (<i>Pterospermum celebicum</i>) | 300,000 | 450,000 | Plank |
| Wakan (<i>Lithocarpus celebicus</i>) | 300,000 | 450,000 | Plank |
| Kananga (<i>Cananga odorata</i>) | 300,000 | 450,000 | Plank |

Source : 1. Toko / Timbunan di Tomohon (the owner: Mr.Piet Oroh)

2. Mr. Nico Polii (forestry officer / KRPH Tomohon)

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Cempaka (<i>Elmerillia sp.</i>) | | 1,000,000 | Plank/Beam |
| Nantu (<i>Palaquium obtusifolium</i>) | | 500,000 | Plank/Beam |
| Wakan (<i>Lithocarpus celebicus</i>) | | 500,000 | Plank/Beam |

Source : Usaha Karya Woloan Village

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Linggua (<i>Pterocarpus indicus</i>) | | 2,000,000 | Plank |
| Cempaka (<i>Elmerillia sp.</i>) | | 800,000 | Plank/Beam |
| Nantu (<i>Palaquium obtusifolium</i>) | | 500,000 | Plank/Beam |

Source : UD Purna Yudha Kinamang Leilem Village

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Linggua (<i>Pterocarpus indicus</i>) | | 2,000,000 | Plank |
| Cempaka (<i>Elmerillia sp.</i>) | | 800,000 | Plank/Beam |
| Nantu (<i>Palaquium obtusifolium</i>) | | 500,000 | Plank/Beam |

Source : UD. Reymond Leilem Village

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Cempaka (<i>Elmerillia sp.</i>) | | 900,000 | Plank |
| Nantu (<i>Palaquium obtusifolium</i>) | | 600,000 | Plank/Beam |
| Lower quality than Nantu | | 375,000 | Plank/Beam |

Source : Walian Jaya (Timber Shop) Tomohon

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Linggua (<i>Pterocarpus indicus</i>) | | 2,500,000 | Plank |
| Cempaka (<i>Elmerillia sp.</i>) | | 925,000 | Plank/Beam |
| Nantu (<i>Palaquium obtusifolium</i>) | | 625,000 | Plank/Beam |
| Lower quality than Nantu | | 425,000 | Plank/Beam |

Source : UD. Kalpataru Manado

| Spesies | Selling price from farmer (Rp / m3) | Selling price at the shop (Rp / m3) | Remarks |
|---|--|--|------------|
| Linggua (<i>Pterocarpus indicus</i>) | | 2,000,000 | Plank |
| Cempaka (<i>Elmerillia sp.</i>) | | 900,000 | Plank/Beam |
| Nantu (<i>Palaquium obtusifolium</i>) | | 500,000 - 550,000 | Plank/Beam |
| Lower quality than Nantu | | 350,000 | Plank/Beam |

Source : Dinas Kehutanan Minahasa (Mr. Esry Wowor)

Table III-1.4.3 Useful Tree Species in the Study Area including Intensive Area

| No | Latin Name | Lokal Name | Usage |
|----|----------------------------------|-----------------|---|
| 1 | 2 | 3 | 4 |
| 1 | <i>Agathis celebica</i> | Agatis / Damar | Construction, Plywood, Furniture, Music and sports instruments, matches, pulp, pencil |
| 2 | <i>Annona mucikata</i> | Sirsak | Fruits |
| 3 | <i>Artocarpus integra</i> | Nangka | Fruits, Vegetables |
| 4 | <i>Aleurites moluccana</i> | Kemiri | Spice, Cosmetics |
| 5 | <i>Areca oxycarpa</i> | Palem | Land conservation |
| 6 | <i>Areca cathecu</i> | Pinang | Medicine, Ornamental purpose |
| 7 | <i>Arenga undulatifolia</i> | Aren/enau | Sugar, Alkohol, Broom, rope |
| 8 | <i>Averrhoa carambeia</i> | Belimbing | Fruits |
| 9 | <i>Albizia falcataria</i> | Sengon | Construction, Wrapping materials |
| 10 | <i>Casuarina sumatrana</i> | Cemara | Land conservation |
| 11 | <i>Casuarina junghuniana</i> | Cemara | Land conservation |
| 12 | <i>Casuarina equisetifolia</i> | Cemara | Land conservation, Ornamental |
| 13 | <i>Cananga odorata</i> | Kenanga | Construction |
| 13 | <i>Cinnamomum burmanii</i> | Kayu manis | Spice |
| 14 | <i>Cocos nucifera</i> | Kelapa | Oil, Flour, Firewood, Furniture |
| 15 | <i>Cordia blancoi</i> | Kanonan | Fuel wood, Paste |
| 16 | <i>Durio zibethinus</i> | Durian | Construction, Fruits |
| 17 | <i>Dysoxylum caulestachium</i> | Tombawak | Construction |
| 18 | <i>Excocoria agalloca</i> | mapopok | Construction |
| 19 | <i>Elmerillia celebica</i> | Cempaka wasian | Construction, Door and window frame |
| 20 | <i>Elmerllia ovalis</i> | Cempaka | Construction, Door and window frame |
| 21 | <i>Eugenia aromatica</i> | Cengkih | Fruits |
| 22 | <i>Eugenia aquatica</i> | Jambu air | Fruits |
| 23 | <i>Eugenia malaccensis</i> | Jambu | Fruits |
| 24 | <i>Erytrina cristagali</i> | Dadap | Land conservation |
| 24 | <i>Ficus celebensis</i> | Beringin | Land conservation |
| 26 | <i>Ficus benyamina</i> | Beringin | Land conservation |
| 27 | <i>Gnetum genemon</i> | Melinjo/ganemo | Vegetable |
| 28 | <i>Garcinia mangostana</i> | Manggis | Fruits |
| 29 | <i>Koordersiodendron pinatum</i> | Kayu bugis | Construction |
| 30 | <i>Lansium domesticum</i> | Lansat | Fruits |
| 31 | <i>Lithocarpus celebicus</i> | Wakan | Construction |
| 32 | <i>Livistona rotundivolia</i> | Woka | Land conservation, Wrapping materials |
| 33 | <i>Metroxylon sagu</i> | Rumbia | Sago flour, Roofing materials |
| 34 | <i>Myristica fragrans</i> | Pala | Fruits, Spece |
| 35 | <i>Mangifera indica</i> | Mangga | Fruits |
| 36 | <i>Nephelium lappacium</i> | Rambutan | Fruits |
| 37 | <i>Octomeles Sumatrana</i> | Binuang | Construction, Door and window frame |
| 38 | <i>Palaquium Abovatum</i> | Pulutan | Construction, Door and window frame |
| 39 | <i>Palaquium Obtusifolium</i> | Nantu | Construction, Door and window frame |
| 40 | <i>Pangium Edule</i> | Pangi | Vegetable |
| 41 | <i>Pinus merkusii</i> | Pinus | Construction, Firewood, Pulp, Resin |
| 42 | <i>Pingafetha Filaris</i> | Nibong | Land conservation |
| 43 | <i>Pterocarpus indicus</i> | Angsana/Linggua | Furniture, Door and window frame |
| 44 | <i>Pterospermium Celebicum</i> | Wolo | Construction |
| 45 | <i>Parsia Speriosa</i> | Petai | Vegetable |
| 46 | <i>Parsia Americana</i> | Alpoket | Fruits |
| 47 | <i>Pometia Tomentosa</i> | Wusel | Construction |
| 48 | <i>Sivietenia Macrophylla</i> | Mahoni | Furniture, Door and window frame |
| 49 | <i>Spondias pinata</i> | Kedondong | Fruits |
| 50 | <i>Toona Celebica</i> | Lalumpek | Construction |

Table III-1.5.1 Agricultural Land Use by Slope and Farming Type

| Location | Sub-district | Farming Type | Steep slope | Moderate slope | Gentle slope | Flat | Total | Location | Sub-district | Farming Type | Steep slope | Moderate slope | Gentle slope | Flat | Total |
|----------|--------------|--------------|-------------|----------------|--------------|------|-------|------------|--------------|--------------|-------------|----------------|--------------|-------|-------|
| East | Toulimambot | AGF.- I | 294 | 0 | 0 | 0 | 294 | West | Remboken-E | AGF.- I | 0 | 30 | 0 | 0 | 30 |
| | | AGF.- II | 0 | 20 | 0 | 0 | 20 | | | AGF.- II | 0 | 0 | 60 | 0 | 60 |
| | | AGF.- III | 79 | 70 | 0 | 0 | 149 | | | AGF.- III | 0 | 105 | 20 | 0 | 125 |
| | | Upland-F | 0 | 31 | 0 | 7 | 38 | | | Upland-F | 0 | 0 | 0 | 53 | 53 |
| | | Lowland-F | 0 | 0 | 0 | 169 | 169 | | | Lowland-F | 0 | 0 | 0 | 0 | 0 |
| | | Total | 373 | 121 | 0 | 176 | 670 | | | Total | 0 | 135 | 80 | 53 | 268 |
| | Eris | AGF.- I | 874 | 0 | 0 | 0 | 874 | Kakas-W | AGF.- I | 0 | 175 | 0 | 0 | 175 | |
| | | AGF.- II | 13 | 49 | 0 | 0 | 62 | | AGF.- II | 0 | 30 | 15 | 35 | 80 | |
| | | AGF.- III | 88 | 0 | 0 | 0 | 88 | | AGF.- III | 0 | 135 | 0 | 0 | 135 | |
| | | Upland-F | 0 | 23 | 0 | 6 | 29 | | Upland-F | 0 | 0 | 0 | 50 | 50 | |
| | | Lowland-F | 0 | 0 | 0 | 100 | 100 | | Lowland-F | 0 | 0 | 0 | 7 | 7 | |
| | | Total | 975 | 72 | 0 | 106 | 1,153 | | Total | 0 | 340 | 15 | 92 | 447 | |
| | Kakas-E | AGF.- I | 297 | 218 | 0 | 0 | 515 | Tondano | AGF.- I | 140 | 281 | 0 | 0 | 421 | |
| | | AGF.- II | 0 | 75 | 0 | 32 | 107 | | AGF.- II | 0 | 450 | 0 | 0 | 450 | |
| | | AGF.- III | 0 | 36 | 0 | 0 | 36 | | AGF.- III | 0 | 570 | 0 | 0 | 570 | |
| | | Upland-F | 0 | 0 | 0 | 32 | 32 | | Upland-F | 0 | 20 | 440 | 81 | 541 | |
| | | Lowland-F | 0 | 0 | 0 | 119 | 119 | | Lowland-F | 0 | 0 | 0 | 88 | 88 | |
| | | Total | 297 | 329 | 0 | 183 | 809 | | Total | 140 | 1,321 | 440 | 169 | 2,070 | |
| South | Langowan | AGF.- I | 101 | 100 | 0 | 0 | 201 | Remboken-W | AGF.- I | 0 | 351 | 0 | 0 | 351 | |
| | | AGF.- II | 0 | 0 | 209 | 232 | 441 | | AGF.- II | 0 | 59 | 260 | 0 | 319 | |
| | | AGF.- III | 0 | 260 | 79 | 0 | 339 | | AGF.- III | 0 | 400 | 0 | 0 | 400 | |
| | | Upland-F | 0 | 0 | 0 | 398 | 398 | | Upland-F | 0 | 0 | 320 | 160 | 480 | |
| | | Lowland-F | 0 | 0 | 0 | 105 | 105 | | Lowland-F | 0 | 0 | 0 | 30 | 30 | |
| | | Total | 101 | 360 | 288 | 735 | 1,484 | | Total | 0 | 810 | 580 | 190 | 1,580 | |
| | Tompaso | AGF.- I | 15 | 13 | 0 | 0 | 28 | Total | AGF.- I | 1,721 | 1,168 | 0 | 0 | 2,889 | |
| | | AGF.- II | 0 | 8 | 98 | 111 | 217 | | AGF.- II | 13 | 691 | 642 | 410 | 1,757 | |
| | | AGF.- III | 0 | 125 | 0 | 0 | 125 | | AGF.- III | 167 | 1,701 | 99 | 0 | 1,968 | |
| | | Upland-F | 0 | 0 | 6 | 134 | 140 | | Upland-F | 0 | 74 | 766 | 921 | 1,761 | |
| | | Lowland-F | 0 | 0 | 0 | 20 | 20 | | Lowland-F | 0 | 0 | 0 | 638 | 638 | |
| | | Total | 15 | 146 | 104 | 265 | 530 | | Total | 1,901 | 3,634 | 1,507 | 1,969 | 9,012 | |

Note: AGF-I; Agroforestry type I, AGF-II; Agroforestry type II, and AGF-III; Agroforestry type III

Steep slope: Slope more than 25%, Slope; slope 15-25%, Gentle slope; slope 8-15% and Flat; slope 0-8%

Table III-1.5.2 Present Crop Production in the Intensive Area

| Location | | Tree crops | | | | | | | Herbaceous crops | | | | | |
|----------|-----------------|------------|-------|--------|-------|----------|--------|--------|------------------|-------------|---------|---------|-------------|-------|
| | | Coconut | Clove | Coffee | Cocoa | Cinnamon | Vanila | Fruits | Maize | Ground nuts | Cowpeas | Cassava | Vegetables* | Paddy |
| East | Area (ha) | 83 | 846 | 55 | 3 | 26 | 18 | 64 | 623 | 3 | 9 | 3 | 1 | 620 |
| | Yield (kg/ha) | 1,200 | 200 | 950 | 600 | | 100 | | 2,900 | 1,080 | 900 | 15,000 | 7,000 | 4,800 |
| | Production (ton | 100 | 169 | 52 | 2 | 0 | 2 | 0 | 1,807 | 3 | 8 | 45 | 7 | 2,976 |
| South | Area (ha) | 49 | 201 | 19 | 0 | 3 | 7 | 19 | 1,785 | 19 | 83 | 1 | 155 | 328 |
| | Yield (kg/ha) | 1,200 | 200 | 950 | 600 | | 100 | | 2,900 | 1,080 | 900 | 15,000 | 7,000 | 4,800 |
| | Production (ton | 59 | 40 | 18 | 0 | 0 | 1 | 0 | 5,177 | 21 | 75 | 15 | 1,085 | 1,574 |
| West | Area (ha) | 54 | 424 | 69 | 29 | 0 | 24 | 146 | 2,935 | 301 | 37 | 29 | 185 | 200 |
| | Yield (kg/ha) | 1,200 | 200 | 950 | 600 | | 100 | | 2,900 | 1,080 | 900 | 15,000 | 7,000 | 4,800 |
| | Production (ton | 65 | 85 | 66 | 17 | 0 | 2 | 0 | 8,512 | 325 | 33 | 435 | 1,295 | 960 |
| Total | Area (ha) | 186 | 1,471 | 143 | 32 | 29 | 49 | 229 | 5,343 | 323 | 129 | 33 | 341 | 1,148 |
| | Yield (kg/ha) | 1,200 | 200 | 950 | 600 | | 100 | | 2,900 | 1,080 | 900 | 15,000 | 7,000 | 4,800 |
| | Production (ton | 223 | 294 | 136 | 19 | 0 | 5 | 0 | 15,495 | 349 | 116 | 495 | 2,387 | 5,510 |

* Yield is estimated by yield of tomato.

Table III-1.6.1 Tree Species for Agroforestry

| Species | Suitable | Rain fall | Suitable Soil | | | Production age | Adaptability |
|------------------------------------|--------------|-------------|-----------------|------------|--------------|------------------|--------------|
| | Altitude (m) | (mm/year) | pH | Depth (cm) | Type | | |
| Estate crops | | | | | | | |
| Clove (Eugenia aromatica) | 200-600 | 1500-4700 | 3.0-7.0 | | Well drained | 5-6 | o |
| Coconut (Cocos nucifera) | 0-600 | 1200-2000 | 4.3-8.3 | 75 | | 4 | o |
| Coffee (Coffea sp.) | 0-600 | 1550-1800 | 4.5-5.5 | 150 | Loomy | 3 | o |
| Vanilla (Vanilla fragras) | 0-800 | 2000-2500 | | Deep | loomy sand | 3 | o |
| Cinnamon(Cinnamommum zeylanicum) | | | | | | 5-6 | o |
| Cocoa (Theobroma cacao) | 0-500 (1000) | 1000-3000 | | Deep | Loamy sand | 3 | o |
| Nutmeg (Myristica fragrans) | 0-700 | 1400-2450 | 4.5-7.5 | | Sandy soil | | o |
| Candle nuts (Aleurites moluccana) | 0-700 | 1000-2500 | | | Volcanic | 5-6 | o |
| Cashew (Anacardium occidentale) | 0-700 (800) | 500-3200 | 5-8 | Deep | Sandy | 5-6 | o |
| Sugar palm (Arenga pinnata) | 700-1000 | | | | Volcanic | 3 | o |
| Pepper (Piper nigram) | 0-500(1000) | 1500-2000 | 4.3-7.4 | | Loomy | | x |
| Rubber (Heveabrsiliensis) | 0-500 | Rain forest | Acidic-nutral | | | 5 | x |
| Fruits | | | | | | | |
| Durian (Durio zibethinus) | 1-1000 | 1500-2500 | 5.5-7 | | Well drained | 5-10 | o |
| Mango (Mangifera indica) | 0-500(600) | 760-2000 | 5.5-7.5 | Deep | Loam | 4 | o |
| Mangostin (Garcinia mangostana) | 0-500 | 1500-2500 | Acidic | Deep | Loam | 10-15 | o |
| Avogado (Persea americana) | 0-500 | 1500-3000 | 5.5-6.5 | | Volcanic | 6 | o |
| Langsat (Lancium domesticum) | 30-500 | 1500-2500 | 5.5-7.0 | | Loose | 5 | o |
| Rambutan (| 200-1500 | 1500-2500 | 5.5-7.0 | | Well drained | 8 | o |
| Jackfruit (Artocarpus integra) | 0-700(1000) | >1500 | 5.0-7.0 | Deep | Well drained | 5 | o |
| Banana (Musa sp.) | 0-1500 | 1400-2500 | | | | | o |
| Guava (Psidium guajava) | 0-800 | 700-3700 | 5.5-7.5 | Deep | Well drained | 5 | o |
| Citrus sp. | 0-1200 | 1500-2000 | 5.5-6.5 | 100 | Sandy loam | 3-4 | o |
| Trees | | | | | | | |
| Cempaka(Elmerillia ovalis) | 0-1000 | 2000-4000 | | | | 20 | o |
| Albizia(Paraserianthes falcataria) | 0-1200 | 2000-4000 | Acidic-nutral | | Well drained | 5 (for pulp), 20 | o |
| Piper (Piper aduncum) | | | | | | | Autogenensis |
| Ficus sp | | | | | | | Autogenensis |
| Pangium (Pangium edule) | | | | | | | o |
| Tayapu (Trema orientaris) | 300-2500 | 1000-2000 | Nutral-basic | | Loam | 15 | o |
| Mahogany(Swientenia sp.) | 50-1400 | 1600-4000 | Nutral-basic | | Nutral-basic | 15 | o |
| Nyatou Batu(Paraquium sp.) | 0-1000 | 2000-4000 | Acidic-nutral | | | 20 | o |
| Kanonang (Cordia blancoi) | 0-1000 | Rain forest | Acidic-nutral | | | | o |
| Dadap/Walantaken (Erythrina) | 0-1000 | Rain forest | Acidic-nutral | | | | |
| Angsana pterocarpus | 0-1000 | Rain forest | | | | 30 | o |
| Linggua (Pterocarpus indica) | 0-1800 | 2000-4000 | | | | 30-40 | o |
| Pinus sp. | 200-2000 | | | | Volcanic | | x |
| Teak(Tectona grandis) | 0-900 | 1250-2500 | Acidic-nutral | | Well drained | 80 | x |
| Meranti (Shorea Sp.) | 0-1000 | | | | Well drained | 50 | x |
| Multipurpose trees | | | | | | | |
| Calliandra calothyrsus | 150-1500 | 2000-4000 | moderate acidic | | Well drained | | o |
| Gliricidia sepium | 0-1600 | 1500-2300 | Acidic-nutral | | Well drained | | o |
| Gmelina arborea | 0-1200 | 950-4500 | Acidic | | Well drained | 15 | o |
| Leucaena Leucocephala | 0-1000 | 600-3000 | Nutral-basic | | Well drained | | x |
| Acacia auriculiformis | 0-800 | 1500-2500 | 3-9 | | | 5-7 (for pulp) | x |
| A. mangium | 0-720 | 1000-4500 | Acidic-nutral | | | 5-7(for pulp) | x |
| Jatropha Curcas(Balacai) | 10-1000 | 2000-4000 | | | | | |

Source: Imperata Grassland Rehabilitation using Agroforestry and assisted Natural Regeneration, ICRAF 1999

Jenois-Jenis Pohon Serba Guna BRLKT 1999/2000, Nettare no Yuyo Jushu, TARC Japan 1977

Note: o; Suitable, x: not suitable

Table III-1.6.2 Planted Area, Production and Value of Clove in North Sulawesi

| Year | Price (Rp/kg) | Planted area (ha) | Production (ton) | Yield (kg/ha) | Exchange Rp/US\$ 1 | Price (US\$/kg) | Value (US\$ mil) |
|------|------------------|----------------------|---------------------|------------------|-----------------------|--------------------|---------------------|
| 1969 | 1,189 | 15,396 | 2,007 | 130 | | | |
| 1970 | 1,396 | 10,616 | 2,103 | 198 | 381 | 3.66 | 7.7 |
| 1971 | 1,334 | 18,425 | 2,022 | 110 | | | |
| 1972 | 1,478 | 18,149 | 904 | 50 | | | |
| 1973 | 1,328 | 19,484 | 8,000 | 411 | 618 | 2.15 | 17.2 |
| 1974 | 3,528 | 20,486 | 700 | 34 | 551 | 6.41 | 4.5 |
| 1975 | 4,135 | 24,485 | 2,800 | 114 | 522 | 7.92 | 22.2 |
| 1976 | 4,301 | 25,406 | 160 | 6 | 450 | 9.56 | 1.5 |
| 1977 | 4,146 | 26,856 | 12,000 | 447 | 474 | 8.74 | 104.9 |
| 1978 | 4,130 | 28,432 | 2,400 | 84 | 621 | 6.65 | 16.0 |
| 1979 | 8,161 | 30,008 | 4,800 | 160 | 627 | 13.01 | 62.5 |
| 1980 | 7,796 | 31,157 | 12,042 | 386 | 628 | 12.42 | 149.6 |
| 1981 | 8,144 | 33,158 | 6,700 | 202 | 644 | 12.64 | 84.7 |
| 1982 | 8,289 | 34,734 | 9,116 | 262 | 693 | 11.97 | 109.1 |
| 1983 | 7,960 | 36,301 | 10,000 | 275 | 994 | 8.01 | 80.1 |
| 1984 | 6,322 | 38,041 | 3,500 | 92 | 1,074 | 5.89 | 20.6 |
| 1985 | 8,535 | 39,305 | 4,000 | 102 | 1,125 | 7.58 | 30.3 |
| 1986 | 6,750 | 40,856 | 5,000 | 122 | 1,641 | 4.11 | 20.6 |
| 1987 | 6,100 | 40,856 | 5,000 | 122 | 1,650 | 3.70 | 18.5 |
| 1988 | 4,400 | 42,650 | 1,000 | 23 | 1,729 | 2.54 | 2.5 |
| 1989 | 6,350 | 43,650 | 3,500 | 80 | 1,795 | 3.54 | 12.4 |
| 1990 | 7,050 | 43,650 | 7,000 | 160 | 1,901 | 3.71 | 26.0 |
| 1991 | 7,900 | 43,700 | 14,215 | 325 | 1,992 | 3.97 | 56.4 |
| 1992 | 5,270 | 43,700 | 10,000 | 229 | 2,062 | 2.56 | 25.6 |
| 1993 | 3,200 | 43,700 | 6,000 | 137 | 2,110 | 1.52 | 9.1 |
| 1994 | 3,000 | 43,700 | 10,500 | 240 | 2,200 | 1.36 | 14.3 |
| 1995 | 2,500 | 43,485 | 10,990 | 253 | 2,308 | 1.08 | 11.9 |
| 1996 | 2,601 | 43,009 | 4,200 | 98 | 2,383 | 1.09 | 4.6 |
| 1997 | 2,997 | 43,009 | 7,400 | 172 | 4,650 | 0.64 | 4.8 |
| 1998 | 6,707 | 43,009 | 15,550 | 362 | 8,025 | 0.84 | 13.0 |
| 1999 | 20,107 | 43,009 | 1,800 | 42 | 7,100 | 2.83 | 5.1 |
| 2000 | 35,000 | 43,009 | | | 8,600 | 4.07 | |

Source: 1. Dinas Perkebunan North Sulawesi, 2. Dinas perkebunan Minahasa
3. Peranan Komoditi Cengkeh Terhadap Pertumbuhan Ekonomi
Daerah Sulawesi Utara, 4. Bank Negara Indonesia

Table III-1.6.3 The Area of Improper Agricultural Land Use

| Site | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|------------------|----------------------|-----------------------------|--------------------------|--------------------------|----------------------------|---------------------------|--------------------------|--------------------------|--------------------------|----------------------------|--------------------------------|---------------------------------|---|--|--------------------------|--------------------------|---------------------------------------|-------------------------|--------------------------|
| Location | Kecamatan Village | Kakas Passo | Kakas Passo | Kakas Passo | Kakas Passo | Kakas Passo | Kakas Passo | Remboken Sinuian | Remboken Leleko | Remboken Leleko | Tondano Urongo | Tondano Palelowan | Tondano Palelowan | Tondano Palelowan | Tondano Palelowan | Tondano Palelowan | Tondano Palelowan | Langowan Kawatak | Eris Tandegan |
| | | N 01°16'39" E 124°51'19" | N 01°12'46" E 124°51'23" | N 01°12'46" E 124°51'27" | N 01°12'57" E 124°51'36" | N 01°12'42" E 124°51'20" | N 01°12'56" E 124°51'23" | N 01°13'20" E 124°51'23" | N 01°14'07" E 124°52'18" | N 01°14'15" E 124°52'24" | N 01°14'10" E 124°52'40" | N 01°14'15" E 124°52'49" | N 01°14'40" E 124°53'24" | N 01°14'44" E 124°53'25" | N 01°15'10" E 124°53'40" | N 01°15'27" E 124°53'44" | N 01°15'48" E 124°53'59" | N 01°7'46" E 124°50'20" | N 01°13'20" E 124°56'16" |
| Area | Length (m) | 80 | 30 | 30 | 50 | 50 | 40 | 35 | 40 | 35 | 50 | 20 | 50 | 50 | 40 | 40 | 40 | 350 | 100 |
| | Width (m) | 100 | 40 | 180 | 55 | 100 | 50 | 30 | 50 | 50 | 50 | 50 | 150 | 100 | 50 | 50 | 100 | 400 | 150 |
| | Area (sq. m) | 8,000 | 1,200 | 5,400 | 2,750 | 5,000 | 2,000 | 1,050 | 2,000 | 1,750 | 2,500 | 1,000 | 7,500 | 5,000 | 2,000 | 2,000 | 4,000 | 140,000 | 15,000 |
| Gradient (%) | | 50 | 50 | 50 | 50 | 58 | 36 | 27 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| Elevation | | | | | | | | | | | | | | | | | | | |
| Present land use | | AGF- II Bamboo | Fallow | UF | UF | AGF-III Bamboo | AGF-III | UF | AGF-II | Fallow/AGF-II | Fallow/AGF-II | AGF-III Ficus Albizia | AGF-III | AGF-III Bamboo | AGF-II | AGF-II Bamboo | AGF-II | AGF-I/UF | AGF-III Cempaka |
| | Tree | | | | | | | | | | | | | | | | | | |
| | Fruit | Banana | Banana | Banana Langsat | Banana Langsat | Avogado Langsat | Mango Langsat | | Mango Durian | Mango Banana Langsat | Mango Banana Langsat | Jackfruit Banana | Jackfruit Mango Banana Langsat | Jackfruit Mango Banana Langsat | Durian Langsat | Banana Papaya | Durian Jackfruit Guava Mango | | |
| | Estate crops | Coconut Clove Sinamon | | | | Papaya Clove Coffee | Clove | | Coconut | Clove Coconut | Clove Coconut Sugar palm | Coconut Sugar palm | Coconut Sugar palm | Clove Coffee Coconut Sugar palm | Coconut | Coconut Clove | Coconut Clove | Clove Sugar palm | Clove |
| | Field crops | Maize | | Maize | Maize Cassava Fallow | Maize | Maize | Maize | Maize | Maize Fallow | Maize Fallow | Maize Cassava | Maize Cassava | Maize Cassava | Maize | Maize | Maize | Maize | Maize Groundnut |
| | Headge crop | Gliricidea | | Gliricidea Bnana | None | Banana | None | None | Gliricidea | Gliricidea | Gliricidea | Gliricidea Banana Cassava | None Banana Cassava | None Banana Cassava | None | None | Gliricidea | Gliricidea Banana | Gliricidea |
| | Ridge | | | | | 0.15x0.3; 0.8 | | | | | Terrace: 1.2x0.5 | | | | | | | | |

Table III-1.8.1 Status of Existing Check Dam (1/2)

| No. | Name of the Dam | Location | | | | | | | Year of Construction | Government Agency | Catchment Area (ha) | Dam Dimension | | | | |
|---------|-----------------|----------------|----------------|--------------|--------------|-------------------|------|-------|----------------------|------------------------------|---------------------|-------------------------|-----------------------|------------------|----------------|-----------------|
| | | North Latitude | East Longitude | Town | Sub District | Sub-watershed No. | Zone | Area | | | | Type | No. of the Dam (nos.) | Crest Length (m) | Dam Height (m) | Crest Width (m) |
| CD - 1 | Tataaran II | 01°16'45" | 124°52'02" | Tataaran II | Tondano | 2 | Bm1 | West | 1983/1984 | BRLKT | 133 | Earth Fill Dam | 1 | 25.0 | 4.0 | 4.0 |
| CD - 2 | Tataaran II | 01°16'39" | 124°52'05" | Tataaran II | Tondano | 2 | Bm1 | West | 1984/1985 | BRLKT | 32 | Earth Fill Dam | 1 | 45.0 | 6.5 | 10.0 |
| CD - 3 | Tataaran I | 01°16'06" | 124°52'48" | Tataaran I | Tondano | - | Bm2 | West | 1983/1984 | BRLKT | 81 | Earth Fill Dam | 1 | 45.0 | Unknown | 4.0 |
| CD - 4 | Roong | 01°15'57" | 124°53'32" | Tounsaru | Tondano | 5 | Bm2 | West | 1982/1983 | BRLKT | 100 | Earth Fill Dam | 1 | 40.0 | 4.5 | 3.5 |
| CD - 5 | Leleko | 01°15'01" | 124°51'56" | Leleko | Remboken | 6 | Bm2 | West | 1984/1985 | BRLKT | 68 | Earth Fill Dam | 1 | 45.0 | 5.0 | 2.5 |
| CD - 6 | Kasuratan | 01°15'07" | 124°50'11" | Kasuratan | Remboken | - | Bm3 | West | 1991/1992 | BRLKT | 22 | Earth Fill Dam | 1 | 30.0 | 2.0 | 3.5 |
| CD - 7 | Pulutan | 01°13'11" | 124°50'09" | Pulutan | Remboken | - | Bm2 | West | 1995/1996 | District Forest Survice | 13 | Earth Fill Dam | 1 | 44.0 | 6.0 | 3.5 |
| CD - 8 | Touure | 01°08'50" | 124°47'15" | Touure | Tompaso | 10 | Bm2 | South | 1991/1992 | BRLKT | 59.2 | Earth Fill Dam | 1 | - | - | - |
| CD - 9 | Tumaratas | 01°09'12" | 124°48'14" | Tumaratas | Langowan | 11 | F | South | 1993/1994 | District Forest Survice | 379 | Earth Fill Dam | 1 | 45.0 | 8.0 | 4.0 |
| CD - 10 | Tounelet | 01°07'57" | 124°50'21" | Tounelet | Langowan | - | Bm2 | South | 1997/1998 | District Forest Survice | 19 | Earth Fill Dam | 1 | 40.0 | 4.5 | 3.5 |
| CD - 11 | Tountimomor | 01°11'04" | 124°52'26" | Tountimomor | Kakas | - | - | - | 1997/1998 | District Forest Survice | 6,770 | Gabion Box Check Dam | 2 | 7.0 | Unknown | - |
| CD - 12 | Telap | 01°12'44" | 124°54'48" | Telap | Eris | 16 | Bm1 | East | 1994/1995 | District Forest Survice | 42 | Dam Penahan | 4 | 4.0 | 0.0 | - |
| CD - 13 | Eris | 01°13'30" | 124°55'06" | Eris | Eris | 17 | Bm1 | East | 1984/1985 | BRLKT | 100 | Earth Fill Dam | 1 | 75.0 | 2.5 | 4.0 |
| CD - 14 | Tandengan | 01°13'51" | 124°55'47" | Tandengan | Eris | 19 | Bm1 | East | 1984/1985 | BRLKT | 30 | Earth Fill Dam | 1 | 40.0 | 4.0 | 4.0 |
| CD - 15 | Ranomerut | 01°14'41" | 124°56'01" | Ranomerut | Eris | - | Bm2 | East | 1983/1984 | BRLKT | 13 | Earth Fill Dam | 1 | 35.0 | 3.0 | 6.0 |
| CD - 16 | Touliang Oki | 01°15'07" | 124°56'36" | Touliang Oki | Eris | 24 | Bm2 | East | 1997/1998 | Provincial Irrigation Office | 104 | Wet Masonry Gravity Dai | 1 | 80.0 | 5.0 | 3.0 |
| CD - 17 | Touliang Oki | 01°15'25" | 124°56'13" | Touliang Oki | Eris | - | Bm2 | East | 1983/1984 | BRLKT | 21 | Earth Fill Dam | 1 | 50.0 | 3.5 | 4.0 |

Table III-1.8.1 Status of Existing Check Dam(2/2)

| No. | Name of the Dam | Condition of Sediment Control | | | Condition of Water Supply | | | | Condition of Dam Body |
|---------|-----------------|-------------------------------|-------------------------|--------------------------------------|----------------------------|-------------------------|-----------------------------------|---|---------------------------------|
| | | Status of Sediment Control | Deposition Gradient (%) | Average Sediment Yield (ton/ha/year) | Intention for Water Supply | Purpose of Water Supply | Present Land Use of Downstream | Condition of Downstream Irrigation System | |
| CD - 1 | Tataaran II | Functioning | N/A | N/A | Yes | Irrigation | Arable Upland | Not functioning | |
| CD - 2 | Tataaran II | Functioning | N/A | N/A | Yes | Irrigation | Arable Upland | Not functioning | |
| CD - 3 | Tataaran I | Abandoned | N/A | N/A | Yes | Irrigation | University Campus / Arable Upland | Abandoned | |
| CD - 4 | Roong | Functioning | 0.5 | 2,800 | Yes | Irrigation | Grassland | Not Functioning | |
| CD - 5 | Leleko | Functioning | 1.8 | 3,000 | Yes | Irrigation | Arable Upland | Not functioning | A part of dam body has damaged. |
| CD - 6 | Kasuratan | Functioning | N/A | N/A | No | None | - | - | A part of spillway has damaged. |
| CD - 7 | Pulutan | Functioning | 3.0 | 1,000 | No | None | - | - | |
| CD - 8 | Touure | Not Functioning | N/A | N/A | No | None | - | - | Dam body has collapsed. |
| CD - 9 | Tumaratas | Functioning | N/A | N/A | Yes | Irrigation | Paddy Field | Good | |
| CD - 10 | Tounelet | Functioning | N/A | N/A | Yes | Irrigation | Paddy Field | Unknown | |
| CD - 11 | Tountimomor | Functioning | N/A | N/A | No | None | - | - | |
| CD - 12 | Telap | Functioning | N/A | N/A | No | None | - | - | |
| CD - 13 | Eris | Functioning | N/A | N/A | Yes | Inland Fishery | Fish Pond | - | |
| CD - 14 | Tandengan | Functioning | N/A | N/A | Yes | Irrigation | Paddy Field | Not functioning | |
| CD - 15 | Ranomerut | Functioning | N/A | N/A | Yes | Irrigation | Paddy | Bad | |
| CD - 16 | Touliang Oki | Functioning | N/A | N/A | No | None | - | - | |
| CD - 17 | Touliang Oki | Functioning | N/A | N/A | Yes | Irrigation | Paddy | Good | |

Table III-1.10.1 Species of Commercial Importance in the Intensive Area(1/2)

| No | Species | Kal | Tam | Kas | Man | Commercial Value |
|----|-------------------------------|-----|-----|-----|-----|--------------------------------------|
| 1 | <i>Ainnaucleafagifolia</i> | | + | | | Commercial wood |
| 2 | <i>Ailanthus integrifolia</i> | | + | + | + | Commercial wood |
| 3 | <i>Alstonia scholaris</i> | + | | | | Commercial wood and medicinal plants |
| 4 | <i>Areca vestiaria</i> | | + | + | + | Ornamental plant |
| 5 | <i>Arengapinnata</i> | | | + | + | Multi-useful plant |
| 6 | <i>Begonia</i> sp | | + | | | Ornamental plant |
| 7 | <i>Bhischoffia javanica</i> | + | | | | Ornamental plant |
| 8 | <i>Calamus</i> sp 2 | | + | + | + | Industrial materials |
| 9 | <i>Calamus</i> sp 2 | | + | | + | Industrial materials |
| 10 | <i>Calamus zollingeri</i> | + | | | | Industrial materials |
| 11 | <i>Calathea</i> sp | | + | | | Ornamental plant |
| 12 | <i>Callophyllum</i> sp 1 | + | + | + | | Ornamental plant |
| 13 | <i>Calophyllum soulattn</i> | + | | | + | Ornamental plant |
| 14 | <i>Calophyllum</i> sp 2 | | + | | | Ornamental plant |
| 15 | <i>Cananum hirtutum</i> | | + | + | | Commercial wood |
| 16 | <i>Canarium</i> sp 1 | | + | + | | Commercial wood |
| 17 | <i>Canarium</i> sp 3 | | | + | + | Commercial wood |
| 18 | <i>Canarium</i> sp 4 | | | | + | Commercial wood |
| 19 | <i>Canarium</i> sp 5 | | + | | | Commercial wood |
| 20 | <i>Canarium</i> sp 2 | + | | | | Commercial wood |
| 21 | <i>Cananum vulgare</i> | + | | + | | Commercial wood |
| 22 | <i>Caryota mitis</i> | + | | + | | Ornamental plant |
| 23 | <i>Garyota urens</i> | | | | + | Ornamental plant |
| 24 | <i>Casuarina selebica</i> | + | | | | Commercial wood/ Ornamental wood |
| 25 | <i>Cinamomum culilawan</i> | | | | + | Medicinal plant |
| 26 | <i>Dracaena</i> sp | | | + | | Ornamental plant |
| 27 | <i>Dracontomelon dao</i> | | | + | | Commercial wood |
| 28 | <i>Elmenilia ovalis</i> | + | + | + | | Commercial wood |
| 29 | <i>Erythrina</i> sp | | | | + | Commercial wood |
| 30 | <i>Ficus benyamina</i> | + | | | | Ornamental plant |
| 31 | <i>Ficus celebensis</i> | + | + | + | | Ornamental plant |
| 32 | <i>Flagellaria indica</i> | | | | + | Ornamental plant |
| 33 | <i>Garctinia macrophylla</i> | | | + | | Commercial wood |
| 34 | <i>Homalium celebicum</i> | + | | | | Commercial wood |
| 35 | <i>Homalium</i> sp | | + | + | | Commercial wood |
| 36 | <i>Knema</i> sp | | | | + | Commercial wood |
| 37 | <i>Lantana camara</i> | | | + | | Medicinal plant |
| 38 | <i>Lithocarpus celebicus</i> | + | | | | Commercial wood |
| 39 | <i>Lithocarpus</i> sp | | + | + | + | Commercial wood |
| 40 | <i>Macaranga gigantea</i> | + | | | | Commercial wood |
| 41 | <i>Magnolia paulantha</i> | | + | | | Commercial wood |
| 42 | <i>Mallotus</i> sp | + | | + | + | Commercial wood |
| 43 | <i>Mangifera minor</i> | + | | | | Commercial wood |
| 44 | <i>Myristica fatua</i> | | | + | | Commercial wood |
| 45 | <i>Nephrolepis biserata</i> | | + | | | Ornamental plant |
| 46 | <i>Oplismenus</i> sp | | + | + | + | Ornamental plant |
| 47 | <i>Palaquium</i> sp 2 | + | | | | Commercial wood |

Note: Kal = Kaluta forest, Tarn = Tarnpusu forest, Kas = Kasuratan forest,
Man = Manimporok forest

Table III-1.10.1 Species of Commercial Importance in the Intensive Area(2/2)

| No | Species | Kal | Tam | Kas | Man | Commercial Value |
|----|----------------------------------|-----|-----|-----|-----|------------------|
| 48 | <i>Palaquium obovatum</i> | + | | + | | Commercial wood |
| 49 | <i>Palaquium obtusifolium</i> | | | + | + | Commercial wood |
| 50 | <i>Palaquium</i> sp 1 | | | + | | Commercial wood |
| 51 | <i>Palaquium</i> sp 3 | | | | + | Commercial wood |
| 52 | <i>Pharaserianthes minahasae</i> | + | | | | Commercial wood |
| 53 | <i>Pigaffeta flaris</i> | | | + | + | Ornamental plant |
| 54 | <i>Pinanga caesia</i> | + | + | + | + | Ornamental plant |
| 55 | <i>Pinanga celebica</i> | | | + | | Ornamental plant |
| 56 | <i>Pinanga</i> sp | | + | + | + | Ornamental plant |
| 57 | <i>Polyalthia macrophylla</i> | | | | + | Commercial wood |
| 58 | <i>Pathos</i> sp | + | | | | Commercial wood |
| 59 | <i>Pterocarpus indicus</i> | + | | | | Commercial wood |
| 60 | <i>Sarcocephallus cadamba</i> | + | | | | Commercial wood |
| 61 | <i>Schefflera</i> sp | + | | | + | Ornamental plant |
| 62 | <i>Schimattogictis</i> sp | | | + | | Ornamental plant |
| 63 | <i>Scindapsus</i> sp | | + | + | | Ornamental plant |
| 64 | <i>Selaginella intermedia</i> | | | + | | Ornamental plant |
| 65 | <i>Shorea</i> sp | | | | + | Commercial wood |
| 66 | <i>Spathoglottis</i> sp | | | | + | Ornamental plant |
| 67 | <i>Syngonium</i> sp | | + | + | + | Ornamental plant |
| 68 | <i>Talauma celebica</i> | | + | + | | Commercial wood |
| 69 | <i>Terminalia bellinca</i> | | + | + | + | Commercial wood |
| 70 | <i>Trema orinentalis</i> | | | | + | Commercial wood |
| 71 | Unknown 11 | + | | | | Commercial wood |
| 72 | Unknown 13 | | | + | + | Ornamental plant |
| 73 | Unknown 14 | + | + | + | + | Ornamental plant |
| 74 | Unknown 15 | | | + | | Ornamental plant |
| 75 | Unknown 16 | | + | + | + | Ornamental plant |
| 76 | <i>Ficus microcarpa</i> | | + | | | Ornamental plant |
| 77 | <i>Ficus</i> sp 1 | | | + | | Ornamental plant |

Note: Kal = Kaluta forest, Tarn = Tarnpusu forest, Kas = Kasuratan forest,
Man = Manimporok forest

Table III-1.10.2 Dangerous Species and Threatened Status of Plants in the Intensive Area

| No | Species | Kal | Tam | Kas | Man | Dangerous Spciesd | Threatened Status | |
|----|----------------------------------|-----|-----|-----|-----|-------------------|---------------------------------|-------------------------------|
| | | | | | | | Protected By I.G. ¹⁾ | IUCN ²⁾ Categories |
| 1 | <i>Ailanthus integrifolia</i> | | + | + | + | | | R |
| 2 | <i>Areca vestiaria</i> | | + | + | + | | | R |
| 3 | <i>Calamus zollingeri</i> | + | | | | | | R |
| 4 | <i>Canarium sp 2</i> | + | | | | | | R |
| 5 | <i>Caryota mitis</i> | + | | + | | | Pr | |
| 6 | <i>Garyota urens</i> | | | | + | | Pr | |
| 7 | <i>Casuarina selegica</i> | + | | | | | | R |
| 8 | <i>Chisocheton warburgii</i> | | + | + | + | | | R |
| 9 | <i>Dillenia celebica</i> | + | | + | | | | R |
| 10 | <i>Homalium celebicum</i> | + | | | | | | R |
| 11 | <i>Hydnophytum formicarum</i> | | | + | | | Pr | |
| 12 | <i>Kibara coriacea</i> | | + | + | + | | | LR/lc |
| 13 | <i>Lithocarpus celebicus</i> | + | | | | | | R |
| 14 | <i>Magnolia paulantha</i> | | + | | | | | R |
| 15 | <i>Manglietia glauca</i> | + | + | + | + | | | R |
| 16 | <i>Myristica fatua</i> | | | + | | | | LR/lc |
| 17 | <i>Pharaserianthes minahasae</i> | + | | | | | | R |
| 18 | <i>Pigaffeta flaris</i> | | | + | + | | Pr | |
| 19 | <i>Pinanga caesia</i> | + | + | + | + | | | R |
| 20 | <i>Pinanga celebica</i> | | | + | | | | R |
| 21 | <i>Piper aduncum</i> | + | | + | | Dangerous | | |
| 22 | <i>Pterocarpus indicus</i> | + | | | | | | VU A1d |
| 23 | <i>Saurauza minahasae</i> | | | | + | | | R |
| 24 | <i>Talauma celebica</i> | | + | + | | | | R |
| 25 | <i>Terminalia bellinca</i> | | + | + | + | | | R |
| 26 | Unknown 13 | | | + | + | | Pr | |
| 27 | Unknown 2 | + | | + | | Dangerous | | |

Note: Kal = Kaluta forest, Tarn = Tarnpusu forest, Kas = Kasuratan forest, Man = Manimporok forest

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources

Pr: Protected by PP No. 7/1999 Concerning the protection of plants and animals.

R: Population is characterised by an acute restriction in its area of occupancy (typically less than 100 km²) or in the number of locations (typically less than 5). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming Critically Endangered or even Extinct in a very short period.

LR/nt: A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. **Near Threatened (nt)**. Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

Vu C1+2a: A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future. C. Population estimated to number less than 10,000 mature individuals and either: 1. An estimated continuing decline of at least 10 % within 10 years or 3 generations, whichever is longer, or 2. A continuing decline, observed, projected or inferred, in numbers of mature individuals and population structure in the form of a severely fragmented (i.e. no sub-population estimated to contain more than 1000 mature individuals)

Table III-1.10.3 Threatened Status of Animals in the Intensive Area

| No | Scientific Name | Family | Location | Threatened Status | |
|----|---------------------------------------|-----------------|-------------------|------------------------------------|----------------------------------|
| | | | | Protected By I.G. ¹⁾ | IUCN ²⁾ Categories |
| 1 | <i>Accipiter</i> sp | Accipitridae | Kas | Pr | |
| 2 | <i>Aetopigia siparaja</i> | Nectariniidae | Kas | Pr | |
| 3 | <i>Centropus celebensis</i> | Centropoindae | Tam | | R |
| 4 | <i>Dendrocopos temminckii</i> | Picidae | Tam | | R |
| 5 | <i>Dicaeum auralimbatus</i> | Dicasidae | Tam, Kas | | R |
| 6 | <i>Dicaeum celebicum</i> | Dicacidae | Kai, Tm, Kas | | R |
| 7 | <i>Dicaeum nehrkorni</i> | Dicacidae | Tam, Man | | R |
| 8 | <i>Ducula forsteni</i> | Columbidae | Kal, Tm | | R |
| 9 | <i>Enodes erythrophris</i> | Stumidae | Kal | | R |
| 10 | <i>Eudynamis melanorkynca</i> | Cuculidae | Kal | | R |
| 11 | <i>Ficedula rufigula</i> | Muscicapidae | Kal, Ku | | R/LR/nt |
| 12 | <i>Macropigia amboinensis</i> | Columbidae | Kal, Tm, Kas, Man | Pr | VU C1+2a |
| 13 | <i>Mulleripicus fulvus</i> | Picidae | Man | | R |
| 14 | <i>Myzomela sanguinolenta</i> | Meliphagidae | Ku, Man | Pr | |
| 15 | <i>Nectarinia aspasia</i> | Nectariniidae | Kal | Pr | |
| 16 | <i>Nectarinia jugularis</i> | Nectariniidae | Tm | Pr | |
| 17 | <i>Pachycephala sulfuriventer</i> | Pachycephalidae | Tam, Ku, Man | | R |
| 18 | <i>Penelopides exarhatus</i> | Bucerotidae | Kal | Pr | R |
| 19 | <i>Phaenicophaeus calyborhincus</i> | Cuculidae | Kal, Tm, Kas | | R |
| 20 | <i>Pitta erythrogaster</i> | Pittidae | Tam, Kas | Pr | |
| 21 | <i>Prioniturus platturus</i> | Psittacidae | Kal | | R |
| 22 | <i>Prosciurillus leucomus</i> (Tupai) | | Kal | | R |
| 23 | <i>Treron vernans</i> | Columbidae | Tam | | R |
| 24 | <i>Trichastoma celebensis</i> | Timaliidae | Kal, Tam, Ku | | R |

Note: Kal = Kaluta forest, Tarn = Tarnpusu forest, Kas = Kasuratan forest, Man = Manimporok forest

1) Indonesian Government, 2) International Union for Conservation of Nature and Natural Resources
Pr: Protected by PP No. 7/1999 Concerning the protection of plants and animals.

R: Population is characterised by an acute restriction in its area of occupancy (typically less than 100 km²) or in the number of locations (typically less than 5). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming Critically Endangered or even Extinct in a very short period.

LR/nt: A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Near Threatened (nt). Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

Vu C1+2a: A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future. C. Population estimated to number less than 10,000 mature individuals and either: 1. An estimated continuing decline of at least 10 % within 10 years or 3 generations, whichever is longer, or 2. A continuing decline, observed, projected or inferred, in numbers of mature individuals and population structure in the form of a severely fragmented (i.e. no sub-population estimated to contain more than 1000 mature individuals)

Table III-2.4.1 Application of Different Farming Category to Each Zone

| Location | Kecamatan | Type | P Zone | Bm1 Zone | Bm2 Zone | Bm3 Zone | Bw Zone | F Zone | Total | Location | Kecamatan | Type | P Zone | Bm1 Zone | Bm2 Zone | Bm3 Zone | Bw Zone | F Zone | Total |
|----------|-------------|--------------|--------|----------|----------|----------|---------|--------|-------|----------|--------------|--------------|--------|----------|----------|----------|---------|--------|-------|
| East | Toulimambot | AGF - I | 0 | 127 | 0 | 0 | 0 | 0 | 127 | West | Remboken-E | AGF - I | 0 | 0 | 6 | 0 | 6 | 0 | 12 |
| | | AGF - I/IM | 0 | 167 | 0 | 0 | 0 | 0 | 167 | | | AGF - I/IM | 0 | 0 | 18 | 0 | 0 | 0 | 18 |
| | | AGF - II/IM | 0 | 0 | 20 | 0 | 0 | 0 | 20 | | | AGF - II/IM | 0 | 0 | 0 | 60 | 0 | 0 | 60 |
| | | AGF - III/IM | 0 | 79 | 70 | 0 | 0 | 0 | 149 | | | AGF - III/IM | 0 | 0 | 107 | 14 | 4 | 0 | 125 |
| | | UF/IM | 0 | 0 | 31 | 0 | 0 | 7 | 38 | | | UF/IM | 0 | 0 | 0 | 0 | 5 | 48 | 53 |
| | | LF/IM | 0 | 0 | 0 | 0 | 0 | 169 | 169 | | | LF/IM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Total | 0 | 373 | 121 | 0 | 0 | 176 | 670 | | | Total | 0 | 0 | 131 | 74 | 15 | 48 | 268 |
| | Eris | AGF - I | 0 | 370 | 0 | 0 | 10 | 0 | 380 | | Kakas-W | AGF - I | 0 | 0 | 39 | 0 | 0 | 0 | 39 |
| | | AGF - I/IM | 0 | 494 | 0 | 0 | 0 | 0 | 494 | | | AGF - I/IM | 0 | 0 | 136 | 0 | 0 | 0 | 136 |
| | | AGF - II/IM | 0 | 13 | 49 | 0 | 0 | 0 | 62 | | | AGF - II/IM | 0 | 0 | 30 | 15 | 0 | 35 | 80 |
| | | AGF - III/IM | 0 | 88 | 0 | 0 | 0 | 0 | 88 | | | AGF - III/IM | 0 | 0 | 135 | 0 | 0 | 0 | 135 |
| | | UF/IM | 0 | 0 | 23 | 0 | 3 | 3 | 29 | | | UF/IM | 0 | 0 | 0 | 0 | 0 | 50 | 50 |
| | | LF/IM | 0 | 0 | 0 | 0 | 10 | 90 | 100 | | | LF/IM | 0 | 0 | 0 | 0 | 0 | 7 | 7 |
| | | Total | 0 | 965 | 72 | 0 | 23 | 93 | 1,153 | | | Total | 0 | 0 | 340 | 15 | 0 | 92 | 447 |
| South | Kakas-E | AGF - I | 0 | 172 | 0 | 0 | 14 | 0 | 186 | Tondano | AGF - I | 0 | 30 | 0 | 0 | 30 | 0 | 60 | |
| | | AGF - I/IM | 0 | 111 | 218 | 0 | 0 | 0 | 329 | | AGF - I/IM | 0 | 80 | 281 | 0 | 0 | 0 | 361 | |
| | | AGF - II/IM | 0 | 0 | 75 | 0 | 0 | 32 | 107 | | AGF - II/IM | 0 | 0 | 450 | 0 | 0 | 0 | 450 | |
| | | AGF - III/IM | 0 | 0 | 36 | 0 | 0 | 0 | 36 | | AGF - III/IM | 0 | 0 | 570 | 0 | 0 | 0 | 570 | |
| | | UF/IM | 0 | 0 | 0 | 0 | 2 | 30 | 32 | | UF/IM | 0 | 0 | 20 | 440 | 0 | 81 | 541 | |
| | | LF/IM | 0 | 0 | 0 | 0 | 10 | 109 | 119 | | LF/IM | 0 | 0 | 0 | 0 | 0 | 88 | 88 | |
| | | Total | 0 | 283 | 329 | 0 | 26 | 171 | 809 | | Total | 0 | 110 | 1,321 | 440 | 30 | 169 | 2,070 | |
| South | Langowan | AGF - I | 0 | 15 | 0 | 0 | 0 | 0 | 15 | Remboken | AGF - I | 0 | 0 | 40 | 0 | 0 | 0 | 40 | |
| | | AGF - I/IM | 0 | 86 | 100 | 0 | 0 | 0 | 186 | | AGF - I/IM | 0 | 0 | 311 | 0 | 0 | 0 | 311 | |
| | | AGF - II/IM | 0 | 0 | 0 | 209 | 0 | 232 | 441 | | AGF - II/IM | 0 | 0 | 59 | 260 | 0 | 0 | 319 | |
| | | AGF - III/IM | 0 | 0 | 260 | 79 | 0 | 0 | 339 | | AGF - III/IM | 0 | 0 | 400 | 0 | 0 | 0 | 400 | |
| | | UF/IM | 0 | 0 | 0 | 0 | 0 | 398 | 398 | | UF/IM | 0 | 0 | 0 | 320 | 0 | 160 | 480 | |
| | | LF/IM | 0 | 0 | 0 | 0 | 0 | 105 | 105 | | LF/IM | 0 | 0 | 0 | 0 | 0 | 30 | 30 | |
| | | Total | 0 | 101 | 360 | 288 | 0 | 735 | 1,484 | | Total | 0 | 0 | 810 | 580 | 0 | 190 | 1,580 | |
| | Tompaso | AGF - I | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Total | AGF - I | 0 | 715 | 85 | 0 | 60 | 0 | 860 | |
| | | AGF - I/IM | 0 | 14 | 13 | 0 | 0 | 0 | 27 | | AGF - I/IM | 0 | 952 | 1,077 | 0 | 0 | 0 | 2,029 | |
| | | AGF - II/IM | 0 | 0 | 8 | 98 | 0 | 111 | 217 | | AGF - II/IM | 0 | 13 | 691 | 642 | 0 | 410 | 1,756 | |
| | | AGF - III/IM | 0 | 0 | 125 | 0 | 0 | 0 | 125 | | AGF - III/IM | 0 | 167 | 1,703 | 93 | 4 | 0 | 1,967 | |
| | | UF/IM | 0 | 0 | 0 | 6 | 0 | 134 | 140 | | UF/IM | 0 | 0 | 74 | 766 | 10 | 911 | 1,761 | |
| | | LF/IM | 0 | 0 | 0 | 0 | 0 | 20 | 20 | | LF/IM | 0 | 0 | 0 | 0 | 20 | 618 | 638 | |
| | | Total | 0 | 15 | 146 | 104 | 0 | 265 | 530 | | Total | 0 | 1,847 | 3,630 | 1,501 | 94 | 1,939 | 9,011 | |

Note: AGF-I/IM; Improved agroforestry type I, AGF-II/IM; Improved agroforestry type II, and AGF-III; Improved agroforestry type III

UF/IM: Improved upland farming, LF: Lowland farming

**Table III-2.5.1 Required Activities of Institutional Development
of Each Component (1/3)**

| | |
|-----|--|
| (a) | Community Institutional Development |
| | <ul style="list-style-type: none"> - To prepare minimum requirements for village cadre selection, - To prepare and apply village cadre recruiting procedure, - To select first generation of village cadres and NGO members as to attend training programs as well, - To prepare and apply village cadre introductory program, - To develop village cadre human resource management capacity in relevant government office (forestry services) and a village level proposal process, - To prepare guidelines and technical manual for proposal development - To train local village communities based on technical manual & guidelines, - To repair guidelines for proposal selection, - To facilitate project proposal process in selected villages, - To deploy extension workers in the field, - To promote project process, - To implement village proposal process for nursery development, proper farming practices, physical measures construction, and agroforestry development, - To prepare ongoing proposal preparation selection, funding process, and implementation. |
| (b) | Technical Institutional Development |
| | <ul style="list-style-type: none"> - To develop physical measures construction training for extension workers, - To establish agroforestry research and development capacity (AFRDC), - To prepare facility, - To recruit consultants, - To prepare research programs, - To implement research programs, - To prepare annual reports and recommendations, - To establish and maintain demonstration plots, - To prepare modules for village cadre training center, - To appoint village cadre training center (VCTC) - To prepare facility, uniforms and kits, - To prepare basic programs such as agroforestry, environmental and watershed awareness, priority project identification, proper farming practices, physical measures construction, and project management, - To begin village cadre induction and orientation, - To strengthen village cadre training center (receive updated modules, recommendations from AFRDC) - To prepare advanced agroforestry extension worker training program - To apply basic extension cadre training program for new recruits - To apply advanced extension cadre training program (physical measures, proper farming, and agroforestry) |

**Table III-2.5.1 Required Activities of Institutional Development
of Each Component (2/3)**

| (c) Institutional Development of Forestry Services |
|--|
| <p><u>1) Information Systems Development I (District level)</u></p> <ul style="list-style-type: none"> - Establish office in district structure - Engage institutional development and information systems consultant - Install computers and related hardware in district office - Install software in district office - Select staff for training - Select training contractor - Computer operation training I (Basic Computer Operation 10 trainees x 10 days) - Computer operation training II (Business Software 10 trainees x 10 days) - Computer operation training III (Database & Data Processing 10 trainees x 10 days) - Computer operation Training (Advanced training, desktop publishing and GIS, 25 trainees X 4 sessions X 10 days) - Research and identify routine data gathering points - Install data gathering equipment and facilities - Develop simple watershed database - Develop standard data forms for branch offices - Training for branch staff - Develop standardized project monitoring and evaluation forms - Train staff in differential GPS operation - Deploy branch office staff - Gather data - Design input data screen form - Data coding - Data entry - Forward data to province office - Descriptive analysis and report writing training I - Descriptive analysis and report writing workshop I <p><u>2) Information Systems Development II (Province level)</u></p> <ul style="list-style-type: none"> - Engage database and computer communications specialist - Install computers and related hardware in province office - Install software in province office - Install LAN intranet - Design website with IT staff - Select staff for general training - Install watershed database - Computer operation training I (basic computer operation 15 trainees x 10 days) - Computer operation training II (Business Software 15 trainees x 10 days) - Computer operation training III (database & data processing 15 trainees x 10 days) - Computer operation training IV (desktop publishing and graphics design combined with district office) - Descriptive analysis and report writing training workshop I (15 trainees x 2 days) - Descriptive analysis and report writing seminar I (15 trainees x 2 days) - Develop simple but attractive environmental leaflet for village awareness - Develop posters (environmental awareness) - Computer GIS operation training I on the job - Train staff in differential GPS operation on the job - Develop environmental impact signaling system - Environmental impact signaling report 1 - Environmental impact signaling report 2 - General real time on the job training and coaching for information systems and product development in province and district Offices <p><u>3) General capacity strengthening</u></p> <ul style="list-style-type: none"> - Technical assistance with counterpart arrangements where existing office staff work together with technical assistance staff. |

**Table III-2.5.1 Required Activities of Institutional Development
of Each Component (3/3)**

| | |
|-----|---|
| (d) | Accurate Village Boundary Mapping |
| | <ul style="list-style-type: none"> - To recruit survey and mapping consultant - To consultant preparations - To gather existing village boundary maps from Sub Districts and Department of Lands - To develop standard approach for mapping village boundaries - To have meetings with all Sub District Heads for explaining objectives of village boundary mapping - To use differential GPS to locate and establish village reference points - To relate maps to natural and man made boundaries (streams, roads etc.) - To establish boundaries through map and aerial photo interpretation on 1:10,000 maps - To create village boundary layer in GIS - To overlay village boundaries on zoning and problem maps - To provide recommendations to Sub District and village about zoning needs |
| (e) | Institutional Integration and Strengthening of Legal and Regulatory Framework |
| | <ul style="list-style-type: none"> - To revise laws and adapt regional regulations (Forestry/Social Forestry) - To research and establish joint decree - To establish Watershed Conservation Committee - To establish forum for integration of government activities |
| (f) | Strengthening of Watershed Conservation Capacity at University of Manado |
| | <ul style="list-style-type: none"> - To work with staff to strengthen the research capacity and supervise watershed program - To work with university staff to select research topics - To researcher undertake research - To present findings and recommendations to university - To revise based on inputs if necessary - To present final report to Watershed Conservation Committee - To work with public relations and community information section to develop simplified report - To translate simplified report - To layout and prepare simplified report - To disseminate simplified report to community |

Table III-3.1.1 Activities Needed EIA

| Activities | Scale/Area |
|--|-------------------------|
| I. FORESTRY FIELD | |
| 1 Development of Safari Garden | >= 250 ha |
| 2 Development of Zoo | >= 100 ha |
| 3 Forestry Exertion Authority | All size |
| 4 Sago Forest Exertion Authority | All size |
| 5 Industrial Plants Forest Exertion Authority | >= 10,000 ha |
| 6 Bamboo Forest Exertion Authority | All size |
| 7 Exertion of Natural Tourism in | |
| - National Park | >= 100 ha |
| - Natural Tourism Park | >= 100 ha |
| - Hunting Park | >= 100 ha |
| - Botanical Forest | >= 100 ha |
| All the activities appropriate to the Conclusion of Forestry Department no. 167/Kpts-II/1994 | |
| II. TOURISM FIELD | |
| 1 Hotels | >=200 rooms or area>5ha |
| 2 Golf Area | All size |
| 3 Park | >= 100 ha |
| 4 Tourism Area | All size |
| III. AGRICULTURE FIELD | |
| 1 Wet rice field on the Forest | >= 1,000 ha |
| 2 Food plantation cultivation and horticulture with or without its exemption units | >= 3,000 ha |
| 3 Estate season plant cultivation with or without its exemption unit | >= 5,000 ha |
| 4 Estate Plant cultivation with or without its exemption unit | >= 10,000 ha |
| 5 Fishpond cultivation | >= 50 ha |
| IV. PUBLIC WORK | |
| 1 River normalization | |
| Medium city | >= 5 km |
| Village | >= 10 km |
| 2 Water | >= 500 l/second |
| V. Relocation AND Forest cleared Settlement | |
| 1 Settlement and relocation activities | >= 1,500 ha |

Table III-3.3.1 Initial Environmental Examination - Scoping Check List-1(1/3)

| Issues | Judgement | | | |
|--|---|-------------------------------|--|---|
| | Set-up of monitoring institution for watershed management | Establishing community forest | Introduction/Extension of agroforestry | Introduction/Extension of erosion control farming practices |
| 1. Social Issues | | | | |
| Scheduled relocation | D | D | D | D |
| Unwilling relocation | D | D | D | D |
| Alteration of the right on land tenure, & residence | D | D | D | D |
| Change of life style | D | B/C | C | C |
| Conflict between population | C | A | C | C |
| Effect on indigenous people, minority, & nomads | D | D | D | D |
| Reform of traditional institution, & custom | C | D | B | C |
| Obstruction on fishing right, water right, local regulations | C | D | D | D |
| Alteration of social structure by organization, etc. | C | C | C | C |
| Radical change of social structure, & population increase | D | D | D | D |
| Lost opportunity on production, such as loss of land | D | C | C | D |
| Transfer, conversion of foundation of economic activity, or unemployment | D | C | C | D |
| Enlarging income gap | D | C | C | C |
| Impact on existing transportation | D | D | D | D |
| Impact on schools & hospitals | D | D | D | D |
| Cutting off the local society by roads | D | D | D | D |
| People's perception | C | C | A | A |
| 2. Health & Hygiene | | | | |
| Occurrence of local diseases | D | D | D | D |
| Spread of malaria/ filaria epidemic | D | D | D | D |
| Increase of pesticide consumption | D | D | D | D |
| Accumulation of remained toxic matter | D | D | D | D |
| Increase of waste and excrement | D | D | D | D |
| Garbage & trash dump, falling standards of hygiene | D | D | D | D |
| Spread of vermin | D | D | D | D |

Table III-3.3.1 Initial Environmental Examination - Scoping Check List-1(2/3)

(Continued)

| Issues | Judgement | | | |
|---|---|-------------------------------|--|---|
| | Set-up of monitoring institution for watershed management | Establishing community forest | Introduction/Extension of agroforestry | Introduction/Extension of erosion control farming practices |
| 2. Health & Hygiene (continued) | | | | |
| Dump of construction waste, excavated soil, sludge, trash, etc. | D | D | D | D |
| 3. Historical remains, Cultural legacy, superb panorama, etc. | | | | |
| Destruction or damage of historical remains and cultural legacy | D | D | D | D |
| Loss of precious scenery | D | C | D | D |
| Effects on underground resources | D | C | D | D |
| Change of ground features by construction of the structures | D | D | D | D |
| Disturbance of harmonic scenery by construction of the structures | D | D | D | D |
| 4. Area of precious fauna and flora, and eco-system | | | | |
| Alteration of vegetation | A | D | B | D |
| Invasion and propagation of harmful fauna and flora | C | B | B | B |
| Extermination or decrease of precious or specific fauna and flora | A | B | B | D |
| Disappeared wetland or peat bog | D | D | D | C |
| Loss of bio-diversity | B | B | B | D |
| Loss of rain forest/ wild lands | A | C | B | D |
| 5. Soils and Lands | | | | |
| Land devastation (incl. Desertification) | D | D | D | D |
| Loss of soil fertility | D | D | D | D |
| Soil pollution by discharge or diffusion of toxic waste water | D | D | D | D |
| Soil loss | D | D | D | D |
| Loss of top-soil after forest cutting | D | D | D | D |
| Loss of top-soil after land consolidation | D | D | D | D |
| Modified important ground feature and loss of important geology by cut and bank | D | D | D | D |

Table III-3.3.1 Initial Environmental Examination - Scoping Check List-1(3/3)

(Continued)

| Issues | Judgement | | | |
|--|---|-------------------------------|--|---|
| | Set-up of monitoring institution for watershed management | Establishing community forest | Introduction/Extension of agroforestry | Introduction/Extension of erosion control farming practices |
| 6. Hydrology & Water quality | | | | |
| Change of flow/water surface | D | B | B | B |
| Occurrence of inundation and floods | D | D | D | D |
| Change of groundwater flow and groundwater table | D | B | B | C |
| Pollution or deterioration of water quality | D | D | D | D |
| Turbid water by soil erosion / reduced discharge | D | D | D | D |
| Exhausted groundwater by excess extraction or lowered recharge | D | D | D | D |
| Seeped toxic water of buried materials | D | D | D | D |
| Eutrophication | D | D | D | D |
| Water temperature change | D | D | D | D |
| 7. Lake and River | | | | |
| Sedimentation in lake | D | C | C | C |
| Sedimentation in rivers | D | C | C | C |
| Riverbed degradation | D | C | C | C |
| 8. Others | | | | |
| Increased opportunity of slope failure, accidents | D | D | D | D |
| Pollution by exhaust or toxic gas of vehicles and plants | D | D | D | D |
| Noise and vibration caused traffic, pumps, etc. | D | D | D | D |
| Change of temperature and wind by large scale development | D | D | D | D |

Judgement scores

A : Serious impact anticipated, need careful assessment in the site,

B : Anticipated impact

C : Unknown (necessary to assess, detail could be clarified in a further assessment),

D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.3.2 Initial Environmental Examination - Scoping Check List-2(1/3)

| Issues | Judgement | | | |
|--|--|---|--------------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| 1. Social Issues | | | | |
| Scheduled relocation | D | A | C | D |
| Unwilling relocation | D | A | C | D |
| Alteration of the right on land tenure, & residence | D | A | D | C |
| Change of life style | D | A | D | C |
| Conflict between population | D | A | A | C |
| Effect on indigenous people, minority, & nomads | D | C | D | D |
| Reform of traditional institution, & custom | D | B | C | D |
| Obstruction on fishing right, water right, local regulations | D | C | A | D |
| Alteration of social structure by organization, etc. | D | C | C | D |
| Radical change of social structure, & population increase | D | D | D | D |
| Lost opportunity on production, such as loss of land | C | A | C | C |
| Transfer, conversion of foundation of economic activity, or unemployment | D | C | D | C |
| Enlarging income gap | D | C | D | D |
| Impact on existing transportation | D | D | D | C |
| Impact on schools & hospitals | D | C | D | D |
| Cutting off the local society by roads | D | D | D | D |
| People's perception | C | C | C | C |
| 2. Health & Hygiene | | | | |
| Occurrence of local diseases | C | C | D | D |
| Spread of malaria/ filaria epidemic | C | D | D | D |
| Increase of pesticide consumption | C | D | D | D |
| Accumulation of remained toxic matter | D | D | D | D |
| Increase of waste and excrement | D | D | D | D |
| Garbage & trash dump, falling standards of hygiene | D | D | D | D |
| Spread of vermin | C | D | D | D |

Table III-3.3.2 Initial Environmental Examination - Scoping Check List-2(2/3)

(Continued)

| Issues | Judgement | | | |
|--|--|---|--------------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| 2. Health & Hygiene (continued) | | | | |
| Dump of construction waste, excavated soil, sludge, trash, etc. | C | C | D | C |
| 3. Historical remains, Cultural legacy, superb panorama, etc. | | | | |
| Destruction or damage of historical remains and cultural legacy | C | C | D | C |
| Loss of precious scenery | C | C | D | C |
| Effects on underground resources | C | C | D | C |
| Change of ground features by construction of the structures | C | C | D | C |
| Disturbance of harmonic scenery by construction of the structures | C | C | D | C |
| 4. Area of precious fauna and flora, and eco-system | | | | |
| Alteration of vegetation | D | D | D | D |
| Invasion and propagation of harmful fauna and flora | C | C | D | D |
| Extermination or decrease of precious or specific fauna and flora | D | D | D | D |
| Disappeared wetland or peat bog | D | D | D | D |
| Loss of bio-diversity | D | D | D | D |
| Loss of rain forest/ wild lands | D | D | D | D |
| 5. Soils and Lands | | | | |
| Land devastation (incl. Desertification) | D | D | D | D |
| Loss of soil fertility | D | D | D | D |
| Soil pollution by discharge or diffusion of toxic waste water | D | D | D | D |
| Soil loss | D | D | D | D |
| Loss of top-soil after forest cutting | D | D | D | D |
| Loss of top-soil after land consolidation | D | D | D | D |
| Modified important ground feature and loss of important geology by cut and bank | D | D | D | C |

Table III-3.3.2 Initial Environmental Examination - Scoping Check List-2(3/3)

(Continued)

| Issues | Judgement | | | |
|--|--|---|--------------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| 6. Hydrology & Water quality | | | | |
| Change of flow/water surface | C | A | D | B |
| Occurrence of inundation and floods | D | D | D | D |
| Change of groundwater flow and groundwater table | D | D | A | D |
| Pollution or deterioration of water quality | D | D | D | A |
| Turbid water by soil erosion / reduced discharge | D | D | D | A |
| Exhausted groundwater by excess extraction or lowered recharge | D | D | D | D |
| Seeped toxic water of buried materials | D | D | D | D |
| Eutrophication | D | D | B | D |
| Water temperature change | D | C | D | D |
| 7. Lake and River | | | | |
| Sedimentation in lake | A | A | D | A |
| Sedimentation in rivers | A | A | D | A |
| Riverbed degradation | D | D | D | C |
| 8. Others | | | | |
| Increased opportunity of slope failure, accidents | D | D | D | D |
| Pollution by exhaust or toxic gas of vehicles and plants | D | D | D | D |
| Noise and vibration caused traffic, pumps, etc. | D | D | D | D |
| Change of temperature and wind by large scale development | D | D | D | D |

Judgement scores

A : Serious impact anticipated, need careful assessment in the site,

B : Anticipated impact

C : Unknown (necessary to assess, detail could be clarified in a further assessment),

D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.1 Impact Assessment for Planned Activity on Soil and Land (1/2)

| Issues | Activities | | | |
|---|---|-------------------------------|---|---|
| | Set-up of monitoring institution for watershed management | Establishing community forest | Introduction/ Extension of agroforestry | Introduction/Extension of erosion control farming practices |
| Land devastation (incl. Desertification) | D | D | D | D |
| Loss of soil fertility | D | D | D | D |
| Soil pollution by discharge or diffusion of toxic waste water | D | D | D | D |
| Soil loss | D | D | D | D |
| Loss of top-soil after forest cutting | D | D | D | D |
| Loss of top-soil after land consolidation | D | D | D | D |
| Modified important ground feature and loss of important geology by cut and bank | D | D | D | D |

Judgement scores *A : Serious impact anticipated, need careful assessment in the site,*
B : Anticipated impact
C : Unknown (necessary to assess, detail could be clarified in a further assessment),
D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.1 Impact Assessment for Planned Activity on Soil and Land (2/2)

| Issues | Activities | | | |
|---|--|--------------------------------------|-----------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| Land devastation (incl. Desertification) | D | D | D | D |
| Loss of soil fertility | D | D | D | D |
| Soil pollution by discharge or diffusion of toxic waste water | D | D | D | D |
| Soil loss | D | D | D | D |
| Loss of top-soil after forest cutting | D | D | D | D |
| Loss of top-soil after land consolidation | D | D | D | D |
| Modified important ground feature and loss of important geology by cut and bank | D | D | D | C |

Judgement scores *A : Serious impact anticipated, need careful assessment in the site,*
B : Anticipated impact
C : Unknown (necessary to assess, detail could be clarified in a further assessment),
D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.2 Impact Assessment for Planned Activity on Hydrology(1/2)

| Issues | Activities | | | |
|--|--|--------------------------------------|-----------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| Change of flow/water surface | D | D | D | D |
| Occurrence of inundation and floods | D | D | D | D |
| Change of groundwater flow and groundwater table | D | D | D | D |
| Pollution or deterioration of water quality | D | D | D | D |
| Turbid water by soil erosion / reduced discharge | D | D | D | D |
| Exhausted groundwater by excess extraction or lowered recharge | D | D | D | D |
| Seeped toxic water of buried materials | D | D | D | D |
| Eutrophication | D | D | D | D |
| Water temperature change | D | D | D | D |

Judgement scores *A : Serious impact anticipated, need careful assessment in the site,*
B : Anticipated impact
C : Unknown (necessary to assess, detail could be clarified in a further assessment),
D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.2 Impact Assessment for Planned Activity on Hydrology(2/2)

| Issues | Activities | | | |
|--|--|--------------------------------------|-----------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| Change of flow/water surface | D | D | D | D |
| Occurrence of inundation and floods | D | D | D | D |
| Change of groundwater flow and groundwater table | D | D | D | D |
| Pollution or deterioration of water quality | D | D | D | D |
| Turbid water by soil erosion / reduced discharge | D | D | D | D |
| Exhausted groundwater by excess extraction or lowered recharge | D | D | D | D |
| Seeped toxic water of buried materials | D | D | D | D |
| Eutrophication | D | D | D | D |
| Water temperature change | D | D | D | D |

Judgement scores *A : Serious impact anticipated, need careful assessment in the site,*
B : Anticipated impact
C : Unknown (necessary to assess, detail could be clarified in a further assessment),
D : No impact anticipated, not necessary IEE and/or EIA
D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.3 Impact Assessment for Planned Activity on Fauna and Flora(1/2)

| Issues | Activities | | | |
|---|---|-------------------------------|--|---|
| | Set-up of monitoring institution for watershed management | Establishing community forest | Introduction/Extension of agroforestry | Introduction/Extension of erosion control farming practices |
| Occurrence of local diseases | D | C | C | D |
| Spread of malaria/ filaria epidemic | D | C | C | D |
| Increase of pesticide consumption | D | C | C | D |
| Accumulation of remained toxic matter | D | D | D | D |
| Increase of waste and excrement | D | D | D | D |
| Garbage and trash dump, falling standards of hygiene | D | D | D | D |
| Spread of vermin | D | D | D | D |
| Dump of construction waste, excavated soil, sludge, trash, etc. | D | D | C | D |
| Alteration of vegetation | D | D | D | D |
| Invasion and propagation of harmful fauna and flora | C | D | D | D |
| Extermination or decrease of precious or specific fauna and flora | D | D | D | D |
| Disappeared wetland or peat bog | D | D | D | C |
| Loss of bio-diversity | D | D | D | D |
| Loss of rain forest/ wild lands | D | D | D | D |

Table III-3.4.3 Impact Assessment for Planned Activity on Fauna and Flora(2/2)

| Issues | Activities | | | |
|---|--|--------------------------------------|-----------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| Occurrence of local diseases | D | D | D | D |
| Spread of malaria/ filaria epidemic | D | D | D | D |
| Increase of pesticide consumption | D | D | D | D |
| Accumulation of remained toxic matter | D | D | D | D |
| Increase of waste and excrement | D | D | D | D |
| Garbage and trash dump, falling standards of hygiene | D | D | D | D |
| Spread of vermin | D | D | D | D |
| Dump of construction waste, excavated soil, sludge, trash, etc. | D | D | D | D |
| Alteration of vegetation | D | D | D | D |
| Invasion and propagation of harmful fauna and flora | D | D | D | D |
| Extermination or decrease of precious or specific fauna and flora | D | D | D | D |
| Disappeared wetland or peat bog | D | D | D | D |
| Loss of bio-diversity | D | D | D | D |
| Loss of rain forest/ wild lands | D | D | D | D |

Judgement scores

A : Serious impact anticipated, need careful assessment in the site,

B : Anticipated impact

C : Unknown (necessary to assess, detail could be clarified in a further assessment),

D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.4 Impact Assessment for Planned Activity on Socio-economy(1/2)

| Issues | Activities | | | |
|--|---|-------------------------------|--|---|
| | Set-up of monitoring institution for watershed management | Establishing community forest | Introduction/Extension of agroforestry | Introduction/Extension of erosion control farming practices |
| Scheduled relocation | D | D | D | D |
| Unwilling relocation | D | D | D | D |
| Alteration of the right on land tenure, & residence | D | D | D | D |
| Change of life style | D | B/C | C | C |
| Conflict between population | D | D | C | C |
| Effect on indigenous people, minority, & nomads | D | D | D | D |
| Reform of traditional institution, & custom | D | D | D | D |
| Obstruction on fishing right, water right, local regulations | D | D | D | D |
| Alteration of social structure by organization, etc. | D | D | D | D |
| Radical change of social structure, & population increase | D | D | D | D |
| Lost opportunity on production, such as loss of land | D | D | D | D |
| Transfer, conversion of foundation of economic activity, or unemployment | D | D | D | D |
| Enlarging income gap | D | D | D | D |
| Impact on existing transportation | D | D | D | D |
| Impact on schools & hospitals | D | D | D | D |
| Cutting off the local society by roads | D | D | D | D |
| People's perception | D | D | D | D |
| Destruction or damage of historical remains and cultural legacy | D | D | D | D |
| Loss of precious scenery | D | D | D | D |
| Effects on underground resources | D | D | D | D |
| Change of ground features by construction of the structures | D | D | D | D |
| Disturbance of harmonic scenery by construction of the structures | D | D | D | D |
| Increased opportunity of slope failure, accidents | D | D | D | D |
| Pollution by exhaust or toxic gas of vehicles and plants | D | D | D | D |
| Noise and vibration caused traffic, pumps, etc. | D | D | D | D |
| Change of temperature and wind by large scale development | D | D | D | D |

Judgement scores

A : Serious impact anticipated, need careful assessment in the site,

B : Anticipated impact

C : Unknown (necessary to assess, detail could be clarified in a further assessment),

D : No impact anticipated, not necessary IEE and/or EIA

Table III-3.4.4 Impact Assessment for Planned Activity on Socio-economy(2/2)

| Issues | Activities | | | |
|--|--|--------------------------------------|-----------------------------------|--|
| | Expansion of woodland, Prevention of deforestation | Green belt along the lake and rivers | Regulation of fishery in the lake | Construction of erosion control structures |
| Scheduled relocation | D | D | D | D |
| Unwilling relocation | D | D | D | D |
| Alteration of the right on land tenure, & residence | D | D | D | D |
| Change of life style | D | D | D | D |
| Conflict between population | D | D | D | D |
| Effect on indigenous people, minority, & nomads | D | D | D | D |
| Reform of traditional institution, & custom | D | D | D | D |
| Obstruction on fishing right, water right, local regulations | D | D | D | D |
| Alteration of social structure by organization, etc. | D | D | D | D |
| Radical change of social structure, & population increase | D | D | D | D |
| Lost opportunity on production, such as loss of land | D | D | D | D |
| Transfer, conversion of foundation of economic activity, or unemployment | D | D | D | D |
| Enlarging income gap | D | D | D | D |
| Impact on existing transportation | D | D | D | D |
| Impact on schools & hospitals | D | D | D | D |
| Cutting off the local society by roads | D | D | D | D |
| People's perception | D | D | D | D |
| Destruction or damage of historical remains and cultural legacy | D | D | D | D |
| Loss of precious scenery | D | D | D | D |
| Effects on underground resources | D | D | D | D |
| Change of ground features by construction of the structures | D | D | D | D |
| Disturbance of harmonic scenery by construction of the structures | D | D | D | D |
| Increased opportunity of slope failure, accidents | D | D | D | D |
| Pollution by exhaust or toxic gas of vehicles and plants | D | D | D | D |
| Noise and vibration caused traffic, pumps, etc. | D | D | D | D |
| Change of temperature and wind by large scale development | D | D | D | D |

Judgement scores

A : Serious impact anticipated, need careful assessment in the site,

B : Anticipated impact

C : Unknown (necessary to assess, detail could be clarified in a further assessment),

D : No impact anticipated, not necessary IEE and/or EIA

Table III-4.1.1 Watershed Conservation Plan for Each Zone in the Intensive Area

| Item | Zone | | | | | |
|--|--|---|--|--|--|---|
| | P Zone | Bm1 Zone | Bm2 Zone | Bm3 Zone | Bw Zone | F Zone |
| 1 Physical Watershed Conservation Measures 1.1 Forestry Management and Rehabilitation | 1) Boundary survey for protection forests 2) Community forestry (Soputan protection forest at south area) 3) Reforestation 4) Forest patrol 5) Research for non-wood products | The same plan will be applied for Bm1 and Bm2 zones 1)Nursery (9 locations), 2)Extension workers (30 persons), 3)Fuel wood plantation (150ha), 4)Delivery station(7 locations) | | No plan | 1) Establishment of green belt | No plan |
| 1.2 Agriculture/Agroforestry Improvement | 1) Fruit tree dominant agroforestry system in the middle part of community forest | 1) AGF-I(Type I-2,4,5)/IM 2) Introduction of culture practice considering soil conservation | 1) AGF-III(Type III-2)/IM 2) Application of AGF-I(Type I-2,4)/IM to place with low resistance to soil erosion 3) Application of AGF-II(Type II-2)/IM and UF/IM to place with high resistance to soil erosion | 1) AGF-II(Type II-2/IM) and UF/IM 2) Application of AGF-III(Type III-2/IM) to a part of sloped area | 1) Application of AGF-I(Type I-2) to sloped area along road. 2) Application of AGF-III (TypeIII-2) to gentle-sloped area 3) Application of AGF-I (TypeI-6) to undualted grass fallow 4) Provision of hedge raw at boundary of home garden | 1) Application of AGF-II(Type II-2)/IM and UF/Im with hedge raw |
| 1.3 Erosion Control Facility Development | 1) Slope Protection works for hillsides at Mt.Maimberg in the South Area. | 1) Construction of slope protection works for road at Eris-3 in the East Area 2) Construction of check dam at Tandengan in the East Area 3) Construction of check dam at Ranomerut in the East Area | 1) Construction of slope protection works for road at Paleloan in the East Area 2) Construction of check dam at Tataaran in the West Area 3) Rehabilitation of existing check dam at Leleko in the West Area | 1) Rehabilitation of existing check dam at Kasuratan in the West Area | No plan | 1) River bed protection works at 6 sites on Panasen river in the South 2) River bank protection works at 900m site on Panasen river in the South Area 3) Construction of check dam at Tounipus in the East Area 4) Rehabilitation of existing check dam at Tountimomor in the South Area |
| 2 Institutional Development | Applied for all zones. 1)Community institutional development, 2)Technical institutional development, 3)Institutional development of forestry services, 4) Accurate village boundary mapping, 5) Institutional integration and strengthening of legal and regulatory framework, 6) Strengthening of watershed conservation capacity at university of Manado, 7) Strengthening of local NGOs. | | | | | |
| 3 Community Empowerment | Applied for all zones. Provide relevant information and data to implementers and supporting agencies to be able to facilitate decision making for community empowerment. | | | | | |
| 4 Monitoring and Evaluation System 4.1 Engineering Items 4.2 Socio-Economic Items | Applied for all zones. 1) Soil erosion and sedimentation, 2) Water quality, 3) Water balance, 4) River bed erosion and slope failures Applied for all zones. 1) Micro planning for sustainable land use, 2) Awareness raising and environmental education, 3) Organizing of local people and reorienting of officials, 4) Strengthening of social safety net, 5) Gender and conservation. | | | | | |

Note 1

AGF—I (TypeI-2)/IM Improved Estate Crop Dominant Agroforestry System
AGF—I (TypeI-4,5,6)/IM Improved Tree(woody trees and tree crops) Dominant Agroforestry System
AGF—II (TypeII-2)/IM Improved Herbaceous Crop Dominant Agroforestry System
AGF—III (TypeIII-2)/IM Improved Inter-cropping System
UF/IM Improved Upland Cultural Practice

Note 2

S Zone is not included in Watershed Conservation Plan.