3.9 Items Related to Local Development

Among the subject forests of the Plan, those with recreational use and landscape maintenance functions will be improved in order to facilitate the increased use of forests by local people for public health, educational and cultural purposes.

3.9.1 Establishment of General Arboretum

(1) Purpose of the Work

This work aims at establishing an arboretum consisting of species found in the Study Area and *Prunus* spp. and a turfed area. The use of these areas for observation and recreation by local people is intended to assist their understanding of the forest ecosystem and the development of outdoor recreational activities by local people.

(2) Details of the Work

① Location and Area

Craiova Forest Range Office UP IV Cosoveni

144A 20.1 ha (50 years old)
144E 5.2 ha (50 years old)

② Work Volume, Period and Cost

Work Volume		Operation Year			Cost (US$ 1,000)
		1	2	3	
Planting	40 local species of Olt and Dolj Counties (one block: 50 m x 50 m)	———	———	———	52,216
	Five *Prunus* species (planting in three lines)	———	———	———	
Observation Paths	Main paths (2 m wide, 2.3 km)	———	———		7,360
	Branch paths (1 m wide, 4.9 km)	———	———		12,250
Information Boards	Information boards on ecosystem (1 m x 1 m, 90 sites)			———	4,770
Rest Houses	Log houses (50 m², 8 sites)			———	4,400
Car Parks	1,000 m², 8 sites			———	26,400
Turfed Gardens	1,000 m², 7 sites 5,000 m², 7 sites	———	———		6,780
Annual Operation Cost	Two staff members				1,140
Total					115,316

(3) Work Implementation Method

① Planting

Planting will be conducted in accordance with the manner described in 3.3 - Items Related to Reforestation.

② Observation Path

As the site is flat, this path will be manually constructed.

③ Information Boards

Two information boards will be erected for each species.

④ Rest Areas

Simple rest areas using cut trees will be created.

⑤ Car Park

Each car park will have the capacity to accommodate 50 cars.

⑥ Turfed Areas

The turfed area to be introduced at 144E will have an area of 0.5 ha. The other seven areas will have an area of 0.1 ha each.

⑦ Annual Management Cost

The arboretum will be managed by the Craiova Forest Range Office. The annual management cost is estimated for 10 years, including the initial construction period.

The distribution of the various work related to the general arboretum is shown in App. F-6.

3.9.2 Establishment of Forestry Work Demonstration Forests

(1) Purpose of the Work

Following the progress of the privatisation of forests as well as the work related to national forests, the improvement of forestry skills in the private sector is becoming increasingly necessary. Accordingly, the establishment of forestry work demonstration forests at the following sites where such skills can be learned is planned under the Plan.

(2) Details of the Work

① Location and Area

Bals Forest Range Office UP V Saru

142B 1.3 ha (75 years old)
157E 2.4 ha (75 years old)

Craiova Forest Range Office UP IV Cosoveni

145A 19.2 ha (50 years old)

② Work Volume, Period and Cost

Bals UP V

Site	Type of Demonstration	Area (ha)	Costs (US$)
142B	Plantation management operation	1.3	3,253
157E	Natural forest management operation	2.4	647

Craiova UP IV

Site	Type of Demonstration	Area (ha)	Costs (US$)
145A	Natural forest management operation	5.1	800
	Plantation management operation	4.4	9,461
	Natural forest management operation	9.7	21,168

Total		22.9	35,329

Work Volume	Operation Year		Cost	Inclusive Indirect Cost
	1-5	6-10	(US$)	(US$)
Forestry Work Demonstration Forest			35,329	40,628

The distribution of the various work related to the forestry work demonstration forests is shown in App. F-6.

③ Management Methods

Bals UP V 142B: Plantation Management Operation

The moderately damaged stand of the F6 type will be reforested. The cutting method will be group selective cutting, the planting method will be group planting and the soil preparation method will be strip soil preparation using a mini back-hoe.

The planting species will be *Q. frainetto, Q. cerris, Pyrus pyraster* and assistant trees. Mulching with a plastic film will be conducted at the time of planting. A cultivator will be used for scarifying. Drainage and infiltration works will be constructed in remaining areas.

Bals UP V 157E: Natural Forest Management Operation

Twenty percent selective cutting will be conducted, mainly featuring poorly formed trees. Tree selection will be conducted as part of the natural forest management with the necessary tending. Crisscrossed drainage and infiltratration works will be constructed at intervals of 6.25 m throughout the stand to facilitate natural regeneration.

Craiova UP IV 145A-1: Natural Forest Management Operation

Only poorly formed trees in the middle and lower storys will be cut. Crisscrossed drainage and infiltration works will be constructed at intervals of 6.25 m throughout the stand to facilitate natural regeneration.

Craiova UP IV 145A-2: Plantation Management Operation

The moderately damaged stand of the F6 type will be reforested. The cutting method will be group selective cutting, the planting method will be group planting and the soil preparation method will be strip soil preparation using a mini back-hoe.

The planting species will be *Q. frainetto* and assistant trees. A cultivator will be used for scarifying. Drainage and infiltration works will be constructed in remaining areas.

Craiova UP IV 145A-3: Plantation Management Operation

Strongly damaged stands of the F5 (2.5 ha), F6 (2.4 ha), F7 (2.4 ha) and F8 (2.4 ha) types will be reforested. A variety of planting species, such as *Q. frainetto, Q. cerris, Q. robur, Q. petraea, Q. pedunculiflora, Fraxinus excelsior* and *Tilia platyphyllos*, etc., will be planted.

Mechanical reforestation will be conducted. Large machinery will be used for soil preparation while a cultivator will be used for scarifying.

3.10 Items Related to Technical Development and Extension of New Techniques

The priority technical development items and necessary equipment/facilities during the plan period are described below. Further details of these items are described in App. F-7.

(1) Development of Breeding Technique for Resistant Trees

A breeding technique for resistant trees will be developed to create *Q. frainetto* and *R. pseudoacacia* trees which are highly resistant to drought. The actual development process will consist of (i) selection of candidate resistant trees, (ii) propagation of resistant planting stock, (iii) verification of resistance and (iv) establishment and management of scion gardens and seed orchards. The rooted cuttings for planting will be mass-produced from clones produced at the scion garden. The planting stock will be mass-produced from seeds produced at the seed orchard. A healthy forest which is resistant to drought will be created in the future using this planting stock.

1) Selection of Candidate Resistant Trees

a) Selection Criteria

- Selection of stands with strong damage and large area in need of restoration and then selection of candidate resistant trees. Selection of stands with moderate damage in areas of forest range offices where the above strongly damaged stands are selected.

- Tree selection area: minimum of 3 ha for *Q. frainetto* stands and 1.5 ha for *R. pseudoacacia* stand.

- Selection of five healthy candidate trees at each selected stand.

- Selection of candidate trees with a sufficient stem diameter of 10 cm or more which is suitable for the collection of cuttings and showing healthy growth of the coppiced shoots.

b) Timing of Selection

The work to select the candidate trees must be conducted in the first year of the Forest Restoration Plan.

c) Selection of Candidate Tree Selection Sites

Fifty-eight sites have been selected in Olt and Dolj Counties as the candidate tree selection sites, consisting of 40 *Q. frainetto* sites (32 strongly damaged sites and eight moderately damaged sites) and 18 *R. pseudoacacia* sites (15 strongly damaged sites and three moderately damaged sites).

2) Propagation Resistant Planting Stock

a) Propagation Method of Cuttings

- Two methods are used to obtain *Q. frainetto* cuttings, i.e. cuttings from hydroponics and cuttings from coppiced shoots from stems. In the case of *R. pseudoacacia*, cuttings are obtained from coppiced shoots.

- Preparation of materials to produce cuttings: the logs used for hydroponics are prepared from branches of the candidate trees and have dimensions of 3 - 10 cm in diameter and 30 - 40 cm in length with two cut ends.

- Prepared logs are immersed in a water-filled container (diameter: 25 - 30 cm; depth: 20 - 25 cm) and kept in the mist house.

- The cuttings are prepared to a length of 15 cm.

- Cuttings from prepared logs: 10 cuttings are harvested from one log. Ten logs are produced from each candidate tree. A total of 20,000 cuttings are produced from 40 stands (10 x 10 x 5 x 40 = 20,000).

- Cuttings from coppiced shoots

  • *Q. frainetto* : 500 cuttings per stand to produce 20,000 cuttings from 40 stands

  • *R. pseudoacacia* : 500 cuttings per stand to produce 9,000 cuttings from 18 stands

- Mist houses required

  • Management area of hydroponic container: 90 m^2

  • Management of cuttings from logs and coppiced shoots: two houses (each managing some 25,000 cuttings)

b) Yield of Rooted Cuttings

The following quantities of rooted cuttings are expected to be obtained from the initially produced cuttings.

Q. frainetto	-	hydroponics	3,000 for test forests
			3,000 for seed orchards
	-	coppiced shoots	3,000 for test forests
			3,000 for seed orchards
R. pseudoacacia	-	coppiced shoots	1,350 for test forests
			1,350 for seed orchards

c) Breeding Calender of Rooted Cuttings

< First Year >

Mid-April	:	preparation of hydroponic logs
Late April	:	commencement of hydroponics
Late May	:	planting of cuttings from hydroponics (*Q. frainetto*) and from coppiced shoots (*Q. frainetto* and *R. pseudoacacia*) in the mist house
Late September-Early October	:	transplanting of rooted cuttings from the mist house to the outside nurseny to consolidate the roots and acclimatise
< Second Year >	:	continued acclimatisation in the outside nursery

< Third Year >

April	:	delivery of planting stock to the test forest-cum scion gardens and seed orchards

3) Testing of Resistance

a) Securing of Sufficient Quantity of Planting Stock for Testing

For the establishment of a test forest, 15 rooted cuttings per individual tree (group of three cuttings x five times) among those rooted cuttings obtained from hydroponics and coppiced shoots are required.

b) Establishment of Test Forests

Q. frainetto: one each in Olt and Dolj Counties

- Olt County

Selection of a moderately damaged stand in the area of the Bals Forest Range Office and planting of rooted resistant cuttings of the candidate trees selected from 11 sites.

Number of rooted cuttings: 11 x 5 x 15 = 825

Test forest area: 825 ÷ 6,667 = 0.13 ha

- Dolj County

Selection of a moderately damaged stand in the area of the Craiova Forest Range Office and planting of the rooted resistant cuttings of the candidate trees selected from 29 sites.

Number of rooted cuttings: 29 x 5 x 15 = 2,175

Test forest area: 2,175 ÷ 6,667 = 0.33 ha

R. pseudoacacia

Selection of a moderately damaged stand in the area of the former Apele Vii Forest Range Office in Dolj County and planting of rooted resistant cuttings of the candidate trees selected from 18 sites in two countries.

Number of rooted cuttings: 18 x 5 x 15 = 1,350

Test forest area: 1,350 ÷ 6,667 = 0.2 ha

c) Test Period

The period to test the resistance is 10 years.

4) Establishment of Seed Orchards

The establishment of seed orchards will commence at the same time as the establishment of test forests. As a result of the resistance test, some of the clones planted at seed orchards will be rejected. In view of this likelihood, the planting density will be higher than the standard planting density for the establishment of seed orchards and will be 3,000 rooted cuttings per ha.

Q. frainetto

The establishment of a seed orchard will be attempted at a weakly damaged site in the area of the Bals Forest Range Office in Olt County. Some 3,000 rooted resistant cuttings of the candidate trees selected from 40 sites in two counties will be planted.

Seed orchard area: 1.1 ha (0.1 ha for buffer zone forest)

R. pseudoacacia

The establishment of a seed orchard will be attempted at a weakly damaged site in the area of the former Apele Vii Forest Range Office in Dolj County. Some 1,350 rooted resistant cuttings of the candidate trees selected from 18 sites in two counties will be planted.

Seed orchard area: 0.5 ha (0.05 ha for buffer zone forest)

5) Management of Test Forests and Seed Orchards

a) Management of Test Forests

As the test forests will also act as scion gardens, individual trees which are judged to show low resistance will be removed by means of improvement cutting. During the test period of 10 years, a survey on the decline of the planted clones will be conducted and those with a lower degree of decline will be established as resistant clones.

b) Management of Seed Orchards

The planned seed orchards can be considered as a type of test forests. In addition to the data obtained from the separately establishment test forests, the resistance of each individual tree planted at these seed orchards will be surveyed for a period of 10 years after their creation to obtain reference data to establish resistant clones.

6) Annual Work Volume and Cost

The annual work and cost of developing a breeding technique for resistant trees are shown in Table 3-10-1.

Table 3-10-1 The Annual Work Plan and Cost of Developing a Breeding Technique for Resistant Trees.

Planning Item	Annual Work																						Cost
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	(US$)
- Selection of Resistant Candidate Trees	⟷																							1,740
- Propagation of Resistant Planting Stock		⟷	⟷																					212,245
- Testing of Resistance (Estabulishment of Test Forest-cum-Scion Gardens)				⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷											1,290
- Establishment of Seed Stands				⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	⟷	1,933

Notes

1) Planned Volume
   - Selection of candidate trees: *Q. frainetto* = 40 sites, *R. pseudoacacia* = 8 sites, five trees selected per site
   - Propagation of resistant planting stock: *Q. frainetto* = 3,000 from hydroponics, 3,000 from coppiced shoots; *R. pseudoacacia* = 1,350 from coppiced shoots
   - Testing of resistance: *Q. frainetto* = one site in the area of Craiova Forest Range Office, 2,175 rooted cuttings, 0.33 ha; one site in the area of Bals Forest Range Office, 825 rooted cuttings, 0.13 ha; *R. pseudoacacia* = one site in the area of former Apele Vii Forest Range Office, 1,350 rooted cuttings, 0.12 ha
   - Establishment of seed orchards: *Q. frainetto* = one site in the area of Bals Forest Range Office, 3,000 rooted cuttings, 1.1 ha; *R. pseudoacacia* = one site in the area of former Apele Vii Forest Range Office; 1,350 rooted cuttings, 0.5 ha
2) Production of scions at scion gardens: scions for reforestation purposes can be produced in the 14th year (one year after the completion of the resistance test)
3) Production of seeds at seed orchards: acorns are expected to be produced some 20 years after the establishment of the seed orchards

7) Point to Note

As the breeding technique for resistant trees has not yet reached the level of practical application, it will be necessary to conduct a preliminary test to confirm the applicability of the technique.

3.11 Work Volume of Damage Restoration Measures

The annual work volume of the damage restoration measures to be implemented in Olt and Dolj Counties is shown in the table below.

Table 3-11-1 Damage Restoration Work Volume by Year

Olt County

Operation Year	Cruising		Log Production		Reforestation		Drainage and Infiltration Works	Supplementary Planting at Forest Mantle	Improvement of Forest Roads
	Area ha	Volume m3	Area ha	Volume m3	Soil Preparation ha	Planting ha	ha	ha	km
2	259.7	10,951							9
3	283.7	13,797	259.7	10,951	28.0				9
4	313.1	16,253	283.7	13,797	49.0	28.0	448.1	6.0	8
5	328.4	17,830	313.1	16,253	78.4	49.0	1,500.0	7.4	8
6	396.5	27,697	328.4	17,830	93.7	78.4			8
7	398.5	33,030	396.5	27,697	167.0	93.7			
8	354.1	27,130	398.5	33,030	217.0	167.0			
9			354.1	27,130	172.6	217.0			
10						172.6			
Total	2,334.0	146,688	2,334.0	146,688	805.7	805.7	1,948.1	13.4	42

Dolj County

Operation Year	Cruising		Log Production		Reforestation		Drainage and Infiltration Works	Supplementary Planting at Forest Mantle	Improvement of Forest Roads
	Area ha	Volume m3	Area ha	Volume m3	Soil Preparation ha	Planting ha	ha	ha	km
2	470.0	21,992							7
3	528.5	26,406	470.0	21,992	106.0				7
4	659.0	38,173	528.5	26,406	164.4	106.0	383.1	6.0	7
5	764.5	47,888	659.0	38,173	299.3	164.4	1,500.0	6.0	7
6	857.2	66,552	764.5	47,888	400.5	299.3	1,500.0	7.1	7
7	916.3	74,968	857.2	66,552	465.6	400.5			
8	787.3	63,202	916.3	74,968	584.1	465.6			
9			787.3	63,202	488.6	584.1			
10						488.6			
Total	4,982.9	339,181	4,982.9	339,181	2,508.5	2,508.5	3,383.1	19.1	35

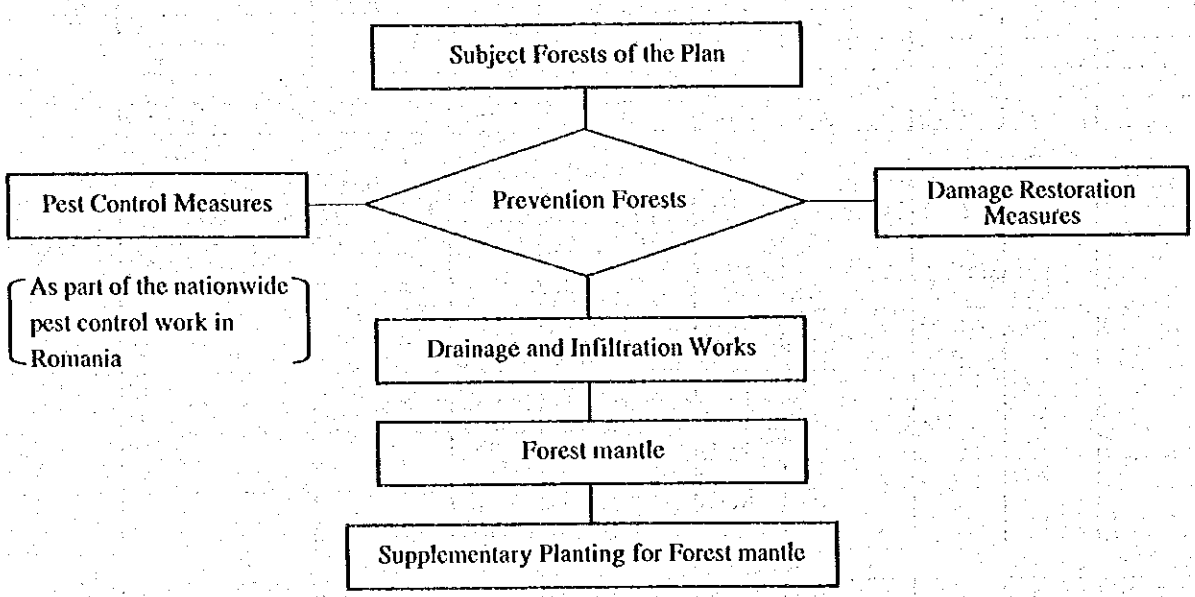
Total

Operation Year	Cruising		Log Production		Reforestation		Drainage and Infiltration Works	Supplementary Planting at Forest Mantle	Improvement of Forest Roads
	Area ha	Volume m3	Area ha	Volume m3	Soil Preparation ha	Planting ha	ha	ha	km
2	729.7	32,943							16
3	812.2	40,203	729.7	32,943	134.0				16
4	972.1	54,426	812.2	40,203	213.4	134.0	831.2	12.0	15
5	1,092.9	65,718	972.1	54,426	377.7	213.4	3,000.0	13.4	15
6	1,253.8	94,249	1,092.9	65,718	494.2	377.7	1,500.0	7.1	15
7	1,314.9	107,998	1,253.8	94,249	632.6	494.2			
8	1,141.4	90,332	1,314.9	107,998	801.1	632.6			
9			1,141.4	90,332	661.2	801.1			
10						661.2			
Total	7,316.9	485,869	7,316.9	485,869	3,314.2	3,314.2	5,331.2	32.5	77

CHAPTER 4 FOREST DECLINE PREVENTION SYSTEM

The field survey findings clearly indicate that forest decline is closely linked to the specific environment of individual stands, including such meteorological conditions as a low rainfall level and high temperature, and compacted clayey soil. At decline prevention forests with minor decline, improvement of the soil structure can be expected to prevent the progress of forest decline. Accordingly, drainage and infiltration work where the top soil layer is ploughed in strips is planned. In addition, there is scattered belt-like open land due to the progress of forest tree decline along the edges of decline prevention forests. At this site supplementary planting is planned to create forest mantle to protect these forests.

4.1 Forest Decline Prevention System



4.2 Construction of Drainage and Infiltration Works

Drainage and infiltration works will be constructed at prevention forests to reduce the water stress at these forests by means of facilitating the drainage of stagnant water in the top soil layer and enhancing the water retention function of the soil so that the progress of forest decline is contained.

(1) Specifications

The specifications of the planned drainage and infiltration works are as follows.

1) The standard depth and width are approximately 20 cm and 50 cm respectively.

2) The standard interval is 12.5 m. In principle, linar channels are planned and standing trees will be avoided.

3) The total channel length per unit area, i.e. one hectare, is 800 m.

Four wheel drive tractors equipped with either a disc plough or carried plough will be used for the construction of the works. A disc plough will be used at those sites where the ground surface is reasonably soft while a carried plough will be used at those sites with a hard ground surface.

(2) Subject Prevention Forests

Drainage and infiltration works will be constructed throughout prevention forests as a decline prevention measure. The areas of the subject prevention forests are shown in Table 4-2-1.

Table 4-2-1 Areas of Subject Prevention Forests for Construction of Drainage and Infiltration Works as Decline Prevention Measure

County	Forest Range	Forest Area (ha)	Operation Area (ha)
Olt	Bals	837.3	837.3
	Caracal	292.6	292.6
	(Corabia)	2.6	2.6
	Slatina	438.9	438.9
	(Draganesti-Olt)	177.0	177.0
	Vulturesti	25.5	25.5
	Sub-Total	1,773.9	1,773.9
Dolj	Amaradia	354.2	354.2
	Calafat	0.0	0.0
	(Poiana Mare)	0.0	0.0
	Craiova	705.4	705.4
	Filiasi	145.9	145.9
	Perisor	1,060.6	1,060.6
	Sadova	0.0	0.0
	(Apele Vii)	2.6	2.6
	Segarcea	223.0	223.0
	Sub-Total	2,491.7	2,491.7
Total		4,265.6	4,265.6

(3) Annual Plan and Cost

The annual work volume for the construction of drainage and infiltration works as a damage restoration measure and the cost are shown in Table 4-2-2.

Table 4-2-2 Annual Work Volume and Cost of Drainage and Infiltration Works as Decline Prevention Measure

County	Operation Year										Total	Cost
	1	2	3	4	5	6	7	8	9	10	(ha)	(US$)
Olt				722.0	1,051.9						1,773.9	13,423
Dolj				1,374.8	1,116.9						2,491.7	18,855
Total				2,096.8	2,168.8						4,265.6	32,278

4.3 Supplementary Planting at Forest Mantle

Supplementary planting will be conducted at those stands where the forest mantle coverage is less than 60% to achieve a target coverage of 80% for the purpose of containing the progress of forest decline by means of mitigating damage due to drought, high temperatures, strong wind and stock raising.

(1) Supplementary Planting Standards

1) The planting species for forest mantle will be *R. pseudoacacia, Elaeagnus augustifolia* and *Gladitschia triacanthos* with a standard planting density of 10,000 trees/ha (planting distance of 1m x 1 m). Although the relevant cost under the Plan is estimated on the basis of these three species, *Crategus monoghina* is also suitable as a planting species for forest mantle.

2) For soil preparation, a mini backhoe will be used to plough the ground for a width of 50 cm and a depth of 40 cm.

3) For tending, a 30 cm wide cultivator will mainly be used to scarify the ground.

(2) Subject Prevention Forests

Stands of which the forest mantle coverage is less than 60% will be subject to supplementary planting for forest mantle.

(3) Annual Work Volume and Cost

The annual work volume and the cost of supplementary planting at forest mantle and the cost are shown in Table 4-3-1.

Table 4-3-1 Annual Work Volume and Cost of Supplementary Planting at Forest Mantle

County	Operation Year										Total	Cost
	1	2	3	4	5	6	7	8	9	10	(ha)	(US$)
Olt				4.5							4.5	8,100
Dolj				4.7							4.7	8,459
Total				9.2							9.2	16,559

CHAPTER 5 EVALUATION OF THE PLAN

Evaluation of the various work envisaged under the Plan is conducted from four different approaches: (i) environmental impacts which could occur with the actual implementation of the work, (ii) financial analysis related to the capability of the work implementation body, (iii) economic analysis which takes the forest-related economic activities in the Plan Area into consideration and (iv) indirect impacts on the local economy which have not manifest themselves as subjects for economic analysis.

5.1 Environmental Impacts Assessment

The forests subject to the Plan are mainly located on either flat land or gently sloping land. The main purpose of the damage restoration measures is to plant and grow species which have high resistance to drought and which suit the specific soil conditions at those sites where the ground has been cleared after the cutting, bucking and skidding of mainly damaged trees. In addition, ploughing of the soil in strips between standing trees is planned for the purposes of draining seasonal stagnant water in the soil and facilitating the infiltration of rainwater during the dry season. During these work processes, while civil engineering and agricultural machinery will be used to plough the top soil layer, the soil will be conserved given the almost flat topography and scattered nature of the soil preparation work with the creation of remaining areas of healthy standing trees. As these activities will improve the physical properties of the soil, natural vegetation will quickly invade and develop root systems. Moreover, after planting, growing trees will cover the ground surface together with natural vegetation, restoring the natural environment.

Following the restoration of forests by means of damage restoration work, various positive effects on the local environment are anticipated. These positive effects include the windbreak effect for farmland, climate mitigation effect, water source conservation effect, soil conservation effect, protection of the growth of wild flora and fauna and beneficial effect on apiculture.

5.2 Work Evaluation

5.2.1 Financial Analysis

The subject forests of the Plan are national forests and, therefore, they have so far been managed by the RNP which is the forest operation and management body of the government. The Government of Romania intends to make the RNP responsible for the tending, production

and sale of wood resources and other work regarding national forests. Accordingly, the work plan is formulated assuming the work implementation system of the RNP based on its present organizational structure and the cost and profit of work implementation are compared to evaluate the work volumes and profitability.

(1) Principles of Plan Formulation

The restoration of damaged forests where decline has been taking place must be implemented as soon as possible to prevent a further spread of the phenomenon of forest decline. The work plan by year is formulated on the basis of the principles described below, simultaneously taking such urgency and the work volumes and work implementation method of the forest branch offices which have so far managed the subject forests upto the present time into consideration. The total period for the financial and economic analyses is upto the 169th operation year when the final harvest of *Quercus* spp., the main species of the restored forests, can be expected.

- With the commencement of the work, the RNP and ICAS will conduct a field reconnaissance of the subject forests in the first year. Based on the reconnaissance findings, the concrete details of the work for each year will be determined in view of the preparation of the budget.

- In the second year, cruising will be conducted at stands where cutting will commence from the third year. Thereafter, cruising will be conducted at stands subject to cutting in the year preceding the planned cutting year in order to prepare a concrete plan for cutting, production, sale and soil preparation. Preparatory work for the planned procurement of machinery in the third year will be conducted in the second year.

- Damaged trees will mainly be selected for cutting and sale in the early years so that the degree of damage does not progress. Cutting, bucking and skidding work will be planned in the period from the third year to the ninth year.

- Soil preparation work to prepare for reforestation will be planned to take place immediately after cutting in the period from the third year to the ninth year.

- Planting will be conducted between the fourth year and the tenth year. As the planning stock of *Q. frainetto* is currently in short supply vis-a-vis the required quantity for reforestation, the RNP is planning to produce planting stock from cuttings. As four years are required for the production of cuttings as planting stock, including the preparatory period, the planting of a larger amount of planting stock from the eighth

year to the tenth year should be planned. Accordingly, a high amount of planting, mainly consisting of *Q. robur* and *R. pseudoacacia*, of which the production of planting stock is comparatively easy, should be planned from the fourth year to the seventh year.

- In regard to the planting species, reforestation using fast growing species for early sale is advantageous to increase profitability. However, given the insufficient performance of fast growing species in reforestation experiments in the Study Area, *Quercus* spp. will be selected from among various species for the current *Quercus* spp. stands because of their best growth performance vis-a-vis drought and the compacted clayey soil in the area.

- The containment of the reforestation cost to a low level is a highly effective means of improving profitability. For this purpose, it is planned to keep the actual area for soil preparation smaller. At regeneration sites after clear cutting, a soil preparation rate of 67% is planned with soil preparation being conducted in strips. At regeneration sites after group selective cutting, soil preparation in narrower strips will be conducted to achieve a soil preparation rate of 50%. Soil preparation at cut-over sites using large machinery will be conducted by those companies in possession of such machinery which are currently subcontracted for this work and the new procurement of expensive machinery is not planned.

- Manual scarifying work has so far been conducted three times a year using hand tools. Under the Plan, cultivators will be used to improve the work productivity in order to reduce the number of scarifyings to twice a year to reduce the tending cost. The actual work area will also be reduced, resulting in improved productivity compared to work covering the entire area because of the reduction of the soil preparation area.

- The construction of drainage and infiltration works is planned from the fourth year to the sixth year in order to arrest the process of forest decline in the early years. This work will be conducted at weakly damaged stands in parallel with field work to identify cutting areas and remaining areas based on the cruising findings.

- In regard to supplementary planting as a measure to improve forest mantle, *R. pseudoacacia*, *G. triacanthos* and *E. angustifolia*, of which the production of planting stock is comparatively easy and which have strong resistance to wind pressure, will be used. Given the small area planned for this work, it will be implemented at an early stage from the fourth year to the sixth year.

- The improvement of forest roads is planned at those sections requiring improvement to establish access to the subject forests of the Plan. The work will be planned from the second year to the sixth year in such a manner that access to stands subject to the planned work can be improved in the previous year to ensure high efficiency of the planned work.

- The required quantity of machinery will be procured at the beginning of each year so that the planned work volume in each year can be properly completed. The cost will be accounted for in the budget for the year in question although necessary preparations must be made in the previous year.

- As the sale of damaged standing trees to private companies is difficult because of low profitability, they will be processed into logs by the RNP for sale.

- All types of work, except forest road improvement work and soil preparation work using large machinery, will be conducted by employing local labourers on a daily basis. Consequently, the official social insurance cost must be included in the labour cost. In view of the small ratio of subcontracted work, the indirect cost related to administrative expenses of the RNP is set at 15% of the direct cost, taking past figures into consideration.

- In regard to the sale of wood, the unit price will be determined for each wood for the forest products industry and firewood/chips for each species, taking the actual sales figures of the RNP in fiscal 1998 into consideration. As the standing trees cut in the early years of the plan period will be mainly damaged trees, the following wood production ratio for the forest products industry is determined based on the field survey findings and standards for purpose of use employed by the RNP.

  • The ratio of wood for the forest products industry is 10% for *Quercus* spp. stands of 80 years of age or more, taking the effective diameter class into consideration.

  • In the case of *R. pseudoacacia* and *Populus* spp., the ratio is 5% for stands of 20 years of age or more.

- The sale of thinned wood produced from plantation sites where reforestation work has been conducted can be anticipated from the 13th year onwards in the case of *R. pseudoacacia* and *Populus* spp. The RNP is currently planning to improve its operation efficiency by means of simplifying its organizational structure. As the diameter size of

thinned wood, including that of *Quercus* spp., is below the relevant standard for the forest products industry, the entire quantity will be priced at the firewood/chips price.

- At *Quercus* spp. plantation sites, the timing of thinning based on the conventional technical standards will be reduced by five years with the precondition that tending will be conducted without fail to facilitate healthy diameter growth. This practice will contribute to realising early income.

- In regard to the sale of wood at the final cutting age which will be the 33rd year or later in the case of *R. pseudoacacia* and *Populus* spp. and the 123rd year or later in the case of *Quercus* spp., sale will take place in the form of standing trees based on the same principle as that for the sale of thinned wood.

From the viewpoint of appropriate management techniques for each species, clear cutting is planned for *R. pseudoacacia* and *Populus* spp. In the case of *Quercus* spp., leading the stands to selective cutting stands will be aimed at. Accordingly, cutting at 120 years after planting will be group cutting at a rate of 33%. Further group cutting at a rate of 33% will take place at 140 years after planting and the remaining 34% will be harvested at 160 years after planting. The harvesting volumes will be determined based on the relevant yield tables, taking the site index into consideration, and the increment for every 20 years will be added.

In regard to the price of standing trees, the current prices for the sale of standing trees, including that for firewood/chips, will be adopted for *R. pseudoacacia* and *Populus* spp. as their continued use as low class general wood in Romania is expected in view of the wood quality.

In the case of *Quercus* spp., in view of the facts that global *Quercus* spp. resources as high quality wood have been declining and that Romania intends to export such wood in lines with its free economy policy, the standing tree price of US$ 200 per m^3 for wood with a diameter size above the standard size for plywood will be used by subtracting the production cost at stands and the average transportation cost to importing countries from the reference price of US$ 300 per m^3 which is the current local price level in Europe and Japan. The production ratio of wood capable of fetching this price is predicted for each planting species and site index, taking the RNP's criteria for wood size for different purposes of use into consideration. The general average ratio is approximately 41%.

Based on the above principles, Table 5-2-1 and Table 5-2-2 show the implementation cost of the planned work and the planned annual expenditure respectively while Table 5-2-3 and Table 5-2-4 show the expected income from wood sales following the cutting and clearance of damaged trees and the planned annual income respectively. Table 5-2-5 shows the income from thinning by year. Table 5-2-6 shows the income from the final cutting by year. Finally, Table 5-2-7 compares the planned income and expenditure.

Table 5-2-1 List of Work Costs

County			Olt County			Dolj County			Total		
Operation Item	Present Stand	Unit	Quantity	Direct Cost US$	Cost Inclusive of Indirect Cost	Quantity	Direct Cost US$	Cost Inclusive of Indirect Cost	Quantity	Direct Cost US$	Cost Inclusive of Indirect Cost
Cruising	*Quercus* spp.	m^3	145,095	28,525	32,807	285,251	55,126	63,397	430,346	83,651	96,204
	Robinia pseudoacacia		1,513	967	1,109	51,426	28,348	32,598	52,939	29,315	33,707
	Populus spp.		80	5	5	2,499	362	416	2,579	367	421
	Total		146,688	29,497	33,921	339,176	83,836	96,411	485,864	113,333	130,332
Wood Production Work	*Quercus* spp.	m^3	145,095	277,790	319,460	285,251	554,558	637,743	430,346	832,348	957,203
	Robinia pseudoacacia		1,513	3,342	3,842	51,426	113,652	130,698	52,939	116,994	134,540
	Populus spp.		80	142	163	2,499	4,423	5,087	2,579	4,565	5,250
	Total		145,688	281,274	323,465	339,176	672,633	773,528	485,864	953,907	1,096,993
Reforestation Work	*Quercus* spp.	ha	780.94	1,502,729	1,728,138	1,915.05	3,641,516	4,187,743	2,695.99	5,144,245	5,915,882
	Robinia pseudoacacia		23.20	31,307	35,005	568.15	928,150	1,067,371	591.35	959,457	1,103,376
	Populus spp.		1.60	2,526	2,905	25.30	60,982	70,329	26.90	63,508	73,034
	Total		805.74	1,536,562	1,767,046	2,508.50	4,630,648	5,325,245	3,314.24	6,167,210	7,092,292
Drainage and Infiltration Works	*Quercus* spp.	ha	1,948.10	12,818	14,741	3,383.13	22,261	25,601	5,331.23	35,079	40,342
Supplementary Planting at Forest Mantle		ha	13.40	20,972	24,118	19.10	29,893	34,377	32.50	50,866	58,496
Forest Road Improvement		km	42	145,593	167,432	35	121,328	139,527	77	266,921	306,959
Total of Original Work				2,026,716	2,330,723		5,560,599	6,394,689		7,587,315	8,725,413
Procurement of Machinery	Tractor (Skidding and Stacking)		4	208,000	228,800	8	416,000	457,600	12	624,000	686,400
	Chainsaw		34	20,672	22,739	78	47,424	52,166	112	68,096	74,906
	Mini Back-Hoe		3	142,500	156,750	7	332,500	365,750	10	475,000	522,500
	Earth Auger		2	4,520	4,972	2	4,520	4,972	4	9,040	9,944
	Cultivator (60cm wide)		17	12,529	13,782	43	31,691	34,850	60	44,220	48,642
	Cultivator (30cm wide)		20	11,340	12,474	51	28,917	31,809	71	40,257	44,283
	Tractor (D & I Work)*		1	53,000	58,300	1	53,000	58,300	2	106,000	116,600
	Total			452,561	497,817		914,052	1,005,457		1,366,613	1,503,274
Procurement of Hand Tools				2,718	2,990		7,331	8,064		10,049	11,054
Cruising	Thinning	m^3	68,218	42,362	48,716	189,362	125,555	144,388	257,520	134,381	193,105
Cruising	Final Cutting	m^3	294,970	54,590	62,779	792,472	143,413	164,925	1,087,442	198,003	227,703
Total for Damage Restoration Measures				2,578,947	2,943,025		6,750,950	7,717,524		9,329,897	10,660,549
Drainage and Infiltration Works	*Quercus* spp.	ha	1,773.90	11,672	13,423	2,491.70	16,395	18,855	4,265.60	28,067	32,278
Supplementary Planting at Forest Mantle		ha	4.50	7,043	8,099	4.70	7,356	8,459	9.20	14,399	16,559
Total for Decline Prevention Measures				18,715	21,522		23,751	27,314		42,466	48,837
Grand Total				2,597,662	2,964,548		6,774,701	7,744,838		9,372,363	10,709,386

* D&I Work: Drainage and Infiltration Works

Table 5-2-2 Compilation of Annual Cost (Expenditure) (Total for Two Counties)

Operation Year	Total Direct Cost for Two Counties US$								Direct Cost Total 1000 US$	Total Inclusive of Indirect Cost 1000 US$	Aggregate Inclusive of Indirect Cost 1000 US$
	Procurement of Machinery	Procurement of Hand Tools	Cruising	Wood Production	Planting and Tending	Drainage and Infiltration Works	Supplementary Planting at Forest Mantle	Forest Road Improvement			
2		215	7,626					55,465	63.3	72.8	72.8
3	414,296	36	10,018	60,012	61,120			55,465	600.9	670.4	743.2
4	286,166	761	15,088	75,793	197,627	5,469	2,034	51,998	634.9	715.8	1,459.0
5	171,836	1,148	19,452	107,126	350,240	19,740	9,507	51,998	731.0	832.1	2,291.0
6	188,548	1,202	18,042	130,173	587,128	9,870	14,407	51,998	1,001.4	1,142.1	3,433.1
7	284,825	1,170	23,301	184,010	637,174		10,003		1,140.5	1,297.3	4,730.4
8	20,942	1,657	19,807	216,170	898,641		5,226		1,162.4	1,335.7	6,066.1
9		1,803		180,622	1,054,523		2,450		1,239.4	1,425.2	7,491.3
10		1,052			864,098		1,298		866.4	996.4	8,487.6
11		250			370,489				370.7	426.3	8,914.0
12		277			271,761		2,191		274.2	315.4	9,229.3
13		53	1,135		250,400		2,450		254.0	292.1	9,521.5
14		134	2,271		210,559		1,298		214.3	246.4	9,767.9
15		67	4,639		112,158				116.9	134.4	9,902.3
16		45	6,793		39,251				46.1	53.0	9,955.3
17		45			26,384				26.4	30.4	9,985.7
18		45	424		36,719				37.2	42.8	10,028.4
19		45	848		31,848				32.7	37.6	10,066.1
20		45	1,706		6,016				7.8	8.9	10,075.0
21			2,536		6,934				9.5	10.9	10,085.9
22					20,162				20.2	23.2	10,109.1
23			266		28,559				28.9	33.2	10,142.3
24			533		25,050				25.6	29.4	10,171.7
25			1,070		6,016				7.1	8.1	10,179.8
26			1,592		6,934				8.5	9.8	10,189.6
27					20,162				20.2	23.2	10,212.8
28					25,889				25.9	29.8	10,242.6
29					21,338				21.3	24.5	10,267.1
30											10,267.1
31											10,267.1
32											10,267.1
33			1,629						1.6	1.9	10,269.0
34			3,263						3.3	3.8	10,272.8
35			6,559						6.6	7.5	10,280.3
36			9,755						9.8	11.2	10,291.5
37			59						0.1	0.1	10,291.6
38			2,538						2.5	2.9	10,294.5
39			3,519						3.5	4.0	10,298.6
40			5,608						5.6	6.4	10,305.0
41			6,417						6.4	7.4	10,312.4
42			17,756						17.8	20.4	10,332.8
43			22,839						22.8	26.3	10,359.1
44			18,851						18.9	21.7	10,380.7
45											10,380.7
46											10,380.7
47											10,380.7
48			1,062						1.1	1.2	10,382.0
49			1,473						1.5	1.7	10,383.7
50			2,347						2.3	2.7	10,386.4
51			2,685						2.7	3.1	10,389.4
52			7,428						7.4	8.5	10,398.0
53			9,555						9.6	11.0	10,409.0
54			7,887						7.9	9.1	10,418.0
55											10,418.0
56											10,418.0
57											10,418.0
58			511						0.5	0.6	10,418.6

(Table 5-2-2 continued)

Operation Year	Total Direct Cost for Two Counties US$								Direct Cost Total 1000 US$	Total Inclusive of Indirect Cost 1000 US$	Aggregate Inclusive of Indirect Cost 1000 US$
	Procurement of Machinery	Procurement of Hand Tools	Cruising	Wood Production	Planting and Tending	Drainage and Infiltration Works	Supplementary Planting at Forest Mantle	Forest Road Improvement			
59			708						0.7	0.8	10,419.4
60			1,128						1.1	1.3	10,420.7
61			1,292						1.3	1.5	10,422.2
62			3,573						3.6	4.1	10,426.3
63			4,596						4.6	5.3	10,431.6
64			3,793						3.8	4.4	10,436.0
65											10,436.0
66											10,436.0
67											10,436.0
68			316						0.3	0.4	10,436.4
69			438						0.4	0.5	10,436.9
70			698						0.7	0.8	10,437.7
71			799						0.8	0.9	10,438.6
72			2,210						2.2	2.5	10,441.1
73			2,843						2.8	3.3	10,444.4
74			2,347						2.3	2.7	10,447.1
75											10,447.1
76											10,447.1
77											10,447.1
78			291						0.3	0.3	10,447.4
79			403						0.4	0.5	10,447.9
80			643						0.6	0.7	10,448.6
81			735						0.7	0.8	10,449.5
82			2,034						2.0	2.3	10,451.8
83			2,617						2.6	3.0	10,454.8
84			2,160						2.2	2.5	10,457.3
85											10,457.3
86											10,457.3
87											10,457.3
88											10,457.3
89											10,457.3
90											10,457.3
91											10,457.3
92											10,457.3
93											10,457.3
94											10,457.3
95											10,457.3
96											10,457.3
97											10,457.3
98											10,457.3
99											10,457.3
100											10,457.3
101											10,457.3
102											10,457.3
103											10,457.3
104											10,457.3
105											10,457.3
106											10,457.3
107											10,457.3
108											10,457.3
109											10,457.3
110											10,457.3
111											10,457.3
112											10,457.3
113											10,457.3
114											10,457.3
115											10,457.3
116											10,457.3
117											10,457.3
118											10,457.3
119											10,457.3

(Table 5-2-2 continued)

Operation Year	Total Direct Cost for Two Counties US$								Direct Cost Total 1000 US$	Total Inclusive of Indirect Cost 1000 US$	Aggregate Inclusive of Indirect Cost 1000 US$
	Procurement of Machinery	Procurement of Hand Tools	Cruising	Wood Production	Planting and Tending	Drainage and Infiltration Works	Supplementary Planting at Forest Mantle	Forest Road Improvement			
120											10,457.3
121											10,457.3
122											10,457.3
123			1,820						1.8	2.1	10,459.4
124			2,538						2.5	2.9	10,462.3
125			4,045						4.0	4.7	10,467.0
126			4,629						4.6	5.3	10,472.3
127			12,692						12.7	14.6	10,486.9
128			16,338						16.3	18.8	10,505.7
129			13,474						13.5	15.5	10,521.2
130											10,521.2
131											10,521.2
132											10,521.2
133											10,521.2
134											10,521.2
135											10,521.2
136											10,521.2
137											10,521.2
138											10,521.2
139											10,521.2
140											10,521.2
141											10,521.2
142											10,521.2
143			1,928						1.9	2.2	10,523.4
144			2,688						2.7	3.1	10,526.5
145			4,284						4.3	4.9	10,531.4
146			4,903						4.9	5.6	10,537.0
147			13,456						13.5	15.5	10,552.5
148			17,314						17.3	19.9	10,572.4
149			14,280						14.3	16.4	10,588.9
150											10,588.9
151											10,588.9
152											10,588.9
153											10,588.9
154											10,588.9
155											10,588.9
156											10,588.9
157											10,588.9
158											10,588.9
159											10,588.9
160											10,588.9
161											10,588.9
162											10,588.9
163			2,043						2.0	2.3	10,591.2
164			2,847						2.8	3.3	10,594.5
165			4,538						4.5	5.2	10,599.7
166			5,192						5.2	6.0	10,605.7
167			14,254						14.3	16.4	10,622.1
168			18,343						18.3	21.1	10,643.2
169			15,128						15.1	17.4	10,660.6
Total	1,356,613	10,651	479,251	953,906	6,167,210	35,079	50,867	266,924	9,329,901	10,660.6	

Table 5-2-3 Income from Wood Sales Following Cutting and Clearance of Damaged Trees

Species	Purpose of Use	Unit Price (US$/m³)	Olt County		Dolj County		Total	
			Quantity (m³)	Sales Amount (US$)	Quantity (m³)	Sales Amount (US$)	Quantity (m³)	Sales Amount (US$)
Quercus spp.	Forest Products Industry	32.0	1,711	54,752	6,016	192,512	7,727	247,264
	Firewood, Chips	16.1	143,385	2,308,499	279,239	4,495,748	422,624	6,804,246
	Sub-Total		145,096	2,363,251	285,255	4,688,260	430,351	7,051,510
Robinia pseudoacacia	Forest Products Industry	19.0	33	627	1,869	35,511	1,902	36,138
	Firewood, Chips	14.9	1,480	22,052	49,557	738,399	51,037	760,451
	Sub-Total		1,513	22,679	51,426	773,910	52,939	796,589
Populus spp.	Forest Products Industry	18.0	4	72	83	1,494	87	1,566
	Firewood, Chips	12.6	76	958	2,416	30,442	2,492	31,399
	Sub-Total		80	1,030	2,499	31,936	2,579	32,965
Total			146,689	2,386,959	339,180	5,494,106	485,869	7,881,065

Table 5-2-4 Yearly Income from Sales of Damaged Trees

(Unit: US$)

Operation Year	Olt Country			Dolj Country			Total for Two Counties
	Forest Products Industry	Other Use	Total	Forest Products Industry	Other Use	Total	
3	11,566	170,404	181,960	29,961	332,118	362,079	544,039
4	12,051	215,703	227,754	28,335	399,402	427,737	655,491
5	3,311	259,428	262,739	31,727	577,065	608,792	871,531
6	3,713	284,246	287,959	48,846	707,001	755,847	1,043,806
7	24,837	433,127	457,964	82,684	1,028,482	1,111,166	1,569,130
8	0	531,790	531,790	7,951	1,202,978	1,210,929	1,742,719
9	0	436,794	436,794	0	1,017,554	1,017,554	1,454,348
Total	55,468	2,331,492	2,386,960	229,504	5,264,600	5,494,104	7,881,065

Table 5-2-5 Income from Thinning by Year

Operation Year	Olt County			Doli County			Total		
	Actual Regeneration Area ha	Thinning (m^3/ha) Planned Volume m^3	Standing Tree Price (Unit Cost US$) Amount US$	Actual Regeneration Area ha	Thinning (m^3/ha) Planned Volume m^3	Standing Tree Price (Unit Cost US$) Amount US$	Actual Regeneration Area ha	Planned Volume m^3	Amount US$
	Populus (F13)	(26)	(10.6)		(26)	(10.6)			
15	1.60	42	441	8.20	213	2,260	9.80	255	2,701
	F9s, m, F10s, m *Robinia*								
		(13)	(12.4)		(13)	(12.4)			
13	1.00	13	161	44.00	572	7,093	45.00	585	7,254
14	4.00	52	645	86.00	1,118	13,863	90.00	1,170	14,508
15	6.00	78	967	175.00	2,275	28,210	181.00	2,353	29,177
16	10.30	134	1,660	258.85	3,365	41,727	269.15	3,499	43,387
Total	21.30	277	3,434	563.85	7,330	90,893	585.15	7,607	94,326
		(13)	(12.4)		(13)	(12.4)			
18	1.00	13	161	44.00	572	7,093	45.00	585	7,254
19	4.00	52	645	86.00	1,118	13,863	90.00	1,170	14,508
20	6.00	78	967	175.00	2,275	28,210	181.00	2,353	29,177
21	10.30	134	1,660	258.85	3,365	41,727	269.15	3,499	43,387
Total	21.30	277	3,434	563.85	7,330	90,893	585.15	7,607	94,326
		(14)	(12.4)		(14)	(12.4)			
23	1.00	14	174	44.00	616	7,638	45.00	630	7,812
24	4.00	56	694	86.00	1,204	14,930	90.00	1,260	15,624
25	6.00	84	1,042	175.00	2,450	30,380	181.00	2,534	31,422
26	10.30	144	1,788	258.85	3,624	44,936	269.15	3,768	46,724
Total	21.30	298	3,698	563.85	7,894	97,884	585.15	8,192	101,582
	F8sm, F7s,m, F6s,m, F5s,m, F11s *Quercus*			F8sm, F7s,m, F6s,m, F5s,m F11m, F12s, F13s, F1s, F2sm, F3m					
		(19)	(13.9)		(19)	(13.9)			
38	27.00	513	7,131	62.00	1,178	16,374	89.00	1,691	23,505
39	45.00	855	11,885	78.44	1,490	20,716	123.44	2,345	32,601
40	72.40	1,376	19,121	124.30	2,362	32,828	196.70	3,737	51,948
41	83.40	1,585	22,026	141.67	2,692	37,415	225.07	4,276	59,441
42	165.44	3,143	43,693	457.36	8,690	120,789	622.80	11,833	164,481
43	217.00	4,123	57,310	584.08	11,098	154,256	801.08	15,221	211,565
44	172.60	3,279	45,584	488.60	9,283	129,039	661.20	12,563	174,623
Total	782.84	148.74	206,748	1,936.45	36,793	511,416	2,719.29	51,667	718,164

Operation Year	Olt County			Dolj County			Total		
	Actual Regeneration Area ha	Thinning (m^3/ha) Planned Volume m^3	Standing Tree Price (Unit Cost US$) Amount US$	Actual Regeneration Area ha	Thinning (m^3/ha) Planned Volume m^3	Standing Tree Price (Unit Cost US$) Amount US$	Actual Regeneration Area ha	Planned Volume m^3	Amount US$
		(15)	(13.9)		(15)	(13.9)			
48	27.00	405	5,630	62.00	930	12,927	89.00	1,335	18,557
49	45.00	675	9,383	78.44	1,177	16,355	123.44	1,852	25,737
50	72.40	1,086	15,095	124.30	1,865	25,917	196.70	2,951	41,012
51	83.40	1,251	17,389	141.67	2,125	29,538	225.07	3,376	46,927
52	165.44	2,482	34,494	457.36	6,860	95,360	622.80	9,342	129,854
53	217.00	3,255	45,245	584.08	8,761	121,781	801.08	12,016	167,025
54	172.60	2,589	35,987	488.60	7,329	101,873	661.20	9,918	137,860
Total	782.84	11,743	163,222	1,936.45	29,047	403,750	2,719.29	40,789	566,972
		(16)	(13.9)		(16)	(13.9)			
58	27.00	432	6,005	62.00	992	13,789	89.00	1,424	19,794
59	45.00	720	10,008	78.44	1,255	17,445	123.44	1,975	27,453
60	72.40	1,158	16,102	124.30	1,989	27,644	196.70	3,147	43,746
61	83.40	1,334	18,548	141.67	2,267	31,507	225.07	3,601	50,056
62	165.44	2,647	36,794	457.36	7,318	101,717	622.80	9,965	138,511
63	217.00	3,472	48,261	584.08	9,345	129,899	801.08	12,817	178,160
64	172.60	2,762	38,386	488.60	7,818	108,665	661.20	10,579	147,051
Total	782.84	12,525	174,104	1,936.45	30,983	430,666	2,719.29	43,509	604,770
		(18)	(13.9)		(18)	(13.9)			
68	27.00	486	6,755	62.00	1,116	15,512	89.00	1,602	22,268
69	45.00	810	11,259	78.44	1,412	19,626	123.44	2,222	30,885
70	72.40	1,303	18,114	124.30	2,237	31,100	196.70	3,541	49,214
71	83.40	1,501	20,867	141.67	2,550	35,446	225.07	4,051	56,313
72	165.44	2,978	41,393	457.36	8,232	114,431	622.80	11,210	155,825
73	217.00	3,906	54,293	584.08	10,513	146,137	801.08	14,419	200,430
74	172.60	3,107	43,185	488.60	8,795	122,248	661.20	11,902	165,432
Total	782.84	14,091	195,867	1,936.45	34,856	484,500	2,719.29	48,947	680,366
		(18)	(13.9)		(18)	(13.9)			
78	27.00	486	6,755	62.00	1,116	15,512	89.00	1,602	22,268
79	45.00	810	11,259	78.44	1,412	19,626	123.44	2,222	30,885
80	72.40	1,303	18,114	124.30	2,237	31,100	196.70	3,541	49,214
81	83.40	1,501	20,867	141.67	2,550	35,446	225.07	4,051	56,313
82	165.44	2,978	41,393	457.36	8,232	114,431	622.80	11,210	155,825
83	217.00	3,906	54,293	584.08	10,513	146,137	801.08	14,419	200,430
84	172.60	3,107	43,185	488.60	8,795	122,248	661.20	11,902	165,432
Total	782.84	14,091	195,867	1,936.45	34,856	484,500	2,719.29	48,947	680,366

Table 5-2-6 Income from Final Cutting by Year

Operation Year	Olt County						Dolj County						Total				Operation Year
	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Total	
			Volume		Standing Tree Price (1000US$)				Volume		Standing Tree Price (1000US$)			Standing Tree Price (1000US$)		(1000US$)	
	ha	m^3	m^3	m^3	Unit PriceUS$	Unit PriceUS$	ha	m^3	m^3	m^3	Unit PriceUS$	Unit PriceUS$	ha				
F13m	*Populus*	(288.8)	(57.5)	(231.3)	(16.0)	(10.6)	F13m	(183.4)	(24.6)	(158.8)	(16.0)	(10.6)					
37	1.60	462	92	370	1.5	3.9	8.20	1,504	202	1302	3.2	13.8	9.80	4.7	17.7	22.4	37
F9s,m, F10s, m																	
Robinia		(192.0)	(20.0)	(172.1)	(16.5)	(12.4)		(181.4)	(19.5)	(161.8)	(16.5)	(12.4)					
33	1.00	192	20	172	0.3	2.1	44.00	7,980	859	7,121	14.2	88.3	45.00	14.5	90.4	104.9	33
34	4.00	768	80	688	1.3	8.5	86.00	15,598	1,679	13,919	27.7	172.6	90.00	29.0	181.1	210.2	34
35	6.00	1,152	120	1,032	2.0	12.8	175.00	31,740	3,417	28,323	56.4	351.2	181.00	58.4	364.0	422.4	35
36	10.30	1,978	206	1,772	3.4	22.0	258.85	46,948	5,054	41,893	83.4	519.5	269.15	86.8	541.5	628.2	36
Total	21.30	4,090	426	3,664	7.0	45.4	563.85	102,266	11,010	91,256	181.7	1,131.6	585.15	188.7	1,177.0	1,365.7	Total
F8sm, F7s,m, F6s,m, F5s,m, F11s							F8sm, F7s,m, F6s,m, F5s,m										
Quercus							F11m, F12s, F13s, F1s, F2sm, F3m										
Reference		(355.0)	(143.8)	(211.2)	(200.0)	(13.9)		(327.0)	(123.5)	(203.5)	(200.0)	(13.9)					
123	27.00	9,585	3,883	5,702	777	79	62.00	20276	7659	12617	1,532	175	89.00	2,309	255	2,563	123
124	45.00	15,976	6,472	9,503	1,294	132	78.44	25,653	9,690	15,962	1,938	222	123.44	3,233	354	3,587	124
125	72.40	25,703	10,413	15,290	2,083	213	124.30	40,650	15,356	25,295	3,071	352	196.70	5,154	564	5,718	125
126	83.40	29,608	11,996	17,613	2,399	245	141.67	46,331	17,501	28,829	3,500	401	225.07	5,899	646	6,545	126
127	165.44	58,734	23,796	34,938	4,759	486	457.36	149,572	56,501	93,071	11,300	1,294	622.80	16,059	1,779	17,839	127
128	217.00	77,038	31,212	45,827	6,242	637	584.08	191,014	72,155	118,859	14,431	1,652	801.08	20,673	2,289	22,962	128
129	172.60	61,276	24,826	36,450	4,965	507	488.60	159,789	60,360	99,429	12,072	1,382	661.20	17,037	1,889	18,926	129
Total	782.84	277,920	112,598	165,322	22,520	2,298	1,936.45	633,284	239,222	394,062	47,844	5,477	2,719.29	70,364	7,775	78,139	Total
	(33%)	(355.0)	(143.8)	(211.2)	(200.0)	(13.9)		(327.0)	(123.5)	(203.5)	(200.0)	(13.9)					
123	8.91	3,163	1,282	1,882	256	26	20.46	6,691	2,528	4,164	506	58	29.37	762	84	846	123
124	14.85	5,272	2,136	3,136	427	44	25.89	8,465	3,198	5,268	640	73	40.74	1,067	117	1,184	124
125	23.89	8,482	3,436	5,046	687	70	41.02	13,415	5,067	8,347	1,013	116	64.91	1,701	186	1,887	125
126	27.52	9,771	3,959	5,812	792	81	46.75	15,289	5,775	9,514	1,155	132	74.27	1,947	213	2,160	126
127	54.60	19,382	7,853	11,530	1,571	160	150.93	49,359	18,645	30,714	3,729	427	205.52	5,300	587	5,887	127
128	71.61	25,423	10,300	15,123	2,060	210	192.75	63,035	23,811	39,223	4,762	545	264.36	6,822	755	7,578	128
129	56.96	20,221	8,192	12,029	1,638	167	161.24	52,730	19,919	32,811	3,984	456	218.20	5,622	623	6,246	129
Total	258.34	91,714	37,157	54,556	7,431	758	639.03	208,984	78,943	130,040	15,789	1,808	897.37	23,220	2,566	25,786	Total

(Table 5-2-6 Continued)

Operation Year	Olt County						Doli County						Total				Operation Year
	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Total	
			Volume		Standing Tree Price (1000US$)				Volume		Standing Tree Price (1000US$)			Standing Tree Price (1000US$)		(1000US$)	
	ha	m^3	m^3	m^3	Unit Price US$	Unit Price US$	ha	m^3	m^3	m^3	Unit Price US$	Unit Price US$	ha				
	(33%)	(377.4)	(163.2)	(211.8)	(200.0)	(13.9)	(33%)	(347.0)	(141.3)	(205.5)	(200.0)	(13.9)					
143	8.91	3,341	1,454	1,887	291	26	20.46	7,100	2,895	4,205	579	58	29.37	870	85	955	143
144	14.85	5,569	2,423	3,146	485	44	25.89	8,983	3,663	5,320	733	74	40.74	1,217	118	1,335	144
145	23.89	8,960	3,899	5,061	780	70	41.02	14,235	5,804	8,431	1,161	117	64.91	1,941	188	2,128	145
146	27.52	10,321	4,491	5,830	898	81	46.75	16,224	6,615	9,609	1,323	134	74.27	2,221	215	2,436	146
147	54.60	20,474	8,909	11,565	1,782	161	150.93	52,377	21,357	31,021	4,271	431	205.52	6,053	592	6,645	147
148	71.61	26,855	11,686	15,169	2,337	211	192.75	66,889	27,274	39,615	5,455	551	264.36	7,792	762	8,553	148
149	56.96	21,360	9,295	12,065	1,859	168	161.24	55,955	22,815	33,139	4,563	461	218.20	6,422	628	7,050	149
Total	258.34	96,880	42,157	54,723	8,431	761	639.03	221,764	90,424	131,340	18,085	1,826	897.37	26,516	2,586	29,102	Total
	(34%)	(385.0)	(173.3)	(211.7)	(200.0)	(13.9)	(34%)	(357.0)	(150.9)	(206.1)	(200.0)	(13.9)					
163	9.18	3,534	1,591	1,943	318	27	21.08	7,526	3,182	4,345	636	60	30.26	955	87	1,042	163
164	15.30	5,891	2,652	3,239	530	45	26.67	9,522	4,025	5,497	805	76	41.97	1,335	121	1,457	164
165	24.62	9,478	4,266	5,211	853	72	42.26	15,089	6,379	8,710	1,276	121	66.88	2,129	194	2,323	165
166	28.36	10,917	4,914	6,003	983	83	48.17	17,198	7,270	9,927	1,454	138	76.52	2,437	221	2,658	166
167	56.25	21,657	9,749	11,908	1,950	166	155.50	55,520	23,471	32,049	4,694	445	211.75	6,644	611	7,255	167
168	73.78	28,406	12,787	15,619	2,557	217	198.59	70,902	29,974	40,928	5,995	569	272.37	8,552	786	9,338	168
169	58.68	22,594	10,171	12,424	2,034	173	166.12	59,312	25,074	34,238	5,015	476	224.81	7,049	649	7,698	169
Total	266.17	102,478	46,130	56,348	9,226	783	658.39	235,068	99,375	135,693	19,875	1,886	924.56	29,101	2,669	31,770	Total

Tree Species	Olt County						Doli County						Total						Total
	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	Actual Regeneration Area	Planned Volume of Final Cutting	Wood for Forest Products Industry	Wood for Other Use	Wood for Forest Products Industry	Wood for Other Use	
			Volume		Standing Tree Price (1000US$)				Volume		Standing Tree Price (1000US$)				Volume		Standing Tree Price (1000US$)		(1000US$)
	ha	m^3	m^3	m^3	Unit Price US$	Unit Price US$	ha	m^3	m^3	m^3	Unit Price US$	Unit Price US$	ha	m^3	m^3	m^3	Unit Price US$	Unit Price US$	
P	1.60	462	92	370	1.5	3.9	8.20	1,504	202	1,302	3.2	13.8	9.80	1,966	294	1,672	4.7	17.7	22.4
R	21.30	4090.00	426	3,664	7.0	45.4	563.85	102,266	11,010	91,256	181.7	1,131.6	585.15	106,356	11,436	94,920	188.7	1,177.0	1,365.7
Q	782.84	291,072	125,444	165,627	25,088.9	2,302.2	1936.45	665,816	268,742	397,074	53,748.3	5,519.3	2719.29	956,888	394,186	562,701	78,837.2	7,821.6	86,658.7
Total	805.74	295,624	125,962	169,661	25,097.4	2,351.6	2508.50	769,586	279,954	489,632	53,933.2	6,664.7	3314.24	1,065,210	405,916	659,293	79,030.6	9,016.3	88,046.9

P:*Populus* R:*Robinia* Q:*Quercus*

Table 5-2-7 Cost-Income Balance by Year (Financial Analysis, Total for Two Counties)

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Aggregate Total Cost 1000 US$	Income 1000US$			Total Income 1000US$	Aggregate Total Income 1000US$	Annual Balance 1000US$	Aggregate Balance 1000US$
			Sale of Damaged Trees	Sale of Standing Trees for Thinning	Sale of Standing Trees for Final Cutting				
2	72.8	72.8				0.0	0.0	-72.8	-72.8
3	670.4	743.2	554.4			554.4	554.4	-116.0	-188.8
4	715.8	1,459.0	657.1			657.1	1,211.6	-58.7	-247.4
5	832.1	2,291.0	871.5			871.5	2,083.1	39.5	-208.0
6	1,142.1	3,433.1	1,043.8			1,043.8	3,126.9	-98.3	-306.2
7	1,297.3	4,730.4	1,569.1			1,569.1	4,696.0	271.9	-34.4
8	1,335.7	6,066.1	1,742.7			1,742.7	6,438.7	407.0	372.7
9	1,425.2	7,491.3	1,454.3			1,454.3	7,893.1	29.1	401.8
10	996.4	8,487.6				0.0	7,893.1	-996.4	-594.6
11	426.3	8,914.0				0.0	7,893.1	-426.3	-1,020.9
12	315.4	9,229.3				0.0	7,893.1	-315.4	-1,336.2
13	292.1	9,521.5		7.3		7.3	7,900.3	-284.9	-1,621.1
14	246.4	9,767.9		14.5		14.5	7,914.9	-231.9	-1,853.0
15	134.4	9,902.3		31.9		31.9	7,946.7	-102.5	-1,955.5
16	53.0	9,955.3		43.4		43.4	7,990.1	-9.6	-1,965.1
17	30.4	9,985.7				0.0	7,990.1	-30.4	-1,995.5
18	42.8	10,028.4		7.3		7.3	7,997.4	-35.5	-2,031.1
19	37.6	10,066.1		14.5		14.5	8,011.9	-23.1	-2,054.2
20	8.9	10,075.0		29.2		29.2	8,041.1	20.2	-2,033.9
21	10.9	10,085.9		43.4		43.4	8,084.4	32.5	-2,001.4
22	23.2	10,109.1					8,084.4	-23.2	-2,024.6
23	33.2	10,142.3					8,084.4	-33.2	-2,057.8
24	29.4	10,171.7					8,084.4	-29.4	-2,087.2
25	8.1	10,179.8					8,084.4	-8.1	-2,095.4
26	9.8	10,189.6					8,084.4	-9.8	-2,105.2
27	23.2	10,212.8					8,084.4	-23.2	-2,128.4
28	29.8	10,242.6					8,084.4	-29.8	-2,158.2
29	24.5	10,267.1					8,084.4	-24.5	-2,182.7
		10,267.1					8,084.4		-2,182.7
33	1.9	10,269.0			104.9	104.9	8,189.3	103.0	-2,079.7
34	3.8	10,272.8			210.2	210.2	8,399.5	206.4	-1,873.2
35	7.5	10,280.3			422.4	422.4	8,821.9	414.9	-1,458.4
36	11.2	10,291.5			628.2	628.2	9,450.1	617.0	-841.4
37	0.1	10,291.6			22.4	22.4	9,472.5	22.3	-819.0
38	2.9	10,294.5		23.5		23.5	9,496.0	20.6	-798.5
39	4.0	10,298.6		32.6		32.6	9,528.6	28.6	-769.9
40	6.4	10,305.0		51.9		51.9	9,580.6	45.5	-724.4
41	7.4	10,312.4		59.4		59.4	9,640.0	52.1	-672.3
42	20.4	10,332.8		164.5		164.5	9,804.5	144.1	-528.3
43	26.3	10,359.1		211.6		211.6	10,016.1	185.3	-343.0
44	21.7	10,380.7		174.6		174.6	10,190.7	152.9	-190.0
		10,380.7					10,190.7		-190.0
48	1.2	10,382.0		18.6		18.6	10,209.3	17.3	-172.7
49	1.7	10,383.7		25.7		25.7	10,235.0	24.0	-148.7
50	2.7	10,386.4		41.0		41.0	10,276.0	38.3	-110.3
51	3.1	10,389.4		46.9		46.9	10,322.9	43.8	-66.5
52	8.5	10,398.0		129.9		129.9	10,452.8	121.3	54.8
53	11.0	10,409.0		167.0		167.0	10,619.8	156.0	210.8

(Table 5-2-7 continued)

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Aggregate Total Cost 1000 US$	Income 1000US$			Total Income 1000US$	Aggregate Total Income 1000US$	Annual Balance	Aggregate Balance
			Sale of Damaged Trees	Sale of Standing Trees for Thinning	Sale of Standing Trees for Final Cutting				
54	9.1	10,418.0		137.9		137.9	10,757.7	128.8	339.6
		10,418.0					10,757.7		339.6
58	0.6	10,418.6		19.8		19.8	10,777.5	19.2	358.8
59	0.8	10,419.4		27.5		27.5	10,804.9	26.6	385.5
60	1.3	10,420.7		43.8		43.8	10,848.7	42.5	427.9
61	1.5	10,422.2		50.1		50.1	10,898.7	48.6	476.5
62	4.1	10,426.3		138.5		138.5	11,037.3	134.4	610.9
63	5.3	10,431.6		178.2		178.2	11,215.4	172.9	783.8
64	4.4	10,436.0		147.1		147.1	11,362.5	142.7	926.5
		10,436.0					11,362.5		926.5
68	0.4	10,436.4		22.3		22.3	11,384.7	21.9	948.4
69	0.5	10,436.9		30.9		30.9	11,415.6	30.4	978.8
70	0.8	10,437.7		49.2		49.2	11,464.8	48.4	1,027.2
71	0.9	10,438.6		56.3		56.3	11,521.1	55.4	1,082.6
72	2.5	10,441.1		155.8		155.8	11,677.0	153.3	1,235.9
73	3.3	10,444.4		200.4		200.4	11,877.4	197.2	1,433.0
74	2.7	10,447.1		165.4		165.4	12,042.8	162.7	1,595.7
		10,447.1					12,042.8		1,595.7
78	0.3	10,447.4		22.3		22.3	12,065.1	21.9	1,617.7
79	0.5	10,447.9		30.9		30.9	12,096.0	30.4	1,648.1
80	0.7	10,448.6		49.2		49.2	12,145.2	48.5	1,696.6
81	0.8	10,449.5		56.3		56.3	12,201.5	55.5	1,752.0
82	2.3	10,451.8		155.8		155.8	12,357.3	153.5	1,905.5
83	3.0	10,454.8		200.4		200.4	12,557.8	197.4	2,103.0
84	2.5	10,457.3		165.4		165.4	12,723.2	162.9	2,265.9
		10,457.3					12,723.2		2,265.9
123	2.1	10,459.4			846.0	846.0	13,569.2	843.9	3,109.8
124	2.9	10,462.3			1,184.0	1,184.0	14,753.2	1,181.1	4,290.9
125	4.7	10,467.0			1,887.0	1,887.0	16,640.2	1,882.3	6,173.2
126	5.3	10,472.3			2,160.0	2,160.0	18,800.2	2,154.7	8,327.9
127	14.6	10,486.9			5,887.0	5,887.0	24,687.2	5,872.4	14,200.3
128	18.8	10,505.7			7,578.0	7,578.0	32,265.2	7,559.2	21,759.5
129	15.5	10,521.2			6,246.0	6,246.0	38,511.2	6,230.5	27,990.0
		10,521.2					38,511.2		27,990.0
143	2.2	10,523.4			955.0	955.0	39,466.2	952.8	28,942.8
144	3.1	10,526.5			1,335.0	1,335.0	40,801.2	1,331.9	30,274.7
145	4.9	10,531.4			2,128.0	2,128.0	42,929.2	2,123.1	32,397.8
146	5.6	10,537.0			2,436.0	2,436.0	45,365.2	2,430.4	34,828.2
147	15.5	10,552.5			6,645.0	6,645.0	52,010.2	6,629.5	41,457.7
148	19.9	10,572.4			8,553.0	8,553.0	60,563.2	8,533.1	49,990.8
149	16.4	10,588.9			7,050.0	7,050.0	67,613.2	7,033.6	57,024.3
		10,588.9					67,613.2		57,024.3
163	2.3	10,591.2			1,042.0	1,042.0	68,655.2	1,039.7	58,064.0
164	3.3	10,594.5			1,457.0	1,457.0	70,112.2	1,453.7	59,517.7
165	5.2	10,599.7			2,323.0	2,323.0	72,435.2	2,317.8	61,835.5
166	6.0	10,605.7			2,658.0	2,658.0	75,093.2	2,652.0	64,487.5
167	16.4	10,622.1			7,255.0	7,255.0	82,348.2	7,238.6	71,726.1
168	21.1	10,643.2			9,338.0	9,338.0	91,686.2	9,316.9	81,043.0
169	17.4	10,660.6			7,698.0	7,698.0	99,384.2	7,680.6	88,723.6
Total	10,660.6		7,893.1	3,442.0	88,049.1	99,384.2			

(2) Evaluation of Financial Analysis Results

The total cost required to implement damage restoration measures for 5,232 ha of damaged forests is approximately US$ 10,660,000. The cost of reforestation and tending for an area of 3,314 ha accounts for 66.5% while the cost of drainage and infiltration works for an area of 5,331 ha, consisting of the remaining area of standing trees and weakly damaged stands, accounts for a mere 0.4%. The procurement cost of machinery and others accounts for 14.1%.

The most expenditure will be incurred upto the tenth year when planting is completed and will range from US$ 670,000 to US$ 1,430,000 annually. Tending expenditure will be required upto the 29th year with an annual figure of between US$ 10,000 and US$ 430,000.

The sale of damaged trees upto the ninth year will earn an income of some US$ 7,890,000, producing an accumulated surplus of US$ 400,000 in that year. However, as tending expenditure will be continually required upto the 33rd year when *R. pseudoacacia* and *Populus* spp. are harvested through final cutting, maximum accumulated over-expenditure of some US$ 2,180,000 will result by this year. On a year by year basis, the tenth year, i.e. immediately after the sale of damaged trees, will produce a deficit of some US$ 996,000. In other years, however, the over-expenditure level, i.e. deficit, will be less than US$ 430,000. Given the recent level of wood sales of some US$ 3,000,000 by the two forest branch offices in question (Table 2-4-35), this deficit level should be manageable within the budget of the RNP.

The period for financial analysis will be upto the 169th year when the final harvesting of the planted *Quercus* spp. is completed. The FIRR (Finacial Internal Rate of Return) calculation result for this long period is 3.5% as shown in Table 5-2-8. During this period, the accumulated balance will go into the black in the 52th year when the second thinning of *Quercus* spp. commences. The total revenue in the analysis period will be approximately US$ 99,384,000 which is 9.7 times higher than the restoration work cost of US$ 10,267,000 for the first 29 years.

The official discount rate in Romania has been fluctuating between 35% and 50% while the consumer price has also been fluctuating between 32% and 155%. Meanwhile, the domestic currency exchange rate vis-a-vis the US dollar has been fluctuating between 123% and 232% while the GDP growth rate has been fluctuating between +7.2% and -7.3%. There has been no real rise of wages.

Table 5-2-8 Calculation of FIRR

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Total Income 1000 US$	Present Value (A)			Present Value (B)		
			Discount Factor 3.50%	Cost 1000 US$	Income 1000 US$	Discount Factor 4.00%	Cost 1000 US$	Income 1000 US$
2	72.8		0.97087	70.67		0.96620	70.3	0.0
3	670.4	554.4	0.94260	631.89	522.59	0.93350	625.8	517.5
4	715.8	657.1	0.91514	655.09	601.38	0.90190	645.6	592.7
5	832.1	871.5	0.88849	739.27	774.31	0.87140	725.1	759.5
6	1,142.1	1,043.8	0.83748	956.48	874.17	0.84200	961.6	878.9
7	1,297.3	1,569.1	0.83748	1,086.43	1,314.12	0.81350	1055.3	1276.5
8	1,335.7	1,742.7	0.81309	1,086.03	1,416.99	0.78600	1049.8	1369.8
9	1,425.2	1,454.3	0.78941	1,125.08	1,148.08	0.75940	1082.3	1104.4
10	996.4		0.76642	763.63		0.73370	731.0	0.0
11	426.3		0.74409	317.24		0.70890	302.2	0.0
12	315.4		0.72242	227.82		0.68490	216.0	0.0
13	292.1	7.3	0.70138	204.90	5.09	0.66150	193.3	4.8
14	246.4	14.5	0.68095	167.78	9.88	0.63940	157.5	9.3
15	134.4	31.9	0.66112	88.85	21.08	0.61780	83.0	19.7
16	53.0	43.4	0.64186	34.02	27.85	0.59690	31.6	25.9
17	30.4		0.62317	18.94		0.57670	17.5	0.0
18	42.8	7.3	0.60502	25.87	4.39	0.55720	23.8	4.0
19	37.6	14.5	0.58739	22.12	8.52	0.53840	20.3	7.8
20	8.9	29.2	0.57029	5.09	16.64	0.52020	4.6	15.2
21	10.9	43.4	0.55368	6.03	24.02	0.50260	5.5	21.8
22	23.2		0.53755	12.46		0.48560	11.3	
23	33.2		0.52189	17.32		0.46920	15.6	
24	29.4		0.50669	14.91		0.45330	13.3	
25	8.1		0.49193	4.01		0.43800	3.6	
26	9.8		0.47761	4.68		0.42310	4.1	
27	23.2		0.46369	10.75		0.40880	9.5	
28	29.8		0.45019	13.40		0.39500	11.8	
29	24.5		0.43708	10.73		0.38170	9.4	
33	1.9	104.9	0.38834	0.73	40.74	0.33260	0.6	34.9
34	3.8	210.2	0.37703	1.41	79.25	0.32130	1.2	67.5
35	7.5	422.4	0.36604	2.76	154.62	0.31050	2.3	131.2
36	11.2	628.2	0.35538	3.99	223.25	0.30000	3.4	188.5
37	0.1	22.4	0.34503	0.02	7.73	0.28980	0.0	6.5
38	2.9	23.5	0.33498	0.98	7.87	0.28000	0.8	6.6
39	4.0	32.6	0.32523	1.32	10.60	0.27060	1.1	8.8
40	6.4	51.9	0.31575	2.04	16.40	0.26140	1.7	13.6
41	7.4	59.4	0.30656	2.26	18.22	0.25260	1.9	15.0
42	20.4	164.5	0.29763	6.08	48.95	0.24400	5.0	40.1
43	26.3	211.6	0.28896	7.59	61.13	0.23580	6.2	49.9
44	21.7	174.6	0.28054	6.08	48.99	0.22780	4.9	39.8
48	1.2	18.6	0.24926	0.30	4.63	0.19850	0.2	3.7
49	1.7	25.7	0.24200	0.41	6.23	0.19180	0.3	4.9
50	2.7	41.0	0.23495	0.63	9.64	0.18530	0.5	7.6
51	3.1	46.9	0.22811	0.70	10.70	0.17910	0.6	8.4
52	8.5	129.9	0.22146	1.89	28.76	0.17300	1.5	22.5
53	11.0	167.0	0.21501	2.36	35.91	0.16710	1.8	27.9
54	9.1	137.9	0.20875	1.89	28.78	0.16150	1.5	22.3

(Table 5-2-8 continued)

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Total Income 1000 US$	Present Value (A)			Present Value (B)		
			Discount Factor 3.50%	Cost 1000 US$	Income 1000 US$	Discount Factor 4.00%	Cost 1000 US$	Income 1000 US$
58	0.6	19.8	0.18547	0.11	3.67	0.14970	0.1	2.8
59	0.8	27.5	0.18007	0.15	4.94	0.13500	0.1	3.7
60	1.3	43.8	0.17483	0.23	7.65	0.13140	0.2	5.8
61	1.5	50.1	0.16973	0.25	8.50	0.12690	0.2	6.4
62	4.1	138.5	0.16479	0.68	22.83	0.12260	0.5	17.0
63	5.3	178.2	0.15999	0.85	28.50	0.11850	0.6	21.1
64	4.4	147.1	0.15533	0.68	22.84	0.11450	0.5	16.8
68	0.4	22.3	0.13801	0.05	3.07	0.09977	0.0	2.2
69	0.5	30.9	0.13399	0.07	4.14	0.09640	0.0	3.0
70	0.8	49.2	0.13009	0.10	6.40	0.09314	0.1	4.6
71	0.9	56.3	0.12630	0.12	7.11	0.08999	0.1	5.1
72	2.5	155.8	0.12262	0.31	19.11	0.08694	0.2	13.5
73	3.3	200.4	0.11905	0.39	23.85	0.08400	0.3	16.8
74	2.7	165.4	0.11558	0.31	19.12	0.08116	0.2	13.4
78	0.3	22.3	0.10269	0.03	2.29	0.07073	0.0	1.6
79	0.5	30.9	0.09970	0.05	3.08	0.06834	0.0	2.1
80	0.7	43.2	0.09680	0.07	4.26	0.06603	0.0	3.2
81	0.8	56.3	0.09398	0.08	5.29	0.06379	0.1	3.6
82	2.3	155.8	0.09124	0.21	14.22	0.06164	0.1	9.6
83	3.0	200.4	0.08858	0.27	17.75	0.05955	0.2	11.9
84	2.5	165.4	0.08600	0.21	14.23	0.05751	0.1	9.5
123	2.1	846.0	0.02716	0.06	22.97	0.01504	0.0	12.7
124	2.9	1,184.0	0.02636	0.08	31.22	0.01453	0.0	17.2
125	4.7	1,887.0	0.02560	0.12	48.30	0.01401	0.1	26.5
126	5.3	2,160.0	0.02485	0.13	53.68	0.01357	0.1	29.3
127	14.6	5,887.0	0.02413	0.35	142.04	0.01311	0.2	77.2
128	18.8	7,578.0	0.02342	0.44	177.51	0.01266	0.2	96.0
129	15.5	6,246.0	0.02274	0.35	142.05	0.01224	0.2	76.4
143	2.2	955.0	0.01504	0.03	14.36	0.00756	0.0	7.2
144	3.1	1,335.0	0.01460	0.05	19.49	0.00730	0.0	9.7
145	4.9	2,128.0	0.01417	0.07	30.16	0.00706	0.0	15.0
146	5.6	2,436.0	0.01376	0.08	33.52	0.00682	0.0	16.6
147	15.5	6,645.0	0.01336	0.21	88.77	0.00659	0.1	43.8
148	19.9	8,553.0	0.01297	0.26	110.93	0.00637	0.1	54.4
149	16.4	7,050.0	0.01259	0.21	88.77	0.00615	0.1	43.4
163	2.3	1,042.0	0.00832	0.02	8.67	0.00380	0.0	4.0
164	3.3	1,457.0	0.00808	0.03	11.78	0.00367	0.0	5.3
165	5.2	2,323.0	0.00785	0.04	18.23	0.00355	0.0	8.2
166	6.0	2,658.0	0.00762	0.05	20.25	0.00343	0.0	9.1
167	16.4	7,255.0	0.00740	0.12	53.66	0.00331	0.1	24.0
168	21.1	9,338.0	0.00718	0.15	67.06	0.00320	0.1	29.9
169	17.4	7,698.0	0.00697	0.12	53.67	0.00309	0.1	23.8
				8,373.1	9,092.0		8,121.7	8,110.9
Total	10,660.6	99,384.2			718.9			-10.8

FIRR= 3.0%+(3.5%-3.0%)×718.88/(718.88+10.8)=3.4926%

FIRR= 3.493%

Considering these figures, the real economic growth is judged to be rather poor. In an area characterised by such socioeconomic conditions, it is important for the RNP to contain and restore forest decline to improve the economic value of forests through the enhancement of wood resources and also to manage decreasing forest land as forests, thereby contributing to the conservation of farming conditions of neighbouring farmland and the living environment for local people.

(3) Sensitivity Analysis

As the subject period of the financial analysis under the Plan is quite long, the impacts of the income level from wood sales from restored forests on the financial analysis is examined here.

Two cases are assumed for calculation purposes. One is that the price of standing trees of *Quercus* spp. sold to the forest products industry will increase by US$ 20 per m^3. The second is that the sales ratio of wood for the forest products industry will increase by 5% for all species. The impacts of these changes on increased income, increase of the present value and FIRR are compared in the following table.

Case	Increased Income Vis-a-Vis Original Plan (US$ 1,000)	Present Value of Income Based on FIRR of 3.5% (US$ 1,000)	Increase by Increased Present Value on Original Plan (US$ 1,000)	FIRR (%)
Original Plan	–	8,111	–	3.49
Increase of *Quercus* spp. price by US$ 20/m^3	7,880	8,168	57	3.53
Increase of Wood Sales to Forest Products Industry by 5%	8,924	8,184	73	3.57

The above results can predict that an increase of wood sales to the forest products industry of 5% will have a substantial impact on increased income and the FIRR compared to a price increase of *Quercus* spp. wood to the forest products industry of US$ 20 per m^3. Even though the change of the FIRR is small, the present income value will increase by some US$ 73,000 compared to the original plan. These results indicate that the skillful sale of wood will significantly affect future business management although the actual performance will be affected by the business situation of the wood industry.

5.2.2 Economic Analysis

It has been clearly established by the field survey that the economic analysis items regarding the subject forests of the Plan, taking activities other than wood production into consideration, include the harvesting of such forest by-products as medicinal herbs, fruits of shrubs and mushrooms, and hunting and apiculture. The analysis results of the potential production capacity of these activities in the local economy, taking the situation of the activities of the RNP and private organizations into consideration, are described below.

- Income from By-Products

  The RNP has been harvesting such forest by-products as medicinal herbs, fruits of shrubs and mushrooms for the purpose of their sale. The sales amount fluctuates from one year to another, depending on the marketable volume level and the market situation. The highest amount in the period from 1990 to 1998 is regarded here as the potential income from the by-products of local forests.

  The actual amount is US$ 251,600 (1997) for Olt County and US$ 68,200 (1990) for Dolj County. In the private sector, these by-products are essentially used for home consumption and do not constitute an economic activity.

- Income from Hunting

  The RNP earns income from hunting by means of charging a hunting fee and from the commissioned sale of the animals which are caught. Again, the amount varies from one year to another depending on the number of hunters and the sales situation. The highest amount in the period from 1990 to 1998 is regarded here as the potential income from hunting in local forests.

  The actual amount is US$ 169,500 (1993) for Olt County and US$ 181,000 (1990) for Dolj County. The General Association of Hunting and Fishery (AGVPS), a semi-private body, earned income of US$ 12,300 for Olt County and US$ 16,700 for Dolj County from hunting fees in 1998.

- Income from Apiculture

  The RNP directly earns income from its apiculture activities. Although the income level varies from one year to another depending on the yield and sales situation, the highest income in the period from 1990 to 1998 is regarded here as the potential income from apiculture in local forests.

The actual amount is US$ 31,200 (1993) for Olt County and US$ 4,500 (1990) for Dolj County. Apiculture is conducted by local people in these two counties and the highest income earned by members of the Romania Apiculture Association is US$ 274,000 (1996) for Olt County and US$ 228,000 (1998) for Dolj County.

The above-mentioned annual incomes are produced from activities in the entire forest areas in the two counties and can be translated to those shown in Table 5-2-9 to represent the potential incomes from the areas of damaged forests to be restored. The resulting annual estimates are approximately US$ 33,000 for forest by-products, US$ 43,000 for hunting and US$ 35,000 for apiculture, totalling some US$ 111,000.

Table 5-2-9 Income from Other Than Wood Production

(Unit: US$ 1,000)

	County	Forest By-products	Hunting	Apiculture	Total
RNP Income	Olt	24.1	16.2	3.0	43.3
	Dolj	8.7	23.1	0.6	32.4
	Sub-Total	32.8	39.4	3.6	75.7
Private Sector Income	Olt	0.0	1.2	2.6	3.8
	Dolj	0.0	2.1	29.0	31.1
	Sub-Total	0.0	3.3	31.6	34.9
Total	Olt	24.1	17.4	5.6	47.1
	Dolj	8.7	25.2	29.6	63.5
	Total	32.8	42.7	35.2	110.6

Among these activities, apiculture can be expected to produce income fairly quickly after the planting of *R. pseudoacacia* in the fourth year as honey bees begin to use these trees around that time while the harvesting of forest by-products and hunting, both of which are mainly conducted in *Quercus* spp. forests, are expected to start to produce positive effects 10 years after planting.

By adding the above incomes to the income from wood production. Table 5-2-10 and Table 5-2-11 compares the cost and income and Table 5-2-11 shows EIRR (Economic Internal Rate of Return) over a period of 169 years respectively. While side income accounts for some 11% of the total income for the entire period, it is produced every year. Consequently, the resulting EIRR of approximately 5.6% is higher than the FIRR. As in the case of the FIRR, this figure is not high enough to attract external capitals to produce economic effects but is valuable as a part, despite small, of sustainable local economic activities in agricultural areas where the economic situation changes very gently.

Table 5-2-10 Cost-Income Balance by Year (Economic Analysis, Total for Two Counties)

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Aggregate Total Cost 1000 US$	Income 1000US$			Income Sub-Total 1000US$	Side Income 1000US$	Total Income 1000 US$	Aggregate Total Income 1000 US$	Annual Balance 1000 US$	Aggregate Balance 1000 US$
			Sale of Damaged Trees	Sale of Standing Trees for Thinning	Sale of Standing Trees for Final Cutting						
2	72.8	72.8								-72.8	-72.8
3	670.4	743.2	554.4			554.4		554.4	554.4	-116.0	-188.8
4	715.8	1,459.0	657.1			657.1		657.1	1,211.6	-58.7	-247.4
5	832.1	2,291.0	871.5			871.5		871.5	2,083.1	39.5	-208.0
6	1,142.1	3,433.1	1,043.8			1,043.8		1,043.8	3,126.9	-98.3	-306.2
7	1,297.3	4,730.4	1,569.1			1,569.1		1,569.1	4,696.0	271.9	-34.4
8	1,335.7	6,066.1	1,742.7			1,742.7		1,742.7	6,438.7	407.0	372.7
9	1,425.2	7,491.3	1,454.3			1,454.3		1,454.3	7,893.1	29.1	401.8
10	996.4	8,487.6							7,893.1	-996.4	-594.6
11	426.3	8,914.0					35.2	35.2	7,928.3	-391.1	-985.7
12	315.5	9,229.3					35.2	35.2	7,963.5	-280.2	-1,265.8
13	292.1	9,521.5		7.3		7.3	35.2	42.5	8,005.9	-249.7	-1,515.5
14	246.4	9,767.9		14.5		14.5	35.2	49.7	8,055.7	-196.7	-1,712.2
15	134.4	9,902.3		31.9		31.9	35.2	67.1	8,122.7	-67.3	-1,779.5
16	53.0	9,955.3		43.4		43.4	35.2	78.6	8,201.3	25.6	-1,753.9
17	30.5	9,985.7				0.1	35.2	35.2	8,236.5	4.8	-1,749.1
18	42.8	10,028.4		7.3		7.3	35.2	42.5	8,279.0	-0.3	-1,749.5
19	37.6	10,066.1		14.5		14.5	35.2	49.7	8,328.7	12.1	-1,737.5
20	8.9	10,075.0		29.2		29.2	35.2	64.4	8,393.1	55.4	-1,681.9
21	10.9	10,085.9		43.4		43.4	110.6	154.0	8,547.0	143.1	-1,538.8
22	23.2	10,109.1					110.6	110.6	8,657.6	87.4	-1,451.4
23	33.2	10,142.3					110.6	110.6	8,768.2	77.4	-1,374.0
24	29.4	10,171.7					110.6	110.6	8,878.8	81.2	-1,292.8
25	8.1	10,179.8					110.6	110.6	8,989.4	102.5	-1,190.4
26	9.8	10,189.6					110.6	110.6	9,100.0	100.8	-1,089.6
27	23.2	10,212.8					110.6	110.6	9,210.6	87.4	-1,002.2
28	29.8	10,242.6					110.6	110.6	9,321.2	80.8	-921.4
29	24.5	10,267.1					110.6	110.6	9,431.8	86.1	-835.3
30		10,267.1					110.6	110.6	9,542.4	110.6	-724.7
31		10,267.1					110.6	110.6	9,653.0	110.6	-614.1
32		10,267.1					110.6	110.6	9,763.6	110.6	-503.5
33	1.9	10,269.0			104.9	104.9	110.6	215.5	9,979.1	213.0	-289.9
34	3.8	10,272.8			210.2	210.2	110.6	320.8	10,299.9	317.0	27.2
35	7.5	10,280.3			422.4	422.4	110.6	533.0	10,832.9	525.5	552.6
36	11.2	10,291.5			628.2	628.2	110.6	738.8	11,571.7	727.6	1,280.2
37	0.1	10,291.6			22.5	22.5	110.6	133.0	11,704.7	132.9	1,413.2
38	2.9	10,294.5		23.5		23.5	75.4	98.9	11,803.6	96.0	1,509.1
39	4.0	10,298.6		32.6		32.6	75.4	108.0	11,911.6	104.0	1,613.1
40	6.4	10,305.0		51.9		51.9	75.4	127.3	12,039.0	120.9	1,734.0
41	7.4	10,312.4		59.4		59.4	75.4	134.8	12,173.8	127.5	1,861.5
42	20.4	10,332.8		164.5		164.5	75.4	239.9	12,413.7	219.5	2,080.9
43	26.3	10,359.1		211.6		211.6	75.4	287.0	12,700.7	260.7	2,341.6
44	21.7	10,380.7		174.6		174.6	75.4	250.0	12,950.7	228.3	2,570.0
45		10,380.7					75.4	75.4	13,026.1	75.4	2,645.4
46		10,380.7					75.4	75.4	13,101.5	75.4	2,720.8
47		10,380.7					75.4	75.4	13,176.9	75.4	2,796.2
48	1.2	10,382.0		18.6		18.6	75.4	94.0	13,270.9	92.7	2,888.9
49	1.7	10,383.7		25.7		25.7	75.4	101.1	13,372.0	99.4	2,988.3
50	2.7	10,386.4		41.0		41.0	75.4	116.4	13,488.4	113.7	3,102.1
51	3.1	10,389.4		46.9		46.9	75.4	122.3	13,610.7	119.2	3,221.3
52	8.5	10,398.0		129.9		129.9	75.4	205.3	13,816.0	196.7	3,418.0
53	11.0	10,409.0		167.0		167.0	75.4	242.4	14,058.4	231.4	3,649.4
54	9.1	10,418.0		137.9		137.9	75.4	213.3	14,271.7	204.2	3,853.6
55		10,418.0					75.4	75.4	14,347.1	75.4	3,929.0
56		10,418.0					75.4	75.4	14,422.5	75.4	4,004.4
57		10,418.0					75.4	75.4	14,497.9	75.4	4,079.8
58	0.6	10,418.6		19.8		19.8	75.4	95.2	14,593.1	94.6	4,174.4
59	0.8	10,419.4		27.5		27.5	75.4	102.9	14,695.9	102.1	4,276.5

(Table 5-2-10 continued)

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Aggregate Total Cost 1000 US$	Income 1000US$			Income Sub-Total 1000US$	Side Income 1000US$	Total Income 1000 US$	Aggregate Total Income 1000 US$	Annual Balance 1000 US$	Aggregate Balance 1000 US$
			Sale of Damaged Tree	Sale of Standing Trees for Thinning	Sale of Standing Trees for Final Cutting						
60	1.3	10,420.7		43.8		43.8	75.4	119.2	14,815.1	117.9	4,394.3
61	1.5	10,422.2		50.1		50.1	75.4	125.5	14,940.5	124.0	4,518.3
62	4.1	10,426.3		138.5		138.5	75.4	213.9	15,154.5	209.8	4,728.1
63	5.3	10,431.6		178.2		178.2	75.4	253.6	15,408.0	248.3	4,976.4
64	4.4	10,436.0		147.1		147.1	75.4	222.5	15,630.5	218.1	5,194.5
65		10,436.0					75.4	75.4	15,705.9	75.4	5,269.9
66		10,436.0					75.4	75.4	15,781.3	75.4	5,345.3
67		10,436.0					75.4	75.4	15,856.7	75.4	5,420.7
68	0.4	10,436.4		22.3		22.3	75.4	97.7	15,954.3	97.3	5,518.0
69	0.5	10,436.9		30.9		30.9	75.4	106.3	16,060.6	105.8	5,623.8
70	0.8	10,437.7		49.2		49.2	75.4	124.6	16,185.2	123.8	5,747.6
71	0.9	10,438.6		56.3		56.3	75.4	131.7	16,316.9	130.8	5,878.4
72	2.5	10,441.1		155.8		155.8	75.4	231.2	16,548.2	228.7	6,107.1
73	3.3	10,444.4		200.4		200.4	75.4	275.8	16,824.0	272.6	6,379.6
74	2.7	10,447.1		165.4		165.4	75.4	240.8	17,064.8	238.1	6,617.7
75		10,447.1					75.4	75.4	17,140.2	75.4	6,693.1
76		10,447.1					75.4	75.4	17,215.6	75.4	6,768.5
77		10,447.1					75.4	75.4	17,291.0	75.4	6,843.9
78	0.3	10,447.4		22.3		22.3	75.4	97.7	17,388.7	97.3	6,941.3
79	0.5	10,447.9		30.9		30.9	75.4	106.3	17,495.0	105.8	7,047.1
80	0.7	10,448.6		49.2		49.2	75.4	124.6	17,619.6	123.9	7,171.0
81	0.8	10,449.5		56.3		56.3	75.4	131.7	17,751.3	130.9	7,301.8
82	2.3	10,451.8		155.8		155.8	75.4	231.2	17,982.5	228.9	7,530.7
83	3.0	10,454.8		200.4		200.4	75.4	275.8	18,258.4	272.8	7,803.6
84	2.5	10,457.3		165.4		165.4	75.4	240.8	18,499.2	238.3	8,041.9
85		10,457.3					75.4	75.4	18,574.6	75.4	8,117.3
86		10,457.3					75.4	75.4	18,650.0	75.4	8,192.7
87		10,457.3					75.4	75.4	18,725.4	75.4	8,268.1
88		10,457.3					75.4	75.4	18,800.8	75.4	8,343.5
89		10,457.3					75.4	75.4	18,876.2	75.4	8,418.9
90		10,457.3					75.4	75.4	18,951.6	75.4	8,494.3
91		10,457.3					75.4	75.4	19,027.0	75.4	8,569.7
92		10,457.3					75.4	75.4	19,102.4	75.4	8,645.1
93		10,457.3					75.4	75.4	19,177.8	75.4	8,720.5
94		10,457.3					75.4	75.4	19,253.2	75.4	8,795.9
95		10,457.3					75.4	75.4	19,328.6	75.4	8,871.3
96		10,457.3					75.4	75.4	19,404.0	75.4	8,946.7
97		10,457.3					75.4	75.4	19,479.4	75.4	9,022.1
98		10,457.3					75.4	75.4	19,554.8	75.4	9,097.5
99		10,457.3					75.4	75.4	19,630.2	75.4	9,172.9
100		10,457.3					75.4	75.4	19,705.6	75.4	9,248.3
101		10,457.3					75.4	75.4	19,781.0	75.4	9,323.7
102		10,457.3					75.4	75.4	19,856.4	75.4	9,399.1
103		10,457.3					75.4	75.4	19,931.8	75.4	9,474.5
104		10,457.3					75.4	75.4	20,007.2	75.4	9,549.9
105		10,457.3					75.4	75.4	20,082.6	75.4	9,625.3
106		10,457.3					75.4	75.4	20,158.0	75.4	9,700.7
107		10,457.3					75.4	75.4	20,233.4	75.4	9,776.1
108		10,457.3					75.4	75.4	20,308.8	75.4	9,851.5
109		10,457.3					75.4	75.4	20,384.2	75.4	9,926.9
110		10,457.3					75.4	75.4	20,459.6	75.4	10,002.3
111		10,457.3					75.4	75.4	20,535.0	75.4	10,077.7
112		10,457.3					75.4	75.4	20,610.4	75.4	10,153.1
113		10,457.3					75.4	75.4	20,685.8	75.4	10,228.5
114		10,457.3					75.4	75.4	20,761.2	75.4	10,303.9
115		10,457.3					75.4	75.4	20,836.6	75.4	10,379.3
116		10,457.3					75.4	75.4	20,912.0	75.4	10,454.7
117		10,457.3					75.4	75.4	20,987.4	75.4	10,530.1
118		10,457.3					75.4	75.4	21,062.8	75.4	10,605.5
119		10,457.3					75.4	75.4	21,138.2	75.4	10,680.9
120		10,457.3					75.4	75.4	21,213.6	75.4	10,756.3

(Table 5-2-10 continued)

Operation Year	Total Cost Inclusive of Indirect Cost 1000 US$	Aggregate Total Cost 1000 US$	Income 1000US$			Income Sub-Total 1000US$	Side Income 1000US$	Total Income 1000 US$	Aggregate Total Income 1000 US$	Annual Balance 1000 US$	Aggregate Balance 1000 US$
			Sale of Damaged Tree	Sale of Standing Trees for Thinning	Sale of Standing Trees for Final Cutting						
121		10,457.3					75.4	75.4	21,289.0	75.4	10,831.7
122		10,457.3					75.4	75.4	21,364.4	75.4	10,907.1
123	2.1	10,459.4			846.0	846.0	75.4	921.4	22,285.8	919.3	11,826.5
124	2.9	10,462.3			1,184.0	1,184.0	75.4	1,259.4	23,545.2	1,256.5	13,082.9
125	4.7	10,467.0			1,887.0	1,887.0	75.4	1,962.4	25,507.6	1,957.7	15,040.6
126	5.3	10,472.3			2,160.0	2,160.0	75.4	2,235.4	27,743.0	2,230.1	17,270.7
127	14.6	10,486.9			5,887.0	5,887.0	75.4	5,962.4	33,705.4	5,947.8	23,218.5
128	18.8	10,505.7			7,578.0	7,578.0	75.4	7,653.4	41,358.8	7,634.6	30,853.1
129	15.5	10,521.2			6,246.0	6,246.0	75.4	6,321.4	47,680.2	6,305.9	37,159.0
130		10,521.2					75.4	75.4	47,755.6	75.4	37,234.4
131		10,521.2					75.4	75.4	47,831.0	75.4	37,309.8
132		10,521.2					75.4	75.4	47,906.4	75.4	37,385.2
133		10,521.2					75.4	75.4	47,981.8	75.4	37,460.6
134		10,521.2					75.4	75.4	48,057.2	75.4	37,536.0
135		10,521.2					75.4	75.4	48,132.6	75.4	37,611.4
136		10,521.2					75.4	75.4	48,208.0	75.4	37,686.8
137		10,521.2					75.4	75.4	48,283.4	75.4	37,762.2
138		10,521.2					75.4	75.4	48,358.8	75.4	37,837.6
139		10,521.2					75.4	75.4	48,434.2	75.4	37,913.0
140		10,521.2					75.4	75.4	48,509.6	75.4	37,988.4
141		10,521.2					75.4	75.4	48,585.0	75.4	38,063.8
142		10,521.2					75.4	75.4	48,660.4	75.4	38,139.2
143	2.3	10,523.4			955.0	955.0	75.4	1,030.4	49,690.8	1,028.2	39,167.4
144	3.1	10,526.5			1,335.0	1,335.0	75.4	1,410.4	51,101.2	1,407.3	40,574.7
145	4.9	10,531.4			2,128.0	2,128.0	75.4	2,203.4	53,304.6	2,198.5	42,773.2
146	5.6	10,537.0			2,436.0	2,436.0	75.4	2,511.4	55,816.0	2,505.8	45,279.0
147	15.5	10,552.5			6,645.0	6,645.0	75.4	6,720.4	62,536.4	6,704.9	51,983.9
148	19.9	10,572.4			8,553.0	8,553.0	75.4	8,628.4	71,164.8	8,608.5	60,592.4
149	16.4	10,588.9			7,050.0	7,050.0	75.4	7,125.4	78,290.2	7,109.0	67,701.3
150		10,588.9					75.4	75.4	78,365.6	75.4	67,776.7
151		10,588.9					75.4	75.4	78,441.0	75.4	67,852.1
152		10,588.9					75.4	75.4	78,516.4	75.4	67,927.5
153		10,588.9					75.4	75.4	78,591.8	75.4	68,002.9
154		10,588.9					75.4	75.4	78,667.2	75.4	68,078.3
155		10,588.9					75.4	75.4	78,742.6	75.4	68,153.7
156		10,588.9					75.4	75.4	78,818.0	75.4	68,229.1
157		10,588.9					75.4	75.4	78,893.4	75.4	68,304.5
158		10,588.9					75.4	75.4	78,968.8	75.4	68,379.9
159		10,588.9					75.4	75.4	79,044.2	75.4	68,455.3
160		10,588.9					75.4	75.4	79,119.6	75.4	68,530.7
161		10,588.9					75.4	75.4	79,195.0	75.4	68,606.1
162		10,588.9					75.4	75.4	79,270.4	75.4	68,681.5
163	2.3	10,591.2			1,042.0	1,042.0	75.4	1,117.4	80,387.8	1,115.1	69,796.6
164	3.3	10,594.5			1,457.0	1,457.0	75.4	1,532.4	81,920.2	1,529.1	71,325.7
165	5.2	10,599.7			2,323.0	2,323.0	75.4	2,398.4	84,318.6	2,393.2	73,718.9
166	6.0	10,605.7			2,658.0	2,658.0	75.4	2,733.4	87,052.0	2,727.4	76,446.3
167	16.9	10,622.6			7,255.0	7,255.0	75.4	7,330.4	94,382.4	7,314.0	83,760.3
168	21.1	10,643.7			9,338.0	9,338.0	75.4	9,413.4	103,795.8	9,392.3	93,152.6
169	17.4	10,660.6			7,698.0	7,698.0	75.4	7,773.4	111,569.2	7,756.0	100,908.6
Total	10,660.6		7,893.1	3,442.0	88,049.1	99,384.2	12,185.0	111,569.2			

Table 5-2-11 Calculation of EIRR

Operation Year	Total Cost 1000 US$	Total Income 1000 US$	Present Value (A)			Present Value (B)		
			Discount Factor 5.50%	Cost 1000 US$	Income 1000 US$	Discount Factor 6.00%	Cost 1000 US$	Income 1000 US$
2	72.8		0.9478673	69.00		0.94340	68.67	
3	670.4	554.4	0.8984524	602.30	498.11	0.89000	596.63	493.43
4	715.8	657.1	0.8516137	609.61	559.63	0.83962	601.02	551.75
5	832.1	871.5	0.8072167	671.65	703.51	0.79209	659.07	690.33
6	1,142.1	1,043.8	0.7651344	873.85	798.65	0.74726	853.43	779.99
7	1,297.3	1,569.1	0.7252458	940.83	1,138.00	0.70496	914.51	1,106.17
8	1,335.7	1,742.7	0.6874368	918.20	1,198.01	0.66506	888.30	1,159.01
9	1,425.2	1,454.3	0.6515989	928.67	947.65	0.62741	894.20	912.48
10	996.4		0.6176293	615.38		0.59190	589.75	
11	426.3	35.2	0.5854306	249.59	20.61	0.55839	238.06	19.66
12	315.4	35.2	0.5549105	174.99	19.53	0.52679	166.12	18.54
13	292.1	42.5	0.5259815	153.66	22.33	0.49697	145.19	21.10
14	246.4	49.7	0.4985607	122.84	24.78	0.46884	115.52	23.31
15	134.4	67.1	0.4725694	63.51	31.70	0.44230	59.44	29.67
16	53.0	78.6	0.4479330	23.74	35.20	0.41727	22.12	32.79
17	30.4	35.2	0.4245811	12.90	14.95	0.39365	11.96	13.86
18	42.8	42.5	0.4024465	17.21	17.09	0.37136	15.88	15.77
19	37.6	49.7	0.3814559	14.36	18.95	0.35034	13.19	17.41
20	8.9	64.4	0.3615791	3.23	23.28	0.33051	2.95	21.28
21	10.9	154.0	0.3427290	3.73	52.78	0.31180	3.40	48.01
22	23.2	110.6	0.3248616	7.53	35.93	0.29416	6.82	32.53
23	33.2	110.6	0.3079257	10.22	34.06	0.27751	9.21	30.69
24	29.4	110.6	0.2918727	8.59	32.28	0.26180	7.70	28.95
25	8.1	110.6	0.2766566	2.25	30.60	0.24698	2.01	27.32
26	9.8	110.6	0.2622337	2.57	29.00	0.23300	2.28	25.77
27	23.2	110.6	0.2485628	5.76	27.49	0.21981	5.10	24.31
28	29.8	110.6	0.2356045	7.01	26.06	0.20737	6.17	22.93
29	24.5	110.6	0.2233218	5.45	24.70	0.19563	4.80	21.64
30		110.6	0.2116794		23.41	0.18456		20.41
31		110.6	0.2006440		22.19	0.17411		19.26
32		110.6	0.1901839		21.03	0.16425		18.17
33	1.9	215.5	0.1802691	0.34	38.85	0.15496	0.29	33.39
34	3.8	320.8	0.1708712	0.64	54.82	0.14619	0.55	46.90
35	7.5	533.0	0.1619632	1.22	86.33	0.13791	1.04	73.51
36	11.2	738.8	0.1535196	1.72	113.42	0.13011	1.46	96.12
37	0.1	133.0	0.1455162	0.01	19.35	0.12274	0.01	16.32
38	2.9	98.9	0.1379301	0.40	13.64	0.11579	0.34	11.45
39	4.0	108.0	0.1307394	0.53	14.12	0.10924	0.44	11.80
40	6.4	127.3	0.1239236	0.80	15.78	0.10306	0.66	13.12
41	7.4	134.8	0.1174631	0.87	15.84	0.09722	0.72	13.11
42	20.4	239.9	0.1113395	2.27	26.71	0.09172	1.87	22.00
43	26.3	287.0	0.1055350	2.77	30.28	0.08653	2.27	24.83
44	21.7	250.0	0.1000332	2.17	25.01	0.08163	1.77	20.41
45		75.4	0.0948182		7.15	0.07701		5.81
46		75.4	0.0898751		6.78	0.07265		5.48
47		75.4	0.0851897		6.42	0.06854		5.17
48	1.2	94.0	0.0807485	0.10	7.59	0.06466	0.08	6.08
49	1.7	101.1	0.0765389	0.13	7.74	0.06100	0.10	6.17
50	2.7	116.4	0.0725487	0.20	8.45	0.05755	0.16	6.70
51	3.1	122.3	0.0687665	0.21	8.41	0.05429	0.17	6.64
52	8.5	205.3	0.0651815	0.56	13.38	0.05122	0.44	10.51
53	11.0	242.4	0.0617834	0.68	14.98	0.04832	0.53	11.71
54	9.1	213.3	0.0585625	0.53	12.49	0.04558	0.41	9.72
55		75.4	0.0555095		4.19	0.04300		3.24
56		75.4	0.0526156		3.97	0.04057		3.06
57		75.4	0.0498726		3.76	0.03827		2.89
58	0.6	95.2	0.0472726	0.03	4.50	0.03610	0.02	3.44
59	0.8	102.9	0.0448082	0.04	4.61	0.03406	0.03	3.50
60	1.3	119.2	0.0424722	0.06	5.06	0.03213	0.04	3.83

(Table 5-2-11 continued)

Operation Year	Total Cost 1000 US$	Total Income 1000 US$	Present Value (A)			Present Value (B)		
			Discount Factor 5.50%	Cost 1000 US$	Income 1000 US$	Discount Factor 6.00%	Cost 1000 US$	Income 1000 US$
61	1.5	125.5	0.0302580	0.06	5.05	0.03031	0.05	3.80
62	4.1	213.9	0.0381593	0.16	8.16	0.02860	0.12	6.12
63	5.3	253.6	0.0361699	0.19	9.17	0.02698	0.14	6.84
64	4.4	222.5	0.0342843	0.15	7.63	0.02545	0.11	5.66
65		75.4	0.0324969		2.45	0.02401		1.81
66		75.4	0.0308028		2.32	0.02265		1.71
67		75.4	0.0291970		2.20	0.02137		1.61
68	0.4	97.7	0.0276748	0.01	2.70	0.02016	0.01	1.97
69	0.5	106.3	0.0262321	0.01	2.79	0.01902	0.01	2.02
70	0.8	124.6	0.0248645	0.02	3.10	0.01794	0.01	2.24
71	0.9	131.7	0.0235683	0.02	3.10	0.01693	0.02	2.23
72	2.5	231.2	0.0223396	0.06	5.17	0.01597	0.04	3.69
73	3.3	275.8	0.0211750	0.07	5.84	0.01507	0.05	4.16
74	2.7	240.8	0.0200711	0.05	4.83	0.01421	0.04	3.42
75		75.4	0.0190247		1.43	0.01341		1.01
76		75.4	0.0180329		1.36	0.01265		0.95
77		75.4	0.0170928		1.29	0.01193		0.90
78	0.3	97.7	0.0162017	0.01	1.58	0.01126	0.004	1.10
79	0.5	106.3	0.0153571	0.01	1.63	0.01062	0.005	1.13
80	0.7	124.6	0.0145565	0.01	1.81	0.01002	0.01	1.25
81	0.8	131.7	0.0137976	0.01	1.82	0.009452	0.01	1.24
82	2.3	231.2	0.0130783	0.03	3.02	0.008917	0.02	2.06
83	3.0	275.8	0.0123965	0.04	3.42	0.008412	0.03	2.32
84	2.5	240.8	0.0117502	0.03	2.83	0.007936	0.02	1.91
85		75.4	0.0111376		0.84	0.007487		0.56
86		75.4	0.0105570		0.80	0.007063		0.53
87		75.4	0.0100066		0.75	0.006663		0.50
88		75.4	0.0094850		0.72	0.006286		0.47
89		75.4	0.0089905		0.68	0.005930		0.45
90		75.4	0.0085218		0.64	0.005595		0.42
91		75.4	0.0080775		0.61	0.005278		0.40
92		75.4	0.0076564		0.58	0.004979		0.38
93		75.4	0.0072573		0.55	0.004697		0.35
94		75.4	0.0068789		0.52	0.004432		0.33
95		75.4	0.0065203		0.49	0.004181		0.32
96		75.4	0.0061804		0.47	0.003944		0.30
97		75.4	0.0058582		0.44	0.003721		0.28
98		75.4	0.0055528		0.42	0.003510		0.26
99		75.4	0.0052633		0.40	0.003312		0.25
100		75.4	0.0049889		0.38	0.003124		0.24
101		75.4	0.0047288		0.36	0.002947		0.22
102		75.4	0.0044823		0.34	0.002780		0.21
103		75.4	0.0042486		0.32	0.002623		0.20
104		75.4	0.0040271		0.30	0.002475		0.19
105		75.4	0.0038172		0.29	0.002334		0.18
106		75.4	0.0036182		0.27	0.002202		0.17
107		75.4	0.0034296		0.26	0.002078		0.16
108		75.4	0.0032508		0.25	0.001960		0.15
109		75.4	0.0030813		0.23	0.001849		0.14
110		75.4	0.0029207		0.22	0.001744		0.13
111		75.4	0.0027684		0.21	0.001646		0.12
112		75.4	0.0026241		0.20	0.001553		0.12
113		75.4	0.0024873		0.19	0.001465		0.11
114		75.4	0.0023576		0.18	0.001382		0.10
115		75.4	0.0022347		0.17	0.001304		0.10
116		75.4	0.0021182		0.16	0.001230		0.09
117		75.4	0.0020078		0.15	0.001160		0.09
118		75.4	0.0019031		0.14	0.001094		0.08
119		75.4	0.0018039		0.14	0.001033		0.08
120		75.4	0.0017098		0.13	0.0009741		0.07
121		75.4	0.0016207		0.12	0.0009190		0.07
122		75.4	0.0015362		0.12	0.0008669		0.07

(Table 5-2-11 continued)

Operation Year	Total Cost 1000 US$	Total Income 1000 US$	Present Value (A)			Present Value (B)		
			Discount Factor 5.50%	Cost 1000 US$	Income 1000 US$	Discount Factor 6.00%	Cost 1000 US$	Income 1000 US$
123	2.1	921.4	0.0014561	0.003	1.34	0.0008179	0.002	0.75
124	2.9	1,259.4	0.0013802	0.004	1.74	0.0007716	0.002	0.97
125	4.7	1,962.4	0.0013083	0.01	2.57	0.0007279	0.003	1.43
126	5.3	2,235.4	0.0012401	0.01	2.77	0.0006867	0.004	1.54
127	14.6	5,962.4	0.0011754	0.02	7.01	0.0006478	0.01	3.86
128	18.8	7,653.4	0.0011141	0.02	8.53	0.0006112	0.01	4.68
129	15.5	6,321.4	0.0010561	0.02	6.68	0.0005766	0.01	3.64
130		75.4	0.0010010		0.08	0.0005439		0.04
131		75.4	0.0009488		0.07	0.0005131		0.04
132		75.4	0.0008993		0.07	0.0004841		0.04
133		75.4	0.0008525		0.06	0.0004567		0.03
134		75.4	0.0008080		0.06	0.0004308		0.03
135		75.4	0.0007659		0.06	0.0004065		0.03
136		75.4	0.0007260		0.05	0.0003834		0.03
137		75.4	0.0006881		0.05	0.0003617		0.03
138		75.4	0.0006522		0.05	0.0003413		0.03
139		75.4	0.0006182		0.05	0.0003220		0.02
140		75.4	0.0005860		0.04	0.0003037		0.02
141		75.4	0.0005555		0.04	0.0002865		0.02
142		75.4	0.0005265		0.04	0.0002703		0.02
143	2.2	1,030.4	0.0004991	0.001	0.51	0.0002550	0.001	0.26
144	3.1	1,410.4	0.0004730	0.001	0.67	0.0002406	0.001	0.34
145	4.9	2,203.4	0.0004484	0.002	0.99	0.0002270	0.001	0.50
146	5.6	2,511.4	0.0004250	0.002	1.07	0.0002141	0.001	0.54
147	15.5	6,720.4	0.0004028	0.01	2.71	0.0002020	0.003	1.36
148	19.9	8,628.4	0.0003818	0.01	3.29	0.0001906	0.004	1.64
149	16.4	7,125.4	0.0003619	0.01	2.58	0.0001798	0.003	1.28
150		75.4	0.0003431		0.03	0.0001696		0.01
151		75.4	0.0003252		0.02	0.0001600		0.01
152		75.4	0.0003082		0.02	0.0001509		0.01
153		75.4	0.0002922		0.02	0.0001424		0.01
154		75.4	0.0002769		0.02	0.0001343		0.01
155		75.4	0.0002625		0.02	0.0001267		0.01
156		75.4	0.0002488		0.02	0.0001196		0.01
157		75.4	0.0002358		0.02	0.0001128		0.01
158		75.4	0.0002235		0.02	0.0001064		0.01
159		75.4	0.0002119		0.02	0.0001004		0.01
160		75.4	0.0002008		0.02	0.00009470		0.01
161		75.4	0.0001904		0.01	0.00008934		0.01
162		75.4	0.0001804		0.01	0.00008429		0.01
163	2.3	1,117.4	0.0001710		0.19	0.00007952		0.09
164	3.3	1,532.4	0.0001621	0.001	0.25	0.00007501	0.000	0.11
165	5.2	2,398.4	0.0001537	0.001	0.37	0.00007077	0.000	0.17
166	6.0	2,733.4	0.0001457	0.001	0.40	0.00006676	0.000	0.18
167	16.4	7,330.4	0.0001381	0.002	1.01	0.00006298	0.001	0.46
168	21.1	9,413.4	0.0001309	0.003	1.23	0.00005942	0.001	0.56
169	17.4	7,723.4	0.0001240	0.002	0.96	0.00005606	0.001	0.44
				7,136.0	7,151.7		6,917.7	6,798.8
Total	10,660.6	111,569.2			15.7			-118.9

EIRR= 5.5%+(6.0%-5.5%)×15.72/(15.72+118.86)=5.558%

EIRR= 5.558%

5.2.3 Impacts on Local Economy

The restoration of damaged forests could have indirect impacts on the local economy which may not be manifest as tangible effects for economic evaluation. Such effects which are actually perceived by local people are the windbreak effect of forests to protect farmland and the recreational use of forests. The water source conservation function and the soil conservation of forests are also performed in the natural environment even though local people are not strongly aware of these functions.

These functions will appear in the form of damage or negative effects when the decline of forests continues. When valued from the viewpoint that properly functioning healthy forests actually prevent such damage, the economic contribution of healthy forests is estimated to be some US$ 12,103,000 for the windbreak effect of protecting the agricultural production behind forests, some US$ 22,788,000 for the water resource conservation effect of supplying irrigation water, some US$ 543,000 for the soil conservation effect of nullifying the cost of soil retaining work required to contain the amount of soil which would be discharged if forests did not exist, and some US$ 15,000 for the recreation effect of forests as the estimated expenditure on picnics in forests around local cities.

- Windbreak Effect

  As the cultivation and harvesting of agricultural products are secured by mitigation of the climatic conditions, mainly on the leeward side of windbreak forest belts, the production value per ha is evaluated as the value of the windbreak effect. If no windbreak forest belt exists, soil mixed with sand is shifted as well as blown in all directions by strong wind, making cultivation impossible.

  The estimated production value of agricultural products in the Study Area as of 1998 is shown in Table 5-2-12 and the unit value per ha is estimated to be approximately US$ 618.

Table 5-2-12 Estimated Production Value of Agricultural Products in Area of Windbreak Forest Belts

Crop	Production Volume per ha (tons)	Ratio of Planting Area (%)	Rate of Production per ha (tons)	Unit Price per kg (US$)	Production Value (US$)
Wheat	3.2	20.7	0.66	0.112	73.9
Maize	5.5	54.1	2.98	0.083	247.3
Sunflowers	1.5	17.8	0.27	0.195	53.7
Melons	22.5	2.5	0.56	0.320	179.2
Grapes	4.5	4.9	0.22	0.290	63.8
Total	-	100.0	-	-	617.9

As an area of 605.6 ha is designated to perform the windbreak function among the subject forests of the Plan, the windbreak effect is provided over an area of 19,984.8 ha with the resulting value of this effect of US$ 12,103,000.

- Water Source Conservation Effect

All forests maintain rainwater in the ground for a long period of time. This water gradually flows towards the lower reaches as groundwater. The field survey found that the water content in local forests and soil of approximately 13% is extremely low. Given the fact that many forests are plain forests, the water moving in the ground is not directly used as drinking and/or irrigation water in urban and rural areas. It is inferred that the water naturally moves in the ground to join Danube River.

Some of the abundant water of Danube River is used for irrigation at a cost of US$ 2.93 per m^3.

Given the area of the subject damaged forests of the Plan of 9,204 ha and precipitation in a normal year of 650 mm, the amount of rainwater which infiltrates the ground in these forests is estimated to be 7,777,380 m^3 a year based on an infiltration rate of 13%. This figure produces an estimated value of the water source conservation effect of approximately US$ 22,788,000 a year based on the unit price of irrigation water.

- Soil Conservation Effect

Among damaged forests, stands covering an area of 201.4 ha are designated to perform the soil conservation function. While these stands currently have standing trees, their soil either suffers from sheet erosion or is vulnerable to erosion with an average inclination of some 12°. The effect of containing the highly likely discharge of sediment by covering this forest land with forests is evaluated as being one effect of the forest restoration work.

As the amount of sediment to be discharged from forest land not covered by forests is put at 87.1 tons per ha based on fact-finding surveys at many areas of devastated land, the above area is estimated to discharge 17,542 tons of sediment or some 9,746 m^3. In order to contain this sediment, the construction of concrete soil retaining works with an effective height of 1.0 m is required at forest edges at the lower part of slopes. The construction cost of such works per m^3 of discharged sediment is estimated to be US$ 55.75 based on the cost in Romania. Accordingly, the total cost for 201.4 ha of forest land, i.e. the value of the soil conservation effect, is estimated to be approximately US$ 543,000.

- Forest Landscape and Recreation Effect

In forests near Slatina and Craiova, families and young people enjoy picnics at the weekend. Assuming the cost of a picnic per person, consisting of the car fuel cost and cost of simple foodstuffs and beverages, some US$ 15,000 is spent every year. The interview survey results on local people indicate that people have covert expectations in regard to recreational activities in forests. This suggests the likelihood of an increased demand for recreation with the further socioeconomic development in the coming years.

If the phenomenon of forest decline is not halted, the forest functions described above will decline with the inevitable result of spreading damage to neighbouring areas. Because of such serious aspects, the implementation of the Plan is extremely important.

- Increased Employment Opportunities

One effect of the Plan vis-a-vis local people will be the provision of opportunities for forest labour for the large potential and excessive local workforce. The annual reforestation area of the two counties has been sharply decreasing, from some 1,000 ha upto three years ago to some 400 ha in more recent years. The implementation of the Plan is expected to create new working opportunities corresponding to the average annual reforestation of some 500 ha.

The aggregate labour volume required for the implementation of the work related to the restoration of damaged forests under the Plan will be some 895,000 person-days as shown in App. F-28. During the first 29 years in particular, some 814,000 person-days of labour will be required for planting and tending and the maximum annual employment level will be 140,000 person-days in the ninth year. Against the background of a declining trend of local waged labour, local people appear to have stronger expectations of employment in forestry work than recent case.

GLOSSARY

GLOSSARY

Declined forest: In the Study, both damaged national forests and national forests being likely to decline are referred to as declined forests.

Forest decline: In the Study, a phenomenon in which trees wither or die back due to drought injury, other factors are defined as forest decline.

Decline grade: An indicator that is used in ICP forest monitoring to indicate a degree of decline per one tree. It is determined by defoliation ratio to a tree. It has degrees from 0 to 4, and they correspond to defoliation ratios of 0-10%, 11-25%, 26-60%, 61-99% and a withered tree respectively. In the Study, tree form, die back, branch and leaf density of each tree were also evaluated by the Study Team. Stumpage with decline degree of 2 and higher are categorized in stumpage which cannot be expected its healthy growth and recovery due to advancement of crown damage.

Stand level decline grade: In the Study, weighted mean of a tree decline in a survey plot is defined as stand level decline grade. It was used as indicators to show damages of a plot in the Study.

Damage grade: In the Study, the ratio of trees with the degree of decline 2 or higher is defined as degree of danger. When the ratio of trees with decline level 2 or higher is from 20 to 39%, it is "weak". 40-59% is "moderate", more than 60% is "strong".

Damaged Forest: Stands which are composed of forest trees of a decline Grade 2 or higher and which require improvement mainly by means of cutting, regeneration and tending work are classified as "damaged forests" in the Study. In other words, damaged forests are stands with a decline grade of "weak", "moderate" or "strong". Measures designed to restore damaged forests are defined as "damage restoration measures" in the Plan.

Prevention Forest: Stands which are composed of forest trees of a decline Grade 1 or lower and which are liable to stagnant water or which have a high potential of forest decline in future years of low rainfall depending on the species, stand age, topographical conditions and soil conditions are classified as "prevention forests" in the Study. Measures to be implemented in prevention forests are defined as "decline prevention measures" in the Plan.

High terrace, middle terrace and low terrace: Categorization of terrace determined by the depth between groundwater level and surface of the earth. In the Study, 3-10m is categorized in low terrace, 10-50m is middle terrace, and more than 50m is high terrace.

Plentiful Discharge, Normal Discharge and Scanty Discharge: These are levels of discharge below which the daily discharge does not fall for a certain number of days a year at a given site. The standard number of days is 95 days for plentiful discharge, 185 days for normal discharge and 275 days for scanty discharge.

Near Infrared Colour Aerial Photographs: Near infrared colour aerial photographs can record the different reflectance of infrared rays in the form of different shades of red. Accordingly, it is feasible to judge the degree of decline of plant vigorousity by examining the lightening shade of red. The shade of red changes in accordance with different levels of spectral reflection, in turn caused by different species and tree ages, and the angle of slope vis-a-vis the sun. To classify plant vigorousity based on near infrared colour aerial photographs, the above factors to determine the level of the shade of red must be strictly determined. Near infrared colour aerial photographs enlarged twofold (resulting scale of 1:12,500) were used for the Study.

Romanian forest planning/Amenajamentul padurilor

For forests management in Romania, forest planning for each UP and general planning for forest range office are issued every 10 years. The Romanian Forest planning is composed of forest management, forest management map, and forest inventory book.

Forest Function Classification: The forest function types used in Romania are classified in the Study into 10 groups: (1) timber production, (2) water source conservation, (3) soil conservation, (4) windbreak, (5) climate mitigation, (6) *Quercus* forest in hill area, (7) recreational use and landscape maintenance, (8) hunting, (9) wildlife protection and preservation and (10) seed stands.

Breed with resistance: selected breed to develop a kind with resistance

Hydroponics: This method involves the immersion of prepared logs in water to facilitate coppicing from logs so that the coppiced shoots can be used as cuttings. In the Plan, this method is applied in Part II - Planning, 3.9 - Items Related to Technical Development and Extension.

Target Species: The reforestation of damaged forests in the Plan is planned by forest management type and by damage grade. Those species which will be tended upto the final cutting season under the reforestation plan are defined as "target species". All target species are high trees.

Assisting Species: The species to be planted to assist the growth of target species are defined as "assisting species" in the Plan. Assisting species are shrubs and will not be tended upto the cutting season.

Biological Control Agent: Materials for preventing disease and insect damage by using living things and their extract as active ingredient: natural enemy, mite, nematode, virus, microbe, pheromone and so on.

Insect Growth Regulator: Materials such as chitin synthesis inhibitor and juvenile hormone substance that disrupt molt and metamorphosis to kill pest insects: Dimilin and others.

Primary Insects: Insects that parasitize foliage, trunks and branches of healthy trees. Many insects including most defoliators and wood borer insects belong to this category.

Secondary Insects: Insects that parasitiize only decline trees that have physiological troubles caused by other factors. Other wood borer insects that parasitize fallen trees and withered trees.

LANDSAT: Earth observatory satellites of the United States, which have been used onshore most widely since the launch of the first LANDSAT on July 23rd in 1972, represent satellite remote sensing. Currently, the 5th LANDSAT launched in 1985 is depended on for data acquisition.

Remote Sensing: Remote sensing is a method to measure reflection or radiation of electromagnetic energy from the ground surface distantly without direct touch. Information acquired through remote sensing is mostly from ground surface, however, it is possible to determine magnetism and gravity as information of the earth's interior from satellites.

GPS camera: GPS (Global Positioning System) is general earth position measuring system to determine the three dimensional position of a point by simultaneously receiving radio waves transmitted from more than one artificial satellites launched by the United States. GPS camera, that integrates GPS with a common camera, record the position information on a film at the same time.

Training Data Classification: Training data classification is a method to classify data based on statistics when an acquainted realm of an item, a part of an image, is to be classified. The data are referred to as grand torus data or training data. In contrast, classification without training data is a method to classify the data into data groups based on similarities of image data with no use of training data.

Plant Stress: Generic of plants stress caused by pest insects, fungus, drought and other geologic factors represented by moisture stress that stems from moisture shortage. Geochemical stress due to geochemical abnormality near the surface of ground is a kind of stress caused by a geochemical factor. Plant stress is used for remote sensing of geo-botany.

Multi-band sensor: Band refers to particular wavelength range used for remote sensing sensor/data. It is usually indicated by nm (upper limit/lower limit) or μm, there are some cases represented by central wavelength. If there were more than one band in a single sensor/data, they are numbered (e.g. TM band 6.) Sensor TM of LANDSAT 5 has 7 bands. Multi-band sensor means a sensor with more than one band like TM.

TM: TM is a optical sensor installed in LANDSAT 4 and 5. TM stands for Thematic Mapper. 6 bands (1-5,7) of visible-short wave long infrared region have 0.042 mard of instantaneous geometric field of view, 30×30m of aerial resolution. Band 6 of thermal infrared region has 120×120m of aerial resolution.

Path/Row: Path and row are used to identify a position of data in a scene collected by polar orbit satellite such as LANDSAT. Vertical line stretching from east to west is referred to as path, and horizontal line stretching from north to south is referred to as row.

Multi-spectrum data: Data acquired by measuring reflection and radiation of electromagnetic energy from an object in more than one observation zone. It is also referred to as multi-band data

Polygon: A kind of format that expresses position and shape of a spatial data. Positions and shapes are expressed by combination of points with position coordinate, line segments defined by placing points in a line, and closed region surrounded by line segments. The closed region is referred to as polygon or area.

Maximum likelihood classifier method: When an observation X is acquired, scales that provide likelihood to observation X are called maximum likelihood. Maximum likelihood is generally defined as function of a certain variable, it is also referred to as likelihood function. Maximum likelihood method is a method to determine a variable which make likelihood (function) largest.

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