CHAPTER 3 COSTS

3.1 Supply and Demand Situation and Prices of Equipment and Materials

In formulating the Plan, the present conditions of labour and equipment and the costs of various types of work were surveyed to obtain basic data to calculate the necessary work cost.

The wages and prices used below were for the summer of 1998 when the third field survey was conducted while the exchange rate used is the average rate for the third quarter of 1998.

(1) Work Practices and Wages

The RNP traditionally conducts its work using local farmers. Full-time employment is available for wood processing and willow craft which are conducted throughout the year. Daily employment is the norm for forestry work. Consequently, a labour shortage may occur during the busy farming seasons but adjustment of the timing of forestry work minimises such a labour shortage. In general, local farmers want more work opportunities. State-run forestry enterprises conducted felling and hauling until several years ago, mainly employing workers on a daily basis. The daily wages set by the RNP for accounting purposes are as follows.

- Ordinary work : 36,490 Lei (US$ 4.21)
- Difficult work : 39,544 Lei (US$ 4.56)
- More difficult work : 41,504 Lei (US$ 4.79)

Interviews with local people found that the daily wage is 15,000 - 50,000 Lei and is mainly around the 30,000 Lei level. In addition to such common forestry work as felling, planting and tending, forestry-related work includes the gathering of medicinal herbs and small fruit. While chainsaws and tractors are used together with hand tools, the use of such machinery is included in the wages. Many women are involved in nursery work and there is no gender gap in terms of wages.

(2) Fuel

Either petrol or light oil is used for forestry machinery and such fuel can be easily obtained from roadside petrol stations. The present price per litre is 4,400 Lei (US$ 0.51) for petrol, 3,400 Lei (US$ 0.39) for light oil and 40,000 Lei (US$ 4.61) for lubricant oil. Firewood is the most common fuel for heating purposes and the average price is 150,000

Lei (US$ 17.30) per m^3. In recent years, urban dwellers have begun using butane gas supplied in cylinders at a price of 33,000 Lei (US$ 3.81) per 16 kg.

(3) Machinery

Chainsaws are commonly used for forestry work. A shop selling Swedish chainsaws was opened in Craiova in 1996, establishing a local supply system. The typical price is 5,272,000 Lei (US$ 608) for a 62 cc engine type. Bush cutters may well be used in the coming years and the typical price is 4,300,000 Lei (US$ 496) for a 31 cc engine type. The costs of a power duster (powder) and power sprayer (liquid) for use on the ground to medical spray are 3,540,000 Lei (US$ 408) and 4,750,000 Lei (US$ 548) respectively.

The RNP rents large machinery as well as its operators from the private sector. The most common machines are skidder type tractors for yarding, bulldozers for stump-pulling and grading and tractors for ploughing. The cost is paid based on the unit cost per hectare. Activities from stump-pulling and the clearing of stumps, etc. to grading, raking, ploughing and soil crushing cost approximately 7.35 million Lei (US$ 848) - 8 million Lei (US$ 923).

A large machinery manufacturer is located in Craiova and the machine prices are 220 million Lei (US$ 25,375) for a tractor with a front arm for yarding and the digging of planting holes, 2.5 million Lei (US$ 300) for a log grab to be mounted on the above tractor and 12 million Lei (US$ 1,384) for a planting hole drill. A four-wheel drive tractor with 195 horse-power and which can be used for yarding, grading and ploughing costs 430 million Lei (US$ 49,596). A ripper and a sub-soiler, etc. which can be attached to this tractor are made to order and each item costs approximately US$ 1,000.

In the case of foreign-made large machinery, import agents operate in Bucharest and market various machines. For example, a German bulldozer with a blade and ripper (12 ton type) costs US$ 129,100 while a German power shovel with a bucket and log grab costs US$ 116,800. Mobile choppers of which the field use is expected to take place in the near future cost US$ 28,100 each.

Although there is no official criteria in regard to the depreciation of large machinery, each company sets its own depreciation period of between 10 and 15 years.

(4) Forestry Tools

Forestry tools made in Romania can be purchased in Craiova while imported tools are available in Bucharest. Some Romanian tools are listed below.

- Spade	: 34,000 Lei (US$ 4)	- Axe	: 27,000 Lei (US$ 3)
- Hoe	: 28,000 Lei (US$ 3)	- Wheelbarrow	: 476,000 Lei (US$ 55)
- Sickle	: 70,000 Lei (US$ 8)	- Sprinkling Can (10 l)	: 97,000Lei (US$ 11)
- Handsaw	: 22,000 Lei (US$ 3)	- Cement (50 kg)	: 73,000 Lei (US$ 8)

While an imported spade costs as much as 200,000 Lei (US$ 23), the quality is good.

(5) Price Fluctuations

Price inflation and the rapid decline of the Lei's foreign exchange rate against the US dollar are highly noticeable.

Table 3-1-1 Consumer Price Changes (Year-on-Year Basis; %)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Increase on Previous Year (%)	41.9	165.6	210.4	256.1	136.8	32.3	38.8	154.8	59.0

Source: Country Report, EIU

Table 3-1-2 Transition of Average Monthly Wage

Year	1996				1997				1998			
Quarter	I	II	III	IV	I	II	III	IV	I	II	III	IV
Wage (1,000 Lei)	256	296	339	396	453	580	654	853	906	960	1,000	1,241
Exchange Rate Against US$	2,937	3,028	3,261	4,035	6,996	7,032	7,613	8,023	8,490	8,670	9,238	10,951
US$ Equivalent	87	98	104	98	65	83	86	106	107	111	108	113

Source: Country Report, EIU

Table 3-1-3 Foreign Exchange Rate

Year	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998
Lei/US$	18	17	22	76	308	760	1,655	2,033	3,085	7,168	8,876
Lei/DM					186	460	1,020	1,419	2,050	4,131	5,036

Source: Country Report, EIU

3.2 Cost of Forest Restoration Operation

Forest operation at damaged stands has so far consisted of artificial regeneration and work to facilitate natural regeneration. Under the Plan, operation mainly consisting of artificial regeneration is planned for *Quercus* spp. stands together with the tending of existing naturally regenerated trees in the case of *Quercus* spp. stands. In the case of *R. pseudoacacia* stands, operation mainly consisting of artificial regeneration is planned for stands with "strong" damage while regeneration by coppicing is mainly planned for stands with "moderate" damage. In the case of damaged *Populus* spp. stands, as dry soil is unsuitable for *Populus* spp. ,artificial regeneration by the mixed planting of *Q. robur* and other species is planned.

Assuming the above regeneration method for different types of stands, the series of work from cutting to regeneration, tending and thinning and the cost per ha are summarised below based on recent operation results.

(1) Cruising

A cruising team is usually composed of four members. An engineer is responsible for tree selection, tree height measurement and entry in the field notebook while three workers conduct diameter measurement and the marking of all selected trees. The work output per day is approximately 200 trees per person per day.

(2) Cutting, Bucking and Yarding Work

As most sites of tree cutting, bucking and yarding work in forests are either flat or gently sloping, the work is conducted using a chainsaw, yarding tractor and log-loader. One work team equipped with these tools/machinery is composed of seven workers and a supervisor. As a result of the aging machinery coupled with the high labour demand for the accumulation and stacking of pulpwood as well as firewood, the current productivity of forest work is approximately 4 m^3 per day at a *Quercus* spp. stand which is low by international standards for similar work on flat land. As the subject trees are broad-leaved trees, much work is required to cut the branches and stems to produce firewood and pulpwood. In regard to the production of pulpwood, because of the absence of a local chip plant, the pulpwood is directly transported by truck to a pulp plant located some 600 km away. The introduction of a mobile chipper at cutting sites in the future should improve the work efficiency. Moreover, it is hoped that the length and quality will be determined based on the actual purpose of use with cross-cutting and the bucking of logs.

The standard costs per ha from cruising and wood production work upto the stacking of logs at the forest edge in damaged forests in the two counties are outlined in Table 3-2-1.

Table 3-2-1 Standard Costs of Cruising and Wood Production Work

Species	Standard Cruising Cost	Standard Wood Production Cost	Remarks
Quercus spp.	93,440 Lei/ha (US$ 11)	798,000 Lei/ha (US$ 90)	520 trees 57 m^3 (log production: 32 m^3)
Robinia pseudoacacia	116,800 Lei/ha (US$ 13)	1,023,000 Lei/ha (US$ 115)	650 trees 66 m^3 (log production: 36 m^3)
Populus spp.	25,500 Lei/ha (US$ 3)	1,198,000 Lei/ha (US$ 135)	137 trees 96 m^3 (log production: 57 m^3)

The following standard figures for cruising and wood production work are established taking the conditions of damaged forests into consideration.

[*Quercus* spp.]

Subject trees for harvesting: 520 trees; volume: 57 m^3; logs; 32 m^3; chips and short firewood: 14 m^3; branches for firewood and pulpwood: 11 m^3

[*R. pseudoacacia*]

Subject trees for harvesting: 650 trees; volume: 66 m^3; logs: 36 m^3; chips and short firewood: 17 m^3; branches for firewood and pulpwood: 13 m^3

[*Populus* spp.]

Subject trees for harvesting: 137 trees; volume: 96 m^3; logs: 57 m^3; chips and short firewood: 20 m^3; branches for firewood and pulpwood: 19 m^3

(3) Reforestation Work

Artificial regeneration work at cut-over sites begins with soil preparation work. In view of the need to improve the soil structure and to make post-planting tending work easy to conduct at former damaged forest land, the RNP has so far conducted stump removal and ploughing using large machinery. To be more precise, a bulldozer is used to uproot stumps, to clear the uprooted stumps, for grading and scarifying, followed by ploughing and harrowing by tractor. The attachments used are a dozer for stump uprooting and grading, a ripper for scarifying, a carry-plough or disc-plough for ploughing and a disc-

harrow for harrowing. In the future, it may be possible to use a more effective drill-type uprooting machine, raker and subsoiler, etc. As many machines are required for such a wide range of work, the RNP subcontracts the work to private companies which own these machines. The cost is some US$ 900 per ha for the entire work, accounting for some 30% of the total reforestation and tending cost.

As the seedlings of broad-leaved trees are adventitious with axial roots, automatic planting machines are not used and the seedlings are manually planted by workers using a spade. Much labour is required for planting because of the large number of seedlings to be planted per ha. Supplementary planting is conducted one year or two years later, depending on the situation of damage to the planted trees. The level of supplementary planting is fairly high with some 20% of the original number of seedlings for *Quercus* spp. and some 40% for *R. pseudoacacia.*

In order to ensure the growth of planted trees, weeding by scarifying is thoroughly conducted to prevent weed growth from the year of planting. In the case of *Quercus* spp. with particularly slow initial growth, this weeding work is conducted for six consecutive years and its cost accounts for some 40% of the total reforestation and tending cost. In the future, it should be possible to plan the introduction of a hand tractor-type cultivator to weed between the lines of planting while areas around the planted trees can be manually weeded using a sickle. Prerequisites for this work are flat topography and advance ploughing and harrowing at the time of grading.

Weeding around naturally regenerated trees should be manually conducted using a sickle. This work is required for three consecutive years after the time of planting in the case of *Quercus* spp.

Improvement cutting is required around the seventh and tenth years after the year of planting to manually cut/remove shrubs, etc. which have invaded the area around the planted trees using a hatchet or handsaw. In addition, improvement cutting is also conducted around the fifteenth and twentieth years to remove badly formed trees, etc. of which good growth cannot be anticipated. This type of work is called the improvement cutting of planted trees and involves a work volume of some 5 m^3 per ha. The removed trees are very thin and are seldom used. If they have a diameter of 4 cm or more, however, they may be used as supports at farmland or as firewood.

Thinning can be planned approximately five times in the case of *Quercus* spp. in the period between the thirtieth year after planting to around the eightieth year. The work

involved is similar to the cutting of damaged trees as it consists of total cruising, cutting, bucking and yarding. From the first thinning, it is possible to select trees of more than 7 m in height and 6 cm in diameter. In the case of later thinning, trees of 16 m in diameter with good form can be sold to forest product industries. App. E-8 shows the thinning system.

The cost of the above-mentioned work at existing stands mainly consisting of *Quercus* spp., *R. pseudoacacia* and *Populus* spp. is outlined in Table 3-2-2.

Table 3-2-2 Standard Cost of Reforestation Work

1,000 Lei/ha (US$/ha)

Work at Existing Stands	*Quercus* spp.		*R. pseudoacacia*		*Populus* spp.	
Grading/Ploughing	7,350	(845)	7,350	(845)	7,350	(845)
Planting	4,977	(572)	3,765	(433)	4,977	(572)
Tending (Supplementary Planting, Scarifying and Improvement Cutting, etc.)	13,953	(1,604)	5,546	(637)	13,953	(1,604)
Thinning	1,774	(204)	1,032	(119)	1,774	(204)

Standard Work

[*Quercus* spp.]

Preparation of soil:

- Stump-pulling, clearing of stumps, grading, scarifying, ploughing and soil crushing using leased large machinery

Planting:

- Quantity of planting: 6,666 planting stock, manual work
- Inclusive of cost of planting stock (*Quercus* spp.: 4,444, supplementary species: 2,222)
- Inclusive of cost of transportation and temporary planting of planting stock

Tending:

- Ridging with soil, supplementary planting (20%), weeding by hoeing (16 times in six years), brush cutting (three times in three years), improvement cutting of shrubs (twice: seventh and tenth years), improvement cutting of planted species (twice: fifteenth and twentieth years)

Thinning: Five times

Year	35	45	55	65	75
Ratio	21%	13%	11%	9%	8%
Volume	19 m^3	15 m^3	16 m^3	18 m^3	18 m^3

[*R. pseudoacacia*]

Soil Preparation:

- Stump-pulling, clearing of stumps, grading, scarifying, ploughing and soil crushing using leased large machinery

Planting:

- Quantity of planting: 5,000 planting stock, manual work
- Inclusive of cost of planting stock (*R. pseudoacacia*: 5,000)
- Inclusive of cost of transportation and temporary planting of planting stock

Tending:

- Ridging with soil, supplementary planting (40%), weeding by hoeing (five times in two years), improvement cutting of shrubs and planted species (twice: fourth and eighth years)

Thinning: Three times

Year	10	15	20
Ratio	21%	14%	10%
Volume	13 m^3	13 m^3	14 m^3

[*Populus* spp.]

Soil Preparation:

- Stump-pulling, clearing of stumps, grading, scarifying, ploughing and soil crushing using leased large machinery

Planting:

- Quantity of planting: 625 planting stock, manual work

- Inclusive of cost of planting stock (*Populus* spp.: 625)
- Inclusive of cost of transportation and temporary planting of planting stock

Tending:

- Ridging with soil, supplementary planting (21%), weeding by hoeing (7 times in three years), brush cutting (once: fourth years), lateral bud removing (twice: first and second years), pruning (once: seventh year)

Thinning : Once

Year	8
Ratio	48%
Volume	26 m^3

The work explained for the planting of *Quercus* spp. also applies to sites where *Pupulus* spp. is cut and *Quercus* spp. is planted.

The standard cost of reforestation work at a *R. pseudoacacia* stand by means of regeneration by coppicing is estimated in Table 3-2-3, taking past data into consideration.

Table 3-2-3 Standard Cost of Reforestation Work by Means of Regeneration by Coppicing

1,000 Lei/ha (US$/ha)

Work at Existing Stand	*R. pseudoacacia*
Root Cutting for Regeneration by Coppicing	244 (28)
Tending (Weeding, Pruning and Improvement Cutting, etc.)	1,461 (168)
Thinning	1,100 (126)

Standard Work

[*R. pseudoacacia*]

Root Cutting to Encourage Coppicing:

- Root cutting between stumps by tractor equipped with sub-soiler
- One assistant for soil preparation

Tending:

- Pruning of coppiced trees: 1,500 trees
- Brush cutting: once in first year
- Improvement cutting of planted species: twice (second and fourth years)

Thinning: Three times

Year	10	15	20
Ratio	19%	16%	13%
Volume	18 m^3	22 m^3	23 m^3

Table 3-2-4 outlines the standard prices of planting stock based on the actual prices at RNP nurseries in Olt and Dolj Counties in the period from 1996 to 1999.

Table 3-2-4 Standard Prices of Planting Stock

(US$/1,000 seedlings)

Species	Unit Price	Species	Unit Price
Quercus frainetto	20.5	*Acer tataricum*	12.0
Quercus frainetto (Cutting stock)	304.0	*Acer campestre*	17.0
Quercus cerris	15.3	*Tilia platyphyllos*	19.1
Quercus petraea	16.6	*Pyrus pyraster*	20.0
Quercus pedunculiflora	17.0	*Prunus cerasifera*	16.9
Quercus robur	17.0	*Crataegus monogyna*	18.8
Robinia pseudoacacia	13.5	*Gladitschia triacanthos*	17.0
Fraxinus excelsior	12.9	*Elaeagnus angustifolia*	17.8
Fraxinus ornus	11.8	*Populus euroamericana*	100.8
Fraxinus pennsylvanica	11.8	*Populus alba*	235.5
Cornus sanguinea	12.8		

SECOND PART

FOREST RESTORATION PLAN

CHAPTER 1 BASIC CONCEPT OF PLANNING

1.1 Status of the Plan

1.1.1 Relationship with Existing Laws

(1) Relationship with Forest Code

The Forest Restoration Plan (hereinafter referred to as "the Plan" in this report) is formulated for forests among those (national forest assets) referred to in the Forest Code (Law No. 26/24, April, 1996). The Plan will basically conform to various technical standards set forth in Article 9 of the Forest Code.

(2) Relationship with Environmental Protection Law

All of the planning items of the Plan will conform to the Environmental Protection Law (Law No. 137/29, December, 1995) and, therefore, will not require an environmental impacts assessment.

(3) Relationship with Land Law

The Plan will exclude private forests which have been retroceded pursuant to the repromulgated Law of the Land Law (Law No. 18/1991) which was again repromulgated in 1998 from the scope of its planning.

1.1.2 Relationship with Forest Planning System

(1) Relationship with Forest Planning System

As stipulated in Article 18 of the Forest Code, a Romanian forest planning is formulated every 10 years for each forest range office of the forest branch offices in accordance with the technical standards for forest management. All of the planned items in the Plan will be incorporated in the existing forest management plans.

(2) Relationship with Forestry Development Strategy

One of the objectives of the Forestry Development Strategy formulated in 1995 is to restore forests damaged by drought and pollution, etc. as described in Section 5.3.4. The formulation of the Plan aims at achieving this objective.

(3) Relationship with Budget System

As the Plan involves forest regeneration and improvement work, commencing with cutting, and work to improve the hydrological conditions of declined forests, there will be an initial period of over-spending.

1.1.3 Relationship with Various Organizations

(1) Relationship with RNP and ICAS

As in the case of existing forest management plans, the Plan will be controlled by the forestry-related administration of the central government (MWFEP-GMOF) as stipulated in Article 18 of the Forest Code. Detailed planning will be conducted by the ICAS with the approval of the MWFEP-GMOF. The actual cutting, regeneration, tending and protection of forests will be conducted by the RNP.

(2) Relationship with Local Administrative Bodies

As stipulated in Article 34 and Article 70 of the Forest Code, the provincial and district councils have the obligation to assist the monitoring work of national and private forests, including those in the subject are of the Plan, within the power afforded them by the Forest Code. These bodies also have the obligation to assist the prevention of forest fires and fire-fighting in such national and private forests.

(3) Relationship with Local Administrative Bodies

The work under the Plan will be conducted by the relevant forest range offices which will directly employ mainly local people as day labourers under the supervision of the respective forest branch offices. In the case of uprooting, soil preparation and forest road improvement work involving large machinery, private companies will be subcontracted to conduct the said work.

1.2 Basic Concept of Plan Formulation

The subject forests of the Plan are classified into the following two groups.

① Forests with trees with a decline grade of 2 or higher requiring restoration of their health by means of mainly cutting, regeneration and tending work. In other words, forests of which the damage must be restored (hereinafter referred to as "damaged forests").

② Forests with trees with a decline grade of 0 or 1 and characterised by topographical conditions prone to stagnant water or forests with a strong likelihood of future decline depending on the species, stand age and topography as well as soil conditions in a low rainfall year. In other words, forests of which the decline must be avoided (hereinafter referred to as "prevention forests").

These forests perform the economic role of producing wood and the role of environmental conservation with public benefit functions. In view of these roles, the creation of stands with an appropriate density vis-a-vis the stand age with species of excellent growth to increase wood production is important in the formulation of the Plan designed to restore the decline of these forests so that various forest functions are properly performed.

Based on the field survey findings, the aerial photographs were interpreted to establish the actual state of the subject forests over a wide area. Factors which could be interpreted on the aerial photographs were the crown density, tree height, species, decline grade and causes of decline. In order to establish a meaningful link between these factors, the ground surveys focused on these factors in order to establish qualitative as well as quantitative data.

1.2.1 Basic Principles of the Plan

The implementation period of the Plan is 10 years. The period of individual work under the Plan has been decided in view of the contents of each planning items and local capability to implement the planned work. The calculation period for the financial and economic analyses under the Plan is 169 years as the period required to realise the target forest type after restoration. The basic principles for the formulation of various measures to be implemented under the Plan are described next.

(1) Measures to Restore Forest Damage (Damage Restoration Measures)

For the restoration of damaged forests, appropriate measures will be implemented to facilitate the development of sound forests while consolidating various forest functions. Further details of the necessary work are given below.

1) Establishment of Appropriate Regeneration Methods

i. Promotion of Effective Regeneration

Damaged forests have a high proportion of dead trees and damaged trees of which the future growth cannot be anticipated and, therefore, an increase of the stand volume is unlikely to take place in the future. At these damaged forests,

dead trees and damaged trees of which the future growth as sound forest trees cannot be anticipated will be removed and vigorous planting stock and young trees will be planted or regeneration by coppicing will be attempted. As there is a high risk that the same damage will re-occur depending on the specific tree decline environment, trees/species with a high resistance to drought will be selected for planting.

ii. Promotion of Experiments Using Cuttings and Grafting Technique

There is a shortage of *Quercus* spp. seeds, particularly those of *Q. frainetto*, in the subject area of the Plan, resulting in an absence of continuous regenreation. For the continuance of effective regeneration, the improvement of nurseries and experiments using cutting and the grafting technique will continue with a view to establishing a production system for the healthy planting stock required in the future.

iii. Expansion of Seed Forests and Seed Orchard

There is an insufficient supply of planting stock in the subject area of the Plan because of the shortage of seeds of *Q. frainetto*, the main planting species. New seed stands will be designated and the proper management of the existing seed orchard will be conducted to secure a sufficient production volume of *Q. frainetto* planting stock.

2) Consolidation of Environmental Conservation Function of Forests

i. Avoidance of Damage by Drought or Excessively Wet Conditions

The drainage of stagnant water from the top soil layer and improvement of the water retention function of soil will be required to alleviate forest decline in mainly those areas of damaged forests where standing trees will be reserved. For this purpose, tilling in strips will be conducted in such remained areas.

ii. Environmental Conservation Function

As forests constitute part of the specific environment of the local catchment area, their water sources conservation, soil conservation, windbreak and landscape functions, all of which are expected to be present at restored forests, will be improved.

iii. Promotion of Local Development

Restored forests should contribute to local development through their water sources conservation, soil conservation, windbreak, educational/cultural/public health enhancement and wood supply functions. Strong efforts will be made to promote the educational, cultural and public health enhancement functions for which the demand by the public is high.

3) Promotion of Efficient Forest Restoration

i. Promotion of Forest Road Network Improvement and Introduction of Machinery

Forest road improvement, taking the location and topographical conditions into consideration, and the introduction of both large and small machinery will be promoted in view of efficient forest restoration.

ii. Promotion of Development and Extension of New Techniques

The development and extension of new techniques regarding mainly the breeding of species with strong drought resistance will be promoted to ensure the efficient restoration of forests.

(2) Measures to Prevent Forest Decline (Decline Prevention Measures)

For the prevention of forest decline, various forest functions will be improved and coordinated, followed by the implementation of appropriate measures to maintain the health of forests. Further details of the necessary work are described below.

1) Prevention of Damage by Drought and Excessively Wet Conditions

For the prevention of forest decline caused by stagnant water, drainage of the stagnant water from the water bearing layer is essential coupled with infiltration of the drained water for its effective use. For this purpose, ploughed strips will be created at stands to avoid drought damage in low rainfall years and to improve the drainage conditions.

2) Restoration of Forest Mantle

Many declined trees are observed at sites where the continuity of the forest mantle has been broken. A forest management method capable of restoring forest mantle will be promoted at these forests.

1.2.2 Contents of Main Planning Items

(1) Main Planning Items for Damaged Forests

1) Cutting of Standing Trees

In order to restore those stands of which the forest functions have declined due to the progress of decline by means of an appropriate regeneration method, a cutting method and cutting rate mainly featuring damaged and declined trees will be determined by species as well as decline grade and cutting will be conducted at the stands subject to damage restoration measures.

2) Reforestation

- Selection of Suitable Sites

As damaged forests of *Quercus* spp. are unsuitable for the planting of *R. pseudoacacia* and other fast growing species due to the site and soil conditions, the planting of *Quercus* spp. is planned. In the case of damaged forests of *Robinia pseudoacacia* where the soil conditions are unsuitable for growth, the planting of species which are suitable for the soil conditions is planned. In the case of damaged *Populus* spp. forests, their conversion to mainly *Quercus* spp. forests is planned.

- Control of Drought by Improvement of Soil Structure

The transition of new reforestation sites to declined forests due to drought must be prevented. For this purpose, a large machine equipped with a ripper will be used to dig ripped strips of 50 cm in depth to create highly resistant stands to drought.

- Adjustment of Timing of Thinning as Drought Damage Control Measure

In order to foster standing trees with a high recovery capability from drought damage, thinning will be conducted five years earlier than suggested by the Romanian silviculture standards to create a crown form with well grown, large spreading branches.

- Measure to Compensate Planting Stock Shortage Due to Seed Shortage Caused by Drought

In view of the present production shortage of *Q. frainetto* planting stock, the mixed planting of *Q. cerris* as well as other assistant trees and shrubs will be conducted to compensate for the shortage of *Q. frainetto* planting stock.

- Reduction of Reforestation Cost

In order to achieve efficient forest management, reduction of the reforestation cost will be attempted. The conventional soil preparation method at cut-over sites in Romania whereby large machinery is used to completely uproot the sites is very expensive. At cut-over sites of damaged trees in *Quercus* spp. forests, therefore, soil preparation method by the two-thirds of the ground, i.e. alternation of 10 m wide soil preparation belts and 5 m wide uncleared strips, will be employed for stands with strong damage as a cost reduction measure. In the case of stands of moderate damage, soil preparation method by half of the ground, i.e. alternation of 0.8 m wide soil preparation belts and 0.8 m wide uncleared strips, will be employed. Uprooted stumps will be left at the uncleared strips. In addition, the repeating times of scarifyings will be decreased to reduce the tending cost.

3) Nursing

- Measures to Increase Production of *Q. frainetto* Seeds

Healthy forests capable of producing seeds among existing *Q. frainetto* forests will be newly designated as seed forests and thinning will be repeatedly conducted at these forests to facilitate seed bearing. In addition, appropriate management will be conducted at the existing seed orchard to increase seed production.

- Measures to Protect Seed Orchard from Insect Damage

In order to prevent damage by seed insects at the *Q. frainetto* seed orchard, measures to control such seed insects as *Balaninus glandium* will be established.

4) Construction of Drainage and Infiltration Works

Drainage and infiltration works will be constructed at those areas of damaged *Quercus* spp. forests where standing trees are remained to facilitate the drainage of stagnant water from the top soil layer and the infiltration of drained water.

5) Protection of Forest Mantles

The supplementary planting of *R. pseudoacacia, Elaegnus augustiflora* and *Gladitschia triacanthos* at forest mantles will be conducted as a measure to prevent damage by drought, high temperatures and strong wind and stock raising, all of which are caused by the destruction of forest mantles, in order to suppress the process of forest decline.

6) Improvement of Forest Roads

There are many cases of vehicle traffic being prevented due to scouring of the road surface by rainwater. Forest road improvement work will, therefore, be conducted to ensure the efficient implementation of the various work envisaged under the Plan.

7) Forest Machinery

The introduction of necessary large and small forest machinery is planned to create forests with a high resistance to drought damage and to ensure efficient production and reforestation work.

8) Local Development

Under the Plan, the creation of a general arboretum and forestry work demonstration forests will be planned for the purposes of further enhancing the recreation function of forests, the expectations of which among local people have been increasing, and facilitating people's understanding of proper forest management.

9) Technical Development

Technical development to breed highly resistant species is planned as a measure to hasten the restoration of damaged forests. Using the breeding method of resistant species, individuals with excellent quality and growth will be selected from among those which are resistant to drought and clones will be produced by cutting. A seed orchard will be then created using these clones as mother trees.

(2) Main Planning Items for Prevention Forests

1) Drainage and Infiltration Works

Hard soil with a low permeability produces a layer containing stagnant water. Drainage and infiltration works will, therefore, be constructed in prevention forests to drain stagnant water in order to prevent forest decline. It is important to soften the soil so that the drained water can easily infiltrate into the soil. These works will have a depth of 20 cm and a width of 50 cm and will be constructed at a rate of 800 m per ha.

2) Protection of Forest Mantle

The supplementary planting of *R. pseudoacacia*, *Elaegnus augustiflora* and *Gladitschia triacanthos* at forest mantles will be conducted as a measure to prevent damage by drought, high temperatures and strong wind and stock raising, all of

which are caused by the destruction of forest mantles, in order to suppress the process of forest decline.

1.2.3 Targets and Planned Work Volumes of the Plan

(1) Targets of the Plan

In the case of damaged forests, regeneration will be attempted, taking the natural conditions of each stand into consideration and using species which promise a successful outcome of the intended reforestation. Accordingly, the growing stock at the final cutting age is shown in Table 1-2-1 as a target figure for the target period which is the expected cutting period for each of the main species for regeneration.

(2) Planned Work Volumes under the Plan

The various types of work listed in Table 1-2-2 will be conducted to achieve the targets described in (1) above. In view of the urgency of the current situation and the implementation volume of the present forestry work, the damage restoration measures will be conducted within 10 operation years. The period of tending means the period upto the improvement cutting of the planted species at *Quercus* spp. stands and is, therefore, 29 operation years. The implementation of thinning at the planted sites of *R. pseudoacacia* and *Populus* spp. can be planned during this period. The period to reach the target stage is planned based on the Romanian yield tables and technical standards is 120 years for stands mainly consisting of *Quercus* spp. and 30 years for *R. pseudoacacia* stands from initial planting. Five thinning operations can be planned at the planting sites of *Quercus* spp., starting from the 35th year upto the 75th year. The decline prevention measures will be implemented in the first half of the period of the anticipated 10 operation years in parallel with the implementation of the damage restoration measures.

Table 1-2-1 Restoration Targets for Damaged Forests

<Olt County>

F.M.T	Present Stand	Stand Area (ha)	Actual Regeneration Area (ha)	Regeneration Species	Target Period	Target Unit Stock (m^3/ha)	Target Stock (m^3)
F1	*Q.frainetto*	0.0	0.0	*Q.frainetto*	120	-	-
F2	*Q.frai.,cer.*	0.0	0.0	*Q.frai,cer*	120	-	-
F3	*Quercus* spp.	0.0	0.0	*Q.ped., pet.,,cer*	120	-	-
F4	*Q.robur*	0.0	0.0	*Q.robur*	120	-	-
F5	*Q.frainetto*	600.1	353.6	*Q.frainetto*	120	324	114,568
F6	*Q.frainetto&cerris*	457.7	259.0	*Q.frainetto,cerris*	120	299	77,401
F7	*Quercus* spp.	70.9	43.3	*Q.robur,petraea,pedun.,cerris*	120	470	20,307
F8	*Quercus*&Others	175.6	125.1	*Q.robur,petraea,pedun.,Fraxinus*	120	520	65,245
F9	*Robinia* above20ys	7.3	7.3	*Robinia,Others* Species for planting: *Robinia*	30 30	176	1,283
F10	*Robinia* under20ys	22.0	14.0	*Robinia,Others* Species for planting: *Robinia*	30 30	200	2,807
F11	*Robinia* above20ys	1.9	1.9	*Q.cerris,frai.* Species for planting: *Q.ce.,fr.*	120 120	210	399
F12	*Robinia* under20ys	0.0	0.0	*Q.cerris,frai.* Species for planting: *Q.ce.,fr.*	120 120	-	-
F13	*Populus* spp.	1.6	1.6	*Q.robur,others* *Populus alba*	120 30	289	462
Total Olt		1,337.1	805.7				282,473

<Dolj County>

F.M.T	Present Stand	Planting Area (ha)	Actual Regeneration Area (ha)	Regeneration Species	Target Period	Target Unit Stock (m^3/ha)	Target Stock (m^3)
F1	*Q.frainetto*	32.8	19.7	*Q.frainetto*	120	374	7,360
F2	*Q.frai.,cer.*	60.4	33.2	*Q.frai,cer*	120	355	11,786
F3	*Quercus* spp.	3.6	1.4	*Q.ped., pet.,,cer*	120	817	1,176
F4	*Q.robur*	0.0	0.0	*Q.robur*	120	-	-
F5	*Q.frainetto*	898.7	561.2	*Q.frainetto*	120	313	175,925
F6	*Q.frainetto&cerris*	1,938.2	1,095.9	*Q.frainetto,cerris*	120	295	323,706
F7	*Quercus* spp.	195.3	115.9	*Q.robur,petraea,pedun., cerris*	120	513	59,443
F8	*Quercus*&Others	140.5	87.7	*Q.robur,petraea,pedun.,Fraxinus*	120	487	42,678
F9	*Robinia* above20ys	357.7	357.7	*Robinia,Others* Species for planting: *Robinia*	30 30	191	68,391
F10	*Robinia* under20ys	238.0	206.2	*Robinia,Others* Species for planting: *Robinia*	30 30	164	33,875
F11	*Robinia* above20ys	1.8	1.8	*Q.cerris,frai.* Species for planting: *Q.ce.,fr.*	120 120	143	257
F12	*Robinia* under20ys	2.5	2.5	*Q.cerris,frai.* Species for planting: *Q.ce.,fr.*	120 120	210	525
F13	*Populus* spp.	25.3	25.3	*Q.robur,others* *Populus alba*	120 30	472	11,931
Total Dolj		3,894.8	2,508.5				737,054

County	Stand Area (ha)	Actual Regeneration Area (ha)	Regeneration Species	Target Period	Target Unit Stock (m^3/ha)	Target Stock (m^3)
Total Olt	1,337.1	805.7				282,473
Total Dolj	3,894.8	2,508.5				737,054
Total	5,231.9	3,314.2				1,019,527

Note F.M.T: Forest Management Type

Table 1-2-2 Volumes of Main Work

<Damage Restoration Measures>

Type of Work		Work Volume	Remarks
Cruising, Cutting, Bucking and Yarding:	Total	485,864 m³	
Main Species of Present Stands	*Quercus*	430,346 m³	
	Robinia	52,939 m³	
	Populus	2,579 m³	
Sale of Wood and Clearance of Damaged Trees:	Total	485,864 m³	
Wood for Forest Products Industry:	Sub-Total	9,717 m³	
	Quercus	7,728 m³	
	Robinia	1,902 m³	
	Populus	87 m³	
Pulpwood and Firewood:	Sub-Total	476,147 m³	
	Quercus	422,618 m³	
	Robinia	51,037 m³	
	Populus	2,492 m³	
Reforestation: Total		3,314.2 ha	By planting species
Main Species of Present Stands:	*Quercus*	2,696.0 ha	2,719.3 ha
	Robinia	591.4 ha	585.2 ha
	Populus	26.9 ha	9.8 ha
Tending			
Supplementary Planting		780.0 ha	
Correction of Planting		3,314.2 ha	
Scarifyng		35,030.9 ha	
Weeding		8,348.4 ha	
Improvement Cutting of Brush		6,023.7 ha	
Intraspecific Improvement Cutting		6,023.7 ha	
Removal of Lateral Buds and Pruning		29.4 ha	
Procurement of Planting Stock:	Total	19,656,057	
Quercus		10,744,668	
Fraxinus		144,949	
Tilia		98,524	
Pyrus		515,641	
Robinia		2,979,130	
Gladitschia		207,100	
Elaeagnus		103,550	
Populus		7,350	
Assisting Species		4,855,144	
Drainage and Infiltration Works		5,331.2 ha	
Supplementary Planting at Forest Mantle		32.5 ha	
Improvement of Forest Roads		77 km	
Cruising (Thinning)		257,520 m³	
Sale of Standing Trees (Thinning):	Total	257,520 m³	
Planting Species	*Populus*	255 m³	
	Robinia	23,406 m³	
	Quercus	233,859 m³	
Cruising (Final Cutting)		1,065,210 m³	
Sale of Standing Trees (Final Cutting):	Total	1,065,210 m³	
Wood for Forest Products Industry		405,916 m³	
Planted Species	*Quercus*	394,186 m³	
	Robinia	11,436 m³	
	Populus	294 m³	
Pulpwood and Firewood		659,293 m³	
Planting Species	*Quercus*	562,701 m³	
	Robinia	94,920 m³	
	Populus	1,672 m³	

<Decline Prevention Measures>

Type of Work	Work Volume	Remarks
Drainage and Infiltration Works	4,265.6 ha	
Supplementary Planting at Forest Mantles	9.2 ha	

(3) Main Machinery Purchase Plan

Given the standard depreciation period of some 10 years for large forest machinery and 2 - 3 years for such small machinery as chainsaws, the types and quantities of the required machinery to meet the envisaged work volume during the Plan period are planned as shown in Table 1-2-3.

In the case of bulldozers required for uprooting and preparation of the soil for reforestation work and also for the repair of forest roads and tractors required for the ploughing and crushing of soil, it should prove effective for those companies which have so far been subcontracted to conduct the said work to use their own machinery and operators.

In regard to thinning and final cutting work, the trees will be sold standing and, therefore, the use of machinery to conduct such work by the forest management body is not planned.

Table 1-2-3 Procurement Plan for Main Machinery

Type of Machine and Timing of Use	Quantity	Remarks
4 WD Tractor	12	For bucking and reforestation
Skidder	6	
Grab for Skidding	6	
Chainsaw	112	Inclusive of regeneration quatity
Mini Back-Hoe	10	
Earth Auger	4	
Cultivator (60 cm)	60	
Cultivator (30 cm)	71	
4 WD Tractor	2	For drainage and infiltration work
Disc Plough	2	
Carried Plough	2	

1.3 Items Related to Plan Implementation Body

At the actual implementation stage of the Plan, the RNP will act as the implementation body. For the implementation of the Plan, the creation of new positions at the RNP, the two forest branch offices responsible for the two counties and 11 forest range offices in the two counties will be necessary to deal with the Plan implementation. The actual number of new positions will consist of one position at the RNP, one position each at the two forest branch offices and

one position each at the 11 forest range offices, resulting in the creation of a total of 14 new positions.

The actual work under the Plan will be conducted by the forest range offices while the forest branch offices will instruct and supervise the work conducted by the forest range offices. The RNP will be responsible for the overall command and supervision of the implementation of the Plan. Similar work has been conducted in accordance with the forest management plans which are formulated every 10 years within the existing organizational structure for forestry work. It will, therefore, be appropriate for the work to be implemented under the Plan to be coordinated with existing work in terms of the locations and workforce assignment.

CHAPTER 2 SUBJECT FORESTS OF THE PLAN

2.1 Forest Selection Criteria

In the case of some forests containing declining trees, the volume of dead trees and severely declined trees is equivalent to or even lower than the natural tree death volume or the standing thinning volume of these forests. These forests are regarded as sound forests on the grounds that there will be no real damage to stands due to tree decline. Meanwhile, stands with a crown density of 60% or more are regarded as sound stands while those with a crown density of less than 60% which have declined due to water stress are identified as the subject forests of the Plan.

2.1.1 Subject Forests for Damage Restoration Measures

The selection criteria and main items of the damage restoration measures to restore the functions of declining stands due to water stress are described below.

(1) Selection Criteria

Forests which meet all of the following criteria are regarded as damaged forests.

i. Stands of *Quercus* spp., *Fraxinus excelsior* and other broad-leaved species with a stand age of mainly 10 - 100 years and stands of *Robinia pseudoacacia* or *Populus* spp. with a stand age of mainly 10-25 years

ii. Stands of which the proportion of standing trees with a decline grade of 2 or higher is 20% or more

iii. Stands of which the crown density is less than 60%. Here the crown density is expressed as the relative percentage of the crown density of a healthy stand when the latter is set at 100%. The latter is equivalent to 80% in terms of the geometrical crown coverage (crown coverage = 0.8 x crown density)

iv. Stands with a declining area of 0.1 ha or more

The total area of damaged forests s 9,204 ha.

(2) Classification of Forest Management Type of Damaged Forests

In order to examine management practice which is appropriate for the actual conditions of each stand under the Plan, damaged forests are classified into the following 13 types

based on the composition of the main species or forest age in the case of *R. pseudoacacia* stands. Accordingly, the Plan is formulated to deal with each of these 13 types although F4 type damaged forests are not observed in the subject area of the Plan.

Table 2-1-1 Classification of Forest Management Type of Damaged Forests

Forest Management Type	Contents
F1	Seed stand of *Q. frainetto*
F2	Seed stand of *Q. cerris*
F3	Seed stand of *Q. pubescens* or *Q. pedunculiflora*
F4	Seed stand of *Q. robur*
F5	Pure forest of Q. *frainetto*
F6	Pure forest of *Q. cerris* or mixed forest of *Q. frainetto* and *Q. cerris*, mixed forest of *Q. cerris* or *Q. frainetto* and other *Quercus* spp.
F7	Other *Quercus* spp. forest, *Q. robur* forest or *Q. petraea* forest
F8	Mixed forest of *Quercus* spp. and other species
F9	*Robinia pseudoacacia* forest of 20 years of age or more (the target species written in the Romanian forest planning is *R. pseudoacacia*)
F10	*R. pseudoacacia* forest of less than 20 years of age (the target species written in the Romanian forest planning is *R. pseudoacacia*)
F11	*R. pseudoacacia* forest of 20 years of age or more (the target species written in the Romanian forest planning is other than *R. pseudoacacia*)
F12	*R. pseudoacacia* forest of less than 20 years of age (the target species written in the Romanian forest planning is other than *R. pseudoacacia*)
F13	*Populus* spp. forest

(3) Main Items of Damage Restoration Measures

The following items are determined in regard to the main types of work to restore and maintain the expected functions of damaged forests.

i. Cutting method and cutting rate by forest management type and damage grade

ii. Regeneration method by forest management type and damage grade

iii. Tending method by forest management type and damage grade

iv. Construction of water channels aimed at drainage and infiltration of water at remaining area (hereinafter referred to as "drainage and infiltration works")

2.1.2 Subject Forests for Decline Prevention Measures

The selection criteria and main items of the decline prevention measures to avoid damage to stands which are expected to decline due to water stress are described below.

(1) Selection Criteria

Forests which meet all of the following criteria are regarded as prevention forests.

i. Stands at middle or high terraces and adjacent to a damaged forest

ii. *Quercus* spp. stands with a stand age of 35 - 65 years

iii. Stands of which the soil unit is Chromic Luvisols (LVx), Vertical Luvisols (LVv), Albic Luvisols (LVa), Stagnic-Vertic Luvisols (LVv-j), Haplic Luvisols (LVh), Vertic-Chromic Luvisols (LVx-v), Cambisols (CM), Chernozems (CH) or Phaeozems (PH)

iv. Stands of 0.1 ha or more containing trees with a decline grade of less than 1

v. Stands with an inclination of three degrees of less

The total area of prevention forests is 4,266 ha.

(2) Main Items of Decline Prevention Measures

i. Construction of drainage and infiltration works

ii. Supplementary planting to maintain or restore forest mantles

2.2 Location and Area of Subject Forests

The total area of forests subject to the Plan is 13,470 ha, of which 9,204 ha consists of damaged forests and 4,266 ha consists of prevention forests.

2.2.1 Area of Damaged Forests

(1) Area of Damaged Forests by Forest Range Office and Damage Grade

The area of damaged forests by forest range office and damage grade is shown in Table 2-2-1. According to the table, Perisor, Bals and Craiova Forest Range Office have damaged forests of more than 1,000 ha. The area of damaged forests in the areas of these three offices accounts for 65% of the total area of damaged forests.

(2) Area of Damaged Forests by Forest Range Office, Forest Management Type and Damage Grade

Table 2-2-2 shows the area of damaged forests by forest range office, forest management type and damage grade. According to this table, more than 2,000 ha of forests of the F5

and F6 types are classified as damaged forests, jointly accounting for 80% of the total area of damaged forests.

(3) Standing Tree Volume of Damaged Forests by Forest Range Office, Forest Management Type and Damage Grade

Table 2-2-3 shows the standing tree volume of damaged forests by forest range office, forest management type and damage grade. As in the case of Table 2-2-2, the standing volumes of the F5 and F6 types are extremely large, jointly accounting for 80% of the total.

Table 2-2-1 Area of Damaged Forests by Forest Range Office and Damage Grade

(ha)

County	Forest Range Office	Forest Area	Damage Area			Total
			Strong	Moderate	Weak	
Olt	Bals	12,110.0	193.5	366.6	1,116.0	1,676.1
	Caracal	4,934.0	125.4	65.6	28.6	219.6
	(Corabia)	4,235.0		5.7	2.5	8.2
	Slatina	9,825.0	74.5	335.8	327.4	737.7
	(Draganesti-Olt)	4,629.0	41.8	102.9	52.2	196.9
	Vulturesti	7,265.0	5.8	19.9	1.6	27.3
Sub Total		42,998.0	441.0	896.5	1,528.3	2,865.8
Dolj	Amaradia	10,722.0	44.5	355.5	63.0	463.0
	Calafat	6,942.0	101.8	18.7		120.5
	(Poiana Mare)	6,929.0	3.7			3.7
	Craiova	11,667.0	519.9	598.7	202.1	1,320.7
	Filiasi	9,163.0	49.0	177.3	231.1	457.4
	Perisor	9,461.0	427.1	1,016.1	1,529.7	2,972.9
	Sadova	6,356.0	12.8	9.9	17.9	40.6
	(Apele Vii)	3,849.0	184.9	117.2	223.8	525.9
	Segarcea	7,718.0	117.4	184.8	131.3	433.5
Sub Total		72,807.0	1,461.1	2,478.2	2,398.9	6,338.2
Total		115,805.0	1,902.1	3,374.7	3,927.2	9,204.0

Table 2-2-2 Area of Damaged Forests by Forest Range Office, Damage Grade and Forest Management Type

(ha)

County	Forest Range Office	Damage Grade	Forest Management Type													Total
			F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	
OLT	Bals	Strong					98.0	63.1	1.6	28.9			1.9			193.5
		Moderate					114.3	234.8	6.3	10.5	0.7					366.6
		Weak					471.7	449.2	50.8	138.9	3.7	1.7				1,116.0
	Caracal	Strong					9.5	8.2	22.7	80.4	3.8	0.8				125.4
		Moderate						25.7	23.8	16.1						65.6
		Weak						9.9	3.5	13.7		1.5				28.6
	(Corabia)	Strong														
		Moderate							0.3	2.6		2.8				5.7
		Weak										2.5				2.5
	Slatina	Strong					34.8	24.4	0.2	12.3		2.8				74.5
		Moderate					218.4	84.4	2.1	21.4	2.8	5.1			1.6	335.8
		Weak					183.7	104.3	1.6	29.8	5.1	2.9				327.4
	(Draganesti-Olt)	Strong					30.3	4.9	1.5	2.7		2.4				41.8
		Moderate					81.5	12.6		0.7		8.1				102.9
		Weak					1.8	50.1			0.3					52.2
	Vulturesti	Strong					5.8									5.8
		Moderate					7.5		12.4							19.9
		Weak							1.6							1.6
Olt Sub Total		Strong					178.4	100.6	26.0	124.3	3.8	6.0	1.9	0.0	0.0	441.0
		Moderate					421.7	357.5	44.9	51.3	3.5	16.0	0.0	0.0	1.6	896.5
		Weak					657.2	613.5	57.5	182.4	9.1	8.6	0.0	0.0	0.0	1,528.3
							1,257.3	1,071.6	128.4	358.0	16.4	30.6	1.9	0.0	1.6	2,865.8
DOLJ	Amaradia	Strong					10.8	1.5			23.5	8.7				44.5
		Moderate		1.0			112.6	208.1	23.0	5.0		5.8				355.5
		Weak		2.6			30.6	28.4	1.4							63.0
	Calafat	Strong								5.4	68.6	27.8				101.8
		Moderate									6.0	12.2			0.5	18.7
		Weak														
	(Poiana Mare)	Strong									3.2				0.5	3.7
		Moderate														
		Weak														
	Craiova	Strong	32.8				355.6	111.0	1.5	17.0	2.0					519.9
		Moderate					242.6	311.8	28.2	14.3			1.8			598.7
		Weak					48.0	151.2	1.9	0.4				0.6		202.1
	Filiasi	Strong					0.6	8.6	2.4	3.5	17.2	16.7				49.0
		Moderate					47.7	76.7	2.4	11.8	13.3	20.0			5.4	177.3
		Weak					84.5	133.4	1.1	10.2	1.1	0.8				231.1
	Perisor	Strong		45.2			31.3	255.3	50.0	16.9	18.4	10.0				427.1
		Moderate		14.2			76.6	881.2	17.0	10.8	15.2	1.1				1,016.1
		Weak		24.9			129.1	1,361.1	6.2	7.5	0.3	0.6				1,529.7
	Sadova	Strong										10.3		2.5		12.8
		Moderate									9.9					9.9
		Weak									17.9					17.9
	(Apele Vii)	Strong					17.9	6.4		0.6	77.6	73.2			9.2	184.9
		Moderate					11.7	5.9	0.6		79.8	18.5			0.7	117.2
		Weak					48.8	19.6			140.7	14.7				223.8
	Segarcea	Strong					1.2	39.8	7.0	14.8	19.6	27.6			7.4	117.4
		Moderate			3.6		34.6	31.9	63.2	40.4	3.4	6.1			1.6	184.8
		Weak					15.7	40.4	40.7	23.9		10.6				131.3
Dolj Sub Total		Strong	32.8	45.2	0.0	0.0	417.4	422.6	60.9	58.2	230.1	174.3	0.0	2.5	17.1	1,461.1
		Moderate	0.0	15.2	3.6	0.0	525.8	1,515.6	134.4	82.3	127.6	63.7	1.8	0.0	8.2	2,478.2
		Weak	0.0	27.5	0.0	0.0	356.7	1,734.1	51.3	42.0	160.0	26.7	0.0	0.6	0.0	2,398.9
			32.8	87.9	3.6	0.0	1,299.9	3,672.3	246.6	182.5	517.7	264.7	1.8	3.1	25.3	6,338.2
Total		Strong	32.8	45.2	0.0	0.0	595.8	523.2	86.9	182.5	233.9	180.3	1.9	2.5	17.1	1,902.1
		Moderate	0.0	15.2	3.6	0.0	947.5	1,873.1	179.3	133.6	131.1	79.7	1.8	0.0	9.8	3,374.7
		Weak	0.0	27.5	0.0	0.0	1,013.9	2,347.6	108.8	224.4	169.1	35.3	0.0	0.6	0.0	3,927.2
			32.8	87.9	3.6	0.0	2,557.2	4,743.9	375.0	540.5	534.1	295.3	3.7	3.1	26.9	9,204.0

Note: See Table 2-1-1 for the second part "Forest Restoration Plan" for the forest management types of damaged forests.

Table 2-2-3 Standing Tree Volume of Damaged Forests by Forest Range Office, Damage Grade and Forest Management Type

(m^3)

County	Forest Range Office	Damage Grade	Forest Management Type													Total
			F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	
OLT	Bals	Strong					10,566	7,466	176	5,498			78			23,784
		Moderate					16,445	29,577	386	1,130	68					47,606
		Weak					70,278	66,988	7,362	23,171	360	33				168,192
	Caracal	Strong					340	799	3,880	10,867	300	38				16,224
		Moderate						2,984	4,905	2,162						10,051
		Weak						992	836	2,362		168				4,358
	(Corabia)	Strong														0
		Moderate							59	517		299				874
		Weak										300				300
	Slatina	Strong					2,174	1,736	13	373		95				4,392
		Moderate					28,066	9,036	152	2,185	216	270			80	40,004
		Weak					24,265	13,320	151	3,010	232	142				41,120
	(Draganesti-Olt)	Strong					5,231	1,189	450	132		65				7,067
		Moderate					14,924	2,505		38		219				17,685
		Weak					347	10,239			57					10,643
	Vulturesti	Strong					798									798
		Moderate					1,049		1,993							3,042
		Weak							228							228
Olt Sub Total		Strong					19,108	11,190	4,519	16,870	300	198	78	0	0	52,264
		Moderate					60,484	44,102	7,495	6,032	284	787	0	0	80	119,263
		Weak					94,890	91,538	8,578	28,544	649	643	0	0	0	224,842
							174,483	146,830	20,592	51,446	1,233	1,628	78	0	80	396,368
DOLJ	Amaradia	Strong					1,186	203			1,806	242				3,437
		Moderate		189			13,115	26,477	2,469	536		175				42,960
		Weak		596			4,147	4,265	88							9,096
	Calafat	Strong								141	6,204	1,479				7,825
		Moderate									569	630			81	1,279
		Weak														0
	(Poiana Mare)	Strong									363				59	422
		Moderate														0
		Weak														0
	Craiova	Strong	5,609				43,364	14,213	122	1,391	146					64,846
		Moderate					30,938	41,547	4,856	2,253			166			79,760
		Weak					5,928	22,339	337	53				44		28,702
	Filiasi	Strong					65	813	137	132	584	307				2,037
		Moderate					5,337	9,649	265	2,589	733	712			109	19,391
		Weak					11,688	18,434	104	2,122	103	36				32,486
	Perisor	Strong		8,351			4,028	29,048	3,330	638	1,704	218				47,318
		Moderate		2,846			8,493	97,279	1,922	696	1,925	108				113,269
		Weak		5,065			14,290	154,892	649	727	19	10				175,650
	Sadova	Strong										289		45		334
		Moderate									708					708
		Weak									1,259					1,259
	(Apele Vii)	Strong					3,081	1,516		109	11,151	4,117			1,656	21,630
		Moderate					2,031	1,036	103		10,474	1,329			34	15,006
		Weak					8,059	4,062			22,956	1,231				36,308
	Segarcea	Strong					91	3,702	1,158	1,447	697	433			392	7,921
		Moderate			935		2,800	4,609	8,350	6,265	141	350			168	23,618
		Weak					1,331	5,412	6,443	4,152		713				18,052
Dolj Sub Total		Strong	5,609	8,351	0	0	51,816	49,495	4,747	3,859	22,655	7,084	0	45	2,107	155,768
		Moderate	0	3,035	935	0	62,713	180,598	17,965	12,338	14,550	3,303	166	0	392	295,994
		Weak	0	5,661	0	0	45,443	209,403	7,622	7,054	24,336	1,990	0	44	0	301,554
			5,609	17,047	935	0	159,972	439,495	30,334	23,251	61,542	12,378	166	90	2,499	753,316
Total		Strong	5,609	8,351	0	0	70,924	60,685	9,266	20,729	22,955	7,282	78	45	2,107	208,032
		Moderate	0	3,035	935	0	123,197	224,699	25,460	18,370	14,834	4,091	166	0	471	415,257
		Weak	0	5,661	0	0	140,333	300,941	16,200	35,598	24,985	2,633	0	44	0	526,395
			5,609	17,047	935	0	334,454	586,325	50,925	74,697	62,774	14,006	244	90	2,579	1,149,684

Note: See Table 2-1-1 for the second part "Forest Restoration Plan" for the forest management types of damaged forests.

2.2.2 Area of Prevention Forests

(1) Area and Volume of Prevention Forests by Forest Range Office

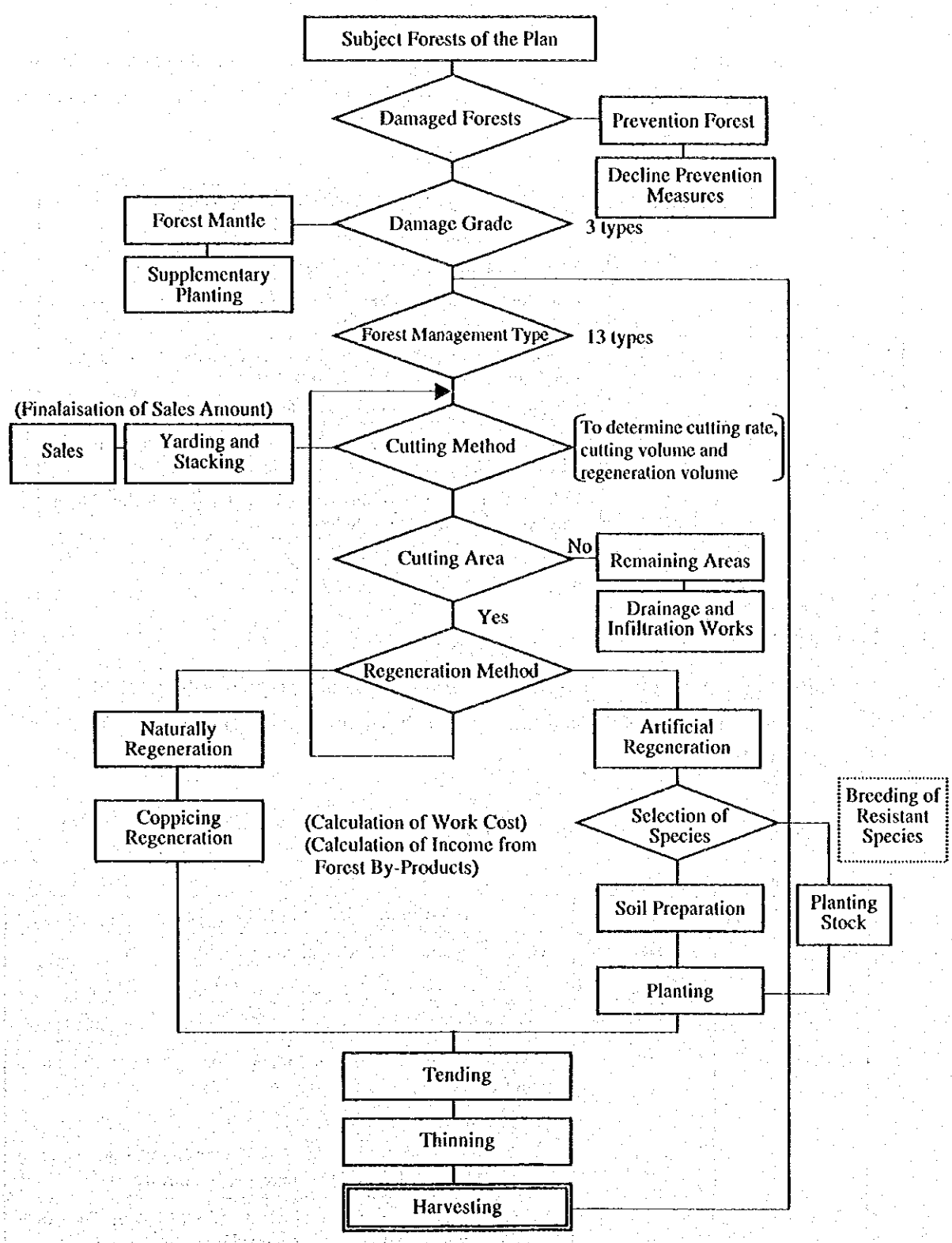
The area and volume of prevention forests by forest range office is shown in Table 2-2-4. As in the case of damaged forests, many prevention forests are found in the areas of the Perisor, Bals and Craiova Forest Range Offices, accounting for 60% of the total in terms of both area and volume.

Table 2-2-4 Area of Prevention Forests by Forest Range Office

County	Forest Range Office	Area (ha)	Volume (m^3)
Olt	Bals	837.3	115,964
	Caracal	292.6	43,391
	(Corabia)	2.6	614
	Slatina	438.9	55,365
	(Draganesti-Olt)	177.0	36,347
	Vultresti	25.5	4,948
Sub Total		1,773.9	256,629
Dolj	Amaradia	354.2	37,864
	Calafat	0.0	0
	(Poiana Mare)	0.0	0
	Craiova	705.4	91,946
	Filiasi	145.9	19,471
	Perisor	1,060.6	123,957
	Sadova	0.0	0
	(Apele Vii)	2.6	1,584
	Segarcea	223.0	33,552
Sub total		2,491.7	308,374
Total		4,265.6	565,003

CHAPTER 3 RESTORATION OF DAMAGED FORESTS

3.1 Damage Restoration System



3.2 Items Related to Cutting

3.2.1 Items Related to Tree Selection and Cutting

(1) Items Related to Tree Selection

The selection of trees for cutting is basically made based on the damage grade and species of damaged forests. The tree selection method based on damage grade is described below.

Damage Grade	Cutting Rate	Selection Method of Damaged Trees
Strong	60%, 80% or 100%	- Group reservation of sites with many healthy trees - Selection of all trees, including healthy trees, in cutting areas - Selection of only Grade 3 and Grade 4 declined trees in remaining areas
Moderate	40%, 50% or 100%	- Group selection of trees at sites with many declined trees (minimum cutting area per site: 0.05 ha) - Selection of all trees, including healthy trees in cutting areas - Selection of usable Grade 3 and Grade 4 declined trees and trees which may damage forests in remaining areas
Weak	0%, 15% or 20%	- Individual selection of usable Grade 3 and Grade 4 declined trees and trees which may damage forests

(2) Items Related to Cutting

The cutting of standing trees is basically based on the damage grade of damaged forests. The standard cutting method and cutting rate by main species and damage grade are described below.

1) *Quercus* spp. Forests (F5, F6, F7 and F8)

Damage Grade	Cutting Rate	Cutting Method of Damaged Trees
Strong	80%	- Group reservation of sites with many healthy trees - Cutting area (80%) - clear cutting (including healthy trees) - Remaining area (20%) - only Grade 3 and Grade 4 declined trees
Moderate	50%	- Group cutting at sites with many damaged trees (minimum cutting area per site: 0.05 ha) - Cutting area (50%) - clear cutting - Remaining area (50%) - cutting of usable Grade 3 and Grade 4 declined trees and trees which may damage forests
Weak	20%	- Individual cutting of usable Grade 3 and Grade 4 declined trees and trees which may damage remained trees

2) *Quercus* spp. Forests (Seed Stands) (F1, F2, F3 and F4)

Damage Grade	Cutting Rate	Cutting Method of Damaged Trees
Strong	60%	- Cutting of only Grade 3 and Grade 4 declined trees
Moderate	40%	- Cutting of only Grade 3 and Grade 4 declined trees
Weak	15%	- Cutting of only Grade 3 and Grade 4 declined trees

3) *R. pseudoacacia* Forests (F9 and F10)

Damage Grade	Cutting Rate	Cutting Method of Damaged Trees
Strong	100%	- Clear Cutting
Moderate (20 years old or more) (F9)	100%	- Clear Cutting
Moderate (less than 20 years old) (F10)	50%	- Group cutting at sites with many damaged trees (minimum cutting area per site: 0.05 ha) - Cutting area (50%) - clear cutting - Remaining area (50%) - cutting of only usable Grade 3 and Grade 4 declined trees and trees which may damage forests
Weak	20%	- Individual cutting of usable Grade 3 and Grade 4 declined forests and trees which may damage forests

4) *R. pseudoacacia* Forests (F11 and F12)

Damage Grade	Cutting Rate	Cutting Method of Damaged Trees
Strong	100%	- Clear cutting
Moderate	100%	- Clear cutting
Weak	20%	- Individual cutting of usable Grade 3 and Grade 4 declined forests and trees which may damage forests

5) *Populus* spp. Forests (F13)

Damage Grade	Cutting Rate	Cutting Method of Damaged Trees
Strong	100%	- Clear cutting
Moderate	100%	- Clear cutting
Weak	0%	- No cutting

The cutting rate for restored forests in the future will be based on the management method corresponding to the functions of each forest.

At all forests, careful attention should be paid to cutting and hauling to avoid (i) damage to healthy trees and (ii) soil erosion.

3.2.2 Cutting Area and Cutting Volume

Cutting, wood production and sales will be planned for damaged forests, mainly featuring dead trees and declined trees. Table 3-2-1 shows the cutting area, regeneration area and cutting volume by county and forest management type for damaged forests. The cutting volume by forest range office and damage grade, the cutting volume by forest management type and damage grade and the cutting volume by forest range office, forest function and damage grade for damaged forests are shown in App. F-1 to F-4.

Table 3-2-1 Cutting Area, Regeneration Area and Cutting Volume by County and Type of Damaged Forest

Olt County

Forest Management Type	Present Stand	Damage Grade	Stand Area ha	Present Stock m³	Unit Stock m³/ha	Subject Area for Cutting ha	Actual Regeneration Area ha	Cutting Volume m³	Remarks
F1	*Q.frainetto*								
			0	0		0	0.00	0	
F2	*Q.frai.,cer.*								
			0	0		0	0.00	0	
F3	*Quercus* spp.								
			0	0		0	0.00	0	
F4	*Q.robur*								
			0	0		0	0.00	0	
F5	*Q.frainetto*	Strong	178.4	19,108	107.1	178.4	142.72	15,286	
		Moderate	421.7	60,484	143.4	421.7	210.85	30,242	
		Weak	657.2	94,891	144.4	657.2	0.00	18,978	
			1,257.3	174,483		1,257.3	353.57	64,507	
F6	*Q.frainetto* & *Q.cerris*	Strong	100.6	11,190	111.2	100.6	80.48	8,952	
		Moderate	357.1	44,064	123.4	357.1	178.55	22,032	
		Weak	613.5	91,538	149.2	613.5	0.00	18,308	
			1,071.2	146,792		1,071.2	259.03	49,292	
F7	*Quercus* spp.	Strong	26.0	4,518	173.8	26.0	20.80	3,614	
		Moderate	44.9	7,495	166.9	44.9	22.45	3,748	
		Weak	57.5	8,578	149.2	57.5	0.00	1,716	
			128.4	20,591		128.4	43.25	9,078	
F8	*Quercus* spp. & Others	Strong	124.3	16,870	135.7	124.3	99.44	13,496	
		Moderate	51.3	6,031	117.6	51.3	25.65	3,016	
		Weak	182.4	28,543	156.5	182.4	0.00	5,709	
			358.0	51,444		358.0	125.09	22,220	
F9	*Robinia* above20ys	Strong	3.8	300	78.9	3.8	3.80	300	
		Moderate	3.5	284	81.1	3.5	3.50	284	
		Weak	9.1	649	71.3	9.1		130	
			16.4	1,233		16.4	7.30	714	
F10	*Robinia* under20ys	Strong	6.0	198	33.0	6.0	6.00	198	
		Moderate	16.0	787	49.2	16.0	8.00	394	
		Weak	8.6	643	74.8	8.6		129	
			30.6	1,628		30.6	14.00	720	
F11	*Robinia* above20ys	Strong	1.9	78	41.1	1.9	1.90	78	
		Moderate							
		Weak							
			1.9	78		1.9	1.90	78	
F12	*Robinia* under20ys	Strong							
		Moderate							
		Weak							
			0.0	0		0.0	0.00	0	
F13	*Populus* spp.	Strong							
		Moderate	1.6	80	50.0	1.6	1.60	80	
		Weak							
			1.6	80		1.6	1.60	80	
Total			2,865.4	396,329		2,865.4	805.74	146,688	

Dolj County

Forest Management Type	Present Stand	Damage Grade	Stand Area ha	Present Stock m^3	Unit Stock m^3/ha	Subject Area for Cutting ha	Actual Regeneration Area ha	Cutting Volume m^3	Remarks
F1	*Q.frainetto*	Strong	32.8	5,609	171.0	32.8	19.68	3,365	
			32.8	5,609		32.8	19.68	3,365	
F2	*Q.frai.,Q.cer.*	Strong	45.2	8,351	184.8	45.2	27.12	5,011	
		Moderate	15.2	3,035	199.7	15.2	6.08	1,214	
		Weak	27.5	5,661	205.9	27.5	0.00	849	
			87.9	17,047		87.9	33.20	7,074	
F3	*Quercus* spp.	Moderate	3.6	935	259.7	3.6	1.44	374	
			3.6	935		3.6	1.44	374	
F4	*Q.robur*								
			0	0		0	0.00	0	
F5	*Q.frainetto*	Strong	372.9	46,580	124.9	372.9	298.32	37,264	
		Moderate	525.8	62,713	119.3	525.8	262.90	31,357	
		Weak	356.7	45,442	127.4	356.7	0.00	9,088	
			1,255.4	154,735		1,255.4	561.22	77,709	
F6	*Q.frainetto* & *Q.cerris*	Strong	422.6	49,494	117.1	422.6	338.08	39,595	
		Moderate	1,515.6	180,598	119.2	1,515.6	757.80	90,299	
		Weak	1,734.1	209,402	120.8	1,734.1	0.00	41,880	
			3,672.3	439,494		3,672.3	1,095.88	171,775	
F7	*Quercus* spp.	Strong	60.9	4,726	77.6	60.9	48.72	3,781	
		Moderate	134.4	17,965	133.7	134.4	67.20	8,983	
		Weak	51.3	7,622	148.6	51.3	0.00	1,524	
			246.6	30,313		246.6	115.92	14,288	
F8	*Quercus* spp. & Others	Strong	58.2	3,859	66.3	58.2	46.56	3,087	
		Moderate	82.3	12,338	149.9	82.3	41.15	6,169	
		Weak	42.0	7,054	168.0	42.0	0.00	1,411	
			182.5	23,251		182.5	87.71	10,667	
F9	*Robinia* above20ys	Strong	230.1	22,655	98.5	230.1	230.10	22,655	
		Moderate	127.6	14,550	114.0	127.6	127.60	14,550	
		Weak	160.0	24,336	152.1	160.0	0.00	4,867	
			517.7	61,541		517.7	357.70	42,072	
F10	*Robinia* under20ys	Strong	174.3	7,084	40.6	174.3	174.30	7,084	
		Moderate	63.7	3,303	51.9	63.7	31.85	1,652	
		Weak	26.7	1,990	74.5	26.7	0.00	398	
			264.7	12,377		264.7	206.15	9,134	
F11	*Robinia* above20ys	Strong							
		Moderate	1.8	166	92.2	1.8	1.80	166	
		Weak							
			1.8	166		1.8	1.80	166	
F12	*Robinia* under20ys	Strong	2.5	45	18.0	2.5	2.50	45	
		Moderate							
		Weak	0.6	44	73.3	0.6	0.00	9	
			3.1	89		3.1	2.50	54	
F13	*Populus* spp.	Strong	17.1	2,107	123.2	17.1	17.10	2,107	
		Moderate	8.2	392	47.8	8.2	8.20	392	
		Weak							
			25.3	2,499		25.3	25.30	2,499	
Sub Total	F1-F4		124.3	23,591		124.3	54.32	10,813	
	F5-F13		6,169.4	724,465		6,169.4	2,454.18	328,363	
Total			6,293.7	748,056		6,293.7	2,508.50	339,176	

Total

	Stand Area ha	Present Stock m^3	Unit Stock m^3/ha	Subject Area for Cutting ha	Actual Regeneration Area ha	Cutting Volume m^3	Remarks
Olt	2,865.4	396,329		2,865.4	805.74	146,688	
Dolj	6,293.7	748,056		6,293.7	2,508.50	339,176	
Total	9,159.1	1,144,385		9,159.1	3,314.24	485,864	

3.3 Items Related to Reforestation

3.3.1 Regeneration and Tending Methods

(1) Regeneration Method

1) Regeneration Method

The felling, regeneration and other forest work methods differ depending on the cutting method, species composition and other details of damaged forests. The forest management practices by forest management type and damage grade for damaged forests are outlined in Table 3-3-1.

In the case of *Quercus* spp., regeneration is, in principle, conducted by means of artificial regeneration with natural regeneration being employed at sites of excellent natural regeneration. For this purpose, supplementary planting will be conducted at sites with few regenerated trees. In regard to coppicing, priority will be given to the fostering of root suckers.

In the case of *R. pseudoacacia*, artificial regeneration will be employed together with natural regeneration by coppicing. Artificial regeneration will be employed for *Populus* spp.

The regeneration method for damaged forests by forest management type is shown in Table 3-3-2.

2) Soil Preparation Method

The soil preparation method by forest management type is shown in Table 3-3-1 and is also described below. Fig. 3-3-1 shows images of group cutting and group reservation at the sites subject to soil preparation.

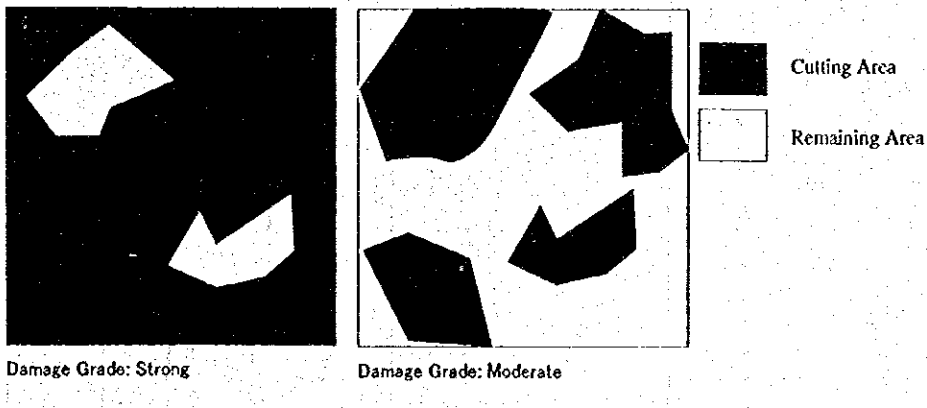


Fig. 3-3-1 Schematic Drawings of Soil Preparation Sites

Table 3-3-1 Management Method by Forest Management Type and Damage Grade

(1) *Quercus* Forests (F5, F6, F7 and F8)

Damage Grade	Cutting Rate	Cutting Method of Declined Trees	Soil Preparation Method	Regeneration Method	Tending Method	Remarks
Strong	80%	- Group reservation at sites with many healthy trees - Cutting area (80%) - clear cutting (including healthy trees) - Remaining area (20%) - cutting of only Grade 3 and Grade 4 declined trees	Uprooting and ploughing (some 20 cm in depth) of 10 m wide belt while stumps are left and ploughing is not conducted at next 5 m belt; alternation of above operation (use of large machinery)	Planting of entire ploughed area (six lines)	Weeding through a combination of self-propelled machinery and hand tool	Naturally regenerated trees in non-ploughed areas and those after planting will be tended together with planted trees
Moderate	50%	- Group cutting at sites with many declined trees (minimum cutting area per site: 0.05 ha) - Cutting area (50%) - clear cutting (including healthy trees) - Remaining area (50%) - selection of Grade 3 and Grade 4 declined trees which are usable or which may damage remained trees	Soil preparation (some 40 cm in depth) of alternate belts of 0.8 m; stumps are left and soil preparation work avoids stumps; drainage and infiltration works in remaining areas of standing trees	Strip planting (one line for each strip)	As above	As above
Weak	20%	- Individual selection of Grade 3 and Grade 4 declined trees which are usable or which may damage remained trees	No soil preparation; drainage and infiltration works to be constructed over entire area	No planting	No tending	

(2) *Quercus* Forests (Seed Stands (F1, F2, F3 and F4)

Damage Grade	Cutting Rate	Cutting Method of Declined Trees	Soil Preparation Method	Regeneration Method	Tending Method	Remarks
Strong	60%	Cutting of only Grade 3 and Grade 4 declined trees	Same method as (1) - Moderate above for clear cutting area of 0.05 ha or larger	Same as (1) - Moderate above	Same as (1) - Moderate above	Same as (1) - Moderate above
Moderate	40%	As above	As above	As above	As above	As above
Weak	15%	As above	No soil preparation; drainage and infiltration works to be constructed over entire area	No planting	No tending	

(3) *R. pseudoacacia* Forests (Regeneration Species: *R. pseudoacacia*) (F9 and F10)

Damage Grade	Cutting Rate	Cutting Method of Declined Trees	Soil Preparation Method	Regeneration Method	Tending Method	Remarks
Strong (F9; F10)	100%	Clear cutting	- Stumps are uprooted - Soil preparation by means of ploughing of entire area (depth: 20 - 25 cm) (use of large machinery)	Planting of entire area	Weeding through a combination of self-propelled machinery and hand tool	
Moderate (20 Years Old or More) (F9)	100%	Clear cutting	No soil preparation (planting is conducted at planting holes made by earth auger or hand tool)	Natural regeneration (by coppicing) Planting at poor natural regeneration sites	Weeding by hand tool	Assumed planting rate of 50%
Moderate (Less than 20 Years Old) (F10)	50%	- Group cutting of areas with many declined trees (minimum cutting area per site: 0.05 ha) - Cutting area (50%) - clear cutting (including healthy trees) - Remaining area (50%) - selection of Grade 3 and Grade 4 declined trees which are usable or which may damage remained trees	As above	As above	As above	Assumed planting rate of 20%
Weak (F9, F10)	20%	- Individual selection of Grade 3 and Grade 4 declined trees which are usable or which may damage remained trees	No soil preparation	No planting	No tending	

(4) *R. pseudoacacia* Forests (Regeneration Species: *Quercus* spp.) F11 and F12)

Damage Grade	Cutting Rate	Cutting Method of Declined Trees	Soil Preparation Method	Regeneration Method	Tending Method	Remarks
Strong	100%	Clear cutting	Same as (1) - *Quercus* forests	Same as (1) - *Quercus* forests	Same as (1) - *Quercus* forests	
Moderate	100%	Clear cutting	Same as (1) - *Quercus* forests	Same as (1) - *Quercus* forests	Same as (1) - *Quercus* forests	Assumed planting rate of 50%
Weak	20%	- Individual selection of Grade 3 and Grade 4 declined trees which are usable or which may damage remained trees	No soil preparation	No planting	No tending	

(5) *Populus* Forests (F13)

Damage Grade	Cutting Rate	Cutting Method of Declined Trees	Soil Preparation Method	Regeneration Method	Tending Method	Remarks
Strong	100%	Clear Cutting	Soil preparation using large machinery; stumps are uprooted	Planting of entire area	Weeding through a combination of self-propelled machinery and hand tool	
Moderate	100%	Clear cutting	Soil preparation using large machinery; stumps are uprooted	Planting of entire area	Weeding through a combination of self-propelled machinery and hand tool	
Weak	0%	No cutting	No soil preparation	No planting	No tending	

Table 3-3-2 Regeneration Method of Damaged Forests by Forest management type

Forest Management Type	Present Main Species	Main Cause of Damage	Regeneration Method	Regeneration Species	Remarks
F8 Mixed Forest (*Quercus* spp. and Other Broad-Leaved Species)	*Quercus* spp. *T. platyphyllos* *F. excelsior* Others	Drought	I. Artificial Reforestation	*Q. robur* *Q. pedunculiflora* *Q. petraea* *F. excelsior* *F. ornus* *T. platyphyllos* *A. campestre* *A. tataricum* Other assisting species	- Group reservation of young, healthy and useful trees to create multi-story stands - Naturally regenerated trees will be tended together with planted trees - Assisting species will be randomly planted at a ratio of one-third
F3 and F7 *Quercus* Forest (Natural Forest; Plantation)	*Q. robur* *Q. petraea* *Q. pedunculiflora*	Drought	II. Artificial Reforestation	*Q. robur* *Q. cerris* *Q. petraea* *Q. pedunculiflora*	- Selection of *Quercus* spp. suitable for soil conditions - Assisting species will be randomly planted at a ratio of one-third
F2 and F6 *Quercus* Forest (Natural Forest; Plantation)	*Q. frainetto* *Q. cerris*	Drought	III. Artificial Reforestation	*Q. frainetto* *Q. cerris* *Pyrus pyraster* Other assisting species	- Mixed planting of *Q. frainetto* and *Q. cerris/Pyrus pyraster* to be considered - Assisting species will be randomly planted at a ratio of one-third - Naturally regenerated trees will be tended together with planted trees
F1 and F5 Pure Forest of *Q. frainetto* (Natural Forest; Plantation)	*Q. frainetto*	Drought	IV. Artificial Reforestation	*Q. frainetto* Other assisting species	- Mixed planting of *Q. cerris* will be conducted depending on soil conditions
F9 and F10 *R. pseudoacacia* Forest (Plantation)	*R. pseudoacacia*	Drought	V. Artificial Reforestation; Natural Regeneration	*R. pseudoacacia* *F. pennsylvanica* *G. traicanthos* *E. angustifolia*	- In places where regeneration of *R. pseudoacacia* by root sucker is excellent, priority will be given to such root suckers - *E. angustifolia* will be planted at grassland areas and forest edges
F11 and F12 *R. pseudoacacia* Forest (Plantation)	*R. pseudoacacia*	Unsuitable Soil	VI. Artificial Reforestation	*Q. frainetto* *Q. cerris* Others	- Species suitable for soil conditions will be planted
F13 *Populus* Forest (Plantation)	*Populus* spp.	Drought	VII. Artificial Reforestation	*Q. robur* *F. excelsior* *T. platyphyllos* *P. alba* *P. nigra* Other assisting species	- Species suitable for soil conditions will be planted based on a thorough survey on advanced species - *Q. robur* and *T. platyphyllos* will be planted in a mixed manner - *F. excelsior* will be planted at concave sites - Assisting species will be randomly planted at a ratio of one-third

Note: Assisting species are usually planted together with *Quercus* spp. and the typical species are: *Acer tataricum, Acer campestre, Prunus cerasifera, Fraxinus ornus, Crataegus monogyna, Cornus sanguinea, Ligustrum vulgare* and *Rosa canina*. (Those underlined are shrubs with a tree height of not more than 5 m)

The concrete soil preparation method based on the damage grade and planting species is described next.

a) *Quercus* spp. Planting Site - A (Strongly Damaged Sites of F5, F6, F7, F8, F11 and F12 Types)

As shown in Fig. 3-3-2, removal of the limbs and tips, digging up, removal of the stumps and soil preparation are conducted at a 10 m wide transect belt. The stumps are left without soil preparation at the next 5 m wide transect belt. The removed limbs, tips and stumps are accumulated at those transect belts where soil preparation is not conducted.

① The stumps are dug using a rake-dozer and are removed and accumulated at those belts where soil preparation is not conducted. The ground is graded.

② Strips to crack the compacted soil are created using a ripper attached to the back of a rake-dozer. The depth and internal of these strips are 50 cm and 1.5 m respectively.

③ The entire ground of the soil preparation area is ploughed using a disc plough attached to a tractor. The depth is 20 cm.

④ The ploughed ground is then harrowed using a disc harrow attached to a tractor. Planting holes are dug manually using a hand tool.

b) *Quercus* spp. Planting Site - B (F1, F2, F3, F4 and Moderately Damaged Sites of F5, F6, F7, F8, F11 and F12 Types)

As shown in Fig. 3-3-3, alternative 0.8 m wide belts of soil preparation areas and non-soil preparation areas are alternatively introduced. The stumps are left at both types of sites and soil preparation is conducted avoiding the stumps even if this means that work line does not always constitute a straight line. The limbs and tips are accumulated at those belts where soil preparation is not conducted. A mini back-hoe is used at the soil preparation sites to plough and harrow the ground to a depth of 40 cm. Planting holes are dug manually using a hand tool.

c) *Quercus* spp. Planting Site - C (Strongly Damaged Sites of F13 Type)

Soil preparation work identical to that for *Quercus* spp. planting site - A is conducted using a rake-dozer and a tractor over the entire cut-over area. In view of the relatively soft soil, however, work using a ripper to strip the soil is

unnecessary. The limbs and tips are accumulated outside the cutting area. Planting holes are dug manually using a hand tool.

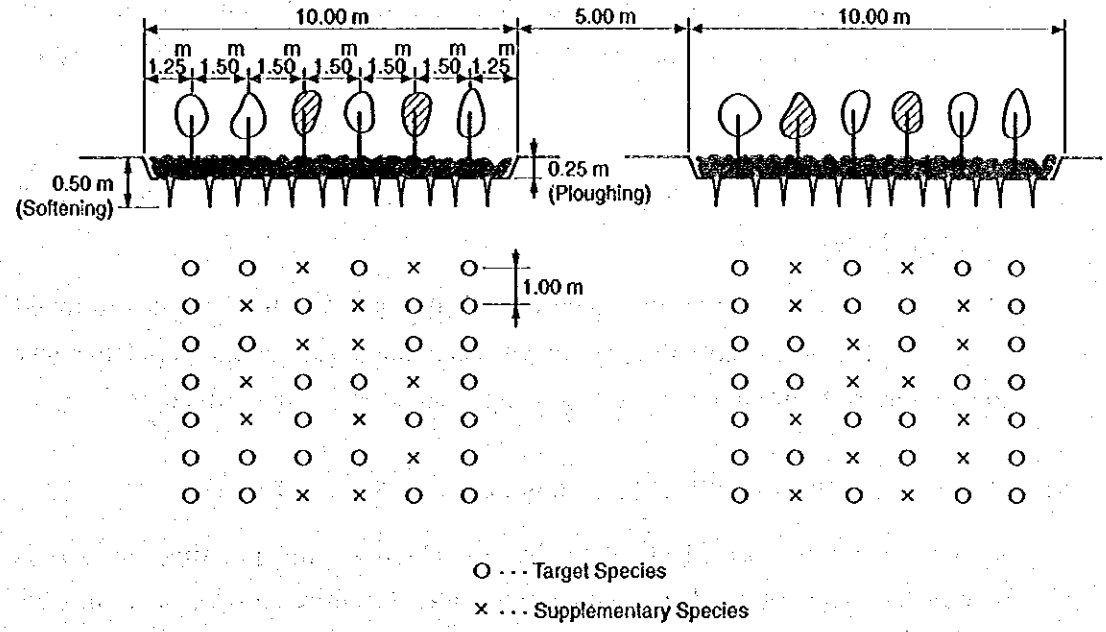


Fig. 3-3-2 Soil Preparation Method at *Quercus* Planting Site A

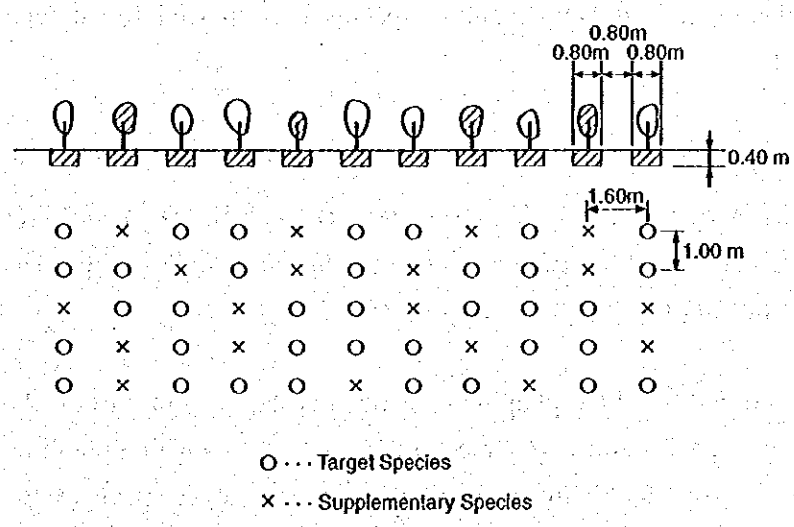


Fig. 3-3-3 Soil Preparation Method at *Quercus* Planting Site B

d) *R. pseudoacacia* Planting Site (Strong Damaged Sites of F9 and F10 Types)

Soil preparation work identical to that for *Quercus* spp. planting site - A is conducted using a rake-dozer and a tractor over the entire cut-over area. In view of the sandy soil, however, work using a ripper to strip the soil is unnecessary. The limbs and tips are accumulated outside the planting area. Planting holes are dug manually using a hand tool.

e) *R. pseudoacacia* Natural Regeneration Site (Moderately Damaged Sites of F9 and F10 Types)

The limbs and tips are accumulated and cleared at standing tree sites to avoid any disruption to the growth of coppiced regenerated trees and of supplementary planted trees. Planting holes are dug using a hand tool or an earth auger.

f) *Populus* spp. Planting Site (Moderately Damaged Sites of F13 Type)

Soil preparation work identical to that for *Quercus* spp. planting site - A is conducted using a rake-dozer and a tractor over the entire cut-over area. In view of the sandy soil, however, the use of a ripper to strip the soil is unnecessary. The limbs and tips are accumulated outside the cutting area. Planting holes are dug manually using a hand tool.

3) Standard Planting Method and Planting Density

The planting density and planting species by damaged forest type are shown in Table 3-3-3.

a) *Quercus* spp. (Including Species for Mixed Planting with *Quercus* spp.)

The target species (*Q. frainetto*, *Q. cerris*, *Q. robur*, *Q. petraea*, *Q. pedunculiflora*, *Fraxinus excelsior*, *Tilia platyphyllos* and *Pyrus pyraster*) will be mixed planted with assistant species.

There will be three planting densities per ha, i.e. 4,000 trees (2,667 trees of the target species and 1,333 trees of assistant species with a planting distance of 1.5 m x 1 m), 6,250 trees (4,167 trees of the target species and 2,083 trees of assistance species with a planting distance of 1.6 m x 1 m) and 6,667 trees (4,445 trees of the target species and 2,222 trees of assistance species with a planting distance of 1.5 m x 1 m).

b) *Robinia pseudoacacia*

R. pseudoacacia, the target species, will be planted together with *Gladitschia triacanthos* and *Elaeagnus angustifolia* in lines or groups. *E. angustifolia* in particular will be planted at forest edges and at the sites with poor soil conditions, such as former *R. pseudoacacia* planting sites which have become grassland following the death of planted trees.

The planting density will be 5,000 trees per ha with a planting distance of 2 m x 1 m.

c) *Populus* spp.

Populus alba or *Populus nigra* will be planted at a density of 625 trees per ha and a planting distance of 4 m x 4 m.

Table 3-3-3 Planting Density and Planting Species by Forest Management Type of Damaged Forest

Forest Management Type	Damage Grade	Planting Density (No. of Trees)			Names of Planting Species
		Total	Target Species	Assistant Species	
F1	Strong	6,250	4,167	2,083	Q.f, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.f, Assistant Trees
F2	Strong	6,250	4,167	2,083	Q.f, Q.c, T.p, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.f, Q.c, T.p, Assistant Trees
F3	Strong	6,250	4,167	2,083	Q.c, Q.pet, Q.ped, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.c, Q.pet, Qped, Assistant Trees
F5	Strong	4,000	2,667	1,333	Q.f, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.f, Assistant Trees
F6	Strong	4,000	2,667	1,333	Q.f, Q.c, T.p, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.f, Q.c, T.p, Assistant Trees
F7	Strong	4,000	2,667	1,333	Q.c, Q.r, Q.pet, Q.ped, T.p, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.c, Q.r, Q.pet, Q.ped, T.p, Assistant Trees
F8	Strong	4,000	2,667	1,333	Q.r, Q.pet, Q.ped, F.e, T.p, Assistant Trees
	Moderate	6,250	4,167	2,083	Q.r, Q.pet, Q.ped, F.e, T.p, Assistant Trees
F9	Strong	5,000	5,000	0	R.p, G.t, E.a
	Moderate	2,500	2,500	0	R.p
F10	Strong	5,000	5,000	0	R.p, G.t, E.a
	Moderate	1,000	1,000	0	R.p
F11	Strong	4,000	2,667	1,333	Q.f, Q.c, Assistant Trees
	Moderate	3,125	2,083	1,042	Q.f, Q.c, Assistant Trees
F12	Strong	4,000	2,667	1,333	Q.f, Q.c, Assistant Trees
F13	Strong	6,667	4,445	2,222	Q.r, F.e, T.p, Assistant Trees
	Moderate	625	625	0	Po. spp.

Note: Q.c; *Q. cerris*, Q.f: *Q. frainetto*, Q.ped: *Q. pedunculiflora*, Q.pet: *Q. petraea*, Q.r: *Q. robur*, R.p: *Robinia pseudoacacia*, Po. spp.: *Populus* spp., E.a: *Elaeagnus angustifolia*, F.e: *Fraxinus excelsior*, G.t: *Gladitschia triacanthos*, T.p: *Tilia platyphyllos*

4) Regeneration Species

The species used for regeneration are classified into target species and assistant species. The target species by type of damaged forest are shown in Table 3-3-3. The main assistant species are *Acer tataricum, Acer campestre, Prunus cerasifera, Fraxinus ornus, Crataegus monogyna, Ligustrum vulgare, Cornus sanguinea* and *Rosa carina.*

In selecting the species for each planting site, the selection of suitable species for each site is important based on a proper understanding of the natural conditions of the site, particularly such soil conditions as the soil type, compactness, moisture conditions and effective depth causes of tree damage and others while referring to the state of growth of previous species and future species indicated by the Romanian Forest Planning. The judgement standards should be those described in App. F-5 (1) - (3), *"Indrumari Tehnice pentre Compozitti"* and *"Norme Tehnice pentru Ingrijirea si Conducerea Arboretelor".*

(2) Tending Standards

The tending standards are shown in Table 3-3-4 through Table 3-3-6. As then natural conditions change from year to year and also from place to place, regular patrolling of the reforestation sites is important to implement tending work at suitable times while referring to the above standards.

Table 3-3-4 Tending Standards for *Quercus* spp.

(times)

Stand Age	1	2	3	4	5	6	7	8	9	10	15	20	35	45	55	65	75
Supplementary Planting		(1)	(1)	(1)													
Correction of Planting		1															
Trimming and Tree Forming		1															
Scarifying	2	2	2	2	2	2											
Weeding by Cutting (at Transect Belts Without Soil Preparation)	1	1	1														
Improvement Cutting (Non-Target Species)							1			1							
Improvement Cutting (Including Target Species)											1	1					
Thinning													1	1	1	1	1

Note: Supplementary planting will be conducted when deemed necessary in view of the supplementary planting criteria *"Indrumari Tehnice pentre Compozitti".*

Table 3-3-5 Tending Standards for *R. pseudoacacia*

(times)

Stand Age	1	2	3	4	5	6	7	8	9	10	15	20
Supplementary Planting		(1)	(1)									
Correction of Planting		1										
Trimming and Tree Forming		1										
Scarifying	2	2										
Improvement Cutting (Including Target Species)				1				1				
Thinning										1	1	1

Table 3-3-6 Tending Standards for *Populus* spp.

(times)

Stand Age	1	2	3	4	5	6	7	8
Supplementary Planting		(1)						
Correction of Planting		1						
Scarifying	2	2	2					
Brush Cutting				1				
Removal of Lateral Buds	1	1						
Pruning							1	
Thinning								1

3.3.2 Reforestation Area

The reforestation area by species is calculated on the basis of the area of cutting and regeneration method by forest management type of damaged forests (Table 3-3-7).

Table 3-3-7 Reforestation Area by Species

Forest Management Type	Present Stand Structure	Regeneration Species	Regeneration Method	Damage Grade	Actual Regeneration Area (ha)		
					Olt	Dolj	Total
F5	Qf	Qf	Planting	Strong	142.7	298.3	441.0
				Moderate	210.9	262.9	473.8
F6	Qc Qf, Qc Qc, Qf, Others	Qc Qf, Qc Pp	Planting	Strong	80.5	338.1	418.6
				Moderate	178.6	757.8	936.4
F7	Other *Quercus* spp. Qr, Qp	Qr, Qc Qpet, Qped, Tp	Planting	Strong	20.8	48.7	69.5
				Moderate	22.5	67.2	89.7
F8	Other *Quercus* spp. & Other spp.	Qr Qpet, Qped, Fe, Tp	Planting	Strong	99.4	46.6	146.0
				Moderate	25.7	41.2	66.8
F9	Rp above 20 years apt for Rp	Rp, Gt, Ea	Planting	Strong	3.8	230.1	233.9
		Rp	Coppicing	Moderate	3.5	127.6	131.1
F10	Rp under 20 years apt for Rp	Rp, Gt, Ea	Planting	Strong	6.0	174.3	180.3
		Rp	Coppicing	Moderate	8.0	31.9	39.9
F11	Rp above 20 years apt for Rp	Qc, Qf	Planting	Strong	1.9		1.9
		Qc, Qf	Coppicing	Moderate		1.8	1.8
F12	Rp under 20 years not apt for Rp	Qc, Qf	Planting	Strong		2.5	2.5
		Qc, Qf	Coppicing	Moderate			
F13	*Populus* spp.	Qr, Fe, Tp	Planting	Strong		17.1	17.1
		Pa	Planting	Moderate	1.6	8.2	9.8
Total					805.7	2,454.2	3,259.9

Seed Stands

F1	Qf	Qf	Planting	Strong		19.7	19.7
F2	Qc	Qc, Qf	Planting	Strong		27.1	27.1
				Moderate		6.1	6.1
F3	Qpub, Qped	Qped, Qpet, Qc	Planting	Moderate		1.4	1.4
Total						54.3	54.3

Planting Total	794.2	2,347.3	3,141,5
Coppicing Total	11.5	161.3	172.8
Total	805.7	2,508.5	3,314.2

Note: Qf: *Q. frainetto*; Qc: *Q. cerris*; Pp: *Pyrus pyraster*; Qr: *Q. robur*; Qpet: *Q. petraea*; Qped: *Q. pedunculiflora*; Tp: *Tilia platyphyllos*; Rp: *Robinia pseudoacacia*; Pa: *Populus alba*; Qpub: *Q. pubescens*; Fe: *Fraxinus excelsior*; Ea: *Elaeagnus augustifolia*; Gt: *Gladitscia triacanthos*

3.3.3 Tending Area

The tending area is calculated based on the reforestation area and the tending standards (Table 3-3-8).

Table 3-3-8 Tending Area

(ha)

Type of Work	Olt			Dolj			Total			Total
Planting Species	*Quercus* spp.	*Robinia*	*Populus*	*Quercus* spp.	*Robinia*	*Populus*	*Quercus* spp.	*Robinia*	*Populus*	
Supplementary Planting	156.6	8.5	0.3	387.3	225.5	1.7	543.9	234.1	2.1	780.0
Correction of Planting	782.8	21.3	1.6	1,936.5	563.9	8.2	2,719.3	585.2	9.8	3,314.2
Trimming and Tree Forming	782.8	21.3		1,936.5	563.9		2,719.3	585.2		3,304.4
Scarifying	9,394.1	85.2	9.6	23,237.4	2,289.6	49.2	32,631.5	2,374.8	58.8	35,065.1
Weeding	2,348.5	21.3	1.6	5,809.4	159.5	8.2	8,157.9	180.8	9.8	8,348.4
Improvement Cutting of Brush	1,565.7	21.3		3,872.9	563.9		5,438.6	585.2		6,023.7
Intraspecific Improvement Cutting	1,565.7	21.3		3,872.9	563.9		5,438.6	585.2		6,023.7
Removal of Lateral Buds			3.2			16.4			19.6	19.6
Pruning			1.6			8.2			9.8	9.8

3.4 Items Related to Nursing

The planting stock required for the Plan will be supplied in the form of seedlings and cuttings. Only *Q. frainetto* and *Populus alba* will use cuttings to produce planting stock. In the case of *Q. frainetto*, the planting stock will, in principle, be produced in the form of seedlings but the extremely small seed production volume in normal years makes it impossible to supply the required quantity of seedlings. To supplement the small quantity of seedlings in normal years, a small quantity of cuttings will be used to produce additional planting stock.

3.4.1 Seeds

(1) Decision on Collection Volume

The seed collection volume is planned based on the standard germination rate of each species. However, as the quality of seeds varies from one year to another, the planned figure must be revised by checking the actual germination rate in a given year in accordance with the following formula.

$$X = x + \frac{x(d + 5)}{100}$$

Where,

X : actual seed collection volume (kg)

x : calculated seed requirement (kg)

d : standard germination rate (%) - actual germination rate (%)

The standard germination rate and standard seeding quantity of the main species are shown in Table 3-4-1.

Table 3-4-1 Standard Germination Rate and Standard Seeding Quantity

Species	Standard Germination Rate (%)	Seeding Quantity per m²		kg/ha
		Number of Seeds	(g)	
Quercus robur	90	30	150.0	4,000
Quercus frainetto	90	33	115.0	3,067
Quercus petraea	85	30	105.0	2,800
Quercus pedunculiflora	85	30	180.0	7,800
Robinia pseudoacacia	95	75	1.6	43
Fraxinus excelsior	85	70	6.3	168
Tilia platyphyllos	90	130	10.0	267
Purnus avium	85	100	20.0	533
Purnus cerasifera	80	60	30.0	800
Acer tataricum	90	120	6.6	176
Acer campestre	63	150	13.0	360
Ligstrum vulgare	85	150	4.2	112
Rosa canina	68	200	4.0	107
Fraxinus ornus	90	100	3.0	80
Cornus sanguinea	95	80	6.0	160

Source: *PEPINIERE: Metode si Procedee pentru Cultura in Pepiniera a Principalelor Specii Forestiere si Ornamentale*

(2) Collection of Seeds

1) Timing

The collection of seeds at the most appropriate time for each species is crucial. As the timing for seeds to mature slightly differs each year because of specific weather conditions, a careful survey must be conducted in advance so that the best timing for

collection is not missed. As the collection of naturally fallen, fully ripe seeds from the ground is necessary in the case of *Quercus* spp., these seeds must be collected immediately after falling to improve the collection efficiency.

2) Collection Method

The most efficient collection method must be selected for each species. In the case of *Quercus* spp., particularly *Q. frainetto*, a net or sheet should be placed on the ground at points of falling to facilitate collection in order to increase the collection efficiency and to prevent a decline of the seed quality.

(3) Treatment of Seeds

The collected seeds should undergo an appropriate seed preparation process for each species. The seeds of *Quercus* spp. must not be allowed to dry out. Seed selection should be conducted in clean water, such as well water, and the selected seeds should then undergo treatment to kill seed pests using carbon bisulphide (CS_2). While seeds to be used in the following spring will be mixed with sand and stored in the ground, it is preferable for sowing to be conducted in the autumn of the year of collection.

(4) Appraisal of Seeds

Verification of the germination rate will be conducted by means of sowing a germination bed or cutting seeds to estimate the germination capacity, etc. This verification process is essential to ensure the efficient use of seeds.

3.4.2 Nursing

(1) Production of Seedlings

1) Sowing Volume

The appropriate sowing volume per unit sowing bed area will be determined by the species, seed quality, duration of stay in seed bed, sowing method, speed of growth, expected yield of planting stock per unit area and planting age, etc. In general, excessive sowing makes the germinated seeds more prone to damage and the resulting high mortality of the seedlings creates more thinning work. At the same time, many seedlings are weak and unsuitable for further nursing. In contrast, insufficient sowing leads to the uneven shape of seedlings and makes the sowing bed vulnerable to weed growth, resulting in uneconomical operation due to weeding work and a small number of healthy seedlings per unit area.

The appropriate sowing volume is calculated by the following formula using the numerical values shown in Table 3-4-1.

$$N = n + \frac{n(d + 5)}{100}$$

Where,

N : sowing volume per 1 m of sowing strip

n : standard sowing volume per 1 m of sowing strip (Table 3-4-1)

d : standard germination rate (%) - actual germination rate (%) (Table 3-4-1)

2) Germination Treatment

Appropriate germination promotion treatment is desirable to ensure the even growth of good quality seedlings. In general, the seeds are kept in cold water for 3 - 5 days. In the case of seeds of *Quercus* spp., germination treatment is unnecessary if they are sown in the autumn of the year of collection.

The seeds of *R. pseudoacacia* must undergo germination treatment consisting of dipping in hot water of 90 - 95°C for approximately two minutes.

3) Sowing of Seeds

The sowing season will be either spring or autumn and the appropriate season should be selected for each species. As the weather conditions slightly differ from year to year, careful attention must be paid to the appropriate timing for sowing by accurately assessing the weather conditions of the year.

Strip sowing is the basic sowing method and the sowing distance should follow the relevant standard for each species shown in Table 3-4-2. Weeding should be conducted when the weeds are still small. The combination of manual work and the use of herbicide should be conducted to ensure efficient weeding.

Rouging is essential for the production of healthy seedlings. At the time of sowing, it is normal practice to sow an excess quantity of seeds to ensure the germination of surplus seedlings over and above the expected number of healthy seedlings in anticipation of mortality and insect damage after germination and to prevent uneven germination. Accordingly, it is necessary to rogue this surplus quantity to grow the required quantity of healthy seedlings. The following types of seedlings will mainly be rogued.

① Seedlings in densely growing areas

② Seedlings of poor growth

③ Seedlings of poor form

④ Seedlings of extraordinary growth

⑤ Seedlings damaged by disease

In the case of broad-leaved trees with large seeds, the seeds are sown with some distance between them. Rouging is, therefore, only conducted for damaged seedlings. The seedlings must be properly watered either in the morning or evening using a sprinkler. The application of additional fertiliser and disinfectant should be conducted when deemed necessary.

4) Production Period and Planting Stock Standards

The nursing period for seedlings and the standards for planting stock are shown in Table 3-4-2.

Table 3-4-2 Seedling Production Standards

Species	Period (year)	Distance Between Strips (cm)	Standard Basal Diameter of Planting Stock (mm)	Number of Seedlings per ha
Quercus robur	2	60-15-60	6.0	400,000
Quercus frainetto	2	60-15-60	6.0	250,000
Quercus cerris	2	60-15-60	7.0	400,000
Quercus petraea	2	60-15-60	6.0	350,000
Quercus pedunculiflora	2	60-15-60	6.0	400,000
Robinia pseudoacacia	1-2	60-15-60	6.0	200,000
Fraxinus excelsior	1-2	60-15-60	7.0	300,000
Tilia platyphyllos	1-2	60-15-60	6.0	200,000
Prunus avium	1-2	60-15-60	6.0	300,000
Acer tataricum	1-2	60-15-60	5.0	300,000
Acer campestre	1-2	60-15-60	5.0	200,000
Ligstrum vulgare	1-2	60-15-60	5.0	250,000
Rosa canina	1-2	60-15-60	5.0	350,000
Fraxinus ornus	1-2	60-15-60	5.0	250,000
Cornus sanguinea	1-2	60-15-60	5.0	300,000

Source: *PEPINIERE: Metode si Procedee pentru Cultura in Pepiniera a Principalelor Specii Forestiere si Ornamentale*

(2) Production of Planting Stock by Cuttings

The production of planting stock by cuttings is restricted to *Q. frainetto* and *Populus alba*.

In the case of *Q. frainetto*, as the rooting rate of cuttings is not particularly favourable, planting stock is mainly produced by sowing to obtain seedlings. However, planting stock is also produced from cuttings as a supplementary method to compensate for the low production volume of seedlings in years of low seed production.

The production of planting stock from cuttings of *Populus alba* is conducted in a similar manner to that of *P. euroamericana*. Given the slightly lower rooting rate than *P. euroamericana*, however, a sunshade is used to improve the rooting rate of *Populus alba* together with treatment to facilitate rooting using a chemical agent (silver nitrate) as described later.

As the rooting rate of *Q. frainetto* is extremely low, the findings of cutting experiments are fully utilised to improve the rooting rate. The planned production processes of planting stock from cuttings of *Q. frainetto* are described below.

1) Collection of Cuttings

Cuttings are collected from young mother trees of good quality to improve the rooting rate. In the case of *Q. frainetto*, cuttings are collected from 2 - 3 year old seedlings. As shoots are used as cuttings, they are usually collected around early May when the first growth of shoots is completed.

2) Rooting Treatment of Cuttings

After dipping the cuttings in clean water or a one-thousandth part silver nitrate solution for 12 hours, either S2 or oxiberon powder is applied to the cut end.

3) Cutting Bed

The cuttings are placed in a bed inside a mist house. The soil used for this purpose consists of a mixture of peat moss and sand in equal parts and the soil bed thickness is approximately 30 - 40 cm.

4) Production Period and Planting Stock Standards

The rooted cuttings are removed from the mist house and are transplanted in an open field in the autumn of the same year. They are grown in this field for 1 - 2 years to

allow sufficient rooting. For reforestation purposes, cuttings which show the same degree of rooting as seedlings are used. If rooting is considered to be insufficient, the cuttings are further nursed in the nursing field.

5) Construction of Mist House

Given the demand for planting stock and the availability of seeds, some 24,000 planting stock must be produced a year from cuttings in years other than bearing years.

Based on the cutting experiment results, the required size of the mist house is calculated as follows.

$$24{,}000 \div (20{,}000 \times 0.5 \times 0.5) \times 1.7 \times 100 = 816\ m^2$$

Notes
① Survival rate inside mist house: 50%
② Survival rate during field nursing period: 50%
③ Quantity of cuttings per 100 m^2: 20,000
④ Ratio of areas other than cutting bed: 0.7

Consequently, two mist houses with a floor area of 410 m^2 each must be constructed.

One mist house in Olt County (Bobicesti Nursery)
One mist house in Dolj County (Zaval Nursery)

3.4.3 Production Volume of Planting Stock

The required volume of planting stock is calculated based on the reforestation area and planting density (Table 3-4-3).

Table 3-4-3 Production Volume of Planting Stock by Species

(Unit: trees)

Species	Number of Nursery Stock		
	Total	Olt	Dolj
Q. frainetto	5,120,108	1,742,390	3,377,718
Q.cerris	4,481,849	845,903	3,635,946
Q.robur	876,078	330,550	545,528
Q.petraea	149,367	62,534	86,833
Q.pedunculiflora	117,268	53,592	63,676
Fraxinus excelsior	144,949	74,418	70,531
Tilia platyphyllos	98,523	44,660	53,863
Pyrus pyraster	515,642	95,866	419,776
Robinia pseudoacacia	2,979,130	81,760	2,897,370
Gladitschia triacanthos	207,100	4,900	202,200
Elaeagnus angustifolia	103,550	2,450	101,100
Populus spp.	7,350	1,200	6,150
Assistant Trees	4,855,144	1,371,651	3,483,493
Total	19,656,057	4,711,873	14,944,184

3.4.4 Designation of Seed Stands and Management of Seed Orchard

The production volume of *Q. frainetto* seeds, which are the most required for the Plan, falls substantially short of the required volume because of the small number of good seed stands and long interval of 8 - 10 years between bearing years. Consequently, the sufficient production of seeds during the plan period cannot be anticipated. In order to attempt increased seed production under the Plan, healthy forests capable of producing seeds will be newly designated as seed stands and thinning will be conducted to facilitate the process of seed bearing.

Moreover, appropriate management, including fertiliser application and pest control using chemical insecticides, will be conducted at the existing seed orchard in order to produce seeds.

(1) Designation of Seed Stands

As the creation of new seed stands takes a long time, existing relatively young *Q. frainetto* stands which have begun seed production will be designated as seed stands under the Plan and thinning will be conducted when necessary to facilitate seed bearing.

1) Candidate Forests for New Seed Stands

The planned forests for designation as seed stands are listed in Table 3-4-4.

Table 3-4-4 Forests to be Designated as Seed Stands

(1) More than 80 years of age

County	Forest Range	UP	ua.	Area (ha)	Age (y)	Productivity	Consistency	Height (m)	BDH (cm)
Olt	Vulturesti	III Topana	39A	10.7	118	3		22/18	42
			43A	7.5	98/148	2/3/2		23/20/24	52/24/34
			43B	8.5	113				
		Sub Total		26.7					
		V Seaca	13B	15.3	112	3/3		20/21	34/34
			17B	12.0	82	2/2		21/22	34/38
			17D	17.8	87	2		19	28
			32C	27.8	102	3		19	34
			34B	26.2	102	3		20	34
		Sub Total		99.1					
	Sub Total			125.8					
Dolj	Amaradia	III Balota	16D	12.4	95	3	0.7	20	30
			17E	15.5	95	3	0.7	20	28
			18C	14.9	95	3	0.8	20	30
			20B	18.4	95	3	0.7	20	30
	Sub Total			61.2					
Total				187.0					

(2) Less than 80 years of age

County	Forest Range	UP	ua.	Area (ha)	Age (y)	Productivity	Consistency	Height (m)	BDH (cm)
Olt	Vulturesti	V Seaca	3C	3.7	72	3		17	20
			24C	16.4	57/77	2/3		15/17	16/28
			25B	36.1	52/72	2/3/3		16/17/15	16/28/16
	Sub Total			56.2					
Dolj	Filiasi	II Argetoaia	114E	6.2	55	3	0.8	14	16
			115B	9.6	55	3	0.9	14	16
			115C	10.6	50	3	0.9	14	16
			116B	1.1	70	3	0.8	17	24
			116F	4.2	50	3	0.9	13	14
			154C	6.5	45	3	0.8	14	16
		Sub Total		38.2					
	Amaradia	III Balota	25B	27.8	50	3	0.8	14	16
			26B	43.5	50	3	0.8	14	18
			27	28.1	50	3	0.8	14	16
			28	22.1	50	3	0.8	13	18
			29A	49.0	50	3	0.8	18	14
			30B	26.1	55	3	0.8	15	
		Sub Total		196.6					
	Sub Total			234.8					
Total				291.0					

2) Management Method

Healthy upper-story trees with a large crown and good quality will be selected as seed trees. In the case of forests which are younger than 80 years old, thinning will be repeated every 10 - 15 years to remove trees other than seed trees in order to facilitate the full development of the crown with a target standing tree density of approximately 0.5 - 0.6.

In the case of forests of 80 years of age or more, intensive thinning will be avoided. Only damaged trees and those trees of which the branches suppress the growth of the branches of seed trees will be removed.

As far as the control of *Balaninus glandium*, a seed insect, is concerned, chemical control is ruled out in view of the required equipment and cost for high trees at the planned seed stand sites and it is hoped that the maintenance of healthy stand conditions will alleviate damage.

(2) Management of Seed Orchard

No new seed orchards are planned under the Plan and the existing seed orchard at Balasan in the area of the Perisor Forest Range Office will be utilised.

1) Seed Orchard Details

The details of the seed orchard to be used under the Plan are given in Table 3-4-5.

Table 3-4-5 Seed Orchard at Balasan (Perisor Forest Range Office)

No.	Area (ha)	Year of Establishment	Original Number of Trees	Existing Number of Trees (15th May, 1999)	/ha
1	1.6	1982	326	115	71.9
2	2.0	1983	408	200	100.0
3	3.5	1984	564	295	84.3
4	2.2	1985	360	150	68.2
5	1.5	1985	235	45	30.0
Total	10.8		1,893	805	74.5

2) Management of Seed Orchard

At present, the average number of seed trees per ha is as small as 75 trees and, therefore, proper management efforts are required to maintain the present state as much as possible.

The soil of the seed orchard has a high sand content and is not particularly suitable for the growth of *Q. frainetto*. The application of organic fertiliser, mainly compost, is desirable to provide nutrients and to improve the soil. The liberal use of chemical fertilisers should be avoided.

Weeding should be conducted every year as required and cut grass should be placed around the base of the trees to prevent drying of the soil.

In regard to tree form, as the tree form has already been established, only the cutting of epinastic branches will be necessary for the purpose of creating a laterally spread crown.

The control of diseases as well as pests is highly desirable. The control of *Balaninus* sp. is particularly important. As a reliable control method has not yet been established for *Balaninus* sp., the spraying of insecticide based on the predicted outbreak of larvae at the site is desirable. The preferable insecticide is MEP emulsion (Sumithion) in view of possible impacts on the environment and economy. A 1: 500 - 1,000 Sumithion solution should be sprayed immediately after the incubation of larvae at a rate of 60 - 80 litres per ha. Confirmation of the suitability of Sumithion prior to its use is important as some species are sensitive to Sumithion and other similar insecticides.

3.5 Items Related to Drainage and Infiltration Works

Drainage and infiltration works will be constructed mainly in those areas where standing trees are remained in damaged *Quercus* spp. forests to drain stagnant water in the top soil layer and to improve the water retention function of the soil.

(1) Specifications

The following specifications will be adopted for drainage and infiltration works.

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

2) The standard interval is 12.5 m. In principle, linear 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 Damaged Forests

Forests where drainage and infiltration works will be constructed as a damage restoration measure are listed in Table 3-5-1.

Table 3-5-1 Forest Management Types of Subject Damaged Forests for Construction of Drainage and Infiltration Works as Damage Restoration Measure

Species	Forest Management Type	Damage Grade	Cutting Rate	Subject Site
Quercus spp.	F5, F6, F7, F8	Moderate	50%	Remaining area (50%)
		Weak	20%	Entire stand
Quercus spp.	F1, F2, F3	Strong	60%	Remaining area (40%)
		Moderate	40%	Remaining area (60%)
		Weak	15%	Entire stand

The area of damaged forests where drainage and infiltration works will be constructed is shown in Table 3-5-2.

Table 3-5-2 Area of Subject Damaged Forests for Construction of Drainage and Infiltration Works as Damage Restoration Measure

County	Forest Area (ha)	Operation Area (ha)
Olt	3,273	1,948.1
Dolj	5,684	3,383.1
Total	8,957	5,331.2

(3) Annual Work Volume and Cost

The planned annual work volume and the cost for the construction of drainage and infiltration works as a damage restoration measure are shown in Table 3-5-3.

Table 3-5-3 Annual Work Volume and Cost of Drainage and Infiltration Works as Damage Restoration Measure

County	Operation Year										Total	Cost
	1	2	3	4	5	6	7	8	9	10	(ha)	(US$)
Olt				448.1	1,500.0						1,948.1	14,741
Dolj				383.1	1,500.0	1,500.0					3,383.1	25,601
Total				831.2	3,000.0	1,500.0					5,331.2	40,341

3.6 Supplementary Planting at Forest Mantle

In the case of those stands of which the coverage ratio by forest mantle is less than 60%, supplementary planting will be conducted to achieve the target coverage ratio of 80% for the purpose of suppressing the progress of forest decline through reduction of the damage by drought, high temperatures, strong wind and stock raising.

(1) Supplementary Planting Standards

1) The planting species to enhance forest mantles will be *R. pseudoacacia*, *Elaeagnus angustifolia* and *Gladitschia triacanthos*. The standard planting density will be 10,000 trees per ha with a planting distance of 1m x 1m. 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 Damaged Forests

The subject forests for supplementary planting at forest mantles will be those stands where the coverage ratio by forest mantle is less than 60%.

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.

(3) Annual Work Volume and Cost

The planned annual work volume and the cost of supplementary planting at forest mantle and the cost are shown in Table 3-6-1.

Table 3-6-1 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				6.0	7.4						13.4	24,117
Dolj				6.0	6.0	7.1					19.1	34,375
Total				12.0	13.4	7.1					32.5	58,492

3.7 Items Related to Forest Road Network

3.7.1 Technical Standards for Forest Roads

The technical standards for forest roads shown in Table 3-7-1 are set for the proper maintenance of and safe passage on forest roads.

Table 3-7-1 Technical Standards for Forest Roads

Item	Standard	Remarks
- Road Width	- 3.50 m	
- Carriage Width	- 2.75 m	
- Shoulder Width	- 0.37 m	
- Design Speed	- 20 km/hr	
- Longitudinal Slope	- 12% or less	
- Roadbed	- Gravel or tree branch paving at standing water sites - Gravel paving at sites with a longitudinal slope of 9% or more	- Basic roadbed thickness: 15cm
- Cross Slope	- 5% or less	
- Drainage Facilities	- Unsupported side ditches - Cross ditches	
- Passing Place	- Minimum width: 5 m - Minimum effective length: 20 m	

Fig. 3-7-1 shows an example of the standard cross-section for forest road earthwork.

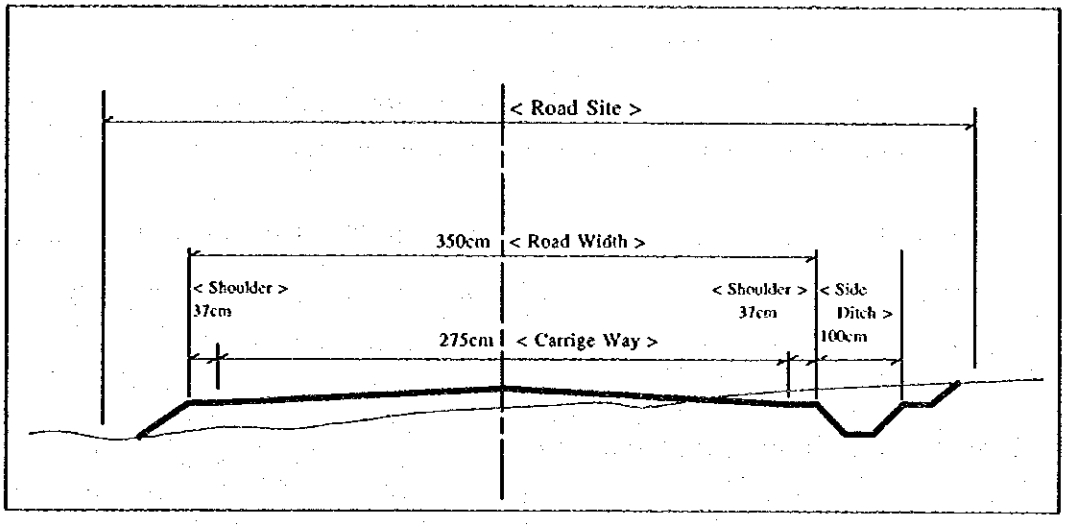


Fig. 3-7-1 Standard Cross-Section for Forest Road Earthwork

3.7.2 Improvement and Maintenance of Forest Roads

No new forest roads will be constructed under the Plan.

(1) Forest Road Improvement Plan

The planned work volume by forest range office is shown in Table 3-7-2. Forest road improvement work will be conducted in accordance with the relevant technical standards for forest roads.

Table 3-7-2 Forest Road Improvement Plan

County	Forest Range	Roadbed Work (km)	Cost (US$ 1,000)	Remarks
Olt	Bals	16.0	55.5	
	Caracal	5.0	17.3	
	Slatina	17.0	58.9	
	(Draganesti-Olt)	4.0	13.9	
Sub-Total		42.0	145.6	
Dolj	Amaradia	5.0	17.3	
	Calafat	1.0	3.5	
	Craiova	15.0	52.0	
	Filiasi	11.0	38.1	
	Perisor	3.0	10.4	
Sub-Total		35.0	121.3	
Total		77.0	266.9	

(2) Maintenance and Management of Forest Roads

In regard to the improvement of forest roads, the following points must be carefully considered for continued proper maintenance and management.

① During the rainy season and after rain showers, the drainage facilities of forest roads, especially cross ditches, should be inspected and repaired if necessary.

② Promotion of the introduction of the benefit principle.

3.8 Items Related to Forest Machinery

The forest machinery to be used for the implementation of the Plan is shown in Table 3-8-1 through Table 3-8-3. The research equipment and facilities are described in 3.10.

Table 3-8-1 Machinery/Equipment Required for Timber Production

Machinery/Equipment	Purpose	Quantity	Cost (US$ 1,000)
4 WD Tractor	Skidding and stacking	12	728
< Attachments for Above >			(Inclusive of attachment cost below)
Skidder	Skidding	6	
Grab for Stacking	Stacking and arrangement of wood	6	
Chainsaw	Felling, trimming and bucking	112	68

Table 3-8-2 Machinery/Equipment Required for Reforestation

Machinery/Equipment	Purpose	Quantity	Cost (US$ 1,000)
Mini Back-Hoe	Soil preparation at group selective cutting sites and forest mantles	10	475
Earth Auger	Digging planting holes at forest mantles	4	9
Cultivator (60 cm wide)	Scarifying at cut-over sites	60	44
Cultivator (30 cm wide)	Scarifying at group selective cutting sites	71	40

Table 3-8-3 Machinery/Equipment Required for Drainage and Infiltration Work Construction

Machinery/Equipment	Purpose	Quantity	Cost (US$ 1,000)
4 WD Tractor	For both damaged forests and prevention forests	2	11
< Attachments for Above >			(Inclusive of attachment cost below)
Disc Plough		2	
Carried Plough		2	