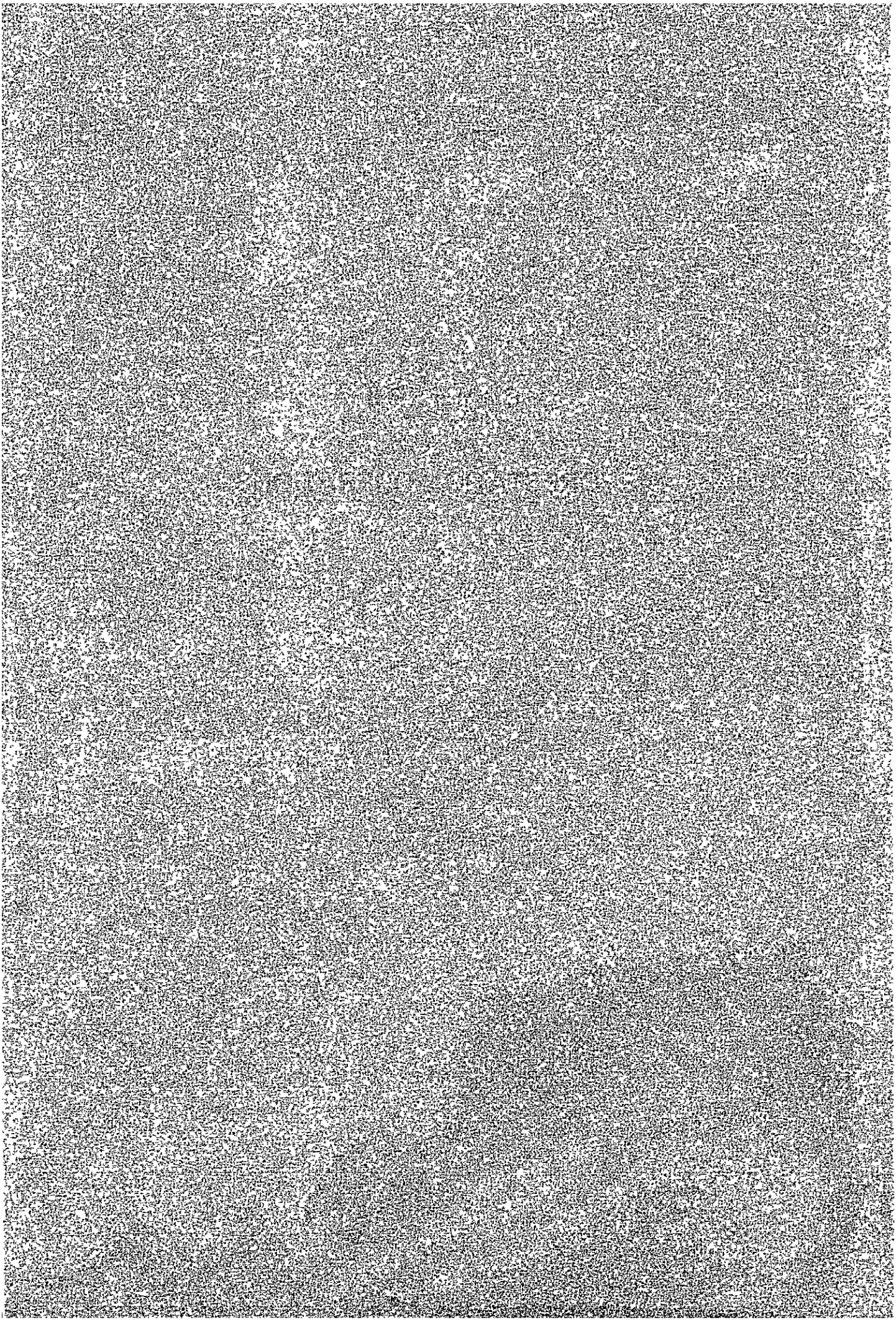
CHAPTER II

AFFORESTATION OPERATIONS



CHAPTER II

AFFORESTATION OPERATIONS

In artificial afforestation, the creation of forests comprised of high quality trees using superior seedlings and efficient methods of work are important factors. In this section, explanation on various tasks from investigation of the area for afforestation to thinning will be explained following the task processes to the extent possible for each factor identified in the "Tipification of Forest Management" established in the Afforestation Plan (Master Plan) for the Eastern Region of Paraguay.

The term afforestation as used here refers to afforestation either through planting of seedlings or through direct seeding.

1. Processes for Afforestation Tasks by Tipification of Forest Management

The Afforestation Task Process under the 5-year afforestation plan is as shown in Figure II-1 through 3. (As explained in the 5-year afforestation plan, the revenue from the prodution with respect to afforestation targeting, the production of fire wood and pulp type categorized as Production Forest I-2 and Production Forest IV-2 respectively will not cover the afforestation cost and no plans are in place with respect to these categories for the time being.)

The type of forest management of afforestation and the objective and objective site for afforestation determined under the Afforestation Plan (Master Plan) for the Eastern Region of Paraguay are shown in Table II-1.

Upon planning afforestation, which of these types are chosen must be determined based on the objective of the afforestation.

In the sections that follow, the task content of afforestation is explained in the flow of such processes to the extent possible in units of afforestation work with similar type.

Table II-1 Type of Forest Management, Objectives and Targeted Areas for Afforestation

Category / Type	Objective of the Afforestation	Objective Site	Remarks
Productive Forest I-1	Timber production	Agricultural land, pastureland, bush land	
Productive Forest II	Agro-forest	Agricultural land, pastureland	Primarily targeted small landowners
Productive Forest III	Timber production and protection of livestock	Pastureland	
Productive Forest IV-1	Timber production and windbreak	Agricultural land, pastureland	Areas with strong seasonal winds
Productive Forest V	Sylvo-pastoral	Agricultural land, pastureland	

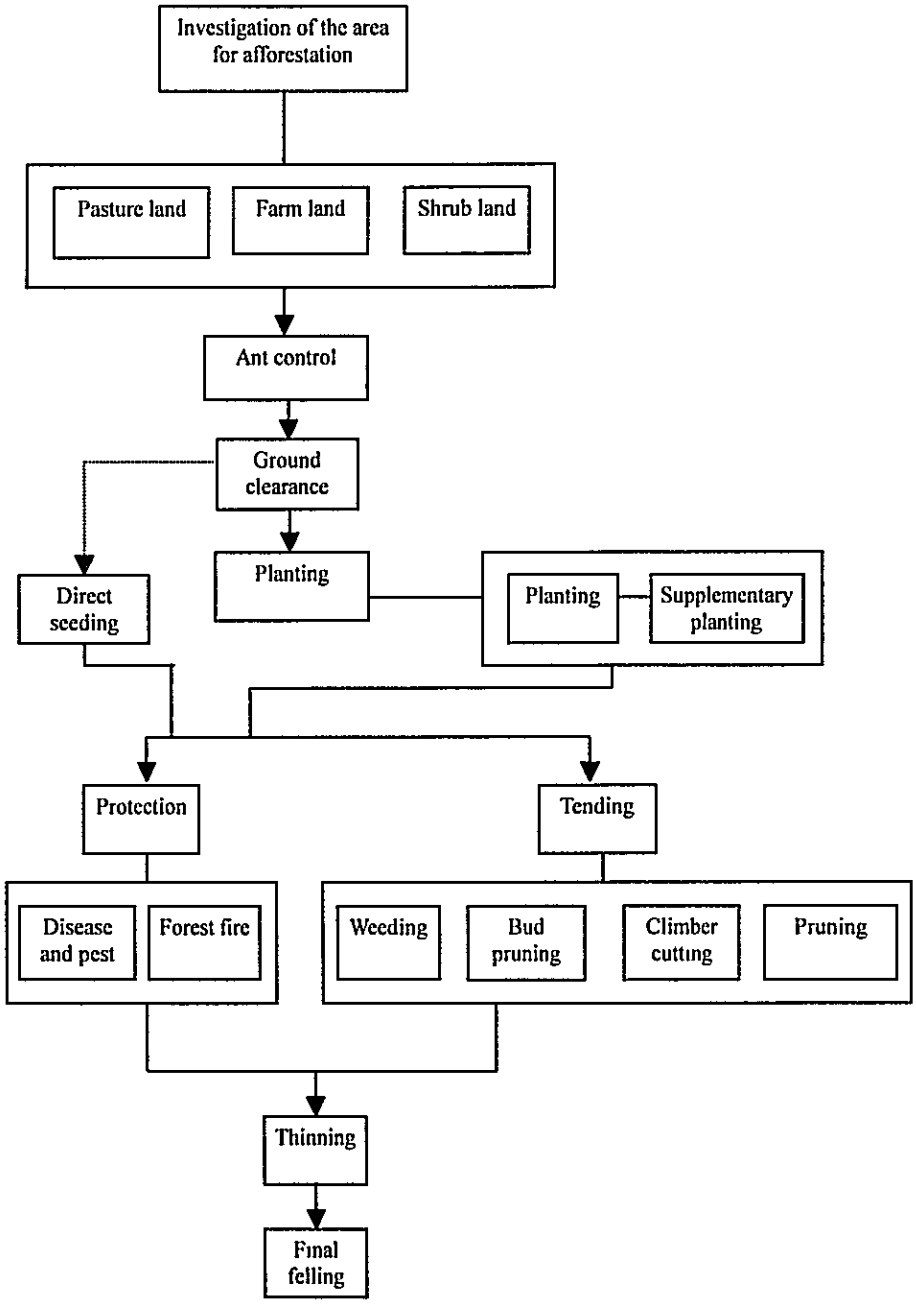


Figure II-1 Afforestation Task Processes
(Productive Forest I-1, Productive Forest III and Productive Forest IV-1)

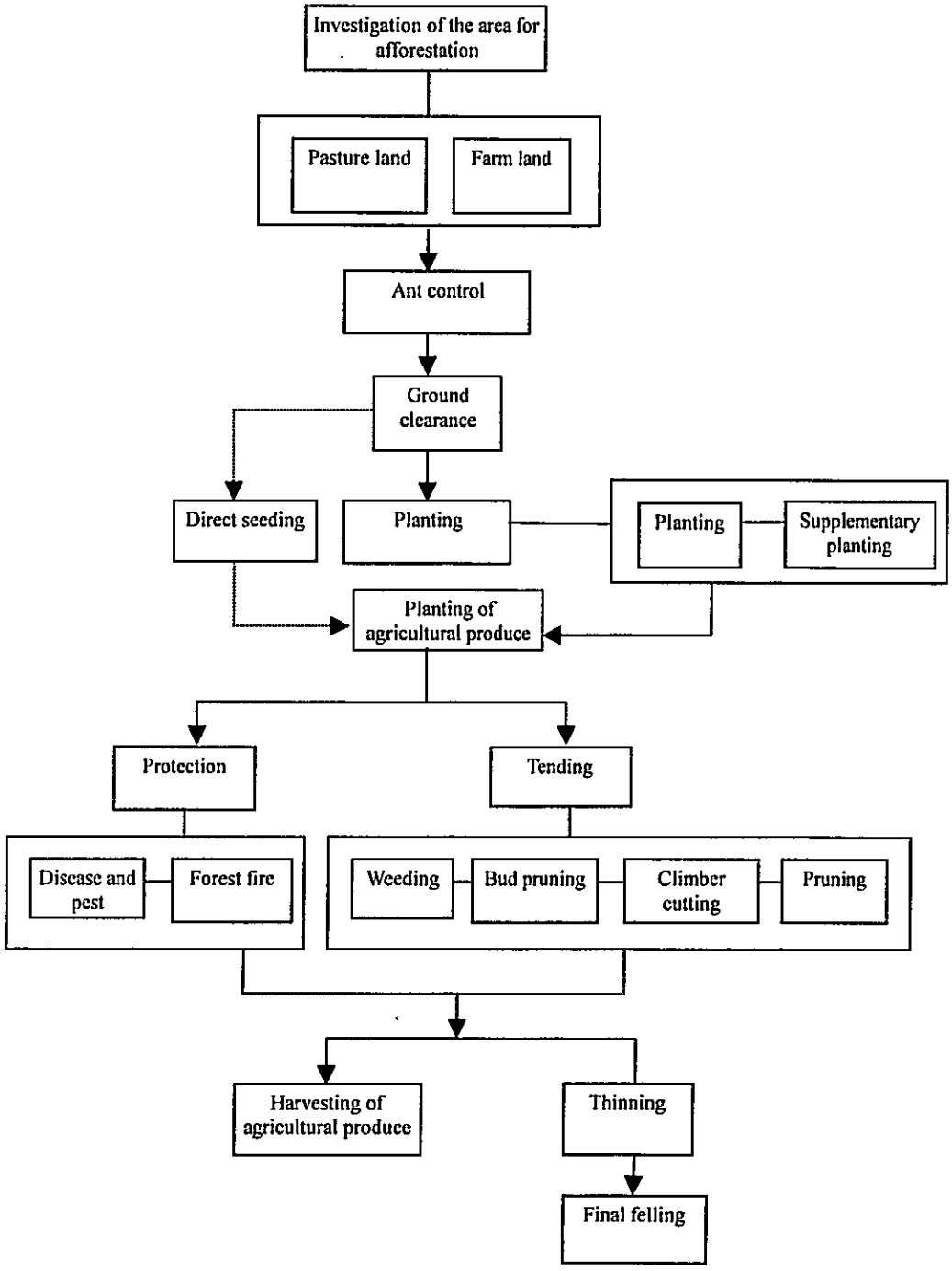


Figure II-2 Afforestation Task Processes (Productive Forest II)

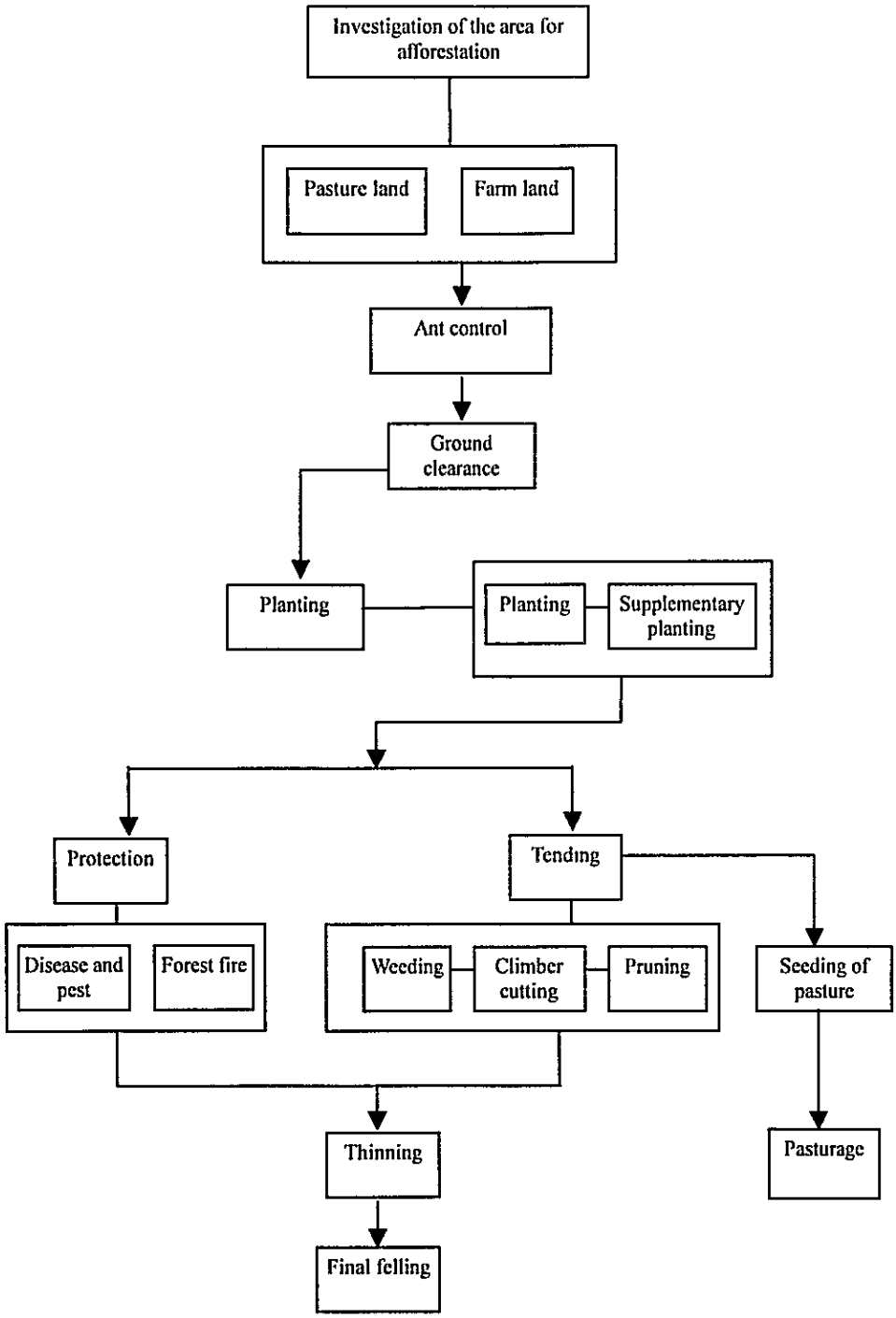


Figure II-3 Afforestation Task Processes (Productive Forest V)

2. Afforestation of Productive Forest I-1, Productive Forest III and Productive Forest IV-1

These forest management types have as its primary objective the production of timber. However, Productive Forest III has another objective to protect grazing livestock from extreme climatic conditions and for Productive Forest IV-1, a secondary objective is to protect agricultural and pasture land from strong winds.

2-1 Investigation of the Area Scheduled for Afforestation

2-1-1 Major Objectives of the Investigation

Prior to implementing afforestation, the location, road conditions, current land use, land mass, terrain, elevation, climate, soil conditions and growth of trees in afforested areas in the vicinity must be investigated. Next, the type category of the afforestation, species used, required amount of seedlings or seeds and the method of obtaining such materials and supply of labor resources are reviewed.

2-1-2 Content of the Items to be Investigated

The meaning, content and points to be noted with respect to the major items to be investigated given above are as follows:

(1) Location

Determining the location of the area scheduled of afforestation accurately is indispensable when the species to be planted is reviewed using maps that provide information on the soil and land use. Moreover, this is necessary in order accurately to identify the afforestation area on maps and in various document related procedures that are required.

(2) Land mass

The land mass of the area targeted for afforestation is obviously necessary in order to review the required amount of seedlings, the required amount of labor and the period required to complete the afforestation.

(3) Circumstances of current land use

The method and difficulty in preparing the land are impacted by whether the area targeted for afforestation is cultivated agricultural land, uncultivated land, natural pasture or shrub land.

(4) Road conditions

The state of the road including public road impacts whether or not seedling may be supplied to the area of afforestation in a healthy state as well as the cost of transporting required equipment and difficulty or otherwise in obtaining labor.

(5) Terrain

While since the majority of land targeted for afforestation is agricultural land or natural pastures and excessively inclined land is not conceivable, localized differences in the terrain may impact the selection of the species to be planted and the current situation needs to be noted (for example, growth of E. grandis is inferior when there are localized lowlands and in such cases, E. camaldulensis should be adopted).

(6) Elevation

The relative difference in elevation of the area targeted for afforestation impacts the selection of the species and the current situation needs to be noted (for example, towards the lower part of sloped land, E. camaldulensis should be adopted in preference to E. grandis).

(7) Climate

The level of precipitation and the temperature of the area targeted for afforestation impacts choice of species. Moreover, in areas with high winds, afforestation should result in windbreak for agricultural and grazing land and consideration needs to be given to a method of afforestation that takes such conditions into account.

(8) Soil conditions

The species selected will differ by whether the soil in the area targeted for afforestation is sandy, clayey, acidic or otherwise. Moreover, as explained in (11), selection of the species also depends on whether the soil is damp, dry or prone to submersion under water. Soil that is damp will require the installation of drainage facilities.

(9) Growth of plantation in the vicinity of the area targeted for afforestation

Growth of afforested trees in the vicinity of the area targeted for afforestation and the method of afforestation provide important information in the review of the species to be planted.

(10) Selection of the type of the forest management

Since the master plan contemplates afforestation broken down into 7 type categories, a category is selected from among these based on the objective of the afforestation project.

When doing this, Productive Forest I-2 and Production Forest IV-2 will not be selected for the reasons given in 1. above.
When selecting Productive Forest III or Productive Forest IV-1, determination of the area for afforestation shall be as follows.

① In case of selecting Productive Forest III

This type category involves production of timber and protection of livestock from severe climatic conditions such as cold winds in the winter and the heat of summer thus mitigating stress through an artificial forest that acts as refuge for livestock (refer to Photo Number 33).

a. A rule of thumb on the scale of afforestation is, with consideration given to the distance that livestock will need to travel, one afforestation area per 100ha when the grazing area is 100ha or more and each afforestation area should be a minimum of about 2ha.

b. For grazing area that is less than 100ha, one afforestation area is created and the minimum area should be about 2ha.

② In case of selecting Productive Forest IV-1

This type category involves production of timber and protection of agricultural produce and pasture land from seasonal strong winds (of 5m/sec or more) through an artificial forest created in agricultural land or pasture land (refer to Photos Number 34 and 35).
The scale of the artificial forest and the method of afforestation should be as follows.

a. The forest should be positioned perpendicularly to the direction of the wind in the agricultural or grazing land to be protected from wind and the width should be about 100 meters and the length any desired value.

b. The order of the artificial forest involves first creating an artificial forest that is approximately 50 meters wide. Concurrently, Grevillea robusta is planted to a width of about 10 meters adjacent to this artificial forest upwind (the density of planting is 3m × 3m). This section is not deforested even when the artificial forest is deforested.

c. When about half the number of years to deforestation of the trees planted in b has passed, the same species is planted to a width of about 50 meters on the downwind side.

d. When the years to deforestation of the trees planted in b has passed, the trees are felled and after this, the same species is replanted. The same procedure is followed for the trees planted under c.

As has been seen, the artificial forest created in the type category Productive Forest IV-1 always has Grevillea robusta upwind from the forest and the trees are not deforested as a unit and the forest is comprised of trees with about a difference of half the life to deforestation. Figure II-4 gives the schematics of this type of artificial afforestation.

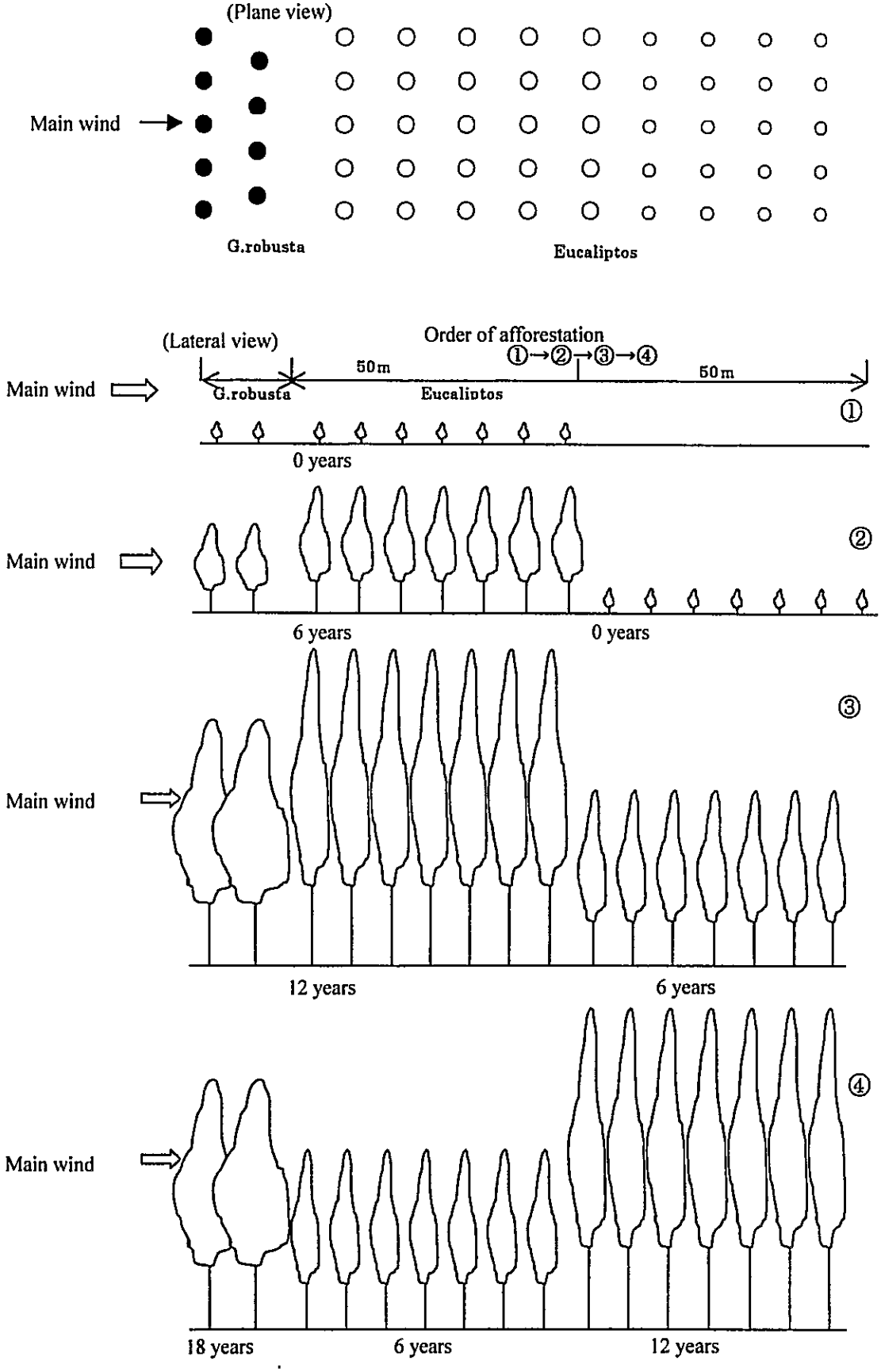


Figure II-4 Example of Afforestation for Type of Productive Forest IV-1 (Eucalyptus)

(11) Selection of the species

Based on the master plan, the main species to be planted are E. gradis, E. camaldulensis, P. elliottii, P. taeda and M. azedarach.

When reviewing the species to be adopted in an area scheduled to be afforested, it is necessary to review the local adaptability and land characteristic adaptability with consideration given to climatic and soil conditions. After such review, determination is made based on "Species and Interval based on the Type of Forest Management" explained in a later section.

a. Review of local adaptability

Local adaptability of eucalyptus and pine is roughly as follows.

(a) Eucalyptus grandis is appropriate for clayey soil that is relatively fertile with good drainage property and grows well in areas II, III and IV in Figure II-5 and in areas with relatively high elevation and little frost in areas IV, V and VI.

(b) Eucalyptus camaldulensis is resistant to sandy soil and to frost as well as to soil with high salinity. The species may be planted throughout the eastern area excluding locations that are submerged in water for long periods throughout the year (with the exception of areas that are seasonally submerged but rapidly dries).

(c) Pinus taeda and Pinus elliottii are more suitable than others in areas IV and V in Figure II-5 and may also be planted in relatively low lands in areas II and III (areas where the temperature is relatively low both in the summer and winter are recommended).
(The source of the above is: Zonificación Potencial para la Reforestación de la Región Oriental, Arno Bune, Ph.D. 1993)

(d) P. gigante may be planted anywhere in the eastern region with the exception of land prone to submersion in water. In particular, the plant grows well in land with sandy soil and good water drainage property.

(e) G. robusta may be planted anywhere in the eastern region with the exception of land prone to submersion in water. In particular, the plant grows well in land with sandy soil. The plant is susceptible to frost when still young.

b. Adaptability to land characteristic conditions

Adaptability to land characteristic conditions of the major species is as shown in Table II-2. For example, in lowlands or basins, species other than E. camaldulensis do not grow well. Moreover, the resistance of E. grandis to frost is less than that of E. camaldulensis.

However, needless to say, E. camaldulensis grows well in areas with better conditions than lowlands and basins.

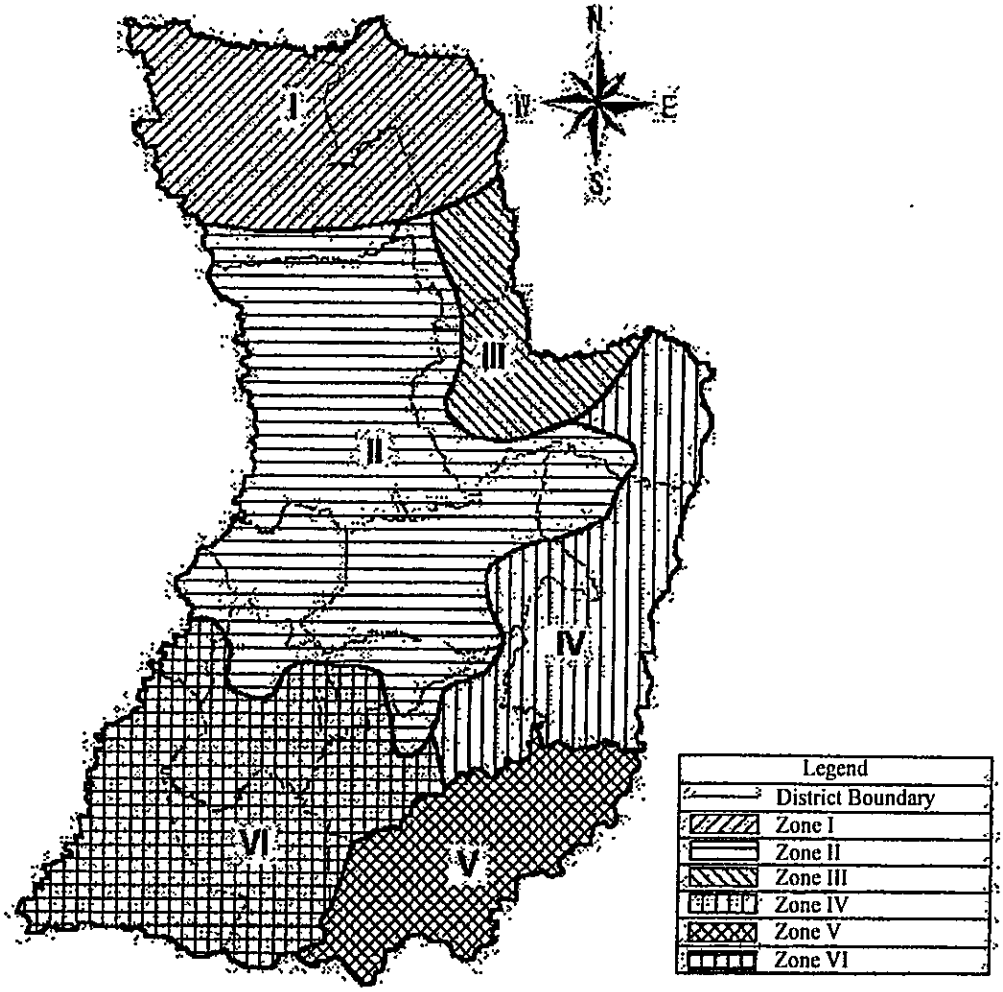


Figure II -5 Zoning of Eastern Region Based on Land and Meteorological Conditions

Table II-2 Adaptability of Major Species to Land Characteristic Conditions

Conditions \ Species			E.camal-dulensis	E.grandis	P.taeda	P.elliottii	M azedarach	G.robusta
Topography	Lowland, basin		O	Δ	Δ	Δ	Δ	Δ
	Sloped (5% or less)		O	O	O	O	O	O
Soil conditions	High salinity		O					
	Sandy soil	Moist	O	O	O	O	O	O
		Dry		O	O	O		
		Seasonal submersion in water	O			Δ		
	Clayey soil	Moist	O	O	O	O	O	O
		Dry		O		O		
		Seasonal submersion in water	O		Δ	Δ		
Frost			O	O	O	Δ		

Source: Zonificación Potencial para la Reforestación de la Región Oriental, Arno Brune, Ph.D., 1993 and Training Textbook" produced by the Afforestation Project for Eastern Paraguay (No. IV)

Note: A circle indicates adaptability while a triangle indicates little possibility of adaptation. Open spaces indicate that there is no adaptability.

(12) Selection of species combination and planting interval

From the perspective of maintaining the soundness of afforested areas (refer to 2-10-3), combining species and the scale of such combination must be reviewed.

Moreover, except in the case of extremely small land mass to be afforested, machines are used in weeding and thinning after afforestation. In order that machines may be efficiently used, the planting density is reviewed based on 2-4-3 "Species and Interval based on the Type of Forest Management". Growth is superior in fertile soil and the closure of the forest due to tree crown comes quickly so that in principle, fewer trees are planted.

(13) Required volume and method of procurement of seedlings or seeds

Once the species and planting density has been determined through the above review, the required volume of seedlings or seeds is reviewed. Next, if the seedlings are to be obtained in-house, the supplier of the seeds is reviewed. When doing this, every effort should be made to obtain seeds with clear area of origin and that have been improved (refer to Table

I-3). Moreover, if a seedling nursery is to be newly established, the location for such nursery will also need to be reviewed.
If the seedlings are to be procured from a third party, the primary criterion is the quality of the seedling produced (that the seeds are improved seeds and the seedlings are healthy) with secondary criteria being the distance required to transport the seedlings and the cost. The supplier is chosen based on these criteria.

(14) Labor and its provision

The required amount of labor is estimated based on the land mass to be afforested and the source of such labor is determined.

2-2 Ant Control prior to Ground Clearance

Damage from leaf cutter ants in afforestation areas will become significant if left unattended. Accordingly, measures regarding these ants are indispensable and discovery of colonies and eradication of the ants should be performed prior to ground clearance. The type of ants and measures required are as follows.

2-2-1 Types and Characteristics of Leaf Cutter Ants

a. Leaf cutter ants may be roughly categorized into two types, Ysaú and Akeke (refer to Photo Number 36). The Ysaú variety is between 12 and 15mm long with 3 protrusions on the upper side of the upper body. The Akeke variety is about 10mm long with 4 to 5 protrusions on the upper side of the upper body.

b. The Ysaú variety creates numerous pathways from the ground and forms a colony deep in the group creating a small mound from the soil that has been dug out. Normally, the Ysaú creates colonies in pastures and natural forests and transports leaves from the plants into the colony where they are fermented to form a culture bed for mushroom that is the food they eat. However, when natural plants diminish as a result of agricultural production and production of grazing grass, these ants target the new agricultural produce within 80 to 100m in the vicinity of their colony as material for food production. These leaves are transported into the colonies using a path with width of about 10cm. There are several entrances to a colony (refer to Photos Number 37 and 38).

c. The Akeke variety forms colonies near the surface or slightly below the surface in natural pastures and as with the Ysaú, when natural plants diminish, targets new agricultural produce within 100m of their colonies as material for food. This type of cutter ant creates

exceedingly small pathways or passes under grass and it is difficult to identify a colony by backtracking from the area where damage has been found. The Akeke variety does not create large entrances to the colony as does the Ysaú variety.

d. In the case of both varieties, the ants eat and transport the leaves to their colonies most actively when the outside temperature is between 15 and 30 degrees centigrade. For this reason the ants are active in the night during the summer and in the day during the winter. Moreover, the ants become inactive when heavy winds are blowing (refer to Photos Number 39 and 40).

2-2-2 Measures for Ant Control

Prior to preparing the land, the area schedule for afforestation and at least 100 meters around this area should be carefully observed to identify the location of colonies and the type of ants. After this, the following measures must be taken.

a. Measures with respect to the Ysaú variety
   Since the colonies are deep in the ground, the following method is employed using liquid, powder or particle insecticides that are marketed specifically for ants.

   (a) The liquid or powder is dissolved in water according to the instructions given and sprayed onto the hole leading to the colony. This method may be implemented regardless of whether or not the ants are in the colony.

   (b) In the case of powder, another method is to use a pump-like sprayer and to spray the powder directly into the colony hole (product name: Blitz, Nitrosint, etc.) (refer to Photo Number 41). Spraying is discontinued when the chemical begins to come out of other holes. When doing this, greater effect may be achieved by closing other holes connected to the colony. This method may be implemented regardless of whether or not the ants are in the colony.

   (c) A particle substance named Cebo (the ants carry this into the colony and this causes toxicity in the mushroom eaten by the ant thus indirectly killing the ants; product name: Fluramin, Mirex-S, etc.) is sprinkled at the rate of 5 to 10 grams per square meter near the entrance to the colony or the pathway into the colony while the ants are actively causing damage. However, since the particles are sensitive to moisture, this method is not appropriate after rainfall or when humidity is high (refer to Photos Number 42 and 43).
   Moreover, when sprinkling Cebo, gloves should be used and under no circumstances should the substance be handled with bare hands (ants will avoid the substance due

to other odor having been transferred). This task is repeated every 5 to 7 days and continued until the ants become inactive.

b. Measures with respect to the Akeke variety
Since the colonies of the Akeke variety are close to the surface of the ground, liquid, powder or particle insecticide that are marketed specifically for ants is used as follows.

(a) The colony is destroyed using a shovel or hoe and the liquid or powder is directly sprinkled on the ants (refer to Photo Number 44).

(b) The particle Cebo may also be used in the same way as in measures with respect to the Ysaú variety.

2-3 Ground Clearance

Areas targeted for afforestation are assumed to be mainly natural pasture and agricultural land with some brush land. Accordingly, compared to afforestation after deforestation of natural forests, the tasks involved in preparing the land are not complicated. When afforesting bush land, if machines are used, only rarely will field burning be required. Careful preparation of the land will simplify later tasks and have a positive impact on the development of the planted trees.

2-3-1 Time of Land Preparation

If there is an interval of more than a month between ground clearance and afforestation, weeds will proliferate so that ground clearance should be completed immediately prior to the commencement of afforestation.

2-3-2 Method of Ground Clearance

a. For very small scale afforestation (1 to 2ha), the small landowner is assumed to perform ground clearance. For this reason, land preparation is generally preformed using livestock labor and hoe (refer to Photo Number 45).

b. For afforestation other than the above, ground clearance is performed combining tractors and disc hallows. The procedures for this task are as follows.

(a) First, a heavy disc harrow (Rastrón) is used to till the land targeted for afforestation in both the lateral and transversal directions (refer to Photos Number 46 and 47). A month after this, this task is repeated in order to ensure that the land is tilled deeper

and that the weeds that have grown after the initial work are buried to stilt their growing power.

Next a lighter disc harrow (Rastra) is used to run over the land targeted for afforestation in the lateral and transversal directions twice to plow as well as level the land (refer to Photos Number 48 through 51). This process may be limited to once in the case of sandy soil. Doing this enhances the root taking capability of the seedlings that are planted as well as making the weeding process more efficient.

(b) In places that are likely to become moist in basins and lowlands, it is necessary to create furrows of soil (this is called Taipeada; refer to Photo Number 52). However, this task is not only expensive but also impairs work using machines and since the only plant appropriate for such land if E. camaldulensis that has inferior growth characteristics it is better to exclude such land from the afforestation area.

2-4 Planting

2-4-1 Season for Planting

With consideration given to precipitation and climate, estimated season for the planting of major species is given in Table II-3.

Since leaf cutter ants and grasshoppers become active in November and December thus posing a threat to the young leaves of the plants prior to the root taking, this season should be avoided. Moreover, in the areas IV and V in Figure II-5 comprising mainly the Itapua and Alto Parana provinces, frost may cause damage and planting in August or later is desirable.

Figure II-3 Season for Planting Major Species

Species	Type of seedling	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov	Dec.
Pine	Potted seedling			.....	...	—	—	—	—	—	.....	.....	
	Bare root seedling				.....	—	—	.....	—	.....			
Eucalyptus	Potted seedling			....	....	—	—	—	—	—	...	.....	
	Bare root seedling		(The rooting ratio is low and this is thus generally not used)										
Paraiso	Potted seedling			.....	....	—	—	—	—	...	..		
	Bare root seedling				.....	—	—	—	—	.....			
Indigenous species	Potted seedling			.....	..	—	—	—	—	—	.....		
	Bare root seedling				.....	—	—	.....	—	.....			

Source: Training Textbook" produced by the Afforestation Diffusion Project for Eastern Paraguay

Note: —— Appropriate

..... Acceptable (timing should be adjusted depending on precipitation and temperature)

2-4-2 Marking of the Planting Spot

In order to ensure smoothness in tasks primarily using machines after planting, the distance between rows and the distance between the seedlings should be uniformly maintained so that the planted seedlings are positioned in a straight line. In order to do this, with the exception of extremely small areas of afforestation, the locations for planting the seedlings should be marked on site (refer to Photo Number 53).
The following is an example of doing this (refer to Figure II-6).

① Prepare two 100 meter lengths of thin rope (ideally meter ropes), 120 thin sticks appropriate for marking the spots, 4 poles (or a long stick with red tape or cloth attached) and measuring tape.

② Assuming that the row direction runs from east to west, stretch a 100 meter thin rope from either the north or south extremity of the area targeted for afforestation to either the east or west extremity in parallel with the row direction. Ram down thin sticks into the ground in positions at the pre-determined distance between the seedlings to mark where the seedling are to be planted. When doing this, erect the poles at both ends of the rope to indicate the range of the current work.

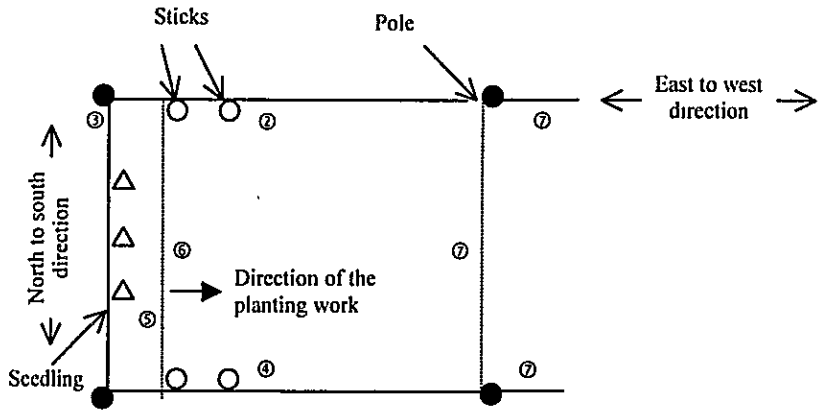


Figure II-6 Marking of the Planting Point

③ From the starting point of the net in ②, fine netting is installed from south to north for a distance of 100 meters.

④ The net from ② running from south to north in ④ is moved 100 meters parallel to the original position and the same task as in ② is repeated.

⑤ The net in ④ running south to north is used to determine the distance between columns and the seedlings are planted at this position.

⑥ The net in ③ is moved in the east to west direction equal to the distance between seedlings and the same task as in ⑤ is repeated.

⑦ After a 100 square meter area as been completed, the tasks from ② to ⑥ are repeated.

2-4-3 Species and Planting Density

Based on the master plan, the planting distances for the species by type of forest management are as shown in Table II-4. For Productive Forest I-1, III and IV-1, there are a plurality of species and planting densities, the appropriate values after taking into consideration 2-1-2 (11) through (12) should be adopted.

Table II-4 Species and Planting Density by Type of Forest Management

Type	Species planted	Distance between plants (m)	Remarks
Productive Forest I-1	E.camaldulensis	3×2.5 (3×3)	• The figures in parentheses represent density that is conceivable as an alternative method. • The figure with the asterisks in Productive Forest V indicates alternate combination of 3×3 and 3×5 (refer to Figure II-13).
	E:grandis	3×2.5 (3×3)	
	M.azedarach	4×4 (4×5, 5×5)	
	P.taeda	3×3 (3×2 5)	
	P.elliottii	3×3 (3×2.5)	
Productive Forest II	M.azedarach	4×4 (4×5, 5×5)	
Productive Forest III	E.camaldulensis	3×2.5 (3×3)	
	E:grandis	3×2.5 (3×3)	
	P.taeda	3×3 (3×2.5)	
	P.elliottii	3×3 (3×2.5)	
Productive Forest IV-1	E.camaldulensis	3×2.5 (3×3)	
	E:grandis	3×2.5 (3×3)	
	P.taeda	3×3 (3×2.5)	
	P.elliottii	3×3 (3×2.5)	
Productive Forest V	E.camaldulensis	3×3+3×5*	
	E:grandis	3×3+3×5*	

2-4-4 Planting

(1) Selection of the seedling

In order that the planted seedling roots and exhibits good growth, it is necessary to select superior seedling. The conditions required of a superior seedling are as follows.

- The balance between the seedling over the ground and under the ground is good

- The shape of the seedling is sturdy and the seedling has not grown excessively
- The branches are growing uniformly
- The lower branches are sturdy and plentiful
- The diameter at the root is large
- The roots are sturdy and rootlets are plentiful
- The color of the seedling is peculiar of the species
- The seedling has not been suffered from disease or pest
- The seedling is not dry

(2) Transportation of the seedling

Care is required when transporting the seedling to prevent dryness and thus weakening of the seedling. In the case of potted seedling, the frame around the truck bed should be high enough or a sheet placed over the potted seedling so that the seedling is not subjected directly to wind. In the case of bare root seedling, the seedlings should be placed in a seedling bag with the roots overlapping and moisturized old hay should be placed around the roots prior to closing the bag. A sheet should be used to cover this on the truck bed in order to prevent direct exposure to wind.

(3) Temporary planting

After transporting the seedling from the nursery to the afforestation site, in the event immediate planting is not possible due to the fact that the site is far from the nursery or the climate is not appropriate for planting, the seedling should temporarily be planted at the site. The reason for doing this is to prevent the seedling from drying, to recover the capacity of the weakened seedling to take root and to acclimatize the seedling to the site conditions. In this case, if the temporary planting is for a day or two, burying the root in the ground or immersing it in water will suffice. If the temporary planting is for longer periods, a deep ditch should be dug and the seedlings aligned in a row ensuring that the root and soil are in sufficient contact and soil should be placed on the roots.

In the case of potted seedling, if immediate planting at the site after transport is not possible, the potted seedling should be placed in the shade of trees or palm leaves used to create a temporary roof to prevent the seedling from drying.

(4) Planting

The procedures for planting are as follows.

① Holes with diameter between 30 and 40cm and a depth of 30cm are dug using a hoe or a sharp shovel in the positions identified for planting. Care should be taken that rubble in the vicinity does not enter the hole.

② The seedlings are placed in the hole. In the case of potted seedling, care must be taken to ensure that the soil in the pot does not spill when the pot is removed. A good way of doing this is to cut the pot using a knife.

③ In the case of bare root seedling, the roots are spread in all directions and soil placed on the root after which the tip of the seedling is held and the plant shaken in an up and down direction to lift the seedling slightly. The vicinity of the seedling is stamped hard with a foot to ensure soil is placed between 1 to 2cm from the base of the seedling.

In the case of potted seedling, the pot is placed in the planting hold and after covering with soil, the vicinity of the seedling is lightly stamped with a foot or held down firmly with a hand to ensure there is no gap between the pot and the planting hole (refer to Photos Number 54 through 56, Figure II-7-9).

④ In order to prevent the planted seedling from drying, materials that cover the ground at the root of the seedling should be avoided.

⑤ When transporting potted seedling, a plurality of seedlings should not bundled and held together at the trunks.

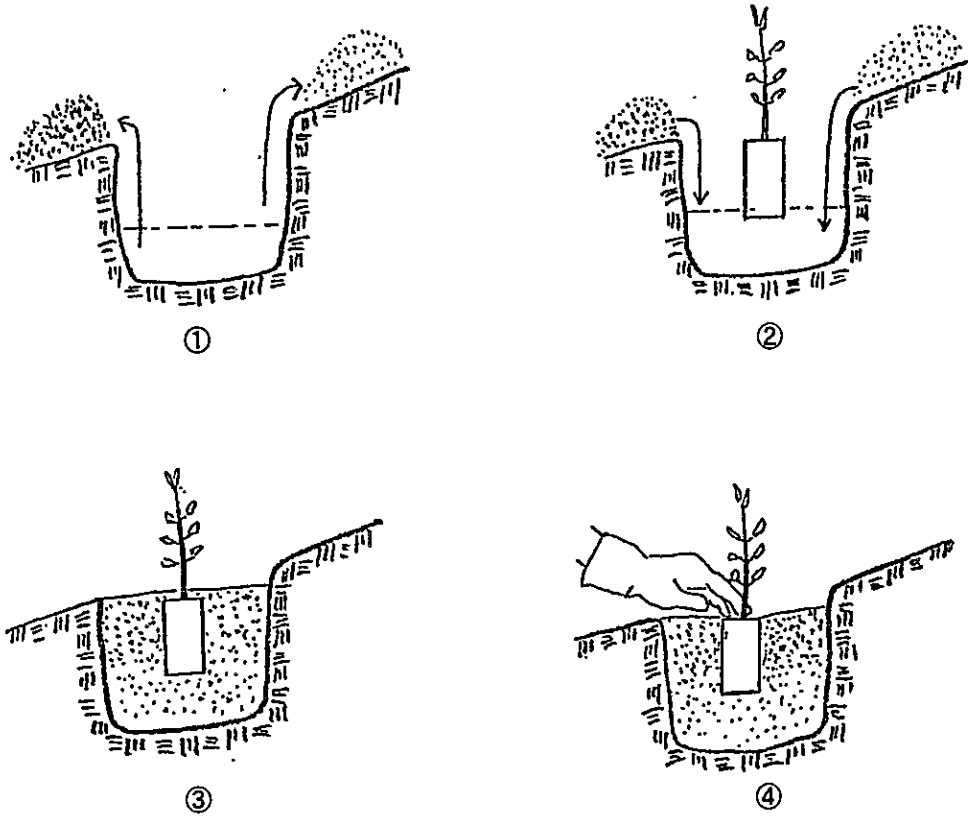


Figure II-7 (1) Planting a Potted Seedling

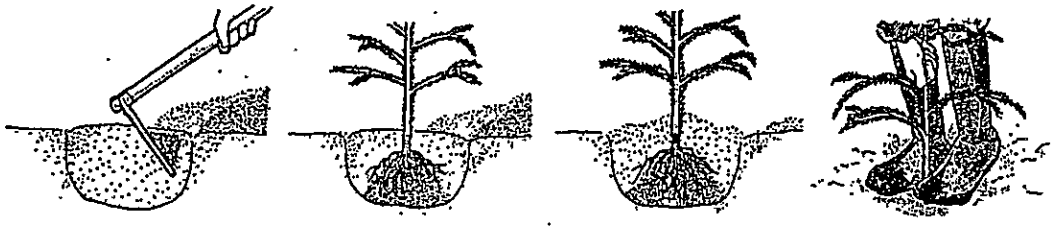


Figure II-7 (2) Planting a Bare Root Seedling

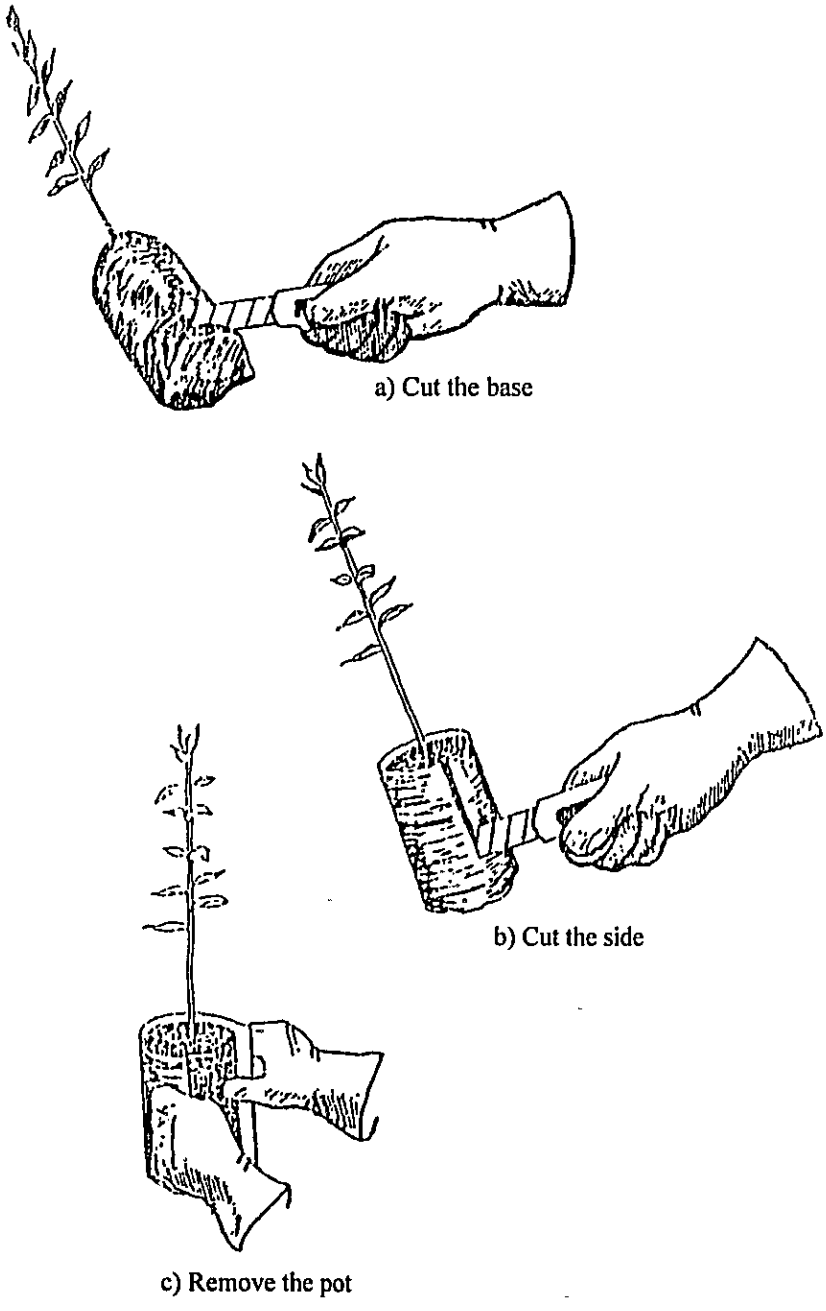
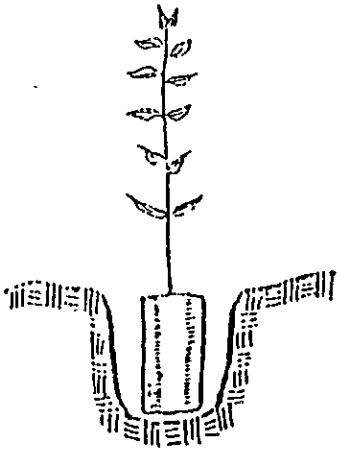
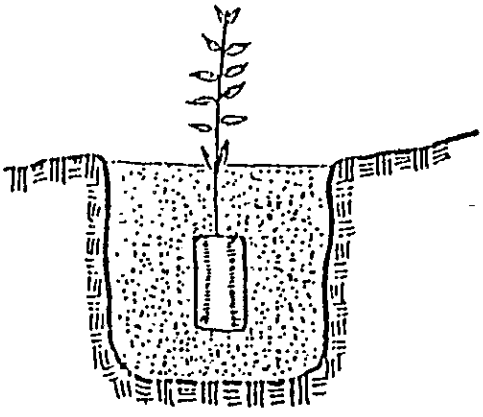


Figure II-8 Removing a Potted Seedling

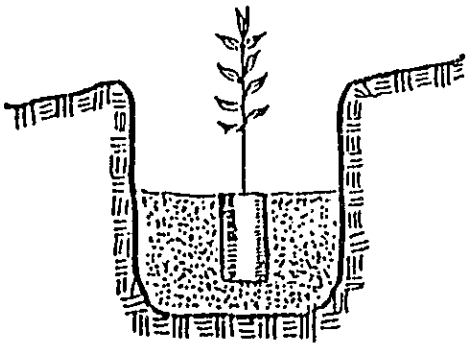


The planting hole is too small

Method of transporting the seedling is an inappropriate



The seedling is planted too deeply



The planting hole is too deep

Figure II-9 Poor Example of Planting a Potted Seedling

(5) Supplementary planting

In the event the numerous seedlings that have been planted wither due to climatic conditions, soil conditions or handling of the seedlings, supplementary planting is performed. A rule of thumb in doing this is to investigate the condition of root taking between 20 to 30 days after the original planting and if more than 15% or 20% of number planted have withered, recovery to about 90% or 100% of the original number is undertaken through supplementary planting (this depends on the intention of the entity performing the afforestation).

In such cases, superior seedlings are used to the extent possible and care is taken in the planting process. If the timing of supplementary planting is delayed, a difference in the rate of growth between the original plants and the plants from the supplementary planting will ensue so that this needs to be addressed in a timely manner. Moreover, if the fertility of the soil is poor, there are cases in which two to three supplementary plantings become necessary.

2-5 Direct Seeding

2-5-1 Objective Species

Targeted by this method is paraiso used in Production Forests I-1 and II. The advantages of this method compared to planting of seedling are: ① since it is possible to choose the best growing young seedling from among the approximately 10 seedlings that germinate in one seeded location, it is possible to undertake measures based on the characteristic growth of individual seedlings; ② injury to the root system upon transplantation can be avoided and this acts positively on growth.

2-5-2 Seeding and Thinning

One example of these is as follows.

a. The seeding season selected should be late August to early September.

b. The selected seeds are immersed in water for one day and night, and the seeds are sterilized by sprinkling the marketed product "Homai" (use of seeds that have been stored for a long period of time must be avoided).

c. Initially, supporsing that 630 plánturas will be planted per hectare, 4 seeds are used per unit 4m × 4m plot of land. The 4 seeds are not planted in one group but rather in units of 2 seeds

with the units separated by 5 to 6cm. The thickness of the top soil should be about 3 centimeters. Marking the seeding spot shall be in compliance with the method described in 2-4-2.

d. After seeding, germination should begin in about 25 days.

e. After germination begins, there may be differences in growth among the individual plants or some plants may be subjected to ant damage. Accordingly, thinning out is performed as a gradual process with the first such process taking place about 3 months after seeding (when the seedlings are about 40cm high) and the second process should take place about 6 months after the seeding. The final thinning out process takes place about 8 months after the seeding (when the seedlings are about 2 meters high) leaving one plant with superior form and growth per location.

2-6 Weeding

2-6-1 The Objective of Weeding

In order for the young plant developed from seedlings or through direct seeding (referred to as "afforested plant" in this section 2-6) to grow, sunlight, moisture and nutrients are required. As the seedlings grow, so too do weeds. The better the growth of the seedling, so also the growth of the weeds. Over time, competition between the seedlings and weeds begins for sunlight, moisture and nutrients and if left unattended, growth of the seedling will be significantly stilted as will the health of the plant.
Weeding involves ridding the vicinity of seedlings of weeds in order to minimize this competition and ensure the healthy growth of the plant.

2-6-2 Guidelines in Undertaking Weeding

(1) Season for weeding

The season for weeding differs by the condition of growth of the afforested plant and the type of weed involved. In general, weeding should be performed before the afforested plant is covered by the weeds. In particular, in the summer of planted year, growth of the weeds is particularly rapid and weeding will need to be undertaken once every 2 to 3 months. In general this season is from around September to May.

(2) Type of Weeding

Weeding is categorized into the following based on the targeted land. These methods may be used singly or in combination depending on the status of weed growth, situation of growth of the afforested plant, availability of labor and cost.

a. Overall cutting: This method involves cutting weeds that impair the growth of the afforested plant throughout the land targeted for afforestation. The ratio of cutting is high and the cost of this method is high.

b. Row cutting: This method involves cutting weeds in rows particularly along the afforested plants. While the cost involved is less than for overall cutting, there is the possibility that the growth of the afforested plants may be affected by the weeds left between the plants.

c. Quadrat cutting: This method involves cutting weeds within a 40 to 50 centimeter radius of the afforested plants using a hoe. While scientific rationale for this method is not necessarily adequate, it is said to be a method that is indispensable to promoting the growth of afforested plants based on experience and is used together with the two preceding methods in the initial stages of growth.

(3) Method of Weeding

a. In general, machine power (light disc hallows called Rastra or weed cutting machines called Rotativo) drawn by tractors are used (refer to Photo Number 57). However, in very small afforestation land, weeding may be manually performed.
Herbicides are also sometimes used but from the perspective of environment preservation and use of local labor, this method shall, in principle, not be used in this project.

b. When machines are used, as long as there is space more than 3 meters between rows and 3 meters between seedling, weeding may be performed in both the lateral and transversal directions. However, if the distance between seedlings is only 2.5 meters, since use of a machine may result in the machine treading on the afforested plant, weeding should be limited to between the columns.

c. If a Rastra is used, the soil will become exposed. Accordingly, during the summer when the sunlight is intense, Rotativo should be used to minimize evaporation from the soil (refer to Photo Number 58).

d. After machine cutting, quadrat cutting is manually performed (refer to Photo Number 59).

(4) Term of the repetition of weeding

In general, the first weeding is performed 3 to 4 months after planting (after the final thinning out in the case of direct seeding). After this, although this will depend on the growth of the afforested plant and the proliferation of weeds, in general, weeding is performed every 4 to 6 months and completed after a maximum of 3 to 4 times. Two implementations of quadrat cutting should generally suffice.

2-7 Climber Cutting

Climbers do not generally appear in the eastern region of Paraguay. However, if land targeted for afforestation has localized areas of vine growth, such climbers may twist around the afforested plants impairing growth or cause the trunk to deform.
For this reason, at the time of weeding in the summer, vine cutting is also undertaken. When implementing this, machetes or pruning shears are used gradually to separate the climbers winding around the crown of the plant.

2-8 Bud Pruning

This task is performed for paraiso as a category of pruning process. In other words, it is the process of removing the young branches from the trunk of the plant with the hands up to about a limit of 1/2 the height of the tree from when the afforested plant is young (budding pruning may be performed with the hands for branches up to 20cm long). With the objective of obtaining trees with straight trunks up to 5 meters to the branches, this process is performed targeting all young plants. Undertaking this process allows avoidance of pruning that may misgive to damage the trunks and is advantageous also from the financial perspective.
Concretely, the process is undertaken about twice for first year trees and between once and twice for second year trees using a ladder or step. The maximum height to which the disbudding process is performed is 5 meters. Everyday patrol of the forest to ensure that the process is not delayed in important. In the event disbudding is inadequate, the remaining branches will need to be pruned during the next pruning season but from the perspective of avoiding deterioration of timber quality, disbudding should be performed to the extent possible.

2-9 Pruning

2-9-1 Objective of Pruning

Pruning is performed in order to prevent knots on the surface of wood produced from the timber or to minimize the size of the surface knots in order to raise the value of the products. In order for timber that has been produced through many years of investment to be competitive on the international market, every care must be taken to produce superior timber.

2-9-2 Guidelines for Undertaking Pruning

Pruning is performed in accordance with "Tending System by Forest Management Type" in the master plan.

(1) Standard for implementing pruning

The standard of implementing pruning with respect to the age of the plant and the target plant when is as follows.

a. Pine

Order of pruning	Age of the plant	Target plant	Number of plants targeted	Height to which pruning is undertaken
Initial pruning	4	Plants other than those targeted for initial thinning out	530 plants	About 2 meters
Second pruning	9 to 10	Same as the initial pruning	530 plants	About 5 meters
Third pruning	14 to 15	Plants other than those targeted for the second and third thinning out	300 plants	About 8 meters

b. Eucalyptus

Order of pruning	Age of the plant	Target plant	Number of plants targeted	Height to which pruning is undertaken
Initial pruning	2 to 3	Plants other than those targeted for the initial thinning out	760 plants	About 2 meters
Second pruning	4 to 5	Plants other than those targeted for the second thinning out	530 plants	About 5 meters
Third pruning	6 to 7	Same as the second pruning	530 plants	About 8 meters

c. Paraiso *

Order of pruning	Age of the plant	Target plant	Number of plants targeted	Height to which pruning is undertaken
Initial pruning	1	All	600 plants	About 1 5 meters
Second pruning	2	Same as above	600 plants	About 2 meters
Third pruning	3 to 4	Same as above	600 plants	About 5 meters

*: With respect to paraiso, pruning is performed only when bud pruning is not feasible.

(2) Season for pruning

Pruning should be performed in the winter when growth is slow.

(3) Method of pruning

Pruning shears and saws are used for pruning and the branches are cut as close to the trunk as possible and parallel to the trunk avoiding removing the bark of the trunk below the branch. When doing this, care is taken to obtain a smooth surface at the cut (refer to Photo Number 60, Figure II-10).

For high locations, a ladder is used.

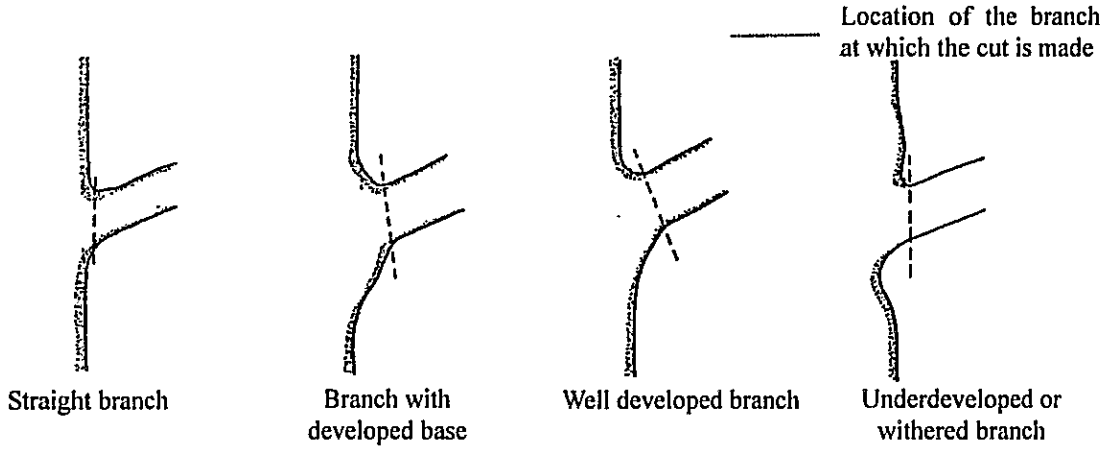


Figure II-10 Position for Pruning

2-10 Damage by Disease and Pest

2-10-1 Major Diseases

Currently, a phenomenon whereby the leaves of certain afforested P. gigante become small and discolored to yellow is seen (refer to Photos Number 61 and 62). There are no other diseases to be noted.

(1) Current situation of the P. gigante disease

a. Phenomenon

(a) The leaves at the extremities become about a third of normal leaves and are discolored to yellow.

(b) While the leaves are normal, they are somewhat emaciated.

b. Assumed cause

(a) Phytoplasma, a microorganism that is positioned between bacteria and virus, is transported with insects acting as the vehicle attacking the trachea of the trunk and exhibiting the disease in 2 to 3 years (in the case of a (a)).

(b) There is also the possibility that the mushroom Basdiomycetes is the cause (in the case of a (b)).

(2) Measures regarding the P. gigante disease

At the present time, there are no effective measures with respect to this disease. For the time being, until firm measures are developed, the following may be implemented in addition to limiting the scale of afforestation to an area that may be appropriately managed on an everyday basis.

① Fell trees that have been affected by the disease;

② Eradicate weeds that provide the habitat for insects;

③ In order to prevent infection from pruning devices, perform bud pruning from when the plants are young;

④ Obtain seeds from healthy trees within a group of trees that has been infected. In this case, there is the possibility of the seeds being infected by the disease and the seedlings grown from the collected seeds are transplanted in the affected area to confirm whether or not the seedlings will be damaged. If as a result the seedlings are not damaged, the seeds so collected may be used to produce the seedlings for afforestation;

⑤ Avoid damaging the trunks or roots during various work;

⑥ Apply oil to the cut when pruning branches that are 2.0 to 2.5 centimeters thick;

⑦ Avoid afforestation on land that is permanently moist;

⑧ In order to prevent the appearance of round spots on leaves caused by such mushrooms as Sercospora meliae or phyllostica axedarachis in the seedling nursery, sprinkle such sterilizing chemicals as Clorothalonil.

2-10-2 Major Pests

(1) Leaf cutter ants

Among the damages caused by insects in an afforestation area, those caused by leaf cutter ants (Ysaú and Akeke) are most significant and common.
For this reason, as explained in 2-2, performing the eradication of ants prior to preparing the afforestation land is indispensable in the afforestation process. Moreover, even after afforestation has been performed, everyday patrol to confirm the emergence of ants is indispensable. The patrol should include an area 100 meters outside the afforested land and should continue for 3 to 4 years after afforestation. In the event the activity of ants is confirmed through such patrols, measures in accordance with those described in 2-2-2 should be taken.

(2) Others

At the present time, there are no insects cause significant damage to afforested areas other than ants.
According to "V° Jornada Forestales de Entre Ríos 1990" of Argentina, "Pulgo del pino" a type of cockroach, causes damage to pine (the insect sucks the sap at the base of the pines of small branches causing the pines to fall). On the other hand, "Orugu defoliadora" a type of caterpillar, causes damage to eucalyptus (by eating the leaves) but only in rare instances. Cabaril, Metomil and an organic phosphorus Fentoato, chemicals in the carbamate family of pesticides are reportedly effective.

2-10-3 Disease and Pest Control through Afforestation Methods

In order to prevent the emergence or spread of damage through disease and pest in afforested land and to create and maintain a healthy forest, consideration should be given to combining the following types of areas of species over the afforestation area in an appropriate manner.

① Avoid afforestation using a single non-native species over 20 hectares or more and give consideration to alternating species in the afforested area;

② Combine afforestation using native species to a specific width (about 30 meters) in afforested area having a single non-native species.

③ Combine the above two methods.

Figure II-11 shows an example of the above.

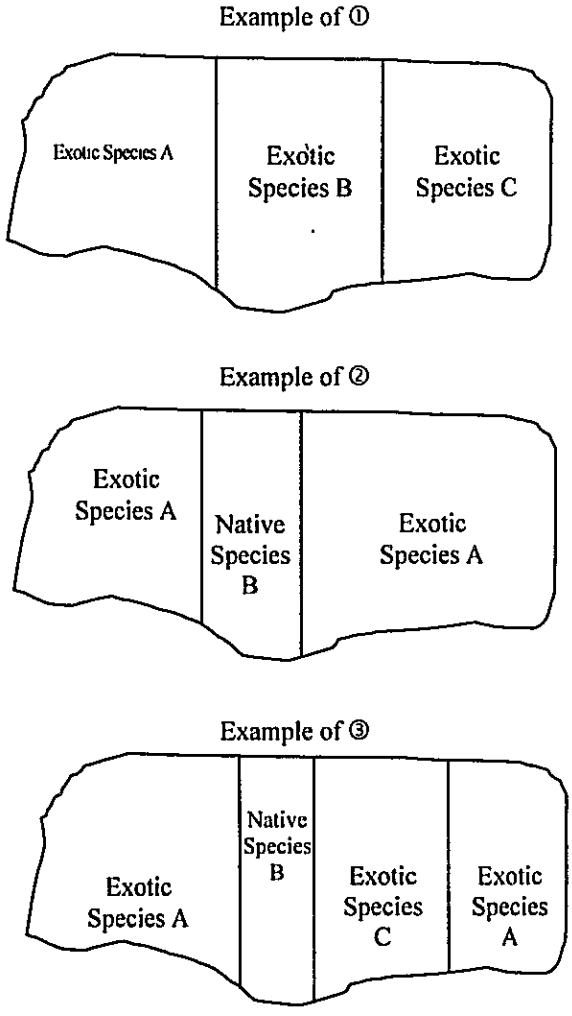


Figure II-11 Example of Combination of Areas of Different Species

2-11 Forest Fire

2-11-1 Types of Forest Fires

In general, forest fires may be categorized into the following types.

(1) Surface fires: This type of fire involves the burning of young seedlings, weeds, fallen branches and leaves on the surface of the ground. This often causes the young plants to wither (refer to Photo Number 63).

(2) Tree crown fire: This type of fire involves the burning of branches, leaves and treetops

and normally results from surface fires spreading. This is particularly a problem with conifers that contain a large amount of sap and is not prevalent in the case of fully grown broadleaf trees.

(3) Trunk fire: This type of tire involves the burning of the tree trunks and is not prevalent in live trees. This type of fire occurs with respect to withered trees or hollowed trees as a result of lightening or the spread of surface fires.

2-11-2 Prevention of Forest Fires

(1) Humidity is most closely linked to the occurrence of forest fires while the spread of such fires is closely related to wind velocity. When the air humidity is 60%, only things that are highly combustible burn but when the humidity declines to 40% or 30%, the rate of conflagration increases to a dangerous level.
In many cases, forest fires are caused by humans. For this reason, patrols in the afforested land should be undertaken when the climatic conditions indicate danger of forest fire towards early detection and early extinguishing.

(2) Consideration should be given to the following as general measures with respect to forest fires.

a. In afforested land is adjacent to public roads, a non-forested area of about 4 meters should be left on the side of the road and the ground dug up. Moreover, combustible materials (such as cut undergrowth, branches, etc.) should not be left on the ground adjacent to such roads. In particular, the ground should be dug up during seasons that present risk of forest fire (refer to Photo Number 64).

b. A fire break line (of approximately 10 meters width) should be created at intervals of about 100 meters and weeding performed. This prevents the spread of forest fire as well as abating the intensity of the fire and functions as a facility for fire fighting activities.

c. Obtain advance understanding on contact points in the event of a forest fire.

d. To the extent possible, have such fire fighting equipment as hoes, shovels, buckets back-carried sprinkler (jet shooters) and chain saws available.

e. When entering seasons prone to forest fire, inspect fire extinguishing equipment and perform repairs and maintenance as needed.

f. To the extent possible, undertake patrols of afforested land adjacent to spots visited by numerous people during high risk seasons and keep close watch on the use of fire in such areas.

g. Conduct educational programs among those residents in the vicinity of afforested areas on the prevention of forest fires.

2-11-3 Extinguishing Forest Fires

(1) Direct extinguishing

Small scale forest fires in their early stages burn at a slow rate and extinguishing may be undertaken where the intensity of the fire is weak. Some effective means of extinguishing such fires are to manually stamp out the fire using branches with leaves, stamping by foot at places where the intensity of the fire is weak, throwing soil on the fire using a shovel or hoe and using a back-carried sprinkler or bucket to extinguish the fire using water where water is available.

(2) Indirect extinguishing

When the fire spreads and increases in intensity, direct extinguishing will become difficult. In such cases, a specific area is mowed to create a fire defense line to undertake prevention of further spread. Needless to say, if such a fire defense line has been created in advance, such fire defense line is used for this purpose. This method involves burning combustible material in the path of the forest fire to prevent fueling the fire in cases of large surface fire when the wind is not strong.

2-11-4 Post Forest Fire Measures

Even when a forest fire has seemingly been brought under control, it is too early to consider the fire to have been extinguished and exposed land with exposed soil is created around the land that has been damaged by the fire and soil is thrown on combustible material. Furthermore, a guard should be deployed until it is certain that no cinders remain.

2-12 Other Damages to Forests

Among other damages that may be caused in a forest are damages from frost in the case of eucalyptus and pine. In the Itapua and Alto Parana provinces that are susceptible to frost, consideration should be given to planting in August or later as explained in 2-4-1. Moreover, after planting or direct seeding, if forest damage ensues not long after germination, a good method is to cut the damaged plant and to nurture the new bud that will appear.

2-13 Thinning

2-13-1 Objective of Thinning

After afforestation, the tree crowns of the developed trees begin to touch each other and competition for light in the given space begins. If this situation were to be allowed to continue, while there will be trees that prevail in this competition and continue growth, overall the afforested area will be comprised of weakened trees. Thinning out is the process by which this competition among the trees is mitigated to create a healthy and useful forest by adjusting the density of trees.

2-13-2 Method of Thinning

One method of categorizing the thinning out process is into qualitative thinning out and systematic thinning out (thinning out by columns).

(1) Qualitative thinning out process

This is a method whereby the trees targeted for the thinning out process are selected with consideration given to the tree crown at the upper reaches of the trees and to the status of competition. A rule of thumb for very general selection of trees targeted for the thinning out process is as follows.

Category of the trees in the afforested area	Character	
	Superior trees	Inferior trees
Trees that obstruct	The thinning is undertaken after consideration is given to whether or not these trees ought to be targeted	These trees are targeted by the thinning
Trees that do not obstruct	These trees are left standing	The thinning is undertaken after consideration is given to whether or not these trees ought to be targeted

Note:

Trees that obstruct: These trees are those that currently obstruct those trees that are to be left for the final timbering or are expected to obstruct such trees in the period leading to the next thinning out process.

Trees that do not obstruct: These trees are those that currently do not obstruct those trees that are to be left for the final timbering and are not expected to obstruct such trees in the period leading to the next thinning out process.

Inferior trees: These trees are those that are damaged, deformed or with weak crowns

Superior trees: These trees are those with straight trunks and conical crowns with plenty of leaves

(2) Systematic thinning out process (thinning out by columns)
This is a method whereby columns that will be subjected to the thinning out process and columns that will not be so subjected are selected mechanically targeting afforested areas with little difference in the level of tree growth and is employed to increase the effectiveness and efficiency of the thinning out process.

(3) Combined thinning out process
This method employs both of the above methods.

The Afforestation Plan (Master Plan) for the Eastern Region of Paraguay indicates the use of this method in principle except for Production Forest V.

2-13-3 Standard for Undertaking the Thinning and Rate of Thinning

(1) A general rule of thumb for the timing by which the thinning out process is undertaken
In general, the following factors constitute the criteria.

a. Condition of the overlap of the tree crowns
The thinning out process is undertaken when the branches and leaves of adjacent trees overlap by about half their lengths on each side.

b. Condition of the length of the crown
The thinning out process is undertaken when the crowns of the trees become about one half the height of the trees.

c. Others
Though this depends on the species and afforested density, the thinning out process is undertaken when competition among the trees commences.

(2) Age of Trees for Undertaking the Thinning Out Process and Rate of Thinning Out
In this project, consideration shall be given to the timing and method for the thinning out process as given above and the age for undertaking the process and rate of thinning out shall be as shown in Table II-5. The following shall be taken into consideration in selecting the trees to be subjected to the thinning out process.

a. To the extent possible, the qualitative method of selection shall be used. In the initial thinning out process, the middle column for every 5 columns shall be selected while the rest will be qualitatively selected within the scope of the rate of thinning out. Figure II-12 shows a model of the selection of trees to be subjected to the thinning out process.
From the second thinning out process, the trees targeted shall be selected using the qualitative method.

b. Trees on the outer perimeter of forests form mantles that protect the inner forest

against wind and are not targeted by the thinning out process.

c. G. robusta upwind from Production Forest IV-1 is also not targeted by the thinning out process. Upon undertaking the thinning out process, care must be given to avoid injuring the trees to be left.

Table II-5 Age of Trees for Undertaking the Thinning and Rate of Thinning (Productive Forests I-1, III and IV-1)

Age of the trees / Species	Initial thinning out process		Second thinning out process		Third thinning out process		Remarks
	Age of the trees	Rate of thinning out	Age of the trees	Rate of thinning out	Age of the trees	Rate of thinning out	
Pine	10 years	50%	15 years	30%	20 years	20%	The rate of thinning is the ratio of the number of trees selected
Paraiso	5 years	50%	8 years	30%			
Eucalyptus	4 years	40%	8 years	30%			

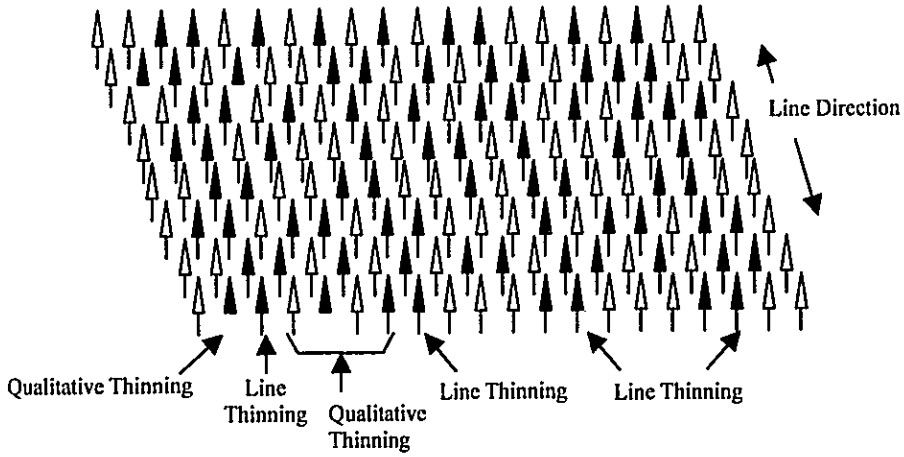


Figure II-12 Example of Tree Selection for Thinning

2-13-4 Season for Undertaking the Thinning

From the perspective of the use of the trees felled in the thinning out process (prevention of insect and mold damage) and the growth of the trees that remain, the winter season is appropriate for undertaking the thinning out process.

3. Afforestation of Productive Forest II

This type of forest management belongs to the so-called agro-forestry type of land use whereby the highly valued paraiso timber is produced and the space between the afforested areas is used for agriculture in order to obtain revenue from agricultural produce in the early stages of afforestation.
The work processes for Productive Forest II are the same as the content of II-2 except for investigation of the area targeted for afforestation, weeding and planting and harvesting of agricultural produce. Accordingly, only these will be explained in order to avoid redundancy.

3-1 Investigation of the Area Targeted for Afforestation

The species of trees to be used in the afforestation shall be paraiso and the space between the trees shall be the standard 4m × 4m. Other factors shall be in accordance with II-2.

3-2 Weeding in the Afforested Area

Generally, the weeding process that continues to the 2nd or 3rd year after planting or direct seeding is in principle not required due to the weeding involved in the agricultural production. However, consideration shall be given to weeding around the roots of the planted trees.

3-3 Planting and Harvesting of Agricultural Produce

3-3-1 Area of Agricultural Cultivation in the Afforested Area

With consideration given to the competition between the roots of the afforested trees and the agricultural produce and the sunlight required by the agricultural produce, no produce should be planted within a radius of 1 meter around the trees. When this standard is applied, approximately 75% of the afforested land mass may be used for cultivation of agricultural produce.

3-3-2 Agricultural Produce to be Cultivated and the Planting Season

Generally, corn, legume, mandioca, cotton, banana, pineapple, papaya and yerba mat. Banana, pineapple, papaya and yerba mat are perennial crops and require large space and long periods for cultivation. Moreover, cotton decreases the fertility of the soil. For these reasons, corn, legume (poroto), mandioca and cotton are recommended as crops to be

cultivated. When cultivating such crops, it is best from the perspective of cultivation and sales to combine several crops including those consumed by the farm itself.
If the initial density of the afforested plants is 4m × 4m, the period during which agricultural produce may be cultivated in the afforested area is about 3 years (refer to Photos Number 65 and 66).

3-3-3 Planting and Harvesting

a. In addition to planting between 2 to 3 rows along the column of the afforested trees, agricultural produce may also be planted between the trees. The timing for planting is as follows:

   - From mid-August to the end of September or from mid-February to the end of March is most appropriate for corn while it is also possible to plant corn between July and mid-August and early November and early February.

   - From early September to mid-November is most appropriate for legume while it is also possible to plant this crop between early July and late August.

   - From early October to late October is most appropriate for cotton while it is also possible to plant up to the end of September and in early November.

b. The timing for harvesting is 4 to 5 months for corn, about 3 months for legume and about 6 months for cotton. The timing for harvesting mandioca is about 1 year.

c. After harvesting for 3 years, whether or not further cultivation is possible is determined based on the condition of tree growth and pruning.

4. Afforestation of Productive Forest V

This type of forest management means land use whereby eucalyptus is planted for the production of timber and an artificial grazing ground is created in the forest for livestock.

The work processes for Productive Forest V are the same as the content of II, 2 except for investigation of the area targeted for afforestation, weeding pruning, thinning, seeding grazing grass and grazing livestock. Accordingly, only these will be explained in order to avoid redundancy.

4-1 Investigation of the Area Targeted for Afforestation

The species and planting distance to be considered in the investigation stage are E. camaldulensis or E. grandis and a combination of 3m × 3m + 3m × 5m based on Table II-4. Figure II-13 shows a model of the spacing of trees and the areas where the grazing ground is created.

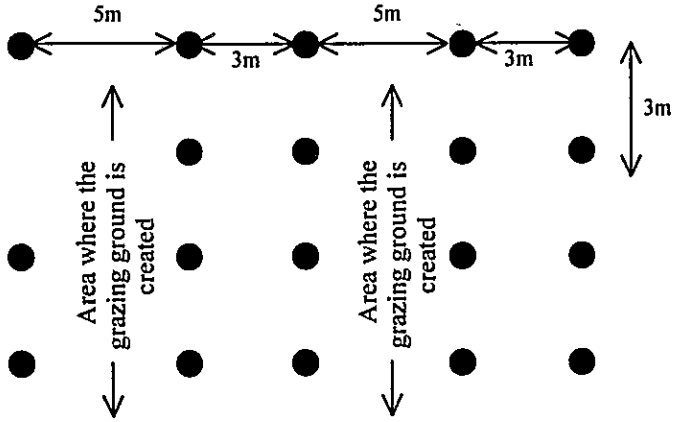


Figure II-13 Space of Trees and Creation of Grazing Ground in Productive Forest V

4-2 Weeding in the Afforested Area

Mechanical or manual initial weeding is performed throughout the afforested area in accordance with the method described in II-2. From the second weeding, mechanical weeding is performed only in the areas where the spacing between trees is 3m × 3m. The manual weeding performed around the planted trees (quadrat method) shall be in accordance with the method described in II-2.

4-3 Pruning

Pruning shall be performed in accordance with the implementation guidelines set forth in "Tending System by Type of Forest Management" in the master plan.

4-3-1 Standard for the Implementation of Pruning

The standard for the age and trees targeted for pruning is as follows.

Species: Eucalyptus (Productive Forest V)

Order of pruning	Age of the tree	Target plant	Number of plant targeted	Height to which pruning is implemented
Initial pruning	2 to 3	Trees other than those targeted for the first thinning out process	550 trees	About 2 meters
Second pruning	4 to 5	Trees other than those targeted for the second thinning out process	330 trees	About 5 meters
Third pruning	7 to 8	Same as for the second pruning	330 trees	About 8 meters

4-3-2 Others

Other tasks related to pruning shall be in accordance with 2-9.

4-4 Thinning

4-4-1 Method of Thinning

The qualitative method shall be used in the thinning. The reason for this is that because of locating the spaces with 5m of planting distance with definite interval the need for thinning out rows is not large from the perspective of the efficiency of mechanized tasks.

4-4-2 Age of the Trees to be Undertaken the Thinning and Rate of Thinning

The age of the trees to be undertaken the thinning and the rate of thinning are as shown in Table II-6

Table II-6 Age of Trees to be Undertaken the Thinning and Rate of Thinning (Productive Forest V)

Age of trees / Species	Initial thinning		Second thinning		Remarks
	Age of the trees	Rate of thinning	Age of the trees	Rate of thinning	
Eucaliptos	4 years	30%	8 years	40%	Qualitative method of thinning

4-4-3 Others

Other tasks involved in the thinning out process shall be in accordance with 2-13.

4-5 Seeding the Grazing Grass

4-5-1 Type of Grazing Grass

Brachiaria (withers in the winter) of the Graminae and Calopogonio (lives through the winter) of the Leguminosae are recommended as they are highly adaptable to various terrain and soil fertility.

4-5-2 Seeding and Weeding

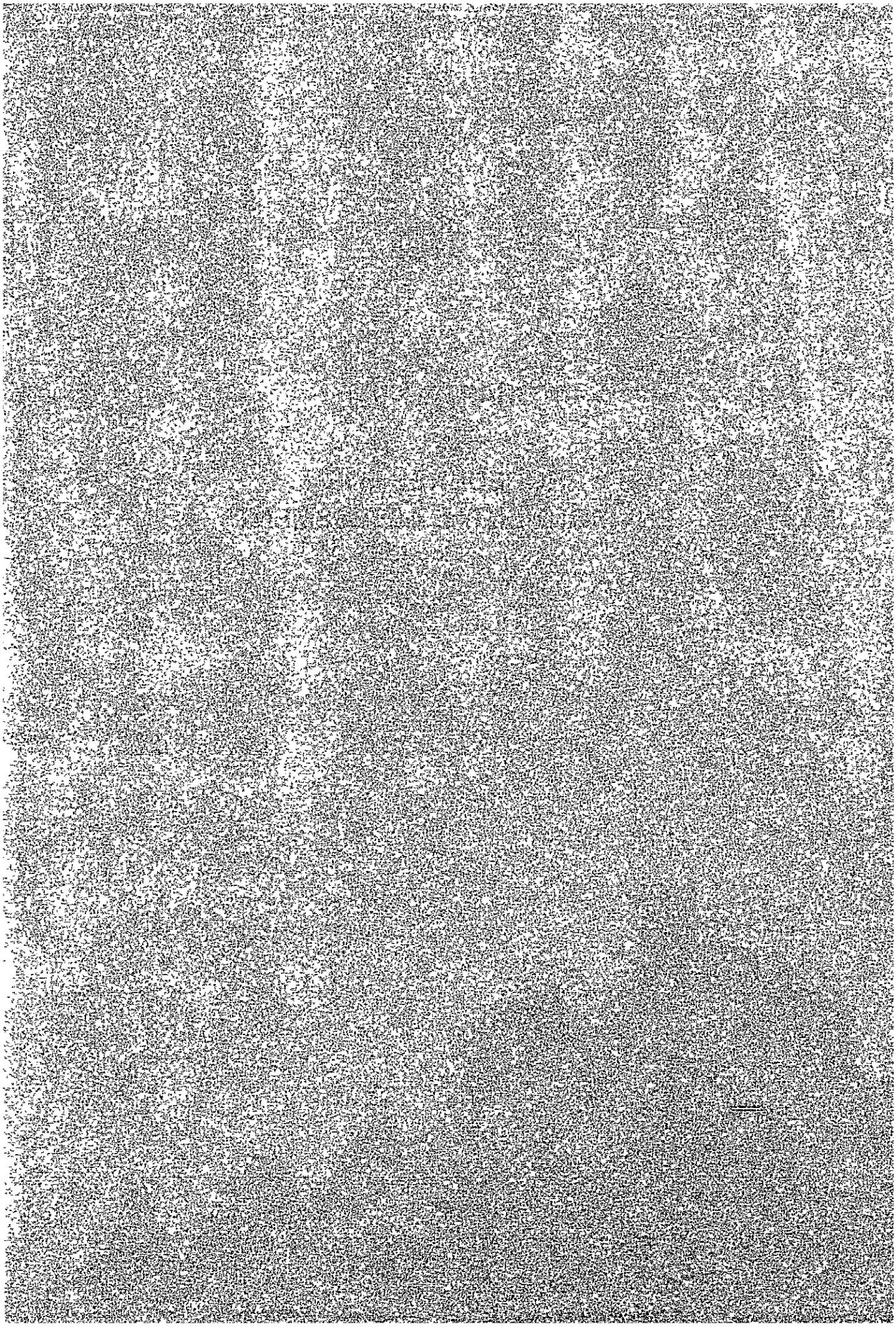
After completion of the initial weeding of the afforested area, the above species are combined and seeded (broadcast sowing) between September and November or March and April and ash, phosphoric acid and calcium sprinkled as fertilizer. After germination, weeds are removed prior to ructification. Weeding must performed annually.

4-6 Grazing of Livestock

Livestock is allowed to graze about 6 months after seeding and after the height of the planted trees has exceeded 2 meters.
As required, electrical fencing may be installed. If there is the need to prevent goat, sheep or other smaller animals from entering the area, net with fine mesh may be attached at the lower part of the fence or tree branches inserted.

CHAPTER III

PROCEDURES FOR ENVIRONMENTAL ASSESSMENT



CHAPTER III

PROCEDURES FOR ENVIRONMENTAL ASSESSMENT

1. Steps in Environmental Assessment of Afforestation Plans

Impact on the environment will conceivably be required in this 5-year afforestation plan when the area of afforestation with a single species is 1,000ha or more. Such assessment will also be required when the area is less than 1,000ha but large afforested areas exist in the vicinity, the content of land use is important or the targeted land is important from the environmental perspective. The steps in environmental assessment of afforestation plans are as follows.

(1) The entity planning the project shall submit a basic environmental questionnaire (Cuestionario Ambiental Basico), land ownership certificate, land location certificate issued by the regional city office and declaration of interest in the activity by the relevant provincial government to SEAM.

(2) SEAM shall conduct hearings on impact on the environment among individuals and organizations that are expected to be impacted if the project were to be implemented.

(3) SEAM shall determine whether or not an environment impact study (EIA; Estudio de Impacto Ambiental) is required. (The determination shall be made within 30 business days after all documents have been filed and if no determination is made by SEAM within this period, the assessment is deemed not required.)

The steps to be taken in the event SEAM determines that EIA is required are as follows:

(1) If the EIA is determined to be required, SEAM shall produce a TOR (Termino de Referencia; Terms of Reference) for the EIA and provide notification to the entity planning the project. SEAM shall also provide a list of consultants capable of performing the EIA to the entity planning the project.

(2) The entity planning the project shall undertake EIA in accordance with the TOR.

(3) When the EIA is completed, the entity planning the project shall submit the EIA and a record of impact on the environment (RIMA: Relatorio de Impacto Ambiental, with an overview of the EIA) to SEAM.

(4) The EIA is publicized over three days in newspapers and over the radio. The RIMA is open to the public for 15 business days counting from the day after the final date of publication of the EIA (the EIA may also be perused if desired).

(5) SEAM shall convene a public hearing as required.

(6) Based on opinions submitted during the period the EIA is publicized, SEAM notifies the entity planning the project on matters that need amendment. (This notice is given within 15 business days after the final date of publication of the EIA.)

(7) The entity planning the project must undertake the amendments within 15 business days (this deadline may be extended).

(8) SEAM must produce a declaration of impact on the environment (DIA: Declaracion de Impacto Ambiental) within 90 business days from the date of final amendment and determine whether or not the project is approved.

In the event the EIA is deemed not required in (3) above, the following steps are taken.

(1) In the event the EIA is deemed not to be required, SEAM shall determine which of the measures for environmental protection (Medidas de proteccion Ambiental) or environment control plan (PCA: Plan de Control Ambiental) are required.

(2) If measures for environmental protection are deemed required, SEAM shall produce a TOR on such measures and notify the entity planning the project.

(3) The entity planning the project shall produce the measures for environmental protection and submit this to SEAM.

(4) SEAM shall inspect the measures for environmental protection and if approved, issue an approval resolution (Resolucion Aprobacion).

(5) If PCA is deemed required in (1) above, SEAM shall produce a TOR for the PCA and notify the entity planning the project. SEAM shall provide a list of consultants capable of undertaking PCA to the entity planning the project.

(6) The entity planning the project shall produce the PCA and submit this to SEAM.

(7) SEAM shall inspect the PCA and if approved, issue an approval resolution (Resolucion Aprobacion).

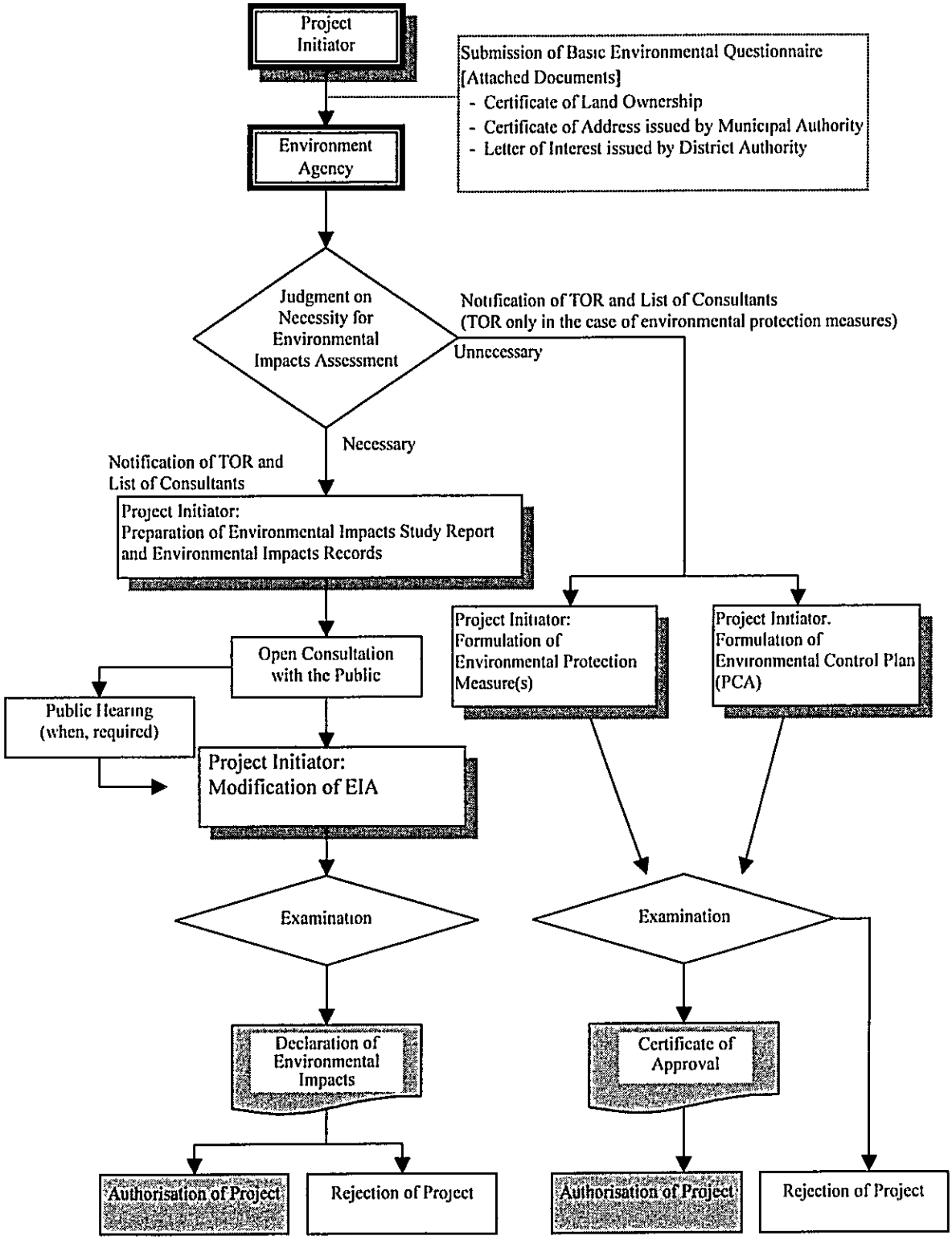


Figure Processes of Environmental Impacts Assessment for Afforestation Project

2. Content of the Basic Environmental Questionnaire

The basic environmental questionnaire is stipulated under government ordinance Number 14281 and includes the following.

(1) Overview of the project

1.1 Name of the project

1.2 Name of the person submitting the questionnaire, address of the company (telephone number, fax number, e-mail address), address of the person submitting the questionnaire (telephone number, fax number, e-mail address)

1.3 Data on the real estate: Registration data, real estate number, registration number, area, province

1.4 Location of the real estate: Scale map or sketch indicating the location, access route and border

1.5 Terrain map of the military topographic bureau indicating the terrain of the real estate (1/10,000, 1/50,000 or 1/100,000 scale)

(2) Statements concerning the project

2.1 Objective of the project

2.1.1 The existence or otherwise of linked projects
Linked project(s) exists____ There are no linked project____
If there are linked projects, what are they and at what stage of developed are such projects?

2.2 Type of activity

a. Forestry

b. Livestock grazing

c. Agriculture

d. Industry

e. Tourism

f. Urbanization, land subdivision

g. Road infrastructure

h. Mining, quarry

i. Electric power, water use project

j. Wildlife protection

k. Others (state concretely)

2.3 Has this project taken into consideration options for technical positioning or is such consideration underway?

Yes____ No____

If consideration has been given, what options were considered and what are the reasons such options were discarded?

2.4 Total investment

2.5 Applicable technology and processes

2.6 Project steps

2.6.1 What are the activities envisioned in the various steps of the project and at which step is the project currently positioned? If no projects have already been undertaken, refer to documents that include statements about the processes to be used.

2.6.2 Give detailed information on the following:

a. Raw materials and expendables (name and volume)

- Solids
- Liquids (m^3/s)
- Gasses (m^3/s)
- Human resources
- Services
- Infrastructure

b. Annual production volume

c. Waste materials

- Solids (annual tonnage, m^3 per year)
- Solids (m^3 per week)
- Gasses (kilograms per hour)

d. Generation of noise (decibels)

Indicate toxicity and rate of generation including volume of noise expected and processing method.

(3) Statements on the area targeted by the project

3.1 Total area to be used exclusively

3.2 Total area of the site

3.3 Characteristics of the area targeted by the project

- Water resources (river, creeks, lakes, marshland)
- Swamp (wetland)
- Plants (grazing pasture, bush, trees)
- Residential areas, cultural, welfare, educational and religious centers within a radius of 500 meters of the project site

3.4 Characteristics of discharges

- Decomposition tank (size, volume or capacity)
- Absorption tank (size, volume or capacity)
- Discharge tank (size, volume or capacity)
- Solid waste (whether or not waste collection services are available)

(4) Sworn declaration and signature of the entity planning the project testifying to the veracity of the information that is provided.

(5) Other information of relevance to SEAM

(6) Appended materials

a. A copy of certification of authenticity against the original by a notary public with respect to the deed of ownership and rights on the property that forms the basis of the request.

b. The original of approval or certification of location provided by the city office of the area where the project, construction or activity is to take place or, if such original is not available, a copy of certification of authenticity against the original by a notary public.

c. The original of the statement of interest by the province concerning the project or, if such original is not available, a copy of certification of authenticity against the original by a notary public.