Republic of the Philippines
Department of Environment and Natural Resources
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MEMORANDUM

FOR : **The Directors**

Biodiversity Management Bureau
Forest Management Bureau
Environmental Management Bureau
Land Management Bureau
Mines and Geosciences Bureau

FROM : The OIC-Director, Policy and Planning Service

SUBJECT : **DRAFT ADMINISTRATIVE ORDER ADOPTING THE FIELD MANUAL FOR TREE SEED COLLECTION, PROCESSING AND CERTIFICATION OF QUALITY PLANTING MATERIALS AND PROVIDING MECHANISMS ON ITS ADOPTION**

DATE : 20 JAN 2021

Background:

The draft administrative order entitled "Adopting the Field Manual for Tree Seed Collection, Processing and Certification of Quality Planting Materials and Providing Mechanisms on its Adoption" was prepared by ERDB in response to the requirement for the sustainable production of quality planting materials using genetically improved germplasms of priority forest tree species with support plantation technology. The draft policy also aims to support the Enhanced National Greening Program (ENGP) which aims to reforest some 1.2 million hectares from 2017 to 2022 in accordance with the updated 2016-2028 Master Plan for Forestry Development.

The draft manual was intended to update the provisions of DAO 2010-11 entitled "Revised Regulations Governing Forest Tree Seed and Seedling Production, Collection and Disposition" in view of the implementation of the Rationalization Plan and translate it into a Manual.

Included in the manual are procedures on tree seed collection, processing and certification of quality planting materials which was developed to serve as a guide to foresters, forest plantation managers, nursery workers and tree seed specialists with the objectives of ensuring the continuous production and adequate supply of phenotypically and genetically-improved planting materials.

SALIENT FEATURES

1. The Field Manual serves as a revision of DAO 2010-11 that complements with the existing structure based on the approved Rationalization Plan.

2. The Field Manual is intended not only for the National Greening Programs (NGP) but also towards improving future reforestation programs and producing superior Quality Planting Materials (QPM).

3. It includes the creation of National Forest Tree Seed Committee (NFTSC) and Forest Tree Seed Centers (FFTSC) which are not included under DAO 2010-11, and which will implement and carry out the necessary plans at the field level, such as but not limited to the assessment and verification of the source, collection and handling of seeds and planting materials; conduct of training; and accreditation of seed sources and forest tree nurseries and others.

4. All the information stated in the Field Manual is considered a set of "how to" which are all science-based or backed up by research studies.

ACTIONS TAKEN:

1. The draft administrative order was first deliberated by the PTWG in 2012 originally entitled "Revising DAO 2010-11 dated May 5, 2010 (Revised Regulations Governing Forest Tree Seed and Seedling Production, Collection and Disposition). However, due to the implementation of the Rationalization Plan, further deliberation was held in abeyance.

2. In 2018, a revised draft was resubmitted to the Office of the Director, PPS and was again deliberated by the PTWG. During the said meeting it was recommended that ERDB should come up with a field Manual to be adopted thru a policy issuance serving as an amendment of DAO 2010-11.

3. On December 2019, the draft DAO was further revised and resubmitted together with the Field Manual. It was again deliberated by the PTWG on January 11, 2020, however it was suggested that it should be further revised based on the assessment and lessons learned from the implementation of the NGP and on its applicability on the ground.

4. On 30 November 2020, a revised draft entitled "Adopting the Field Manual for Tree Seed Collection, Processing and Certification of Quality Planting Materials and Providing Mechanisms on its Adoption" was resubmitted to the Office of the Director, PPS together with the Field Manual.

ACTION REQUESTED

In this regard, we are respectfully endorsing the hereto attached DAO re: Adopting the Field Manual for Tree Seed Collection, Processing and Certification of Quality Planting Materials and Providing Mechanisms on its Adoption" for your final review and/or concurrence. Kindly return the draft to us together with your comments/inputs (if any) or your concurrence on the said draft on or before **05 February 2021** prior to its endorsement for vetting of the Undersecretaries.

For your preferential and appropriate action.

MELINDA C. CAPISTRANO

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DEPARTMENT ADMINISTRATIVE ORDER
No. 2021 -_____

SUBJECT : ADOPTING THE FIELD MANUAL FOR TREE SEED COLLECTION, PROCESSING AND CERTIFICATION OF QUALITY PLANTING MATERIALS AND PROVIDING MECHANISMS ON ITS ADOPTION

Pursuant to Presidential Decree No. 705, otherwise known as the Revised Forestry Code of the Philippines as amended, Executive Order No. 192 s. 1987 reorganizing the Department of Environment and Natural Resources (DENR), Executive Order No. 318 s. 2004 promoting sustainable forest management, and Master Plan for Forestry Development, and to provide a standard procedure in tree seed collection, processing and certification of planting materials including accreditation of seed sources and forest tree nurseries,the adoption of the Field Manual For Tree Seed Collection, Processing and Certification of Quality Planting Materials and providing mechanisms on its adoption is hereby issued for the guidance of all concerned.

SECTION 1. Basic Policy. It is the policy of the State to ensure the sustainable use, development, management, and conservation of the country's forest resources not only for the present but also for the future generation. The government through the DENR shall promote the use of high quality planting materials in the establishment of tree plantations, tree farms, agroforestry and other forestation activities to promote other forest products in the country.

SECTION 2. Objectives. This Order envisions to attain the following:

2.1 Ensure the continuous production of adequate supply of phenotypically and genetically-improved planting materials to meet the requirements for high quality seeds and seedlings by the government and private sectors in the establishment and development of tree plantations, tree farms, forest gardens, forestation, agro-forestation projects, and rehabilitation of watersheds and coastal areas;

2.2 Develop a forest tree seed and seedling documentation and registry system for effective forest tree seed collection, handling and disposition; and sustainable seedling production;

2.3 Develop an accreditation system for government, local government units (LGUs), and private seed production areas for the operation of forest nursery;

2.4 Provide strategies and guidelines for the establishment, maintenance and protection of existing and potential Seed Production Areas (SPAs), Seedling Seed Orchards (SSOs), Clonal Seed Orchards (CSOs) and Seed Sources (SS); and in the determination of quality planting materials; and

2.5 Update the seed calendar for each forest tree species to serve as a guide for appropriate seed collection period.

SECTION 3. Creation of National Forest Tree Seed Committee (NFTSC) and Field Forest Tree Seed Committee (FFTSC). The DENR shall constitute Committees to be called the Forest Tree Seed Committees to advise the Government on matters arising out of the administration of forest tree seed certification and to carry out the other functions assigned to it by or under this Order.

The FTSC shall be composed of the National Forest Tree Seed Committee and Field Forest Tree Seed Committee.

3.1 National Forest Tree Seed Committee (NFTSC). The Committee shall consist of the following members, namely:

Chairperson	-	Undersecretary (as designated by the DENR Secretary)
Vice-Chairperson	-	Director, Ecosystems Research and Development Bureau (ERDB)
Members	-	Director, Forest Management Bureau (FMB)
		Director, Biodiversity Management Bureau (BMB)
		President, Philippine Wood Producers Association (PWPA)
		President, Society of Filipino Foresters, Inc. (SFFI)

The NFTSC shall have the following responsibilities and functions:

a. Act as the oversight and policy-making body governing forest tree seed collection, handling and disposition; and high quality seedling production;

b. Review and recommend for approval of the DENR Secretary a national framework for tree improvement; and

c. Recommend to concerned/authorized agencies measures to regulate and monitor the exportation and importation of forest tree seeds and other materials.

The NFSTC shall be supported by a National Technical Working Group (NTWG) composed of the following:

Chairperson	-	Assistant Director, ERDB
Vice-Chairperson	-	Assistant Director, FMB
Members	-	Chief, Forest Ecosystem Research Division, ERDB
		Chief, Laboratory and Experimental Services Division, ERDB

Chief, Forest Resources Conservation Division, FMB
Representative, BMB
Representative, PWPA
Representative, SFFI
Manager, Central Forest Tree Seed Center

The NTWG shall have the following functions:

a. Assess the national situation regarding the production of planting materials and recommend measures to ensure that planting stocks of sufficient quantity and high quality are made available in the various regions;

b. Review and assess the state-of-the-art of planting stock production and assess the feasibility and appropriateness of such technologies under Philippine conditions;

c. Evaluate and update the status of all seed sources in the country and recommend measures for the permanent establishment management and protection of such sources;

d. Recommend a forest seed and seedling documentation and registry system for effective forest tree seed collection, handling and disposition; and sustainable seedling production;

e. Develop and recommend an accreditation system for government, LGUs, and private seed production area and nursery operator; and

f. Formulate and recommend to the NFTSC a National Framework/Program on Tree Improvement for review and endorsement to the DENR Secretary for his approval.

The NFTSC and NTWG shall be authorized to call on any DENR official and/or Office, and may invite resource persons from other agencies and/or institutions in the performance of its functions and responsibilities. A Support Staff from the ERDB and FMB shall provide secretariat services to the NFTSC and NTWG.

3.2 The Field Forest Tree Seed Committee (FFTSC). An FFTSC shall likewise be created in different regional clusters to be composed of the following:

Chairperson	-	Center Head, ERDB Research Center
Members	-	Assistant Regional Director for Technical Services
	-	Forest Tree Seed Center Manager
	-	Representative, PENRO/CENRO (Technical Services)

The FFTSC shall implement and carry out the plans and programs as mandated by the NFTSC at the field level, specifically on the assessment and verification of the source, collection and handling of seeds and planting materials; and in the accreditation of government/LGU and private seed sources, and forest nurseries.

The FFTSC shall train extension workers, LGU staff, forest guards and other personnel in the Region, PENRO and CENRO on the above-mentioned activities.

On Forest Tree Seed Certification, the functions of the FFTSC are the following:

a. Adopt the standard forest tree seed certification scheme/criteria;

b. Review and recommend for accreditation of seed sources and forest tree nurseries;

c. Formulate a pricing system for seeds or other germplasm to be sold by accredited seed suppliers and private small tree farmers; and

d. Perform other functions the NFTSC may assign.

SECTION 4. Creation of Forest Tree Seed Center (FTSC). A Forest Tree Seed Center is a designated place where collected seeds from documented seed sources shall be brought, received, recorded, processed (dried, cleaned, and stored) tested, sorted, registered, and distributed to the nurseries and for the eventual out-planting (forestation and breeding). To continuously support the need of quality planting materials, the FTSC ensures the quality of the seeds produced from superior stands (Seed Production Areas/Individual Plus Trees Areas) through science-based tests and assessments.

SECTION 5. Certification of Seeds and Other Sources of Planting Materials. An application for Seed Certification shall be submitted to the Field Forest Tree Seed Committee which shall be accompanied by the required documents as provided in the Field Manual.

SECTION 6. Accreditation of Seed Sources. An application for Accreditation of Seed Sources shall be submitted to the FFTSC which shall be accompanied by the required documents as provided in the Field Manual.

SECTION 7. Accreditation of Forest Tree Nurseries. An application for accreditation for forest tree nursery shall be submitted to the concerned PENRO/CENRO for initial evaluation and field verification. Said application shall be accompanied by prescribed documents as provided in the Field Manual.

SECTION 8. Fund Support. The DENR shall allocate funds out of the yearly General Appropriation under appropriate budget line item to pursue the activities and program of NFTSC and FFTSC in carrying out the mandates as indicated in this Order.

SECTION 9. Penal Provisions. Any person, group of persons or organizations cutting, mutilating and damaging trees within SPAs, SSOs, CSSOs and SS without any permit or not in accordance with the prescribed silvicultural treatment shall be punished in accordance with Section 68 and 69 of P.D. 705, as amended, and P.D. 953.

SECTION 10. Supplementary Guidelines. The NFTSC is hereby authorized to issue specific and supplementary guidelines relative to this Order.

SECTION 11. Repealing Clause. The provisions of DAO 09, series of 1995, DAO 2010-11, and other related issuances which are inconsistent with this Order are hereby revoked or modified accordingly.

SECTION 12. Effectivity. This Order shall take effect upon acknowledgment by the Office of the National Administrative Registry (ONAR), and fifteen (15) days after its publication in a newsletter of general circulation.

ROY A. CIMATU
Secretary

FIELD MANUAL
FOR TREE SEED COLLECTION, PROCESSING AND CERTIFICATION OF QUALITY PLANTING MATERIALS

PREFACE

To ensure high percentage of field survival of planted tree seedlings and increase the productivity of plantations, it is important that good quality seeds and propagules are used in planting. Seedling quality is also a major factor that determines the success of any reforestation. The Department of Environment and Natural Resources (DENR) promotes the use of quality planting materials in the establishment of tree plantations, tree farms, agroforestry and other forestation activities for forest conservation and sustainable supply of wood and other forest products in the country.

To further address the concerns in the production of planting stocks, DENR Administrative Order No. 9, series of 1995 (DAO 1995-09) or the Regulation of Forest Tree Seed Production, Collection and Disposition was updated through the issuance of DAO 2010-11 (Revised Regulations Governing Forest Tree Seed and Seedling Production, Collection and Disposition) to include provisions not only on seed production and collection but also seedling production, distribution, certification, and forest nursery accreditation.

This manual was designed as a response to the requirement of sustainable production of quality planting materials using genetically improved germplasms of priority important forest tree species with support technology for plantation. It also supports the Enhanced National Greening Program (ENGP) which targets to reforest some 1.2 million hectares between 2017 to 2022 in accordance with the updated 2016-2028 Master Plan for Forestry Development.

Presented in this manual are the procedures on tree seed collection, processing and certification of quality planting materials developed to serve as a guide to foresters, forest plantation managers, nursery workers and tree seed specialists to ensure the continuous production and adequate supply of phenotypically and genetically-improved planting materials.

DENR Secretary

FOREWORD

With the changes in the organizational and institutional structure of the Department of Environment and Natural Resources (DENR), the Ecosystems Research and Development Bureau (ERDB) incorporated some provisions not included in the DAO 2010-11 or the Revised Regulations Governing Forest Tree Seed and Seedling Production, Collection and Disposition in this manual.

The revised procedures pertaining to the forest tree seed and seedling production, collection and disposition are discussed in this manual for tree seed collection, processing and certification and production of quality planting materials.

It is hoped that this piece of work will serve as a guide to stakeholders in producing quality planting materials and for other forest rehabilitation efforts of the government.

ERDB Director

Definition of Terms

Certified Seeds – seeds collected from trees of proven genetic superiority, as defined by a certifying agency, and produced under conditions that assume genetic identity.

Clonal Seed Orchard (CSO) – seed orchard raised from selected clones vegetatively propagated by grafting, cutting, marcotting, budding, air-layering or tissue culture.

Clone – a population of genetically identical trees or individuals propagated asexually from single superior parent.

Cloning – a technique of vegetative reproduction that allows using instantly the genetic gains recognized from tested selections and to multiply clones of superior parents.

Forest Tree Breeding – the application of knowledge of genetics to develop improved trees. The activities are geared to solve some specific problems or to produce a specially desired product, an example of such direct breeding is the development of pest-resistant trees or breeding trees that possess specially desired wood.

Forest Tree Improvement – usually synonymous with forest tree breeding but may refer to tree breeding in combination with cultural practices.

Forestation – establishment of vegetative cover through the process of reforestation and afforestation.

Genotype (genotypic characteristic) – an individual's hereditary constitution, with or without phenotypic expressions of one or more characters it underlies.

Germplasm – the collective hereditary materials that are the physical basis for inheritance.

Heritability - is a ratio of genetic variance in a population to total variance of the same population. It measures the degree by which the parental genes are transmitted to the offspring/progeny.

Intermediate seeds - type of seeds which can survive with fairly low moisture content (12-14%) without losing viability and can be stored for 3-8 months but can suffer injury when exposed at temperature.

Lesser-known Species/Lesser-used Species – timber which is less known or less accepted by end-users especially in commerce and/or trade both locally and internationally, because they are characterized by incompleteness of information as to species identification, available volume and end-use properties.

Orthodox seeds - type of seeds which can be dried at low moisture of around 5% and successfully stored at low temperature or subfreezing temperature for a long period.

Phenotype – the visible characteristics or physical appearance of an individual plant/tree.

Plus tree – a tree possessing better or superior phenotypic characteristics and appears adaptable. It has not been tested for its genetic worth, although the chances of it having a good phenotype are high for characteristics with a reasonable heritability.

Progeny test (trial) – evaluation of parent plant by comparing the performance of their offspring.

Propagule – a plant part such as bud, shoot, tuber, root, or spore used to propagate an individual vegetatively.

Provenance – the original native source of a population or source of seed, pollen or propagules.

Pruning – removal of undesirable branches.

Quality Planting Material – is a germplasm (can be seeds, seedlings, cuttings, wildings) coming from genetically superior parent tree which has been properly grown in a nursery with the best cultural management that will prepare the seedling to withstand unfavorable environmental conditions when outplanted in the field.

Recalcitrant seeds - type of seeds that cannot survive drying below relatively high moisture content (30-40%) and do not tolerate low temperature. The seeds lose their viability and cannot be successfully stored for a long time.

Roguing/Thinning – systematic removal of trees with undesirable traits or phenotype from a seed orchard or Seed Production Areas.

Seedling – includes all planting materials coming from seeds, wildings, cuttings and other sources.

Seed Bank – a facility for multiplication, collection, distribution (sale) and promotion of the use of genetically improved seeds and propagules. It includes seed processing unit, seed storage chambers, seed testing laboratory and an office.

Seed Orchard (SO) – is a plantation of selected clones or seedlings from selected trees, which are isolated to reduce pollination from outside sources, rogued of undesirables and is managed to produce frequent, abundant, and easily harvested crops of seeds.

Seed Production Area (SPA) – a stand of trees that has been selected for superior phenotypic performance upgraded by removal of undesirable trees and then managed for early and abundant seed production, typically by thinning.

Seed Sources (SS) – the stand of trees from which seeds are collected.

Seedling Seed Orchard (SSO) – seed orchard raised from seedlings produced from selected parents through natural or controlled pollinations followed by a rouging that will remove the poorest trees, generally leaving the best families for seed production.

Seed Stand - is an even-aged stand with a gregarious dominant species delineated to collect seeds from chosen mother tree. Example: Dipterocarps, Almaciga, Mancono, etc.

Vegetative Propagation – is the production of the new copies of mother trees directly obtained from the vegetative parts.

Wildings – refer to the young seedlings growing naturally underneath the mother trees and/or under the forest canopy. These could be used as substitute for nursery-grown planting stocks.

1 INTRODUCTION

The need to improve the quality and quantity of seeds for reforestation activities of the government particularly by the Department of Environment and Natural Resources (DENR) has been recognized as early as 1985. Several efforts have been implemented to develop a sustainable genetic resource conservation program for several forest tree species. Conservation programs include establishment of species provenance trials and seed orchards. However, due to changes in the organizational and institutional structure, the implementation of these initiatives became intermittent. As a response, the DENR has issued policies to address the need for quality seeds through the establishment of phenotypically and genetically improved plantations of priority forest tree species. In 1990, a guideline (DENR Memorandum Circular No. 21) in the handling and disposition of endemic forest tree seeds was issued in support of the National Forestation Program to ensure the adequate supply of industrial timber and fuel wood species. This effort was reinforced by the formulation and issuance of DENR Administrative Order No. 9, series of 1995 (DAO 1995-09) or the Regulation of Forest Tree Seed Production, Collection and Disposition which would regulate the collection, distribution and use of forest tree seeds. To further address the concerns in the production of planting stocks, the said Order was updated in through the issuance of DAO 2010-11 to include provisions not only on seed production and collection but also seedling production, distribution and forest nursery accreditation.

While planting stocks can be produced through vegetative propagation (cloning) and from collection of wildings, the majority of the requirement for planting materials still comes from seeds. With the establishment of seed sources such as seed production areas and seed orchards, seed production and collection can be made economically effective and efficient. The production of planting stocks coming from phenotypically and genetically superior trees will help to contribute in the attainment of the goals and objectives of sustainable forest management. Managing forest at sustainable level will address the problems on forest degradation and deforestation while providing positive impact to people and environment. The revision of DAO 2010-11 should respond to the requirement of sustainable production of quality planting materials using genetically improved germplasms of priority important forest tree species with support technology for plantation, reforestation and other rehabilitation efforts of the government. Additionally, this will give due emphasis on priority and economically important indigenous forest tree as alternative to industrial tree plantation species.

This Manual was develop to serve as guide to foresters, forest managers, nursery workers and tree seed specialist in the collection, handling, processing and storage of seeds and other planting materials.

2 QUALITY FOREST TREE SEED

The quality of seed is essential to the success of every forestation efforts. However, majority of plantation development activities rely on the use of seeds with unknown provenance, regardless of quality. Seed quality should always be an important consideration in the implementation of forest tree planting activities. It is essential to select the best mother trees as sources of planting materials for establishing a plantation. The aim of selection is to choose the best phenotypic trees. This will be the starting point in the improvement of the genotypic characteristics of the planting materials.

However, the genotype of the trees will be evident when their offspring have been grown and evaluated.

2.1 Selection of Seed Sources

Seed sources can be identified and selected from natural tree stands or plantations. The following should be considered in the selection of areas for establishment of seed sources:

a. Selection should concentrate on natural stands or plantations that are average or better in growth, bole quality, straightness, branch angle and other characteristics of interest. Locating such stands requires a thorough familiarity to the existing stands within the regions/sectors. A map of plantations or natural stands must be available. Delineate on the map as well as on the ground the plantations or stands on which selection will be done.
b. Selection should concentrate on plantations that have an age ranging from 5 years to not older than 10 years than the projected rotation age of the plantations that are to be established.
c. Avoid selecting from stands that have been thinned from above (i.e. selectively logged). If the stand has been thinned from below (to eliminate overtopped and damaged trees), allow crown competition to re-establish before selection.
d. Once the decision has been made to look over an area for candidate trees, a thorough systematic search should be made. The search shall be conducted in four stages: first, qualitative and subjective selection and marking; second, systematic grading of candidate trees; third, determine the best candidate trees within the stand; and fourth, remarking of selected trees.

All information gathered on the identified seed sources should be recorded using Detailed Information on Identified Seed Sources Form (Annex 1).

2.2 Types of Seed Sources

Seed sources are classified according to the intensity by which they are managed and the quality of seeds produced. For this purpose, three types of seed sources will be discussed.

Seed trees or Individual plus trees. These areindividual trees from which seed is collected. They should have superior characteristics - such as straight stem form or rapid growth

Seed Production Areas (SPAs). A plantation of known origin or stand of natural forest with superior phenotypic characters selected on the basis of its maturity and capacity to produce abundant seeds.

Seed Orchards. These are plantations of selected superior trees isolated to reduce pollination from genetically inferior sources outside the orchard and intensively managed to produce regular, abundant and early harvests of seed. Seed orchard is classified into:

1. Clonal/Vegetative Seed Orchard (CSO) – seed orchard raised from selected clones vegetatively propagated by grafting, cutting, marcotting, budding, air-layering, or tissue culture.

2. Seedling Seed Orchard (SSO) – seed orchard raised from seedlings produced from selected parents through natural or controlled pollination followed by a roguing that will remove the poorest trees, generally leaving the best families for seed production.

3 ESTABLISHMENT AND MANAGEMENT OF SEED SOURCES

Majority of the planting materials, particularly seeds, used in any reforestation activities by the government and the public are sourced from trees which did not undergo any evaluation and selection process. Thus, resulting to seedlings that are of low quality and survival. It is important that proper selection of mother trees are done to ensure that the seeds collected are of high quality.

3.1 Establishment Procedure

a. Establish corners of the plantation by using markers of brightly painted colored posts.
b. Evaluate the standing tree population using plantation inventory with certain sampling intensity.
c. All data should be recorded using the Assessment Table Form (Annex 2). Inspect the stand and set proportions to approximate Normal Distribution to predict the growth traits i.e. improve heritability such as stem straightness.
d. In conducting plantation inventory, it is suggested to first use DBH as the selection criterion for initial assessment. Depending on the selection intensity, trees belonging to the upper diameter (DBH) classes will be selected as Candidate Plus Trees (CPTs). If the stand selected satisfied the minimum requirements to be considered as SPAs, further assessment shall be done using the guidelines for qualitative traits. CPTs with the highest accumulated points in terms of qualitative traits will be selected as Individual Plus Trees (IPTs).
e. The selection of mother trees is based on the following parameters, namely:

Health	-Tree health
Stem form	-Stem straightness
	-Forking/stem branching
	-Circularity of the stem
Branching characteristics	-Branch angle
	-Branch thickness
	-Branch persistence

Tree health is the most important parameter when selecting potential plus trees. This will be used as primary deciding factor whether to include the trees to be surveyed in the list of potential or candidate plus trees. All the trees must be assessed for traits or characteristics using a subjective 3-point score wherein a score of 3 represents the highest value. The grading system is primarily intended for timber producing species and it is not considered absolute for other species. The grading system will vary depending on the purpose of establishing such seed source. In this case, if the purpose is for fuelwood production, select trees which have multiple stems. If the purpose is for fruit orchard, select trees which have low and wide branches for ease of collection. For urban planting, select trees which have wider crown for shade purposes and it should have branches that are persistent and durable.

3.2 Grading Scheme for Selecting Plus Trees

The grading scale for mother trees is based on the following categories:

Tree health

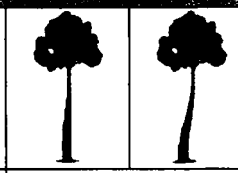
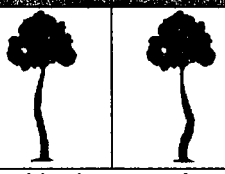
Tree health is based on the absence of symptoms and signs of pests and diseases. This shall be assessed through ocular observation of the color of the crown and degree of damage on tree stem, branches, and fruits.

Score	Description
3	10 to 25% of the crown is chlorotic and 10% damage caused by insects and pathogens in other parts of the tree
2	25 to 50% of the crown is chlorotic and 25% damage caused by insects and pathogens in other parts of the tree
1	More than 50% of the crown is chlorotic and there is evident damage of insects and pathogens in other parts of the tree

If the health assessment score is 1 or 2, the tree is automatically removed from the list of potential plus trees.

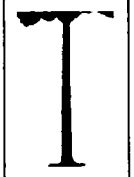
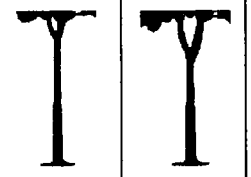
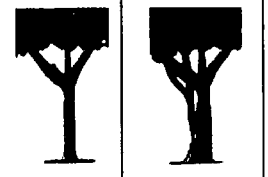
Stem straightness

This refers to the position of the stem in relation to the vertical axis. Stem straightness is directly related to wood quality.

Appearance			
Description	Straight with a narrow bend (less than 10° from the vertical axis) occurring at 1-2 meters from the ground	Trunk bending 10 to 15° from the vertical axis formed in the middle part of the stem length	Trunk bending greater than 20° within the merchantable length of the stem

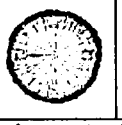
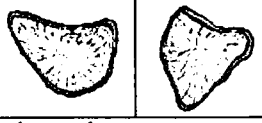
Forking and multiple stem leaders

This parameter describes the presence of multiple stems instead of the normal single stem. Forking reduces quality, quantity, and economic value of the wood. The degree of forking shall be rated according to the number of forked stems and the position of the stem where the fork has developed.

Appearance			
Description	Trunk does not fork and stem leaders developed above 5 meters from the ground with one stem considerably smaller than the main stem	Two stem leaders developed above 5 meters from the ground, the stems are of relatively the same size	More than two stem leaders developed within 5 meters from the ground

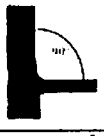
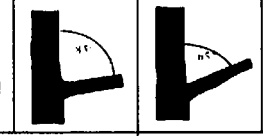
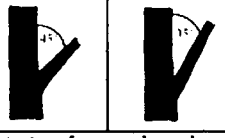
Stem Circularity

Normally, a tree exhibits a cylindrical stem. However, environmental and genetic factors affect stem development causing the tree to produce irregular or eccentric stem. The circularity of the stem affects wood quality and lumber recovery. Stem circularity shall be determined using the overall appearance of the stem from the breast height and at 5 meters interval along the length of the stem.

Appearance			
Description	The stem is relatively circular in shape with no obvious ridges	The stem resembles a slighly oblong-shaped appearance and prominent ridge can be observed	The stem has prominent ridges and assumes irregular shape in all axis

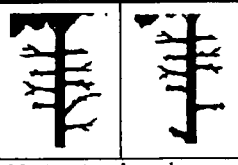
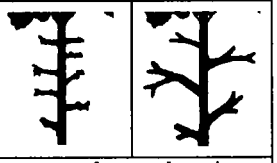
Branch angle

This refers to the angle the branch forms with the vertical axis of the tree stem.

Appearance			
Description	Majority of mature branches are 76° to 90° from the stem axis	Majority of mature branches are 51° to 75° from the stem axis	Majority of mature branches are less than 50° from the stem axis

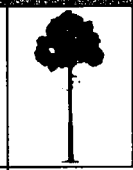
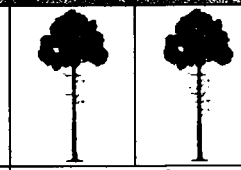
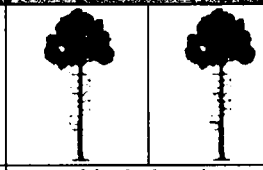
Branch thickness

This relates to the diameter of branches in relation to the size of the stem. The thickness of the branch provides information regarding the self-pruning characteristic of the tree. Also, large branches may produce localized knots reducing the wood quality.

Appearance			
Description	Most mature branches have base diameter below 15% of stem diameter	Most mature branches have base diameter below 16 to 40% of stem diameter	Majority of mature branches have thick branches relative to stem diameter

Branch persistence

This pertains to the attachment of dead branches on the stem. Ideally, dead branches fall readily after canopy closure. This will avoid embedded branch base which leads to development of wood defects including knots. Only branches with a diameter of at least 5 cm shall be considered in assessing this parameter.

Appearance			
Description	Dry branches shed or fall-off relatively fast (self-pruning)	Stem exhibits self pruning but some branches dry branches still remain	Most of the dry branches remain attached to the stem even after several years

Grade Computation

The grade of a single mother tree shall be the average of all grades obtained from all parameters assessed for that specific tree. Annex 2 shall be used when encoding the data obtained during the conduct of mother tree selection for uniformity. A sample computation is shown below:

Assessment Parameters	Grade
Stem straightness	3
Forking/stem branching	2
Stem circularity	3
Branch angle	2

Branch thickness	2
Branch persistence	3
Total	15
Average Grade	2.5~3.0 Highly acceptable

3.3 Selection of Potential Seed Production Areas (SPAs)

Seed Production Areas can be established/demarcated from existing reforestation projects, and plantations inside land tenure holders (SIFMA, TPLA, CBFM, etc. and in natural stands). There are preconditions to be fulfilled in upgrading these plantations/stands in SPA, such as:

1. The origin of the seeds from which the plantation has been established should be documented.
2. The area should contain a large number of good phenotypic individuals. Depending on the site and species, the eventual stand after rouging/ thinning will usually be no less than 200 trees/hectare
3. The trees should be mature for seed production: 8 years to not older than 25 years depending on the species. Seeds from very young or very old trees have problem of viability or poor growth as compared to middle-aged trees.
4. The plantation/stand shall be accessible for ease of management and collection of seeds.
5. The plantation/stand shall be free from pest and diseases.

3.3.1 Upgrading of Natural or Plantation Forest into Seed Production Area

a. Delineation of the area - The area of the SPA would depend upon the amount of seed required and production capacity. Borders should be determined by the use of geographic positioning system (GPS) devices. It should be distinctly demarcated with signs or posts. If possible, establish a perimeter fence and fire line for protection purposes. Provide signboard indicating the following information:

Location:
Species common name:
Species scientific name:
Area in hectares:
Age of stand:

b. Selection of trees
   - Conduct 100% inventory of all trees once the seed stand has been selected.
   - The selection criteria for plus trees should be followed. In case two trees are of equal appearance, selection should be based on thinning.
   - An overall rating for each tree can be obtained by weighing each trait measured according to importance, and adding the scores together. The highest score represents the plus tree.

- Mark the candidate plus trees. The numbering system for each tree chosen as plus tree should be standardized. The tree ID No. should be assigned to a plus tree and must remain constant throughout the life of the plus tree. If the tree dies, retire the number and never apply it to another tree.
- The tree is marked (painted with one band) to an assigned ID No.

Example: PT 12-051-ARKidapawan which means:

PT – plus tree
12 – Region
051 – plus tree number
ARKidapawan – location code
(Amas Reforestation Project, Kidapawan City)

c. Mapping of individual trees
- Chart on a map the location of all trees, dead or alive, in the delineated plantation.
- Indicate the corners or boundaries of the SPA and its relative location with other existing plantations.
- Properly indicate in the map the location of trees, using appropriate symbol, such as x for trees to be removed, + for dead trees and Θ for plus trees.
- Mapping of individual trees
- Chart on a map the location of all trees, dead or alive, in the delineated plantation.
- Indicate the corners or boundaries of the SPA and its relative location with other existing plantations.
- Properly indicate in the map the location of trees, using appropriate symbol, such as x for trees to be removed, + for dead trees and Θ for plus trees.

Θ	x	x	Θ	x	Θ	+	Θ
+	+	x	x	x	+	x	+
x	x	Θ	+	Θ	+	x	Θ
Θ	x	x	Θ	+	Θ	+	x
+	Θ	+	+	+	x	+	x
x	+	Θ	x	x	x	Θ	+

Figure 1. Sketch showing trees to be retained and to be removed

d. Roguing/thinning
- The final spacing should be decided; for most tree species the final spacing should be 6-10 meters, leaving a stock of 100-200 trees per hectare.
- Inferior trees should be marked for thinning even if it will create large opening in the stand.

- The trees marked for either rouging or thinning should be cut.
- In felling, the direction of fall shall be well aligned so as not to cause damage to the selected plus trees.
- A second rouging may be necessary to remove other inferior trees that might have been missed during the elimination process.

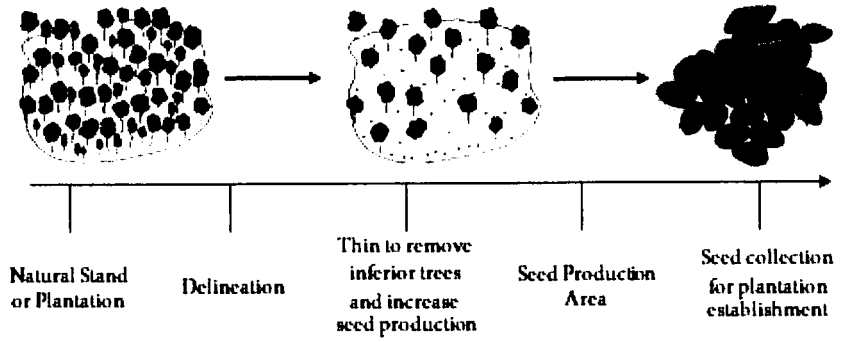


Figure 2. Illustration of Seed Production Area establishment

e. Removal of cut material - Residues from rouging and thinning impede traffic in the area, can be a fire hazard, and may attract pest and diseases, hence should be removed. If the residues will be utilized, i.e. for lumber, fuelwood, charcoal, necessary documentary requirements should be prepared by the Community Environment and Natural Resources Office (CENRO).

f. Establishment of a pollen dilution zone - Inferior individuals of the same species or other trees that can hybridize with the selected species are removed in a zone around the seed stand in order to avoid pollen contamination. If a pollen dilution zone cannot be established, the selected stand have better core of a larger stand with good phenotype individuals. Other tree species not belonging to the same family of the target plus trees may also be planted and used as part of the dilution zone.

3.3.2 Management of Seed Production Area

A seed production area must be managed properly in order to yield full production of seeds. The following silvicultural management operations should be undertaken:

a. Regular weeding - The trees in a seed production area have a wide spacing which will benefit the up growth of secondary vegetation. During the first year after roguing/ thinning, weeding will be a major task.

b. Fertilization - Seed production will generally be favored if fertilization is applied. Nitrogen usually favors only the vegetative growth and not flowering. Nitrogen fertilizer may be applied during crown establishment or regeneration. NP granulated fertilizer with micronutrients is applied during flower differentiation. The amount and timing is important to obtain an optimal effect.

c. Thinning and pruning - The tree crown should be kept open and exposed to light. Small additional thinning and pruning after the main one may be undertaken to maintain an open crown and consequently promote flowering.

d. Flower induction - The operation of inducing flowering by imposing stress on the tree or by applying hormones is usually not applicable to seed stands due to the high cost involved.

3.4 Seed Orchard

SSO and CSO represent a more advanced step than SPA. These are intensively managed to produce regular, abundant and early harvest of quality seeds. They are also intended for the mass production of genetically improved planting materials.

3.4.1 Establishment Procedure for Seed Orchard

a. Individual Tree Selection - This involves the selection of superior genotypes in plantations of seed bearing trees.

b. Site selection
- The site must be accessible. Preferably, it can be reached by vehicles.
- It must have good drainage, preferably with sandy loam soil.
- Moderate to poor in soil fertility.
- Must be isolated or far from a plantation or natural stand/forest of the same species.
- For species that are easily damaged by salinity, the orchard must be away from the coastal areas.
- Preferably in areas which are not frequently visited by strong typhoons.

c. Site Preparation - The planting site must be thoroughly cleaned by removing debris and big stumps. All standing trees are felled, slashed, and dumped in the sides of the orchard site where they are burned. As much as possible, the soil of the area must not be disturbed, except loosening it if compacted.

d. Propagation

For Seedling Seed Orchard

Seeds are collected from selected plus trees and these are germinated and raised in the nursery. Cultural morphological grading is required to select only those seedlings which are vigorous for outplanting. This selection will more or less contribute to increase the low selection differential attributed to this seed orchard.

For Clonal Seed Orchard

Rootstock to which a scion or bud is grafted or budded is usually grown in containers (usually polyethylene bags) in about a year's time, depending on the kind of tree species. Preferably, only one-year old branches are grafted.

The scions or buds or cuttings, etc., are collected from selected trees, preferably one-to-two years old. The grafted materials, budded, marcotted, rooted cuttings, tissue cultured plants can also be used.

e. Orchard Design

Number of clones or families

In seedling seed orchard more open-pollinated families are included, as many as 100 or more while clonal orchard design are based on between 20 and 50 clones. Higher number is recommended because of difficulties associated with finding sufficient plus trees, or clonal failures which occur during propagation and to permit rouging on the basis of progeny test results.

Initial planting distance

The decision on what spacing or how wide the trees are to be planted in the seed orchard is governed by the natural crown development of the species and the need to maximize cross-pollination in the orchard. If the natural crown formation of the species is broad, the wider spacing it would require and vice versa for narrow crown species. After 10 years, the crown of the trees would already be overlapping especially if there is no roguing conducted. It would be desirable at this option to consider an initial spacing of about 12m x 12m for all these species.

Planting pattern

A square or rectangular arrangement of plants is often used. Rectangular pattern will provide access to machinery or vehicle. The square patterns are more common; they follow the long established traditions of commercial fruit grower and are well-adapted for mechanical between-row tending in two directions.

f. Outplanting

The seedlings or vegetatively propagated materials are outplanted on a pre-laid-out planting according to the chosen design. The planting spots are marked with a stake and an identification tag indicating the clone number or plus tree number and place of origin. Outplanting is usually done at the onset of the rainy season. Proper planting procedure must be followed to ensure successful establishment of the planting materials.

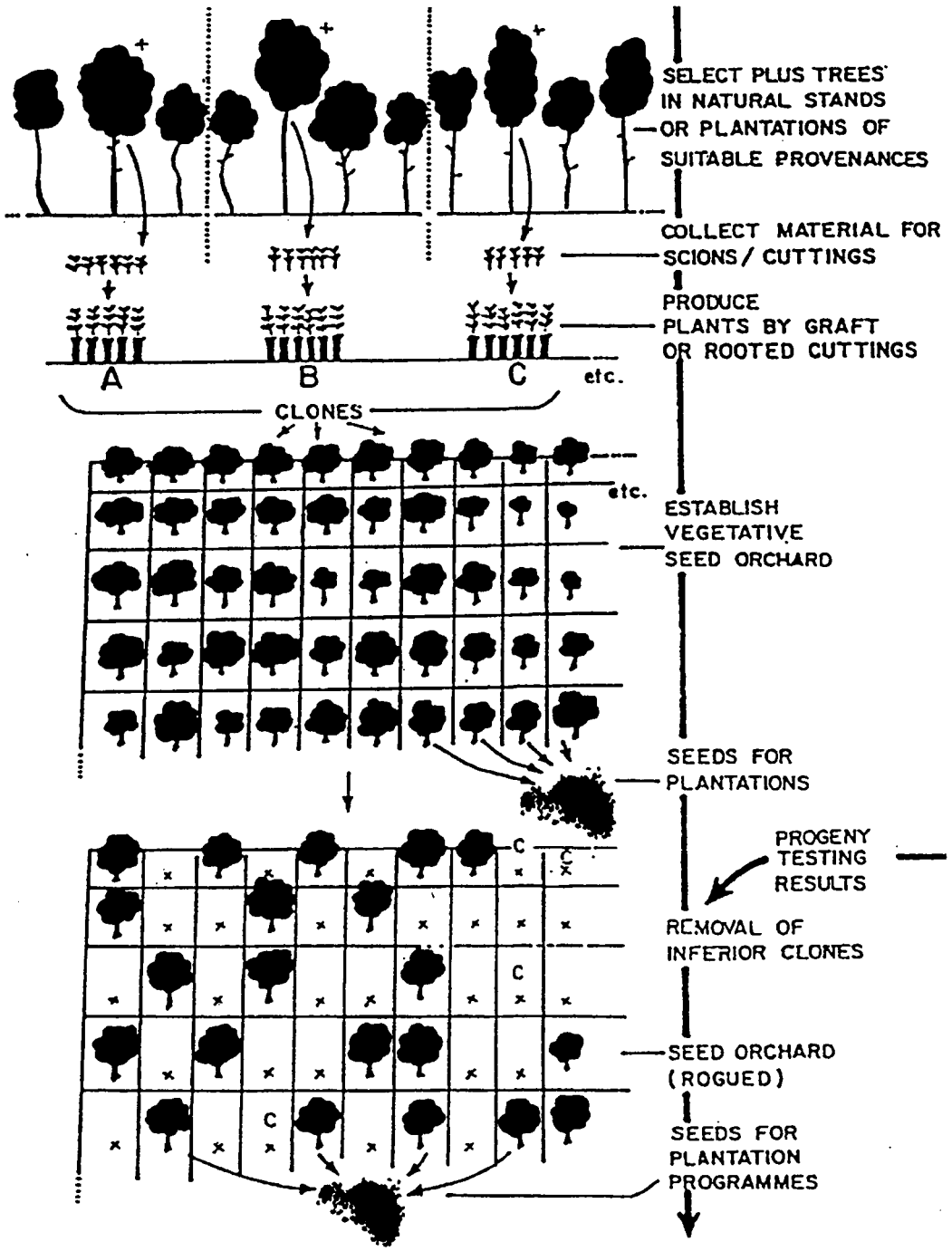


Figure 3. Illustration of Clonal/VegetativeSeed Orchard establishment

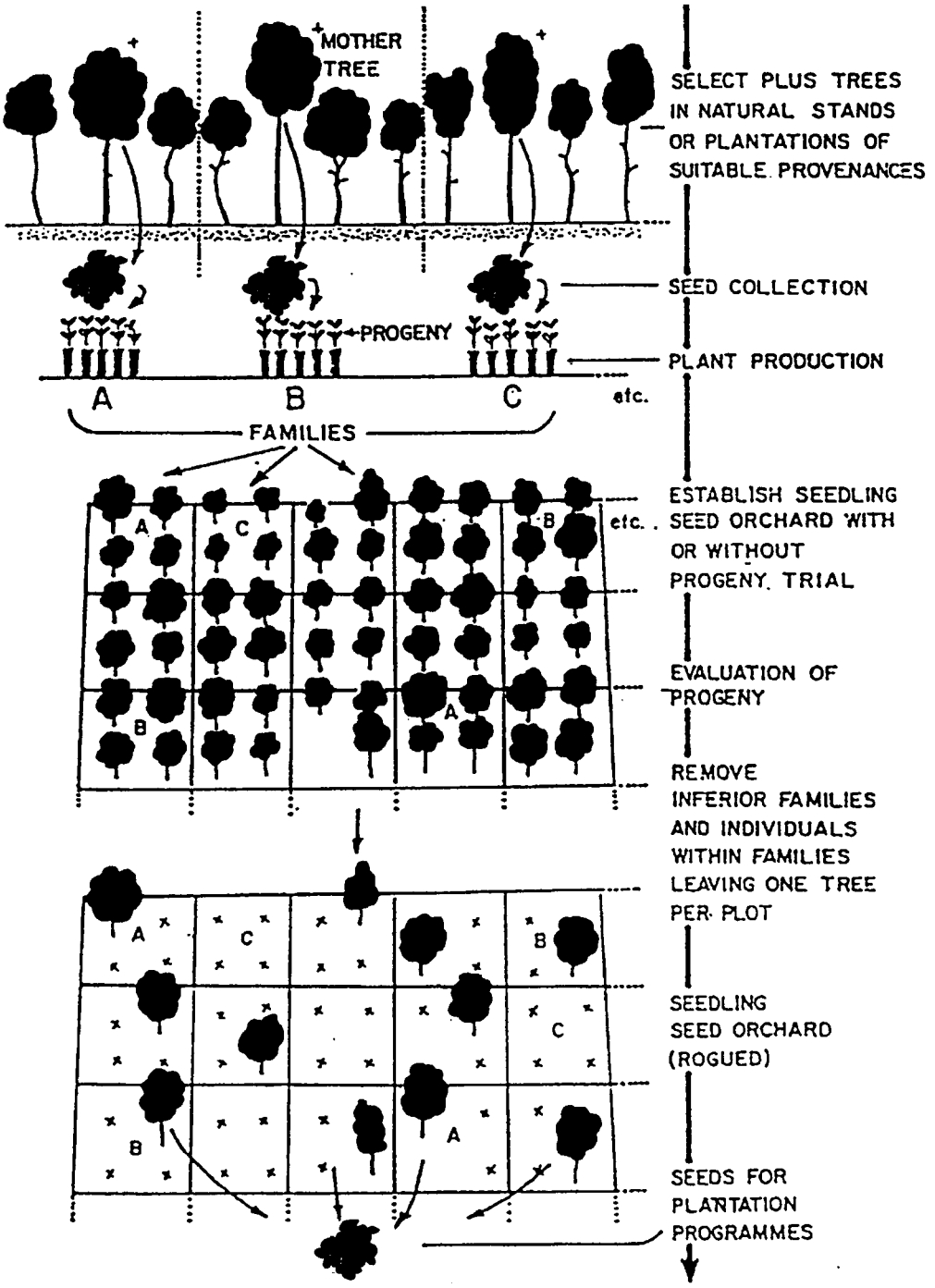


Figure 4. Illustration of Seedling Seed Orchard establishment

3.4.2 Management of Seed Orchard

The object of seed orchard management is to secure early and abundant production of sound seeds and to maintain production. This involves careful attention of the orchard trees and their crops, especially the orchard site. Seed orchard management is extremely complex. Proper procedure will vary according to the species, location of the orchards, and conditions encountered from one year to another within the same orchard.

a. Ground cover management - Removal of weeds within 1 meter radius is necessary during the early stage of development of the orchard trees. The weeds removed can be placed around the base of the young plants to serve as mulch to retain moisture. As the trees grow older, cover crop such as leguminous plants can be planted on the area to minimize weeding operation, to prevent soil compaction, and increase fertility of the soil.

b. Soil management - Soil texture has an influence on the moisture and nutrient-holding capacity, compatibility, erodibility, and other soil characteristics. The soil texture most desired will vary with species, although similarly sandy loam overlying friable subsoil, such as sandy clay, is conducive to flowering.

   Subsoiling - The practice in which the area is plowed deep cultivating the soil in loose condition, sever surface roots, resulting in greater root proliferation to greater depths, and it reduces surface water runoff, thereby improving soil moisture retention in the seed orchards. Subsoiling operation is done just prior to floral initiation. It improves flower production as well as plant development and vigor. It may also help prevent damage by diseases that spread by root grafts through the severances of the roots that would be used by the disease movement.

   Fertilization - Applications of nitrogen and phosphorous promotes flowering for nearly all species, especially in hardwoods. Before application, it is necessary to conduct a soil analysis to determine whether the soil is deficient of a particular macro-element, essential micro-elements, and whether it is acidic or basic. For most hardwoods, the pH is much higher, about 5.5 to 6.5 which is conducive for growth and flowering.

   The amounts of lime and fertilizer suggested for use in a seed orchard are based on the age of the trees, species, geographical location, and soil type, and no single application is suitable to all. Fertilizers should be applied just before the initiation of floral buds to increase flowering. It helps keep the trees healthy and to grow to a large size, resulting in more productive bud location. Fertilizer dosages are adjusted as the trees grow older, more for growth and vigor at the early stage and to favor flowering at a later date.

   Irrigation - In some areas, orchards are irrigated to induce more flowering especially in the droughty areas. It is usually at the later stage as water stress, in some cases, triggers more flower production.

c. Pest control - Pests are those biological elements that cause damage to the trees, such as man, animals, insects and diseases. Man may come and gather firewood, or simply for vandalism, cut the trees or burn the area. Animals, wild and domesticated, could destroy the seed orchard either by trampling or browsing the plants. There are numerous species of insects that cause damage to the plants, as well as there are diseases that infect and

destroy the seed orchard plants. Proper control and preventive measures must be adopted against the potential destruction these pests would make on the seed orchard.

d. Other management/cultural methods to increase flowering:
   - Partial girdling of the stem often result in increased flower and fruit crops.
   - Top pruning keep tree height down and to make seed collection easier has been widely used. Removal of unnecessary branches is a must to reduce the "sinks" of food otherwise can be used for production of flower and seeds.

e. Keeping Records - is an important activity in orchard management. The records provide a history of the orchard upon which present and future recommendation are based. They identify the genetic material contained therein, and they reduce the possibility of errors. Of great importance is the fact that they provide a record of what environment and management practices have influenced the orchard, how these were handled, and what the results were.

   Records should, except for general information on site (location, climate, soil, age of stand etc.) include all major operations like rouging, thinning, pruning, etc. The number of trees in the SPA is an important figure because it is an indication of the genetic base.

4 ESTABLISHMENT AND MANAGEMENT OF SEED SOURCES

4.1 Seed Collection

Methods of collection, processing and handling of seeds are usually recommended for individual tree collections. All information on the phenological characteristics of the species shall be recorded using the Phenology Calendar Form (Annex 3) lodged at ERDB. The very first consideration in planning seed collection is the identification of species/ provenances to be collected. After this, careful planning of all preceding activities shall be done such as where the collection is to be done, when to collect, and how much to collect (quantity). Seeds must be collected in areas where seed is to be planted (species site matching). If there is no local source, collect seeds in areas with the same climatic condition.

1. Staff Requirement
   - Collection Team Leader – supervises and undertakes seed collection particularly on the technical documentation
   - Support Staff (Tree Climber, Seed Collector, Driver)
   - Laboratory Technician – supervises documentation in relation to seed handling, seed testing, certification, dispatch and issuance of seedlot numbers

2. Timing of Collection

   The flowering and seed maturity period of the targeted species shall be monitored. Collections shall be concentrated on trees with moderate to heavy fruiting (more than 50% of the crown flowers). Seed collection sites and schedule shall be determined upon the conduct of inspection, verification, and characterization of seed sources.

3. Methods of Seed Collection
    - Collection from the ground
    - Collection from standing trees
    - Natural seed fall

4. Transporting of the Collected Fruits/Seeds
    - Appropriate handling shall be observed immediately after collection to maintain high seed quality since newly collected fruits and seeds are susceptible to damage due to high moisture content.
    - In case of bulk collection that includes twigs, leaves, and other debris, field processing shall be done immediately to reduce the weight of materials to be delivered.
    - Proper ventilation of the collected fruits/seed shall be provided during transport.
    - For fruits with fleshy pulp, the pulp shall have to be removed as soon as possible to avoid fermentation.
    - Reduction of transit time shall be done specifically for recalcitrant seeds which have low tolerance to high temperature. Direct exposure to sunlight shall be avoided as this may damage the seeds. On the other hand, too high moisture content may cause the seeds to germinate. Appropriate technologies to maintain seed viability from collection until the processing in the laboratory or nursery shall be applied.

4.2 Seed Processing

a. Seed Extraction

Seed processing shall involve the removal of debris and chaff contaminating the seeds. The activities shall depend on the selected species. Basically, the process shall involve:

- Extracting the seeds from the fruits (drupe and other species with hard endocarp);
- Extracting from fleshy fruits (berries);
- Extracting from pods and cones; and
- Dewinging or removal of wings as in the dipterocarp seeds

b. Seed Drying

Proper drying of newly extracted seeds from fleshy fruits shall be done to protect the seed from deteriorating. This shall be done either by sun or air drying. In sun drying, the seeds shall be scattered in a mat or in a clean, cemented area directly exposed to sunlight. In air drying, the seeds shall be spread in a mat or in an elevated area in sieve or wire mess. The length of drying shall be determined for each tree species.

c. Seed Cleaning/Upgrading

Seeds shall be cleaned after drying to remove further the impurities particularly for small seeded species. The common method of cleaning (like winnowing or blowing of air to separate seed from debris) shall be done.

d. Seed Sorting

Segregation of seeds shall be done depending on weight and size.

e. Purity test – determination of purity of the seeds. Use Annex 4.1 (Purity Test)

- Direct examination of the seeds shall be done either by the naked eye or by the use of microscope;
- Blotter test – seeds shall be sown in petri dishes or trays with filter paper or paper towel, then seeds shall be exposed in incubator with light for 7 days then examined under the microscope on the 8th day/ for the presence of micro fungi.
- Agar plate test – seeds shall be disinfected with 10% sodium hypochlorite (NaClO) for 5 minutes, then wash 3x with sterile distilled water and plated in potato dextrose agar (PDA) and incubate in chamber with light for one (1) week. Seeds shall be examined in stereoscopic microscope or in compound microscope for identification.

5 SEED STORAGE

Seeds collected, processed, and tested shall be brought to the nearest Forest Tree Seed Centers (FTSCs), regardless of geographical location and regional jurisdiction. The following techniques in seed storage shall be observed and shall be supported by Seed Record Card (Annex 7):

1. Seeds shall be kept in an environmental condition such that they are maintained viable;
2. Seed respiration shall be controlled in the level that would keep the seed but would not support germination; and
3. Seeds shall be kept and properly labeled for future use especially during seed off year when seeds are no longer available for collection.

The diagram below shows the process flow for forest tree seed technology.

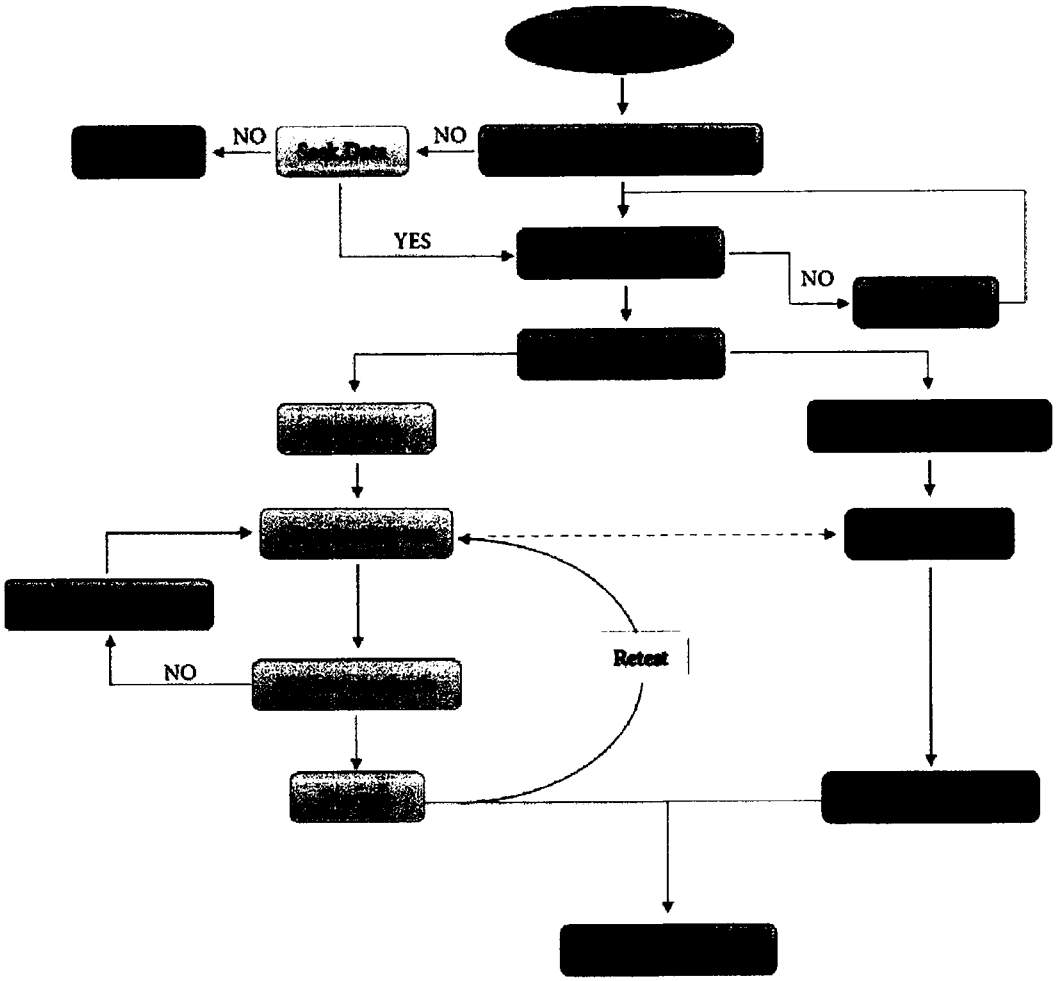


Figure 5. Process flow of forest tree seed technology

6 SEED CERTIFICATION

The following shall be the procedure in the certification of quality seeds:

1. Fill up Seed Certification Application Form (Annex 8) for certification of a seed lot or propagating material available at the ERDB Research Centers. Applicants should have provided the following documentary documents:
   a. Detailed information on identified Seed Sources
   b. Tree Seed Assessment Table
   c. Phenology Calendar Form
   d. Purity/Seed Count/Seed moisture Content
   e. Germination Test Form
   f. Seed Health Testing Form
   g. Seed Record Card

2. If seeds and other forms of germplasm will come from private/individual suppliers, the Application Form for Accreditation of Forest Seed Suppliers and Nurseries must be filled up and that necessary annexes are also supplemented.

3. An approved application form becomes the certificate of the seed lot. The full seed lot number should be recorded in Consignment Note (Annex 9) and other bills of sale, disposition or distribution for seed and planting stock.

   A computerized register of all seed lots and planting materials certified by this scheme will be maintained by the seed certification service/unit. The origin, parentage and collection information provided at the time of certification is stored with the collection number and classification codes.

   Provisions:
   Seed quality such as germination percentage and number of viable seed per kilogram are not covered by this scheme. Where these factors are an issue, they should be covered by separate laboratory reports.

   The FFTS Committee reserves the right to delay or refuse certification of a seedlot or planting material if it is considered in the interests of prospective users of the material. Reasons for refusal include:

   - Insufficient information provided;
   - Seed collected from a lone tree or clonal block where inbreeding could be a major factor;
   - Insufficient quantity of seed; and
   - Any person or Agency disputing the decision of the FFTS Committee may apply to the NFTS Committee to have the case considered.

4. After all supplemental information was provided, a consignment note mentioned earlier shall be prepared for dispatch. The process of seed certification is shown in the diagram below:

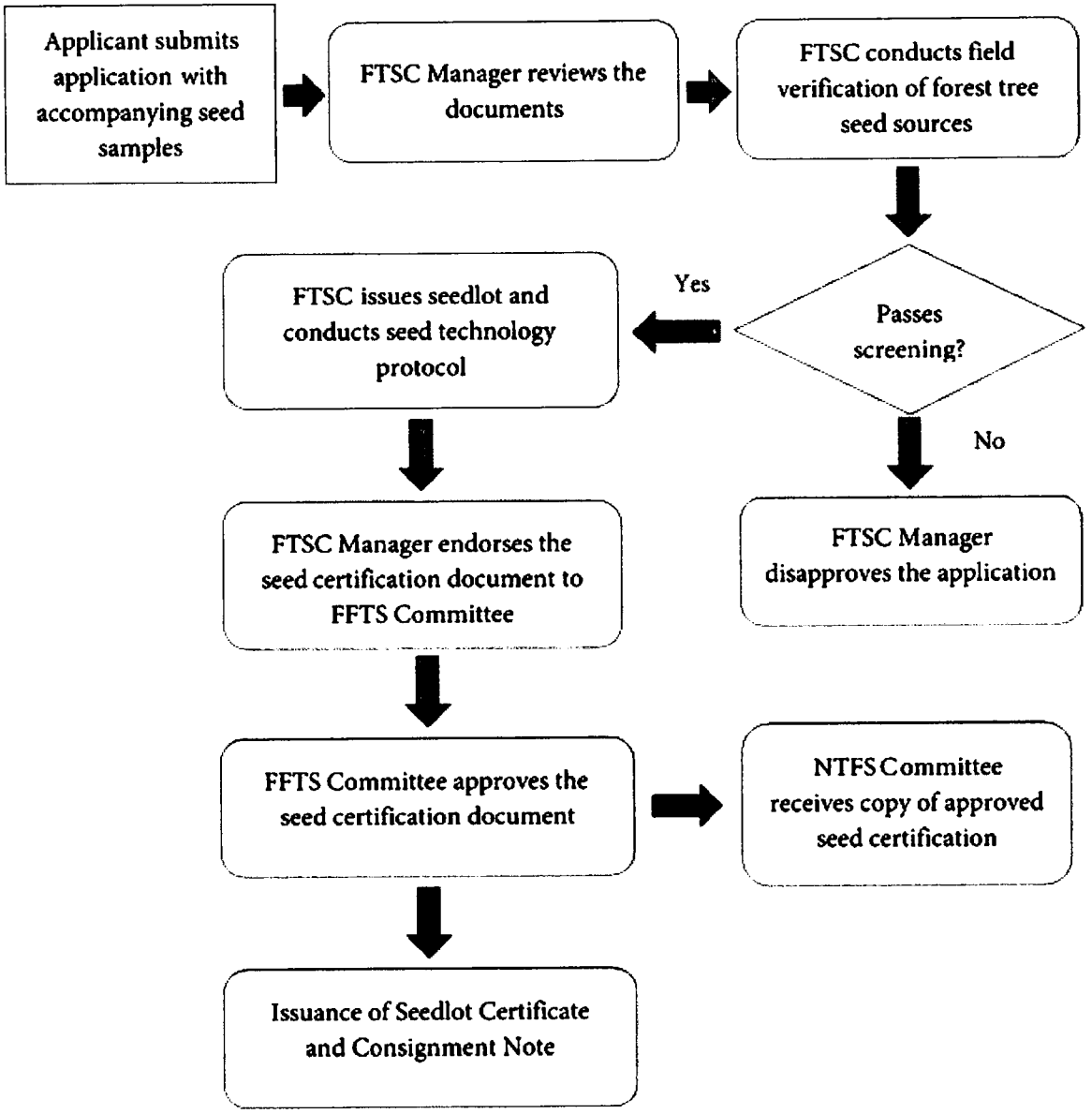


Figure 6. Flow chart for seed certification

7 SEED DISPOSITION AND DISTRIBUTION

Germplasm distribution is the supply of representative samples of seed lots from a Forest Tree Seed Center in response to requests for germplasm users. Germplasm should be distributed in a way that ensures it reaches its destination in good condition.

Registration is carried out in order to allow Forest Tree Seed Center to keep accurate records of samples and to produce inventory lists for conservation, distribution and other aspects of germplasm management.

Registration is done when the sample first enters the seed bank and is the assignment of a unique identification called the accession number for tracking each seed sample received by a seed bank in order to distinguish it from other samples.

For seeds and plants, the seed bank or nursery officer guarantees that seed classification code on the packing or consignment note or invoice is the one allocated by the certification unit, that the material is of the declared identity and that the standards set by the certification service allocated specific to the plant material is correctly used. A prefix code representing each region had already been formulated representing regional collections (Annex16).

Certification requires evaluation, classification, and registration. Certification of seed lots and plant material is necessary from the seed collector through the dispatcher of genetic materials from the seed bank and nursery providing accurate information. All seed leaving the seed center is documented with a combined Seed Certificate (Annex 8) and Consignment Note (Annex 9). This provides the consignee with basic information about the seedlot i.e. seedlot number, species, number of parent trees, weight of seed sample, locality of origin and an estimate of viability. If requested by the consignee, a copy of the seed collection report sheet can be sent with the seed to provide additional information.

8 CERTIFICATION OF SEED SOURCES

Applicants should file a request for seed source certification using Annex 10. All detailed information should be provided in the Seed Sources Certification Form (Annex 11). The seed sources shall be assessed and validated by the designated Forest Tree Seed Center Manager. The approval of certification shall be issued by the Field Forest Tree Seed Committee(FFTS). The seed source certification and quality seed certification shall be administered at the following forest tree seed centers:

Office	FTSC Location
Ecosystems Research and Development Bureau Main Office (ERDB)	Los Baños, Laguna
Watershed and Water Resources Research, Development and Extension Center (WWRRDEC)	Loakan, Baguio City
Urban and Biodiversity Research, Development and Extension Center (UBRDEC)	Pagbilao, Quezon
Coastal Resources and Ecotourism Research, Development and Extension Center (CRERDEC)	Camp 7, Minglanilla, Cebu
Forest and Wetland Research, Development and Extension Center (FWRDEC)	Bislig City, Surigao del Sur
Agroforestry Research, Development and Extension Center (ARDEC)	Tagum City, Davao del Norte

Procedures for the Certification of Forest Seed Sources:

1. The applicant, whether individual, cooperative, corporation, academe, LGUs, POs, NGOs, and other interested groups should presently own or has/have leased forest seed sources.
2. The applicant should file an application using the prescribed application form for certification of seed sources to the FTSC Manager.
3. The application should be accompanied by duly accomplished Seed Sources Certification Form.
4. The Forest Tree Seed Center Manager shall review the documents and shall conduct field verification and assessment of the forest seed sources to be certified. The criteria are as follows:
   a. The seeds must be produced in suitable areas as discussed in the establishment of seed sources.
   b. The characteristics of parent/plus trees in the area shall be considered.
      - Height – the tree crown or branches occupy the highest level of the stand of trees.
      - Diameter – diameter of the bole or trunk is as big as possible for the species.
      - Bole – the bole or trunk of the tree is uniformity straight from the base to the top.
      - Crown – the branches of the tree are equally distributed.
      - Health – tree is free from pest, diseases and defects.
   c. The applicant should have skills on seed production technology including seed collection, seed extraction, and drying, seed testing and seed storage.
   d. Presence of necessary facilities needed for the production of seeds shall also be considered.
5. The certification document shall be endorsed by the FTSC Managerto the FFTSCfor approval.
6. The certification fees shall be set as follows:
   a. Individual application – P 500.00
   b. Corporation application – P 1000.00
7. The original copy of seed sources certification document (which is the duly accomplished and signed Seed Certification Form) shall be issued to the applicant and a photocopy shall be retained at the concerned Forest Tree Seed Center and another copy to be submitted to NFTSC.
8. The Certification of Seed Sources shall be valid for a period of two years.

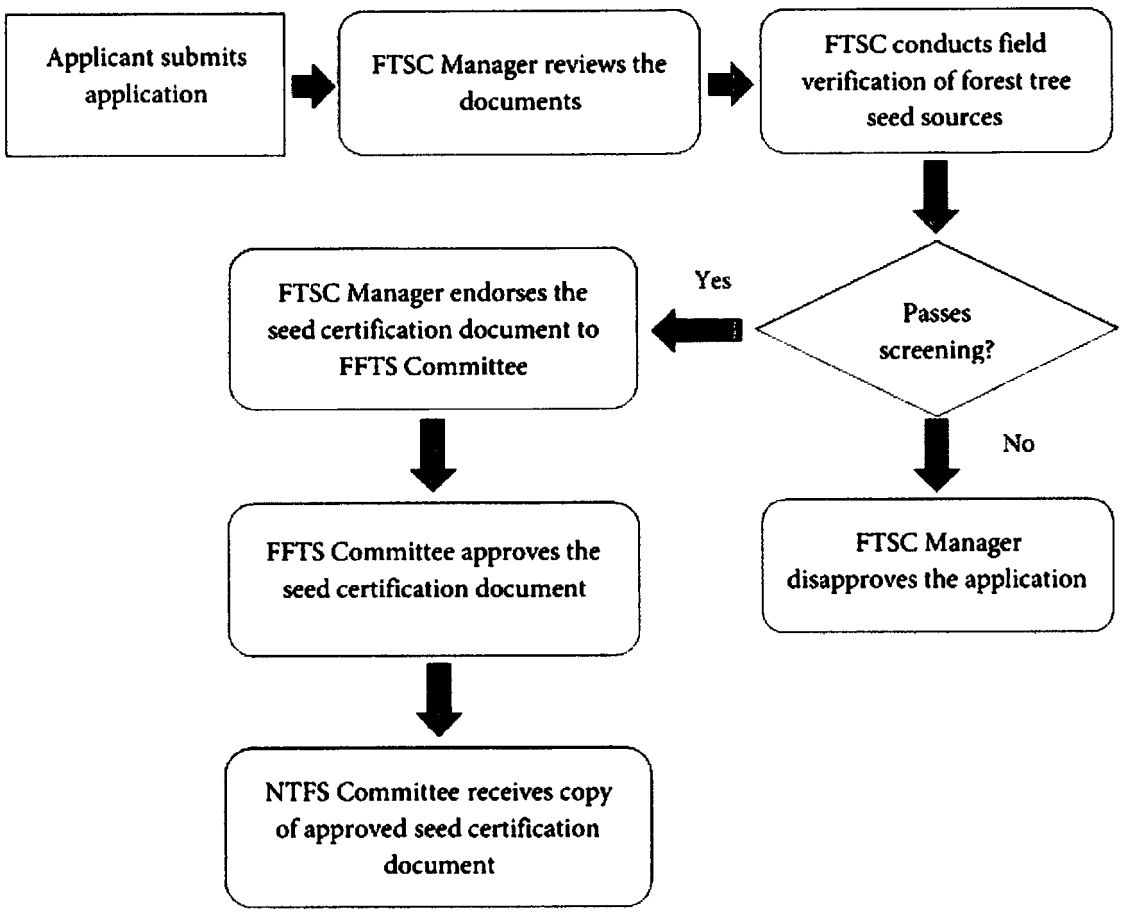


Figure 7.Flowchart for the Certification of Seed Sources

9 ACCREDITATION OF FOREST TREE SEED SUPPLIERS

An application form for accreditation of forest tree seed suppliers (Annex 12) shall be submitted to the FFTS Committee. The Committee shall issue the forest seed suppliers accreditation document (Annex 13). Accreditation applies to any LGU, academe, government and non-government organization, private individual, corporation or cooperative engaged in seed production and disposition.The procedure for Accreditation of Forest Tree Seed Suppliers is as follows:

1. The applicant, whether individual, cooperative, corporation, academe, LGUs, POs, NGOs, and other interested groups should have identified and certified seed sources.
2. The applicant should file an application using the prescribed application form for accreditation to the Forest Tree Seed Center Manager for initial assessment and evaluation.

3. The Forest Tree Seed Center Manager shall review the application and supplementary documents of the forest seed suppliers to be accredited. The seeds must come from identified and certified seed sources. The Officer shall either approve or disapprove the application for accreditation.
4. The accreditation document shall be signed/approved by the Research Center Head.
5. The accreditation fees shall be set as follows:
a. Individual application – P 500.00
b. Corporation application – P 1000.00
6. The original copy of the accreditation document shall be issued to the applicant and a photocopy shall be retained at the concerned Forest Tree Seed Center and another copy to be submitted to NFTS Committee.
7. The Accreditation Document shall be valid for a period of two years.
8. The continuance, suspension or cancellation of the accreditation shall be determined by the performance of the seed supplier. The grounds for cancellation and penalties are as follows:
   a. Procuring seeds from non-documented sources.
   b. Non-compliance with the required supplemental annexes/documents.

10 COLLECTION AND PROPAGATION OF WILDINGS

Wildings are seedlings that grow naturally in the forest or in the wild. They are usually found under trees that have fruits and seed. These could be used as substitute for nursery-grown planting stock. However, their survival in the planting site is generally low if they are planted without passing through a hardening process. Wildings can be used, when nursery-raised seedlings or seeds to be planted are not available.

Collection of wildings within protected area shall be covered by DENR Memorandum Circular 2004-06 (Guidelines in the Integration of Rainforestation Farming Strategy in the Development of Open and Denuded Areas within Protected Areas and other Appropriate Forest Lands). The wildings to be collected shall be subjected to rigid selection. Collection techniques with least or no detrimental effects to the existing population of non-target species and habitats in the area shall be used in wildings collection. Only wildings of good quality and appropriate size shall be selected/ collected. All the suppressed and undersized wildings shall be retained in the forest floor. The quantity of wildings to be collected per site shall not exceed fifty (50%) of the stocks/regenerations, such that for every ten (10) wildings surviving around a mother tree, only five (5) shall be collected. Species site matching would be taken into consideration. Wildings collected from a certain location should be planted in places with similar climatic type and site conditions to ensure higher survival and better growth performance.

11 CLONAL OR VEGETATIVE PROPAGATION

Vegetative/clonal propagation through macropropagation such as stem cuttings using mist and non-mist systems and grafting, and through micropropagation like tissue culture are techniques applied for mass production of the improved materials. The indigenous species which were

successfully propagated by stem cuttings and the recommended rooting hormones and concentration are listed in Annex 17. Other parties that may engage in clonal propagation such as, but not limited to State Universities and Colleges (SUCs), shall also follow the same procedures.

Procedure in Vegetative Propagation:

11.1 For Non-Mist System

1. Materials
    - Shoots with relatively woody system about pencil size, preferably leafless and juvenile stem shortly before emergence of new leaves (dormant stage).
2. Collection and processing
    - Collect shoots with 2-3 nodal cuttings early in the morning.
    - Using a sharp pruning shear, reduce the leaves into 1/3 of the original size.
    - Immediately immerse the collected materials in a pail with sufficient water to prevent desiccation.
3. Sterilization
    - Prepare sterilant, such as benlate or captan 500, following the instructions indicated in the label/packaging.
    - Soak the prepared cuttings for 30 minutes.
4. Rooting hormone application
    - Remove cuttings from the sterilant and allow the excess solution to drip.
    - Scrape part of the basal portion of the cuttings.
    - Dip ends of cuttings in the rooting hormone and concentration for 30 minutes.
5. Rooting Media
    - Combine 1:1 proportion of sterilized sand and fine coconut coir dust.
    - Place the rooting mix in a tray with a relative depth of 4 inches. Bottom should be perforated with small holes. Hyko trays are recommended containers.
    - Water the rooting media, preferably with clean sterile water.
6. Root induction
    - Bore a hole about the average size of cuttings before planting the stem cuttings to prevent wounding of the base.
    - Ensure the strong hold of the cuttings in the rooting media to avoid disturbance when moving the tray.
7. Incubation
    - Enclose in a large transparent poly bag with a diameter of 62" x 25" supported by a frame of bent wire.
    - Tie the end of the poly bag to prevent desiccation.
    - Allow the set up to incubate for a period of 6-8 weeks (depends on the kind of species) to induce full root development.
    - Periodic application of water using hand mist sprayer should be done as soon as the walls of the plastic sheets show signs of drying.
    - Carefully remove dead parts of cuttings to prevent fungal growth or contamination.
8. Harvesting, acclimatization and hardening
    - Carefully remove the rooted cuttings from the tray avoiding damage to newly formed roots.
    - Transfer into 4" x 6" black plastic bag containing top soil, river sand , and compost (1:1:1)

- Acclimatized inside the plastic globules employing gradual opening for 2 weeks and gradually transfer to the partially open nursery.
- Water with foliar fertilizers and/or 14-14-14 NPK solution (2 tsp/gallon).
- Transfer to open nursery and maintain watering and fertilizing until ready for transplanting in the field.

11.2 For Mist System

1. Collection and preparation of planting materials
    - Cuttings of about 25 cm will be taken from phenotypically healthy growing trees, preferably 2 year old and above and/or from the hedge garden.
    - The collection will be done early in the morning between 7 a.m. to 9 a.m. with the cuttings placed immediately in a bucket filled with water to prevent the cuttings from desiccation.At the laboratory, using a sharp pruning shears, 2-3 nodes cuttings, pencil size, will be prepared from the collected stem cuttings and will be returned to the bucket with water.
    - Cuttings will be prepared with their leaves trimmed half of their original size.
    - Application of Fungicide/Decontamination
    - The fungicide will be prepared according to manufacturer's direction by dissolving 0.25 tablespoon Dithane powder in one litter of distilled water.
    - The cuttings will be pre-treated by fungicide for 30 minutes before these will be subjected to the hormone preparation.

2. Preparation of the rooting hormone
    - The desired rooting hormones (i.e. IBA, IAA, NAA and other ready-made rooting hormones like Superthrive, Hormex, and Rootone F) will be prepared. IBA, IAA, and NAA will be prepared in liquid form. The diluted liquid hormone will be prepared by slowly dissolving 1 gram powder in ethyl alcohol with continuous stirring.
    - When the powder completely dissolved, distilled water will be added to complete volume of 1,000 ml. This will serve as the 1,000 ppm stock from where different concentrations such as 100 ppm, 200 ppm, 300 ppm, etc. will be prepared.

3. Treatment Application
    - Cuttings will be soaked in the prepared liquid hormone with the lower portion of the cuttings soaked for 30 minutes.

4. Preparation of propagation beds
    - An elevated propagation bed made of concrete provided with misting system shall be used. Sieved pure river sand treated with fungicides will be poured onto the propagation bed. Sand will be used because this was proven to be a good rooting medium due to its low content of contaminants and good drainage.
    - An automatic timer set at a duration of 5 minutes which turns on every half an hour between 8 a.m. to 5 p.m. and hourly for the rest of the day.
    - A solution of 1% dithane will be applied in the propagation beds 3 days before setting the prepared cuttings and weekly intervals thereafter to avoid onset of contaminants on the cuttings.

5. Setting of cuttings in the propagation bed
    - Sand medium will be marked where setting of cuttings will be placed.
    - Bore a hole about the average size of cuttings before setting the cuttings to prevent wounding of the base.
    - After setting the cuttings, the sand will be tapped/pressed gently with the fingertips to firm up and ensure strong hold of the cuttings in the rooting media.
    - The distance between each planted material will be set depending on the diameter of the cuttings and the size of leaves.
6. Harvesting of rooted cuttings
    - Periodically checked the set-ups for root development.
    - Harvesting will be done carefully by lifting each cuttings using a stick.
    - The harvested cuttings will then be transferred in 4" x 6" black polyethylene plastic bags containing top soil, river sand, and compost (1:1:1) and will be placed in a plastic globules for recovery and acclimatization for at least 2 weeks.
    - After 2 weeks, the potted rooted cuttings will be transferred and reared in the recovery shed and in the hardening shed, maintaining watering and fertilizing until ready for transplanting in the field.

11.3 Vegetative Propagation through Grafting

1. Select the part that will serve as scion. It must have buds. Remove the leaves but leave the buds or nodes.
2. Select your stock. Split cut the top end of the selected part.
3. Sharpen the end of the scion and insert to the split-cut top end of the stock.
4. Apply wax over the cut portion. This prevents the evaporation of water. Wrap a plastic sheet around the grafted sheet around the grafted part tightly, but do not cover the nodes.
5. Cover the grafted portion loosely with a plastic bag.
6. When the young leaves appear, remove the plastic bag. Leave the plastic sheet around the graft.
7. Remove the plastic wrapping after five months.
8. If the plant is fully developed, it may then be ready for outplanting.

11.4Propagation through Tissue Culture

Tissue culture is the general term for the techniques of growing plant cells, tissue and organs using aseptic procedures and under artificial environmental conditions and culture medium. The clonal propagation of a selected plant using tissue culture techniques is called micropropagation. It involves the growing of a small piece of a plant inside culture bottles with the necessary nutrients and in the absence of microorganisms under laboratory conditions.

The system of propagation has several advantages: a) it reduces the time and amount of plant material needed to propagate a new species; b) it is more precise because the nutritional and environmental conditions can be easily controlled; c) it is safer to use than other traditional methods of vegetative propagation because it allows disposal of tissues affected by viruses.

11.4.1 Stages of Tissue Culture

a. Establishment of Aseptic Cultures

One of the basic requirements of tissue culture is a sterile environment. Aseptic techniques or procedures which are used to prevent the introduction of viruses, fungi, bacteria or other microorganisms is a must in all aspects: the glassware, the water to be used for culture, the explants or initial material for culture, laboratory gown, the staff involved etc.

b. Rapid numerical increase of organs or other structures

The conditions which permit the shoot tips, axillary buds or organogenic callus to be established and maintained should be defined. Then the means of stimulating multiple shoots or buds from these cultures must be ascertained. The major objective is the production of multiple shoots per explant via organogenesis, or multiple embryos via somatic embryogenesis.

c. Preparation of propagules for successful transfer to soil

Rooting shoots in order to produce plantlets can be done in vitro or in the nursery through direct rooting techniques. The requirement however, is a sterile environment, wherein the sand to be used has to be sterilized. Rooting in vitro is expensive that 30-70% of the production cost is spent for this alone.

However, a cost effective protocol has been developed in Nepal on direct rooting of micro-shoots in non-sterile sand. It made a significant contribution to inexpensive nursery establishment of in vitro multiplied shoots of red gum.

The shoots should be maintained under high humidity, thereby requiring the use of sealed large plastic bags, air-tight for a certain period of time. Hardening of established plantlets has to be gradual to prevent wilting and eventual death of plantlets.

d. Field Establishment

After undergoing all the hardening processes in the nursery, the plantlets are now ready for outplanting. The procedure for the outplanting of seedlings and other propagules is normally followed.

11.4.2 Methodologies in Tissue Culture

a. Stockplant preparation

In order to reduce the population of contaminants and therefore, reduce laboratory sterilization activities, the stockplants (i.e. sources of explants or initial material for tissue culture) are given insecticide and fungal sprays at the hedge garden weeks prior to collection of explants. Fertilization and other maintenance activities that would make them healthy should also be conducted.

b. Preparation of stock solutions

Plant tissue culture media are generally made up of some or all of the following components; macronutrients, vitamins, amino acids or other nitrogen supplements, sugars, other undefined organic supplements, solidifying agents or support systems and growth regulators. Some of the media used for tissue culture are Murashige and Skoog's (MS) (1974) and McCown and Lloyd Plant Medium (WPM) (1981). Other media have also been used depending on the species.

c. Explant Collection, Preparation and Sterilization

An explant is a piece of plant from which a culture is started. Meristems, shoot tips, juvenile stems, anthers, flower buds, young leaves, embryos, hypocotyl, seeds, rhizome tips, bulb scales and many others can serve as explants or sources of explants. Sizes of explants range from 0.1 mm to 2 inches or more.

Obtaining sterile plant material is difficult, therefore, explants are submitted to cleaning treatments. The smaller the explant, the less contamination there is to remove. Solutions used to sterilize explants must preserve the plant tissue but at the same time destroy any fungal or bacterial contaminants.

Explants are normally washed in a mild soapy detergent before treatment with a sterilizing solution. After the tissue is washed, it should be rinsed under running tap water for 10-30 minutes and then submerged into the disinfectant solution under sterile conditions in the laminar flow hood.

The weakest bleach solution effective against contaminations on any particular explants should be used. Explant materials may remain contaminated if the solution is too weak to kill the contaminants, however, the material can also be burned if solutions are too strong.

All surfaces of the explant must come in contact with the sterilant. After the allotted time for sterilization, the sterilant should be transferred to another container and the explant washed at least three times in sterile distilled water.

Disinfectants for sterilizing explants:

Disinfectant	**Concentration**	**Exposure time (min)**
Calcium hypochlorite	9-10%	5-30
Sodium hypochlorite	0.5-5%	5-30
Hydrogen peroxide	3-12%	5-15
Ethyl alcohol	75-95%	Several seconds to several minutes
Silver nitrate	1%	5-30
Bromine water	1-2%	2-10
Mercuric chloride	0.1-1%	2-10
Antibiotics	1-50mg/liter	30-60

d. Media Preparation, Dispensing, Sterilization, pH determination

Agar is still preferred over liquid medium because of the following reasons:

- Loss of vital chemicals from cells by leaching maybe more severe in liquid medium;
- Agar, besides providing a solid support for the tissues, could be beneficial because of its adsorptive capacity and like charcoal, may remove some cellular waste products;
- Cells agitated in liquid medium are prone to mechanical damage

The sequence of steps involved in preparing a medium is as follows:

- Required quantities of agar (usually 4 g/li) and sucrose (20-30 g/li) are weighed and dissolved in water about ¾ the final volume of the medium, by heating them in a water bath. This is not necessary for liquid form.
- Appropriate quantities of the various stock solutions, including growth regulators and other special supplements are added.
- The final volume of the medium is made up with distilled water
- After mixing well, the pH of the medium is adjusted using 0.1 N NaOH if the pH is too acidic and 0.1 N HCL if the pH is too basic
- The medium is poured into the desired culture vessels. About 10-15 ml of the medium is dispensed in a small test tube and about 50 ml in a 150 ml flask. If during steps (b) to (e), the medium starts to gel, the flask/beaker containing the medium should be heated in a water bath and poured only when it is in a uniformly liquid state.
- The culture vessels are plugged with rubber stoppers or with non-absorbent cotton wool wrapped in gauze
- The culture vessels containing the medium are transferred to appropriate baskets and covered with aluminum foil or used bond paper to check wetting of plugs during autoclaving at 121EC with pressure of 15 psi for 15 minutes. Autoclaving for a longer period should be strictly avoided because this may induce chemical changes in the media and decompose carbohydrates, vitamins, and growth regulators.
- The medium is allowed to cool at room temperature and is stored at 4EC. When preparing a solid medium in culture tubes, it is desirable to make slants by keeping the tubes tilted during cooling. Such slants provide a larger surface area for tissue growth.

e. Culture/sub-culture

The instruments for septic manipulations such as forceps, scalpels, needles, and spatula are normally included in the autoclaving of the media for better sterilization. During the operations, these are sterilized from time to time by dipping in 95% ethyl alcohol followed by flaming and cooling. Suitable culture sizes of explants are then prepared from the surface sterilized planting materials.

The inner portion of the planting materials is normally used for culture. Closure of the bottle is removed, the inoculum transferred into the medium, the neck of the vial flamed, and the closure replaced in quick succession.

Once the medium becomes brown or desiccated, the cultures need to be transferred to fresh medium. The transfer of cultures to another medium is done for continued growth. Technically, this is called aging which is the result of exhaustion of nutrients; inhibition of diffusion, evaporation accompanied by an increase in the concentration of some constituents of the medium; and accumulation of metabolites which may kill the culture.

12 ACCREDITATION OF FOREST TREE NURSERIES

An application for accreditation for forest tree nursery shall be submitted to the concerned CENRO/ PENRO for initial evaluation and field verification. Said application must be accompanied by the following information:

a. Name of nursery;
b. Name of owner and proof of land ownership/ tenure;
c. Address;
d. Area, location and capacity of forest nursery;
e. Membership in association;
f. Sources of seeds, wildings and cuttings (Annex 1);
g. List of available facilities such as water system, potting and hardening sheds, among others;
h. Accessibility and disposal of planting materials produced;
i. Capability of nursery operator (training/s attended, employment of nursery consultant, or three (3) years of experience on nursery operation;
j. Photograph of the nursery;
k. Business permit;
l. Certificate of Registration from DTI; and
m. Authenticated tax clearance

The procedure for the accreditation of forest nurseries is as follows:

1. The applicant, whether individual, cooperative, corporation, academe, LGUs, POs, NGOs, and other interested groups should have duly identified and certified seed sources and must be presently operating.
2. The applicant should file an application using the prescribed form for accreditation (Annex 14) to the concerned Provincial Environment and Natural Resources Office (PENRO)/Community Environment and Natural Resources Office (CENRO) for initial validation and field verification.
3. The documents shall be forwarded to the FFTSC for review and proper endorsement to the Regional Director for approval.
4. The accreditation fees shall be set as follows:

   Individual application – P 500.00
   Corporation application – P 1,000.00

5. The original copy of the Forest Nursery Accreditation Document (Annex 15) shall be issued to the applicant and a photocopy shall be furnished to the FFTSC and NFTSC.

6. The Accreditation Document shall be valid for a period of two years.
7. The continuance, suspension or cancellation of the accreditation shall be determined by the performance of the forest nurseries owners/operators. The grounds for cancellation and penalties are as follows.

   Grounds for penalties:
   a. Procuring seeds from non-documented sources.
   b. Major deviation from prescribed standards of producing quality planting materials (Annex 18).

   Penalties
   a. First Offense – Warning
   b. Second Offense – Suspension for 6 months
   c. Third Offense – Cancellation

Any local government unit, academe, government and non-government organization, private individual, corporation and cooperative engaged in managing a forest tree nursery are subject for accreditation. An administrative fee shall be collected for nursery accreditation.

For government plantations, only seedlings coming from accredited nurseries shall be used in tree plantation development, tree farms, agroforestry, urban forestry and other related reforestation activities. For private tree plantations, the use of seeds/seedlings coming from accredited nurseries shall be encouraged.

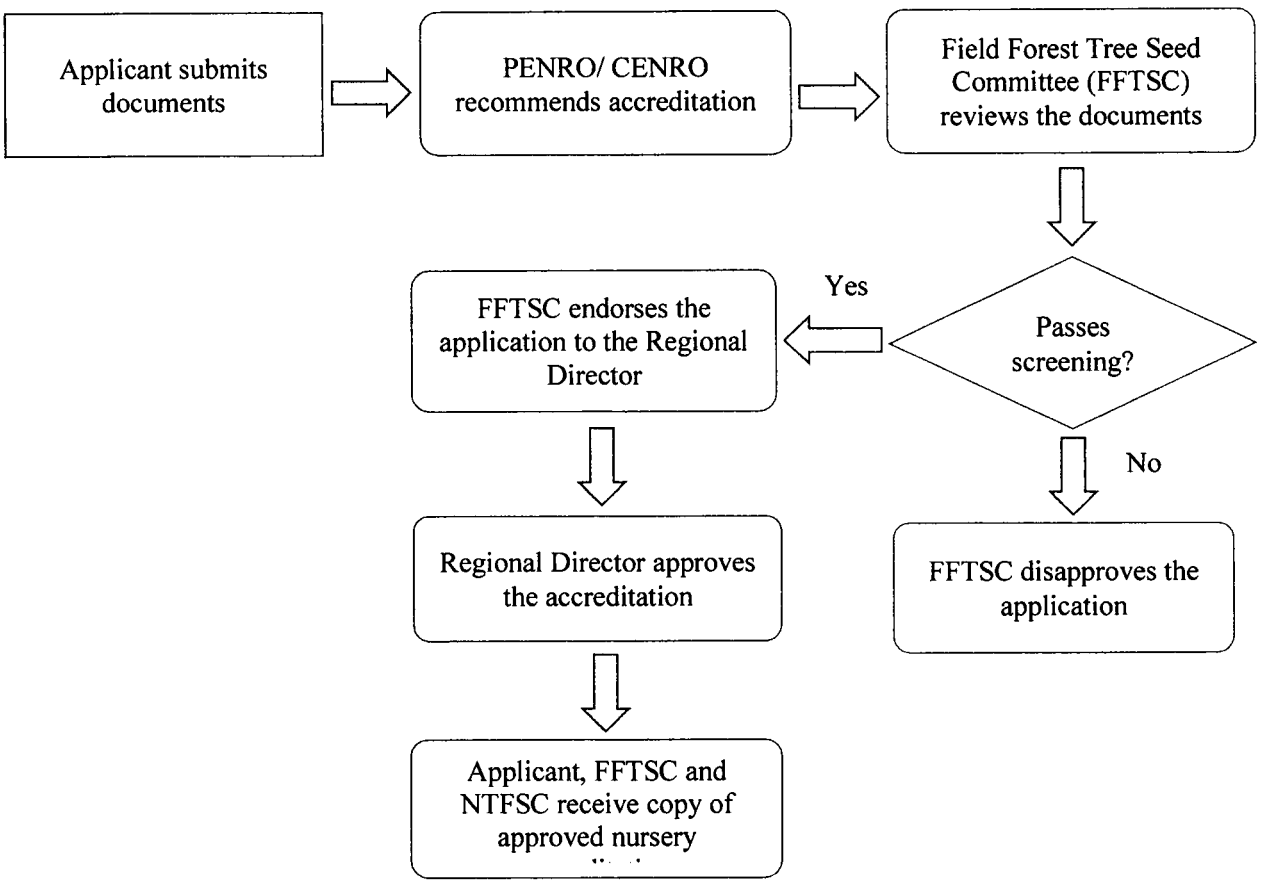
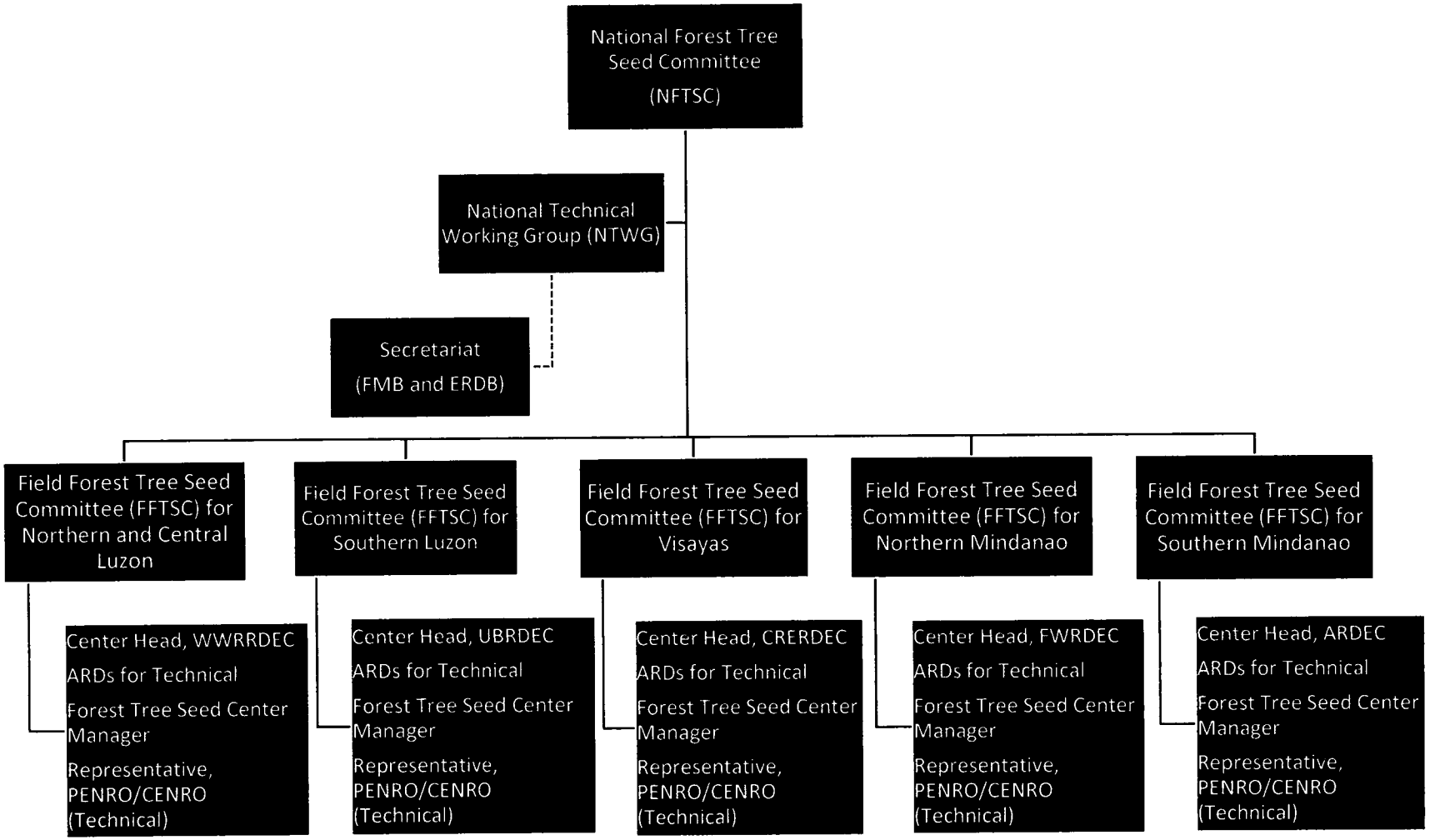


Figure 8. Flowchart for the Application on Accreditation of Forest Tree Nurseries

13 DOCUMENTATION AND RECORD KEEPING

All the data/information collected and generated pertaining to forest tree seed and seedling production, collection and disposition shall be properly recorded, documented and managed as input in the development and operation of forest tree database management and information system.



Organizational Structure on Forest Tree Seed Committees

Annex 1. Detailed Information on Identified Seed Sources

Location: _____

Species Name (Botanical): _____ Species Code: _____

(Local/vernacular)

: _____

Owner/Contact Person: _____

Date: _____

Latitude: _____ Longitude: _____

Altitude: _____

Detailed description of how to reach the site: _____

_____

_____

Map Reference: _____

Access Road Description: _____

Natural Boundaries: _____

Site Description:

Topography/Aspect: _____

Soil Type: _____ Drainage : _____

General Description:

Climate Rainfall (mm): Min.: _____ Mean: _____ Max: _____

Month of dry season: _____

Stand Description

Total Area (hectares): _____ Year Established: _____

Establishment method (Natural/Plantation):

_____

Associated important species: _____

Trees per hectare (all species) _____

Description of uniformity of spacing or grouping of trees _____

_____

Protection and Management Needs:

_____

Remarks: _____

Annex 2. Seed Tree Assessment Table

Species: _____

Location/Site: _____

Provenance: _____

Tree No.	GPS Reading		Stem					Branching Habit			Tree Health
	Easting	Northing	DBH (cm)	Height (m)	Straightness/ Form	Axis Persistence/ Forking	Circularity	Angle	Thickness	Pruning	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
Sum											
Mean											
Var.											

Annex 3. Phenology Calendar Form

Location: _____

PHENOLOGY CALENDAR

No.	Common Name	Scientific Name	MONTHS											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Note:

Leaf legends	**blue line**
Flower legends	**red line**
Fruit development	**green line**
Maturity/collection	**brown line**

Annex 4. Seed Purity, Seed Count and Seed Moisture Content Test

Species: _____ Origin: _____
Seedlot: _____ Sampling Date: _____

Annex 4.1. Purity Test

$$\text{Purity \%} = \frac{\textit{Weight of pure seeds}}{\textit{Total Weight of the original sample}} x100 \qquad \text{Purity \%} = -x100$$

Purity % = _____

Comments: _____

Annex 4.2. Seed Count Test

Instrument used: _____
Weight (g): _____
Replicate Count 1: _____
Replicate Count 2: _____
Replicate Count 3: _____
Average Seed Count: _____
Comments: _____

Annex 4.3. Seed Moisture Content

Time In: _____ Time Out: _____

Room Temperature: _____ °C Relative Humidity: _____

Instrument Used:

☐Moisture Meter		☐Oven Dry Method	
Weight (g)	_____	Weight (g)	_____
Replicate 1:	_____	Replicate 1:	_____
Replicate 2:	_____	Replicate 2:	_____
Replicate 3:	_____	Replicate 3:	_____
Average MC:	_____	Average MC:	_____

Comments: _____

Note:

$$\%MC = \frac{M_2 - M_3}{M_2 - M_1} x100$$

Where: M1 = Weight of the container
M2 = Weight of the container + seed before oven drying
M3 = Weight of the container + seed after oven drying

Tested by: _____ Signature: _____
Date Accomplished: _____

Annex 4. Seed Purity, Seed Count and Seed Moisture Content Test

Species: _____ Origin: _____
Seedlot: _____ Sampling Date: _____

Annex 4.1. Purity Test

$$\text{Purity \%} = \frac{\textit{Weight of pure seeds}}{\textit{Total Weight of the original sample}} x100 \qquad \text{Purity \%} = -x100$$

Purity % = _____

Comments: _____

Annex 4.2. Seed Count Test

Instrument used: _____
Weight (g): _____
Replicate Count 1: _____
Replicate Count 2: _____
Replicate Count 3: _____
Average Seed Count: _____
Comments: _____

Annex 4.3. Seed Moisture Content

Time In: _____ Time Out: _____

Room Temperature: _____ °C Relative Humidity: _____

Instrument Used:

☐Moisture Meter		☐Oven Dry Method	
Weight (g)	_____	Weight (g)	_____
Replicate 1:	_____	Replicate 1:	_____
Replicate 2:	_____	Replicate 2:	_____
Replicate 3:	_____	Replicate 3:	_____
Average MC:	_____	Average MC:	_____

Comments: _____

Note:

$$\%MC = \frac{M_2 - M_3}{M_2 - M_1} x100$$

Where: M1 = Weight of the container
M2 = Weight of the container + seed before oven drying
M3 = Weight of the container + seed after oven drying

Tested by: _____ Signature: _____
Date Accomplished: _____

Annex 5. Germination Test Form

_____ Tree Seed Center

Species: _____ Seedlot/Field No.: _____
Origin: _____ Altitude: _____ Collection Date: _____
Supplier: _____ Date Received: _____ Amount: _____
Methods: _____ Representative weight (g) _____ Replications: _____
Pre-treatment: _____ Sown Date: _____ Germination begun: _____
Previous viability for species: _____ grams or count _____
Based on _____ Count days _____

Date Examined	Test Period	Replicates													
(twice a week)	(days)	1		2		3		4		5		6		7	
		GS	AS	GS	AS	GS	AS	GS	AS	GS	AS	GS	AS	GS	AS
Number of Moldy Seeds															
Weight of replicate or count															
No. of germination/dish															
Squash Test/Firm/dish															
Replicate Average Viability/10g															
Replicate Average Germination %															

Bulk Calculation: Index:

Average of __ Replicates: _____
Average Viability: _____ /10g
Average of Germination: _____

GS – Good Seeds
AS – Abnormal Seeds

A= Albino
C= Abnormal cotyledon
R=Abnormal radicle
H= Abnormal hypocotyl
M= Moldy seedling

Enter on Card ☐
Private Seed Test ☐
Retest ☐
Write Off ☐

Comments: _____

Annex 6. Seed Health Testing Form

Species: ____________________
Scientific Name: ____________________
Sample Number: ____________________

Method of Testing: ____________________
Date Tested: ____________________
Date Collected: ____________________
Place Collected: ____________________

	Plate Number										Remarks
	1	2	3	4	5	6	7	8	9	10	
Germination											
Organism/ % Infection											

Annex 7. Seed Record Card

Seedlot No.	Species Code	Botanical Name	Store Code	Cost Code

EXACT LOCALITY OF COLLECTION	PARENT TREE (S)	SEED
Barangay:	☐ In bulk No. of Parents	Collector:
City/Municipality:	☐ Individual tree	Collectors No.:
Province:		Collection Date:
Latitude (N) Longitude (E)	DBH (cm):	Project:
Altitude (m) Aspect	Total Height (m):	Identified by:
Slope	Form:	Condition:
Geology and Soil:	Remarks:	Storage: ☐ 18 to 22°C
		☐ 3 to 5°C ☐ -15 to -18°C
pH		Quantity (g):
Forest Type:	Fumigation Method:	GERMINATION
Associate Trees:		Method / Date (From, To) / Viability/ 10g (%)
	Date:	

Seedlot No.		DISTRIBUTION	Amount received (in grams):	
File No.	Date	Consignee	Amount Sent	Amount Left

Annex 8. Application for Seed Certification

A

Name: _____
Address: _____
Species: _____
Year of Collection: _____ Collection No.: _____
Quantity of Collection (in kg): _____
Quantity of Seed Extracted (in kg): _____
Location of Seed Source
Barangay: _____
City/Municipality: _____
Province: _____

Date: _____
Intended Purpose:
☐ Proposed Breed _____
☐ Seed Region _____

Type of Stand
☐ Natural Stand
☐ Plantation
Year Established: _____

B Use This Box For: **Native Species or Non-Orchard Lots**

Parent Stand Seedlot No. _____

Registered Seed Stand No. or Parentage: _____

No. of trees from which seed was collected: _____
(*under 20 state number, over 20 estimate*)

No. of trees in Parent Stand: _____

Size of collection area (in ha): _____

Species neighboring seed collection area are: _____

☐ Mixed Stand ☐ Pure Stand

If mixed stand, state other species or forest association: _____

Latitude (N) _____ Longitude (E) _____

Altitude (masl): _____

Note: Include a detailed map of the seed collection area

C Use This Box For: **Clonal Seed Orchard or Control-Pollinated Seed Orchard**

Clonal Series: _____ No. of Clones Planted: _____

No. of clones remaining after thinning: _____

No. of clones from which seed was collected: _____

Date orchard was last thinned: _____

Distance from external pollen source (m): _____

Type of Pollination:

☐ Open-pollinated

☐ Control-pollinated

Seed parentage description or clone number of parent trees: _____

D Has seed from this source previously been certified? ☐ Yes ☐ No

If Yes, show the Classification and Seedlot No. previously certified:

Has anything been done to the seed source that warrants a change in classification? ☐ Yes ☐ No

If Yes, state changes _____

The foregoing information gives a correct description of the seedlot collected.

Signed _____ Designation _____

E Certified by the Seed Certification Service as:

Species: _____
Species Code: _____
Seedlot No.
Provenance or Clone Name: _____
Special Comments: _____

Chairman _____ Date _____

Received: _____ Register: _____

Annex 8. Application for Seed Certification

Note:

Box A – provides information on supplier or collector, species and seed quantity.

Box B – describes the origin, size and type of parent stand, and has provision for recording the latitude, longitude, and altitude of species collections.

Box C is to be used for collections of clonal materials

Box D is to be completed by the applicant in all cases. At the bottom is the supplier guarantee of seed identity.

Box E is for Seed Certification Service Unit

After processing by the Seed Certification Service Unit, an approved application becomes the certificate.

Source: Vincent TG. 1987. Certification System for Forest Tree Seed and Planting Stock. FRI Bulletin No. 134 Ministry of Forestry Forest Research institute Rotorua, New Zealand.

Annex 9. Consignment Note for Seed Certification

Consignee: _____

_____

_____

Seedlot No.	Species	No. of parent trees	Weight (kg)	Locality	Zone	Latitude (N)	Longitude (E)	Elevation (masl)	Viability (kg)	Pre-Treatment

Prepared by:

_____

Signature over Printed Name

Date: _____

Attested by:

_____

Research Center Head/FTSC Manager
(Signature over Printed Name)

Annex 10. Application for Seed Source Certification

Name of Applicant: _____

Name of Establishment or Business Name: _____

Address: _____

_____

Region:

Location of Seed Source/s: _____

_____

Area (in hectares): _____

I hereby certify that I will abide and follow the guidelines/policies of the Department of Environment and Natural Resources (DENR) in the proper management of seed sources.

_____

Signature over Printed Name of Applicant

Annex 11. Seed Sources Certification Form

SPECIES

SPECIES (Latin) _____ Date _____

Vernacular _____

Common (English) _____

LOCATION

ALTITUDE _____ LAT _____ LONG _____

REGION _____ CENRO _____

PENRO _____

MAP REF _____

ACCESSIBILITY _____

ROAD CLASSIFICATION _____

SITE

Soil

Slope ☐ steep ☐ gentle ☐ flat Aspect: _____

Drainage: ☐ poor ☐ average ☐ good

Representative Weather Station: _____

Name and Location: _____

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total/ Mean
Rainfall													
Temperature													

Annex 11. Seed Sources Certification Form (continued)

STAND

(1) NATURAL ☐ mature ☐ young ☐ no. of seed bearers ___ approx. area ___

Present state: ☐ in groups ☐ scattered ☐ dense

Association: Major Species: _____

_____

(2) PLANTATION ☐ planted/sown Year ____ Area (ha) _____ Trees/ha _____

☐ not thinned ☐ thinned

CRITERIA FOR SELECTION ☐ Access ☐ Growth (volume) ☐ Stem form

☐ Health ☐ Branching ☐ Seed production

PROTECTION ☐ Safe ☐ Vulnerable ☐ Threatened

Ave. Diameter/girth _____ Ave. height _____

SEED COLLECTION RECORD

PERMIT REQUIRED ☐ NO ☐ YES FROM _____

GENERALLY: FLOWERS FROM ___ TO ____ COLLECTION FROM _____ TO _____

FREQUENCY _____

SEED ASSESSMENT METHOD _____

COLLECTION METHOD _____

COOLECTION AND SEED HISTORY:

YEAR	MONTH	KG	NO. SEED TREES	MAN DAYS	GERM %	MOIST %	1000 SW	VIABLE/KG

Annex 11. Seed Sources Certification Form (continued)

GENETIC DATA

SEED ORIGIN ☐ known ☐ unknown

Introduced from (Location): _____

Purchased from/by: _____

Testing of offspring: ☐ Yes ☐ No

If "Yes" test results from: Trial No. _____ Year _____ Place _____

Relevance to planting site: ☐ relevant ☐ not relevant ☐ possible

GENETIC HISTORY:

Parental generation, source of present seed production area: _____

No. of seed bearers: _____ Status of source: ☐ tested ☐ untested

Test results prior to purchase: Relevance to environment usage: ☐ Good

☐ Limited

☐ Poor

Ref. to trial no. and date _____

_____

_____

REFERENCE TO BREEDING RECORD/TEST RESULTS: _____

_____

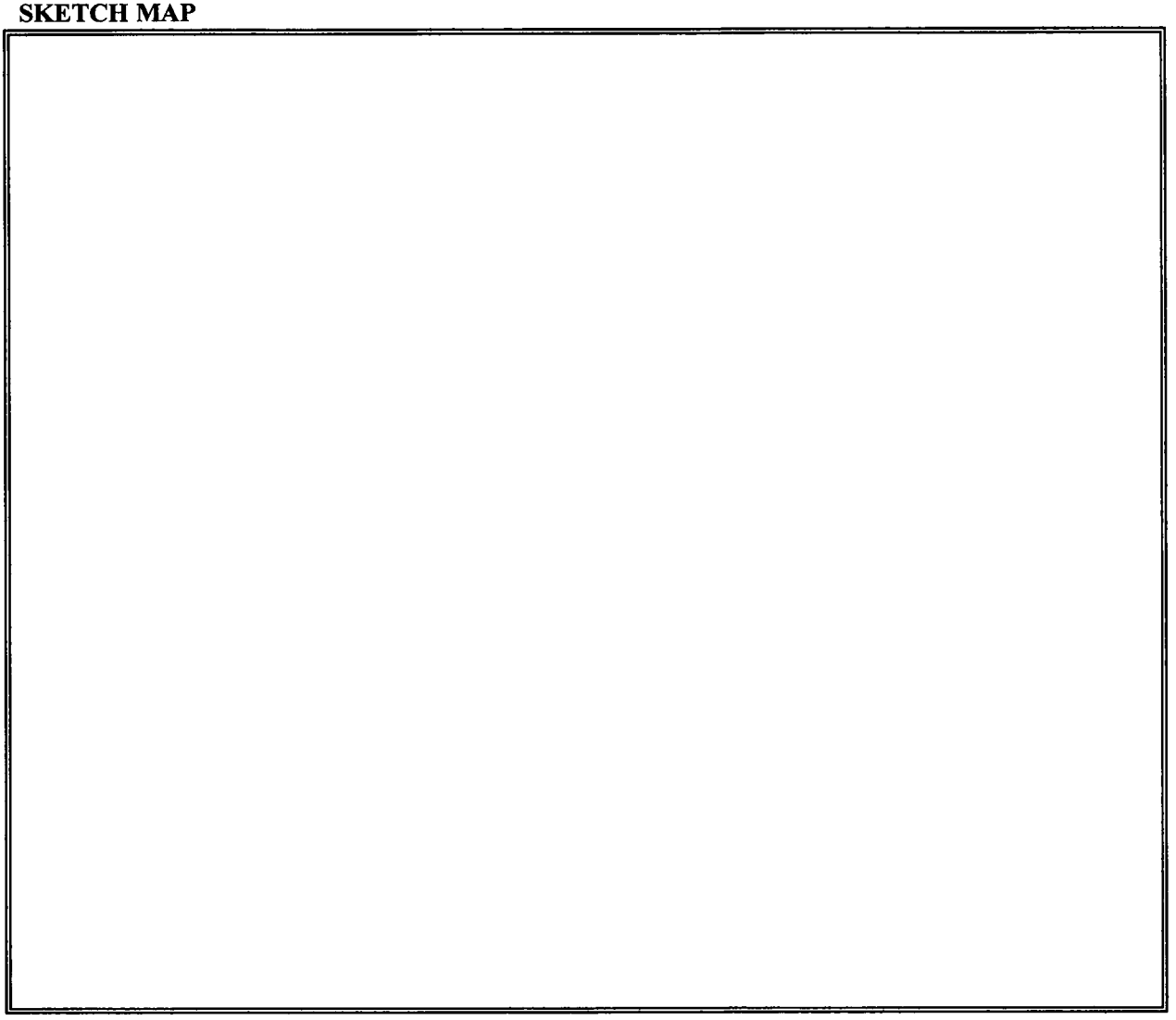
ANNUAL FORESTATION TARGETS (FOR THIS SPECIES)

Name and Location of Project	Area (in ha)

REMARKS

Annex 11. Seed Sources Certification Form (continued)

SKETCH MAP



Assessed and Validated By:

_____

Forest Tree Seed Center Manager
(Signature over printed name)

Approved By:

_____

Chair, FFTS Committee
(Signature over printed name)

Annex 12. Application Form for Accreditation of Forest Seed Suppliers

Name of Applicant: _____

Name of Establishment or Business Name: _____

Address: _____

_____

Region:

Location of Identified and Certified Seed Source/s: _____

_____

Area (in hectares): _____

I hereby certify that I will abide and follow the guidelines/policies of the Department of Environment and Natural Resources (DENR) in the proper management of seed sources.

_____

Signature over Printed Name of Applicant

Annex 13. Forest Seed Suppliers Accreditation Document

Name of Seed Supplier: _____

Address: _____

Telephone: (Landline) _____ (Mobile) _____

Please fill up the needed information below:

Species (Common and Scientific Names)	Quantity Available/To be collected (in kg)	Certified Seed Source	No. of Seed Bearing Trees to Collect From	Specific Location of the Certified Seed Source

Assessed and Validated by:

_____

Forest Tree Seed Center Manager
(Signature over printed name)

Approved by:

_____

Chair, FFTSCommittee
(Signature over printed name)

Annex 14. Application Form for Accreditation of Forest Nurseries

Name of Applicant/Nursery Owner/Operator: _____
Address: _____
Proof of Land Ownership/Tenure: _____
If corporation, Proof of SEC Registration: _____
Name of Establishment or Business Name: _____
Name of Nursery: _____ Location: _____
Area of the nursery (in square meters): _____ Seedling capacity: _____

Please fill up the needed information below:

Species (including wildings and cuttings)	**Location of the Certified Seed Sources**

Accessibility (approximately how many kilometers from the main road): _____
Disposal/distribution of planting materials produced (approximately how many kilometers from the nursery to the planting site): _____

I hereby certify that I will abide and follow the guidelines/policies of the Department of Environment and Natural Resources (DENR) in proper forest nursery management.

_____
SIGNATURE OVER PRINTED NAME OF APPLICANT

Annex 15. Forest Nurseries Accreditation Document

Name of Nursery: _____
Name of the nursery owner/operator: _____
Address: _____
Telephone: (Landline) _____ (Mobile) _____

1. **Nursery Facilities** *(maximum of 14 points)*

   A. Seed laboratory/processing area (Score: _____)
   1 – No seed laboratory (i.e. for pre-cleaning, drying, pre-treatment, and storage)
   2 – With seed laboratory (i.e. for pre-cleaning, drying, pre-treatment, and storage)

   B. Seed sterilization area (Score: _____)
   1 – None
   2 – With media (germination and potting mix) preparation and storage

   C. Germination shed (Score: _____)
   1 – Germination trays laid on bare soil
   2 – With benches (waist height) and rotating fine droplets sprinklers

   D. Potting shed (Score: _____)
   1 – No specified potting area
   2 – With covered structure for bagging and potting

   E. Recovery shed/shade house area (Score: _____)
   1 – No recovery shed
   2 – With overhead netting and overhead rotating sprinklers

   F. Hardening area/shed (Score: _____)
   1 – No specified hardening area
   2 – With overhead water sprinklers and stand out beds

   G. Water system (Score: _____)
   1 – No water storage source
   2 – With water storage source and facilities

2. **Skills of the nursery operator to produce quality planting materials** *(maximum of 6 points)*

   A. Training (participation in training on nursery development and management conducted by DENR or any reputable agency providing high quality training) (Score: _____)
   0 – No training attended
   1 – Attended one training
   2 – Attended two to three trainings
   3 – Attended more than three trainings

B. Experience (length of time of actual exposure in nursery seedling production) (Score: _____)

0 – Less than one year
1 – One year to two years
2 – Two to five years
3 – More than five years

3. <u>Morphological grading/seedling physical quality</u> (destructive sampling of 50 seedlings selected using Quota Sampling) *(maximum of 15 points).*

A. Health and vigor – absence of pests and diseases (Score: _____)

0 – Poor (more than 15 samples affected by pests and diseases)
1 – Moderate (10-15 samples affected by pests and diseases)
2 – Good (5-9 samples affected by pests and diseases)
3 – Excellent (less than 5 samples affected by pests and diseases)

B. Stem form – straightness of the stem: (Score: _____)

0 – Poor (more than 15 samples have branched shoots, with two or more stem leaders and bent shoots more than 30 degrees from stem axis)
1 – Moderate (10-15 of samples have branched shoots, with two or more stem leaders and bent shoots more than 30 degrees from stem axis)
2 – Good (5-9 of samples have branched shoots, with two or more stem leaders and bent shoots more than 30 degrees from stem axis)
3 – Excellent (less than 5 samples have branched shoots, with two or more stem leaders and bent shoots more than 30 degrees from stem axis)

C. Root form – evidence of root deformation e.g. J-roots, pot bound roots and root curling: (Score: _____)

0 – Poor (more than 10 samples have J, pot bound and curled roots and primary roots growing out from container and penetrating into the ground)
1 – Moderate (5-10 samples have J, pot bound and curled roots and primary roots growing out from container and penetrating into the ground)
2 – Good (1-4 of samples have J, pot bound and curled roots and primary roots growing out from container and penetrating into the ground)
3 – Excellent (none of the samples have J, pot bound and curled roots and no primary roots growing out from container and penetrating into the ground)

D. Sturdiness – robustness of the stem; assessed using Sturdiness Quotient (SQ); ideal value is less than 6 (Score:_____)

0 – Poor (more than 15 samples have SQ of more than 6)
1 – Moderate (10-15 samples have SQ of more than 6)
2 – Good (5-9 samples have SQ of more than 6)
3 – Excellent (less than 5 samples have SQ of more than 6)

E. Shoot – root ratio – balance of shoot to root biomass (Score:_____)

0 – Poor (more than 15 samples have S:R value of 2 and above)
1 – Moderate (10-15 samples have S:R value of 2 and above)
2 – Good (5-9 samples have S:R value of 2 and above)
3 – Excellent (below 5 samples have S:R value of 2 and above)

4. <u>Production capacity</u> - capacity to supply planting stock *(maximum of 3 points)* **(Score: _____)**

1 – Low (less 1,000 seedlings per production season)
2 – Moderate (1,000 to 5,000 seedlings per production season)
3 – High (more than 5,000 seedlings per production season)

Total score: _____

MAXIMUM RATING: 38 points
PASSING SCORE: 23 points (60% of the total points)

Summary of Evaluation

Parameter	Score
1. Nursery Facilities (max. 14 pts.)	
a. Seed laboratory/processing area	
b. Seed sterilization area	
c. Germination shed	
d. Potting shed	
e. Recovery shed/shade house area	
f. Hardening area/shed	
g. Water system	
2. Skills to produce quality planting materials (max. 6 pts.)	
a. Training	
b. Experience	
3. Morphological grading/seedling physical quality(max. 15 pts.)	
a. Health and vigor	
b. Stem form	
c. Root form	
d. Sturdiness	
e. Shoot – root ratio	
4. Production capacity (max. 3 pts.)	
TOTAL	

SEEDLING MORPHOLOGICAL GRADING AND PHYSICAL QUALITY
(Tally Sheet)

Sample no.	Health	Stem form	Root form	Height (cm)	Base diameter (mm)	Sturdiness	Shoot biomass	Root biomass	S:R
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Recommendation:

_____

_____

_____

Date of Evaluation: _____

Evaluators' name and signature:

1. _____ 2. _____ 3. _____

ASSESSED AND VALIDATED BY:

_____

PENRO/CENRO
(Signature over printed name)

ATTESTED BY:

_____

Chair, FFTS Committee
(Signature over printed name)

APPROVED/ACCREDITED BY:

_____

Regional Director
(Signature over printed name)

Annex 16. List of Prefix Code and Seedlot Numbers

Research Center	Region	Province	Prefix Code and Seedlot Number
	ERDB Main Office		A0-00001.....n-PT0001...n
WWRRDEC	CAR	WWRRDEC	B0-00001.....n-PT0001...n
		Abra	B1-00001.....n-PT0001...n
		Apayao	B2-00001.....n-PT0001...n
		Benguet	B3-00001.....n-PT0001...n
		Ifugao	B4-00001.....n-PT0001...n
		Kalinga	B5-00001.....n-PT0001...n
		Mountain Province	B6-00001.....n-PT0001...n
	Region 1	WWRRDEC	C0-00001.....n-PT0001...n
		Ilocos Norte	C1-00001.....n-PT0001...n
		Ilocos Sur	C2-00001.....n-PT0001...n
		La Union	C3-00001.....n-PT0001...n
		Pangasinan	C4-00001.....n-PT0001...n
	Region 2	WWRRDEC	D0-00001.....n-PT0001...n
		Batanes	D1-00001.....n-PT0001...n
		Cagayan	D2-00001.....n-PT0001...n
		Isabela	D3-00001.....n-PT0001...n
		Nueva Vizcaya	D4-00001.....n-PT0001...n
		Quirino	D5-00001.....n-PT0001...n
	Region 3	WWRRDEC	E0-00001.....n-PT0001...n
		Aurora	E1-00001.....n-PT0001...n
		Bataan	E2-00001.....n-PT0001...n
		Bulacan	E3-00001.....n-PT0001...n
		Nueva Ecija	E4-00001.....n-PT0001...n
		Pampanga	E5-00001.....n-PT0001...n
		Tarlac	E6-00001.....n-PT0001...n
		Zambales	E7-00001.....n-PT0001...n
UBRDEC	Region 4A (CALABARZON)	UBRDEC	F0-00001.....n-PT0001...n
		Batangas	F1-00001.....n-PT0001...n
		Cavite	F2-00001.....n-PT0001...n
		Laguna	F3-00001.....n-PT0001...n
		Quezon	F4-00001.....n-PT0001...n
		Rizal	F5-00001.....n-PT0001...n

Research Center	Region	Province	Prefix Code and Seedlot Number
UBRDEC	Region 4B (MIAMAROPA)	UBRDEC	G0-00001.....n-PT0001...n
		Marinduque	G1-00001.....n-PT0001...n
		Occidental Mindoro	G2-00001.....n-PT0001...n
		Oriental Mindoro	G3-00001.....n-PT0001...n
		Palawan	G4-00001.....n-PT0001...n
		Romblon	G5-00001.....n-PT0001...n
	Region 5	UBRDEC	H0-00001.....n-PT0001...n
		Albay	H1-00001.....n-PT0001...n
		Camarines Norte	H2-00001.....n-PT0001...n
		Camarines Sur	H3-00001.....n-PT0001...n
		Catanduanes	H4-00001.....n-PT0001...n
		Masbate	H5-00001.....n-PT0001...n
		Sorsogon	H6-00001.....n-PT0001...n
CRERDEC	Region 6	CRERDEC	I0-00001.....n-PT0001...n
		Aklan	I1-00001.....n-PT0001...n
		Antique	I2-00001.....n-PT0001...n
		Capiz	I3-00001.....n-PT0001...n
		Guimaras	I4-00001.....n-PT0001...n
		Iloilo	I5-00001.....n-PT0001...n
		Negros Occidental	I6-00001.....n-PT0001...n
	Region 7	CRERDEC	J0-00001.....n-PT0001...n
		Bohol	J1-00001.....n-PT0001...n
		Cebu	J2-00001.....n-PT0001...n
		Negros Oriental	J3-00001.....n-PT0001...n
		Siquijor	J4-00001.....n-PT0001...n
	Region 8	CRERDEC	K0-00001.....n-PT0001...n
		Biliran	K1-00001.....n-PT0001...n
		Eastern Samar	K2-00001.....n-PT0001...n
		Leyte	K3-00001.....n-PT0001...n
		Northern Samar	K4-00001.....n-PT0001...n
		Samar	K5-00001.....n-PT0001...n
		Southern Leyte	K6-00001.....n-PT0001...n
FWRDEC	Region 9	FWRDEC	L0-00001.....n-PT0001...n
		Zamboanga del Norte	L1-00001.....n-PT0001...n
		Zamboanga del Sur	L2-00001.....n-PT0001...n
		Zamboanga-Sibugay	L3-00001.....n-PT0001...n

Research Center	Region	Province	Prefix Code and Seedlot Number
FWRDEC	Region 10	FWRDEC	M0-00001.....n-PT0001...n
		Bukidnon	M1-00001.....n-PT0001...n
		Camiguin	M2-00001.....n-PT0001...n
		Lanao del Norte	M3-00001.....n-PT0001...n
		Misamis Occidental	M4-00001.....n-PT0001...n
		Misamis Oriental	M5-00001.....n-PT0001...n
	Region 13	FWRDEC	P0-00001.....n-PT0001...n
		Agusan del Norte	P1-00001.....n-PT0001...n
		Agusan del Sur	P2-00001.....n-PT0001...n
		Surigao del Norte	P3-00001.....n-PT0001...n
		Surigao del Sur	P4-00001.....n-PT0001...n
		Dinagat Islands	P5-00001.....n-PT0001...n
ARDEC	Region 11	ARDEC	N0-00001.....n-PT0001...n
		Compostela Valley	N1-00001.....n-PT0001...n
		Davao del Norte	N2-00001.....n-PT0001...n
		Davao del Sur	N3-00001.....n-PT0001...n
		Davao Oriental	N4-00001.....n-PT0001...n
	Region 12	MDARRC	O0-00001.....n-PT0001...n
		North Cotabato	O1-00001.....n-PT0001...n
		Sarangani	O2-00001.....n-PT0001...n
		South Cotabato	O3-00001.....n-PT0001...n
		Sultan Kudarat	O4-00001.....n-PT0001...n

Annex 17. List of species with developed clonal propagation protocol

	Common Name	Scientific Name	Rooting Hormone	Concentration (ppm)	Rooting Media
Dipterocarps					
1	Dagang	*Anisoptera aurea* Foxw.	IBA	500	River sand and coconut coir dust
2	Palosapis	*Anisoptera thurifera* (Blanco) Blume	IBA Superthrive Vitamin-Hormone	500 1 ml/1 Liter of water	River sand and coconut coir dust
3	Apitong	*Dipterocarpus grandifloras* (Blanco) Blanco	IBA	1000	River sand and coconut coir dust
4	Narek	*Hopea cagayanensis* (Foxw.) Slooten	IBA	100	River sand and coconut coir dust
5	Dalingdingan	*Hopea foxworthyi* Elmer	IBA	600	River sand
6	Gisok-gisok	*Hopea philippinensis* Dyer	No rooting hormone		River sand and coconut coir dust
7	Yakal-saplungan	*Hopea plagata* S.Vidal	No rooting hormone		River sand and coconut coir dust
8	Bagtikan	*Parashorea malaanonan* Merr.	No rooting hormone		River sand and coconut coir dust
9	Almon	*Shorea almon* Foxw.	NAA	500	River sand and coconut coir dust
10	Mangasinoro	*Shorea assamica* Dyer	IBA	100	River sand and coconut coir dust

Annex 17. List of species with developed clonal propagation protocol

	Common Name	Scientific Name	Rooting Hormone	Concentration (ppm)	Rooting Media
Dipterocarps					
1	Dagang	*Anisoptera aurea* Foxw.	IBA	500	River sand and coconut coir dust
2	Palosapis	*Anisoptera thurifera* (Blanco) Blume	IBA Superthrive Vitamin-Hormone	500 1 ml/1 Liter of water	River sand and coconut coir dust
3	Apitong	*Dipterocarpus grandifloras* (Blanco) Blanco	IBA	1000	River sand and coconut coir dust
4	Narek	*Hopea cagayanensis* (Foxw.) Slooten	IBA	100	River sand and coconut coir dust
5	Dalingdingan	*Hopea foxworthyi* Elmer	IBA	600	River sand
6	Gisok-gisok	*Hopea philippinensis* Dyer	No rooting hormone		River sand and coconut coir dust
7	Yakal-saplungan	*Hopea plagata* S.Vidal	No rooting hormone		River sand and coconut coir dust
8	Bagtikan	*Parashorea malaanonan* Merr.	No rooting hormone		River sand and coconut coir dust
9	Almon	*Shorea almon* Foxw.	NAA	500	River sand and coconut coir dust
10	Mangasinoro	*Shorea assamica* Dyer	IBA	100	River sand and coconut coir dust

	Common Name	Scientific Name	Rooting Hormone	Concentration (ppm)	Rooting Media
11	Yakal	*Shorea astylosa* Foxw.	No rooting hormone		River sand and coconut coir dust
12	White lauan	*Shorea contorta* S. Vidal	IBA	2000	River sand and coconut coir dust
13	Guijo	*Shorea guiso* Blume	IBA	1000	River sand and coconut coir dust
14	Red lauan	*Shorea negrosensis* Foxw.	IBA	100	River sand and coconut coir dust
15	Mayapis	*Shorea palosapis* Merr.	IBA	150	River sand and coconut coir dust
16	Tangile	*Shorea polysperma* Merr.	IBA	500	River sand and coconut coir dust
17	Narig	*Vatica mangachapoi* Blanco	IBA	100	River sand and coconut coir dust
Non-Dipterocarps			IBA		River sand and coconut coir dust
18	Almaciga	*Agathis philippinensis* Warb	IBA	300	River sand and coconut coir dust
19	Akle	*Albizia acle* (Blanco) Merr.	IBA	25	River sand and coconut coir dust
20	Bignai	*Antidesma bunius* (L.) Spreng.	IBA	50	River sand and coconut coir dust
21	Tabon-tabon	*Atuna racemosa* Raf.	IBA	300	River sand and coconut coir dust
22	Kalingag	*Cinnamomum mercadoi*S. Vidal	IBA	300	River sand and coconut coir dust
23	Dao	*Dracontomelon dao* (Blanco) Merr. & Rolfe	IBA	100	River sand and coconut coir dust

	Common Name	Scientific Name	Rooting Hormone	Concentration (ppm)	Rooting Media
24	Dungon	*Heritiera sylvatica* S.Vidal	IBA	300	River sand and coconut coir dust
25	Laneteng-gubat	*Kibatalia gitingensis* (Elmer) Woodson	No rooting hormone		River sand and coconut coir dust
26	Amugis	*Koordersiodendron pinnatum* Merr.	IBA	300	River sand and coconut coir dust
27	Nato	*Palaquium luzoniense* (Fern.-Vill.) Vidal	IBA	500	River sand and coconut coir dust
28	Malugai	*Pometia pinnata* J.R. Forst. & G. Forst.	IBA	500	River sand and coconut coir dust
29	Philippine Teak	*Tectona philippinensis* Benth. & Hook.f.	IBA	100	River sand and coconut coir dust
30	Kalantas	*Toona calantas* Merr. & Rolfe	IBA	100	River sand and coconut coir dust
31	Mangkono	*Xanthostemon verdugonianus* Náves ex Fern.-Vill.	IBA	300	River sand and coconut coir dust
32	Banuyo	*Wallaceodendron celebicum Koord.*	IBA	100	River sand and coconut coir dust

Annex 18. Standard and prescribed height and diameter for plantable quality planting materials

Group of Species		Nursery Growing Period		Plantable Height (cms)	Plantable Diameter (cms.)	Plantable Height (cms.)	Plantable Diameter (cms.)	Other Desirable Characteristics
		In Germination trays/beds (weeks)	In pots/ transplant beds (months)					
Indigenous species				**From seeds**		**From cuttings**		
1)	***Anacardiaceae*** Example:							
	Dao *(Dracontomelon dao)*	4 to 5	6 to 7	45-50	0.6-0.7	30-45	0.4	Sturdy stem and free from any infestation
	Balinghasai *(Buchanania arborescens)*	4	7 to 8	30-35	1.0-1.1	30-45	0.4	Sturdy stem and free from any infestation
	Paninglin *(Buchanania microphylla)*	4	7 to 8	30-35	0.4-0.5	30-45	0.4	Sturdy stem and free from any infestation
2)	***Apocynaceae*** Examples:							
	Dita *(Alstonia scholaris)*	3	4	20-30	0.2-0.3	30-45	0.4	Sturdy stem and free from any infestation
	Batino (Alstonia macrophylla)	3	4	20-30	0.2-0.3	30-45	0.4	Sturdy stem and free from any infestation
3)	***Araliaceae*** Example: Malapapaya *(Polyscias nodosa)*	3 to 4	6	15-20		30-45	0.4	Sturdy stem and free from any infestation; and with green leaves
4)	***Casuarinaceae*** Example: Agoho *(Casuarina equisetifolia)*	4	6	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
5)	***Combretaceae*** Example: Kalumpit *(Terminalia microcarpa)*	4	4	25-30	0.3-0.5	30-45	0.4	Free from any infestation

	Group of Species	Nursery Growing Period		Plantable Height (cms)	Plantable Diameter (cms.)	Plantable Height (cms.)	Plantable Diameter (cms.)	Other Desirable Characteristics
		In Germination trays/beds (weeks)	In pots/ transplant beds (months)					
6)	***Dipterocarpaceae*** Examples:							
	Apitong *(Dipterocarpus grandiflorus)*	1 to 4	8 to 12	25-30	0.5-1.0	30-45	0.4	Sturdy stem and free from any infestation
	Palosapis *(Anisoptera thurifera)*	1 to 4	8 to 12	25-30	0.5-1.0	30-45	0.4	Sturdy stem and free from any infestation
	White Lauan (Shorea contorta)	1 to 4	3 to 6	25-30	0.5-1.0	30-45	0.4	Sturdy stem and free from any infestation
	Red Lauan *(Shorea negrosensis)*	1 to 4	8 to 12	25-30	0.5-1.0	30-45	0.4	Sturdy stem and free from any infestation
7)	***Ebenaceae*** Examples:							
	Kamagong *(Diospyros discolor)*	2 to 3	7 to 8	15-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Anang *(Diospyros pyrrhocarpa)*	3	7	15-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
8)	***Euphorbiaceae*** *Example :* *Gubas (Endospermum peltatum)*	3 to 6	1 to 2	15-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
9)	***Fabaceae*** Example:							
	Narra *(Pterocarpus indicus)*	1 to 2	5 to 6	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Akle *(Albizia acle)*	4	8 to 9	18-20	0.6-0.7	30-45	0.4	Sturdy stem and free from any infestation
10)	**Lauraceae** Example:							
	Margapali *(Cinnamomum philippinense)*	4	7	30-35	0.7-0.8	30-45	0.4	Sturdy stem and free from any infestation

Group of Species		Nursery Growing Period		Plantable Height (cms)	Plantable Diameter (cms.)	Plantable Height (cms.)	Plantable Diameter (cms.)	Other Desirable Characteristics
		In Germination trays/beds (weeks)	In pots/ transplant beds (months)					
11)	***Meliaceae*** Example:							
	Igyo *(Dysoxylum gaudichaudianum)*	2	4	25-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Mamalis *(Pittosporum pentandrum)*	3 to 4	4	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Kalantas *(Toona calantas)*	4	5 to 6	25-30	0.9-1.0	30-45	0.4	Sturdy stem and free from any infestation
12)	***Myristicaceae*** Example:							
	Duguan *(Myristica philippinensis)*	10	6	15-20	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Tanghas *(Myristica elliptica)*	3	7	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Tapol *(Horsfieldia ardisiifolia)*	10	7	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Anuping *(Gymnacranthera farquhariana)*	3	7	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
13)	***Myrtaceae*** Example:							
	Lipote *(Syzygium polycephaloides)*	2	7	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Bagras *(Eucalyptus deglupta)*	1 to 2	2 to 4	15-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
14)	***Naucleaceae*** Example:							
	Kaatoan Bangkal *(Anthocephalus chinensis)*	8 to 10	3 to 4	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation

Group of Species		Nursery Growing Period		Plantable Height (cms)	Plantable Diameter (cms.)	Plantable Height (cms.)	Plantable Diameter (cms.)	Other Desirable Characteristics
		In Germination trays/beds (weeks)	In pots/ transplant beds (months)					
15)	***Pinaceae*** Examples: Benguet Pine *(Pinus kesiya)* Mindoro Pine *(Pinus merkusii)*	 2 to 4 2 to 4	 7 to 12 2 to 3	 15-30 25-30	 0.3-0.5 0.3-0.5	 30-45 30-45	 0.4 0.4	 Sturdy stem and free from any infestation Sturdy stem and free from any infestation
16)	***Podocarpaceae*** Example: Almaciga *(Agathis philippinensis)*	 2	 3 to 4	 25-50	 0.3-0.5	 30-45	 0.4	 Sturdy stem and free from any infestation
17)	***Sterculiaceae*** Example: Kalumpang *(Sterculia foetida)*	 2	 3	 25-30	 0.3-0.5	 30-45	 0.4	 Sturdy stem and free from any infestation
18)	***Ulmaceae*** Example: Magabuyo *(Celtis luzonica)*	 4	 6 to 7	 45-50	 0.6-0.7	 30-45	 0.4	 Sturdy stem and free from any infestation
19)	***Verbenaceae*** Example: Molave *(Vitex parviflora)*	 4	 2 to 3	 25-30	 0.3-0.5	 30-45	 0.4	 Sturdy stem and free from any infestation
Exotic species								
1)	***Fabaceae*** Giant Ipil-ipil *(Leucaena pulverulenta)*	 2 to 5	 2 to 3	 15-30	 0.3-0.5	 30-45	 0.4	 Sturdy stem and free from any infestation
2)	***Mimosaceae*** Examples: Auri *(Acacia auriculiformes)*	 1 to 2	 4 to 5	 25-40	 0.3-0.5	 30-45	 0.4	 Sturdy stem and free from any infestation

	Group of Species	Nursery Growing Period		Plantable Height (cms)	Plantable Diameter (cms.)	Plantable Height (cms.)	Plantable Diameter (cms.)	Other Desirable Characteristics
		In Germination trays/beds (weeks)	In pots/ transplant beds (months)					
	Rain tree *(Samanea saman)*	2 to 3	4 to 6	25-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Moluccan sau *(Paraserianthes falcataria)*	2 to 3	1 to 2	15-Oct	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Mangium *(Acacia mangium)*	1 to 2	2 to 3	25-40	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
3)	***Meliaceae*** Example: Mahogany *(Swietenia macrophylla)*	3 to 4	4 to 6	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
4)	***Verbenaceae*** Example: Yemane *(Gmelina arborea)*	2 to 3	5 to 6	20-30	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation
	Teak *(Tectona grandis)*	4 to 5	10 to 12	30-40	0.3-0.5	30-45	0.4	Sturdy stem and free from any infestation