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Best Fit Practices for Reforestation in Lebanon to Enhance Climate Resilience in Remote Hilly Areas

DELIVERABLE TASK 1

THE NATIONAL CENTER FOR FORESTRY SEEDS OF LEBANON. TECHNICAL DOCUMENT: REPORT, BLUEPRINT AND BUDGET

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1. INTRODUCTION.

Among professionals whose work involves the management and improvement of forest genetics, interest in production and conservation of forest genetic resources is an area that has gained importance in recent years. The multi-use of forests should include existing knowledge of genetic resources in order to develop and improve forests while preserving them.

At the present time the supply of seeds for species of interest in Lebanon is insufficient. In some cases there are not seeds, and when certified seeds are available, they come from outside Lebanon. The seed sources collected within Lebanon are not regulated and should not be used for reforestation, because they do not guarantee the origin or quality. The reproductive material that is being used right now in Lebanon can not ensure adequate traceability of the fruits and seeds from collection to commercialisation. Nowadays there are not defined systems of collection and control systems to ensure the intermediate and final users that the fruits and seeds have remained identified throughout the production process.

In order to ensure the traceability and quality of the seeds, it's necessary that previously has been defined the different regions of provenance from Lebanon. We will have to locate and register basic materials (seed source and selected stand) in each of these regions, so that seeds may only be collected in those areas to provide the seed centres.

Additionally, a seed centre which ensures the quality and traceability of the reproductive material origin is needed in Lebanon. This seed centre will allow the storage of the seeds from the best areas of the country to be used in reforestation. This regulated seeds, if used properly, might prevent the introduction of seeds with different genetic origins. Additionally, the use of regulated seeds often improves the adaptation and survival of plants to the environment. If a seed centre is not created, there is a risk to implement reforestations with inappropriate material which might endanger the future of the forests of Lebanon.

This document identifies the essential points for the design of a seed centre that meets the necessary traceability required to seed ensuring the quality of the reforestation.

2. PURPOSE OF THE NATIONAL CENTRE FOR FORESTRY SEEDS OF LEBANON

The main purpose for the National Centre for Forestry Seeds of Lebanon (NCFSL) is to collect, sell, distribute and register quality seeds of interesting species used for reforestation. NCFSL will know the provenance of all forest-relevant species and will sell and provide quality seeds and plants to both Government and private nurseries to ensure successful reforestation campaigns in the coming years.

A secondary objective of NCFSL will be to store, preserve and make available outside their natural habitat the fruits and seeds, which could be used to proliferate forest species.

The NCFS should consider other possible functions in the medium and long term as:

- Collect plant species which are difficult to preserve in the medium and long term.

- Carry-out seed analysis (i.e. characterization, viability test, germination and emergence of seed lots test, diseases analysis).

- Establish Seed Orchards (i.e. plantations of selected clones or families which are isolated or managed to avoid or reduce pollination from outside sources, and managed to produce frequent, abundant and easily harvested crops of seed).

- Develop guidelines for production and management of forest plants.

- Implement strategic genetic improvement programs in order to obtain quality reproduction materials.

- Implement strategic genetic conservation for specific forest species due to their importance, uniqueness and state of health in the natural populations.

- Environmental education implementing rising awareness activities (e.g. provide plants to forest schools to encourage interest in nature, collaborate in the preparation of promotional materials for schools, teach in schools about the importance and necessity of the existence of forest seedlings to reforest and to restore degraded areas)

All these roles can be adapted in accordance with the increasing needs of production, commercialization and conservation of the fruit and seeds used to proliferate forest species, so called Forest Reproductive Material (FRM).

The impact of a specific centre type would vary depending on the different roles attributed to it,that is, it must take into account all the functions you want to assign to the centre to optimize its size and space needed.

The implementation of rules governing the production and marketing of forest reproductive material (FRM) in Lebanon, forces set up a certification system, which structures the quality of the materials according to the degree of selection that have been subjected.

The selection process ensures a number of genetic gains that result in terms of improvement of production.

Therefore rules are necessary to identify a material and register in the properly category and a control system to ensure that the identity of any known material origin and provenance is maintained throughout the production process is also required.

3. OBJECTIVES.

The main objective of this document is to set up and put into operation the National Centre for Forestry Seeds of Lebanon by implementing the project described below.

The centre would consist of an initial seed processing plant, warehouse, and a laboratory to study seed quality and to prepare the seeds. It is proposed not to use a drying oven to start with, although it can be an option for the future.

4. SECTIONS OF THE FORESTRY SEED CENTRE.

The centre will also be equipped with an office for administration and sales of seeds and laboratory. The centre should have a least around 3,000 m^2. On the same land, outdoor- and covered-drying beds will be built, as well as an area for processing recalcitrant species, a biomass storage area, a series of storage sheds and a parking lot. The followings are the main sections of the centre. Annex 3 of this document include a more detailed plan.

4.1. WAREHOUSE.

A 1,000 m^2 (20x50) warehouse will be built, consisting of three separate areas with wall partitions, with access through 3 m x 2.5 m doors.

4.1.1. ZONE A.

All services future clients might need will be found in this zone. It will have an exterior 2 m x 2.5 m door and will be comprised of the following areas:

4.1.1.1. Offices.

All commercial and administrative tasks will be carried out in this area.

4.1.1.2. Laboratory.

Quality analyses (purity, humidity and germination), pre-germination treatments, investigation and technical support will take place in this area.

4.1.1.3. Orders.

This area is reserved for placing orders, receiving clients and processing packages. It will have an outside door for client, carrier and courier access.

4.1.1.4. Tool storage.

This will be a small warehouse, where the tools, bags and containers for seed storage will be kept.

4.1.1.5. Humidity Chamber.

This is a special chamber for recalcitrant species, of the genus *Quercus*, etc (i.e., seeds with a high moisture content which cannot be preserved for long periods of time).

The chamber will have an open floor plan, measuring approximately 5 m x 5 m, which will allow for the storage of a minimum of 20,000 kg (approx. 30,000 liters) of recalcitrant seeds. The temperature of the chamber must remain between -5 and 0 ºC, with a consistent humidity level of 60-75%. All seeds preserved in this chamber must be stored in open stackable boxes which will be placed on top of pallets. The seeds in each box cannot be more than 10-12 cm deep, with a volume of 20 liters.

The proper humidity and temperature control of this chamber will ensure that the recalcitrant seeds are preserved as long as possible (not exceeding a certain amount of time). The seeds will be inspected and processed weekly, by mixing the seeds and taking fungus-control measures.

These seeds should never contain less than 30% humidity to insure their viability.

4.1.1.6. Dry Chamber.

This chamber will be used to preserve traditional species and for pre-germination treatments (stratification). Traditional seeds are those which must be preserved between 2 and 4ºC, have a humidity content of 6-15% and can be preserved in a dry chamber for several years.

This 5 m x 5 m chamber will be filled with module shelves. The distance between each shelf will be large enough to horizontally place airtight containers with a 15 kg capacity. One of the modules will be used to preserve and control the pre-germination treatments being processed and another module will be for small to medium sized containers.

The containers for this chamber will be plastic, airtight containers with the following capacities: 12, 5, 2, 1, 0.5 and 0.1 kg. Certain species may need to be stored in raffia bags.

The temperature in this room must remain between 2 and 4 ºC and the humidity between 10 and 15% at all times.

4.1.1.7. Lunch room.

This area will have a small kitchen, a refrigerator and a table, so the employees can eat lunch.

4.1.1.8. Changing rooms.

This area will have lockers, two toilets and two showers for employee use.

4.1.1.9. Restrooms.

There will be two restrooms, one which will be handicap accessible.

Zone A will be directly connected to Zone B through a 3 m x 2.5 m double-leaf sliding door.

4.1.2. ZONE B.

This zone will have a 3 m x 3 m exterior door. All fruit will be received, weighed and stored for processing here. There will be three rooms attached to this zone; one for maceration (soaking), another for drying the seeds and the final room will be reserved for the future installation of a biomass boiler.

4.1.2.1. Seed drying area.

This will be a closed and ventilated room, with a small extraction system in order to eliminate excess humidity, as well as a heating/cooling system and thermostat to continuously control the room temperature.

Shelving will be installed for storing drying trays to maximize the useable square footage of the room.

4.1.2.2. Maceration area.

This will be a well ventilated and closed room with a small extraction system and temperature control system.

The room will have two sinks for the washing of containers and the maceration materials, such as macerators and containers (baskets) for macerating. It will also be equipped with mesh shelves, where the previously macerated materials will be placed, in order to remove all external moisture before moving them to the seed drying area.

4.1.2.3. Fenced Storage.

Fenced storage will be built; measuring 2.5 m x 2.5 m, so 4 pallets (European or American) can fit inside. The installation of metal shelves for storing forest species, which take up little space, is recommended as well.

Goods should never be stored directly on the floor.

4.1.2.4. Weighing area.

The weighing area for voluminous and heavy loads will have a weighing platform with a maximum capacity of 1,500 kg. It will measure 1,250 cm x 1,250 cm, in order to accommodate both European and American pallets.

The weighing platform will be embedded into the floor.

4.1.2.5. Boiler room.

The boiler room will have a 2 m x 2.5 m exterior door. The room will be prepared for the future installation of a biomass boiler.

This zone will communicate with zones A and C via double-leaf sliding doors, measuring 3 m x 2.5 m.

4.1.3. ZONE C.

This zone will be solely used for the production and cleaning of the forest seeds.

It will have two exterior doors, one 3 m x 3 m door located at the front of the warehouse and a second 2 m x 2.5 m door at the back of the warehouse, connected to the drying oven.

Listed below are the machines that will be needed for seed extraction.

4.1.3.1. Crushing mill.

This mill will be mainly used in extracting *Pinus pinea* seeds. It will separate the cone's bracts, which allows for the extraction of the seeds (pine nuts) found inside the cones. The mill will also help in extracting seeds from other species from the genus *Pinus* that produce cones and large seeds.

4.1.3.2. Rotating cylinder (trommel).

This machine is used in extracting seeds from the genera *Pinus, Picea, Cupressus, Cedrus, etc.*

The slow rotating drum extracts the seeds, as they pass through it, falling into a bin below, while the empty cones are taken out of the front of the trommel and placed into a container or bag.

4.1.3.3. Screening machines.

Sieves are used to eliminate the large caliber debris of the species being sifted. The sieve has sets of screens with different mesh sizes, making it quite versatile and useful for most species.

4.1.3.4. Winnowing machine.

The winnowing machine is used for cleaning via a vertical air stream, whose velocity can be regulated. This machine is used for the final cleaning of many species, eliminating impurities.

Given the quantity of impurities the winnowing machine produces, it would be recommended to install an extraction/collection system connected to the outside.

4.1.3.5. Threshing machine.

The threshing machine crushes the fruit and has different mesh sizes, which allows for the shelling of all types of legumes and labiates.

As with the winnowing machine, an extraction/collection system is recommended.

4.1.3.6. Sorting machine.

This machine thoroughly cleans the seeds.

The sorter has three fans (winnowers) controlled independently and three consecutive sieves. When the seed comes out it is clean and ready for humidity analysis. If the humidity content of the seed is adequate then the seeds can be prepared for storage or sold.

4.1.3.7. Brushing machine.

The brushing machine is designed to brush the fruits using small interchangeable brushes with different degrees of stiffness, which makes this machine quite versatile. Using the correct brushes you can even scarify fruit or seeds.

Again, an extraction/collection system connected to the outside is advised.

4.1.3.8. Almond peeler.

This machine is designed to remove the pulpy shell of the almond.

4.1.3.9. Set of manual sieves.

A complete set of manual sieves, with all mesh sizes included, is necessary for the manual cleaning of any species. It is recommended that there be two complete sets of manual sieves.

4.1.3.10. Work table.

A 3 m x 1.5 m work table is needed to comfortably carry out any necessary manual cleaning.

4.1.3.11. Oven.

The drying oven will be for fruit, mainly cones. This oven will have continuous temperature and humidity control as the fruits are dried.

The oven uses hot air, with mobile air ducts, that open when there is a high humidity content in the oven. Probes, which will be introduced into the cones, will control the humidity and turn off the oven once the indicated humidity level is reached in the cones.

The size of the processing area has been designed taking into consideration the future installation of a hot air furnace, which will be used to dry fruit and to heat the warehouse and the drying areas.

4.1.3.12. Forklift.

The forklift will be used to carry heavy and bulky loads, which is important in cleaning up the genus *Pinus* and the recalcitrant seeds. As it will be used both inside and out, it is recommended that it be an all-terrain forklift.

4.1.3.13. Manual pallet lift truck.

This lift will be used to move pallets manually inside the warehouse.

4.2. OUTSIDE AREAS.

This section will describe the rest of the areas in the lot.

As mentioned before, the lot will be completely flat and empty.

4.2.1. Recalcitrant seed floating area.

This 80 m^2 area will have a 200 cm x 150 cm x 100 cm (l x w x h) pool, with an overflow door and a collection basin with a grill, which will allow floating seeds to be evacuated and the overflowing water can be recirculated using a pump connected to the pool.

Recalcitrant species will be removed with the help of a screen or a metallic structure with holes in it, which must smaller than the seeds processed. The size of the structure will be slightly less than the pool, and designed to be used with a forklift.

The maximum capacity for the floating pool with its structure will be about 500 kg per float.

4.2.2. Outdoor drying beds.

These drying beds will measure 5 m x 12 m, with a 1% incline to allow the rainwater to drain naturally and to avoid puddles, which could affect the quality of the seeds. It is also recommended that they be surrounded by a 20 cm high frame to avoid any seeds being blown away with the wind. Take into consideration when placing the frame that it will need drain holes for the rainwater.

The number of drying beds will be directly related to the maximum production capacity of the warehouse; it is recommended, however, that there be at least four 5 m x 12 m beds.

The versatility of these beds is important as they can be used to dry, clean and store seeds, and as drying beds for cones and to extract legume seeds without using the threshing machine.

It is also important to note that the outdoor bed system is not fit for drying fruit or seeds that can be easily dispersed by the wind, for which the use of greenhouses is recommended.

These drying beds are perfect for species such as *Pinus pinea.*

When these beds are used it would be ideal if the fruits were covered by a screen to minimize the loss of seeds due to wind or animals.

Take into consideration the location of these beds, so that they are in direct sunlight for the longest amount of time possible.

4.2.3. Covered drying beds (greenhouses).

The 5 m x 10 m greenhouses will be used to air fruit, as well as to naturally dry various species. Greenhouses are useful in drying fruit that needs to open up in order to disperse its seeds (*Pinus, Cupressus, Abies, Cedrus, etc.)*, since the heat in the greenhouse speeds up the opening process

of the cones. As these drying beds will be closed, the wind cannot scatter the seeds, nor will animals have access to them.

The greenhouses are useful in drying large volumes of seeds for storage.

It is recommended that 4 covered drying beds be installed.

4.2.4. Biomass storage area.

This will be an 80 m^2 area, with walls at least 1.5 m high, that surround three of the four sides, giving it a volume of at least 120 m^3.

Here all byproducts will be stored to use as biomass fuel for the drying oven or the biomass boiler.

4.2.5. Sheds.

When building the sheds it is important to take into consideration that the forklift will need to be able to enter with its masts down.

There should be a shed beside the pool for floating recalcitrant seeds, which will be used for housing the storage boxes the recalcitrant species go in, and two more should be located behind the work warehouse for receiving large shipments of fruit (mainly conifers), whose volume makes it impossible to put them in the warehouse.

Preferably, the fruit should be stored in big bags with a capacity of 1 m^3 and placed on top of pallets.

At certain times, when large quantities of cones are received during the harvest season and do not fit in the sheds, they can be stored in the 1 m^3 big bags on top of pallets behind the warehouse.

4.2.6. Parking lot.

The parking lot will be used for employee vehicles.

In addition to the installations previously described, the NCFS could expand if they decided to pursue other goals, such as:

- Create more buildings, such as a conference room and an auditorium.
- Lath houses or greenhouses for producing forest reproductive material.
- Areas for conservation and improved crops.

5. HUMAN RESOURCES OF THE FORESTRY SEED CENTRE

The required employee positions with their respective staffing levels at the National Centre for Forestry Seeds of Lebanon are as follows:

− 1 Botanical and Environmental Restoration Technician: He/she will act as the seed salesperson and production manager, in charge of calculating the annual fruit harvest. This person must have botany and environmental restoration expertise specific to Lebanon.

− 1 Seed Lab Technician: It is difficult to find a technician with this specific skill set and it may start as a part-time position until production and harvest volumes increase.

− 2 Species Processing Workers. At least one of these employees must complete intensive training.

− 1 Employee for Purchasing. This position is easily filled, not much special training is required.

These are the ideal employee positions and staffing levels; however, it might be possible to decrease the number of Processing Workers until the volume of seed production increases.

In addition to the aforementioned personnel, harvesters would also be needed. People living near the harvesting areas can be hired, supervised by the Botanical Technician, with the help of the trained Processing Worker. The locals, who tend to take better care of the harvesting areas partly because of the financial profit, can carry out the initial cleaning of the fruits and seeds. This will also help boost the rural economy. Please note that the collection of singular species or special harvests (harvesting of pinecones and such, in which experienced climbers are necessary) will require qualified collectors.

6. SYSTEMS OF COLLECTION OF FOREST REPRODUCTIVE MATERIAL

In order to define a system of collection of forest reproductive material that is suitable and provides minimum guarantees, it is proposed to define regions of origin in Lebanon to differentiate roughly the different areas of the country, and also to select basic materials for the species of greatest relevance to each of the regions, either seed or stands sources, of identified or selected category.

6.1. REGIONS OF PROVENANCE

There are genetic differences between plant populations. The division of land into large areas should allow distinguishing areas with populations showing differences related to growth, production and adaptation.

The region of provenance can be defined as a distinct territorial area which is the commercial unit according to its geographical distribution.

The region of provenance for a species or sub-species is the area or group of areas subject to sufficiently uniform ecological conditions in which are basic materials that have similar genetic or phenotypic characteristics, taking into account altitude limits when necessary. It is the starting point for the selection of basic material for the production of reproductive material.

For basic materials, and in accordance with existing regulations adapted to the project objectives, is understood as populations where forest reproductive material is obtained. They are, in short, the ones that finally reach the market, and are labelled and certified for its use in reforestation.

The division of regions of origin is due to the variability of forest species, i.e., the processes of selection, genetic drift, mutation, gene flow and phenotypic plasticity. These phenotypic and genetic differences are the basis on which the delimitation of regions of origin of the main forest species is established, as the basic marketing unit of identified and selected reproductive materials. Genetic differences require a deeper knowledge of the species, which means that often the delimitation is based mainly on phenotypic differences.

Ecological criteria such as climate, geology and soil, geography, species distribution, economic and silvicultural criteria and administrative boundaries can be applied to delimit the regions of origin.

The region of provenance has some fundamental characteristics, related to their main applications:

- Determines the maximum geographic boundaries within which you can mix the seed harvested from seed sources (trees within an area of fruits and seeds) or stands (population bounded by trees that have sufficient uniformity in their composition).
- Facilitates the trade of forest reproductive material by identifying the region in which the fruits and seeds have been collected.
- Facilitates recommendations on seed use in national programs of reforestation.
- Can be used to plan actions for improvement and conservation.
- Is possible to differentiate, based on ecological criteria, size and quality regions of wide use, regions of restricted area, and regions of local use. Regions of wide use are those that present greater interest as supplier of seeds from the existing basic materials. These regions or origin include the main ecological conditions for the use of each species, have masses that have good quality and are sufficiently extensive. Regions of restricted area are smaller regions where conservation actions are priority. Regions and seeds from local use are the others

regions, usually composed of small populations and isolated from the main populations of the rest of the country, with particular and different ecological conditions of the other larger populations. These kinds of regions are only recommended to be used within the region to which they belong. Reforestation programs must know the type of region of provenance where the seeds to be planted are harvested to adapt the plantation to its correct use.

6.1.1. REGIONS OF PROVENANCE FROM LEBANON

Failing to define specific regions of provenance for each of the species of forest interest, it is proposed to start with the next division of wide use, related to the relief of the country:

1. Coastal strip
2. Mount Lebanon
3. Syncline Depression of the Bekaa
4. Anti-Lebanon mountains

Each unit has common or comparable characteristics and different between them, so in the coastal strip height above sea level reaches 100 meters, in Mount Lebanon is where the highest point in the country (3,088 m) is, the Depression of the Bekaa height is between 800 and 1,200 m and the Anti-Lebanon mountains highest point is at 2,814 m.

6.2. BASIC MATERIAL

All marketing systems try to determine the identity and quality of the reproductive material and establish an administrative follow, so that these remain in production processes until to the end user.

To keep track of forest reproductive material the only warranty remaining for the user to verify the identity of the material in the purchasing document is to expect that the flow controls in harvesting the fruits, seeds process and transformation, storage and commercialisation, and finally, in the production of the plant have successfully worked. Current techniques of genetic markers are still far from solving the problem of controlling the reproductive material, and suppose a significant economic investment.

Basic materials with which the project focuses are the seed sources and stands.

6.2.1. BASIC MATERIALS FROM LEBANON

To declare the first basic materials it is proposed to collect all those areas where historically nuts and/or seeds have been collected, and all those others known and believed that might be interesting. To make the decision to incorporate positively in the register it is necessary to take

some data. It is recommended that these materials meet the below explained data on the source-identified and selected category. If the materials are not adapted to the conditions in each category they should be rejected as FRM harvesting areas.

6.2.2. DATA REQUIRED FOR THE REGISTRATION OF BASIC MATERIAL

Creating a database where all declared basic materials appear is essential for the proper management and control.

Many more data could be incorporated, but the more common and indispensable data to be registered are the following:

- Category: Identified / Selected
- Objective: multifunctional, timber production, fruit production...
- Authenticity of the basic material: Autochthonous / Non-autochthonous / Unknown Origin
- Species: scientific name of the species
- Region of provenance: Coastal strip / Mount Lebanon / Syncline Depression of the Bekaa / Anti-Lebanon mountains
- Material code
- Location of the basic material
- UTM Coordinates in meters
- Range altitude: altitude range of the basic material, expressed in meters
- Surface: surface area in hectares
- Ownership: Public / Private
- Property Details

Complementarily it is recommended to incorporate graphical information through any plane of delimitation and photographs, as well as provide information on the history of the declaration, who made the proposal, who and on what date was the visit, and finally, if it decides authorize or not the basic material.

Adding details of the mountain itself will give useful information for future harvests, so you can specify for example the access type, slope, target species or the undergrowth.

6.3. FOREST REPRODUCTIVE MATERIAL

It is proposed that the nuts and/or seeds collected from declared basic materials be divided in two categories, the source-identified and the selected category.

6.3.1. THE SOURCE-IDENTIFIED

Identified reproductive materials are those in which the material can be a seed source or stand located within a single region of provenance.

Those obtained from a seed source have not previously undergone phenotypic selection and only origin can be guaranteed, which can be autochthonous, non-autochthonous, or unknown. Only the identity of the material should be guaranteed, i.e. the place where it has been collected. The admission unit is the stand and for the seed sources it will be the mountain or an area with well-defined boundaries that facilitate the subsequent collection and control of seed. The seed source or stand must be located within a single region of provenance, as the basic unit of certification is the very region of provenance.

There is no guarantee of genetic quality in the production obtained. The use of this material as a general rule provides a high variability and high adaptability; this is because the gathering is done under a large number of trees over a large area, which also makes that seed production be high. In this type of forests no work is made to increase seed production, which makes that the cost of maintenance of this basic material be reduced.

There are other interesting requirements that ensure the quality of reproductive material:

- To ensure isolation from different sources that may contaminate the mass of interest to be declared.
- To check that the ecological characteristics where the basic materials can be found are the same as those expected for the specific region of provenance.
- To check that the basic materials are adapted to the conditions in which they live. This can be done through the study of the detection of possible pests and/or diseases and other adverse agents.

The proposal on seed sources falls to the objective of providing seeds for reforestation with species of medium or low economic value, seeking to ensure the provision of local seeds, from a known origin. The forest reproductive material identified has a very clear objective, to be used in reforestation of protective nature.

A number of requirements must condition the approval of basic material of this category, relating to the commercialisation of that forest reproductive material:

- The reproductive material produced by vegetative propagation of basic materials or seeds of these, if these don’t guarantee high variability, should not be admitted.

- The region of provenance, the location and altitude range where the materials are collected should always be declared.

For the commercialisation of seeds coming from several seed sources corresponding to a single region of provenance, these could be mixed, and the resulting lot would be identified with the name of that region. The sale shall be identified with a yellow label.

The admission of seed sources of unknown origin is the least desirable option, and if these are declared they can not be mixed with other with known origin in the same region, and should be commercialised separately to try to conserve the genetic and the information of that material with known origin. The origin of natural forests should be preserved and limit the inclusion of seeds indiscriminately or resulting from afforestation with unknown origin.

6.3.2. THE SELECTED CATEGORY

Selected reproduction materials are those that correspond to a stand located within a single region of provenance and which have been phenotypically selected at the population level (selected stand). A selection on a forest level was undergone in the basic material obtained in this category. In a mountain of a region of provenance different stands that have superior phenotypic characteristics from the rest are selected. The material in this category will be commercialised under the name of the region of provenance and with a green label. Seeds collected in the same crop from different selected stands included in the same region of provenance may be mixed. The admission unit is the stand.

The costs of this basic material are higher than in the source-identified, as thinning is necessary to remove feet with undesirable phenotypes.

The forest reproductive material is characterized by:

- A high genetic variability, secured by the collection of a large number of trees in a woodland enough large and with good quality.
- An acceptable genetic quality that will increase with intensity of selection.
- Since the selection is made on natural forests that have neither pests nor diseases, on the contrary, they have good resistance to other adverse agents, it is expected that they adapt to certain ecological conditions.
- A good phenotypic quality, evaluated through characters with high heritability such as stem straightness, fork and the percentage of branches if we are talking about timber production.

For the approval of this basic material it should be indicated the purpose for which the material is selected, and in this category, if it is possible to include artificial hybrid materials of the species that may be of interest.

It is also proposed that this category can support reproductive material produced by vegetative propagation of basic materials from seeds, trying to get a high variability. The commercialisation of reproductive material of genetically modified organisms should not be accepted.

6.3.2.1. Selected stands

Next the focus is a bit more on selected stand, as these may be the figure more interesting for producers in the short-term objectives.

A stand is a defined population of trees with uniformity in composition. The extension is not fixed but should be a population in the genetic sense, i.e., its trees are able to interbreed. The stands are basic materials that can be used for the production of reproductive material of the source-identified and selected category. The stands that refer to the selected category are called selected stands which are phenotypically higher than average according to the criteria set.

The selected stands are those that have been chosen by a phenotypic evaluation in the field using a sample of some trees of the population. The rigor of the evaluations can be very variable, and really is so among the countries using them. Its acceptance may be conditioned upon the extraction of deformed feet to meet the requirements established.

Phenotypic selection can be based on the appearance of an individual for himself, so although genetic gain can be reduced diversity increases. The heritability of the characters used in phenotypic selection is usually between 5 and 20%, which can cause undesirable characters remain even among the selected trees.

The selected stands are an easy and safe way to get quality seed and high genetic variability for species in which the collection by climbing is easy and the productivity per hectare is higher, and therefore, the harvest yield is also high. For these different species, selected stands are less useful and it is proposed:

- The collection is made in years of good harvest (also increases the quality of the seed), considering the ease of seed conservation, and when they coincide with the final cutting for its higher-efficiency.
- Avoid trees that are in marginal situations or isolated to avoid increasing inbreeding.
- It would be advisable to make a series of silvicultural work to increase production. These works can be:

- Thinning, with which trees with undesirable phenotypic characters are deleted and an increased size of the crown is achieved, provided that the trees on which it is performed are not very grown.
- The use of fertilizers may be appropriate in some cases.
- Checking the accessory vegetation will also facilitate seed collection and the access in the collection area.
- Pruning is essential to facilitate the collection in standing trees as they allow better access for climbing to the tops.
- Making firebreaks around selected stands, in addition to monitoring the presence of pests and diseases that may affect the production of pineapple.

To approve a select stand this must be located within a single region of provenance and different requirements should be evaluated: origin, isolation, effective population size, age and development, uniformity, adaptability, health status, volume production of wood, wood quality, shape and pattern of growth, access, demarcation and, if the goal is to produce fruit, it would be necessary to assess the productions and the health status of those products.

General criteria, independent of the main objective, to select a stand:

- Origin: must be declared if known.
- Isolation: the selected stands must be located at a sufficient distance from other bodies of poorer quality of the same species or from masses of species or varieties with which could hybridize. A more intense monitoring will be done when the masses surrounding indigenous stands are non-autochthonous or unknown.
- Effective size of population: population should consist of a sufficient number of trees, density and distribution, so as to ensure adequate interpollination and avoid unfavorable effects of inbreeding.
- Age and development: should allow assessment of the selection criteria.
- Uniformity: must have a normal degree of phenotypic variability within populations, and if necessary, lower feet will be removed for their approval.
- Adaptability: must be well adapted to the ecological conditions prevailing in the region of provenance. To check this adaptation the vigor of trees, fruiting and regeneration of the masses can be followed.

- Health and resistance: should be free from attacks by damaging organisms and show resistance to the adverse climatic and location where they are growing, except as it is related to damage caused by pollution conditions.
- Access: must be easily accessible, especially when it is the time of harvest of forest reproductive material.
- Delimitation: limits must be clear and should be supported by geographical divisions or planning of the mountains.
- Other: it should be checked that the ecological characteristics where the basic material is, coincide with the region of provenance where it belongs.

Specific selection criteria according to the main objective:

Timber production

- -Volume production of timber: it will be above average masses observed in the same region of provenance in similar ecological and management conditions.
- -Wood quality: the characters related to quality, which must be greater than the observed in the rest of the masses of the same species within the same region of provenance, will be evaluated.
- Growth form or habit: must show particularly good morphological features, especially regarding the tilt and fork of the stem, angle and insertion of the branches in the stem and good natural pruning.

Fruit production

- Fruit production: the average production of fruit per hectare and year must be greater than the observed average of the rest of the masses of the same species in the same region of provenance with similar treatments.
- Health status of the fruit: trees, in a major proportion, must be free from attacks of organisms harmful to the fruit.

The reproductive material obtained from the selected stand is characterized by:

- Knowing the geographical origin of the parents when selected stands are established in natural areas.
- The most important gain is the adaptation. Seed well adapted to a moderate cost is available.
- Qualitative gains such as the shape of the tree can be obtained if the best trees are left to produce more seed.

- Gains in production are lower because the heritability of these characters is often low and the selection can not be intense and is conditional on the elimination of feet into the stand.

A larger selection the production increases but the variability is reduced, so the source-identified has a greater variability than the selected, which can provide increased production.

When an adequate number of basic materials are obtained, this should be published so that this information is useful for different collectors and producers of FRM, whether they be public or private. An online application can facilitate the consultation of these data. In this application only the registered data of the basic materials incorporated into the database would be introduced and so these can be displayed them graphically with their boundaries and location on any available layer (orthophoto, relief...).

While no basic materials are declared it is recommended go to FRM of the usual areas trying to follow to the maximum the suggested criteria and taking the maximum number of the site and the species data concerned, to provide minimal information for the consumer and when later assessing the category of material from where the FRM has been collected.

6.3.3. COLLECTION OF FRM

Once the basic concepts are identified, it is already possible to move to the FRM collection phase, within the basic material and region of provenance of interest, and for a species in question.

For each species that is wanted to be collected, we should assess if we collect fruits, seeds or plant parts, and we must bear in mind the purpose of the material collected, if it is for reforestation with protective or producer aim. Thus, for protective objectives we collect from seed sources and for producers' objectives we collect from selected stands.

According to the dimension of SCL and the needs of the country some constraints will have to be taken into account when collecting FRM, as:

- Needs
- Amount to collect
- Period and deadlines of the collection
- "Alternate bearing" character of the species
- Access to the area where we want to collect material
- After analyzing the constraints we must bear in mind a number of pre-harvest activities:
- Choose the region of provenance and basic material (default collection area)
- We must make surveys and monitoring the state of maturation of FRM in the collection site

- Choose how the material is collected: we must see FRM features, the trees, the stand, the place and the means available. From here we can pick MFR directly from the soil by natural fall or from trees; standing trees, climbing the tree, using stairs...; or using cuttings.
- Talk to the landowner and communicate collection to ensure the control system.

Before starting the collection of seeds of a given specie, direct observations of ripeness must be done. The color of the fruit and the status of the embryo (which can be assessed by cutting the seed) can be used as an ripeness indicator.

. You can plan early harvest to extend the collection period, minimizing loses of fruits and seeds dispersion although is should be noted that the collection is more laborious, there is more work for the ripering, extraction is more difficult and reduces the viability and vigor of the seeds.

6.3.3.1. Criteria for the conditions of collection of reproductive material (fruits and seeds) in the basic materials

1) Collect in areas where there are a sufficient number of trees to avoid inbreeding.
2) Avoid picking in areas likely to be affected by the proximity of forest stands of different genotype or inferior quality.
3) Harvest should be done when the fruit or seed production occurs in a large number of trees for high genetic diversity.
4) The selected trees should be well adapted to the ecological conditions of the region.
5) Trees must be free from attacks by damaging organisms and show good resistance to unfavourable soil and climatic conditions of the station where they are.
6) A similar number of seeds of each individual tree are harvested.
7) Avoid picking in margins or from isolated trees.
8) Pick from mature individuals
9) Avoid shoddy stands on the seed source
10) For selected stands avoid trees with low phenotypic characteristics
11) Avoid locations with low production

6.3.3.2 Collection Methods

Factors to consider in choosing the method of collection:

- Features of the fruit / seed
- Features of specimens
- Features of BM
- Features of the location
- Available means

6.3.3.3 Collection systems

- From ground:
    - Natural Fall
    - Fall caused (shaking down and mechanical shaking)
- For individuals standing:
    - Accessible from ground
        - By hand
        - By using tools
    - Accessible by stairs, elevators or climbing equipment
- For individuals felled or cut branches

7. DISTRIBUTION OF FOREST REPRODUCTIVE MATERIAL

The collected material must be used to produce short-term plant, serving as a reserve for medium-term actions, and be a source of ex situ conservation of genetic resources of the country.

7.1. EXTRACTION AND ADEQUACY OF SEEDS

The first step to consider after harvest is transporting the material to CNSL. It must be done as soon as possible. If this process is not done properly some seeds can germinate or lose viability, others can ferment. It is recommended to perform a pre-clean in the pickup location to make the transport easier and avoid the effect of pathogens. It should also be prevented that the material be directly exposed to sun or rain, and that the material piles make difficult the ventilation.

Already in the BNSL the fruits and/or seeds will be inspected, labelled and their processing will begin. Conservation must be done in a cool and ventilated place, away from attacks by rodents and birds.

Depending on the type of fruit some will have to cash them turning to avoid overheating and others will have to be kept them fresh in cold storage.

Some seeds must be extracted from its fruits. According to the fruits drying techniques (natural or artificial), maceration or other can be applied, and can be done manually or using machines, always in accordance with the means available and the amount of fruit to be treated.

Seeds with wings must be withdrawn before storage or sowing.

After these steps of removal and adjustment of the seeds they must be cleaned to obtain a high purity, so it is necessary to remove those damaged, broken or empty seeds, and all existing inert material. For this operation screening, calibration or flotation works can be applied among others.

7.2. CHARACTERIZATION AND SAMPLES TEST

When clean seeds are available it is advisable to test characterization, viability, germination and emergence.

Seed analysis allows obtaining basic information to determine the quality of a seed lot. In addition it allows evaluating future collection methods, pest and diseases control, appropriate management for storage, prior treatments to germination and sowing. It is considered a very good tool to optimize the processes of seed handling and reduce losses in production of plants.

Three types of analysis are recommended:

- Prior to the purchase of a consignment, to check the quality of the lot.
- After reception, to characterize the lot obtained.
- Periodic, to check the status of the seed over time.

All analyses are performed according to ISTA (International Seed Testing Association) and the variables analyzed in each lot are the following:

- The health status
- Purity (% by weight of pure seed)
- 1,000 seed weight
- Germination capacity (% viable seeds)
- Germination power (potential germination)

- Number of empty seeds
- Moisture content

In species with difficult germination experiences designed to secure the best germination method and to know the physiological characteristics of the seeds of the species are performed. Moisture determinations are also made in the seeds of hardwoods to know its proper storage.

7.3. CONSERVATION AND STORAGE OF SEEDS

The conservation of seed lots is a basic tool for CNSL as it will provide seed independently of annual crops, while it has an ex situ resource available.

The durability of a seed lot is highly variable depending on the species. What is sought to keep a lot in time is to apply low temperature and control moisture content, different for orthodox and recalcitrant seeds.

Orthodox seeds can be dried to a low moisture content, and can be stored for long periods of time if the humidity is set between 5 and 10% and the temperature is low (between 0ºC and 20ºC, or for some species 0°C). Within this group are most conifers and many hardwoods. To store this type of seed it is used sealed containers. If you want to save seeds for long periods the temperature should be between -15°C and -20°C, and if you want to keep the short to medium term should be between -5 and 5°C. This must be present to have cold rooms or other, according to the objectives set in the CNSL.

However recalcitrant seeds require a high moisture content (between 20 and 50%), otherwise they lose the ability to germinate. They can not be stored for long periods. In this group there are species of the genus *Quercus sp*.

Throughout this process we must remember to have all lots clearly identified, so it is recommended to use two identical labels for each unit, one to go inside the seed lot and the other one on the outside. The label material must withstand the conditions of conservation and management.

7.4. PRODUCTION OF PLANT MATERIAL

7.4.1. CULTURE CRITERIA

The production of forest plants for use in reforestation work must be done in container given the soil and climatic conditions of the country. Some criteria for plant cultivation and management in container are the following:

- **Substrate**. The substrate must have physical, chemical and biological characteristics adequate for the cultivation of forest plants. The total porosity should be at least around 80%.
- **Container**. The container must meet the following characteristics:
  - Effective root anti-curling device, either by the shape of its walls or by the inclusion of certain directional guides.
  - With walls impermeable to the roots, so that they can not pass from one to another.
  - Sufficiently raised over the field (minimum 10 cm) to produce the root auto-pruning
  - Allowing easy and complete extraction of the root ball to avoid the root system damage.
  - Those systems in which part or the entire container is introduced into the soil next to the plant should not be admissible.
  - The minimum volume will not be less than 200 cc for conifers and shrubs and 300 cc for broadleaved trees.
- **Fertilization**. Do not admit plants that have not been fertilized.

7.4.2. PLANT QUALITY CRITERIA

For plant quality is understood as the capacity development and survival time of a plant, for this reason incorporates genetic content as the origin of the seeds and as cultural work throughout the production process. Quality is an aspect relating mainly to the species and the planting site, and this quality should be required differently depending on the time of planting in autumn or spring. Other factors such as unwanted vegetation that compete with the plant produced can define or accentuate some parameters in the plant that we want to use in reforestation.

The aim of deforestation also affects the production of a plant, so if we want to perform actions of productive nature we will need straighter plant and with one-terminal guidance, and for plants with protective nature, the roots will be the main quality objective. Planting mode, manual or mechanized, also needs a more or less consistent roots ball, so for mechanized planting it should be used a plant with not disassemble roots ball. Therefore, to know the quality of plant we need, we have to know the planting site, the objectives pursued in the action and the way in which this will be performed. It should be noted that the transportation, loading and unloading of material and the location of plants and maintenance until planting are basics that if left unattended dismantle all the work done to produce quality plants.

Focusing on morphological plant quality, we can distinguish two types of criteria, quantitative and qualitative. Quantitative criteria are based, and in this order of importance, in height, root collar diameter and age. Generally, the relationship air part / root part should be proportioned, the height of the plant should be equal or below 1.5 to the container one and 5 times the diameter of the container. The minimum root collar diameter vary for each species, for example for 1 *Pinus pinea* of 1 sap can not be less than 3 mm and for *Quercus calliprinos* should exceed 2 mm, in any case plants with a very small root collar will hinder survival. In terms of age the plants used in reforestation should be usually 1 or 2 saps, and exceptionally 3 saps for species of the genus Abies sp for instance. For their part, qualitative criteria are referring to the conformation and health status.

Those that have any of these defects are not considered quality plants:

1. Unhealed wounds. At the time of planting, any wound must be healed. Only the wounds of small size in secondary branches arising from the manipulation of plants from the nursery to planting can be admitted
2. Absence of gems susceptible to produce an apical sprout
3. Multiple stems. It is understood by multiple stems when the plant collar have several stems likely to develop independently
4. Stems with many guides except those belonging to the genus *Quercus sp*.
5. Deformed root system
6. Signs of drying in stem or roots, overheating, mold, decay or damage caused by harmful organisms (e.g. insects, fungi, rodents)
7. Imbalance between air part and root part
8. Stems with strong curvature
9. Branch nonexistent or grossly inadequate, except for those belonging to the genus *Quercus sp*.
10. Latest needles severely damaged. Plants that have more than a quarter of the needles of the last growing season damaged would be excluded
11. The plants in which the main root forms an angle not exceeding 110º with the stem
12. Secondary roots nonexistent or seriously amputated except those belonging to the genus *Populus sp.* and cuttings that do not have large root development. The total absence, however, would imply rejecting the plant.

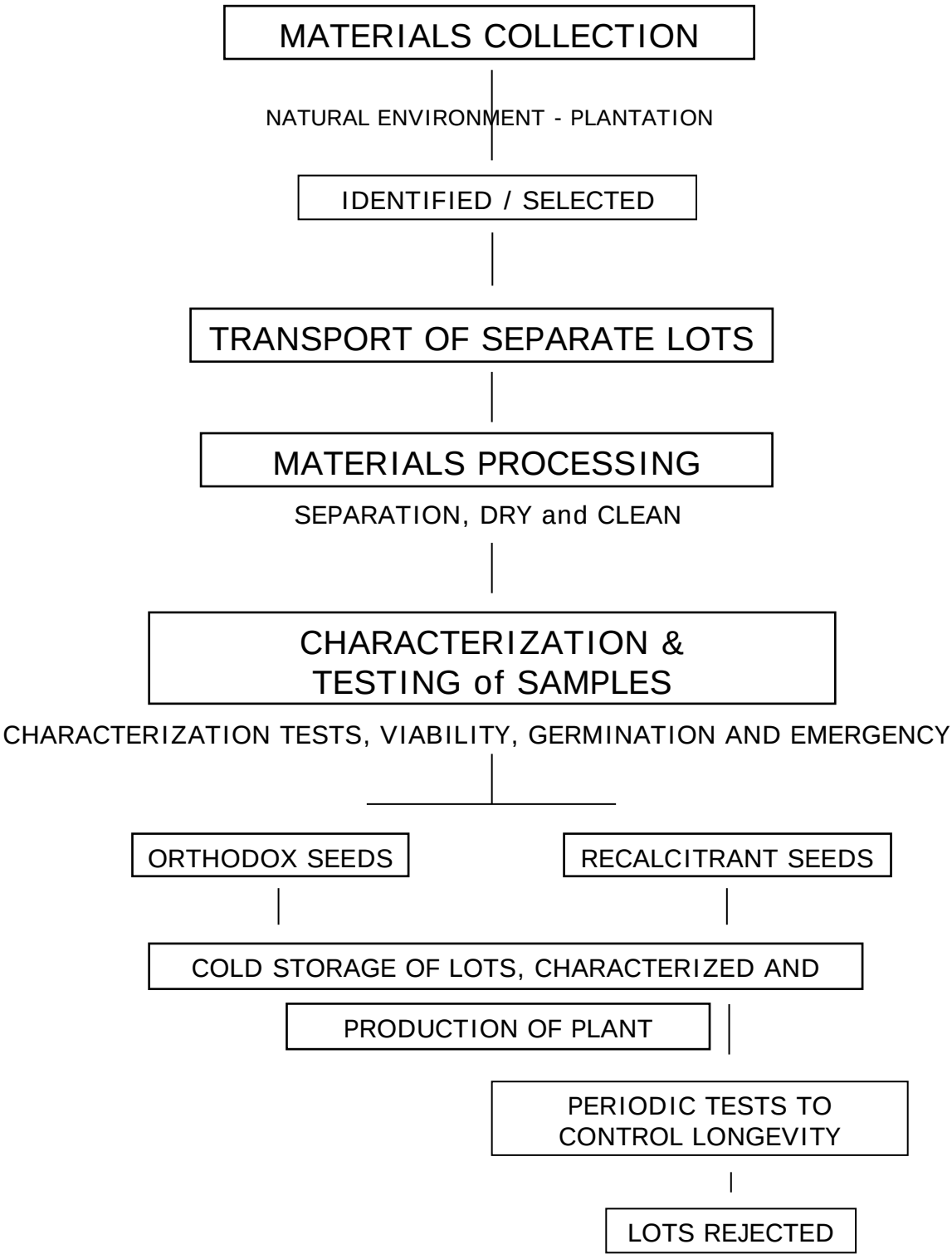
7.4.3. TREE CULTURE MANAGEMENT CRITERIA

The main criteria that should be considered during the cultivation process are the following:

- At the end of the cultivation period the root system must have formed a compact root ball that allows easy handling in the field and avoids that the root ball disintegrates.
- It will require that the plant has a high humidity at the time of going to planting.
- The transportation of the plant must ensure that it does not suffer strong drafts, always trying that the vehicles be of closed box, and if not, shall have a mesh to protect from drafts. This will be done as quickly as possible, taking special care in loading and unloading.
- Maintenance of plants in the place of planting should not delay in time. The plants should be kept moist and protected from the wind, and out of reach of wildlife present in the area.

7.4.4. SCHEME ON THE COLLECTION AND DISTRIBUTION OF FOREST REPRODUCTIVE MATERIAL

PHASES AND HANDLING OF FOREST REPRODUCTIVE MATERIAL- SEEDBANK



8. CONTROL SYSTEM OF FOREST REPRODUCTIVE MATERIAL

8.1. PURPOSE AND LEGAL GROUNDS

To assure intermediates and end users the origin and quality of forest reproductive material is necessary to regulate the system. Henceforth a series of sections and guidelines that should be embodied in a government regulation are detailed. These sections and guidelines are based on what is contained in Council Directive 1999/105 / EC (EUROPEAN UNION), of December 22, 1999, but some aspects have been adapted to the current situation of the country and its short-term needs.

8.2. SPECIES SUBJECT TO CONTROL SYSTEM

All criteria and rules governing the traceability of forest reproductive material shall be applied to species with forest relevance in Lebanon, either tree or shrub, native or non-native species from natural forests or reforestation. So any species that is marketable should be monitored, especially the ones with larger interest and presence in the country as *Cedrus libani*, *Pinus pinea*, *Quercus calliprinos* or *Quercus infectoria* to name just a few.

8.3. SYSTEM AND INSTRUMENTS OF CONTROL OF FRM

The establishment of a control system of the production process for FRM marketing purposes aims to provide guarantee to the intermediate or end user of the origins and characteristics of the material purchased, aspects that should be noted in rules.

To ensure traceability of the process it will be necessary that FRM be clearly identifiable from collection to marketing.

The control instruments that need to be considered are the following:

- Official register of suppliers
- Certificate of origin and quality of material
- Declaration of the production and marketing
- Recording of the movements of the FRM
- Analysis of external quality of seed
- Evaluation of external quality of plants
- Labels and documents of the supplier

The BNSL should apply the controls and proceed to make inspections in the areas of collection and production of FRM, as well as inspections for documentation needed.

The instruments to implement the control system should be collected in the near future in a legal document.

8.3.1. REGISTRATION OF SUPPLIERS OF PLANT MATERIAL

Previously, entities that can participate in the whole process must be identified. It is necessary that these are registered in a database, as well as suppliers of plant material, understood as the natural or legal persons engaged in the FRM marketing and import professionally. They must be previously enrolled in an official register of the government. In the registration application it should be indicated whether they engaged in the production or marketing of FRM, or both. Their available facilities should also be identified.

For these entities the control should be involved in the following activities:

- Collection of fruits and seeds
- Process of extraction and conditioning of seeds.
- Production of plant
- Commercialization of fruits and seeds
- Commercialization of plants

Throughout the process of production and marketing of FRM, identification will be always maintained to know the origin and quality of the material.

To collect fruits and seeds it would be necessary that the collector notifies by species, region of provenance and basic material where he wants to collect and the amount and dates for the collection. It is also appropriate to notify the completion of the work. The Government will be responsible for accepting the collection application.

8.3.2. CERTIFICATE

Registrants can go to pick FRM in the areas previously identified and authorized, and is in the same place that the Government will control material collected and their characteristics, to certify the origin and quality of the material.

The Government shall issue a certificate concerning the collection, indicating the characteristics of the material and a code or number will be assigned.

8.3.3. DECLARATION AND REGISTRATION

Each entity must report annually what has produced and keep track of the FRM movements that have arisen.

Fields that should be incorporated are those associated with the identification of the supplier and those relating to the production and marketing of FRM, as well as if they are fruits, seeds or plants, species, category, quantity produced and the quantity commercialized.

8.3.4. DOCUMENT AND LABELS

At the time of the sale of any material is necessary to provide a document in which the source and material characteristics are specified.

Minimum fields that the document should contain in the case of fruits and seeds:

- Document number
- Certificate number
- Lot number
- Species: scientific name of the species
- Nature: Fruit / Seed
- Code of the basic material
- Region of provenance
- Category
- Objective
- Year of maturation
- Autochthonous material / Non autochthonous / Unknown origin
- Quantity: in kilograms
- Purity: expressed as a percentage
- Weight of 1000 seeds: expressed in grams
- Name of producer

Minimum fields that the document should contain in the case of plants:

- Document number
- Certificate number
- Lot number
- Species: scientific name of the species
- Code of the basic material
- Region of provenance
- Category
- Objective
- Age
- Autochthonous material / Non autochthonous / Unknown origin
- Container volume: expressed in cm^3
- Name of producer

Each material has to be identified separately to avoid confusion between different materials. The identification of materials with different colored labels is a fast, effective and visually control.

For the source-identified a yellow label will be used, and for the selected category a green one. For security an equal label will be placed inside and outside the container.

Minimum fields that the labels should contain in the case of fruits and seeds:

- Certificate number
- Lot number
- Species: scientific name of the species
- Code of the basic material
- Region of provenance
- Category
- Objective
- Year of maturation
- Autochthonous material / Non autochthonous / Unknown origin
- Quantity: expressed in kilograms
- Name of producer

Minimum fields that the labels should contain in the case of plants:

- Certificate number
- Lot number
- Species: scientific name of the species
- Code of the basic material
- Region of provenance
- Category
- Objective
- Age
- Autochthonous material / Non autochthonous / Unknown origin
- Quantity: expressed in kilograms
- Name of producer

8.3.5. HEALTH CONTROL

Another aspect to consider is the sanitary control of FRM in the nursery where it is produced, so actions with unsuitable material that may compromise the already established vegetation can be avoided. The Government should do some routine testing to detect the presence of quarantine pests, and if the FRM is in sound condition to make a document ensuring the use of that material by the end user.

Health control must therefore fall either on the seeds as on the plants, either through external quality analysis or inspections.

8.3.6. INFRACTIONS AND SANCTIONS

It is necessary to establish a system of sanctions for those who do not meet what has been specified above.

9. ANNEX 1. FORESTRY SEED CENTRE MODELS IN THE MEDITERRANEN.

NAME	9.1. CENTRO NACIONAL DE RECURSOS GENÉTICOS FORESTALES ALAQUÁS
Location:	Valencia - SPAIN
Established:	2011
Land Area:	• 10,46 hectares
Organization It Relies On:	• Ministry of Agriculture, Food and Environment
Field of Work:	• Conservation of genetic resources • Improving forest genetics • Nurseries • R+D • Production and supply of forest reproductive material • Ex situ testing • Collaboration with other institutions and bodies • Environmental outreach and education
Infrastructures:	• Buildings comprised of a forest house, with a conference room and offices; installations for employees: warehouses, and a garage for machinery and vehicles • Vegetable pathology laboratory, with several rooms: for receiving samples, crop preparation, observation and identification; and three climate controlled growth chambers • Seed extraction: traditional solar drying bed (2.345 m^2), covered drying bed (608 m^2) and warehouses for fruits and seeds • Plant cultivation: lath houses (1.000 m^2), greenhouses (250 m^2) and traditional beds • Irrigation system: two water tanks, an irrigation head, fertilization pump, programmable irrigation system

	• Other facilities: composting site, weather station, forest trail, etc.
Production capacity:	• Not specified
Website:	• http://www.magrama.gob.es/es/desarrollo-rural/temas/politica-forestal/CNRGF_Alaquas_versi%C3%B3n_Website_tcm7-283506.pdf
Contact Information:	Centro Nacional de Recursos Genéticos Forestales "Alaquás" C/Cami mas de Moret, 2 Pol. Ind. ElsMohínos 46970 Alaquás VALENCIA
Photos:	 

NAME	9.2. CENTRO NACIONAL DE RECURSOS GENÉTICOS FORESTALES EL SERRANILLO
Location:	Guadalajara - SPAIN
Established:	1985
Organization It Relies On:	• Ministry of Agriculture, Food and Environment
Field of Work:	• General supply, via national programs, of fruit and seed collection, processing and conditioning, storage treatment and expedition • R+D • Seed analysis • Creating, maintaining and expanding seed orchards • Collaboration with other forestry agencies: research institutes and universities
Infrastructures:	• Cold storage with an 80 ton capacity • Pinecone dryers • Seed cleaning and sorting machines • R+D Laboratory
Production CapacityIn 1999:	• 18.400 kg of seeds dispatched • 59.400 kg of pinecones processed • 1.660 kg of fleshy fruits • 2.360 kg of other fruits • Cleaned and prepared 4.100 kg of other seeds • Carried out preliminary analyses, intake analyses and periodic seed analyses
Contact Information:	Centro Nacional de Recursos Genéticos Forestales "El Serranillo" Ctra. de Fontanar, Km.2 Apdo. de Correos: 249 19080 Guadalajara SPAIN Tel.: +34 949 212760, +34 949 212651 Fax: +34 949 211096 e-mail: serranillo@magrama.es
Website:	http://www.magrama.gob.es/es/desarrollo-

	rural/temas/politica-forestal/recursos-geneticos-forestales/rgf_red_centros_serranillo_mejora.aspx
Photos:	 

NAME	9.3. CENTRO NACIONAL DE RECURSOS GENÉTICOS FORESTALES VALSAÍN
Location:	Segovia - SPAIN
Established:	1986
Land Area:	• 92 hectares
Organization It Relies On:	• Ministry of Agriculture, Food and Environment
Field of Work:	• General supply, via national programs, of fruit and seed collection, processing and conditioning, storage treatment and expedition • R+D • Seed analysis • Creating, maintaining and expanding seed orchards • Collaboration with other forestry organizations: research institutes and universities
Infrastructures:	• Building (Casa de La Mata): With a conference room, office and a small laboratory • Greenhouses and nurseries: Automated greenhouse (144 m^2) and lath house (450 m^2). Two 36 m^2 greenhouses. Terraced nursery (1.252 m^2) and the Santa Cecilia nursery (1.362 m^2). Wells (3) and cisterns (3)
Production capacity:	• Not specified
Website:	http://www.magrama.gob.es/es/desarrollo-rural/temas/politica-forestal/CNRGF_Valsain_versi%C3%B3n_Website_tcm7-283507.pdf
Contact Information:	Centro Nacional de Recursos Genéticos Forestales "Valsaín" Casa de la mata s/n 40100 San Ildefonso SEGOVIA SPAIN

Photos:	

NAME	9.4. CENTRO NACIONAL DE SEMILLAS FORESTALES (CENASEF)
Location:	Amarante PORTUGAL
Established:	1990
Land Area:	• Not specified
Organization It Relies On:	• Nature and ForestConservationInstitute (Instituto de conservación de la naturaleza y los bosques)
Field of Work:	• Seed harvesting • Seed processing • Laboratory analysis and seed characterization • Storage • Marketing • Harvesting and cleaning for external companies • Sales of cones as biomass
Infrastructures:	• Office • Laboratory • Cold storage rooms • Warehouse • Species processing building • Greenhouse-drying room
Production capacity:	• 20 tons of conifers • 10 tons of other forest species
Website:	• http://www.icnf.pt/portal/florestas/gf/ps/cenasef
Contact Information:	CENASEF – Centro nacional de semillas forestales. Forest park 4600.250 Amarante PORTUGAL Tel.- (351) 255 433 412 Fax.- (351) 255 433 411 Email: cenasef.geral@icnf.pt

Photos:

NAME	9.5. SÉCHERIE DE LA JOUX
Location:	FRANCE
Established:	1983
Land Area:	Several properties. Not specified.
Organization It Relies On:	• ONF (Office national des forèts).
Field of Work:	• Fruit harvesting • Tree and shrub seed production (50% of production in France) • Dedicated crops • Seed treatment • Seed classification • Conservation • Quality analysis • Cultivation contracts for the reforestation of indigenous species • R+D • Sale of emptied pinecones • Educational tool
Infrastructures:	• Workshop • Treatment room • Office • Sheds • Laboratory • Parking lot • Pinecone ripening room (2000m^2) • Drying room • Cold storage rooms. • 2 additional production machines and drying rooms on nearby properties.

Production capacity:	• Several tons (50% of production in France)
Website:	http://www.onf.fr/produits_prestations/sommaire/besoins_reponses/foret/reponses/20080519-151335-121890/++oid++11ec/@@display_media.html
Contact Information:	Sécherie de la joux 39300 supt FRANCE Tel (33) 03 84 51 42 09 Fax (33) 03 84 51 46 63
Photos:	  

NAME	9.6. CNBF DE PIEVE S. STEFANO
Location:	ITALY
Established:	1961
Land Area:	• Not specified
Organization It Relies On:	• Corpoforestaledellostatu
Field of Work:	• Fruit harvesting • Forest seed production • Conservation • Sales
Infrastructures:	• Oven • Crushing mill • Petkus cleaning machines • Macerator • 4 chambers (total 500m^3)
Production capacity:	• Not specified
Website:	• http://www.corpoforestale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/2147
Contact Information:	Centro de Pieve santo Stefano Tel. 0575-799024 Fax. 798 135 0575 E-mail: **utb.pievesemi@corpoforestale.it**
Photos:	

NAME	9.7. SRBIJASUME
Location:	Pozega SERBIA
Established:	2007
Land Area:	• 17 Hectares
Organization It Relies On:	• A public Forestry Management Company
Field of Work:	• Receives and processes seeds and cones • Seed extraction • Drying • Calibration • Empty seed elimination • Treatments • Seed storage • Educational activities and research
Infrastructures:	• Drying room • Laboratory • Experimental nursery • Office and seed production building • Conference room • Cold storage rooms
Production capacity:	• Not specified
Website:	• http://www.srbijasume.rs/semcentar1.html
Contact Information:	MihajloPupin Bulevar 113, 11070 Belgrade, SERBIA

Photos:

NAME	9.8. TRUŠNICASEED AREA AND NURSERY
Location:	Jastrebarsko BOSNIA
Established:	1994
Land Area:	Not specified
Organization It Relies On:	• The Forest Management Society of Bosnia
Field of Work:	• Seed harvesting and production • Conservation • Laboratory • Plant production
Infrastructures:	• Cleaning and calibration machine for pinecones and seeds • Drying room • Desalination plant • Impurity separation via water • Cleaning and calibration machines • Winnowing machine • Pressurized air cleaning machine • Sieves • 3 forest nurseries • Laboratory
Cone drying Production capacity:	• Drying room. 1400 liters • Desalination plant 20-40 kg seeds/hour • Impurity separation via water. 10-50 kg/hour • Cleaning and calibration machines 30-50 kg/hour
Website:	http://www.sumesb.com.ba/sjemenarstvo i rasadnici.html
Contact Information:	Sociedad de gestión forestal de Bosnia 770. slavnebrdske brigade bb., 70220 DonjiVakuf, Bosna i Hercegovina Tel- +387 (0) 30 270 735 Fax- +387 (0) 30 206 644

Photos:	

10. ANNEX 2. SPECIES GROUPS TO STUDY AND SEEDS PROCESS DESCRIPTION.

TAXON	10.1. GENUS *ABIES*
Season:	September-October
Harvesting Method:	Climbers
Processes:	• Drying rooms • Drying ovens
Necessary Equipment:	• Rotating sieve (trommel), sieve, winnowing machine, sorting machine • A ventilated drying oven with temperature control
Total processing time:	1000 kg/day once the cones are opened.
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction via drying beds:

1. The fruit is received and weighed (cones).
2. Spread a thin layer of cones in the covered drying beds. This process aerates the cones and they lose all external moisture. As the humidity decreases the cones will open naturally.
3. Mix daily to aerate correctly.
4. If the drying bed's location permits, keep the cones in the drying bed until they have fully opened. Otherwise, once the external moisture is released from the cones, collect and store the cones in a well ventilated and dry place until spring, when they will need to be spread over the drying bed until they open completely.
5. Once the cones have opened, sweep everything up and place it in the trommel

until it is half-full. Let the trommel run for half an hour. This step is repeated until all cones from the same lot have been processed.

6. The empty cones will be stored in an area specifically designed for them, to later be used as biomass.

7. The remaining material, seeds and impurities will pass through a sieve with a mesh size double that of the seed size. This will separate the seeds from the larger byproducts. Then passthe seeds through a smaller mesh size.

8. Place the seeds in a vertical winnowing machine, where the first winnowing process will eliminate the smaller byproducts that passed through the sieves. The second, finer, blast of air will eliminate the empty seeds. The sorting machine could be used in this step, as well.

9. Place a thin layer of the extracted seeds on trays in the drying area, until the seeds have a moisture content of 9-11%, to preserve correctly. Mix the seeds at least a couple of times a day, to dry evenly.

10. Extract a sample to analyze at the lab.

11. Store in an airtight container.

12. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

13. Place in a dry chamber between 2 and 4 ºC.

Extraction via drying oven:

1. The fruit is received and weighed (cone).

2. Spread a thin layer of the cones on drying trays and place them in the oven.

3. Turn the oven on, being sure to control the temperature and to keep the air ducts opened, allowing the moisture created during this process to come out. Start to increase the temperature gradually, until it reaches 50 ºC.Once the oven reaches 50 ºC, keep it constant, until the moisture content of the cones is 6-8%. After 24-36 hours, the cones will have fully opened.

4. Once the cones are opened, put the contents of the trays into the trommel until

Process Description

it is half-full. Run the trommel for half an hour and repeat the process until all cones from the drying oven have been processed.

5. Repeat steps 6 through 13 from the previous process.

TAXON	10.2. GENUS *ACER*
Season:	October-November
Harvesting Method:	Manual
Processes:	• Manual sorting
Necessary Equipment:	• Manual sieves, table
Total Processing Time:	5 kg/hour
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The correct cleaning of this genus requires they be harvested correctly in the field. The samaras must be released, in situ, from the cluster.
2. The fruit is received and weighed (samaras)
3. Examine the lot, manually separating the samaras that didn't separate from the clusters during harvesting, being careful not to break the wing of the fruit and eliminating as much branch debris as possible.
4. Spread the seeds in a thin layer on trays in the drying area until the seeds have a humidity content of 7-10%, to ensure proper storage. Mix the seeds at least a few times a day, to dry evenly.
5. Extract a sample to analyze at the lab.
6. Store in raffia bags.
7. Label the container, inside and out, with a minimum of the following

Process Description

information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

8. Place in a drying chamber between 2 and 4 ºC.

TAXON	**10.3. GENUS *AMYGDALUS***
Season:	September-October
Harvesting Method:	Hand pole-beating
Processes:	• Peel
Necessary Equipment:	• Almond peeler
Total Processing Time:	300 kg/hour
Preservation Method:	Store in a humidity chamber between -3 and 0 ºC
Maximum Storage Time:	1 year

Process Description

Process Description

Extraction:

1. The fruit is received and weighed (almonds).
2. Pass the fruit through the peeler.
3. Sift to remove impurities.
4. Extract a sample to analyze at the laboratory.
5. Store in open boxes or raffia bags.
6. Label the container, inside and out, with a minimum of the following information:

   Lot Number

   Species

   Year Harvested

   Region of provenance

   Treatment
7. Place in a humidity chamber between -3 and 0 ºC**.**
8. Control the condition of the almond frequently.

TAXON	10.4. GENUS *BERBERIS*
Season:	October-December
Harvesting Method:	Manual
Processes:	Maceration
Necessary Equipment:	• Macerator, brushing machine, sorting machine
Total Processing Time:	5 kg/hour
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.
2. Submerge in water for 24-48 hours.
3. Macerate 2 kg of fruit with a beater (macerator) on slow speed, adding 1 liter of water at a time.
4. The maceration process must be carried out carefully, making sure the macerator does not come into contact with the bottom of the macerating container and it must be moved constantly, to avoid breaking the seeds.
5. Wash the resulting product, eliminating all floating seeds and byproducts. Wash several times.
6. Place the seeds on trays in the maceration area to dry.
7. Once the exterior moisture has evaporated, place the seeds in the brushing machine, with medium strength brushes, in order to eliminate the tegument that could be stuck to the seeds.
8. Take the seeds to the sorting machine, where the rest of the impurities and empty seeds will be removed.
9. Spread a thin layer of seeds on trays in the drying area, until the seeds have a moisture content of 6-8%, to store correctly. Mix the seeds several times a

Process Description

day, to dry evenly.

10. Extract a sample to analyze at the lab.

11. Store in an airtight container.

12. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

13. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.5. FLESHY FRUIT
Season:	August-October
Harvesting Method:	Manual
Processes:	• Maceration
Necessary Equipment:	• Macerator, brushing machine, sorting machine
Total Processing Time:	5 kg/hour
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.
2. Submerge the fruit in water for 24 hours.
3. Macerate 2 kg at a time with the macerator on low speed. Add one liter of water at a time.
4. The maceration process must be carried out carefully, making sure the macerator does not come into contact with the bottom of the macerating container and it must be moved constantly, to avoid breaking the seeds.
5. Wash the resulting product, eliminating all floating seeds and byproducts. Wash several times.
6. Place the seeds on trays in the maceration area to dry.
7. Once the exterior moisture has evaporated, place the seeds in the brushing machine, with medium strength brushes, in order to eliminate the tegument that could be stuck to the seeds.
8. Take the seeds to the sorting machine where the rest of the impurities and empty seeds will be removed.
9. In thin layers, spread the seeds on trays in the drying area, until the seeds have a moisture content of 6-8%, in order to store them properly. Mix the

Process Description

seeds several times a day, to dryevenly.

10. Extract a sample to analyze at the lab.

11. Store in an airtight container.

12. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

13. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.6. GENUS *CASTANEA*
Season:	September-October
Harvesting Method:	Manually from the ground
Processes:	• Floatation
Necessary Equipment:	• Floating pool, fork lift, screens or a metal structure
Total Processing Time:	500 kg/hour
Preservation Method:	Store in a humidity chamber between -3 and 0 ºC
Maximum Storage Time:	For some time, however, their viability decreases and it is much more difficult to preserve them after 4 months

Process Description

Extraction:

1. The fruit is received and weighed (chestnut).
2. Fill the pool up to the overflow hole.
3. Place the open screen or the specially made metal structure inside the pool.
4. Pour 500 kg of chestnuts on top of the screen or metal structure, stirring them for 5 minutes. This process will make the empty chestnuts float.
5. Any floating chestnuts will not be used for planting. By pouring 500 kg of chestnuts, the water will overflow. Open the overflow hole and allow the water and empty chestnuts to naturally flow out. The water will pass through the grill, placed on top of the basin and the floating, empty chestnuts will fall on the grill, ready to be placed in a storage bag.
6. Once everything that has floated to the top has been removed, take out the screen or metal structure from the water and let it drip dry.
7. In a well ventilated and shady area, spread the chestnuts out on the screen or metal structure until all external moisture has been completely removed. Mix frequently.
8. This genus does not require further processing, since the chestnuts should arrive clean when harvested.

Process Description

9. Once dry, place 20 liters of chestnuts per box.

10. It is a good idea to measure the volume of recalcitrant species, since with moisture loss, the weight of each lot may vary significantly, while the volume does not change significantly.

11. Extract a sample to analyze at the lab.

12. Store in open boxes.

13. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

14. Place in a humidity chamber between -3 and 0º C**.**

15. Recalcitrant species and species preserved in humidity chambers must have frequent controls, mixing each box in order to avoid self-germination and fungi growth.

TAXON	10.7. GENUS *CEDRUS*
Season:	October-December
Harvesting Method:	Climbers
Processes:	• Drying beds • Drying oven
Necessary Equipment:	• Rotating sieve (trommel), roughing screen, vertical winnowing machine, sorting machine • Ventilated oven with temperature control
Total Processing Time:	1000 kg/day once the cones are opened
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction via drying beds:

1. The fruit is received and weighed (cones).
2. Spread a thin layer of cones in covered drying beds. This process aerates the cones and allows the exterior moisture to evaporate. As the moisture content decreases, the cones will naturally open.
3. Move daily to aerate properly.
4. If the drying area permits, leave the cones in the drying bed until they have opened completely, otherwise, when all external moisture has been removed collect and store the cones in a covered and well ventilated area until spring, when they can be spread out in the drying beds again until fully opened.
5. Once the cones are opened sweep everything up and fill the trommel half way. Run the trommel for half hour, to ensure that all seeds are extracted. Repeat this step until all cones from the same lot have been processed.
6. The empty cones should be stored in a place made specifically for them, to use as biomass.

Process Description

7. All remaining material, seeds and impurities are then passed through a sieve whose mesh size is double that of the seed's size, separating the seeds from the larger byproducts. Then pass the seeds through a smaller sieve, removing smaller impurities.

8. The wings of this genus should not be removed from the seeds.

9. Pass the remaining seeds through the sorting machine, where the rest of the impurities will be removed.

10. Spread a thin layer of seeds on trays and place them in the drying area, until they have a moisture content of 9-11%, in order to store correctly. Stir them at least a few times a day, to dryevenly.

11. Extract a sample to analyze at the lab.

12. Store in an airtight container.

13. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

14. Place in a dry chamber between 2 and 4 ºC.

Extraction via drying ovens:

1. The fruit is received and weighed (cones).

2. Spread a thin layer of cones on the drying trays and place them in the oven.

3. Turn the oven on, being sure to control the temperature and to keep the air ducts opened, allowing the moisture created during this process to come out. Start to increase the temperature gradually, until it reaches 50 ºC. Once the oven reaches 50 ºC, keep it constant, until they have a moisture content of 6-8%. After 24-36 hours, the cones will have opened.

4. Once the cones are opened, put the contents of the trays into the trommel until it is half-full. Run the trommel for half an hour and repeat the process until all cones from the drying oven have been processed.

5. Repeat steps 6 through 14 from the previous process.

TAXON	10.8. GENUS *CUPRESSUS*
Season:	October-December
Harvesting Method:	Manually with a ladder
Processes:	• Drying beds • Drying oven
Necessary Equipment:	• Rotating sieve (trommel), roughing screen, vertical winnowing machine, sorting machine • Ventilated oven with temperature control
Total Processing Time:	1000 kg/day once the cones are opened
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	Minimum of 5 years

Process Description

Extraction via drying beds:

1. The fruit is received and weighed (cones).
2. Before spreading this genus' cones out it is recommended they be passed through a roughing screen to remove all remaining leaves. This step will help avoid any leaves getting mixed with the seeds once they have been extracted, as both are of similar size.
3. Spread a thin layer of cones in the covered drying beds, in order to aerate them. As they lose moisture they will naturally open.
4. Mix daily to aerate properly.
5. If the location of the drying beds permits, leave the cones there until they have fully opened.Otherwise, collect and store them in a covered place once all exterior moisture has been removed, keeping the cones there until spring, when they can be spread out in the drying beds again until they are fully opened.
6. Once the cones are opened sweep everything up and fill the trommel half way. Run the trommel for half hour, to ensure that all seeds are extracted. Repeat

this step until all cones from the same lot have been processed.

7. The empty cones should be stored in a place specifically for them, to use as biomass.
8. All remaining material, the seeds and impurities, are then passed through a roughing screen, whose mesh size is slightly larger than the seeds, thus separating the seeds from the rest of the larger byproducts.
9. Take the seeds to a winnowing machine, to help remove the rest of the impurities that passed through the first sieve, resulting in a clean, but not very viable seed (this genus has a lot of empty seeds).
10. Pass the seeds through the sorting machine, where the empty seeds will be removed, until the desired germination percentage is reached. This process can also be carried out using the winnowing machine.
11. Spread the remaining seeds in thin layers on trays in the drying area, until the seeds have a moisture content of 4-6%, for proper storage. Mix at least a couple of times a day until the desired moisture content is reached.
12. Extract a sample to analyze at the laboratory.
13. Store in an airtight container.
14. Label the container, inside and out, with a minimum of the following information:

    Lot Number

    Species

    Year Harvested

    Region of provenance

    Treatment
15. Place in a dry chamber between 2 and 4 ºC.

Extraction via drying ovens:

1. The fruit is received and weighed (cones).
2. Before placing the cones of this genus in the oven it is advisable to pass them through a roughing screen to remove any leaves that are mixed in with the cones. This step will help avoid leaves mixing with the seeds once they have been extracted, as both are of similar size.
3. Spread a thin layer of cones on the drying trays and place them in the oven.
4. Turn the oven on, being sure to control the temperature and to keep the air

Process Description

ducts opened, allowing the moisture created during this process to come out. Start to increase the temperature gradually, until it reaches 50 ºC. Once the oven reaches 50 ºC, keep it constant, until the moisture content of the cones is between 4 and 6%,when the cones will have fully opened.

5. Once the cones are opened, put the contents of the trays into the trommel until it is half-full. Run the trommel for half an hour and repeat the process until all cones from the drying oven have been processed.

6. Repeat steps 7 through 15 from the previous process.

TAXON	10.9. FAMILIA *FABACEAE*
Season:	September-December
Harvesting Method:	Manual
Processes:	• Threshing
Necessary Equipment:	• Sieve, winnowing machine • Threshing machine
Total Processing Time:	Varies depending on the species
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Threshing:

1. The fruit is received and weighed (pods).
2. If the pods are going to be stored for later processing they must be spread in a thin layer on top of a screen in covered drying beds. This will allow a clean collection of the pods. Large quantities of pods can be stored in raffia bags or airtight containers can be used for smaller quantities.
3. If the pods are going to be processed upon arrival, they will go directly to the threshing machine.
4. The product from the threshing machine should then be sifted.
5. The empty pods will be stored in the fenced storage area for use as biomass.
6. The dirty seeds will then pass through the winnowing machine, where they will be fully cleaned.
7. To eliminate the moisture from the seeds, they will be spread out in thin layers on trays in the drying area, until the seeds have a moisture content of 6-8%, for proper storage. Mix at least a couple of times a day, to dryevenly.
8. Extract a sample to analyze at the lab.
9. Store in an airtight container.

Process Description

10. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

11. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.10. GENUS *FRAXINUS*
Season:	October-March
Harvesting Method:	Manually with a ladder
Processes:	• Manual sorting
Necessary Equipment:	• Table
Total Processing Time:	10 kg/hour
Preservation Method:	Store in a humidity chamber between -3 and 0 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The correct cleaning of this genus requires they be harvested properly. The samaras must be released, in situ, from the cluster.
2. The fruit is received and weighed (samaras)
3. Examine the lot, manually separating the samaras that didn't separate from the clusters during harvesting. Be careful not to break the wing of the fruit and eliminate as much branch debris as possible.
4. Spread a thin layer of the extracted seeds on trays in the drying area, until the humidity content is between 7 and 10%, for correct storage. Mix the seeds at least a couple of times a day, to dry evenly.
5. Extract a sample to analyze at the lab.
6. Store in raffia bags.
7. Label the container, inside and out, with a minimum of the following information:

    Lot Number

    Species

    Year Harvested

    Region of provenance

Process Description

Treatment

8. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.11. GENUS *JUGLANS*
Season:	October-December
Harvesting Method:	Manual
Processes:	• Manual sorting
Necessary Equipment:	• Table
Total Processing Time:	20 kg/hour
Preservation Method:	Store in a humidity chamber between -3 and 0 ºC
Maximum Storage Time:	1 year, after which their viability significantly decreases

Process Description

Extraction:

1. The correct cleaning of this genus requires they be harvested properly, collecting the walnuts after the fleshy part (husk) has fallen off.

2. The fruit is received and weighed (seed)**.**

3. Manually inspect the lot, removing any walnuts that are still attached to the husk.

4. Place the seeds to dry, spreading a thin layer of walnuts on trays in the drying area, until they reach a moisture content of 7-10%, for correct storage. Mix the seeds at least a couple of times a day,to dry evenly.

5. Extract a sample to analyze at the lab.

6. Store the seeds in raffia bags or opened boxes.

7. Label the container, inside and out, with a minimum of the following information:

Lot Number

Process Description

Species

Year Harvested

Region of provenance

Treatment

8. Store in a humidity chamber between -3 and 0 ºC.

TAXON	10.12. GENUS *JUNIPERUS*
Season:	October-March
Harvesting Method:	Manual
Processes:	• Maceration
Necessary Equipment:	• Macerator, brushing machine, sorting machine
Total Processing Time:	5 kg/hour
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.

2. Submerge in water for 24-48 hours.

3. It is not recommended preserving this genus to dry at a later time.

4. Macerate 2 kg at a time with the macerator on low speed. Add one liter of water at a time.

5. The maceration process must be carried out carefully, making sure the macerator does not come into contact with the bottom of the macerating container and it must be moved constantly, to avoid breaking the seeds.

6. Wash the resulting product, eliminating all floating seeds and byproducts. Wash several times.

Process Description

7. Place on trays in the maceration area to dry.

8. Once the exterior moisture has evaporated, place the seeds in the brushing machine, with medium strength brushes, in order to eliminate the tegument that could be stuck to the seeds.

9. Take the seeds to the sorting machine where the rest of the impurities and empty seeds will be removed.

10. Spread a thin layer of seeds on trays in the drying area until the seeds have a moisture content of 6-8%, to store correctly. Mix the seeds at least a couple of times a day, to dry evenly.

11. Extract a sample to analyze at the lab.

12. Store in an airtight container.

13. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

14. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.13. FAMILIA *LABIATAE*
Season:	August-September
Harvesting Method:	Manually with a sickle
Processes:	• Drying beds
Necessary Equipment:	• Sieve, brushing machine, winnowing machine, sorting machine
Total Processing Time:	20kg inflorescences/day
Preservation Method:	Store in a drying chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.
2. Spread a thin layer of inflorescences on top of screens in the covered drying beds. This process aerates them and evaporates the exterior moisture.
3. Once the inflorescences are completely dry, pass them through a roughing screen, where the friction from sifting will separate them from the branches.
4. Pass the resulting product through the brushing machine, where the inflorescence will be broken, thus extracting the seeds.
5. Pass through the winnowing machine to eliminate the majority of the waste.
6. A final pass through the sorting machine will eliminate empty seeds and unwanted byproducts.
7. Spread a thin layer of seeds on trays in the drying area, until they have a moisture content of 4-6%, for correct storage. Mix at least a couple of times a day, to dry evenly.
8. Extract a sample to analyze at the lab.
9. Store in an airtight container.
10. Label the container, inside and out, with a minimum of the following

Process Description

information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

11. Place in a dry chamber between 2 and 4 ºC**.**

TAXON	10.14. GENUS *LONICERA*
Season:	September-October
Harvesting Method:	Manual
Processes:	• Maceration
Necessary Equipment:	• Macerator, brushing machine, sorting machine
Total Processing Time:	5 kg/hour
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.
2. Submerge in water for 24-48 hours.
3. Macerate 2 kg at a time with the macerator on low speed. Add one liter of water at a time.
4. The maceration process must be carried out carefully, making sure the macerator does not come into contact with the bottom of the macerating container and it must be moved constantly, to avoid breaking the seeds.
5. Wash the resulting product, eliminating all floating seeds and byproducts. Wash several times.
6. Place on trays in the maceration area to dry.
7. Once the exterior moisture has evaporated, place the seeds in the brushing machine, with medium strength brushes, in order to eliminate the tegument that could be stuck to the seeds.
8. Take the seeds to the sorting machine where the rest of the impurities and empty seeds will be removed.
9. Spread a thin layer of seeds on trays in the drying area, until they have a moisture content of 6-8%, for correct storage. Mix at least a couple of times a

Process Description

day, to dry evenly.

10. Extract a sample to analyze at the lab.

11. Store in an airtight container.

12. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

13. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.15. FAMILIA *OLEACEAE*
Season:	October-December
Harvesting Method:	Hand pole-beating
Processes:	• Maceration
Necessary Equipment:	• Macerator, brushing machine, sorting machine
Total Processing Time:	
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.
2. Submerge in water for 24 hours.
3. Macerate 2 kg at a time with the macerator on low speed. Add one liter of water at a time.
4. The maceration process must be carried out carefully, making sure the macerator does not come into contact with the bottom of the macerating container and it must be moved constantly, to avoid breaking the seeds.
5. Wash the resulting product, removing all floating seeds and tegument.
6. Place on trays in the maceration area to dry.
7. Once the exterior moisture has evaporated, place the seeds in the brushing machine, with medium strength brushes, in order to eliminate the tegument that could be stuck to the seeds.
8. Pass through the winnowing machine to completely clean the seeds.
9. Spread a thin layer of seeds on trays in the drying area, until they reach a moisture content of 6-8%, for correct storage. Mix at least a couple of times a day, to dry evenly.
10. Extract a sample to analyze at the lab.

Process Description

11. Store in an airtight container.

12. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

13. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.16. SPECIES *PINUS PINEA*
Season:	November-January
Harvesting Method:	Climbers
Processes:	• Drying beds • Drying oven
Necessary Equipment:	• Crushing mill, roughing screen, vertical winnowing machine • Ventilated oven with temperature control
Total Processing Time:	1000 kg/day once the cones are opened
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	A minimum of 5 years

Process Description

Extraction via drying beds:

1. The fruit is received and weighed (cones).
2. Spread a thin layer of cones on the outdoor drying beds. This process aerates the cones and they lose all external moisture. As the humidity decreases the cones will open naturally.
3. Mix daily to aerate evenly.
4. Keep the cones in the outdoor drying beds during the entire part of this process.
5. Once the cones have opened, sweep them up and place them in the crushing mill. The mill will separate the bracts from the rachides of the cones, allowing the pine nuts to fall out.
6. The resulting material will be passed through a roughing screen, twice the size of the seeds, which will separate the seeds from large caliber byproducts. Then the pine nuts will be passed through a slightly smaller sieve in order to eliminate the remaining impurities, which are larger than the pine nuts.
7. The waste from the cones (bracts and rachides) will be stored in a space

designed specifically for them, to be used as biomass.

8. Pass the seeds through the vertical winnowing machineto remove all impurities that are smaller than the pine nuts.

9. Spread a thin layer of seeds in the drying area, until they have a moisture content of 6-8%, to store correctly. Mix the seeds at least a couple of times a day, to dryevenly.

10. Extract a sample to analyze at the lab.

11. If necessary the seeds can be treated to prevent the fungal pathogen *Fusarium*, by placing the seeds in a mixer and adding 3 grams of powder fungicide (iprodione) per kilogram of seeds. Mix for 2-3 minutes until a whitish film covers the entire lot.

12. Store in an airtight container.

13. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

14. Place in a dry chamber between 2 and 4 ºC

Extraction via drying oven:

1. The fruit is received and weighed (cone).

2. Spread a thin layer of cones on drying trays and place them in the oven.

3. Turn the oven on, being sure to control the temperature and to keep the air ducts opened, allowing the moisture created during this process to come out. Gradually increase the temperature until it reaches 55-60 ºC, which is when the cones will fully open, without compromising the viability of the seeds. Once the ideal temperature is reached, keep it constant, until the moisture content of the cones is between 6 and 8%. After 24-36 hours, the cones will have fully opened.

4. Repeat steps 5 through 14 from the previous process.

TAXON	10.17. GENUS *PINUS* (EXCLUDING*PINUS PINEA*)
Season:	October-March, depending on the species
Harvesting Method:	Climbers
Processes:	• Drying beds • Drying oven
Necessary Equipment:	• Rotating sieve (trommel), mixer, roughing screen, vertical winnowing machine, sorting machine • Ventilated oven with temperature control
Total Processing Time:	1000 kg/day once the cones are opened
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	A minimum of 5 years

Process Description

Extraction via drying beds:

1. The fruit is received and weighed (cones).
2. Spread a thin layer of cones in the covered drying beds, aerating the cones and removing all external moisture. As the moisture is removed, the cones will naturally open.
3. Mix daily to aerate correctly.
4. If the drying bed's location permits, keep the cones in the drying bed until they have fully opened. Otherwise, once the external moisture is released from the cones, collect and store the cones in a well ventilated and dry place until spring, when they will need to be spread over the drying beds until they open completely.
5. Once the cones are opened, put the contents of the trays into the trommel until it is half-full. Run the trommel for half an hour and repeat the process until all cones from the drying beds have been processed.
6. The empty cones will be stored in a space designed specifically for them, to use as biomass.

Process Description

7. To separate the seeds from the wings, place them in a mixer and add water with a 25/0.5 ratio and run for 15 minutes.
8. The resulting material, seeds, wings and impurities will pass through a roughing screen with a mesh size double that of the seeds, in order to separate the seeds from the large caliber byproducts.
9. Place the seeds in the vertical winnowing machine, where the first pass through will eliminate the wings and impurities that passed through the roughing screen.
10. Pass the seeds through the sorting machine to remove the empty seeds and any remaining waste.
11. Spread a thin layer of seeds on trays in the drying area until the seeds have a moisture content of 6-8%, to store properly. Mix the seeds at least a couple of times a day, to dry evenly.
12. Extract a sample to analyze at the lab.
13. If necessary the seeds can be treated to prevent the fungal pathogen Fusarium, by placing the seeds in a mixer and adding 3 grams of powder fungicide (iprodione) per kilogram of seeds. Mix for 2-3 minutes until a whitish film covers the entire lot.
14. Store in an airtight container.
15. Label the container, inside and out, with a minimum of the following information:

    Lot Number

    Species

    Year Harvested

    Region of provenance

    Treatment
16. Place in a dry chamber between 2 and 4 ºC

Extraction via drying oven:

1. The fruit is received and weighed (cone).
2. Spread the cones in a thin layer on the drying trays and place them in the oven.
3. Turn the oven on, being sure to control the temperature and to keep the air ducts opened, allowing the moisture created during this process to come out.

Process Description

Gradually increase the temperature, until it reaches the opening temperature specific to each *Pinus*species. Once the ideal temperature is reached, keep it constant, until the moisture content of the cones reaches 4-6%. After 24-36 hours all cones will have opened.

4. Depending on the species the drying temperature will vary, so as not to damage the seeds while opening the cones.

5. Once the cones are opened, put the contents of the trays into the trommel until it is half-full. Run the trommel for half an hour and repeat the process until all cones from the drying oven have been processed.

6. Repeat steps 6 through 16 from the previous process.

TAXON	10.18. GENUS *POPULUS*
Season:	April-June
Harvesting Method:	Aspiration, raking
Processes:	
Necessary Equipment:	• Brushing machine, sorting machine
Total Processing Time:	
Preservation Method:	Store in a freezer
Maximum Storage Time:	2 years

Process Description

Extraction:

1. The correct cleaning of this genus depends on a proper harvesting of the *populus* tufts, which can be suctioned or raked up. It is important to collect the tufts with the least amount of impurities possible, for a quick and easy cleaning.
2. The fruit is received and weighed (tufts with white hairs)
3. Pass the tufts through the brushing machine using soft brushes.
4. Pass through the sorting machine to obtain clean seeds.
5. Place a fine layer of the extracted seeds on trays in the drying area, until the seeds reach a moisture content of 6-8%, in order to preserve correctly. Mix the seeds at least a couple of times a day, to dry evenly.
6. Extract a sample to analyze at the lab.
7. Store in an airtight container.
8. Label the container, inside and out, with a minimum of the following information:

    Lot Number

    Species

    Year Harvested

Process Description

Region of provenance

Treatment

9. Place in a house style freezer.

TAXON	10.19. GENUS *QUERCUS*
Season:	October-December
Harvesting Method:	Hand pole-beating, manually
Processes:	• Floatation
Necessary Equipment:	• Floating pool, forklift, screens or metal structure
Total Processing Time:	2 hours/500 kg
Preservation Method:	Store in a humidity chamber between -3 and 0 ºC
Maximum Storage Time:	For some time, however, their viability decreases and it is much more difficult to preserve them after 4 months

Process Description

Extraction:

1. The fruit is received and weighed (acorns).
2. Fill the pool up to the overflow hole.
3. Place the open screen or the specially made metal structure inside the pool.
4. Pour 500 kg of acorns on top of the screen or metal structure, stirring them for 5 minutes. This process will allow the empty acorns to float.
5. By pouring in 500 kg of acorns in the pool, the water will overflow. Open the overflow hole and allow the water and empty acorns to naturally flow out. The water will pass to the grill, placed on top of the basin and the floating, empty acorns will fall onto the grill, ready to be placed in storage bags. The floating acorns are not viable and will not be used for planting.
6. Once everything found floating has been removed, take out the screen or metal structure from the water and let it drip dry.
7. In a well ventilated and shady area, spread it out until all external moisture has been completely removed. Mix frequently.
8. Once dry, place 20 liters of acorns in each box.
9. It is a good idea to measure the volume of recalcitrant species, since with moisture loss, the weight of each lot may vary significantly, whereas the

Process Description

volume does not.

10. Extract a sample to analyze at the lab.

11. Store in opened boxes.

12. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

13. Place in a humidity chamber between -3 and 0 ºC**.**

14. Recalcitrant species and species preserved in humidity chambers must have frequent controls, mixing each box in order to avoid self-germination and fungi growth.

TAXON	10.20. GENUS *STYRAX*
Season:	September-October
Harvesting Method:	Manually, Hand pole-beating
Processes:	• Maceration
Necessary Equipment:	• Macerator, brushing machine, sorting machine
Total Processing Time:	
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	5 years

Process Description

Extraction:

1. The fruit is received and weighed.
2. Submerge in water for 24 hours.
3. Macerate 2 kg at a time with the macerator on low speed. Add one liter of water at a time.
4. The maceration process must be carried out carefully, making sure the macerator does not come into contact with the bottom of the macerating container and it must be moved constantly, to avoid breaking the seeds.
5. Wash the resulting product, eliminating all floating seeds and tegument found.
6. Place on trays in the maceration area to dry.
7. Once the majority of the external moisture is removed, move the seeds to the drying area.
8. Once the exterior moisture has evaporated, place the seeds in the brushing machine, with medium strength brushes, in order to eliminate the tegument that is stuck to the seeds.
9. Take the seeds to the sorting machine where the rest of the impurities and empty seeds will be removed.
10. Spread a thin layer of seeds on trays in the drying area until the seeds

Process Description

have a moisture content of 6-8%, to store properly. Mix the seeds at least a couple of times a day, to dry evenly.

11. Extract a sample to analyze at the lab.

12. Store in an airtight container.

13. Label the container, inside and out, with a minimum of the following information:

Lot Number

Species

Year Harvested

Region of provenance

Treatment

14. Place in a dry chamber between 2 and 4 ºC.

TAXON	10.21. GENUS *ULMUS*
Season:	April-June
Harvesting Method:	Leaf blower, rake
Processes:	• Manual sorting
Necessary Equipment:	• Table
Total Processing Time:	10 kg/hour
Preservation Method:	Store in a dry chamber between 2 and 4 ºC
Maximum Storage Time:	2 years

Process Description

Extraction:

1. To clean this genus correctly, they must be collected carefully, by raking the samaras that have fallen to the ground or blowing them with a leaf blower, without picking up sand in the process.
2. The fruit is received and weighed (samaras).
3. Sift to remove small caliber impurities.
4. Examine the lot, removing leaves, branches and other impurities not previously removed.
5. Spread a thin layer of seeds on trays in the drying area, until the seeds have a moisture content of 3-7%, to store properly. Mix the seeds at least a couple of times a day, to dry evenly.
6. Extract a sample to analyze at the lab.
7. Store in raffia bags.
8. Label the container, inside and out, with a minimum of the following information:

    Lot Number

    Species

    Year Harvested

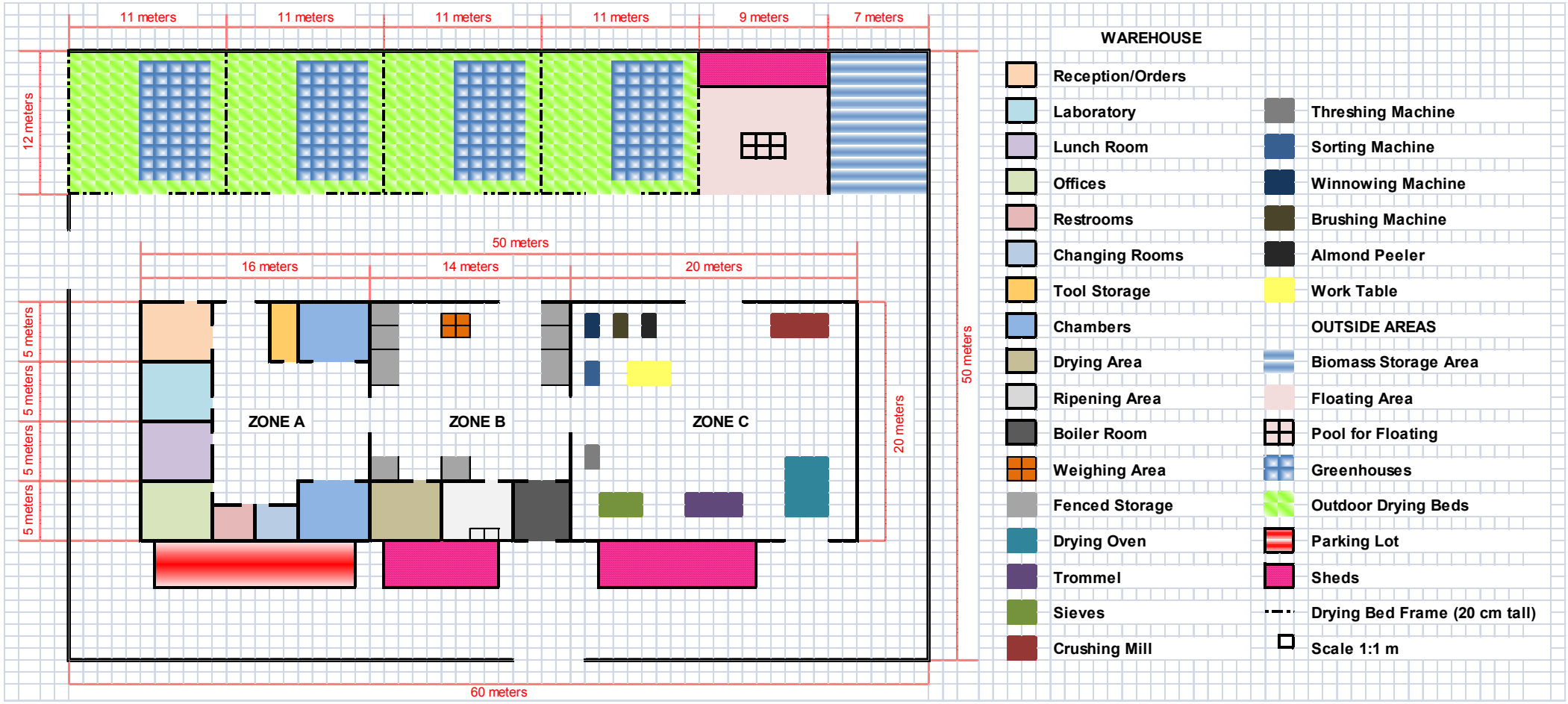
Process Description

Region of provenance

Treatment

8. Place in a dry chamber between 2 and 4 ºC.

11. ANNEX 3. BLUEPRINT OF THE NATIONAL CENTRE FOR FORESTRY SEEDS.



12. ANNEX 4. TECHNICAL SPECIFICATIONS FOR MACHINERY.

Westrup Mod LA-H:

http://westrup.com/Products-Seed-and-Grain/Laboratory-equipment/LA-H

Westrup Mod LA-LS

http://westrup.com/Products-Seed-and-Grain/Laboratory-equipment/LA-LS

Weighing Platform+ Indicator

http://www.balanco.com/es/pesaje-industrial/plataformas-de-pesaje/platataforma-de-pesaje-pvmdb/id/459

Hand pallet truck

http://www.elevacion.es/es/product/horquillas-540-x-1500-mm-1

Table sifter

http://www.casatabares.com/sites/default/files/documentos/relacionados/catalogo_a4.pdf

Crushing mill

http://www.casatabares.com/sites/default/files/documentos/relacionados/catalogo_a4.pdf

Winnowing machine

http://www.casatabares.com/sites/default/files/documentos/relacionados/catalogo_a4.pdf

Trommel

http://www.casatabares.com/sites/default/files/documentos/relacionados/catalogo_a4.pdf

Drying oven

http://www.casatabares.com/sites/default/files/documentos/relacionados/catalogo_a4.pdf

Biomass boiler

http://www.casatabares.com/generadores-biomasa-modelo-c-4-cl-lena-briquetas-pellets-carbon-casca-pina-hueso-aceituna

Threshing machine

http://www.casatabares.com/sites/default/files/documentos/relacionados/catalogo_a4.pdf

Macerator

http://www.sammic.es/catalog/preparacion-dinamica/batidora-mano-industrial

Tunnel greenhouse

http://www.invernaderosima.com/index.php/productos/tunel-kit

Almond peeler

http://www.estupina.com/es/productos/peladora-de-almendras/peladora-de-almendras-para-uso-particular/peladora-de-almendras-pequena-5000-3-mre/29/

Forklift

http://www.agria.net/

Mixer

http://www.inhersa.com/htm/es/prod2/control?zone=pub&sec=prod2&pag=ver&idBloque=1&loc=es&id=8

ANNEX 5. BUDGET.

MACHINERY	CHARACTERISTICS	RRP. Approx
Westrup Mod LA-H	Brushing machine/polish/hull/scarify	13.535,00 €
Accessories LA-H	Set of beaters	165,00 €
Accessories LA-H	Set of nylon brushes 0,5mm	185,00 €
Accessories LA-H	Set of nylon brushes 0,9mm	175,00 €
Accessories LA-H	Additional mantles	495,00 €
Westrup Mod LA-LS	Cleaning/sorting machine	25.945,00 €
Accessories LA-LS	Scalping screens - Perforation 1.0 – 1.9 mm (Half length)	60,00 €
Accessories LA-LS	Scalping screens - Perforation 2.0 mm + larger (Half length)	45,00 €
Accessories LA-LS	Grading screens - perforation 0.5 – 0.9 mm	260,00 €
Accessories LA-LS	Grading screens - Perforation 1.0 – 1.9 mm	205,00 €
Accessories LA-LS	Grading screens - Perforation 2.0 mm + larger	170,00 €
Weighing Platform+ Indicator	4 cell weighing platform. Embedded or above ground. MOD-DB.	2.265,00 €
Hand pallet truck	Manual Mod. TM-30-TV	450,00 €
Manual sieves	Complete set of 14 sieves	400,00 €
Table sifter	Table sifter with interchangeable screens	19.633,46 €
Crushing mill	Crushing mill for *Pinus pinea* cones	24.042,70 €
Winnowing machine	Pneumatic vertical winnowing machine	8.107,00 €
Trommel	Rotating cylinder	9.196,00 €
Drying oven*	Cone drying oven	40.000,00 €
Biomass boiler*	Biomass boiler	30.000,00 €
Threshing machine*	Threshing machine with interchangeable sieves	10.000,00 €
Macerator	Sammic beater TR-750	600,00 €
Tunnel greenhouse	6x10 tunnel kit	1.217,21 €
Almond peeler	Almond peeler Mod.5000/3 MRE	1.100,00 €
Forklift	All terrain Agria TH-160	34.000,00 €
Mixer	MIXER H-250	1.660,00 €
Laboratory*	Germinator, moisture scale, binocular, etc	20.000,00 €
TOTAL Machinery		**243.911,37 €**

BUILDINGS	CHARACTERISTICS	RRP. Approx.
TOTAL Construction (2000 m2)	2000 m2 x 900 €/m2	**1.800.000 €**
HUMAN RESOURCES	**CHARACTERISTICS**	**RRP. Approx.**
Technician	1 Botanical and Environmental Restoration Technician (annual)	18.000 €
Technician	1 Seed Lab Technician (annual)	14.400 €
Non-specialised workers	2 Species Processing Workers (annual)	24.000 €
Temporal workers	60 working days /year (20 €) (annual)	1.200 €
TOTAL HR PER YEAR		**57.600 €**

* Estimation