



**BOTANIC  
GARDENS**  
CONSERVATION  
INTERNATIONAL

# Developing Propagation Protocols

Templates for propagation protocol  
forms and experimental trial data  
collection forms



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# Propagation protocols

A propagation protocol is a technical document that contains, at the time it is published, a set of best practice, technical, and practical guidelines for the propagation and growing of plants.

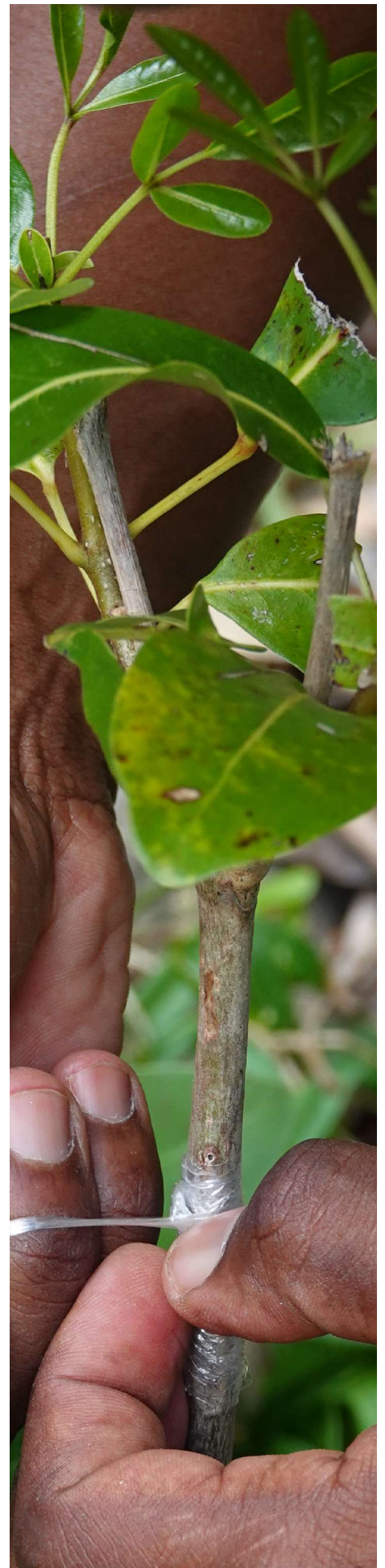
This document should include the most effective method for propagation and growing of the target species with low-tech methods for the local situation where the propagation is taking place and it can be improved or adjusted in the future.

**“A propagation protocol is like writing a recipe including all the ingredients and steps to make a plant”**

Different plant species require different conditions to be propagated and grown. In many cases, information on how to germinate, root, or grow them is scarce or unknown - especially for threatened species. The development and sharing of propagation protocols is a way to overcome this lack of information to propagate plants successfully. This information contributes to the conservation of threatened plants, and it is key in reforestation and restoration processes.

Below are some examples of propagation protocols that have been developed to be easily readable and usable by a variety of propagators, whether local communities, horticulturists, local plant nurseries, or others. A key element of these examples is that all the important processes are captured with photographs, so the protocols are user friendly to aid readers to propagate and grow the plants.

For example of published propagation protocols, [click here](#).



# Steps to develop a propagation protocol

The development of a propagation protocol must follow best practices. These are the steps which should be taken to ensure all important processes and information are included whilst developing a propagation protocol.

**Remember:** Seed collection should include a viability test, which will give a percentage of seeds collected that are fully developed embryos and not infested or immature. This can be compared with germination results to provide greater understanding of successes seen. The viability information should be recorded in your propagation protocol.

Various tests exist to check seed viability:

- cut test
- floating test
- tetrazolium test
- x-ray test

## STEP 1: PLAN

### Know your target species

Search for existing information and understand the ecology of the target species. If information for your target species is not available, search for closely related species. This information will help you understand the optimum growing conditions for your target species and design experimental trials.

### Plan the time for propagation

Create a propagation calendar to figure out the best time to start propagating based on phenology calendars, available facilities and time, and the type of propagation material.

While some plant materials can be stored over longer periods before propagation, like orthodox seeds, others need to be propagated soon after collection to avoid viability loss, such as recalcitrant seeds or vegetative cuttings.

### Establish facilities, equipment, and team for propagation

Make sure you have the right facilities and equipment needed to carry out the propagation and the growing of the plants, and your team has the right skills, such as, horticultural, data collection and entry, and data analysis.

### Obtain your propagation material

The type of propagation will depend on the material available at the time of collection. There are two types of plant propagation: **sexual propagation**, when seeds are used to produce a new individual that is genetically different to the mother plants, and **asexual or vegetative propagation**, when a new plant is grown from a fragment of the mother plant resulting in genetically identical plants. Some of the most used vegetative propagation methods are cuttings, air layering, and grafting.

## STEP 2: SET UP

For the propagation to be completed, the plants should be grown and established. Therefore, to fulfill the propagation of the target species, it is important to follow these practical stages:

- 1) **Establish the propagation:** seed sowing, rooting of cuttings, air layering or grafting.
- 2) **Monitor the propagation success:** seed germination, rooting of plants, or successful grafts.
- 3) **First potting (except for grafting):** seedlings and rooted plants are transferred to individual containers and to the environment where they will grow.
- 4) **Monitor plant growth:** monitor the growth and health of the propagated plants until these are established.

When there is not existing information of the propagation for your target species, you may need to set up your own experimental trials

[See \*\*Design experimental trials\*\* section for more information.](#)



## STEP 3: MONITOR & RECORD

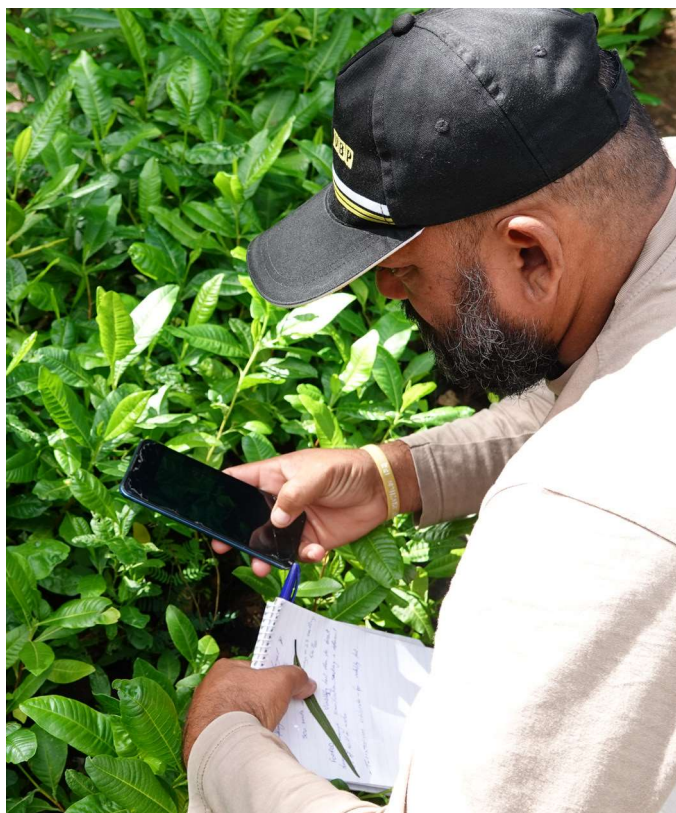
It is important to continuously monitor, and record the propagation success, the growth of the propagated plants and the plants' health throughout the entire process.

**Remember to take photos to illustrate the propagation methods and process.**

## STEP 4: WRITE UP & SHARE

Once you have achieved the propagation and establishment for your target species, ensure the most effective results are written up into a propagation protocol form and shared with the wider community.

**Remember: you can always aim to improve the protocol with further trials.**



# Design experimental trials

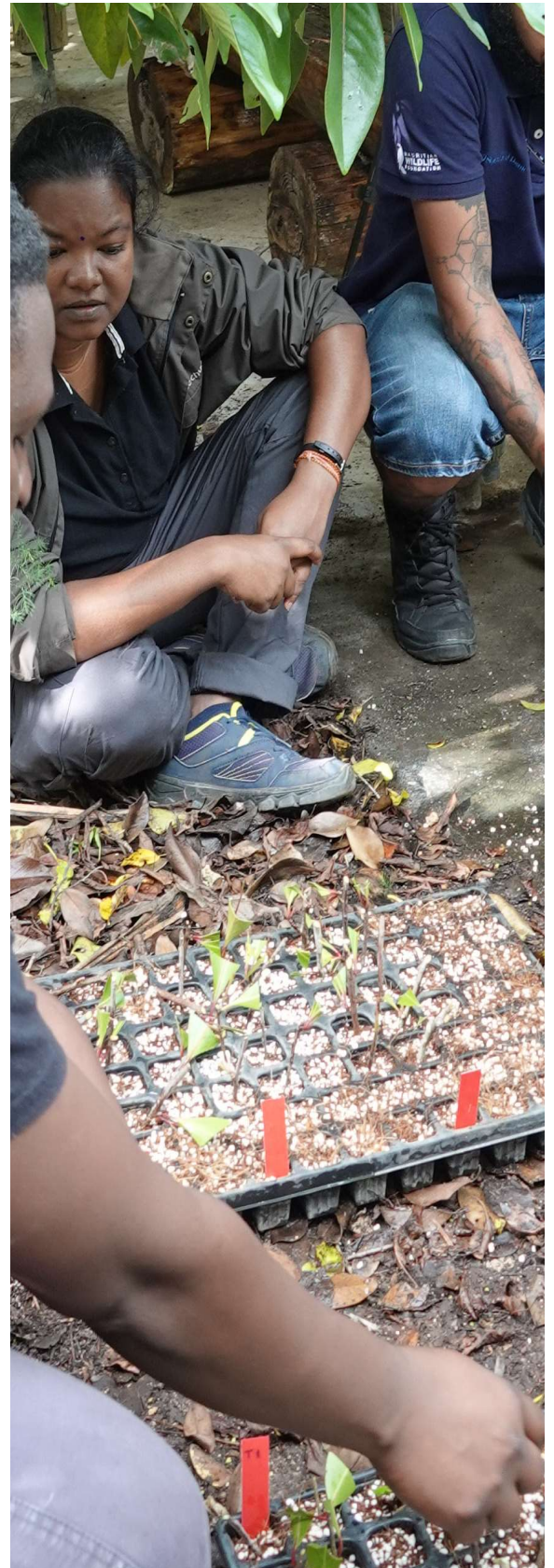
If little or no information is available about the propagation of the target species, or if current success of propagation practices could be improved, a set of propagation trials can be designed to understand improved methods and conditions to propagate and grow the target species.

Different **factors may influence the sexual and asexual propagation success** of your target species. These can be manipulated and changed to observe their effect on the propagation success:

- **Media type:** type of substrate used as sowing or rooting media.
- **Environmental conditions:** temperature, humidity, light conditions used during germination or rooting.
- **Propagation material:** type of seed or part of the plant used for rooting (softwood, semi-hard wood, hardwood, leaves, etc)
- **Treatment:** pre-sowing treatment applied to the seed to break dormancy (scarification, chemical treatment, soaking, stratification) or type of hormones applied to stimulate the growth of roots.

For the experiment, select one or two of these factors to test on your target species, these are your different **trials**. Factors that are not being tested and other procedures should be **standard** across all trials. Make sure you **replicate** the trials to reduce the chance that results are influenced by unknown factors. When possible, it is important to include a **control** trial, where no treatment is applied, to verify the effect of the different treatments.

The experiments should be inspected regularly, and data collected to measure the speed and number of successes. After completing your experiments, data should be analysed to obtain and compare propagation results. The most successful results of the trials will inform the propagation protocol, which recommends how to effectively grow the target species.



# How to use this booklet

This booklet contains a set of templates that can be downloaded and/or printed to be used to present the results for others to follow, and to collate information on propagation trials undertaken.

You can find the following forms:

**Propagation protocol forms** will help you collate all the important information needed to propagate and grow your target species either from seed or vegetative material. The document should be filled with the best information available at the time. It must be accompanied with photographs. It is not a static document, and it can be improved upon or adjusted in the future if better methods are discovered. There will be sections in the form where information is neither available, known or needed, in this case it is acceptable to write 'unknown' or 'none'.

**Experimental trials data collection forms** will help you record and monitor the information throughout the entire experimental process. For the experimental trials, factors that may influence the propagation of your target species will be varied and monitored to understand which factors are most important for successful propagation.



[Click here to download the forms](#)

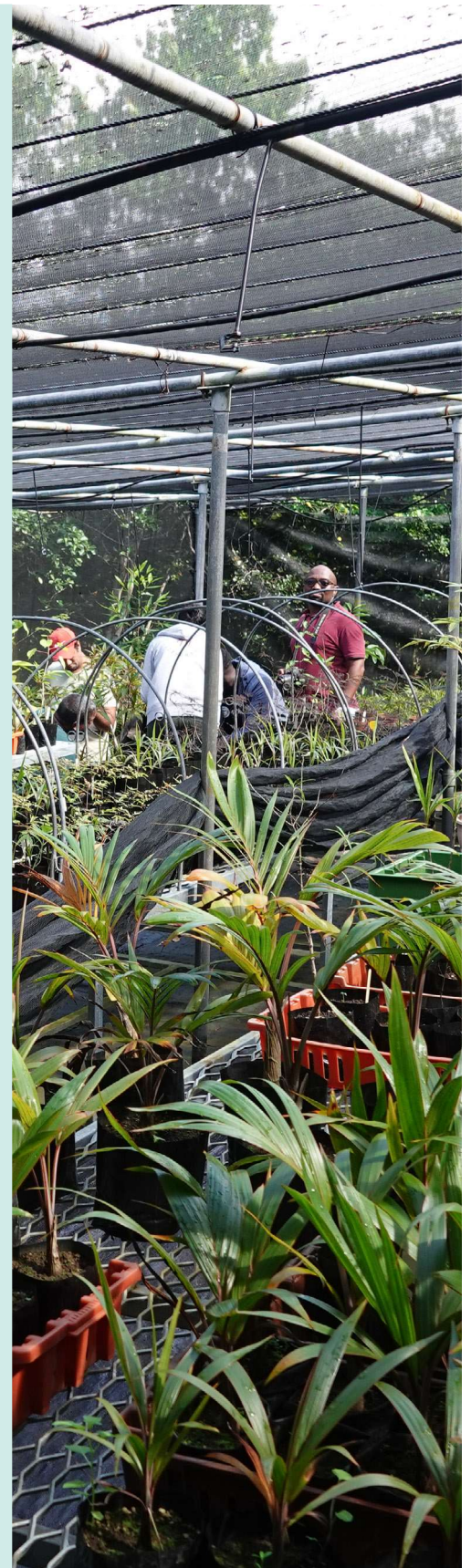


# How to share propagation protocols

**Sharing the propagation methods and results to propagate your target species, is an essential step once you have developed new propagation protocols.**

The sharing of the propagation protocol will help with the efficient propagation of the target species more widely to secure the conservation of threatened species in need of help. These protocols can be followed and/or adapted in the future by your team, conservation practitioners and plant nursery staff.

The propagation protocol results are shared in a technical document that will recommend an efficient way to propagate and grow the target species. Photographs of all the processes must be included. Remember to add the authorship and include the logo of your organisation. For sharing your propagation protocol, you can use the Propagation Protocol Forms available in this booklet, but you can also create your own document where you include all the information and photographs for the propagation of the target species.





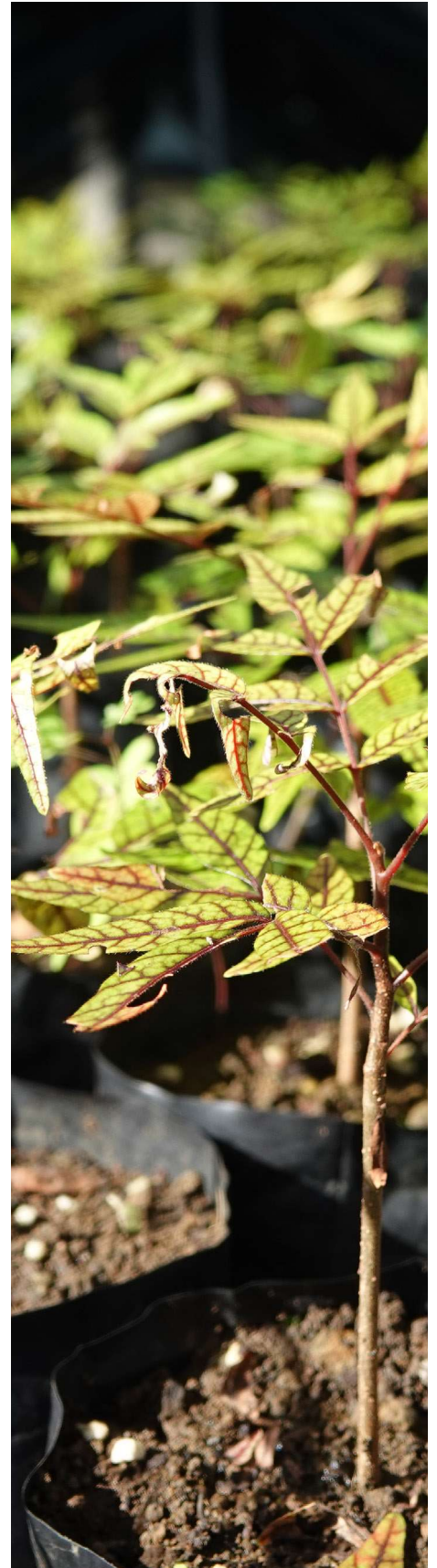
# How to share propagation protocols for trees

**BGCI supports the sharing of propagation protocols for tree species through the BGCI tool: Conservation Action Tracker.**

BGCI's Conservation Action Tracker is a global online tool displayed in the GlobalTree Portal under 'Species Search'. This tool presents known information on conservation actions for each tree species worldwide, including whether propagation protocols exist for the target tree species.

The information gathered by the Conservation Action Tracker is crucial to guide, prioritise and scale up the conservation of tree species by identifying gaps in the conservation of tree species, increasing collaboration to avoid effort duplication, making information available to be used by conservationists, scientists and decision-makers, and providing a portal to share crucial conservation resources such as propagation protocols.

Using the Conservation Action Tracker, you can share conservation action information for your target tree species and share the developed propagation protocols for tree species. Upload your propagation protocols on your organisation's website and share the link through the [Conservation Action Tracker online form](#).



# Seed Propagation Protocol Form

# SEED PROPAGATION PROTOCOL

This form collates the information about the best method for seed propagation and growing up of the target species.

Authorship (*people that contributed propagation information*):

Date of publication:

Logo/s of the affiliated organisation(s):

## GENERAL INFORMATION

<b>Taxon name</b>	<i>Scientific name of the propagated species</i>		<b>Name/s of propagator/</b>	<i>Name(s) of the person or people that carried out the propagation</i>	
<b>Family</b>	<i>Plant family of the propagated species</i>		<b>Organisation</b>	<i>Organisation(s) where the propagation was carried out</i>	
<b>Origin of seeds</b>	<i>Site(s) and country where seeds were collected</i>		<b>Site and country</b>	<i>Site(s) and country where the propagation took place</i>	

## SEED DESCRIPTION & PROCESSING

**Description of the seeds and the processing of the seeds before seed sowing.**

<b>Time of year for seed collection</b>	<i>List month/s of the year when seed collection is best</i>	
<b>Fruit/seed transport</b>	<i>Describe how fruit/seeds have been stored during transport from the field to the nursery</i>	
<b>Processing of fruits/seeds</b>	<i>Describe how the fruits/seeds are processed in situ or in the nursery (seed extraction methods, seed cleaning, handling of fruits/seeds...)</i>	
<b>Method to assess seed viability</b>	<i>Describe method used to estimate seed viability (e.g. floating test, cut test, tetrazolium test, X-ray test)</i>	
<b>% Estimated seed viability</b>	<i>(Number of viable seeds) x 100 / (Total number of seed for which viability was estimated)</i>	
<b>Type of seed</b>	<i>Choose one of these options: Orthodox, Intermediate, Recalcitrant or Unknown</i>	
<b>Seed size</b>	<i>Include a measuring unit (e.g. mm, cm...)</i>	
<b>Number of seeds per gram</b>	<i>Count a reasonable number of seeds and weigh them. Then, divide the number of seeds by their weight (e.g. 100 seeds / 5 g = 20 seeds/g)</i>	
<b>Seed storage</b>	<i>If seeds have been stored before germination, mention storage facilities (seed bank, fridge, freezer), and describe conditions (humidity, temperature), type of container, and storage time length.</i>	

+ **Add photographs of the fruit and seeds. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

# SEED PROPAGATION PROTOCOL

## GERMINATION

Description of procedures, materials for seed germination and the germination success.

Procedures	Seed treatment	<i>Describe treatment applied to the seed before sowing (e.g. mechanical scarification, chemical scarification, soaking, stratification, smoke treatment...). If applied, include the duration of the treatment.</i>	
	Seed sowing media	<i>Media composition: include percentages/ratio for the different components</i>	
	Container	<i>Describe size and material of the container in which seeds are sown</i>	
	Seed spacing	<i>Describe the recommended spacing between the seeds when sown. Include a measuring unit (e.g. mm, cm...)</i>	
	Seed depth	<i>Describe how deep the seeds are sown. Include a measuring unit (e.g. mm, cm...)</i>	
	Watering technique	<i>Describe watering tool, technique and frequency during sowing and germination</i>	
	Germination facilities	<i>Describe the facilities where the germination of seeds took place (e.g. close case, outdoor shaded area, heated bench, covered/bagged container...)</i>	
	Environmental conditions	<i>Describe the environmental conditions where germination took place (temperature, humidity, and photoperiod)</i>	
Success	Time of year for seed germination	<i>List month/s of the year when seed germination is best</i>	
	Duration until germination	<i>Average number of days/months/years until seeds germinated</i>	
	% Germination success	<i><math>(\text{Number of seeds germinated}) \times 100 / (\text{Total number of seeds sowed})</math></i>	
Materials	<i>List the materials needed for seed germination to help with the planning of this activity. E.g. trays, sieves, dibbers, labels, ruler...</i>		

- + **Add photographs of the germination process. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

# SEED PROPAGATION PROTOCOL

## FIRST POTTING

Description of procedures and materials for the cultivation of the plants and the success of the growing of the plants.

Procedures	<b>Growing Media</b>	<i>Media composition: include percentages/ratio for the different components</i>	
	<b>Container</b>	<i>Describe size and material of the container in which plants are potted</i>	
	<b>Fertiliser</b>	<i>If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, dissolved on water, foliar application)</i>	
	<b>Watering technique</b>	<i>Describe watering tool, technique and frequency while growing the plants</i>	
	<b>Plant growing facilities</b>	<i>Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)</i>	
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)</i>	
Success	<b>Number of days until first potting</b>	<i>Average number of days since the start of seeds sowing until first potting</i>	
	<b>Duration until established plants</b>	<i>Average number of days/month/years for which the plant growth was monitored until the establishment of plants</i>	
	<b>% Plants established</b>	<i><math>(\text{Number of plants established}) \times 100 / (\text{Total number of plants potted})</math></i>	
	<b>Health observations</b>	<i>Record any signs of pest or disease, nutrient deficiency, damage... and the stage when they were observed (e.g. during germination, growing of seedlings, growing of plants...)</i>	
<b>Materials</b>	<i>List material needed for potting to help with the planning of this activity. E.g. pots, dibbers, labels...</i>		

- + **Add photographs of the pricking out, potting, and the growing of plants. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

# Vegetative Propagation Protocol Form for Cuttings

# VEGETATIVE PROPAGATION PROTOCOL: CUTTINGS

This form collates the information about the best method for the propagation of cuttings and growing up of the target species.

Authorship (*people that contributed propagation information*):

Date of publication:

Logo/s of the affiliated organisation(s):

## GENERAL INFORMATION

<b>Taxon name</b>	<i>Scientific name of the propagated species</i>		<b>Name/s of propagator/s</b>	<i>Name(s) of the person or people that carried out the propagation</i>	
<b>Family</b>	<i>Plant family of the propagated species</i>		<b>Organisation</b>	<i>Organisation(s) where the propagation was carried out</i>	
<b>Origin of vegetative material</b>	<i>Site(s) and country where vegetative material was collected</i>		<b>Locality and country</b>	<i>Site(s) and country where the propagation took place</i>	

## ROOTING OF CUTTINGS

Description of procedures, materials and success of rooting of cuttings.

<b>Procedures</b>	<b>Transport of cuttings</b>	<i>Describe how cuttings have been stored during transport from the field to the nursery</i>	
	<b>Vegetative material used for rooting</b>	<i>Describe the type of cutting material (e.g. softwood, semi-hard wood, hardwood, root, leaf...)</i>	
	<b>Cutting size</b>	<i>Specify the size of cutting (length, diameter). Include a measuring unit (e.g. mm, cm...)</i>	
	<b>Cutting preparation</b>	<i>Describe the processing (e.g. sterilise...) and preparation of the cutting (e.g. reducing leaf surface, removal lower leaves...)</i>	
	<b>Rooting hormone</b>	<i>If used, type of rooting hormone (liquid, powder or gel), which active ingredients (IAA, NAA &amp; IBA) and concentration</i>	
	<b>Rooting media</b>	<i>Media composition: include percentages/ratio for the different components</i>	
	<b>Container</b>	<i>Describe size and material of the container in which cuttings are placed</i>	
	<b>Cutting spacing</b>	<i>Recommended spacing between cuttings or number of cuttings included in each container</i>	
	<b>Watering technique</b>	<i>Describe watering tool, technique and frequency during rooting</i>	
	<b>Rooting facilities</b>	<i>Describe the facilities where the rooting of cuttings took place (e.g. close case, misting unit, outdoor shaded area, heated bench, covered/bagged container...)</i>	
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where rooting took place (temperature, humidity, light levels)</i>	
<b>Success</b>	<b>Time of year for rooting</b>	<i>List month/s of the year when rooting is best</i>	

	<b>Duration until rooting</b>	<i>Average number of days/months/years until cuttings rooted</i>	
	<b>% Cuttings rooted</b>	<i>(Number of cuttings rooted) x 100 / (Total number of cuttings prepared)</i>	
<b>Materials</b>	<i>List of materials for rooting to help with the planning of this activity. E.g. secateurs, pots, trays, labels...</i>		

- + **Add photographs of the rooting process. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

## VEGETATIVE PROPAGATION PROTOCOL: CUTTINGS

### FIRST POTTING

Description of procedures and materials for the cultivation of the plants and the success of the growing of the plants.

<b>Procedures</b>	<b>Growing Media</b>	<i>Media composition: include percentages/ratio for the different components</i>	
	<b>Container</b>	<i>Describe size and material of the container in which plants are potted</i>	
	<b>Fertiliser</b>	<i>If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, dissolved on water, foliar application)</i>	
	<b>Watering technique</b>	<i>Describe watering tool, technique and frequency while growing the plants</i>	
	<b>Plant growing facilities</b>	<i>Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)</i>	
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)</i>	
<b>Success</b>	<b>Number of days until first potting</b>	<i>Average number of days since preparation of the cutting until first potting</i>	
	<b>Duration until established plants</b>	<i>Average number of days/month/years for which the plant growth was monitored until the establishment of plants</i>	
	<b>% Plants established</b>	<i>(Number of plants established) x 100 / (Total number of plants potted)</i>	
	<b>Health observations</b>	<i>Record any signs of pest or disease, nutrient deficiency, damage... and the stage when they were observed (e.g. during rooting, growing of plants...)</i>	
<b>Materials</b>	<i>List material needed for potting to help with the planning of this activity. E.g. pots, dibbers, labels...</i>		

- + **Add photographs of the potting process and the growing of plants. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**



# Vegetative Propagation Protocol Form for Air Layering



# VEGETATIVE PROPAGATION PROTOCOL: AIR LAYERING

This form collates the information about the best method for air layering of the target species.

Authorship (people that contributed propagation information):

Date of publication:

Logo/s of the affiliated organisation(s):

## GENERAL INFORMATION

<b>Taxon name</b>	<i>Scientific name of the propagated species</i>		<b>Name/s of propagator/</b>	<i>Name(s) of the person or people that carried out the propagation</i>	
<b>Family</b>	<i>Plant family of the propagated species</i>		<b>Organisation</b>	<i>Organisation(s) where the propagation was carried out</i>	
<b>Site and country</b>		<i>Site(s) and country where the propagation took place</i>			

## AIR LAYERING

### Description of procedures, materials and success of the air layering.

<b>Procedures</b>	<b>Position of air layering</b>	<i>Explain in detail the location of the air layering in relation to buds and describe the maturity of the stem (soft wood, semi-hard wood, hard wood). Illustrate with photographs below</i>	
	<b>Cut to the stem</b>	<i>Describe the cut made to the stem (e.g. cutting a ring of the bark, upward slanted-cut...)</i>	
	<b>Rooting hormone</b>	<i>If used, type of rooting hormone (liquid, powder or gel), which active ingredients (IAA, NAA &amp; IBA) and concentration</i>	
	<b>Rooting media</b>	<i>Media composition: include percentages/ratio for the different components</i>	
	<b>Wrapping technique</b>	<i>Describe the wrapping of the rooting media and material used (e.g. air layering balls, plastic and foil...)</i>	
	<b>Moisture maintenance</b>	<i>Describe how to keep the media moist (e.g. adding water, hydrogel, changing the moss...) and monitoring frequency</i>	
	<b>Type of environment</b>	<i>Describe the environment where air layering took place (e.g. glass house, outdoors, in situ...)</i>	
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where air layering took place (temperature, humidity)</i>	
<b>Success</b>	<b>Time of the year for air layering</b>	<i>List month/s when air layering is best</i>	
	<b>Duration until rooting</b>	<i>Average number of days/months/years until roots were visible in the air layering</i>	
	<b>% Air Layer success</b>	<i>(Number of new plants rooted) x 100 / (Total number of air layering attempted in mother plant)</i>	

<b>Materials</b>	<i>List of materials needed for air layering to help with the planning of this activity. E.g. aluminium foil, plastic bags, hydrogel, strings...</i>	
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- + **Add photographs of the air layering process. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

## VEGETATIVE PROPAGATION PROTOCOL: AIR LAYERING

### FIRST POTTING

**Procedures and materials for the cultivation of the plants and the success of the growing of the plants.**

<b>Procedures</b>	<b>Growing Media</b>	<i>Media composition: include percentages/ratio for the different components</i>	
	<b>Container</b>	<i>Describe size and material of the container in which plants are potted</i>	
	<b>Fertiliser</b>	<i>If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, dissolved on water, foliar application)</i>	
	<b>Watering technique</b>	<i>Describe watering tool, technique and frequency while growing the plants</i>	
	<b>Plant growing facilities</b>	<i>Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)</i>	
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)</i>	
<b>Success</b>	<b>Number of days until first potting</b>	<i>Average number of days since air layering was prepared until first potting</i>	
	<b>Duration until established plants</b>	<i>Average number of days/month/years for which the plant growth was monitored until the establishment of plants</i>	
	<b>% Plants established</b>	<i><math>(\text{Number of plants established}) \times 100 / (\text{Total number of plants potted})</math></i>	
	<b>Health observations</b>	<i>Record any signs of pest or disease, nutrient deficiency, damage... and the stage when they were observed (e.g. during rooting, growing of plants....)</i>	
<b>Materials</b>	<i>List material needed for potting to help with the planning of this activity. E.g. pots, dibbers, labels...</i>		

- + **Add photographs of the potting process and the growing of plants. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

# Vegetative Propagation Protocol Form for Grafting



# VEGETATIVE PROPAGATION PROTOCOL: GRAFTING

This form collates the information about the best grafting method of the target species.

Authorship (*people that contributed propagation information*):

Date of publication:

Logo/s of the affiliated organisation(s):

## GENERAL INFORMATION

<b>Taxon name</b>	<i>Scientific name of the propagated species</i>		<b>Name/s of propagator/s</b>	<i>Name(s) of the person or people that carried out the propagation</i>	
<b>Family</b>	<i>Plant family of the propagated species</i>		<b>Organisation</b>	<i>Organisation(s) where the propagation was carried out</i>	
<b>Origin of scions</b>	<i>Site(s) and country where scions were collected</i>		<b>Site and country</b>	<i>Site(s) and country where the propagation took place</i>	

## GRAFTING

### Description of procedures, materials and success of grafting.

<b>Procedures</b>	<b>Transport of scions</b>	<i>Describe how scions have been stored during transport from the field to the nursery</i>	
	<b>Scion material</b>	<i>Describe the type of material used as scion (diameter, length, part of the plant...) and the maturity (soft wood, semi-hard wood, hard wood)</i>	
	<b>Type of graft</b>	<i>Name the technique used: whip and tongue graft, side-veneer, cleft graft, t-bud, tip-graft...</i>	
	<b>Grafting details</b>	<i>Describe the technique in detail, illustrate with photographs below</i>	
	<b>Rootstock name</b>	<i>Scientific name of the species used as rootstock</i>	
	<b>Rootstock material</b>	<i>Describe the size and age of rootstock used</i>	
	<b>Inter-stock</b>	<i>If used, name the species used as inter-stock and its size</i>	
	<b>Grafting facilities</b>	<i>Describe the facilities where grafting took place (e.g. hot pipe, fleece tent, outdoors, polytunnel, etc...)</i>	
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where grafting took place (temperature, humidity, light levels)</i>	
	<b>Watering regime</b>	<i>Describe the watering regime of the rootstock, frequency and technique</i>	
<b>Success</b>	<b>Grafting aftercare</b>	<i>Describe the technique for suppressing rootstock growth (e.g. pruning, growth regulators, root pruning, girdling...)</i>	
	<b>Time of the year for grafting</b>	<i>List month/s of the year when grafting is best</i>	
	<b>Duration until graft success</b>	<i>Average number of days/months/years until scions successfully grafted</i>	

	<b>% Graft success</b>	<i>(Number of scions successfully grafted) x 100 / (Total number of scions attempted grafting)</i>	
	<b>Health observations</b>	<i>Record any signs of pest or disease, nutrient deficiency, damage...and the stage when they were observed (e.g. before callusing, after callusing...)</i>	
<b>Materials</b>		<i>List materials needed for grafting to help with the planning of this activity. E.g. knife, budding strips, grafting wax...</i>	

- + **Add photographs of the grafting process. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

# Seed Germination Experimental Trials Data Collection Form

GENERAL INFORMATION					GERMINATION TRIALS											Germination success (%)	
Taxon name	Collection Number/ Accession Number	Name/s of propagators	Trial number	ID number	Date of sowing	Number of seeds sown	Seed treatment	Duration of the treatment	Media type	Seed spacing	Seed depth	Container	Facilities	Environmental conditions	Watering technique	Duration until germination	Germination success (%)
Scientific name of the species you are propagating	The unique identifier for the batch of seeds obtained from the same source at the same time. <b>IMPORTANT:</b> For trials, do not mix materials with different collection/accession number	Name(s) of the person or people that carried out the propagation	Each trial number is a different experiment. <b>IMPORTANT:</b> Include a 'control trial' where seeds would have no treatment applied to them.	Create a unique ID number: Unique to the species, accession number and trial number. <b>IMPORTANT:</b> Remember to label your experimental trials with the corresponding ID number	Date when the sowing is carried out	Number of seeds sown per trial. <b>IMPORTANT:</b> NT: all trials must have the same number of seeds	Describe treatment applied to the seed before sowing (e.g. mechanical scarification, chemical scarification, soaking, stratification, smoke treatment...)	If applied, describe the duration of the specific treatment	Media composition: include percentages/ratio of the different components	Describe the spacing between the seeds when sown	Describe how deep the seeds are sown	Describe size and material	Describe the facilities where the germination of seeds took place (e.g. close case, outdoor shaded area, heated bench, covered/bagged container...)	Describe the environmental conditions where germination took place (temperature, humidity, and photoperiod)	Describe watering tool, technique and frequency during sowing and germination	Average number of days/months/years until seeds germinated	Formula: Count final total number of germinated seeds alive x 100 / number of seeds sown





**FIRST POTTING**

ID number	Date of potting	Number of seedlings potted	Growing media	Container	Fertiliser	Plant growing facilities	Environmental conditions	Watering technique	Duration until established plants	Plants established (%)
Unique ID number: Unique to the species, accession number and trial number. <b>IMPORTANT:</b> Remember to label your experimental trials with the corresponding ID number	Date when the first potting is done	Number of seedlings potted under the same conditions. <b>IMPORTANT:</b> Do not mix seedling from different trials when potting.	Media composition: include percentages/ratio of the different components	Describe size and material	If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, foliar on water, foliar application)	Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)	Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)	Describe watering tool, technique and frequency while growing the plants	Average number of days/month/year for which the plant growth was monitored until the establishment of plants	Formula: Count final total number of plants established x 100 / number plants potted



# Cuttings Experimental Trials Data Collection Form



CUTTING PROPAGATION TRIALS																		
GENERAL INFORMATION			CUTTING PROPAGATION TRIALS															
Taxon name	Collection Number/ Accession Number	Name/s of propagator/s	Trial number	ID number	Date of propagation	Number of cuttings	Vegetative material used for rooting	Cutting size	Cutting preparation	Rooting hormone	Rooting media	Cutting spacing	Container	Rooting facilities	Environmental conditions	Watering technique	Duration until rooting	Propagation success (%)
	The unique identifier for the batch of cuttings obtained from the same source at the same time. <b>IMPORTANT:</b> Do not mix materials with different collection/accession number	Name(s) of the person or people that carried out the propagation	Each trial number is a different experiment. <b>IMPORTANT:</b> Include a 'control trial' when possible.	Create a unique ID number: Unique to the species, accession trial number. <b>IMPORTANT:</b> Remember to label your experimental trials with the corresponding ID number	Date when the propagation is carried out	Number of cutting attempts using the same technique. <b>IMPORTANT:</b> T. all trials must have same number of cuttings	Describe the type of cutting material (e.g. softwood, semi-hard wood, hardwood, root, leaf...)	Specify the size of cutting (length, diameter)	Describe the processing (e.g. sterilise...) and preparation of the cutting (e.g. reducing leaf surface, removal lower leaves...)	If used, type of rooting hormone (liquid, powder or gel), which active ingredients (IAA, NAA & IBA) and concentration	Media composition: include percentages/ratio of the different components	The spacing between cuttings when rooted in the same container	Describe size and material	Describe the facilities where the rooting of cuttings took place (e.g. close case, misting unit, outdoor shaded area, heated bench, covered/bagged container...)	Describe the environmental conditions where rooting took place (temperature, humidity, light levels)	Describe watering tool, technique and frequency during rooting	Average number of days/months/years until cuttings rooted	Formula: Count final total number of cuttings rooted x 100 / number of cuttings prepared for rooting
Scientific name of the species you are propagating																		

## ROOTING MONITORING

ID number	Taxon name	Date	Number of successes	Health observations
<p><i>Unique ID number: Unique to the species, accession number and trial number</i></p>	<p><i>Name of the species you are monitoring</i></p>	<p><i>Date when the monitoring is done</i></p>	<p><i>Count the number of rooted cuttings since the last Date. IMPORTANT: The number is non-cumulative (count only the new rooted cuttings since your last monitoring date)</i></p>	<p><i>For each trial and along the whole propagation process, record signs of pest, disease, nutrient deficiency, damage... If you are not able to name the problem, make a clear description and help it with photos</i></p>







# Air Layering Experimental Trials Data Collection Form





**FIRST POTTING**

ID number	Date of potting	Number of rooted plants potted	Growing media	Container	Fertiliser	Plant growing facilities	Environmental conditions	Watering technique	Duration until established plants	Plants established (%)
Unique ID number: Unique to the species, accession number and trial number. IMPORTANT: Remember to label your experimental trials with the corresponding ID number	Date when the first potting is done	Number of rooted plants potted under the same conditions. IMPORTANT: Do not mix plants from different trials when potting.	Media composition: include percentages/ratio of the different components	Describe size and material	If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, dissolved on water, foliar application)	Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)	Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)	Describe watering tool, technique and frequency while growing the plants	Average number of days/month/year s for which the plant growth was monitored until the establishment of plants	Formula: $\frac{\text{Count final total number of plants established} \times 100}{\text{number plants potted}}$

### PLANT GROWING MONITORING

<b>ID number</b>	<b>Taxon name</b>	<b>Date</b>	<b>Number of successes</b>	<b>Health observations</b>
<i>Unique ID number: Unique to the species, accession number and trial number</i>	<i>Name of the species you are monitoring</i>	<i>Date when the monitoring is done</i>	<i>Count the number of established plants since last Date</i>	<i>For each trial and along the whole propagation process, record signs of pest, disease, nutrient deficiency, damage... If you are not able to name the problem, make a clear description and help it with photos</i>

# Grafting Experimental Trials Data Collection Form







For more information on how to develop a propagation protocol and design experimental trials, check the following resources:

- Global Trees Campaign's Basic Guidance for Threatened Tree Conservation:
  - [Brief 7: How to germinate seed and care for young seedlings](#)
  - [Brief 8: How to solve germination problems](#)
- BGCI's Online Training Platform:
  - [Tree Conservation: Propagation Protocols](#)
  - [Tree Conservation: Vegetative Propagation of Threatened Trees](#)

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