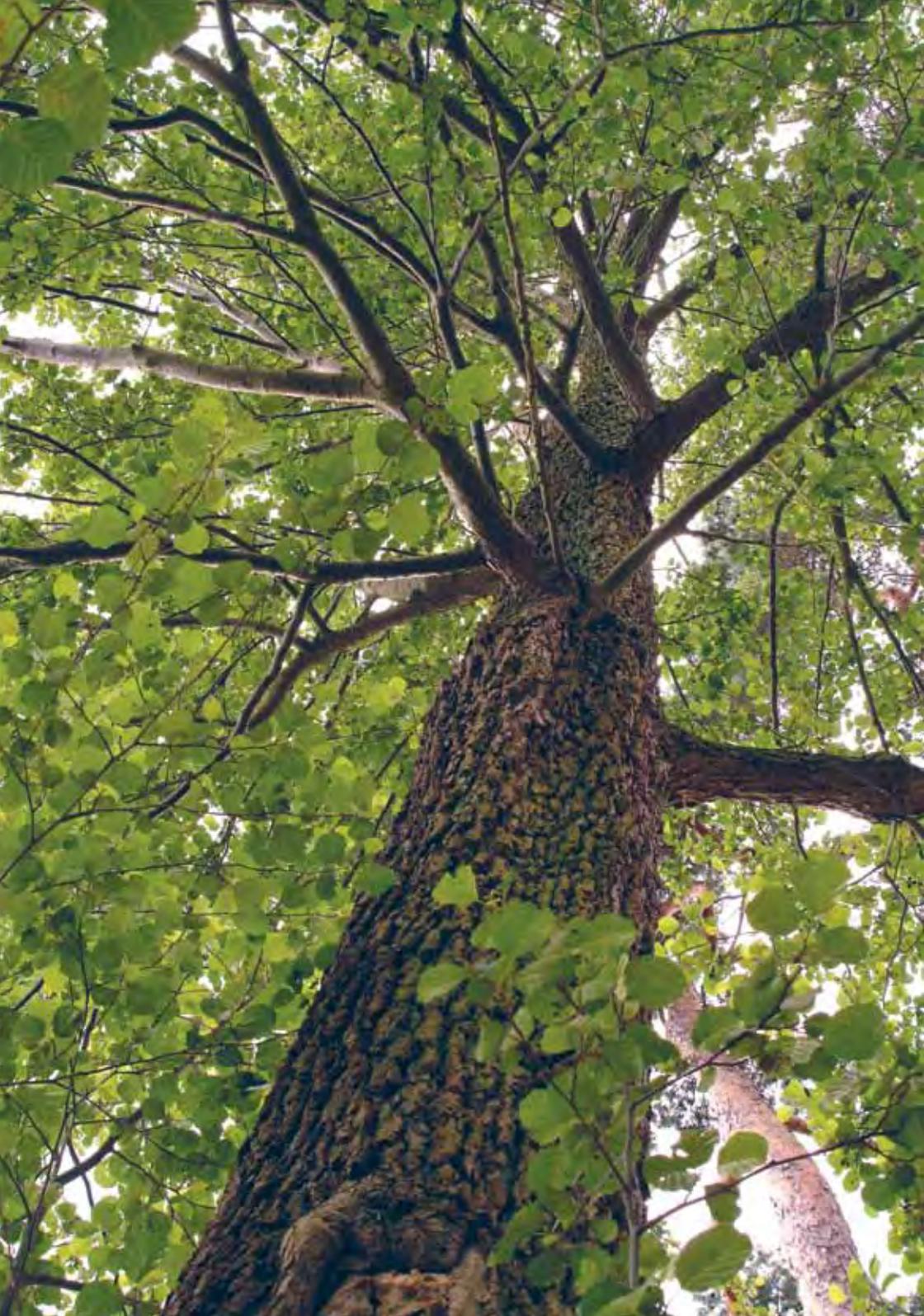




UK National
Tree Seed Project
Seed Collecting Manual



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Authors

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1. Introduction

The UK National Tree Seed Project (UKNTSP) welcomes partners and volunteers to collect seed samples of nationally important trees and shrubs from across their UK range. This project will build a national *ex situ* collection of UK tree seed, maintained and managed by the Millennium Seed Bank (MSB). The collection will be genetically comprehensive and comprise sufficient seeds to support research and conservation, in order to meet the challenges facing UK forests.

This guide has been compiled as information and advice for professional and volunteer foresters, arborists and conservationists collecting seeds for the UKNTSP.

2. Planning your collection

There are two approaches to planning your seed collections, depending on the circumstances of your organisation. You may wish to pledge to collect certain species, and then find sites from which to collect them; or you may have known sites and then decide which species you can collect from them. This section offers guidance on important things to consider in both cases before you go out to the field. Prior to making any firm collecting plans, your organisation should discuss its contribution with the Project Officer who is co-ordinating the collection of species across the UK.

Key points:

1. Collect from naturally-occurring populations¹.
2. Make sure you have landowner consent.
3. Match your planned collection dates with your expected seeding times but stay flexible.

¹ The term 'population' is used to denote a discrete group of plants of the same species among whom interbreeding occurs.

2.1 Identifying collecting sites

The Forestry Commission have identified four regions of provenance based on similar ecological and climatic characteristics. The four regions are further divided into a total of 24 seed zones (Figure 1). The project aims to collect seed from each target species in every Forestry Commission seed zone in which naturally-occurring populations are found, unless there is evidence based on population genetic studies to do otherwise. In each zone we aim to have a collection made above and below 300m elevation where possible.

Collections of target species should be made from well documented naturally-occurring populations, within the species native range (Preston, Pearman & Dines, 2002). Ideally collect from ancient semi-natural woodland at least 4ha in size. As far as possible collectors should ensure that their target populations for seed collecting are neither planted nor cultivated. Indicators of suitable target populations include evidence of coppicing, absence of organised planting patterns, a wide age-class distribution and presence in old records or maps (see <http://www.magic.gov.uk/>). Knowledge of the site's history and management is invaluable in planning the collection and will also aid the use and understanding of the collection.

You should try to visit sites before collecting. This is useful to confirm the identity of species, to collect voucher specimens and to monitor seed maturity, making sure your planned date of collection coincides with when seeds are at the point of natural dispersal.



Figure 1. Map of UK regions of provenance and native seed zones (Herbert, Samuel & Patterson, 1999).

2.2 Targeting species

An initial target list for the project has been developed by ranking UK woody species according to key criteria such as conservation status, prevalence in the landscape, vulnerability to pests and diseases and native status. Where subspecies are well recognised, we also aim to target the collection of subspecies across their native distribution. The priority list can be found in Annex 1. You are welcome to select the species and regions you would like to target in consultation with the Project Officer. This decision should be based on the abundance, accessibility and seed dispersal timing of the species. The Project Officer will advise on whether collections are required from the species in your chosen seed zone and how to prioritise your selection.

2.3 Timing your collection

Timing is important when planning your seed collection as plans may often need to be made some time in advance. However, plans can be confounded as seed abundance and timing varies considerably from year-to-year and by location-to-location. Plans should therefore be flexible and based on monitoring of the target population. The aim is to collect mature seed at the point of natural dispersal as this will maximize longevity in long-term storage. General guidance on timings can be found Annex 1.

2.4 Logistics and safety

Preparing well in advance of collecting will mean your fieldwork will go smoothly and safely. Ideally visit the sites before collecting and plan access routes, equipment required and a timetable for your collections. Prepare a risk assessment and develop contingency plans. See Annex 2 for a suggested equipment list and Annex 3 for health and safety guidance. Only collectors with appropriate qualifications and experience should carry out tree climbing.

2.5 Authorisation

Please ensure that you have the permission of the landowner to collect seed from their land and ensure they are aware of the potential use of seed by asking them to sign the landowner consent form (Annex 4). If you are the landowner please also read and sign this consent form. Even where permission to collect has been granted by the landowner, you may need to liaise with local site managers with regard to access. Also check if there are any conditions for collecting on their land such as insurance requirements and completion of health and safety assessments. If you are tagging the trees you are collecting from, you will need to ensure you have consent to do this.

Collection of species included in Schedule 8 of the Wildlife and Countryside Act (1981) requires a specific permit from the relevant statutory conservation agencies (Natural England, Natural Resources Wales or Scottish Natural Heritage).

Collecting within Sites of Special Scientific Interest should be an approved activity by the statutory conservation agencies. The landowner should ensure this is the case prior to giving permission for the collection to take place. This may require a specific request to be made.

Conditions on collecting or use of plant material imposed by landowners or by permits must be fully adhered to. Please include copies of consent and restrictions when returning collections and detail them on the field data form (Annex 5).

2.6 Bio-security and plant health

Please follow your organisation's bio-security and plant health procedures to minimise the risk of spreading pathogens as you visit sites.

The movement of plant material from some species within the UK may be restricted by a statutory Plant Health Order if there are specific risks. Under MSB's Plant Health Licence, such restricted seed and herbarium specimens can be transported to MSB under quarantine procedures. In this case you will need a 'Letter of Authority' which states that the seed and herbarium specimen are covered by Kew's Plant Health Licence. This can be obtained from the Project Officer. Guidance on bio-security (including equipment, Figure 2), plant health and the transportation of restricted material can be found in Annex 6.



Figure 2. Bio-security kit (see Annex 6 for details).

3. Assessing the population in the field

It is important that you take some time in the field to check the seeds you are planning on collecting and to have a clear plan of how to go about it, before launching into the actual seed collecting. This will mean that the value of the collection is maximised, i.e. that there are enough well identified good quality seeds, and that the collection is genetically diverse.

In order to decide whether the target population is suitable for sampling, it is helpful to make a preliminary visit to the site to assess the population, to confirm species identification, to estimate the likely harvesting date and potential seed yield. Collectors should work through the Pre-Collection Checklist provided in Annex 7 before any collections are made.

Key points:

1. Work through the Pre-Collection Checklist.
2. Make sure everyone can identify the target species.
3. Collect mature seed at the point of natural dispersal.
4. Carry out a cut-test to check the proportion of good seed and adjust collecting effort accordingly.
5. Aim to collect 10,000 seeds from as many trees as possible (at least 15).

3.1 Identify the target species

It is critical to the value of the seed collections that species are accurately identified; this can be more difficult for some of the target species than others. Make sure you are aware of similar species and sub-species, and that every collector in the team is able to recognise the target species. It is important that you include a herbarium specimen with your collection (instructions are available in Annex 8). This will be a lasting verification of identification which will be stored in Kew's Herbarium, and also may be used for chemical or genetic analysis.

3.2 Assessing seed maturity

It is important that seeds are collected when mature. As a general guide, seed are best collected when at the point of natural dispersal. It is possible to tell whether seed are mature by the external colour and how easily it can be detached from the parent plant (Figure 3). As a guide look for:

- seeds which detach easily from the parent plant
- changes in fruit colour
- changes in seed coat colour
- fruits splitting or breaking open
- seeds rattling or are hard and dry and some seeds are already dispersed

Be careful that you don't collect seed from the previous season.

Further evidence of seed maturity can be found when seed are examined internally, using a 'cut-test'. To carry out a cut-test you will need to cut 10 – 20 seeds, collected from several well-spaced individuals in the population, and carefully examine these using a hand lens (especially for smaller seeds). Use secateurs, scissors, nail clippers or similar sharp blades. Tiny seeds can be held on adhesive tape for easier cutting. Immature seeds will have milky or jelly-like contents, becoming firmer and generally whiter as the seeds mature. Seeds collected before or after this stage may not survive as long in storage. Using the Pre-collection Checklist (Annex 7) will help you consider the implications after assessing the seed maturity.

3.3 Assessing seed quality

Many seeds that you will find will be empty, infested with insects or damaged. It is vital therefore that you carry out a cut-test to help you estimate the proportion of healthy seeds and adjust the number of seed you collect accordingly. During the cut-test, look for evidence of insect infestation, shown by the presence of an insect or the frass that they have left behind. You may also find entry holes on the outside of the seed coat.



Figure 3. Ash seeds (*Fraxinus excelsior*) displaying changes in seed coat colour.



Figure 4. An ash seed-cut test (*Fraxinus excelsior*) showing an empty seed (left) and full seed (right). Note the firm white contents of the full seed.

Some species can produce many aborted or 'pseudo' seeds which are empty (Figure 4) – the cut-test will reveal these seeds and they should be avoided or accounted for when collecting.

Find out the average number of seed in each dispersal unit (fruit, cone, etc.) in order to estimate the number of dispersal units to collect per tree. If the proportion of empty, damaged or immature seeds found in the cut-test is very high, you should consider seeking another population for collection.

Again, working through the Pre-collection Checklist (Annex 7) will help you to adapt your sampling strategy in order to meet your collection targets.

3.4 Sampling strategy

The sampling aim is to maximise the genetic diversity of the seed collection, making the most of the time and resources available.

Sampling a population

Plan to sample randomly and evenly across the extent of the population; you may need to use a system to do this, such as each group of collectors following a random transect and selecting trees according to a random number. In practice, your strategy will probably be based on practical considerations, such as finding accessible trees. Avoid biased sampling, such as the temptation to collect from the plants with the most abundant seeds available or from 'desirable' trees. The only exception to this is the deliberate sampling of individual trees showing resistance to pests or diseases, to which the rest of the population appears to be affected: please note this in the individual tree location data.

Try to avoid sampling from isolated plants and ideally collect from trees at least 50m apart. Make sure that individuals are separate and unconnected, unlike multi-stemmed coppices.

Number of plants to collect from

Technical advice differs when recommending the number of plants to collect seeds from in order to sample the genetic diversity of a population. There are clearly a large number of variables that should be taken into account. Brown and Marshall (1995) recommend that collectors should aim to collect material from 50 plants. However, Brown and Hardner (2000), advise on collecting from 15 plants, when sampling from forest trees. Based on these general figures, you will need to develop a realistic target for the number of plants you are able to collect from, given your own resources and the population size. In general, it is better to collect fewer seeds from a larger number of trees than a large number of seeds from fewer trees.

Sampling within a tree

Flowers from different parts of the tree may have been pollinated by different male trees. It is therefore important to collect seeds across the plant, for example from both the higher and lower branches. This may require tree climbers, the use of throw-lines or pole pruners.

Number of seeds to collect

Ideally collect 10,000 healthy seeds from the population. The achievability of this target will inevitably vary considerably, depending on the availability of seed. Smaller collections are still very valuable, particularly from species that are either threatened or of restricted distribution (e.g. Figure 5, Plymouth pear).

Working through the Pre-Collection Checklist (Annex 7) will help you to work out your seed targets. You will need to consider:

- the number of seeds to aim for per tree
- the number of seeds per dispersal unit
- the percentage of healthy seeds



Figure 5. Plymouth pear (*Pyrus cordata*) designated as Vulnerable on the IUCN Red List and one of Britain's rarest trees (found in only two locations in the wild). It is a wild relative of the domestic pear.

4. How to collect seed

Key points:

1. Collect seed from across the canopy, not from a single branch.
2. Do not collect seed from the ground.
3. Bag your collection in a way which allows air flow.
4. Make sure everything associated with each collection is labelled with the same unique collection number.

4.1 Collecting techniques

Seed collecting from wild plants requires care, resourcefulness and determination. There are many different collecting techniques. The most appropriate technique will depend on the species, particularly the height of the tree and type of dispersal unit (fruit, cones, winged seeds, nuts). Possible techniques to use during field collection are:

Felling

This is possibly the most efficient way of collecting seeds from trees, but should only be used if trees are being felled or re-coppiced as part of management and when this coincides with seed ripening. Collect seeds from recently felled trees, but avoid gathering seeds which were already on the ground.

Pruning clusters of fruit

Cut groups or clusters of fruits using secateurs or long-armed tree pruners (Figure 6). If you are a professional tree climber this may also be a good option. This is a very effective technique when:

- seed is clustered at the distal (terminal) parts of branches
- the species is abundant and a small associated loss of branch and foliage is acceptable
- seed is beyond arm-reach but can be accessed using tree-pruners



Figure 6. Pruning clusters of seeds using a pole pruner.

Shaking branches

Careful shaking of branches by hand or using ropes will sometimes dislodge the best available seed and provides good genetic representation across the canopy. Seed can be collected on a tarpaulin held or spread out beneath the tree (Figure 7). Shaking branches may be useful when collecting:

- dehiscent fruits with medium-large seeds
- seeds with irritant plumes
- from spiny trees
- on level, open terrain suitable for tarpaulin use

This technique would not be suitable for light, plumed seed which may be carried away by air currents. Please be cautious as heavy beating or shaking of branches may cause damage to trees.



Figure 7. Shaking branches using a throw-line to release seeds onto a tarpaulin.

Hand picking of whole fruits

The most basic and flexible of techniques, hand picking or plucking, has many benefits. Consider though, if you can use a more efficient technique. Plucking is particularly suitable when:

- target fruits can easily be selected by eye
- non-target (e.g. immature or damaged) fruit cannot be excluded from the collection by more efficient techniques
- fruits are easily accessible and collectors can tie buckets or similar containers around the waist, releasing both hands for collecting
- collecting many-seeded fleshy or dry indehiscent fruits

Bagging seed-heads

If there is frequent access to the collecting site, and if seeds would otherwise be lost, fix a well-tied mesh bag loosely over pre-dispersal seed heads. Seeds are then captured as soon as they are shed, and can be periodically removed. This method is successfully used on a small scale.

Collecting from the ground

You will frequently find seeds on the ground below trees or shrubs, but they will often be damaged by pests or pathogens. The seeds may have been on the ground for several months, and could even date from the previous year. Such seed will have aged and life-span in storage will be greatly reduced. Avoid collecting seed you have found on the ground.

4.2 Collection containers

Seed collections should be placed into cloth or paper bags or envelopes. For wet seed, nylon mesh bags are useful as they allow maximum drying. It can help to initially collect into buckets and then transfer into bags (Figure 8). Choose the type of bag you use based on the size and number of seed you are collecting; it is probably best to have a number of different sized bags with you as it not always easy to predict this beforehand.



Figure 8. Gathering together a seed collection from a single tree.

Allow plenty of space in each bag for air to circulate. Collections from individual trees should always be contained in separately labelled bags. Bags and buckets can be provided by the MSB.

4.3 Collecting from individuals

Wherever possible, please keep the seed from each individual tree in a separate bag, labelled with its tree number. You can number these trees simply 'tree 1', 'tree 2', 'tree 3' etc. Record each tree's exact location, ideally with a GPS. Please use the UKNTSP tags provided to tag the trees you have collected from. This, together with the co-ordinates, will mean the trees can be located again in the future.

4.4 Labelling and collection numbering

Each collection you make should have its own unique collection number chosen by you. This collection number should be used to label all documents, every seed collection bag and the herbarium specimen. It will probably help if you have a system for your organisation to use when numbering. This number will help your organisation keep track of collections made and helps the MSB follow collections before they are fully accessioned.

Label each seed bag inside and out with a jewellery tag. Each tag should be labelled with your collection number and the tree number. Jewellery tags can be provided by the MSB.

5. Care of collections

All collecting effort can be wasted if seeds are not looked after immediately after harvest. Poor handling can significantly reduce both the longevity of the seed in the bank, and its viability for users. So please take care of your collections both in the field and before sending them to us at the MSB.

The key objective is to allow the seeds to start to lose moisture under ambient conditions, and to avoid re-absorption of moisture.

Key points:

1. Dry the seeds as much as possible but do not heat them.
2. Allow plenty of air flow around the seed collections.
3. Transfer seeds into dry bags if seeds and collecting bags are wet.
4. Send the seeds to the MSB as soon as possible.

5.1 Care of collections in the field

In the field, you should collect in such a way that prepares your collection for drying on return from the field. You should collect into porous (cloth or paper) bags that allow drying to take place. Allow for plenty of air to circulate within the bags, i.e. only half-fill bags and tie at the top, not by compressing the seed together. Do not collect into plastic bags, unless you are collecting fleshy fruit (see below).

5.2 Care of collections on return from the field

Here, the priority is to surface-dry the seeds, and dispatch them to MSB as soon as possible. This will maximise the lifespan of the collections. To surface-dry the seeds, transfer them into dry bags and keep them off the ground, in a cool, dry place with good ventilation. Agitate the bags daily to allow the air to circulate and to assist drying throughout the collection. If there is no risk of them getting mixed-up, keep the bags open at the neck. But be careful that labels stay with seeds and don't get mixed up!

Make sure the seeds are sealed up at night as the humidity is likely to rise overnight when temperatures fall. When the seeds are surface-dried, dispatch them to the MSB as soon as possible.

Fleshy fruits require careful handling and rapid dispatch to the seed bank. Some processing by collectors will avoid seeds degrading and fruit fermenting during transit. Fruits can be gently squashed in a mesh bag or over a sieve to remove juice and pulp. The seeds and remaining pulp can then be spread out on a piece of nylon mesh or cloth to dry. Use sealable plastic bags for fleshy fruit as they will stick to cloth and paper bags, making them difficult to remove later on.

6. Documents and information

Key points:

1. Ensure all documents are fully completed.
2. Make sure all items have the same collection number.
3. Collect a herbarium specimen from your population.

To help you plan your seed collection and to ensure that all the documents are in place there is a checklist provided as Annex 10.

6.1 Field data form

Please ensure you fill in the Field Data Form (Annex 5) with as much relevant information as possible for each collection. Without accurate field data the seed collection is of little use for research. As a minimum, please make sure you complete all of the 'essential' sections. If you have any questions, speak to the Project Officer.

6.2 Individual tree locations

Where you have recorded the co-ordinates of individual trees, please email this data to the Project Officer in an Excel spreadsheet labeled with the collection number. Number trees 1,2,3, etc. and include latitude and longitude co-ordinates, ideally in degrees, minutes, seconds format.

It would also be useful if collectors could note any particular characteristics of the individual tree which are of note, such as late flowering, high fecundity etc. This data could be very valuable for future use.

6.3 Herbarium specimens

All UKNTSP collections should be accompanied by a single herbarium specimen per population. The herbarium material must be taken from the same population of plants that seeds were collected from. Please see Annex 8 for guidance on taking herbarium specimens. If you require herbarium presses, please speak to the Project Officer. Label the specimen with a jewellery tag and your collection and tree numbers.

6.4 Donations form/notification of transfer

If your organisation has signed a Memorandum of Collaboration with RBG Kew, every shipment must be accompanied by the Notification of Transfer that forms part of that agreement. This provides a declaration that all material has been collected and transferred to Kew according to the terms of that agreement.

In all other cases – every shipment must be accompanied by a MSB Donations form (Annex 9). This provides a declaration that all material has been collected and transferred to Kew legally, and confirms agreement to the stated treatment and uses of the collections at Kew. The form must include a list of all the collections which are being donated to Kew.

6.5 Plant health documentation

If you are transporting material covered by a Plant Health Order please include a 'Letter of Authority' with your collection. This is available from the Project Officer.

6.6 Landowner consent and permits

Please ensure the landowner has agreed to the collection and provide a signed landowner consent form (Annex 4).

You should also include copies of the permits and consents which you have received to carry out the fieldwork and transfer the collections, e.g. consent from statutory agencies.

6.7 Social media

It would be great if you could post a comment and photo to our Facebook group about your collection.

7. Dispatching the seed collection

Key points:

1. Dispatch your collection as soon as possible.
2. Avoid sending the collection to arrive Friday, Saturday or Sunday.

7.1 Packaging

Send the seeds in their porous collecting bags, securely fastened (please do not staple) and labelled. Small, delicate seed collections should be protected by a layer of cardboard or 'bubble wrap' to avoid the possibility of damage in transit. Include clear warnings of any toxic or irritant plant material contained within the batch. Package the herbarium specimens carefully between stiff cardboard and put hard copies of the documents together in an envelope or file. Make sure the box fits tightly around the collections and specimens inside – use packing material if necessary.

7.2 Transit

As soon as possible, dispatch seed collections and other items using the MSB DHL account. The Project Officer can give you the account number.

For DHL you need to:

1. Package up the seeds, documents, and herbarium specimens, but leave the box open so the courier can check what it is.
2. Complete the DHL waybill as follows.
 - Section 1 tick 'charge to receiver';
 - Section 2 complete shipper's (your) details;
 - Section 4 enter weight and size of package;
 - Section 5 description i.e. seeds, herbarium specimen and documentation;
 - Section 7 signed by shipper (you);
 - Section 8 tick 'domestic'.
3. Call 0844 248 0844 and arrange pick up.
4. The courier will separate the waybill – one copy for the sender, one will be taped to the package and one for courier.

If you prefer, you can arrange Royal Mail delivery.

Please avoid dispatching your collection so that it arrives on a Friday, Saturday or Sunday; it would be better to store the collection in a dry and airy room and dispatch at the start of the week.

Please let us know you have sent your collection.

8. How to contact us

For enquires please contact:

Simon Kallow
UK National Tree Seed Project Officer

Tel. 01444 894164
Email ukntsp@kew.org

Millennium Seed Bank Partnership
Royal Botanic Gardens, Kew
Wakehurst Place
Ardingly
West Sussex
RH17 6TN

Please join our Facebook group (UK National Tree Seed Project) where you can post activities, join in further discussions and ask questions.



Figure 9. The Millennium Seed Bank, Wakehurst Place.

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Annexes

All annexes are available by email or downloadable from our Facebook Group.



ANNEX 1. TARGET SPECIES

Priority number	Scientific name	Common name	Seeding time	Collecting guide
1	<i>Juniperus communis</i>	juniper	Sept–Nov	Pluck/ shake branches. You should be able to hear pips shake.
2	<i>Pinus sylvestris</i>	Scots pine	Oct–Jan	Prune/ shake branches to collect cones when they have turned from green to brown.
3	<i>Fraxinus excelsior</i>	ash	Sept–Nov	Prune/ shake branches when keys turned brown.
4	<i>Alnus glutinosa</i>	common alder	Sept–Feb	Prune/ pluck to collect cones when they have turned from green to brown.
5	<i>Cotoneaster cambricus</i>	wild cotoneaster	Sept	Pluck fruit by hand.
6	<i>Erica vagans</i>	Cornish/ wandering heath	Oct	Pluck fruit by hand.
7	<i>Fagus sylvatica</i>	beech	Sept–Nov	Prune/ shake and collect plump ripe nuts.
8	<i>Pyrus cordata</i>	Plymouth pear	Oct	Prune/shake/ pluck to collect fruit.
9	<i>Betula pendula</i>	silver birch	Aug–Oct	Prune/ pluck then strip strobiles when still intact, place in bag to dry.
10	<i>Betula pubescens</i>	downy birch	Aug–Oct	Prune/ pluck then strip strobiles when still intact, place in bag to dry.
11	<i>Buxus sempervirens</i>	box	Aug–Sept	Pluck fruit from branches.
12	<i>Corylus avellana</i>	hazel	Sept–Oct	Collect nuts when they ripen from green to brown.
13	<i>Crataegus monogyna</i>	common hawthorn	Sept–Nov	Prune/ shake branches and collect red berries.
14	<i>Cytisus scoparius</i>	broom	Sept–Nov	Strip branches before pods dehisce.
15	<i>Frangula alnus</i>	alder buckthorn	Sept–Oct	Pluck/ prune/ shake berries.
16	<i>Ilex aquifolium</i>	holly	Nov–Feb	Pluck/ shake/ prune to collect ripe red berries.
17	<i>Lonicera periclymenum</i>	honeysuckle	Sept	Prune/ pluck ripe fruit.
18	<i>Populus tremula</i>	aspen	Mid Mar–Apr	Prune branches and collect seed.*
19	<i>Potentilla fruticosa</i>	shrubby cinquefoil	Aug–Sept	Pluck fruit by hand.
20	<i>Prunus avium</i>	wild cherry	July	Shake branches, collect fruits when turn from yellow to red.
21	<i>Prunus spinosa</i>	blackthorn	Sept – early Oct	Pluck/ shake branches, collect sloes after leaves have fallen.
22	<i>Rubus idaeus</i>	raspberry	Late July–Aug	Pluck fruit by hand.
23	<i>Sambucus nigra</i>	elder	Aug–Sept	Shake branches and collect berries when turn dark purple-black.
24	<i>Sorbus aucuparia</i>	rowan	Late Aug–Sept	Shake/ prune to collect the berries.
25	<i>Ulex europaeus</i>	common gorse	May–July	Pluck/ shake before pods burst.

26	<i>Ulmus glabra</i>	wych elm	May–July	Prune/ shake branches to collect when wings begin to turn brown.
27	<i>Acer campestre</i>	field maple	Oct–Jan	Prune/ shake when bracts turn brown.
28	<i>Carpinus betulus</i>	hornbeam	Nov	Prune/ shake when bracts turn brown.
29	<i>Cornus sanguinea</i>	European dogwood	Sept–Oct	Pluck/shake branches as soon as fruit is black.
30	<i>Eunymus europaeus</i>	spindle	Sept–Nov	Shake/ hand pick when fruit are orange.
31	<i>Hippophae rhamnoides</i>	sea buckthorn	Sept–Feb	Pluck/ shake when fruit orange-yellow.
32	<i>Hypericum androsaemum</i>	tutsan	Sept	Pluck berries. CAUTION: the berries are poisonous.
33	<i>Ligustrum vulgare</i>	common privet	Sep–Oct	Shake/ prune fruit from branches when ripe.
34	<i>Malus sylvestris.</i>	crab apple	Sept–Nov	Shake the branches and collect the fruit.
35	<i>Populus nigra</i> subsp. <i>betulifolia</i>	black poplar	March–April	Bag female flowers before they are receptive and dust in the bag with known <i>betulifolia</i> pollen in a bag from male trees.*
36	<i>Prunus padus</i>	bird cherry	July–Aug	Shake branches and collect when the cherries have turned black.
37	<i>Ribes alpinum</i>	mountain currant	July–July	Pluck berries by hand.
38	<i>Ribes spicatum</i>	downy currant	June–July	Pluck berries by hand.
39	<i>Ruscus aculeatus</i>	butcher's broom	Dec–Apr	Pluck berries by hand.
40	<i>Suaeda vera</i>	shrubby sea-blite	Oct–Nov	Pluck fruit by hand.
41	<i>Taxus baccata</i>	yew	Sept–Oct	Pluck fruit/ shale branches when outer berries are bright red. CAUTION: the seeds are poisonous.
42	<i>Tilia platyphyllos</i>	large-leaved lime	Oct	Prune/ pluck fruits after the leaf-like bracts have turned brown, usually following a frost.
43	<i>Viburnum opulus</i>	guilder rose	Sept–Oct	Prune/ pluck shake to release the berries.
44	<i>Sorbus torminalis</i>	wild service	Sept–Oct	Shake/ prune to collect clusters of fruit.
45	<i>Tilia cordata</i>	small-leaved lime	Oct	Prune/ pluck fruits after the leaf-like bracts have turned brown, usually following a frost.

Whilst the species listed above are priorities for collection, other woody species may also be collected, please consult the Project Officer regarding this.

Where subspecies are well recognised, we also aim to target the collection of subspecies across their distribution, these have been omitted from this table for simplicity.

*These seeds will require very careful handling: collect when fully ripe, avoid high and low temperatures, avoid quick drying and dispatch as-soon-as-possible to the MSB.

ANNEX 2. CHECKLIST OF SUGGESTED FIELD EQUIPMENT

Documents

Permits and authorisation
Landowner contact details
Seed collecting manual
Pre-collection check lists
Field data forms
Risk assessments (with details of nearest A&E)

Clothes

Include suitable footwear for the terrain, water-proofs and a hat
Gloves without finger ends are useful in cold locations

Navigation

Maps
Compass

Safety

Mobile phone and charger
Two-way radio (if no phone coverage)
Water
First aid kit
Sun protection
Insect repellent
Hot water flask
Tick removal tool
Helmets
Leather gloves

Habitat and species identification

List of targeted species
Field guides
Magnifying lenses (10x, 20x)
Camera and batteries
Binoculars

Seed collecting equipment

Different sizes of paper, cloth and mesh bags
Wash basins/metal sieves/tray (if collecting fleshy fruit)
Scissors and secateurs
Pole or long-handled pruners
Pocket knife
Buckets (at least 4)
Throw line and weights
Tree climbing equipment (x2)*
Tree tags
Hammer
Nails

Herbarium specimen equipment

Portable herbarium press
Newspapers and folders for herbarium specimens
Large plastic bags

Data collection

Jewellery tags
Clipboard
Field notebook
Pencils and permanent markers
Global positioning system (GPS) and batteries

Biosecurity kit

See Annex 6.2

*only those with appropriate qualifications can tree climb

ANNEX 3. HEALTH AND SAFETY GUIDANCE

Introduction

Most people undertaking seed collecting work for the Millennium Seed Bank Partnership will be familiar with the hazards of working outdoors, many of which can be avoided through common sense. It is, however, perhaps worth highlighting the following potential problems which may affect seed collectors.

Always make sure that you wear appropriate clothing (including suitable footwear for the terrain, water-proofs and a hat). Maps, a GPS receiver (incl. spare batteries), compass and altimeter can help you navigate safely in your collecting area.

Take a mobile phone (in areas without signal a two-way radio), appropriate First Aid kit, sun protection, insect repellent, water bottles (for cold locations, a hot water flask) and where applicable, a spare set of vehicle keys with you.

During the planning of your collecting trip, check if you have/need relevant insurance cover and what the local conditions are likely to be (weather forecast – e.g. floods, thunderstorms). Is the terrain likely to cause any potential problems (e.g., walking on steep slopes or along cliff edges)?

If you are going as a group, it is advisable to check whether any of the group members has got any underlying health issues (e.g. history of angina, severe allergies, diabetes etc) and whether any of the group members is a trained first aider.

All tree climbers need relevant qualifications and skills

Phytophotodermatitis or toxic plants

Many species of plant, particularly umbellifers, contain sap which can be irritating to the skin, or may even be toxic. If you are particularly prone to skin problems, or if you are unsure about the effects of a particular species, it is advisable to wear gloves when collecting.

Lyme Disease

<http://www.nhs.uk/conditions/lyme-disease/pages/introduction.aspx>

This infection can be transmitted to humans by the bite of a female tick. Although the majority of tick bites will be completely harmless, it is worth taking precautions in areas where the disease is known to occur. To prevent bites wear long trousers tucked into socks or wellingtons, and shirts or jackets with long sleeves and cuffs.

Check for ticks on returning home and follow on-line advice for removal if any are found. Note symptoms and seek medical advice if any occurs.

Leptospirosis (Weil's Disease)

<http://www.nhs.uk/conditions/Leptospirosis/Pages/Introduction.aspx>

This disease is spread in the urine of rats and cattle and therefore is most common in areas where these animals are found. The infection enters the body through cuts and abrasions or through the mucus membranes of the nose and mouth. It is common in rivers, ditches, canals and on farms. The risk of infection can be greatly reduced by covering all skin abrasions, taking particular care to wash the hands with soap and water, and avoiding touching the eyes, nose or mouth.

Lone Working

Lone working in the field is highly inadvisable. If this cannot be avoided, take a mobile phone with you and be sure to let someone know exactly where you are going and when you expect to be back.

Please see these websites for further information:

<http://www.hse.gov.uk/>

<http://www.hse.gov.uk/treework/index.htm>

<http://vscg.co.uk/>

ANNEX 4. PROVISIONAL LANDOWNERS CONSENT FORM



1. ABOUT THE UK NATIONAL TREE SEED PROJECT (UKNTSP)

Could you imagine how our countryside would look with no ash, beech or oak trees?

To ensure this never happens, Royal Botanic Gardens, Kew is setting up the UK National Tree Seed Project.

We aim to collect and store seed from all UK trees and shrubs across their UK distribution, so the full genetic diversity of each species will be conserved. Seed will be collected both by RBG Kew's own staff and by partner organisations. The seed will be processed and stored at Kew's Millennium Seed Bank, which already stores seed from over 30,000 plant species from across the globe.

This priceless collection will serve as a back-up in case these species are lost in the landscape, but more urgently it will also provide seed material for current research needs, including testing for natural resistance and the development of disease and pest controls. These seeds can also be used for restoring trees to our landscapes and increasing UK tree cover – currently amongst the lowest in Europe.

In order to complete such an ambitious project, Kew welcomes and acknowledges the support of landowners in providing access to collection sites and plant material. Kew is a botanical garden incorporated in the United Kingdom by the National Heritage Act 1983 and an exempt charity whose mission is to inspire and deliver science-based plant conservation worldwide, enhancing the quality of life. Kew is supported by the United Kingdom Department of Environment, Food and Rural Affairs (Defra), which is ultimately responsible to Parliament for Kew's key aims and activities.

2. USE OF MATERIAL

This document explains the uses that may be made of plant material collected for the UK National Tree Seed Project. If the landowner does not place any express restrictions on these uses, then access to the plant material shall have been granted on the basis that Kew may use the collected plant material as set out below.

Plant material shall be accessioned into the Kew collections at Wakehurst Place, Ardingly, West Sussex, or at Kew, Richmond Surrey, as appropriate.

Kew shall use the plant material in furtherance of its charitable purposes. Plant material may be:

- (a) Made available for scientific study to Kew staff and authorised visitors; and/or
- (b) Used for the common good in the areas of education, conservation and public display; and/or
- (c) Sampled for pollen, spores, DNA, anatomical or cytological preparations and/or chemicals for scientific research purposes; and/or
- (d) Sent on loan, supplied, or further distributed for the purposes of scientific research, conservation or horticulture; and/or
- (e) Digitally imaged and published in botanical databases freely available on the internet.

Further information is available from:

UK National Tree Seed Co-ordinator: Clare Trivedi c.trivedi@kew.org.

UK National Tree Seed Officer: Simon Kallow s.kallow@kew.org

On the web via www.kew.org/ukntsp

CONSENT FORM

I consent to the collection of plant material from my/ my organisation's land and to be transferred to RBG Kew for long term conservation in the MSB and supply / use as outlined above.

I consent that the trees which the seeds are collected from may be tagged to identify them in the future.

Name:	Address:
Date:	Phone:
Organisation:	Email:
	Signed:

ANNEX 5. FIELD DATA FORM

PLEASE USE BLOCK CAPITALS IF HANDWRITTEN

Project

UKNTSP

(BOLD TYPE= ESSENTIAL FIELDS)

Date Collected ____ / ____ / ____

Your collection no. _____

Collector(s) names and organisation _____

SITE DATA

Location details and name _____

County _____

Latitude _____ Longitude _____ or Grid ref: _____

Please circle: GPS / Google Earth / map used? _____ GPS Datum: WGS84/OSGB36 _____

Altitude (m) _____

Landowner contact details: _____

Has the landowner given consent for collection to take place? YES NO

HABITAT DATA

Habitat description & associated species _____

Ancient semi-natural woodland / Wood pasture / Amenity / Agriculture/ Scrub / Heath / Forestry / Riparian

Slope° _____ NVC community _____

Aspect _____ Modifying factors _____

Land form _____ Land use _____

Geology _____ Drainage _____

Soil texture _____ Crown cover % _____

Soil colour _____ Soil pH _____

IDENTIFICATION DATA

Family _____ Identified by _____

Genus _____ Institute _____

Species _____

Infra-specific _____ Date identified ____ / ____ / ____

Schedule 8 species? YES NO If yes, in whose name is the licence held _____

General description

Plant Habit: tree/shrub _____ Plant height (m): _____

Other descriptors: _____

SAMPLING DATA

Herbarium specimen taken YES No. of plants sampled _____ No. of plants found in population _____

Permission to use image: YES Area sampled (sq.m) _____ % population producing seed _____

Seed from individual trees kept separate YES Trees tagged YES

Seed harvesting: early, mid, late season / Seeds collected from plants, ground, both / State of seed moist, dry, both

Please list other documentation included with seed collection(s). _____

ANNEX 6. BIOSECURITY GUIDANCE

6.1 GENERAL GUIDANCE

What is Biosecurity?

Good biosecurity is a way of working that identifies and minimises the risk of spread of non-native species – including parasites and pests and diseases of plants and animals – through careful planning and good hygiene protocols.

What is the purpose of this guidance?

This document is intended as a general guide to good working practice in order to minimise the risk of introducing or moving non-native species (NNS). NNS can include invasive animal and plant species, pests, diseases and parasites. This guidance aims to provide concise practical guidance for staff visiting other sites and undertaking fieldwork, surveys and seed collection in the field.

Staff requiring more detailed advice and help in assessing and managing biosecurity risks should contact Kew's Plant Health and Quarantine Unit.

Who is this guidance for?

All staff, students, volunteers and associates working at Kew or Wakehurst, visiting and/or undertaking fieldwork at other sites (including gardens, nurseries, national parks, woodland and forests) and involved in collecting and moving plant material.

General principles:-

1. Make sure your equipment, footwear, protective clothing and vehicle are clean before heading to your location. Ideally, take a second set of clean footwear with you. Don't be a vector for an invasive plant, pest or disease. Make sure you have appropriate materials available for cleaning tools – there is a list of Defra-approved disinfectants available from Kew's Plant Quarantine Unit – and wear the personal protective equipment (PPE) recommended.
2. Be mindful of the risk to your health from parasites (e.g. ticks) and zoonoses (lyme's disease, leptospirosis, etc.) that can be carried by rats and other animals. There is helpful advice on the HSE website about how to identify and manage such risks.
3. Keep access to a minimum. If practical, do NOT take vehicles onto premises, keep to established tracks and park vehicles on tracks or hard standing.
4. Wherever possible, avoid areas with known plant disease.
5. Work from areas of **low risk to high risk**. Plan your visits in advance so that the highest risk visit is the last of the day if you can. If you are based on a single site all day, visit lowest risks areas of the site first and finish at the highest risk ones (e.g. if you are collecting seeds from ash trees then collect from known infected ash trees last – disinfecting your hands and equipment between individual trees).

1. If you are visiting conservation areas or agricultural or horticultural holdings, visit areas with the highest value/grade of plants **first** and work towards the lowest (high value to low value) e.g. ancient woodland then managed areas, nursery then garden, etc.
2. Please ensure your footwear and equipment are clean (i.e. free from visible signs of soil and debris) **before** leaving the site. Soil, leaf litter, seeds and other plant material can be vectors for pests and diseases. Knives, secateurs and saws can be a very effective way of transferring disease from plant to plant so make sure you follow the advice in the Kew Biosecurity Pack on how to sterilise your tools.
3. Ensure your vehicle is kept clean – in particular, remove any accumulated mud from tyres, wheel-arches, mats, etc. **before** leaving the site.
4. Make use of any facilities provided on the site to clean footwear/equipment/vehicle.

ANNEX 6.2 RBG KEW BIOSECURITY EQUIPMENT

The specific clothing, including PPE, that you will need to carry, will vary according to the work you will be doing, where you will be doing it, the weather and other factors.

Any PPE should be capable of being disinfected unless it is disposable. If you need to clean and disinfect footwear and equipment you should use appropriate materials. The Kew Biosecurity Kit contains basic cleansing and disinfection equipment.

You may need additional materials for cleaning specialist equipment or clothing – make sure they are compatible and be sure to check the instructions before using any disinfectants or sterilants.

The basic Kew Biosecurity Kit comprises the following:-

- Plastic storage box
- Supply of water in a 5l container
- A Defra-approved disinfectant (e.g. Clean-Kill)
- Defra-approved sterilant spray for tools (Propellar)
- Lint-free cloths
- Bucket or boot tray
- Eye protection
- Protective gloves
- Hard brush
- Means of applying disinfectant e.g. washing up brush and/or spray bottle
- Hand sanitiser and paper towels
- Selection of re-sealable bags
- Clear bags for contaminated waste, for disposal by incineration

ANNEX 7. PRE-COLLECTION CHECKLIST

IDENTIFICATION

Locality (GPS or map co-ordinates) _____

Family _____

Genus _____

Species _____

Date of assessment ____ / ____ / ____

ASSESSMENT

Taxon identified and apparently similar taxa distinguished YES NO

Approximate area of population (m², km²) _____

Approx. number of accessible individual plants 1-10 11-50 51-100 101-1000 >1000

READINESS OF POPULATION FOR SEED COLLECTION

Most frequently occurring phenological stage (please tick or give percentage)

Flowering _____%

Immature seeds _____%

Around natural dispersal _____%

Post dispersal _____%

Estimated number of individual plants at natural dispersal _____

PHYSICAL QUALITY

Cut-test 10-20 seeds of the sample examined, indicate the most frequently occurring (please tick or give percentage)

Full seeds _____%

Empty seeds _____%

Infested seeds _____%

Immature seeds _____%

Average number of seeds per fruit/dispersal unit _____

Average number of fruits/dispersal units per individual plant _____

Is it possible to collect 10,000 healthy seeds around natural dispersal without taking more than 20% of the available seeds? YES NO

MONITORING

For populations NOT yet at natural dispersal, estimate suitable date to return and collect seeds

____ / ____ / ____

ANNEX 8. HOW TO PREPARE A HERBARIUM SPECIMEN

Herbarium specimens are dried and pressed plants fixed on a sheet of cartridge or other archival quality paper with a label attached in the bottom right hand corner to indicate provenance, collector, number and identity. They are an important record of plant diversity for study by plant taxonomists, ecologists, etc. In seed conservation, they are an essential means of keeping a permanent reference to confirm the identity of plants from which a seed collection has been made.

Collecting specimens

Decide which parts should be collected, and how the morphology, size range, and other features of the whole plant can best be represented and recorded in the herbarium specimen. Bear in mind that the specimen will ultimately be fixed flat to cartridge paper 42 x 26 cm. (about the size of a typical field press). With British trees, this might include a portion of branch, showing the pattern of branching and arrangement of leaves on the stem, including the stem apex, where possible. Be aware that the leaves of some trees (e.g. *Populus*) can be variable according to whether they are found on vigorously growing shoots, suckers, or dwarf lateral shoots. Also important is to include flowering or fruiting structures. Stems should be cut at an oblique angle so that the stem cross-section is visible when the specimen is mounted.

Gather material representative of the population. If any species is known to be rare, conservation must be kept in mind, taking care not to cause harm to an individual or population. The press may be taken into the field and filled as fieldwork progresses, or material placed in a plastic bag and processed promptly when back at base. The latter approach is not recommended for delicate material.

Data

It is important when recording data about the collections that a good description of the plant is made, taking care to note any features that are not apparent from the pressed specimen, e.g. the height and shape of the tree, diameter of the trunk at breast height (d.b.h.), description of the bark, colours and shapes of plant parts that are likely to change upon drying.

Numbering the collections

It is recommended that the herbarium voucher be numbered with the same number as its associated seed collection number and tree number. Write the number on a tag attached to the specimen itself, as well as at the bottom right hand corner of the enclosing sheet of newspaper.

Pressing the specimen

The specimens should be laid out between sheets of newspaper, with leaves and stems folded or trimmed to fit the sheet. The leaves should be spread so as to avoid as much overlap as possible; at least one should be turned to expose the undersurface. If leaves are crowded, some can be removed but at least the petioles should be left attached to show the position of the leaves. Place the specimen in the press, sandwiched between additional sheets of newspaper, blotting paper or cardboard to absorb moisture, and fasten the straps as tightly as possible.

Bulky organs (e.g. fruits) that are too thick to be mounted to a sheet, can be left out of the press and dried loose in a labelled paper or cotton bag. Large fruits can be cut into sections to reveal internal structure.

Drying

Place the press somewhere dry and warm, such as in an airing cupboard or above a radiator. Check the specimens periodically, replacing any damp blotters to speed up the drying process.

When the specimens are dry, they can be removed from the press and secured between pieces of cardboard and tied with string, ready for packaging and shipping.

For more detailed information on collecting herbarium specimens, including plants requiring different techniques (herbs, bulbs, succulents, etc.), see *The Herbarium Handbook* (Bridson & Forman, 1992).

ANNEX 9. ROYAL BOTANIC GARDENS, KEW DONATION FORM

Donation of Material to the Royal Botanic Gardens, Kew

The Royal Botanic Gardens, Kew is very grateful to all institutions and individuals who donate material and associated data in support of Kew's mission *to inspire and deliver science-based plant conservation worldwide, enhancing the quality of life*. As part of Kew's commitment to upholding the 1992 Convention on Biological Diversity and in accordance with Kew's policy on access and benefit-sharing, before accepting any such material, Kew must be satisfied that material and data has been legally acquired and exported from the country of origin and that Kew is aware of any original terms of acquisition and benefit-sharing. This will enable Kew to ensure that it only accepts material and data into its collections that it can properly and legally curate. We therefore ask all donors to complete and sign this document. By signing this document the donor confirms that:

- The material and any associated data was, to the best of their knowledge, collected in accordance with all national and international laws and regulations in force at the time of collection: for example, collecting and export permits were obtained and, where required, access and benefit-sharing agreements entered into;
- The donor confirms that material is transferred legally to Kew;
- The donor is aware of, and agrees with, the uses that Kew may make of the material and associated data, once it is accessioned into the Kew collections;

1. Material donated

Please list on reverse, or on a separate sheet if more appropriate, the reference numbers and details of herbarium specimens and/or plant or fungal material being donated to Kew.

2. Material legally acquired and transferred

Please indicate here if collecting/export permits or access agreements are attached to this document. If documentation is not attached, please explain its absence on reverse, or on a separate sheet if more appropriate.

Documentation attached	
Documentation not attached	

3. Terms of original acquisition

Please list on reverse, or on a separate sheet if more appropriate, the terms and conditions under which the material or data was originally acquired and any additional restrictions on the future use of the donated material and data.

4. Use of material by Kew

Kew may use the donated material as follows. It may be:

- (a) Seed studies, such as tests required to understand seed storage requirements including germination tests and dormancy studies, moisture relation tests, seed morphology studies and diagnostic characterisation;
- (b) Herbarium studies to understand their identification and classification, such as the comparative observation, characterisation, analysis, databasing and imaging, sampling for pollen, DNA and anatomical preparations;
- (c) Horticultural studies and public display, such as propagation and cultivation of plant material to better understand how to grow and reproduce the plant, including micro-propagation techniques, and display of labelled specimens in curated botanic garden collections which may be viewed by the public;
- (d) Genetic studies, such as DNA extraction and banking, PCR amplification, DNA sequencing and fingerprinting and DNA barcoding from tissue samples, for use to infer phylogenetic relationships or to study and help conserve the diversity of genes and genomes at the population level.

5. Use of associated data by Kew

Kew may use any associated data (including any intellectual property rights relating thereto (for example database rights) for Kew's charitable purposes. Kew's right to use the data shall include (but not be limited to): the right to develop derivative works using the data and the right to distribute the data to third parties.

Kew will not commercialise material collected after the CBD came into force (29 December 1993) without the prior informed consent of the country of origin and appropriate stakeholders. Kew also undertakes to share fairly and equitably any benefits arising from such commercialisation.

PTO

I hereby donate the material and associated data to Kew to use for the stated purposes and declare, that to the best of my knowledge and belief, the information that I have given in this document is accurate.

Signed:

Name:

Position:

Institution:

Date:

Scientific name(s)	Wild collected/ natural source? (Y/N)	Material type (herbarium sheet, carpological, DNA, plant, cuttings, seeds, in vitro culture, etc)

Additional terms and conditions of use of material by Kew	
Field or database records attached (yes/no?)	
Permits/ documentation attached, where applicable? Please give details (eg collecting permit, export permit, CITES label, etc).	

FOR KEW INTERNAL USE ONLY

Material received at Kew/ Wakehurst by (please write name, dept and contact no. in capitals)	Staff name: Dept: Email/telephone ext:
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ANNEX 10. SEED COLLECTING CHECKLIST

Planning your collection

- Select a species and site
- Make a collecting pledge
- Plan your collection timing
- Get signed landowner consent
- Get statutory consent (if necessary)
- Prepare equipment
- Prepare a biosecurity kit
- If the species has a Plant Health Order get a Letter of Authority from us.

Assessing the population in the field

- Identify the species
- Assess seed maturity
- Assess seed availability
- Decide a sampling strategy

Collecting material and data in the field

- Create a collection number
- Collect seeds
- Label the seed bags with collection and tree numbers
- Tag trees
- Record individual tree locations
- Complete the field datasheet
- Take a herbarium specimen
- Label the herbarium specimen with collection and tree numbers
- Take a photo

Care of collections

- Surface dry the collection and transfer to labelled paper bags.

Organising the documents

- Label all documents with the collection number
- Download GPS data (in Excel as DMS), label with collection number and email to us
- Complete a Notice of Transfer (if you have Memorandum of Collaboration with Kew) or complete a Donation Form
- Complete a Letter of Authority if the species you are collecting has a Plant Health Order
- Check and complete the Field Data Form

Transportation

- Arrange DHL pick-up
- Tell us it has been couriered
- Make a comment to our Facebook group (optional)



Royal Botanic Gardens Kew,
Millennium Seed Bank,
Wakehurst Place, Ardingly,
West Sussex RH17 6TN
01444 894164

Help to support Britain's trees

The UK National Tree Seed Project has been made possible by funding, generated by players of People's Postcode Lottery, a British charity lottery. See www.postcode lottery.co.uk for further information.



You too can support this ambitious project and help to secure the future of Britain's trees by donating to the Kew Fund, or you can adopt a seed to save a species from as little as £25. Find out more at www.kew.org/support

