TECHNICAL NOTE

USDA NATURAL RESOURCES CONSERVATION SERVICE PACIFIC ISLANDS AREA

Vegetative Technical Note – No. 8

PLANT MATERIALS COLLECTION GUIDE

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INTRODUCTION

This Technical Note provides information on the recommended procedures for collecting various types of plant materials for Plant Materials Center (PMC) testing. The collection of seed or vegetative plant material of potential conservation plant species is the basis for plant selection and improvement. A 'wish list' of potential species is prioritized to identify the most appropriate plants species for a given project goal. Once background information is gathered and geographic distribution determined, collection locations are then identified. When appropriate sites supporting viable populations of a target species are located, the plants should be monitored regularly in order to successfully collect seeds or other reproductive plant parts at the optimum stage of maturity.

Locating Collection Sites

1) Always obtain permission from the landowner on private lands and obtain collection permits on public lands prior to making collections.
2) If possible, use Global Positioning System (GPS) coordinates to locate collection sites.
3) If a goal of the revegetation effort is to restore the site, plant materials should be collected as close to the target planting area as possible.
4) It may also be advisable to identify several sites with various elevations, rainfall, aspects, or soils from which to collect.
5) Avoid areas with heavy weed infestations to prevent unintentional gathering of weed seeds that could contaminate the collection.
6) Do not collect from sites that have been previously planted, research areas, or from areas with threatened or endangered plants.

Identifying the "Right" Plant

Verify that the plant material being collected is the species desired. Confirmation may require the assistance of a botanist, plant materials specialist, or other plant expert. Positive identification may require that plants be examined during flowering and may also require examination of the entire plant, including flowers, seed, stems, leaves and roots.

Collecting material from many parent plants will help to capture inherited and environmental variation and ensure genetic diversity. Avoid mixing multiple species from a single collection site and collections from different sites should be kept separated. For each collection site, randomly collect material from at least 30 to 100 individual plants. If this is not possible, make the collection from a larger population at a different site. Sometimes naturally occurring populations are uncommon and small in size. In this case, collections should be made from 25-50% of the population or as many different plants in the population as possible. When collecting seed, it is important not to harvest all the seeds from one individual plant. Furthermore, try to collect an even amount of seed from as many individuals as possible. This sampling approach will provide a higher level of sampling confidence within and among populations.

Avoid collecting from just the big plants. The plant that looks small in one year may be the plant with important genes for disease resistance, while the big plant may be trading disease resistance or some other trait for size. Avoid collecting vegetative material during low water years and long periods of drought. Plants during these periods may be under stress and stem cuttings may not have peak energy reserves which, in turn, translate into lower establishment success. Also, do not collect seed or other vegetative material from diseased or insect-infested plants.

Plant Collection Information, Form NRCS-ECS-580, must be completed and accompany each collection. This form provides critical information for each collection including plant and collection site information. Each collection that is sent to a Plant Materials Center must have this data in order to track the collection through the evaluation, seed increase, and potential release process. The Plant Materials Center will assign a unique accession number to establish the identity of each viable collection. This process also allows for returning to the original site to collect additional plant material if needed.

Keni Reyes collecting seed from healthy plant population of *Wikstomia uva-ursi* (akia).

How Much To Collect

The amount of raw material that is needed for a collection depends on its anticipated use and method of collecting, but in general the more material you can get the better. Keep in mind; the PMC may need enough material for multiple rows, replicated studies, purity tests, germination tests and other procedures. When collecting seeds, to ensure the survival of small and vulnerable plant populations, the best practice is to make less intense, frequent harvests as opposed to more intense, infrequent harvests.

TYPES OF PLANT MATERIAL COLLECTIONS

Seed Collections

TIMING

The timing of seed collection is crucial to ensure that the seeds collected are viable and have good germination vigor. Collection of immature seed results in low seed viability. Delayed harvesting may result in seed loss from shatter or dispersal after ripening. Plant phenology (the sequence of plant development) must be judged to determine the stage of maturity for the proper timing of seed collection.

Flowering plants are can be categorized as having determinate or indeterminate flowering. Plants with determinate inflorescence are those in which the terminal or central flower is the oldest and blooming and seed maturation is downward, outward, and fairly uniform. Indeterminate flowering is when the basal or outer flower is the oldest with blooming and seed maturation occurring in an upward or inward pattern. Indeterminate plants generally have many different stages of flowering on the same stalk with the most mature near the base or outer regions of the stalk which can make seed collection of viable seeds more difficult. Flowering, which is the first stage of seed phenology, is obvious for many herbaceous and woody plant species that have colorful petals, bracts or sepals. Flowering in grasses is more difficult to observe and careful attention is required to identify the flowering stage (anthesis) of grasses when pollen is being shed. In cross-pollinated grasses, the male and female flowering structures are visible and need only close inspection to determine when pollen is being shed. In self-pollinated grasses, both sexual structures are contained within the palea and lemma, and the floret must be dissected to assess the stage of anthesis. Generally, grass seed is mature and ready to harvest 4 to 6 weeks after flowering is completed. Seed fill can be checked by cross-sectioning several seeds with a knife or fingernail clipper to observe the presence of endosperm.

Grass seed progresses through a sequence of developmental stages following flowering:

1) *Milk stage* - Seeds squeezed between the thumb and forefinger exude a milky substance. These seeds have no viability.
2) *Soft-dough stage* - Seeds squeezed between the thumb and forefinger exude a soft, dough-like endosperm. These seeds have low to no viability.
3) *Hard-dough stage* - Seeds squeezed between the thumb and forefinger do not exude endosperm. The endosperm is firm and retains its shape when squeezed or rubbed. Seed collection should begin at the transition from the soft-dough to hard-dough stages. At this stage, the amount of plump, fully matured seed can be increased by not stripping the seed from the plant. Cutting seed heads (inflorescences) with the stem attached allows maturation to continue as the collected plant material dries.
4) *Mature* - Seeds are usually very hard. Unfortunately, maturity and seed shatter often occur simultaneously. By starting seed collection efforts at lower elevations and following maturation up slope, the optimum seed collection period can be extended. If seeds of the target species have shattered on south- or west-facing slopes, seed of the same species may still be available for collection on north- or east-facing slopes.

For plants with fleshy fruits, changes in color, taste, odor, or texture often signal seed ripening. Changes in color from green to red, blue, purple, or white often indicate seed maturity. Other fruits, whose seeds are wind-dispersed, usually change from green to brown or straw color. Some woody species require two years to reach maturation before they begin to produce seed.

TECHNIQUES

Grass seeds can be harvested by stripping seed off the stem or by clipping the seed culm (stem) just below the spikelet. The seeds of many broadleaf herbaceous plants can be collected by holding a bag or tray under the plant and shaking seeds from the plant. For species that dehisce (e.g. splitting of a seed pod) explosively, the entire inflorescence must be cut before maturity and allowed to dry in mesh bags. Pods from species having spike-type inflorescences (e.g. *Achranthes splendens*) may be stripped in the same manner as grasses. The pappus bearing (parachute-type) seeds of many species in the composite (sunflower) family can be swept or brushed into bags if timing of collection is ideal. For very small annual plants, the simplest method may be pulling the entire plant and bagging in cloth or paper bags. Seeds of many woody, non-fleshy-fruited plants are collected by holding a tray or bag under the branches and flailing the branches with a stick, knocking the seed into the receptacle.

PROCESSING AND STORAGE

It is important to use paper or cloth bags to store non-fleshy seed collections. The moisture content of freshly collected seed is quite high and plastic or other nonporous containers trap moisture and cause spoilage of the seed. Seed should be spread out to dry in a ventilated, well-lit room, but avoid prolonged temperatures greater than 90º F because desiccation and high temperatures will kill the seed. The layer should be only a few inches thick to provide adequate airflow through the drying plant material, reduce heat buildup and to minimize the incidence of mold. To speed the drying process, turn the material occasionally (once or twice daily). If materials are dried outdoors, it may need to be brought indoors or covered at night to prevent re-hydration of the material from higher nighttime humidity and dew. The material may also need to be protected from rodents and wind. If the seed collection is small and fits in a paper grocery sack, the material can be arranged into a donut shape around the sides of the bag with a hole created in the middle to allow air circulation. Ship dried seed to the PMC as soon as possible. If dried seed must be stored for an extended time it should be stored in cool, dry conditions.

Fleshy fruits spoil quickly if not stored properly after collection. Place containers of fleshy seed in a cool, shady place while collecting. Overheating can kill seed. Place non-dried fleshy fruits into a non-porous plastic bag and chill prior to shipment. When ready to ship, place the plastic bag into a heavy cardboard box. Material should be shipped to the Plant Materials Center within 24 hours. Avoid shipment late in the week that might result in weekend storage at a post office.

Vegetative Collections

There may be situations when the collector may chose not to collect the seed of a plant. These include:

1) The plant does not produce seeds or produces seeds infrequently.
2) The seeds are not viable.
3) The seeds have already been dispersed from the plant prior to collection.
4) Insects or animals have consumed or damaged the seeds.
5) Propagules from seed are slow to mature.

In any of these situations a vegetative collection would be the alternative to collecting seed. Vegetative collections include whole plants, divisions, and cuttings. Propagation from a vegetative collection is the reproduction of complete plants from the vegetative parts of the original parent plant. Primarily, vegetative propagation is used to clonally reproduce some specific attribute that is unique to an individual plant, which could be lost through sexual reproduction. This form of propagation is also useful to avoid long, seed-dormancy-breaking periods or to control growth form.

A limitation of this form of propagation is the potential to restrict the genetic expression of a plant population. Adequate population sampling is particularly important when the goal of the project includes maintaining the genetic diversity of a given plant community.

It should also be noted that, prior to shipping collections to the PMC, vegetative materials should be thoroughly washed and completely free of soil, insects, and disease.

WHOLE PLANTS

Techniques for collecting whole plants differ depending on the plant type. Wet-land plants, because of their tremendous root systems, are easily harvested and can be transplanted directly to a new site or used for divisions in containerized plantings. On the other hand, transplanting wild-land plants is often unsuccessful because they are often found growing under stressed conditions and cannot recover from transplanting shock as well as cultivated plants. Wild-land plants often contain a smaller, coarser root system and successful transplanting requires experience, skill, proper handling, ideal temporary storage, and proper care. Successful transplanting typically increases as plant size decreases, while transplanting of large shrubs and trees is usually unsuccessful.

DIVISIONS

Grasses and forbs may be propagated by splitting the foliage and corresponding root system into multiple pieces and then transplanting. This process works with rhizomes, stem tubers, and tuberous roots. The entire plant may be removed and then divided, or part of the mother plant removed and the rest left in place to continue growing. Transplanting, transport, temporary storage, and growing conditions are the same as those described below for cuttings.

CUTTINGS

Cuttings can be made from true stems, modified stems (rhizomes, tubers, corms, and bulbs), leaves, leaf-buds, or roots. Parent plants should be healthy, free from serious insects or diseases, of moderate vigor, and of a known identity. When harvesting from native stands, ensure the stand will not be denuded or destroyed by your cutting activity. Try to spread your harvesting activity throughout the stand.

All cutting tools should be sharp and able to make clean cuts. Collect live wood at least 9 months or older; however, very old wood should not be used. For nursery stock, approximately 8 inch long cuttings are taken from the terminal end of branches and should contain at least two internodes. Longer sections of stems may be taken and later trimmed into multiple cuttings. Cutting size should generally be ¾ inch (at least ¼ inch) diameter or larger depending upon the species. Larger diameter cuttings have more energy and stored reserves than smaller diameter cuttings. The basal cut is made about ½ inch below a node. The apical bud at the tip of the branch plus the next several inches of the cutting should be removed. This prevents loss of energy from stored reserves, which can reduce the chance of survival, and reroutes energy to the side buds including the root buds. Trim off all side branches so the cutting is a single stem. Following pruning, it is a good idea to make a straight cut to help indicate the top of the cutting and an angled cut to help indicated the bottom.

Cuttings should be stored in plastic bags, moistened with water, and then placed in a refrigerator or cooler with ice prior to planting. Use a towel or other insulating material between the ice and cuttings to prevent freezing. If ice is unavailable, the storage area should be dark, moist, and cool at all times. Storage duration should be minimized to assure viability. Do not allow the cuttings to heat up or become desiccated during transport to the PMC. Cuttings should be delivered as quickly as possible to guarantee success.

Glenn Sakamoto (right) demonstrating how to take cuttings from pohinahina (*Vitex rotundifolia)*.

References

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USDA Natural Resources Conservation Service. 2000. National Plant Materials Manual.

Society for Ecological Restoration International. 2004. Ex Situ Plant Conservation, Supporting Species Survival in the Wild. Washington, DC: Island Press

QUICK GUIDE FOR PLANT COLLECTIONS

- Given the perishable nature of vegetative collections, be sure to coordinate timing of collection with the Plant Materials Center to assure the viability of collections is not jeopardized.
- Confirm the identity of potential collections with Plant Materials Specialist or other plant expert.
- Scout plant populations in advance of collecting material. Only collect from healthy, turgid, moderately vigorous, and adequately sized specimens. Avoid unhealthy, low vigor, or stressed plants.
- Sample from enough individual plants to assure adequate population sampling. Depending on population size, plant material should be collected from 25-50% of the population or from 30-100 individuals if possible.
- Collect vegetative material in the cool early morning hours. Keep vegetative materials cool and moist. Minimize handling and storage.
- In most cases, when selecting stems for cuttings, be sure that the basal ends of stem cuttings are at least ¼" in diameter.
- Keep collections from different parent plant populations in separate bags. Verify the species and attach a permanent label on the outside of the bag and also place a label inside the bag to verify the outside label. Record the location of each plant population by writing it down or using a GPS device.