Writing Woody Plant Specifications for

RESTORATION AND MITIGATION PROJECTS

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Abstract

Describing what types of native plants to include in restoration and mitigation projects requires knowledge about plant species, genetics, form and size, health, and possible substitutions available from local nurseries. A thorough understanding of project goals and plant characteristics will ensure success.

KEYWORDS: nursery stock, plant form, genetics, native plants

NOMENCLATURE: Hitchcock and Cronquist (1973)

Currently, specifying plants for restoration projects tends to be based on ornamental standards; until recently, that's all we had. However, goals of restoration and ornamental projects are different and plant specifications should reflect this. Ornamental project goals are human oriented, such as providing beauty, shade, screening, and so on. Restoration project goals are ecologically oriented, such as restoring wildlife habitat, increasing species diversity, filtering sediments from water, and stopping soil erosion. Ornamental plant specifications tend to focus on plant appearance. Restoration plant specifications should emphasize health, function, and adaptability.

Note that I differentiate between specifications for restoration projects and for ornamental projects, not between those for native plants and ornamental plants. The difference is not in the plant species but in the project goals. "Ornamental" generally refers to non-native plants but native plants are used ornamentally, too. When native plants are used ornamentally, ornamental specifications are appropriate, although not necessarily easy to apply.

The American Association of Nurserymen, Inc sponsored development of standardized specifications for sizing and describing plants to facilitate nursery plant commerce. Standard specifications categorize plants into groups such as shade and flowering trees, coniferous evergreens, deciduous shrubs, and broadleaf evergreen shrubs. Each category is sub-divided; for example, broadleaf evergreen shrubs are divided into 5 types: spreading, semi-spreading, globe or dwarf, broad upright, and cone. Root depth and width, top height and spread, and stem diameter (caliper) are described for each type with species examples given. Restoration practitioners cannot use these specifications because most native plants have not been categorized in this way, nor should they be, since aesthetic value is not usually a goal of restoration projects.

Restoration practitioners could make good use of standard plant specifications if they were written for restoration situations. Lists of local species divided into categories like type of root growth, growth rate, wildlife use, or ability to withstand transplant shock, along with standard language for specifying genetic provenance, and measures of health and vigor would be useful. However, until such a reference is developed, restoration practitioners will have to modify ornamental plant specifications to fit their projects needs. Here are some details of what I include when writing woody plant specifications for streamside restoration and wetland mitigation projects in western Washington. Other projects and projects in other bioregions may need other details. Pros and cons to each item must be considered in context with your goals, site, project, and plant availability.

Remember that specifications should state exactly what you want in a plant but not tell the grower

how to grow it. Specifications should include species, genetic provenance, plant form, size, health, quantity, and substitutions.

Species

Use the full scientific name, with variety or subspecies if applicable in your area. Decide whether ornamental or agricultural cultivars of natives are acceptable or not and say so. Ornamental cultivars will have a capitalized name in single quotation marks after the species name; for example, *Ribes sanguineum* 'King Edward VII' is a cultivar of the Pacific Northwest native red-flowering currant (*Ribes sanguineum* Pursh [Grossulariaceae]) bred in England to have larger, longer-lasting flowers. Is an ornamental cultivar still a native? That depends on your project goals and it's for you to decide.

Keep a file current with catalogs of area nurseries that sell plants appropriate for restoration projects. Then when it's time to write plant specifications, you already know what is generally available. Don't specify plants that cannot be obtained. If you cannot find plants that you want for your projects, talk to the nurseries directly about species, forms, or sizes you would like them to grow. One practitioner in my area called several nurseries, including mine, and informed us that in 1 y she would start specifying a new sedge (*Carex comosa* Boott [Cyperaceae]) and invited us to accompany her seed collecting.

Genetic Provenance

If you care about the genetic provenance of plants (where the propagation material was originally collected), specify it. Don't assume that a local nursery has local genetic material. Some nurseries do all or much of their own propagation and some do little or none, instead buying small plants (liners) and "growing them on" for resale. For example, it's easy in western Washington to obtain locally grown plants whose genetic provenance (seed source) is Montana. Always ask nurseries to certify where their plants originate. They may not know, but if customers keep asking, eventually the nurseries will start answering.

Plant Form

Are you going to use bareroot or container material? Bareroot plants are grown outdoors in the ground, are harvested while dormant, and transported without soil around the roots. Bareroot plants are cheaper to buy, and because they are easier to transport and quicker to plant, they are also cheaper to install than container plants. Bareroot plants should only be planted when dormant, limiting their season of use in my area to December through March. I believe bareroot plants are more difficult to plant correctly and have higher mortality because they suffer so much more root disturbance. Since they generally lack the fibrous roots that would allow them to survive anaerobic conditions, they don't grow well in saturated or flooded soils (McInnich and others 1994).

Bareroot plants are generally grouped into size categories for sale (for example, 15 to 30 cm (6 to 12 in), 30 to 45 cm (12 to 18 in), 45 to 60 cm (18 to 24 in), 60 to 90 cm (2 to 3 ft), and 90 to 120 cm (3 to 4 ft) branched) and priced accordingly. Check how local nurseries categorize plants and write specifications to match. If you write size specifications that cross categories (for example, 38 to 50 cm [15 to 20 in]), only plants from the larger category will meet specifications. You may end up with plants larger than needed, adding cost to the project.

Container plants generally survive better than bareroot because fewer roots are disturbed during handling. Container plants are easier to plant correctly (especially for novices) and unlike bareroot that can only be harvested and planted when dormant, container plants can be hardened, shipped, and planted over a much longer season. A project delay is unlikely to affect already procured container plants, but it could be disastrous for already harvested bareroot plants. However, containerized plants are more expensive to buy, ship, and install, in part because they are bulkier to handle, store, and transport. Container plants are generally found in 4-, 7.5-, and 18-l (1-, 2-, and 5-gal) pots.

Plugs are plants grown in very small containers, usually long narrow tubes that are specified by name (for example, styroblocks, conetainers), diameter and length, volume, or a combination of all three. Plugs combine the low cost and fast installation of bareroot with the seasonal flexibility and improved survival of container plants. Although plugs are widely used in reforestation, production of other native plant species in plugs is limited in the PNW.

Plugs (P) and bareroot plants can also specified by age with a 2-part code such as 1+1, 1+2, P+1, and so on. The first number represents the number of years as a seedling in the original container or nursery bed at high growing densities. The second number is the number of years in a transplant bed or larger container. So a 1+1 bareroot tree spent 1 y in a seedling bed and 1 y in a transplant bed. A plant that grew 1 y in a seedling bed and 1 y in a transplant bed will be larger than a plant that spent 2 y in a seedling bed because transplant beds have lower growing densities, allowing plants to grow larger. For example, a 1+2 tree usually will be larger than a 2+1 tree even though both are 3 y old. A P+1 could be larger or smaller than a bareroot 1+1 depending on the size of the plug container that was used.

Live stakes are large hardwood cuttings of species, like willows (*Salix* spp. [Salicaceae]), that root easily so they can be propagated directly on site. Stakes are specified by diameter and length and are generally more expensive to buy than bareroot plants but less expensive to install. Stakes are less expensive than container plants in all respects. Depending on species and quantity needed, it may be easy for inexperienced workers to collect live stakes near the project

site, thereby obtaining inexpensive plant materials of local genetics.

Balled and burlapped (B&B) plants are larger, field-grown trees and shrubs dug up with soil around their roots and wrapped with burlap and wire or twine to keep the rootball together. B&B are specified by height and sometimes stem diameter (caliper) height is commonly 1.5 to 2.5 m (5 to 8 ft) but caliper varies widely by species and size.

Size

Consider many morphological characteristics when specifying plants. Small plants (up to 18 l [5 gal]) are less expensive to buy and install and are easier, especially for novice planters, to handle and plant correctly. Small plants adapt more easily to new site conditions, recover faster from transplant stress, and require less irrigation water to get established (Harris and others 1999). However, small plants can be overwhelmed by weeds, and are more easily damaged by trampling or browse.

Larger plants (mostly B&B material) are most expensive to buy, install, and maintain. Large plants require a longer period of more intensive maintenance before they are established in their new site. Large plants have more difficulty recovering from the stress of transplanting and may have a more difficult time adapting to new site conditions. When under stress, plants are more susceptible to adverse environmental conditions and insect and disease problems (Harris and others 1999). Large plants are more resistant to browse or trampling damage and are frequently used when an "instant landscape" effect is needed, what I call "opening day syndrome."

Bareroot plants are specified by height and sometimes by root spread. Be aware that different species have different types of root growth: some may grow shallow and wide while others grow deep and narrow. Occasionally caliper is used for very large bareroot plants and can be useful for avoiding tall spindly plants. Container plants are always specified by container size, often by height, and occasionally by caliper in the largest containers.

Cane number is sometimes specified for shrubs, a common ornamental specification that may not serve you on a restoration project. Ornamental growers routinely prune shrubs to increase cane numbers; restoration growers usually don't and many native species don't naturally send up multiple canes when they are young. Therefore, requiring multiple canes could reduce your pool of shrubs to choose from or increase plant prices because of the additional labor involved in pruning.

Health

Insect predation on a plant may cause it to increase chemical levels in leaves to ward off future predation, so mild predation in the nursery may predispose a plant to greater resistance in the field (Benz 1977; Niemala and others 1984). However, insects are also common disease vectors. In general, be less concerned about leaf problems, especially in autumn when senescing leaves are susceptible to various fungal and bacterial spots. Be very concerned about disease or pest damage on stems and roots. Look under leaves for insect pests and always examine roots as well as the tops of plants for insect and disease evidence, mechanical damage, and so on.

Specify weed-free plants. Weed control is a component of many restoration projects and we shouldn't import problems for ourselves.

Plants should be gradually, over the course of a few weeks or a month, adapted to the outside environment if it is significantly different from the greenhouse environment. Most growers harden their plants off routinely, but it does not hurt to specify it.

Substitutions

It's common and acceptable in the ornamental nursery trade to substitute a similar species for an unavailable plant. If this is unacceptable, and rarely is it acceptable for restoration projects, specify that substitutions be allowed only with your consent. Better yet, if you have acceptable substitutions, list them in the specifications to assist with timely plant procurement and reduce project delays. Due to the shortage of native plants in my area, I list all species that will work in the different planting zones and direct the contractor, for example, to use 4 of 7 species listed in roughly equal amounts. This saves the contractor having to call me every time a specified species cannot be found.

Final Check

Check your specifications again and think about how site conditions or project needs affect your specifications. Plant specifications must always, like everything else on the project, reflect project goals and site characteristics. For example:

- if site access is poor, moving large material in could be difficult;
- without irrigation, large plants may be more at risk than small plants in a drought;
- volunteers or novice planters may have a harder time correctly planting large or bareroot material;
- digging proper holes for large plants is difficult in compacted soil;
- bareroot plants are unavailable in early fall;
- larger material may survive trampling or browsing better.

Check the species you have selected to use and consider tailoring your specifications to reflect your knowledge of particular growth characteristics. The better you know your plant species, the better your specifications will be. For example:

- groundcovers and other shallow rooted species will not be able to root to the bottom of a large pot;
- plants with long taproots may benefit from deeper containers;
- some plants do not tolerate root disturbance well and should only be specified in containers;
- slow growing plants in large containers will be older and therefore

more expensive than a fast growing species of the same size;
- a fast growing species or one that spreads aggressively may out compete other installed plants on a site and should be specified in smaller quantity;
- if a plant species is not commonly grown, large numbers or unusual sizes may be difficult or impossible to obtain.

Many details must be considered when writing plant specifications for restoration projects. The Society for Ecological Restoration and the Society of Wetland Scientists are organizations where restoration practitioners can find others with whom to discuss problems and issues (contact information provided below). Also, some native plant growers are very knowledgeable about plant specifications; after all, they see many specification lists every year. Just remember that your specifications must be tailored to your goals, the needs of your site and project, and the availability of plants in your area. Have fun writing.

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