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For General Release

ArcheWild Native Species Procurement Specification

Introduction

There are three primary questions that need answering when specifying native plants for restoration programs and for open spaces.

- Species – How to choose which species will satisfy a specific goal or purpose?
- Genetics – How to obtain suitable genetics for the chosen species?
- Form – How to choose the most appropriate size or form; often a cost-benefit evaluation?

Few publically-available documents describe how to adequately perform the above activities. Instead, individuals and organizations tend to rely on professionals and pseudo-professionals for advice, with very mixed results. In general, seeking answers from websites is the least reliable option.

This document provides a conceptual framework for answering the above questions that should help with assessing advice procured through various means.

Species Selection

Aside from decorating a backyard landscape, choosing native plants for nearly any other purpose is a scientific process rooted in both the 'reference site' and 'plant community' concepts. In its simplest form, observation and documentation of the target or project site allows the professional to assign a label or category, such as 'Dry Oak – mixed hardwood forest' or ''Red-cedar – prickly pear shale shrubland' or any of 100s more. From this starting point, a nearby site with the same or very similar characteristics is evaluated to determine both the species composition and proportions. The idea is that, "if these plants are working well over there, in very similar conditions, then they should work well over here."

Biodiversity is rarely something that can be purchased and planted. In most common natural conditions, regardless of habitat type, research shows that typically 8-12 species comprise 80% of all species present. This range increases to 15-18 to capture 90% of all species present. So, usually, plant lists should typically include only 8-12, maybe 15, different plant species and ideally reflect the relative proportions found in natural settings.

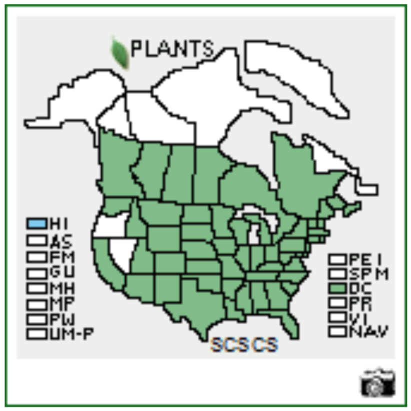
'Restoration' efforts that really aren't focused on restoration per-se but instead have different goals are exceptions to this approach. For example, in heavily degraded or post-agricultural sites where most, if not all, native plant seed sources have been eradicated, the land owner might choose an objective of re-introducing several dozens of different species into a dedicated 'nursery' area to act as a seed source for surrounding areas. Another is agro-forestry, where plant lists are built using species that provide near and mid-term cash crops.

Plant lists should always list the full botanical names. Common names are easily misunderstood and abused by the nursery trade. Specifying 'bluestem' is a reference to more than 26 different species.

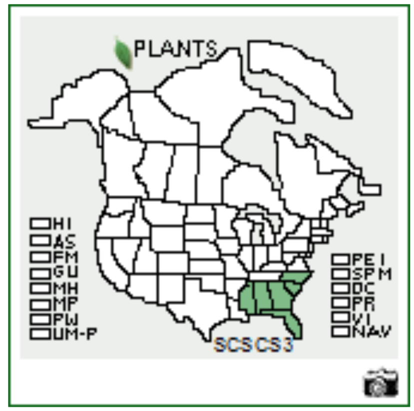
Even specifying 'little bluestem' is a reference to 6 different species, none of which are replacements for the other.

Schizachyrium scoparium (little bluestem) is an over-specified native plant, often used in inappropriate situations, that actually doesn't exist! Instead, there are three distinct and different species and each grows in different habitats and have different growth habits:

Schizachyrium scoparium var. *divergens*
little bluestem



Schizachyrium scoparium var. *scoparium*
little bluestem



Schizachyrium scoparium var. *stoloniferum*
creeping bluestem

The proper way to request the ubiquitous 'little bluestem' is to list **Schizachyrium scoparium var. scoparium**. High-quality native plant nurseries know the difference and their plant labelling system should reflect the actual species in the container. You'll at least be asking for, and hopefully getting, the plant that you actually want.

Use the USDA Plants Database (click the link) to lookup the proper names for the species that you want.

Three important notes on looking up correct plant names:

1. Botanical names aren't always what you think they are or what the nursery trade regularly uses. For example, Aster novae-angliae is now called Symphyotrichum novae-angliae.
2. Botanical names change frequently. Taxonomists, for example, can't make up their mind if chokeberries are of Aronia or Photinia genus, and they have flipped back and forth over the years.
3. The USDA site sometimes lags behind the taxonomists' name changes. For the most current and up-to-date botanical names, check the Integrated Taxonomic Information System (ITIS) where you can read the latest accepted botanical name and all of the preceding names for a particular species. Click this link to view the nearly 50 defunct species now all considered to be variants of the generic Schizachyrium scoparium.

Specifying Genetics

This seemingly complex topic really isn't. The countless number of papers and research programs looking into plant genetics all point to one simple reality: **genes matter and using local seed sources is safer than using foreign ones.** See Appendix A for a list of links to popular paper on the subject.

At one end of the genetic spectrum we have Equisteum hyemale var. affine (scouring rush), for which genetic studies suggest that this is effectively the same plant growing everywhere around the world from Alaska to Florida to Ukraine. At the other end, we have Trillium erectum (red trillium), for which each population is considered genetically distinct and unique to that population. The implication is that you can plant scouring rush anywhere you like from any source and be accurate and appropriate in doing so. However, buying red trillium and planting it anywhere other from where it originated is probably a futile, and certainly an inappropriate, exercise.

Most native plants demonstrate genetic uniqueness to a set of site conditions nearer to red trillium than scouring rush. For example, Asclepias tuberosa (butterfly milkweed) appears to exhibit noticeable and important genetic differences every 50 miles or so, which reflects the various changes in soils, hydrology, and other relevant factors when you travel 50 miles in any direction.

The problem with using distance as a measure of genetic appropriateness has very severe limitations, however. There can be a dozen or more different combinations of soil, hydrology, and other factors within a small geographic area. Take Bucks County PA, for example, which has 5 very different ecological zones (click this link) ranging from dry upland areas, to ancient volcanic diabase areas, to coastal plain areas. These areas are amazingly different from each other in terms of their soil, hydrology, and other factors, which is what makes Bucks County such a botanically-rich area. And the types of plants that grow in each zone are quite different from each other. A specification stating that all plants must be native to within 50 miles of Philadelphia, for example, is almost meaningless as that would include all of Bucks County and several other counties from Maryland, Virginia, Delaware, and New Jersey. Specifying native plants doesn't work this way. Instead, we need a land classification system that identifies areas of relative same-ness irrespective of where they are located geographically.

Case Studies

The value of using a land classification system is that it focuses on similar site characteristics and is a proxy for the 'reference site' conceptual construct and it provides a standardized means of communication between researchers, producers, and consumers of native plants. Here are two examples of how this is used:

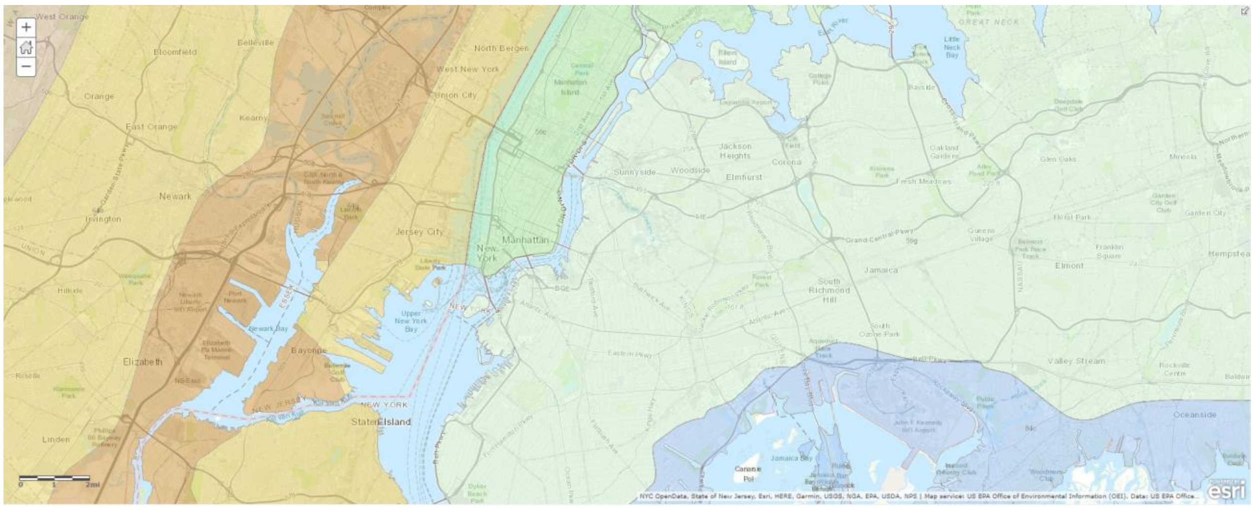
- A plant species that grows in a shale barren near State College, PA should be genetically similar and suitable for use in a shale barren in the Green Ridge in Maryland, given their relative proximity and nearly identical habitat characteristics
- A plant species that grows well in the dense, wet clay of the upper Piedmont is genetically distinct and better attuned to growing in dense, wet clay than the genes from the same species growing on a sand dune near Lake Erie.

A brilliant and forward-thinking employee of the Environmental Protection Agency (EPA) foresaw the need for such a land classification system. James Omernik published "Ecoregions: A Framework for

Managing Ecosystems" in 1987 that is rapidly becoming the industry standard for land classification and specifying native plants. Click this link for a list of ecoregion publications by Omernik and the EPA staff.

Omernik's EcoRegion land classification system is widely available for public use as a GIS layer. A quick link to an EcoRegion lookup tool can be found here (click the link).

The image below shows 6 the different EcoRegions within 20 miles of Manhattan. The New York City municipal nursery grows ecoregion-specific plants for use on projects throughout the city. ArcheWild grows ecoregion-specific plants for customers ranging from Boston to Cleveland to Roanoke to Asheville.



Open the lookup tool, enter your address, adjust the transparency level of the ecoregion layer, and then scroll in to see the ecoregion code for your project site. This ecoregion code is your preferred ecoregion for specifying and sourcing genetics for your plant list. 'EcoRegion 064a' (Level IV) denotes the upper Piedmont area. Simply specifying 'EcoRegion 064' (Level III) allows for anywhere within the Piedmont.

Some native plant nurseries collect their own seed and track seed provenance, but most do not. Even for those that do, proactively growing and stocking a single species from many different ecoregions is uncommon. For example, ArcheWild grows over 20 different Schizachyrium scoparium var. scoparium crops, each from a different ecoregion to service our broad customer base for this popular restoration species, but we might only grow Campanulastrum americanum from just 3 ecoregions. It's impractical, if not impossible, for a single nursery to grow all native species from all ecoregions. This is why the 'contract grow' arrangement is so quickly dominating the restoration-grade native plant industry. For example, if the US Forest Service wants to use red spruce to restore a portion of Spruce Knob, WV, they collect the seed themselves and have it 'contract grown' by a nursery that will track ecoregion and accession codes for each seed lot, thereby guaranteeing the genetic suitability of their plants to their project sites.

So when specifying native plants for your project, the minimum requirement is listing the ecoregion but can also include the accession code if your nursery supplier is equipped to track crops by seed lot. Click here for an article covering Native Plant Labeling Standards.

Choosing a Form

Do you buy bareroot, plugs, tubelings, band pots, containers, or B&B? 18" tall or 6' tall. The choices and combinations can seem daunting. Often the choice is determined dimply by budgetary restrictions but the rule-of-thumb that one should buy the least expensive plant so that you can plant more plants is rarely the most efficacious approach.

The least expensive plants are often small bareroot, which are easy to plant but have terrible survival rates compared to other product forms. Usually, buying tree tubelings or band pots are up to 3X the cost of bareroot but can have a 10-20x survival rate. So which is the better option?

Similarly, buying a 6' tall containerized tree is easily 3X the cost of a 1-2' tall tree. But the shorter tree must be caged or tubed and/or is subject to deer browse, which is why the 6' tree is normally preferred over the shorter, less-expensive tree.

Conversely, many projects still request gallons, quarts, or even deep plugs for herbaceous species when starter plugs are 80% less expensive to buy and to plant and often have higher survival rates than their larger forms due to lower desiccation risk. In one trial conducted by Izel Plants, an online native plant broker, showed that there were no discernable performance differences between small starter plugs that can cost as little as $0.50 and quarts that can cost up to $5.00, all in an unirrigated setting, and that within a few months the small plugs had achieved exactly the same size as the larger starting form. Click here to see an article on small starter plugs.

So the new rule-of-thumb is that one should specify the smallest 'containerized' form that can be purchased except in the case of trees and shrubs where the terminal buds should be above the deer browse line. Small starter plugs are the most cost-effective form for herbaceous species and tubelings are the most cost-efficient tree/shrub form. Specify 6' trees and shrubs in unprotected settings.

Specification Writing Summary

Use the below checklist to see if your plant specifications are meeting the new industry standards:

- **Specify the full botanical name**; use USDA Plants Database as your everyday guide
- **Specify the EcoRegion genetic source**; use the EPA ecoregion Level III or Level IV codes
- **Specify the seed lot** from which your plants should be grown, using an accession code
- **Require that the full botanical name, ecoregion source, and accession codes are on plant tags**
- **Specify the smallest containerized (plug flat) option** available, or specify 5-6' tall trees/shrubs
- **Validate your plant list** by referencing plant community documentation or a trusted ecologist

Sample Specification

The following example is one of many ways to write a plant procurement specification, but it does include the recommended elements. In general, providing more information to the vendor yields a better project result. Sometimes the vendor might know more about a project site and the plants that would satisfy a clear objective than the engineer or landscape architect in charge.

[see next page]

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EXAMPLE [PAGE 1 OF 2]

Project Description

Our client's project is to convert a 4.5 acre abanonded hay field beside their new home to an authentic meadow that can be maintained with a single mowing event every 2 or 3 years. Their objective is create a naturalistic landscape that matches/mirrors their original 1700's farmhouse and barn on the property. The site is in Bucks County and the GPS coordinates are: **40.423754, -75.389509**. The soil is predominantly undisturbed Reaville Series rev. KK-MJ. There are no height or species composition constraints. Being able to resist invasive species encroachment, including forage grasses, is of paramount performance.

Target seeding date is March 15, 2019. Target plugging date window is April 15-April30, 2019.

Plant Specification

All plant species should be grown from seed originating from wild populations within EcoRegions 064a (Triassic Lowlands) or EcoRegion 064b (Trap Rock and Conglomerate Uplands). Wild is a proxy for areas that show no evidence of major human disturbance over the last 100 years and for which there is no reasonable reason to believe that the area had been artificially seeded during the last 50 years.

If seed is not available from either 064a or 064b, then the architect will accept plants grown from seed orginating from the following list of adjacent EcoRegions, in order or preference:

- 064d (Piedmont Limestone/Dolomite Lowlands)
- 058h (Reading Prong)
- 067a (Northern Limestone/Dolomite Valleys)

The architect believes that due to the proximity of these adjacent EcoRegions (<10 miles) and that the property is located along a known avian flyway that it is reasonable to expect some gene flow betweeen these EcoRegions. Plants grown from any other EcoRegion must have prior approval from the architect.

Plugs shall be the smallest plantable size for each species. The smallest acceptable size shall be a 1.25" deep 200-cell plug and the largest acceptable size shall be a deep 72-cell tray. The architect has a strong preference for 98-cell plug trays based on previous experiences. Any woody species shall be supplied in DP50 forestry trays. Other sizes/forms are permissable with prior architect approval.

Plant Labeling

All plants supplied must be clearly identified with the following information:
- Full botanical name
- EPA EcoRegion coding and EcoRegion name
- Accession code
- Seeding date
- Propating nursery name

Each flat must have one tag firmly attached to the flat (staples preferred). All seed labels must list date of harvest, noxious seed %s, and germination rates.

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EXAMPLE [PAGE 2 OF 2]

Plant List

The following plant list is based on literature search for Upper Bucks County and surrounding areas. The architect will consider recommended alterations if presented with compelling evidence, including botanical survey reports, pictures, or historical records. Client-supplied seed must be used for growing and their accession codes must be clearly indicated on plant tags. This list includes:

- ASINI-1331 Asclepias incarnata spp. incarnata
- LOSI-3737 Lobelia siphilitica
- PYVI-3384 Pycnanthemum virginianum
- HYPR-2049 Hypericum prolificum
- PAAU3-3557 Packera aurea

Seed Mix

	lbs/acre	Species Count
Tridens flavus var. flavus	20	1
Schizachyrium scoparium var. scoparium	5	2
Penstemon digitalis	1	3
Leersia virginica	1	4
Monarda fistulosa ssp. fistulosa var. fistulosa	0.5	5
Solidago speciosa var. speciosa	0.5	6
Ageratina altissima var. altissima	0.5	7
Sorghastrum nutans	0.5	8

See Drawings CVMB-3751-1 and CVMB-3751-2 for the current planting plan. The architect welcomes any feedback on plant placement and spacing.

Primary Meadow Species	QTY	Species Count
Eragrostis spectabilis	5,000	9
Leersia virginica	5,000	10
Monarda fistulosa ssp. fistulosa var. fistulosa	5,000	11
Packera aurea	2,500	12
Lobelia siphilitica	1,000	13
Penstemon digitalis	1,000	14
Pycnanthemum muticum	1,000	15
Hypericum prolificum	1,000	16

Planting Specification

See Drawings CVMB-3751-1 and CVMB-3751-2 for the current planting plan. The architect welcomes any feedback on plant placement and spacing.

Appendix A – Plant Genetics Papers

Regardless what you might hear from plant marketers and landscape designers, genes do matter for a lot of reasons. Below is a selection of papers cited in a nice piece of work titled, "''**How Local Is Local?''—A Review of Practical and Conceptual Issues in the Genetics of Restoration**," by McKay, Christian, Harrison, and Rice. The first paragraph of their summary section reads,

> *"A major genetic concern of restoration practitioners is, ''How local is local?'' Practitioners have a tendency to assume that local adaptation is almost ubiquitous at most spatial scales. Ecological genetics studies generally support the idea that local adaptation, especially across larger geographic or climatic gradients, is the norm. There are also many scientific studies indicating that local adaptation can occur (to varying degrees) at small spatial scales. However, there is also evidence that gene flow, seed banks and, perhaps most importantly, temporal fluctuations in selection can reduce the probability of highly localized ecotypes."*

Note the reference to EcoRegions in the underlined text above.

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