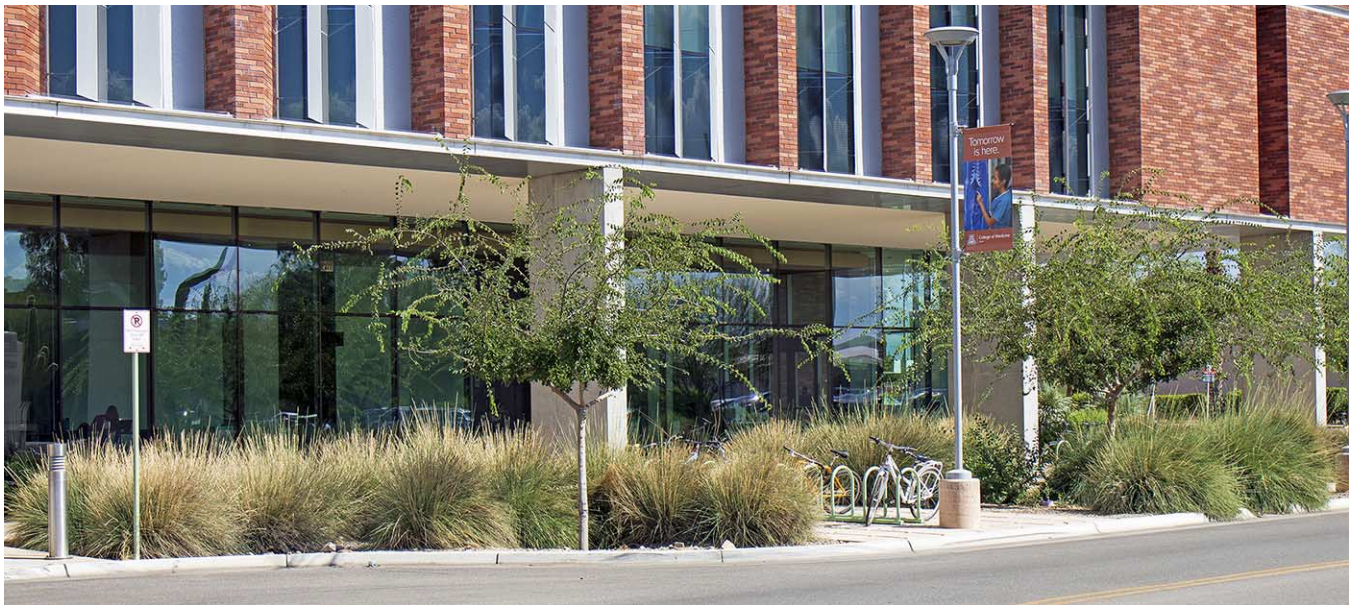

Figure 1. University of Arizona Biosciences Research Laboratory, SE corner of Cherry Ave and Mabel Street *(planting design by Wheat Design Group, 2016).* This project used 200 grasses, predominately the non-native *Muhlenbergia lindheimeri*, in areas that receive building runoff. The non-native *Muhlenbergia capillaris* 'Regal Mist' and the native *Muhlenbergia dumosa* are also used within the project.

Big Farma — How did THAT grass end up here?

by Jennifer Patton[1] and Ben Wilder[2] Photos courtesy the authors.

Have you ever wondered who was responsible for the plant selection in the Home Depot parking lot or at your favorite Starbucks? How about at the new Bioscience building on the UA Campus, or along the newly widened Grant Road between I-10 and Campbell? Planting plans for each of those projects were developed by a landscape architect, typically local, but sometimes from out of state. The American Society of Landscape Architects defines landscape architecture as, "the planning, design, management, and nurturing of the built and natural environments. Landscape architects plan and design parks, campuses, streetscapes, trails, plazas, residences, and other projects that strengthen communities." You will also hear the term "landscape designer." The roles and responsibilities are often similar, but a landscape architect has acquired the necessary years of experience and passed exams that confer registration. All local jurisdictions require planting plans to be sealed by a licensed landscape architect (Figure 1).

So a landscape architect (LA) must have a lot of plant knowledge, right? Interestingly, plant knowledge is not part of the registration exam in Arizona (licensure is conducted on a state-by-state basis). An individual can get registered in Arizona without showing any local plant knowledge (nor do they have to have local work experience). If one is lucky enough to go through the curriculum at the University of Arizona, you will have a semester class on plant materials (learning commonly used and locally available landscape plants, both native and non-native), a semester of landscape ecology, and one semester of planting design.

Landscape architects and designers rely heavily on plant information provided by the major nurseries that supply plants. The top two wholesale nurseries supplying southeastern Arizona are Civano (Tucson) and Mountain States (Phoenix). Both nurseries are active with the local society of landscape architects, sponsoring events, attending trade shows, and presenting at the annual horticultural conferences where they discuss new plant introductions, plants for shade, trees for tight spaces, etc. Plant giveaways and raffles at luncheons and conferences are a big draw.

The nurseries provide cut sheets for the plants that they sell, including photos, general plant attributes, and enticing descriptions. The *Muhlenbergia* x 'Pink Flamingo' is described as a "narrow, upright clump of thin blue-green leaves topped in the fall with dramatic arching plumes of soft pink flowers, reminiscent of headdresses worn by Vegas showgirls." The write up for *Muhlenbergia capillaris* Regal Mist'® states that this grass "can literally stop traffic during fall bloom"! How is a landscape architect to choose?

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Big Farma — How did THAT grass end up here? *continued*

There is a reason that many ecologists and environmental enthusiasts have a very low opinion of landscape architects.

When does a landscape architect use grasses?

(Disclaimer: This article is about grasses, so we will focus on that from here forward, but the principles are the same for all plant species. There is no one way a landscape architect selects plants. Landscape architects have diverse interests and backgrounds. Many are focused foremost on design and aesthetics — how will planting bring a space together — what are the colors and textures that will make the space have an incredible wow factor? Other landscape architects have a more ecological bent and may be considering how plant material can aid in restoration, support pollinators, or benefit local wildlife.)

Grasses may be either container plants or seed. We will discuss seed first.

Seeding with grass

Grasses are used regularly in seed mixes for stabilization and erosion control; grass roots grow quickly and are great at holding soil in place. A careful designer will include annuals and perennial species, as well as cool season and warm season germinators. On large projects, there is no assurance of when the construction will occur, and schedules often change; the seed mix you thought was going to be applied in early October may actually end up being applied in May. A seed mix installed for erosion control may contain up to 50% grass species (shrubs, forbs, and wildflowers make up the remainder); more typically, grass species may constitute 20–30% of the mix (Figure 2).

All jurisdictions require ground cover for dust control and soil stabilization — any disturbed soil surface must be covered. This is typically either rock or seeding (normally hydroseed with mulch and a polymer binder). Seeding is used in areas that can be a bit more "wild"' and won't be treated with herbicide.

Seed species: some jurisdictions provide a list of species that you select from, other jurisdictions may have you conduct site releves, counting every species of plant within a certain area, and extrapolating to arrive at species diversity and density across the site. The goal is to develop a seed mix that mimics the existing plant palette. There are several challenges to this approach. Landscape architects are not celebrated for their plant ID skills, and grasses are notoriously tricky. The fastidious LA ends up at the Herbarium while George patiently IDs collected species (George Ferguson, Collections Manager, University of Arizona Herbarium). From that, a seed list is developed, which is then vetted against what species of seed can be obtained. Those

Figure 2. Hydroseeded mini-benched slope along the east side of the recently widened (2017) Oracle Road near the wildlife overpass. The ADOT landscape architect composes the seed mixes for all ADOT projects. Grass species in this seed mix included *Bouteloua curtipendula, Bouteloua rothrockii, Bouteloua gracilis, Hilaria berlangeri, Muhlenbergia porteri, Sporobolus airoides, and Sporobolus cryptandrus.* Numerous forb and shrub species were also included, such as *Plantago ovata.*

looking for a regional seed source rely on Wildlands Restoration in Tucson — Gary Maskarinec, owner of Wildlands Restoration, has helped us numerous times with species availability and appropriate quantities. However, the landscape architect typically has no control over the seed source. Often the contractor that installs the project has the ultimate selection, and project seed may be sourced from Granite Seed, one of the largest seed suppliers serving the southwest. At this point, there is no knowledge of where the seed that will be applied is grown, or whether the strain is appropriate for the site.

On residential projects where seeding may be used for restoration, considerations for grass seed selection includes the presence (or absence of) awns. People seem to hate it when their kids and dogs come in with fur and socks filled with needle gramma awns. I get calls wanting to know if that grass was intentionally put in the seed mix…And speaking of awns, we learned recently why they invented cowboy boots — solid leather and no laces means nothing to trap the awns. Try wearing your lightweight mesh hikers through a field of needle gramma and you will quickly know what I mean.

Container-grown Grasses

Common spaces where you will see grasses planted are: within detention basins that experience occasional inundation; in streetside water harvesting basins, traffic circles, and chicanes where they are valued for their ability to filter pollutants and aid in infiltration of stormwater; and in parks where their soft nature ensures they won't scratch or poke a playing child (Figure 3).

Selection of grass species often involves a review of the NRCS Soil Survey to see which species historically grew in the area; a

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Figure 3. This streetside chicane planted with native shrubs, trees, and grasses collects runoff during rain events. Grass species are emphasized as their roots are quick to establish, and they help to break up the soil, encouraging infiltration. Grasses also aid in the filtering of runoff. Grass species included in this planting are *Bouteloa gracilis, Bouteloa curtipendula,* and *Muhlenbergia emersleyi*. (Design: Tucson Clean and Beautiful. Construction: Desert Living. Maintenance: Neighbors)

Figure 4. Civano Growers sells tens of thousands of grasses every year. In recent years, Civano has reduced the number of plant species that they grow (from over 400 species to less than 80), focusing on species that people want, that are easy to grow, and that don't require a lot of maintenance. The three grass species that they currently grow (*Bouteloa gracilis 'Blonde Ambition' PP22048, Muhlenbergia capillaris, and Muhlenbergia rigens)* are shown at the Civano growing grounds, south of Tucson. The waiting semi-trucks may transport these grasses to Texas, southern California, Utah, Nevada, or New Mexico.

Big Farma — How did THAT grass end up here? *continued*

site visit can inform which plants are thriving and which aren't. And then the LA will look at the current availability lists from the plant nurseries (and for many LA's, that is where plant selection starts, because it does not matter what is on site if you cannot obtain it, in the numbers required, for the project).

These are the grasses you can get

Roughly speaking, there are 50 species of native perennial grass and 40 species of native annual grass in the Tucson area. Unfortunately, it is impossible to specify just any species of grass for a project—the LA is limited by what growers choose to grow and sell. The species growers choose to grow and sell are those that customers (designers and contractors) ask for. What do customers ask for? Grasses that make a dramatic statement, impress with their color and shape and will grow here. In other words, a very short list of species, nativity optional. For example, Civano Growers and Desert Trees Nursery, the two wholesale nurseries in southern Arizona, currently offer five species of grass between them: *Bouteloa gracilis* 'Blonde Ambition' PP22048, *Muhlenbergia capillaris, Muhlenbergia* x 'Pink Flamingo', *Muhlenbergia rigens*, and *Pennisetum setaceum* 'Rubrum' — respectively, a clone of a cultivar of a blue gramma plant originally from Santa Fe, a southeastern U.S. (Texas and eastern U.S.) native, a cloned hybrid of two non-native *Muhlenbergias*, our native deer grass, and the purple fountain grass, a species with the potential to become invasive. If we add Mountain States wholesale nursery in Phoenix, the list expands to include *Aristida purpurea* and *Bouteloua curtipendula*, along with a handful of non-native cultivars (Figure 4).

It is important to understand that contractors working on large-scale commercial and public projects will typically purchase from wholesale nurseries that can supply the quantities and species required (much more efficient to procure all the needed plants from one source). Large projects require lots of plants all at once (several hundred or more grasses is possible for a single project) and wholesale prices are less than half those of retail. While contract-growing is more common for restoration projects, we have not seen contact-growing used for private development (subdivisions, campuses, commercial, etc.).

To meet this demand, the grower needs to stock thousands of plants. There is a risk to the grower for mis-guessing what the demand will be for any particular species. Grasses root quickly, take over their container and start to look shabby within a relatively short time vs. shrubs and trees. Depending on species and time of year this shelf-life may be a season or so, but no more than a year.

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Figure 5. Desert Survivors is the local go-to for retail customers. The nursery is always fully stocked at spring, monsoon and fall plant sales, but on any given day there will be 25–40 different perennial grass species available for purchase. In the foreground are *Sporobolis airoides*, *Sporobolis wrightii*, and *Heteropogon contortus.*

Figure 6. Nighthawk Natives grows a lot of grasses — they sell over 2,000 grasses annually for restoration projects; another 1,000 or so are purchased by retailers and landscape contractors. Some native species they are currently growing include *Eragrostis intermedia*, *Hilaria berlangeri*, *Hilaria mutica*, *Hopia obtusifolia*, *Schizicarium scoparium and Tridens muticus*.

Big Farma — How did THAT grass end up here? *continued*

Keeping the species list short works well for both the contractor and the grower.

What about the designer? When our firm is working on large public or commercial projects, and we have an interest in using grass, what do we do? We often omit grass species as container plants (grass species are included in seed mixes). We don't use non-native plants in our designs, and in our experience the commonly available native grasses, *B. gracilis* and *M. rigens* don't do well in Tucson without a lot of irrigation. There are so many other native grass species that are better choices and use much less water.

Imagine a more typical landscape architect or designer churning out large project plans for their firm. If they aren't careful, they will specify species they are interested in without checking availability. This means the contractor in the field will have to make a substitution. Sometimes they check with the architect, sometimes they don't. Either way, the LA will not be getting the grass they dreamed about and may get something unfortunate.

Even if *B. gracilis* was *the* Tucson basin grass, we have deep misgivings about specifying a grass that is a clone of a cultivar. Is it really wise to plant thousands and thousands of genetically identical grasses? Won't this take the *B. gracilis* gene pool in an unknown direction? Make the entire gene pool more susceptible to catastrophe? Sure, the seed heads on 'Blonde Ambition' are impressive. They look like fake eyelashes on steroids. The human need is met. But what about the rest of nature? What needs aren't being met? What in this plant has been lost in exchange for the unusual seed head?

Thinking about a blonde's ambition and her impact on wildlife led us to research work done by Douglas Tallamy. Tallamy, an entomology professor at the University of Delaware, is a passionate advocate for planting native plants in our yards as, the title of his most recent book states, "Nature's Best Hope." His research group pitted shrub and tree cultivars against their wild native relatives to see which better supported both the insect herbivore and the insect pollinator. The only clear result of their experiment was that plants that had had their leaf color altered from green to red, blue or purple, consistently inhibited insect herbivory. (See "Further reading" below for links to this study and other interesting web pages about cultivars.) Tallamy, somewhat surprisingly to us, goes on to say that cultivars, if developed solely for the needs of nature, could prove superior to wild natives. A big "if" and a big "could" in our minds. I am sure the indefatigable African grass researchers in Arizona a century ago only imagined the blessings their research would bring.

One of the rules of our practice is "first do no harm." The research that has been done on cultivars' impact to nature is very thin. There are so many variables involved, so many facets and niches of nature that humans could easily miss. The human love affair with cultivars would make it easy to justify their widespread propagation on the slenderest reeds of proof of benefit. Personally, it is easy for us to sacrifice the "enhancements" the horticulturist offers for the comfort we take in knowing our wild, native plants will never let us down.

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Big Farma — How did THAT grass end up here? *continued*

Spotlight on Native Plant Nurseries that Grow Native Grasses

'We' get the plants 'we' ask for. Civano would be happy to sell us wild, native plants if that is what we demanded, and they would do it at the scale and efficiency that they currently devote to cultivars. Put another way, if all of us with a little time on our hands donned backpack sprayers like John Scheuring, John would eventually have to find something else to do, and 'Buffelgrass National Park' would be just a bad memory. In this spirit, Desert Survivors and Nighthawk Natives are two nurseries that every native plant lover should support.

Desert Survivors

Desert Survivors caters to the retail market. Jim Verrier, Nursery Director, told us that they grow around 700 species of native plants! Jim typically grows around 60 species of native grass. When we visited the nursery in September he had 32 grasses available for purchase (more species will be available at their plant sales). Desert Survivors grows all of their grasses from seed collected onsite. No vegetative propagation of cultivars occurs. A couple of Jim's current favorite grasses are *Leptochloa crinita* and *Pappophorum vaginatum*. Both spread readily and can handle basin conditions (Figure 5).

Nighthawk Natives

Nighthawk Natives contract-grows plants for wholesale and retail nurseries, landscapers, and restoration projects. They also sell plants at seasonal sales — if you buy native plants at the Tucson Audubon or Native Seed Search plant sales, you are probably buying Nighthawk Native plants. Berni Jilka, owner of Nighthawk Natives, currently grows about 20 species of native grass from seed collected on site. No vegetative propagation of cultivars occurs. The nursery is happy to contract-grow other native grass species. If you want to try a perennial grass that is well-suited to the hot dry conditions of the Tucson basin, Berni suggests *Muhlenbergia porteri, Sporobolus contractus,* or *Sporobolus airoides* (Figure 6).

Pima County Native Plant Nursery

As an LA that loves native plants, it does not get much better than being the designer on a Pima County project that can utilize the Pima County Native Plant Nursery (City and other government agencies can also make use of the Native Plant Nursery as long as an Inter-Governmental Agreement for the project is in place).

Figure 7. The Pima County Native Plant Nursery grows out plants for specific County projects. Pima County Flood Control and Pima County Department of Transportation are primary users. Here *Bothriochloa barbinodis*, *Bouteloua curtipendula*, *Leptochloa crinite,* and *Digitaria californica* are flourishing.

The nursery is designed to grow-out plants for specific projects. The designer provides the plant list and quantities to the nursery, along with the timeframe for when the plants are needed. This works well on projects like roadways, that have an 18-month design schedule, and a 6-month or longer construction schedule – plenty of time for the plants to be grown. There are complications for the nursery when project schedules change. They can't just 'hold' plants until the project is ready, so they end up doing a lot of juggling, and species substitutions may occur. Those plants may also be used on smaller County projects where there is insufficient time to grow out plants. Currently the nursery is growing over 30 species of Pima County native grasses. Like Nighthawk and Desert Survivors, they grow their grasses from seed, typically from seed collected onsite (Figure 7).

Considerations with grasses in the landscape

As grasses are being used more frequently in street-side water harvesting plantings, we are seeing problems with the establishment of buffelgrass (*Pennisetum ciliare*), fountain grass (*Pennisetum setaceum)*, and lovegrass (*Eragrostis* spp.) species that are drawn to the disturbed soils and moist conditions. At certain times *Muhlenbergia emersleyi* can look strikingly like fountain grass, and immature *Muhlenbergia rigens* can be hard to tell apart from immature buffelgrass.

Our approach as we move forward will be to select grass species that are markedly different in appearance from these invasives. *Leptochloa crinite* (Figure 8), *Heteropogon contortus* (Figure 9), and *Tridens muticus* (Figure 10), for example, are distinctive in appearance and are not invasive look-alikes (Figure 11).

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This Public Plaza managed by Pima County Regional Flood Control District includes a number of native grasses sourced from the Pima County Native Plant Nursey. Container grasses used include *Bouteloua curtipendula*, *Sporobolis wrightii, Heteropogon contortus and Pappophorum vaginatum.* Our approach as we move forward will be to select grass species that are markedly different in appearance from invasives. Clockwise from top left: *Leptochloa crinite* (Figure 8), *Heteropogon contort* (Figure 9), and *Tridens muticus* (Figure 10), for example, are distinctive in appearance and are not invasive look-alikes. Buffelgrass (Figure 11) has volunteered among the plantings — will the maintenance staff be able to routinely identify and remove?

Big Farma — How did THAT grass end up here? *continued*

Acknowledgments

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About the Authors: Jennifer Patton and Ben Wilder are owners of Wilder Landscape Architects in Tucson, Arizona. The firm promotes native plants in their designs to create spaces firmly rooted in their locale.

Further reading:

Do Cultivars of Native Plants Support Insect Herbivores? Tallamy et al. https://journals.ashs.org/horttech/view/journals/horttech/28/5/article-p596.xml.

Common misperceptions about cultivars of native plants https://extension.umd.edu/resource/cultivars-native-plants.

Native Species or Cultivars of Native Plants–Does it Matter? https://piedmontmastergardeners.org/article/native-species-or-cultivars-of-native-plants-does-it-matter/.