

Increased Diversity in Prairie Restorations - Why and How

Chris Hauser and Stephen Packard

Abstract:

In many prairie restorations, Big Bluestem forms a monoculture, eliminating the potential (at least short term) for a diverse community of forbs, sedges and other grasses. Here we share thoughts on ways to avoid and correct this common problem. We discuss species and techniques that can tame the tall grasses to make space for more diverse flora and fauna.

Chris Hauser (CH) is a Restoration Ecologist with the Kane County Forest Preserve District. **Stephen Packard** (SP) directs Audubon – Chicago Region. For contributing to these notes, thanks to **Tom Vanderpoel** (TV) of Citizens for Conservation and **Bill Kleiman** (BK), who supervises management of The Nature Conservancy's Nachusa Grasslands.

Part 1: Why monocultures are a problem, why diversity is important.

- A. Big Bluestem and Switch Grass can form tall grass monocultures (with perhaps a few species of forbs) that form ecosystems with very high competition and very low diversity. They are very un-natural and are stable for at least decades. While a tall grass monoculture may have some redeeming ecological value, so far as reproducing or restoring a real tallgrass prairie community, it stops far short of success.
- B. A holistic goal in prairie restoration should include a diversity that includes conservative plants and animals. All grassland birds of conservation concern require shorter and “softer” grass structure. Most conservative insects require specific host plants for reproduction and live only in diverse grasslands. Most conservative forbs need a similarly diverse community in which to survive and reproduce. It is difficult to increase diversity of tall grass monocultures due to intense soil competition from tall grasses.
- C. *Some questions from CH: often Big Bluestem is said to be taking over even remnants and high quality prairie restorations when planted nearby. What is going on? Is it possible that we are accidentally selecting super aggressive Big Bluestem genotypes by harvesting seed from planted prairies? Is it possible that Big Bluestem is benefiting from some external factor, like atmospheric nitrogen deposition? Is it possible that originally, grazing kept Big Bluestem in check, but with grazing eliminated Big Bluestem is able to dominate?*

Part 2: How to increase diversity in prairie restorations

- A. New **agricultural field** (“de novo”) **prairie plantings**. These ag field plantings are the typical case where a planted “prairie” becomes simply a tallgrass monoculture – often because the original seed mix didn't contain enough of the following groups of plants:
 1. Always include conservative grasses and sedges and rushes:
Examples: Little Bluestem, Prairie Dropseed, small Panicums, Junegrass, Porcupine Grass, Blue Joint Grass, Cx cristatella, Bicknell's Sedge, Juncus, etc.
Little Bluestem is one of the most versatile short grass species, and in dry or dry-mesic plantings, it will win the long-term battle with the tall grasses.
Kane Co FPD and Nachusa Grasslands – used 3 to 5 lbs/acre Little Bluestem. Nachusa typically uses several lbs/acre of other conservative grasses/sedges.
Dry: Little Bluestem, Porcupine Grass, June Grass, Three Awn, small Panicums, Bicknell's Sedge

Mesic: Little Bluestem, Prairie Dropseed, small Panicums, Bicknells Sedge, other sedges

Wet: many Carex species, Sweet Grass, Blue Joint Grass, Cord Grass. Go easy on the cordgrass if you don't have a lot of other wet conservatives; it too can form persistent monocultures (TV).

2. Always include aggressive conservative rhizomatous species: These includes Mountain Mint, Early & Missouri Goldenrods, Prairie Coreopsis, Western/Downy/Stiff Sunflowers, Bastard Toadflax. Heath Aster is one of the best and most versatile in this group, but do not confuse with Hairy Aster, a native weed. These species form a major part of the matrix of most remnant prairies, with the rhizomatous clones completely interspersed among each other. A new planting or an interseeding mix should contain a very good dose of these species, and these species provide great insurance against the aggressive tall grass species.
3. Always include dominant conservative "stay put" species: These include Wild Quinine, both Baptisias, Showy Goldenrod, all four Silphiums, Pale Coneflower, Prairie Dropseed, Lead Plant, Rattlesnake Master. These species are long lived. A seed will germinate, claim a spot, and dominate that spot for many years. These species are important for maintaining long-term stability and overall species diversity.
4. Always include parasitic or allelopathic forbs: These species play a critical keystone role in creating niches for other species. High quality remnant prairies always have parasitic and/or allelopathic forbs. Partially parasitic species include Wood Betony and Bastard Toadflax. Allelopathic species produce chemicals that inhibit other plant species, for example, Downy Sunflower.

*Bastard Toadflax: Every high quality remnant wet-mesic to dry prairie seems to have Bastard Toadflax present. Few prairie reconstructions have this species. It is difficult to restore Toadflax from seed; it's easier to grow or transplant plugs to establish.

*Wood Betony: This seeds quite well and plays a role similar to Commandra in reducing tall grass dominance. Once Wood Betony gets established in a tallgrass monoculture, it is a great opportunity to interseed with conservative grasses, sedges and forbs. Wood Betony can knock back the tall grass monoculture quite thoroughly and open the tallgrass sod for more conservative plants.

5. A note about "pioneer" species: These include Bergamot, Yellow Coneflower, Tall Coreopsis, Canada Rye, False Sunflower, Black-eyed Susan, Round-headed Bush Clover, Foxglove Penstemon. These are good species because they provide quick color to new plantings, and they are important early-successional components of the prairie, but they are quickly overtaken by the tall grasses.

Here is a standard problem with "de novo" plowed ground plantings: many seed mixes are simply tall grasses like Big Bluestem and Indian Grass plus a bunch of these pioneer species. When these are the only forbs in the seed mix, the result will be a tall grass monoculture in a few years. This is probably the most common cause of tall grass monocultures in agricultural field prairie plantings.

(When I give people a tour of prairie plantings I preach seeding very heavily and with great diversity from the start. We have been disappointed with the results of seeding hardy matrix species first with the intent of adding diversity later by overseeding. Our best prairie plantings were seeded with a high diversity of seeds, a large amount of conservative seed, and a total poundage per acre that is higher than most. We also purposefully limit the amount of big blue, Indian, yellow coneflower, monarda, false sunflower, P. digitalis, and black-eyed Susan. Last May I went for a hike

in a planting here by one of Nachusa's hard working stewards, Jay Stacy. Over a ten-acre former corn field he had lots of birdsfoot violets blooming, golden and heart-leaved Alexanders, Bicknell and Muhlenberg's sedges, violet wood sorrel, wide and narrow leaved pussytoes... There were not just one or two of these plants but hundreds, thousands, running off into the distance. As you would be, I was wonder-filled, and much motivated to harvest all season long these same species. BK)

B. Interseeding into old fields

Some of the best restored prairies have resulted from a few years of repeatedly sowing a rich mix of prairie species directly into diverse old fields. This is now a well-established technique. There is a good summary in the *Tallgrass Restoration Handbook* by Packard and Mutell. Rare orchids, gentians, legumes, all the spring flora, and other species often missing from degraded prairies may in a few years be thriving by the thousands.

This technique works slowly or not at all in dense stands of tall goldenrod or certain pasture grasses (especially meadow fescue, but also dense smooth brome or bluegrass). Many prairie species only grow about one inch tall the first year or two. If the other plants (or the dead thatch) are dense enough to shade out small prairie seedlings, then shade control is needed. Mowing is one approach: mow just often enough that the young prairie plants don't get dense shade. Fire will thin out the pasture grasses over one to four years, in most cases; wait to plant until after they've been thinned. Broadcast seed in the fall, once the turf is open enough so that some sunlight gets through to the ground layer all summer long. Plant scarified and inoculated legumes in spring.

Recently abandoned crop fields can be treated somewhat similarly. Here the problem can be bad patches of thistles and other weeds. One option: treat the bad weeds with the most benign and specific herbicide available, for one year before planting. In most cases it will also work to just sow a rich mix of seed and mow the weeds for a few years, whenever they get tall enough to shade the seedlings. Include in the seed mix all prairie species you can get, including such apparently delicate species as shooting star and golden Alexanders. Include all grass species, but go easy on big bluestem and cordgrass. Don't pour in excessive amounts of rattlesnake master, compassplant, etc. just because they are easy and fun to pick. Make the mix as diverse as possible. It probably won't be possible to burn for the first couple of years, but burn as early as you can. Keep mowing as long as there's a bad weed problem. (TV)

C. Increasing diversity in tall grass monocultures (or 'few-cultures').

These suggestions are for people who would like to restore an existing tall grass "monoculture" to a more diverse and more natural prairie.

1. Interseeding

Many conservative species can be interseeded directly into tallgrass monocultures. Some people report best results from burning in fall, then raking or harrowing the seed into the burned turf during the winter. But you can also just broadcast seed in the fall and let rain, freeze and thaw processes work the seed in.

Species to use: avoid the pioneer species listed above. They will not establish among the dominant tall grasses. Strive to include species from the other groups: aggressive conservative rhizomatous forbs, aggressive conservative "stay put" forbs, parasitic or allelopathic forbs, conservative shorter grasses. Even such conservatives as shooting star and golden Alexanders, which seem delicate, will establish well in the big bluestem if it's managed with annual burns for a few years (TV).

Don't hesitate to throw in the seed of shooting star and other spring flora in the fall and then burning in early spring. Most seeds will have worked their way into the dirt and won't be harmed by the flames. A few years of annual burns may help the spring flora get established. Forbs have an easier time fighting big bluestem than the conservative grasses. One way to establish those is to herbicide meandering strips through the monoculture and then planting diverse grasses the following fall.

*White Baptisia is a champion in germinating from seed in tall grass monocultures, no matter how dominant the tall grass. Burn the prairie, and sow the Baptisia seed, and you will have flowering plants in several years.

*Note about Wood Betony: Several prairie managers (from IL, WI, and IA) have suggested that Wood Betony could be a "savior" of our tall grass monocultures. CH agrees it is a powerful tool in opening the tall grass sod. It is easy to establish from seed, it quickly spreads through the monoculture, and it reduces the tall grass species to a foot or two high. The soil is opened up from the intense competition. HOWEVER, this is only half the equation: the land manager MUST be ready to interseed the Betony patches with conservative species to fill the gaps... otherwise weeds like Canada Goldenrod can take over.

Translating individual plants. Some plants can be planted with good luck: CH has had good luck planting Prairie Dropseed, Prairie Coreopsis, and Bastard Toadflax in established tall grass plantings. For best results: plant in early spring, water once at time of planting, and pray for a wet spring and early summer. If dry, water if possible, but this is very difficult. Important: spread mulch about 2-3 inches deep and 2-3 inches radius around each plant. This will greatly increase survival due to (1) increased soil moisture and (2) decreased digging by animals. (CH's experience is that dropseed MUST be planted in spring. Fall-planted Dropseed doesn't survive winter.) To prevent animal browsing and digging, cages should be placed around New Jersey Tea and American Hazelnut for first few summers. Mulch helps too.

2. Burning

Burning is important in opening the dead thatch from the previous year's growth. Many people claim that spring burning (or burning in general) only benefits the tall grasses to the detriment of all forbs, but CH is skeptical and thinks it is a necessary thing to burn a prairie, no matter how dominant the tall grasses might be.

3. Grazing/Mowing:

Some suggest a late summer mowing to weaken the tall grasses the summer before and the summer after interseeding. They suggest that this greatly increases the efficiency of establishment of the seeded species. Some say that grazing is critical to maintaining diversity in tall grass prairies, especially in more western regions of the tallgrass ecosystems.

One final note about selecting species for site conditions: we tend to discount the soil tolerance of many species, limiting them to specific soil moistures or textures. However, a visit to any mesic remnant prairie will show dry, mesic, and wet species growing together. In fact, many species have a very wide range of habitats... including Little Bluestem, Bastard Toadflax, Virginia Mountain Mint, and others. Don't confine species to narrow soil conditions. In the longer run, all the plants will sort themselves out; in the shorter run, increased diversity is likely to provide increased niches that will foster health and diversity in the early stages.

