

USING LOCAL SEED IN PRAIRIE RESTORATION
—data supports the paradigm—

| Danny J Gustafson, David J Gibson and Daviel L Nickrent |

Native grasslands throughout the world are becoming increasingly degraded or lost due to human activities. Preservation and conservation efforts assume that remnant communities exist, unfortunately many historical plant communities have either been completely destroyed or reduced to unsustainably small habitats. Prior to European settlement, Illinois constituted approximately 25% (8.9 million ha [22 million ac]) of the North American tallgrass prairie, however, less than 0.01% of high-quality prairie remains today (Robertson and others 1997). The highest quality remaining remnants are often small pioneer cemeteries and linear-shaped railroad rights-of-way (Figure 1). In the spirit of the first tallgrass prairie restoration project established by Dr Aldo Leopold at the University of Wisconsin in 1935, government and nongovernmental organizations and individual citizens have

Choice among local, non-local, and cultivar seeds for restoring native ecosystems is not purely an academic question—it also has practical consequences. In this article we summarize a series of genetic and competition studies of big bluestem (*Andropogon gerardii* Vitman. [Poaceae]), Indian grass (*Sorghastrum nutans* (L.) Nash. [Poaceae]), and purple prairie clover (*Dalea purpurea* Vent. [Fabaceae]) from remnant and restored Illinois (local) prairies, non-local remnant prairies, and 6 grass cultivars. We found genetic differences between local and non-local seed sources, that large populations do not necessarily have higher genetic diversity relative to small populations, and differences in plant performance could be related to seed source. Although obtaining large quantities of non-local and cultivar grass seeds may be affordable, available, and desirable given the amount of seeds required for prairie restoration, our research indicates genetic and plant performance differences between local and non-local seed sources in all 3 species. Such differences can affect both the short- and long-term success of restoration activities.

**KEY WORDS**
*Andropogon gerardii, Sorghastrum nutans, Dalea purpurea, remnant and restored grasslands, cultivars, ecotype, Poaceae, Fabaceae*

**NOMENCLATURE**
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taken an active role in restoring tallgrass prairies throughout its historical range (Packard and Mutel 1997). Ecological sophistication of restoration practitioners has increased dramatically over the last 3 decades, as evidenced by increased efforts to match ecologically appropriate genotypes to site conditions. Considerations of ecotypic variation, genetic diversity, and introgression of non-local genes into the remnant populations are no longer purely academic concerns but also have practical implications for field restorationists.

In this paper we summarize our genetic and ecological research conducted on big bluestem (Andropogon gerardii Vitman.), Indian grass (Sorghastrum nutans Nash.), and purple prairie clover (Dalea purpurea Vent.) in Illinois restoration projects (Gustafson and others 1999, 2001, 2002, 2004a, b). All 3 species are perennial long-lived prairie plants and significant components of the prairie ecosystem. Our research focused on 3 basic questions: 1) are local (Illinois) populations genetically different from non-local (Arkansas, Kansas, Nebraska, Iowa) populations; 2) what are the levels of genetic diversity in remnant and restored prairies and commonly used grass cultivars; and 3) are differences in plant performance related to seed source?

Genetic analysis of all 3 species showed differences among our local Illinois remnant populations and the non-local populations. This was an important finding because despite the hundreds of papers on the tallgrass prairie, ours were the first to show genetic structuring and differential performance of 3 dominant plant species across the tallgrass prairie landscape. The grass cultivars tested tended to be more similar to one another than they were to local remnant populations, which was expected given they were developed from plant material originating from Kansas, Nebraska, and Iowa. A surprising result was that individual local restored grass populations were not genetically similar to corresponding local remnant populations within the 100 to 150 km (50 to 100 mi) “local collection range” chosen for preserving the local gene pool. Rather, the genetic similarity of restored populations was often identified more so with the person who established the prairie planting.

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tions established from local seed (Gustafson and others 2001). The established local and non-local populations had maintained their genetic identity for over 20 y despite indications of significant pollen exchange. Testing for differences in fitness between hybrid (local crossed with non-local) relative to within genotype crosses was beyond the scope of our study, however, it was clear that collecting seeds from a local population did not ensure we were collecting the local genotype. If preservation of the local genotype is a priority, then one should not use seeds collected from an area that has local and non-local populations planted juxtaposition to one another. Because vegetative reproduction is far more common in A. gerardii (Hartnett 1989) than seedling recruitment in established prairies and the genetic composition of the original planting can have long-term consequences, we strongly recommend documenting the location of the original seed source populations used to establish a restoration project. This documentation requires very little effort, but the potential benefits to our understanding of how to restore our native communities could be far-reaching.

**SUMMARY**

We now have some answers to our original research questions. First, sources of big bluestem, Indian grass, and purple prairie clover from Illinois are different than those from Kansas, Nebraska, and Iowa. Second, small remnant populations do not necessarily have low genetic diversity relative to larger populations. Therefore, management practices to offset inbreeding depression or founder effects in restoration projects are unwarranted unless one has empirical support for such activities. Third, when growing in Illinois, plants collected from local Illinois sources grew differently than plants collected from non-local sources. We would have liked to have included multiple common-garden field experiments, sampled more prairies, and sampled the seed source populations used to establish our restored sites. Despite these limitations, our results are fairly consistent and provide empirical support for using local seed sources for prairie restoration projects. We would also like to stress, to all parties active in native plant propagation and restoration, the necessity for documenting the location of local seed sources. This information is extremely valuable to restoration ecologists, conservation geneticists, and managers of native communities within our modern fragmented landscape.

**REFERENCES**


**Figure 1.** Typical remnant and restored tall grass prairies. a) Weston Cemetery prairie, McLean County, Illinois; 2-ha (5-ac) remnant prairie. b) DeSoto railroad prairie, Jackson County, Illinois; 13-ha (33-ac) remnant prairie. c) Park-Lands Foundation, McLean County, Illinois; 50-ha (123-ac) restored prairie. d) Konza Prairie Biological Station, Riley County, Kansas; 3487-ha (8617-ac) remnant prairie.

Photos a, b, and c by Danny J Gustafson; photo d by Alice Brandon


Photo by Danny J Gustafson

Figure 2. Restored tallgrass prairie at Goose Lake Prairie State Natural Area, Grundy County, Illinois. The area was planted in the 1970s and photographed in September 1998. Left of the bag was established with a Nebraska cultivar of Andropogon gerardii Nebraska cultivar, whereas an Illinois source was used to the right of the bag.

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