

Restoration Cases Flagship Collection

Case #5:

Restoring tallgrass prairie in
Nachusa Grasslands, Illinois, USA



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In Brief

*Newborn bison calves and their mothers at Nachusa Grasslands.
Photo credit: Greg Baker*

Overview

The Nachusa Grasslands Preserve in north central Illinois, USA, is a large-scale, long-term, high-quality restoration effort coordinated by The Nature Conservancy. Since 1986, crew members, volunteers, researchers, and staff have collaborated to reconnect remnant patches of tallgrass prairie, woodland savanna, and wetland ecosystems at Nachusa Grasslands, creating one of the largest and most biologically diverse grasslands in Illinois. Restoration was undertaken by a team of dedicated volunteers and staff with the goal of preserving a rich mosaic of natural habitats and abundance of diverse species. Nachusa is an unusually diverse and spatially heterogeneous mosaic of prairie, wetlands, and savannas with more than 730 native plant and 180 bird species, including a dozen bird species that nest only in grasslands. The Preserve supports a rich diversity of reptiles, insects, mammals, and geological features. Rare, endangered or threatened species of plants, butterflies, turtles, and snakes are regularly monitored. Nachusa Grasslands serves as a living laboratory for natural areas management and restoration, including fire, grazing, invasive species control, and species reintroduction. Bison reintroduction in 2014 provided a key opportunity to better understand the relationship of large mammals to species composition and balance on a prairie. The bison at Nachusa are an essential component of the original ecosystems and landscapes of northern Illinois.

Exemplary practices

Volunteer stewards are the heart and soul of Nachusa Grasslands. The Nature Conservancy works collaboratively with neighbors and adjacent landowners to protect prairie remnants, restore wetlands, conduct regular prescriptive burns, collect and scatter seeds, control invasive species and unwanted trees and brush, and monitor restoration progress. The preserve is divided into management units, many of which are supervised by experienced volunteer stewards who receive great satisfaction from their achievements. Nachusa Grasslands has achieved an unparalleled level of dedicated stewardship, and the restoration effort has become a mainstay of local social and cultural life. The site has become an important hub for research on all aspects of tallgrass prairie restoration, including the effects of bison on the entire ecosystem.

Key lessons learned

- ▶ *Engage volunteers.*
- ▶ *Weed control requires repeated treatments and a variety of approaches. Avoid planting in areas with weed infestations.*
- ▶ *Reseed with high diversity seed mixes from the beginning and use a large quantity of seed.*
- ▶ *Invest in monitoring, scientific research, and partnerships with researchers.*



Restoration narrative



Figure 1. The Doug and Dot Wade Unit of Nachusa Grassland
Photo credit: Dee Hudson, The Nature Conservancy

How it all began

In the mid 1960s, while driving down Lowden Road in rural Ogle County, Illinois, USA, prairie enthusiasts Douglas and Dorothy Wade heard the whistling call of the Upland Sandpiper (*Bartramia longicauda*). They knew that the Upland Sandpiper preferred open prairies and soon confirmed that the sandy knolls being used for cattle grazing were covered with native prairie plants that were otherwise gone from the region. The Wades had stumbled upon Schafer's Knob, a tiny, tallgrass prairie remnant. They knew this was a special place. After meeting fellow prairie enthusiast Tim Keller in 1973, they began working together to protect and restore tallgrass prairie remnants in this area, making arrangements with local landowners to lease 2-ha plots of prairie remnants that they fenced off and conducted experimental prescribed burns (Johnsen, 2013). They witnessed the reemergence of Hill's Thistle, Woolly Milkweed, Prairie Gentian, and many other prairie species, which convinced skeptics that these plants could reappear after so many years of heavy grazing (Prairie Smoke, 1996). Ecologists of the Illinois Natural Area Inventory carefully described and mapped several Nachusa remnants during this decade (Kleiman, 2016a).

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Nachusa Grasslands, USA

Visit and learn more about the project's ecological analytics [here](#)



In 1985, Delbert Schafer's property was sold to a developer who planned to build residential sites. Initial efforts by the Natural Land Institute, The Nature Conservancy (TNC), and the Natural Area Guardians to save the land were unsuccessful and it was scheduled for auction. Around this time, TNC had been looking for opportunities to restore tallgrass prairie ecosystem in Illinois. They were collaborating with the Illinois Natural Areas Inventory (INAI) to identify all of the state's surviving high-quality ecosystems, but no prairie ecosystems that met the INAI's standards were big enough for a single pair of prairie birds to nest, nor to conserve most prairie insect species.

The reality of the need to restore prairie habitat through purchasing degraded land led to a paradigm shift in TNC, and Nachusa offered the best opportunity in the state to restore a large and diverse grassland (Packard, 2017). The mission of TNC has since broadened to restore degraded lands as well as to conserve existing ecosystems through land purchases and easements. The Natural Land Institute purchased the first 53 ha (130 acres) and saved the area of interest from the auction block. When TNC funds became available, ownership was transferred to them in October 1986 and they purchased another 108 ha (267 acres). The purchased land was given the name Nachusa

Grasslands, after the name of the Illinois township, and (according to locals) a Native American name for early settler John Dixon, meaning "head of white hair" (Packard, 2017).

Since 1986, Nachusa crew members and volunteers have been reconnecting remnant prairie, woodlands and wetlands through habitat restoration to create one of the largest and most biologically diverse grasslands in Illinois (Figure 1). Land acquisitions gradually expanded the original size of the Nachusa Grasslands. By 1993, the site had expanded to 402 ha (993 acres) (Prairie Smoke, 1993). In 2021, the preserve covers a total of 1,500 ha (3,800 acres), including 292 ha (721 acres) under conservation easement.

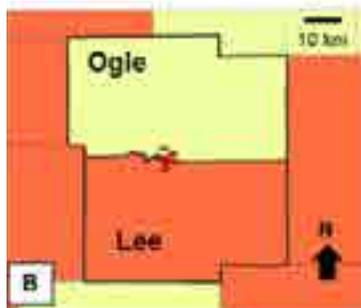
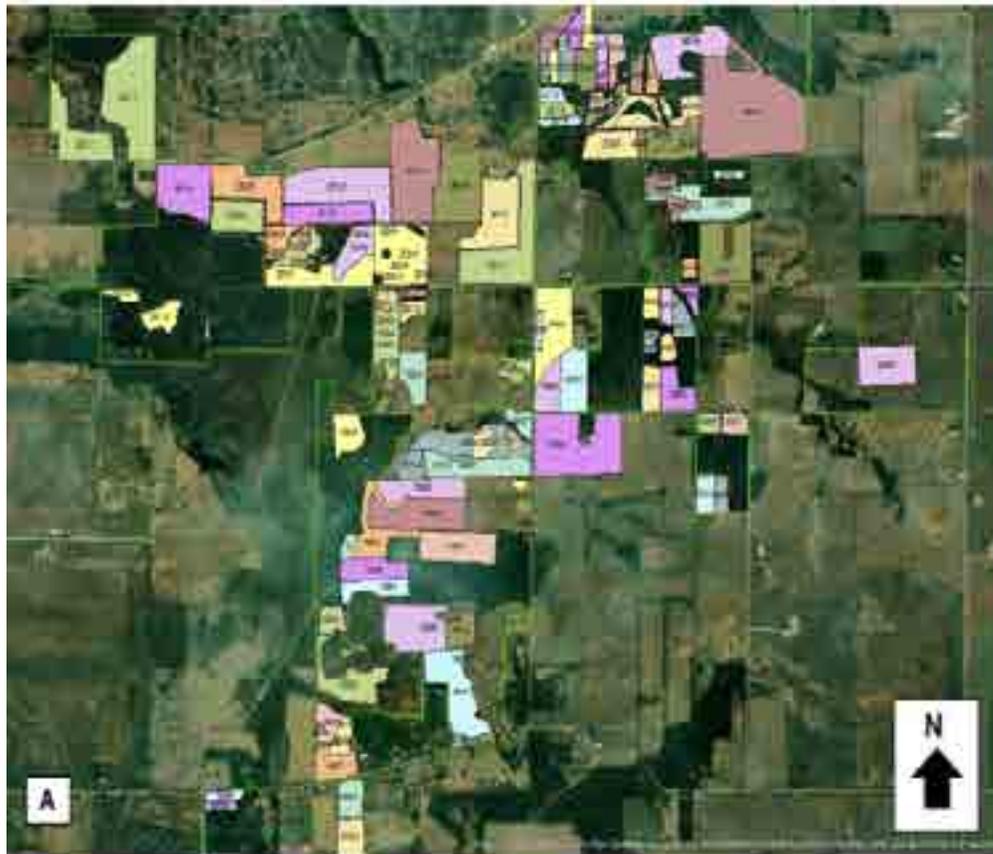


Figure 2. (A) Map of Nachusa Grasslands showing the year that restoration was initiated in each site; (B) location of Nachusa Grassland within Ogle and Lee Counties ; (C) location of Nachusa Grassland within the state of Illinois in the USA. Maps B and C are from Vanek et al, 2020.

Setting the scene

Nachusa Grasslands is located in Franklin Grove, Illinois in Lee and Ogle Counties (41.891°N, 89.343°W) about 160 km (100 miles) west of Chicago (Figure 2). TNC manages the 1,500-ha nature preserve consisting of restored and remnant prairies, oak savanna, and wetlands (Calciferous fens). Nachusa lies within the Grand Prairie physio-geographic region (Vanek et al., 2020). The site borders the Franklin Creek State Natural Area.

The geological history of this region explains why prairie remnants persisted through the past centuries of farming and development. Circa 450 million years ago Illinois was located near the equator and covered by seawater. As the climate cooled and glaciers formed, land began to emerge. Sands deposited during the Ordovician Period of the Paleozoic Era became compacted and uplifted as sandstone bluffs (Figure 3). St. Peters Sandstone, named for the St. Peters River in Minnesota, can be found in several areas in Nachusa Grasslands (Jordan, 2016).

What is now Nachusa Grasslands was typical karst terrane: sandstone outcrops, seeps and springs, sedge meadows, fens, oak savannas, and sinkholes. The land was not suitable for plowed fields, so was used for pasture,

allowing remnants of the extensive tallgrass prairie ecosystem to persist despite grazing pressure. After all, prairie vegetation is well adapted to grazing by large mammals, such as bison, which also roamed the plains in large numbers (Knapp et al., 1999).

Tallgrass prairie is a mesic ecosystem dominated by large grasses that grow to 1–2 m tall, such as Big Bluestem (*Andropogon gerardii*), Indian Grass (*Sorghastrum nutans*), and Canada Wild Rye (*Elymus canadensis*), coupled with shorter grasses and a high diversity of forbs. Woody species are typically excluded by fire or limited to wetlands (NatureServe, 2018).

Tallgrass prairie once covered 57.4 million ha (142 million acres). It stretched from Indiana west to Kansas and from Canada south to Texas. When Illinois became a state in 1818, it was given the nickname “The Prairie State,” paying ode to the tallgrass prairies that once composed 2/3 of Illinois’ landscape. North American tallgrass prairies represent a globally endangered ecosystem (Olson & Dinnerstein, 1998) with more than 90% of original prairie lost (Samson and Knopf, 1994). In Illinois, only 0.1% of the original tallgrass prairie ecosystem remains (Anderson, 2006). The deep and nutrient rich prairie topsoil, paired with the invention of the John Deere plow, enabled early settlers in Franklin Grove to farm row crops,

obliterating the original prairie ecosystem. By the 1970s, most of the prairie remnants in Illinois were restricted to old cemeteries, corners between fence rows, and along railroad right-of-ways (Crosby et al., 2014). In Franklin Grove, almost 111 ha (274 acres) of pure prairie managed to hang on in knobs, small rolling hills alternated with depressions in the landscape, which made plowing and farming difficult. More recently, residential development has become a threat to remnant prairie lands.

Nachusa Grasslands is located on the homelands of the Peoria, Potawatomi, Ochethi Sakowin, Myaamia, Kiikaapoi, Sauk, and Meskwaki people. Native Americans used the land for hunting and possibly agriculture (Crosby et al., 2014). The first Europeans settled in Nachusa toward the end of the 1600s (McCay, 1993). Early surveyors in 1839 did not record any Black Cherry (*Prunus serotina*), Eastern Red Cedar (*Juniperus virginiana*), or Box Elder (*Acer negundo*) trees, which are present today. But they noted several different types of oaks, including Red Oak (*Quercus rubra*) and White Oak (*Quercus alba*), walnuts (*Juglans* spp), and hickories (*Carya* spp.) on the west end of what now is Nachusa (Kleiman 1996). For over 100 years, fires were prevented, allowing trees to establish and grow. For grassland ecosystems, such as prairies and savannas, fire suppression is a source of



Figure 3. A restored savanna forest with St. Peters Sandstone bluffs.
Photo credit: Charles Larry, The Nature Conservancy.

degradation. Some areas of the site were used for crops during the 1900s, particularly soybeans and corn (Crosby et al., 2014).

Between the knobs and ridges at Nachusa is a flat and poorly drained landscape with a clay hardpan below the surface, approximately a meter deep (Bittner, 1996). It is almost impenetrable to water and all of the groundwater must pass horizontally over this hardpan, giving rise to a thriving wetland community. It wasn't until the 1950s that much of this wetland was tiled and drained for agricultural use. These tiles are being dismantled at Nachusa and wetlands are being restored to their original condition (Bittner, 1996).

Beginning in the late 20th century, restoration efforts began to focus on prairie ecosystems in the USA (Barber et al., 2017a). Restoration activities typically include the re-establishment of diverse plant communities, control of exotic plant species, and implementation of regular activities that mimic historic disturbance regimes (e.g., fire, and in some cases grazing, including re-introduction of American bison (*Bison bison*)). The area that is now Nachusa Grasslands was used as pasture by 1873 and converted to row crops by 1939, and sites remained in row-crop production (generally maize-soya bean rotation) until restoration began (Barber et al., 2017b).

Actors and arrangements

Initially, staff from TNC-Illinois administered Nachusa Grassland Preserve, with active engagement of many local prairie enthusiasts and volunteers. In 1993, Nachusa hired its first permanent full-time preserve manager, who continues working as the Project Director. Three additional staff positions have been added over the years. Nachusa completed its first comprehensive Nachusa Grasslands Site Conservation Plan in 2013 (Crosby et al., 2014).

Most of the work at Nachusa Grasslands is carried out by volunteers who work in stewardship teams (Figure 4) and hired seasonal work crews. Volunteer stewards are the heart and soul of Nachusa Grasslands, and some have worked there for over 25 years. Regularly scheduled work days are open to anyone and many folks begin volunteering at Nachusa through the work days.



Figure 4. Volunteer stewards harvesting seeds.
Photo credit: Dee Hudson, The Nature Conservancy

Experienced volunteers lead the work days. Some volunteer stewards manage their own unit(s), whereas others perform specialized tasks (e.g., fixing fences, mechanical repairs, brush removal, citizen science). The volunteer stewards govern themselves with frequent communication with staff. Long-term stewards mentor less experienced volunteers and provide on-the-job training. Volunteer stewards are the “eyes of the preserve,” as they work in all areas and keep close watch on invasive species and rare native species. Volunteers work in invasive species removal, planting, prescribed burns, and managing the bison herd. Volunteers organize garlic mustard purges, multiflora rose massacres, and brush cutting teams. In 1994, Nachusa Grasslands was formally divided into 11 management units, each with its own team of volunteer stewards.

It’s not just the volunteers who have helped preserve the site. According to former TNC-Illinois leader Steve Packard, “Nachusa’s many conservation-minded neighbors are one of the reasons so many rare species have survived in this area” (Packard, 1989a). Some conservation-minded neighbors have sold or donated property to Nachusa.

Beginning in the mid-1990s, Nachusa Grasslands began to hire paid seasonal work crews, teams of university students who work from spring to fall and live on-site.

They quickly learn to identify the forbs, grasses, and sedges of the native prairie as well as the associated soils. They participate in floristic and animal inventories and assist with research experiments and monitoring. While managing weeds and collecting seeds, they learned the breeding songs of birds, and in recent years, the ways of bison. Each worker hand-harvests seed from hundreds of plant species, then processes, mixes and plants the seed into a former corn field (Considine, 2017).

In 2008, “Friends of Nachusa Grasslands” was established as a nonprofit, tax-exempt entity created by Nachusa Grasslands volunteers dedicated to supporting Nachusa Grasslands, unaffiliated with TNC. Their mission is to build endowments that will help defray the cost of natural areas management, staff salaries, and operating expenses; conduct and encourage stewardship; support education and scientific activity; and fund land acquisition at the preserve. “Friends” volunteers run the [Nachusa Grasslands Website](#) and produce an annual report and newsletter each year. They provide essential funding for research, largely for graduate student projects. Friends of Nachusa Grasslands has provided \$259,000 of research grants during 2011–2021. Research partnerships have been established with many groups including Northern Illinois University, Southern Illinois University, Chicago Botanic Garden, and the University of Illinois.

Stakeholder engagement and community outreach

Volunteers have donated more than 200,000 hours of labor to the restoration and management of prairie, wetlands, and savannas at Nachusa Grasslands Preserve. These specially-trained volunteers help TNC conduct controlled burns, monitor wildlife, stop the spread of harmful, non-native invasive species, and harvest thousands of kilograms of seed every year. The seed is used for future prairie plantings and restorations. Volunteers interact closely with each other and with the preserve staff and researchers. There is a strong sense of camaraderie and teamwork. Everyone gets together at lunchtime to share their latest observations and insights. The work of volunteers is greatly honored and valued by Nachusa administrators and researchers at Nachusa through the work days.

Every year since 1990, at the “Autumn on the Prairie” event sponsored by Nachusa Grasslands, volunteers provide demonstrations and lead tours. This is a public outreach activity that attracts more than 600 people to learn about prairie ecosystems. The Nachusa Grasslands outreach committee

was formed in October 2013, and created an Interpretive Master Plan, a visitor use plan, and interpretive exhibits (Kleiman, 2013). Local staff make largely autonomous decisions regarding management and practices at Nachusa Grasslands in close consultation with volunteer stewards and researchers. They also communicate regularly with TNC-Illinois at weekly or monthly staff meetings.





Costs, funding and other support

TNC owns and manages Nachusa Grasslands and pays for staff salaries and supplies. Costs of restoration are greatly reduced as some of the restoration activities rely on volunteer labor, including harvesting and mixing seed, planting, prescribed burning, and weeding. The Friends of Nachusa Grasslands are growing an endowment, funding science grants, make annual donations to TNC, and occasionally obtain grants that support stewardship. If seeds were purchased on the open market, it would cost an estimated US\$12,355 to plant 1 ha of prairie at typical seeding rates (US\$500/acre; Elizabeth Bach, personal information). Prescribed burning is conducted by a mix of staff and volunteers, but would cost US\$4,000 for each fire if contracted out. Nachusa Grasslands administrators have extensive training to run the fire program. Purchase of fire equipment, insurance, and staff training is done by TNC. Weeding costs would be an estimated US\$1000/ha (US\$400/acre).

Implementation

The first efforts to restore croplands to tallgrass prairie at Nachusa began in fall 1987. Early efforts were strongly guided by volunteers who remained engaged for many years. Early volunteers were critical in organizing work teams and documenting information in the issues of *Prairie Smoke*, a newsletter written by and for the volunteers who created Nachusa Grasslands. Local volunteers led seed collecting expeditions in and around Nachusa and then scattered the seeds. Seeds were blended with agricultural lime and oats and spread with a fertilizer buggy into disced ground. The ground was then lightly harrowed, followed by annual burn maintenance. In 1991, 25 volunteers spread over 900 bulk kg of cleaned and uncleaned seed over disced ground. Much of the planting was in land formerly cropped with soybeans, which was also lightly disced prior to planting (Lubbs, 1991). Initially, seeding was done in the fall, but plantings were shifted to spring in 1990 to avoid problems with winter weeds such as horseweed (*Erigeron canadensis*), a winter annual (Lubbs, 1991). Now, seeding is done in fall/early winter. In 1995, an on-site nursery was established for growing plants of 30–50 native species for seed propagation, as the low numbers of plants found in the area were insufficient to produce the necessary quantity of seed for replanting. Successful prairie plantings at Nachusa require heavy

seeding rates (around 56 kg/ha (50 lbs/acre) of bulk seed). Experience revealed that if lighter seeding rates are used, new prairies get swamped out by invasive species before native plants become well established. Also, adding dominant grasses to the initial seed mix leads to plant communities that become overly dominated by grasses and less diverse. Seed mixes include lots of seed from wildflowers, sedges, and “subdominant” grasses such as Little Bluestem (*Schizachyrium scoparium*), Prairie Dropseed (*Sporobolus heterolepis*), and Sideoats Grama (*Bouteloua curtipendula*), but almost no seed from more dominant grasses such as Big Bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*) (Helzer, 2014).



Figure 5. A volunteer planting seed mixtures.
Photo credit: Dee Hudson.

Over time, new areas of cropland and grazing lands were restored, along with areas of wetland and forest. Methods of restoration have varied over time and have included hand and mechanical sowing of seed collected from the study site and local remnants (Figure 5), as well as seed purchased from local nurseries (Hansen and Gibson, 2014). In late summer and fall, when plants have finished flowering and the seed heads are fully ripe, seeds are harvested from 10% to 50% of the available plants, depending on how robust the populations are. This work is done in teams, followed by an evening social event. Broadcast seeding is the technique of choice for the vast majority of sites that participate in the Grassland Restoration Network. Restoration sites fall along a time series of restoration ages (Figure 2), spanning 3 to 32 years since restoration started, which allows researchers to investigate effects of different periods of time since restoration as well as different management regimes on aspects of soil microbial communities (Barber et al., 2017), vegetation composition (Barber et al., 2017; Blackburn et al., 2020), and animal communities (King and Vanek, 2020; Nelson et al., 2021; Guiden et al., 2021). As the area of Nachusa Grasslands grew, so did the

extent of prescribed burning (Figure 6). Each management unit experienced a unique burn history, as a subset of sites are burned each year in either spring or fall (Guiden et al., 2021). Fire return intervals range from 1.2 to 2.4 years. Oak woodlands are burned almost every year. About 30 miles of firebreaks have been created.

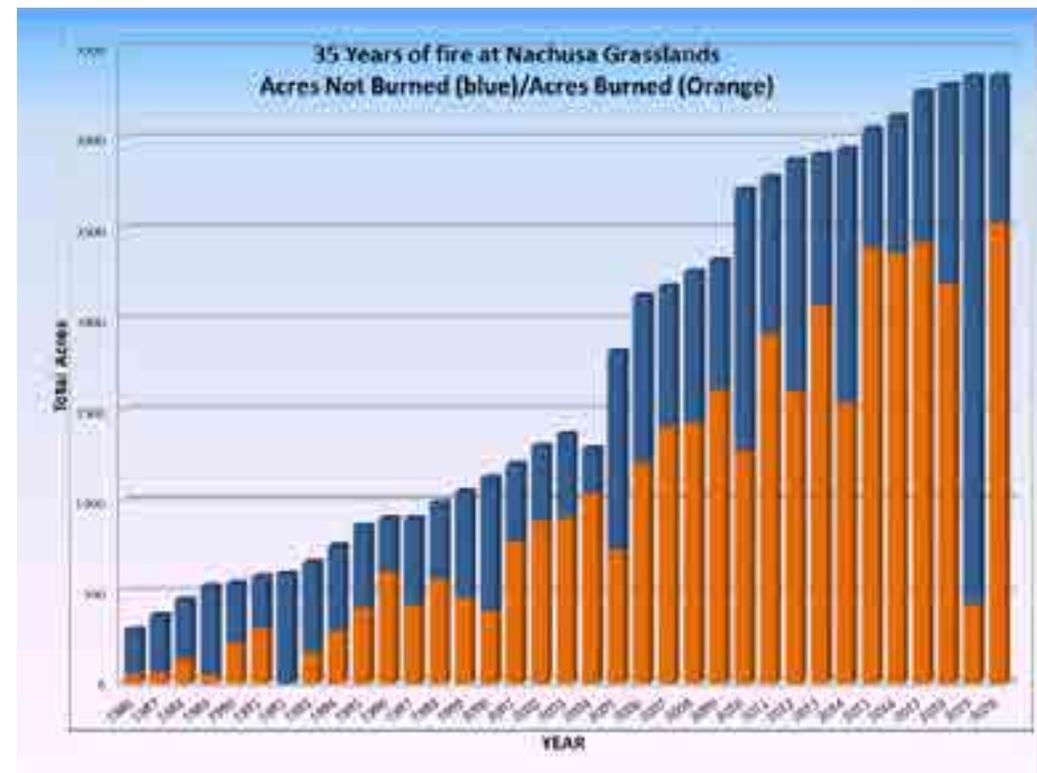


Figure 6. History of prescribed burns at Nachusa Grassland. In 2020-2021, a record high of 1,027 ha burned at Nachusa over 26 days. The average burn unit was 41 ha, typical crew size was 10, and average number of burn days is 18. Source: B. Kleiman

Some acquired lands are leased to farmers for crops until they can be restored. This practice continues today, as new lands are acquired and slated for future restoration efforts. Also, if restoration efforts fail on a particular portion of land, it is also sometimes replanted as cropland to get weeds under control and restoration is undertaken later. A new experimental approach is being applied on former corn fields, based on planting a core group of species that are resistant to the herbicide Transline (72 species have been identified so far). Boom spraying is used to control weeds after planting followed by addition of species to the seed mix after weeds are under control (Considine, 2018). Burning, weeding, and reseeding were successful approaches for tallgrass prairie restoration, but something was missing. The American Bison (*Bison bison*) is thought to be the most influential historical grazer within the tallgrass prairie system (Knapp et al., 1999). Now recovering from the brink of extinction in the late 1800s, bison are being reintroduced for their roles as ecosystem engineers (Biondini et al., 1999; Knapp et al., 1999; Eby et al., 2014). After careful research and consultation with scientists and prairie restoration practitioners the decision was made in 2014 to reintroduce bison to eight sites between 2014 and 2015. The bison were expected to reduce the abundance of warm-season grasses in prairie

plantings, leading to increased abundance of prairie forbs and open up space for annual plants and mammals that require small-scale disturbances. This step required that sufficient areas of high-quality restored prairie habitat were available to support a local bison herd. To prepare for the bison herd, 22 grazing exclosure fences were installed and baseline floristic data were collected in 660 quadrats. After years of preparation, thirty bison from the Wind Cave genetic lineage (no known domestic cattle genes) from Broken Kettle Grassland Reserve in NW Iowa and Wind Cave National Monument in South Dakota were transported and released onto Nachusa Grasslands in October 2014. By 2018, the bison herd has reached its optimum size of about 130. It was the first time American bison roamed free on the Illinois prairie since the 1830s. The bison herd has become a big attraction for Nachusa Grasslands as well as an important focus of long-term research (Blackburn et al., 2020; Guiden et al., 2021). Other restoration activities focused on restoration of insect species, including translocations of the Gorgone Checkerspot butterfly (*Chlosyne gorgone*) from a nearby population by Ron Panzer of Northeastern Illinois University, who also conducted surveys of rare butterflies and other insects at Nachusa Grasslands. Restoring wetlands requires restoring the local hydrology. Wetland

areas were restored by removing clay tiles from the narrow drainage canals and filling in the trenches to lessen water flow and decrease the possibility of erosion. The oak savannas at Nachusa are also being restored by removal of shrubs and tree species that proliferate due to fire suppression, removal of invasive species, reintroducing fire, and reseeding with native prairie species found in these areas (Figure 7). Both volunteers and researchers have been engaged in monitoring Nachusa's bird community since the beginning. The 1990–1991 Breeding Bird Atlas of Nachusa led to a baseline survey supported by TNC-Illinois. Ann Haverstock and other volunteers conducted this survey, recording 104 bird species during the breeding season (Haverstock, 1996). Researchers are monitoring and studying many different taxa within Nachusa Grasslands, including arthropod response to restoration, collection of genetic resources of plants, impacts of bison on grassland bird survival, and monitoring of butterflies, bee communities, snakes, Prairie bush clover, wetland turtles, earthworms, small mammals, and soil microbes (TNC, 2015). The RiverWatch team has been monitoring stream quality in Wade Creek, Clear Creek, Johnny's Creek and Babbling Brook by tracking aquatic macroinvertebrate communities (Vieregg, 2015). The RiverWatch data is collected as part of a statewide citizen science

program. In 2018, Wade Creek had the best stream quality of the 63 streams monitored across Illinois (Bach, 2020). Other team of volunteers has been monitoring dragonflies and damselflies (Odonates) at Nachusa since 2013. Across seven seasons, volunteers observed a total of 45 species and noted annual swarms of Green Darner dragonflies in the late summer as individuals congregate to migrate south for the winter. Calling frog surveys have tracked the presence of nine species occurring at Nachusa over eight years.



Figure 7. A burn sequence in oak savannah habitat at Nachusa Grasslands. Photo credit: Charles Larry and Bill Kleiman, The Nature Conservancy

Outcomes and impacts

Since restoration efforts began in 1986, TNC has converted over 120 patches of agricultural land into high-diversity tallgrass prairies ranging in size from 3 to 60 ha (Hansen and Gibson, 2014). In total, the preserve is now home to 734 native plant species and 180 species of birds. In 2013, the Illinois Nature Preserves Commission dedicated the 405-ha (1,000-acre) core unit of Nachusa as an Illinois Nature Preserve. The successes achieved at Nachusa have impacts across the country and the world. Scientists come to Nachusa to study everything from soil microbes and grasses to insects, mammals, birds, reptiles, and amphibians. The understanding of grassland habitats and restoration knowledge gained at Nachusa is widely shared with restoration and conservation practitioners. For example, bison grazing has the potential to become a preferred conservation strategy for a wide range of lands throughout the Midwest and beyond. Nachusa is the first demonstration site east of the Mississippi.

Significant research findings are emerging. Older restoration sites at Nachusa showed recovery of soil bacterial communities and were similar to local prairie remnants, suggesting that plant-focused restoration approaches also contributed to recovery of



Figure 8. Eastern Prairie Fringed Orchid (*Platanthera leucophaea*).
Photo credit: Joshua Mayer; licensed under the Creative Commons Attribution-Share Alike 2.0 Generic license.

soil biodiversity (Barber et al., 2017). Effects of site-level management on diversity of ground beetles, dung beetles, snakes, and small mammals across different ages of restored tallgrass prairie at Nachusa were much stronger than direct effects of plant diversity (Guiden et al., 2021). The primary determinants of wild bee abundance and richness across tallgrass prairie were found to be the composition of the landscape and presence of bison, not local floral resources within habitat patches (Griffin et al., 2021).

Among the many restoration success stories at Nachusa is the recovery of threatened and endangered prairie species. In 1996, the Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) was reintroduced (Figure 8). By 2015, Nachusa claims one of the largest populations of this species in the state, around 425 plants (Pollack, 2016). Hill's thistle (*Cirsium pumilum* var. *hillii*) is listed as a threatened species in Illinois. The numbers of these plants have increased at Nachusa from about 500 plants in 1995 to 1,214 plants in 2003 (Brunner, 2004). Nachusa supports a large and healthy population of the endangered Ornate Box Turtle (*Terrapene ornate ornate*).

The bison rewilding experiment has led to many outcomes and permanently changed operations and life at Nachusa. As of July 2015,

14 calves had been born at Nachusa (Gregory, 2015) and 20-30 calves have been born each spring since then. The addition of bison to Nachusa Grasslands generated energy and excitement. Volunteer work days reached record attendance, thousands of acres were burned during a robust fire season, a dozen new research projects were conducted, and thousands of pounds of hand-collected seed are collected each year to plant over 28 new ha of high diversity prairie (Kleiman et al., 2016). After three years, grazing did not directly affect plant diversity but was associated with increased spatial variation in community composition (Blackburn et al., 2017).

Efforts at Nachusa have also focused on wetland restoration. In 2015, the Bluestem Bottoms tract was restored to shallow wetlands by scraping and moving a large amount of soil, thanks to the help of the Army Corp of Engineers. As the restored habitat began to develop, more and more wildlife found and used the wetlands. In the spring of 2020, the preserve was treated to its first documented successful nesting of Sandhill Cranes. Two colts fledged and were seen throughout the summer months, until they migrated with their parents in the fall (Figure 9; Hudson, 2021).



*Figure 9. Sandhill crane parents and two colts fledged at Nachusa Grasslands in 2020.
Photo credit: Charles Larry, The Nature Conservancy*

Staff and volunteers from throughout the region work together to preserve and restore Nachusa. Volunteers have donated more than 200,000 hours of labor to restoration and management (more than 7,000 hours of service per year). These specially-trained volunteers help conduct controlled burns, monitor wildlife, stop the spread of harmful, non-native species, and harvest thousands of pounds of seed from the wild and nurseries every year. They help harvest more than 2,500 pounds of seed from the many remnant habitats on the preserve. The seed is used for future prairie plantings and restorations. Many of the hired seasonal crew members go on to successful careers in conservation.

Research has blossomed at Nachusa. As expressed by Holly Jones, a researcher from Northern Illinois University, “It is so exciting to be around a group of people that are so passionate about prairie restoration and that passion inspires my students and me” (Friends of Nachusa Grasslands, 2021).

Over time, outreach has gained importance as a focus of activities at Nachusa. The Youth Stewardship Program began in 1997 with the goal of connecting local students with environmental education and restoration of natural communities. Fourth grade students visit, harvest seeds, and compare different habitats. Although the program is no longer active, over 500 local young people benefitted (Kleiman, 2009).

Key challenges

From the beginning, the goals of Nachusa Grasslands were to protect and restore areas of high-diversity prairie, wetland, and woodland that could support rare, native species and their movements across habitat remnants. Acquiring land through purchases and easements was essential to achieve this goal. Implementation required a landscape approach focused on building connections across remnant and restored habitats. As new areas were acquired, a challenge was to incorporate them into landscape planning without losing the focus on restoring high-quality habitats and ecosystems. Assigning volunteer stewards to each management unit helped to accomplish this goal and to empower local management and continuity over time. Recruiting people to help harvest seeds was challenging early in the life of Nachusa, but the body of volunteers grew strong and steady. Restoration was accomplished in small increments, as human and financial resources allowed. As the effort grew, it became essential to hire permanent staff members.

Control of invasive species was a constant challenge. These invasive plants have included Wild Parsnip (*Pastinaca sativa*), White Sweet Clover (*Melilotus alba*), Garlic Mustard (*Alliaria petiolata*), Multi-flora Rose (*Rosa multiflora*), Autumn Olive (*Elaeagnus umbellata*), Honeysuckle (*Lonicera tatarica*), Reed Canary Grass (*Phalaris arundinacea*), and Birds Foot Trefoil (*Lotus corniculatus*), to name just a few. Many pieces contributed to Prairie Smoke issues focused on efforts to eradicate and control unwanted species, of the herbaceous and woody variety. At Nachusa, Bill Kleiman, Cody Considine, volunteers, and seasonal crews walk every inch of new plantings many times each year until the native plant community is well established. By pulling or spraying, they remove every invasive plant they find, focusing mostly on perennial legumes such as Birds Foot Trefoil, Crown Vetch (*Securigera varia*), and Sweet Clover (*Melilotus* spp). Only when the native community is established can they relax a little, but they remain vigilant. In some cases, it is not possible to keep up with the pressure from invasive plants and the decision was made to just give up and start over, rather than fighting a losing battle for years. This means turning the area back into cropland and focusing on weed control prior to restarting restoration (Helzer, 2014).

Enabling factors and innovations

The financial and scientific support of TNC is essential to both the initiation and the long-term trajectory of success of Nachusa Grasslands. Yet, all the while, local administrators and volunteers were empowered to make important management decisions and to plan local activities and events. This local ownership was critical to building a team of engaged and committed volunteer stewards. While they are the heart of Nachusa, it is also the case that Nachusa is a mainstay of their life and their community.

Strong and caring leadership of staff and volunteers have enabled Nachusa to grow and expand while maintaining the original focus on high-quality habitat restoration. The establishment of Friends of Nachusa was an important step in creating new sources of funding and leadership outside of TNC, further strengthening responsiveness to local needs and supporting growing research and donor communities.

The introduction of bison was a turning point for Nachusa Grasslands and greatly elevated the media profile, and it also signaled that introducing bison is a step towards reconstructing a whole ecosystem. Nachusa Grasslands staff and volunteers discovered that Bison and prescribed burns are excellent ways to communicate important educational messages to the public, such as the central role of grazing and fire disturbances for grassland restoration.

Parting shot

“None of us alive today will ever see a fully restored Nachusa Grasslands in the robust glory of ecological health. Many of its lessons will only be learned by our descendants. But we who have the opportunity to work on it have an extraordinary privilege. We can witness and participate in the beginning of something awesome and wonderful, the rebirth of a massive, complex grassland landscape.”

- Steve Packard (1989b), formerly of the Illinois Nature Conservancy



Figure 11. Populations of rough blazing star (*Liatris aspera*) embellish the Nachusa Grassland landscape. Photo credit: Dee Hudson, The Nature Conservancy



Key lessons learned

- ▶ Engage volunteers. Nachusa has a core team of two dozen volunteer stewards who are task managers and restoration unit managers. Encouraging, training, and empowering volunteers has made the ambitious work of Nachusa Grassland possible. Include a diversity of age, background, experience, and skills within groups of volunteers (Kleiman, 2016b).
- ▶ Hire seasonal work crews and provide on-site housing to recruit highly qualified individuals. These workers often pursue careers in conservation and restoration practice (Kleiman, 2016b).
- ▶ Restoring grassland habitats requires frequent fire. It is important to build an effective and well-trained team to undertake prescribed burns and to start each season with wide fire breaks that are mowed short.
- ▶ Never give up on weed management. Weed control requires repeated treatments and a variety of approaches. Avoid planting in areas with weed infestations. Only plant areas if there is sufficient seed for successful native species establishment. Small plantings tend to have fewer weed problems and produce abundant seed for future plantings (Kleiman, 2016b).
- ▶ Reseed with high diversity seed mixes from the beginning and use a large quantity of seed. It takes about 45–67 kilograms of uncleaned seed per ha (40–60 pounds/acre) to ensure that native plants establish instead of weeds. Seed mixtures can contain seed from over 200 species (Kleiman, 2016b).
- ▶ Invest in monitoring, scientific research, and partnerships with researchers. Focus research efforts on questions to inform practices (Kleiman, 2016b).



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more**

Further information and resources

Storymap Nachusa Grasslands Preserve, The Nature Conservancy in Illinois: <https://storymaps.arcgis.com/stories/8e7c9096777d4fb99396c52dc2e6b2f3>

Video, The Nachusa Grasslands - An Illinois Story: <https://www.youtube.com/watch?v=jczplT4OUFw>

Video, Friends of Nachusa Grasslands: <https://www.youtube.com/watch?v=Heb5mQ9g43E>

Article, New York Times “Setting Fires and Restoring an American Landscape”: <https://www.nytimes.com/2018/04/23/science/prairie-fires-nachusa-illinois.html>

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Prairie Smoke Annual Reports: <https://www.nachusagrasslands.org/prairie-smoke-annual-reports.html>

Al Jazeera TechKnow “Bringing back the bison”: <https://www.aljazeera.com/program/techknow/2016/9/11/bringing-back-the-bison>

Video, Bison Babies Broadcast: <https://www.youtube.com/watch?v=oLJoVS4qpss>

Nachusa Grasslands Plant List 2020: https://www.nachusagrasslands.org/uploads/5/8/4/6/58466593/nachusa_plant_list_2020.pdf

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A photograph of a sunset over a field. The sun is a bright yellow orb in the upper right, casting a warm glow over the landscape. The sky transitions from orange near the horizon to a pale blue at the top. In the distance, there are some structures or trees silhouetted against the horizon. A large black text box is overlaid on the lower half of the image, containing white text.

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