The Significance of Micro-Prairie Reconstruction in Urban Environments

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ABSTRACT An aggressive urban sprawl during the last half century has not only contributed to habitat disturbance and extirpation, as well as a loss of knowledge and appreciation for biodiversity. Across the United States, prairie reconstruction has been a very effective approach for developing sustainable landscape designs in city parks and other open spaces. The purpose of this work is to focus on restoration and reconstruction of selected micro-prairies as a vehicle for enhanced place-based education and to partially remediate the consequences of global climate change and loss of pollinators. From the coastal prairies of southwestern Louisiana, to the eastern edge of the prairie in western Pennsylvania, to the prairies of the bluff region in southeastern Minnesota, this paper presents the accomplishments achieved in the last 18 years of prairie restoration at the micro-landscape level. The micro-prairies presented here also serve as pollinator gardens, with areas that range between 200 m^2 and 10,000 m^2. They were restored between 1996 and 2006 and attract on average 140 visitors per year.

KEY WORDS biodiversity, micro-prairies, pollinators, sustainability, urban landscape

Fragmentation of the prairie ecosystem initiated by the settlement of the first Europeans in the Midwest region of the U.S. almost caused the complete extirpation of native grasslands in less than a century (Smith 2012). However in the last few decades, diverse groups of prairie enthusiasts have organized to restore grasslands in an effort also to reconnect the people who inhabit the North American plains with their environment. The aim of prairie restoration is to repair habitat; restoration includes reconstruction where a prairie is planted on plowed soil.

Current challenges to prairie reconstruction and restoration include an excessive reliance on extractive economies, the relocation of large numbers of people from rural areas to urban areas, and educational voids. The latter refers to problems in modern school curricula, which need to be more eco-driven to educate 21st century citizens to appreciate natural systems (Louv 2005, 2011) and sustainability (Borsari 2012). Over the years, these challenges contributed to an erosion of knowledge about habitat conservation, a dilution for environmentalism, and to a growing lack of appreciation for nature and ecological processes.

Current designs of large-scale farming systems continue to be viewed by many as a successful model of land management despite a massive consumption of oil and other oil-derived products (Jackson 2002). Critics of the present agricultural model have pointed out its major technical and economic limitations (Gliessman 2007, Jackson 2010, Borsari 2011) and paradoxes (Onwueme et al. 2008). In addition, the role that food production plays in affecting natural habitats, by amplifying carbon emissions to the atmosphere (Jackson 2010), is essentially unknown. In spite of serious warnings, industrial agriculture remains largely untouched by the compelling need to conserve habitat and resources, now to the point that land conservation reserve programs have experienced declining participation (Wilson et al. 2012). As the restoration movement is gaining traction to remediate the damages caused by large scale farming, there is an even greater need to reconstruct prairies within the urban communities now occupying portions of what was once the largest grassland ecosystem. These patches of reconstructed native plant communities are "micro-prairies", because their size may range from a few square meters to less than one hectare. Their educational value can be significant in supporting several models of placed-based education (Orr 1992, 1994, Apfelbaum 2009, Vidrine 2010) and remediating nature deficit disorder syndrome (Louv 2005, 2011) that has become pervasive since the massive urban sprawl of the 1960s.

Our objective was to showcase a selection of micro-prairie restorations that occurred over the last 18 years in various regions of the United States. Micro-prairies are the fulcrum of a vision for sustainable landscape design in towns and cities. These can serve as a vehicle to educate the general public about the numerous challenges and benefits of ecological restoration. Micro-prairies are both educational and demonstrational, and their reconstruction may catalyze large-scale restorations. If successful, this endeavor could reverberate at the macro scale across the agricultural landscape in the United States, and foster a form of restorative agriculture that could replace intensively managed monocultures with extensively managed polycultures, thus decreasing the use of non-renewable fossil fuels. This is not a novel concept (Jackson 2002, 2010), since we know that restoring biodiversity on the land is a good way to ameliorate soil, water, and climate problems (Altieri and Rosset 1996, Frison et al. 2011). This approach can be solidly founded in ecological theory and practices. The relationship of prairie restoration at the micro-

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and macro-scales is mutualistic. Prairie reconstruction on a micro-level aims at amplifying the value of restoration at the macro-scale, to achieve higher levels of visibility and accessibility, to insure environmental mitigation, and ultimately contribute to establishing a culture of conservation.

PRAIRIE RESTORATION, AGRICULTURE AND POLLINATION

The reconstruction of large-scale prairie systems uses the same tools and technologies employed in managing conventional farming systems. Although notable studies have demonstrated better productivity of diverse grassland (Tilman et al. 1996, 2006) and forest (Iverson et al. 1997) habitats when compared to agricultural systems, large-scale restorations are not immune from the need for costly resources (e.g., economic, energy, technological) to become established effectively. The environmental benefits of prairie restoration are easily observed because diverse prairie plant communities are resilient to environmental stresses. Also, they attract pollinators and other beneficial insects (Vidrine and Borsari 1999, Spivak et al. 2011). The prairie bioregion of the United States is endowed with some of the world's best soils because of its native biotic diversity and a climate favorable for agriculture. However, climate models for this region predict significant (>4°C) increases in average annual temperature, increased precipitation (25–30% increases in winter and spring), less predictable weather patterns, and increased frequency of extreme events (Union of Concerned Scientist 2009). The effects of climate change generally are predicted to be negative for the Midwest U.S. (O'Neal et al. 2005).

It is impossible to assess accurately the productivity of agricultural systems subject to unpredictable weather patterns, and this information void can exacerbate the effects of global climate change (Parry et al. 2004). Although not immune to the potential for these kinds of damages, industrial agriculture remains mostly oblivious to embracing systemic change as an approach to adaptation to global climate change. Policy development and enactment are often still in their infancy (Pielke 1998) and are typically slow to be employed. For these reasons, providing incentives to prairie restoration efforts becomes imperative more than ever, at every scale, to counteract the unpredictable consequences of a changing climate.

Micro-prairie restoration has been engaging city dwellers for decades, improving living conditions for many by generating vibrant green spaces and unique educational opportunities (Doherty et al. 2001, Vidrine et al. 2001, Diboll 2004). Within an urban context, permaculture can assist with the technical and philosophical tools most suitable for micro-prairie reconstruction because of its holistic approach to design and maintenance of systems. Permaculture is a branch of ecological engineering, which includes sustainable architecture and self-maintained horticultural systems modeled after natural ecosystems (Mollison 1999). A core of moral values (care for the Earth, care for the people, more even distribution of surpluses) leads to the tenets of permaculture design: observe and interact with natural systems, practice conservation, value diversity and multifunctionality of each element, capture and store energy, respond creatively to change, and integrate rather than segregate. These principles inspire the strategies (with major focus on water use, water quality and conservation of energy and resources) and the techniques to fulfill the goals of the design (Mollison 1999).

Soil quality plays a vital role in the successful establishment of diverse plant communities in the urban environment (Kefeli et al. 2007). However, the coexistence of micro-prairies, gardens, and city parks with sidewalks, buildings and parking lots is often challenged by soil contamination and poor fertility due to loss of soil organic matter. Therefore, generous applications of soil amendments and compost may become necessary prior to initiating any sort of restoration project on urban soils (Kefeli et al. 2007). However, in the experience of one of the authors, amending soils in prairie restoration usually caused excessive growth of weedy species, which shaded out seedlings of prairie plants and reduced their growth (Vidrine 2010). Established prairie plant communities enhance soil fertility and add various ecological services to the environment, fostered by living soil organisms and pollinators that facilitate the restoration process. Plant residues and other organic biomass become the low-energy input that soil organisms recycle into fertile compost, which amends the urban soil and regenerates its fertility.

Bees and other pollinators also demand great attention in the design and functioning of large and small prairies. Insects provide pollination services to the established plant community, and they can serve as predators, parasites, and parasitoids of noxious species (Nicholls and Altieri 2012). Spivak et al. (2011) pointed out the great loss in food productivity that may occur, should bee populations (both native and introduced) continue to decline. The homogeneity of agricultural landscapes, with large monocultures of corn and soybean, are biological deserts to pollinators. Canola and alfalfa fields provide some opportunity for bees to consistently collect nectar and pollen throughout the growing season (M. Spivak, University of Minnesota, personal communication). More gravely, the loss of habitat poses more challenges for the survival of bees and other pollinators. Despite the recognized needs for reconstructing refugia within farms (Vidrine and Borsari 1999) or farmscaping (Pickett and Bugg 1998), the typical agricultural landscape remains homogeneous. This landscape often is laden with toxic chemicals such as those of the neonicotinoid group, which have weakened the ability of pollinators to withstand disease (Spivak et al. 2011, Nicholls and Altieri 2012). Introduction of bees in micro-prairie systems becomes pivotal to the preservation of these species in a biologically diverse environment, allowing pollinators to forage successfully and continue to efficiently pro-

vide ecological services to cultivated and uncultivated plants within the city and beyond.

EXAMPLES OF MICRO-PRAIRIE DESIGN AND FUNCTION

Cajun Prairie Gardens

In 1996, a 1.4-ha rural lot on a washed-out rice farm near Eunice, Louisiana, was purchased by the Vidrine family. Approximately 700 m^3 of soil was moved onto the lot as a foundation for home construction. A modest lawn circumscribed the home, whereas the remaining property was developed into a series of gardens with native plants and cultivars. The land was mowed and interseeded for 3 yr. Numerous plugs were transplanted from prairie rescues and from restoration sites in Eunice, namely the Cajun Prairie Restoration Project (a 5.0-ha site) and the Louisiana State University [LSU]-Eunice Restoration Project [a 0.4-ha site]). These two restorations are about 24-yr old and also serve as outdoor classrooms and host sites for community efforts.

Approximately 1.0 ha at the Cajun Prairie Gardens is restored to prairie with ~250 species of native plants. These include the major grasses: yellow Indiangrass (*Sorghastrum nutans)*, big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), eastern gama grass (*Trypsacum dactyloides*), switchgrass (*Panicum virgatum*), and brownseed paspalum (*Paspalum plicatulum*). Numerous forbs include: compass plant (*Silphium laciniatum*), six species of milkweeds (*Asclepias* spp.), four species of blazingstars (*Liatris* spp.), three species of mountain mints (*Pycnanthemum* spp.), three species of bergamots (*Monarda* spp.), four species of obedient plant (*Physostegia* spp.), four species of coreopsis (*Coreopsis* spp.), four species of rudbeckia (*Rudbeckia* spp.), numerous pea species including four species of baptisia (*Baptisia* spp.) and many more. The blooming season extends from mid-February to the end of November. Numerous butterfly and dragonfly species are encouraged to visit and reside in the habitat, which is burned each winter, usually at the end of December. The prairie gardens are divided into a dozen smaller gardens divided by walking paths of mowed grass. These gardens propose a series of varied habitats in the original prairie: drier sites harboring typical prairie plants, mesic areas that are wet and hold water during much of the winter and host plants that tolerate damp sites. Additionally, the Cajun Prairie Gardens host wet areas that flood even during the summer and thus, accommodate species that tolerate hydric soil conditions. The latter sites contain numerous species of *Amsonia, Asclepias, Arnoglossum, Carex, Crinum, Hibiscus, Hymenocallis, Iris, Juncus,* and *Rudbeckia,* (Vidrine 2010). Throughout the year several tours are offered for horticulture, habitat restoration, biology classes for LSU-Eunice, LSU-Baton Rouge, University of Louisiana-Lafayette, and the Cajun Prairie Habitat Preservation Society.

The project was initially conceived as a family effort, and it has been the topic of several scientific papers previously presented at the North American Prairie Conference and for a recent book publication (Vidrine 2010). These gardens demonstrate the results of small prairie landscapes varying in size, moisture gradient, and plant diversity. Early spring provides a flush of color as tickseeds, Louisiana irises, milkweeds, and wild-indigos bloom. Small, diverse gardens with rather large and diverse insect faunas, usually emphasizing butterfly habitats and focusing on monarch butterfly (*Danaus plexippus*) preservation, serve as the focus of the gardens in late spring and fall. Midsummer into fall demonstrates large grass features, blazingstars, and compass plants, along with mass blooming of rose-mallows in the wet prairies. Every two weeks, a new cohort of plants is blooming, with peak blooms in March, May, July, September, and October. Each year, as the gardens undergo succession, the blooming seasons vary somewhat, yet diversity remains the gardens' essence. Diversity in species of blooming plants, diversity in seasonal color, and diversity in butterflies and other insects species are central themes. The most recent addition to the gardens is a muscadine vineyard. Muscadines are native grapes (*Vitis rotundifolia*) that have now been developed into a major, local, agronomic crop.

The ultimate goal of these prairie gardens and those of the Eunice area is to educate the local population in the school of natural landscaping with a focus on the native prairie—formerly a 1.0-million-ha feature in the southwestern Louisiana landscape. The Cajun Prairie is essentially extirpated and is reduced to a few small remnants along railroad rights-of-way comprising less than 25 ha. Thus, these small pieces of restored prairies are gardens representing the last bits of native habitat in southwestern Louisiana.

Slippery Rock University Restoration Site

This effort began in 1995 on a 0.8-ha barren expanse of Slippery Rock University of Pennsylvania that had been previously excavated of its topsoil. Pulverized limestone and compost were applied to facilitate soil reconstruction. Wildflower seeds were dispersed through the years whereas grass species (yellow Indiangrass, little bluestem, switchgrass) were transplanted as plugs. During its early stage of reconstruction, this prairie was revegetated with intended native and opportunistic species (Doherty et al. 2001). However, forbs of the family Asteraceae were interseeded more aggressively through the years to increase diversity and also to enhance the attractiveness of the site. This micro-prairie continues to serve undergraduate and graduate students at Slippery Rock University in a variety of science courses, and tours are regularly offered to the community and visitors by students residents at the associated Robert A. Macoskey Center. Yearly prescribed burns followed by seeding every spring contributed to increase plant diversity and evenness, while

displacing non-native weedy and annual species. Seeds were donated by Jennings Environmental Center, which is located about 6 km south of this site and hosts an original remnant prairie (Borsari et al. 2006). The latest botanic survey conducted with students of Slippery Rock University in 2009 listed 62 native species of forbs and grasses at this site (T. Reynolds, Slippery Rock University, personal communication).

Prairie Garden at Winona State University

The prairie garden was established in 2006 on a small space adjacent to the science complex buildings . This project was spearheaded by the senior author and during the first year, 168 undergraduate students enrolled in an introductory biology course for non-majors were engaged. We purchased seedlings of prairie grasses and wildflowers locally and transplanted them on site using groups of 20–24 undergraduate students. We transplanted 58 species (mainly wildflowers) in the fall of 2006; representative species included switchgrass, little bluestem, and Canada wild rye (*Elymus canadensis*). Since then, the prairie garden has been used for instruction in biology, ecology, geoscience and senior capstone research projects, involving on average 200 students per year.

Additional Micro-Prairies in Winona, Minnesota

Garvin Heights Park in Winona, Minnesota comprises 12 ha of dry bedrock bluff prairie, dry hill oak savanna, and southern dry-mesic oak-hickory woodland. The Mississippi River overlook within the park attracts ~50,000 visitors annually. Beginning in 2001, the City of Winona, Winona State University, and the Minnesota Department of Natural Resources partnered for park restoration and upkeep. Since that time, more than 200 volunteers have assisted in restoration activities in the park, and thousands of others have visited the site

After several decades without management, the Garvin Heights savanna site, formerly dominated by bur oak (*Quercus macrocarpa*), became overgrown with buckthorn, with mature plants, saplings, and seedlings comprising >80% of the sub-canopy and ground cover in 2003 (C. A. Jefferson, Winona State University, personal communication). We first removed buckthorn on the savanna site in 2004. We treated cut stems with the herbicides (e.g., triclopyr and glyphosate) and burned all brush on site. In late summer 2005, we removed buckthorn seedlings and young saplings on site for a second time and treated cut stems with herbicides. We attempted spot burns of the savanna in late spring 2007 and 2008, but their effects were minimally effective because of the lack of fuel. After buckthorn was removed, we purchased and subsequently applied native shrubs and the seeds of savanna forbs and grasses locally to the site. We restored an old, steep trail through the savanna with original limestone steps and new landscaping timbers, which now serves as a scenic overlook for several hundred hikers each week.

The Southeast Tech site (0.38 ha) is located on the campus of Minnesota State College Southeast Technical in Winona, Minnesota. We planted mixed native grasses and forbs in 2004 on a portion of a mowed grass lawn (soccer fields) adjacent to a truck drivers' training course. We restored the site under the direction of a regional prairie restoration company with funding from a state grant. We seeded different plant communities along the length of the site to correspond to soils changing from heavy silt-clay on one end to light sand at the other end, and these communities provide a continually changing landscape of blooms throughout the growing season. The site is bordered by mowed grass fields and a residential neighborhood, and the area is mowed annually in the fall. Small trees are scattered along one side of the restored prairie. The site has provided transplants and seeds for other prairie restoration sites within the city; the work was conducted mainly by university students enrolled in plant ecology classes.

The Valley Oaks site (0.81 ha) is located in a city park in Winona, MN, on a hillside with a 20–30° slope and a westerly aspect. As a former horse pasture, it was mowed regularly for ~10 yr after becoming a park. Various bluebird nest boxes have been present on the site for >20 yr. It is dominated by smooth brome (*Bromus inermis*), goldenrods (*Solidago* spp.), Queen Anne's lace (*Daucus carota*), and rough bedstraw (*Galium asprellum)*, with small (<5 to 20 m^2) patches of reed canarygrass (*Phalaris arundinacea*). The site is bordered by mowed parkland with scattered trees and shrubs, residential lawns, and forest, and it is within 400 m of a native dry bedrock bluff prairie.

Beginning in 2006, the city granted permission to Winona State University to restore the site to native grasses and forbs. We planted seeds of native grasses and forbs on 20 cleared and tilled plots in late fall. We mowed plots twice annually for two years to encourage seed germination and reduce shading and competition. We seeded six and nine additional plots in 2010 and 2012, respectively. University students were involved with the restoration, including gathering seed from a nearby prairie for the 2012 plantings. Park users and nearby residents hike through the site on a daily basis, and local students use the site as an outdoor laboratory.

Meadowmakers

The Meadowmakers' habitats consist of 40 prairie patches ranging in surface area between 0.02 and 0.40 ha. These are located in Pearl River County, MS, on a parcel of approximately 4.0 ha that was purchased in 1997. The purpose of this restoration project was to establish a source of viable germplasm for more prairie restorations in the coastal prairie region adjacent to the Gulf of Mexico and to test the adaptability of this seed source to the broad variety of soil types.

Three consecutive years of plantings were accomplished since 1997 using seed collected from previously restored prairies and prairie remnants in three Louisiana parishes: Acadia, Jefferson Davis, and St. Landry Parishes. Also the Cajun Prairie Habitat Preservation Society restoration site in Eunice, LA provided seeds (Vidrine et al. 2001). Meadowmakers also included 0.4 ha of land devoted to plantings of Jackson Prairie and Black Belt Prairie species with seed collected from roadside Black Belt prairie remnants in four counties in Mississippi (Scott, Clark, Oktibbeha, and Noxubee) and from Sumter County, Alabama. A parcel of 0.4 ha was left untouched to observe the natural process of succession undergone by the land in this southern region. Bahia grass (*P. notatum*), which dominated the site prior to restoration, was tilled into the soil by hand just before seeding. We transplanted plugs of some grasses and forbs from remnant prairies to inoculate the soil with fungi and other beneficial organisms as recommended (Kalevitch and Kefeli 2007, Kefeli et al. 2007).

After 16 years, the Meadowmakers project includes approximately 250 different species of grasses and forbs. This project continues to serve effectively as a demonstration site for establishing native grasslands in this southern region of the United States. The site is visited regularly by students, prairie enthusiasts, professional landscape architects and National Forest and Wildlife Area managers. Meadowmakers' habitat has been a destination for numerous groups and individuals, as well as a significant source of inspiration to local leaders in the prairie restoration movement to restore native grasslands to the coastal region. Typical management practices at Meadowmakers include prescribed burns and selective chemical control of Chinese privet (*Ligustrum sinense*) that continues to dominate the hydric soils of this site. Both annual management practices are normally carried out during the winter months.

Large-scale agriculture continues to maintain a dominant role in shaping the traits of a landscape that was once dominated by grasslands, and its management practices negatively affect the biodiversity, soil fertility, and water quality of a majority of rural environments. Thus, the idea of micro-prairie reconstruction in the urban context, where land and open space are limited, becomes a viable model for sustainable landscape rehabilitation, design, and education. The biocenoses established in micro-prairies amplify the capability of these habitats to regenerate soil fertility and create buffer zones that retain and detoxify polluting substances while limiting water run-off and sedimentation (Jariel et al. 2010, Kalevitch et al. 2006, Neri 1998). Facilitating soil biocenosis to maintain humification processes while also fixing carbon from the atmosphere into the soil assists in reducing the ecological footprint of cities (J. Gonzales, Get Outdoors Houston, personal communication). Carbon fixation and its subsequent conversion from biomass into humus is achieved by a variety of soil biota. This ultimately enhances additional root growth in plants, thus preventing soil erosion and making this a vital process to the sustainability of human-designed systems (Altieri and Rosset 1996). Soil disturbance and erosion reduce soil diversity, and excessive tillage (with concomitant oxidation and mineralization often amplified by fertilizers applications) reduces the organic matter content of soils (Neri 1998).

Any process of soil rehabilitation through prairie reconstruction can be pursued more rapidly and efficiently on the micro-scale than in large fields. During the early stage of prairie reconstruction on large fields, topsoil can be more easily lost to erosion as a consequence of disturbance from heavy, mechanical implements. Therefore, the environmental benefits of restoring prairies can be expected when these are reconstructed on small plots (Kefeli et al. 2007, Jariel et al. 2010).

Another seminal feature of micro-prairies is education, as a majority of city dwellers have been removed from the land for at least a generation (Diboll 2004, Borsari et al. 2006). Developing small prairie patches within cities becomes an effective vehicle to reconnect large segments of modern society with nature, ecology, food webs, and sustainability, while also developing local economies and improving cohesiveness, sense of purpose, and health for communities (Hynes and Howe 2004). Within the conceptual framework of micro-prairie restoration, the role played by community members becomes pivotal to its success, as this effort strives to bring together the largest number of people from across the spectra of age, social status, and culture. Also, the restoration of micro-prairies employs appropriate technologies for the context in which it is taking place. Additional attributes distinguish the two paradigms of prairie restoration/reconstruction (e.g., micro-prairies versus macro-prairies) here discussed, yet despite their differences, they complement each other equally. They both have potential for directing the future of prairie restoration toward higher levels of sustainability, if they comprehend their roles in fostering a culture for habitat and maintaining quality of life, and if they will avoid operating in isolation.

For several decades, reconstructed and remnant native prairies of the Midwestern U.S. have provided tremendous opportunities for prairie enthusiasts to learn about the complex dynamics of biodiverse systems, while attempting to also transfer this knowledge to the cultivated field (Jackson and Jackson 2002). For instance, a study on restored prairie plots demonstrated the greater efficiency and productivity of diverse fields when prairie grasses and forbs were grown in polycultures (Tilman et al. 2006). In contrast, monocultures of crops for alternative energy sources have often amplified both the environmental degradation and the erosion of agrarian systems (Kalevitch et al. 2006). Continual soil disturbance typical of large-scale agriculture leads inevitably to erosion, salinization and loss of biodiversity. We realize that these indirect, environmental costs should be avoided at all

times to insure that lands remain productive and resilient, especially at times of climatic unpredictability. It remains unknown, however, at what level biodiversity may complement successfully the viability of sustainable farming practices. Recent studies have indicated that without maintaining an appropriate carbon balance in the soil, productivity declines to the point that even farming may come to an end (Neri 1998). Restoration ecology (Urbanska et al. 1999) and permaculture have potential for rehabilitating agroecosystems at the macro- and micro-scales with the ecological services they provide, while adaptive management of these multifunctional systems also becomes the tool for coping most successfully with unpredictable and sudden weather changes.

Micro-prairies cannot compete with large, restored prairies in terms of biodiversity, nor for restructuring habitats that can support large, keystone species. However, their potential for insuring opportunities for reconnecting people with nature while improving both environmental quality and the quality of life within cities are not negligible. A patchy landscape of prairie gardens in urban environments can become very attractive and ecologically productive, and its efficiency has been demonstrated by the success of small-scale prairie restoration in various regions of the U.S. (Doherty et al. 2001, Diboll 2004, Borsari et al. 2006, Vidrine 2010). While these systems cannot compete with the productivity and beneficial environmental impact of large prairies, micro-prairies provide services that larger grasslands communities cannot. Among these are the greening of the urban environment, the reduction of sedimentation and non-point-source water pollution, and the improvement of air quality. Moreover, micro-prairies serve as a creative form that aesthetically blends with the built environment while providing relief from stress to its inhabitants (Hynes and Howe 2004).

Micro-prairie systems are easily accessible to all and are managed in a manner that allows anybody to become involved. Thus, they acquire a true heuristic character because they are visible and offer great opportunities to bring the community together. In this context, restoration efforts become valuable, educational and democratic, even if they are accomplished on the smallest parcel of land. These and similar demonstration, postage-stamp prairies rely more on peoples' imagination, creativity and usage opportunities and possibilities. They can reflect a new, distinctive culture of landscape design and habitat restoration. They can be grassroots and serve the purpose of reconnecting human communities with the prairie ecosystem and our natural resource base. The micro-scale approach to prairie restoration or reconstruction becomes the vehicle to improve quality of life in the urban environment, and to reconsider the role and position of humans in nature (Hynes and Howe 2004). Therefore, sustainability can be pursued more holistically when prairie restoration at the micro-level merges with large-scale restoration endeavors.

The micro-prairie restoration paradigm is connected, aware and informed about the restoration issues, which are typical of large scale restoration efforts and prairies. Its alternative design, management, and more limited resource needs inspire macro-prairie restorationists to research more sustainable methods to achieve and maintain the self-sustaining productivity of these systems. The flow of knowledge between the two prairie restoration models (micro-prairie and macro-prairie) is centripetal, transparent, holistic and leads eventually to a unified paradigm, which is striving toward bringing the prairie back 'home'.

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