

POCKET PRAIRIES: Bringing Big Biodiversity to Small Spaces

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Prairies, grasslands, and savannas

Prairies are one of the dominant ecosystems in central North America. They are an incredibly complex and diverse environment that evolved alongside the animals, plants, and climate that have shaped the region for thousands of years. This coevolution has resulted in the prairies becoming the ideal ecosystem for the middle of North America. These prairie grasslands are home to a diverse range of animals. Large herbivores like elk (*Cervus canadensis*), American bison (*Bison bison*), and deer (*Cervidae*) graze over large swathes, while rodents like the American badger (*Taxidea taxus*), plains pocket gopher (*Geomys bursarius*), and prairie vole (*Microtus ochrogaster*) burrow underneath the soil. Many species of birds soar overhead, like songbirds, waterfowl, and birds of prey. Pollinators are also dominant in this ecosystem and rely on the native flowers to survive. Monarch butterflies (*Danaus plexippus*) use these prairies as highways to migrate from Canada to Mexico and back. Many other types of butterflies and bees also roam around pollinating plants, sustaining their growth. These prairie ecosystems provide a valuable and specific resource to both the animals that reside in them and to humans who dwell nearby. Prairies can also hold strong cultural and recreational significance. In Native American culture, prairies have historically been places that many tribes called home and held as sites of religious or spiritual significance.

Prairie plants help remove carbon from the air, and when plant roots die, they break down and deposit the stored carbon into the soil, creating a cyclical, healthy environment. Prairie soil health is greatly improved by the degradation of dead plant material, as it allows a significant amount of organic matter to be recycled, which increases the carbon-storing capacity of soils. With so much organic matter, these soils have a higher water-holding capacity than their non-prairie counterparts. Due to this high water-holding capacity and a high water infiltration rate, prairie lands have become flood-adverse. These factors, along with the existing and plentiful plant roots, greatly reduce runoff of both soil and nutrients.

There are several types of prairies in the United States, which are categorized by the types of plants found in them. The three dominant prairie types are tallgrass prairies, mixed-grass prairies, and shortgrass prairies. The mixed-grass prairie functions as a transition area between the tall and shortgrass prairies. Prairies are characterized by the amount of water they receive, with tallgrass prairies getting the most rainfall, while shortgrass prairies often receive much less and are therefore more drought-tolerant. Tallgrass species are typically found around rivers, streams, or areas where rain pools, while shortgrass species grow on elevated areas like hills. This leads to mixed-grass prairies being divided up based on proximity to available water, as water will drain from high areas to pool in lower places. These three prairie types are found in Texas, with tallgrass prairies found in Eastern and Central Texas, while mixed-grass prairies are concentrated in Central Texas, and shortgrass prairies in West Texas and the Panhandle.

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Tallgrass prairies

There are several tallgrass prairies in Texas; these include the Blackland Prairie, found between Dallas, Waco, Austin, and San Antonio, and the Coastal Prairie, which spans from Houston and Galveston through Corpus Christi to the Rio Grande Plains, as well as several others. These prairies are characterized by tall grasses, mainly the big four grasses of Texas, which include big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), and switchgrass (*Panicum virgatum*). These grasses are C4 plants, which means they are highly energy-efficient and are normally found in warmer climates.

Tallgrass prairies are typically high in biodiversity of plants and animals. The effect on land due to the impact of animals and environmental issues is called a “disturbance,” and these prairies have developed a heavy reliance on disturbances due to annual bison migration and grazing, as well as wildfires. They have evolved to thrive on disturbances, so they are very hearty. Tallgrass prairies are found on land that is also highly productive with plentiful rainfall. This has resulted in prairies that are successful in producing large amounts of forage. Ironically, this productivity was ultimately their downfall as they became prime locations for farmland or other agricultural practices and were heavily affected by the European settlement of North America. Pre-settlement, there were about

60 million hectares of tallgrass prairies in central North America, but currently that number is just 1 percent of its original area. In recent times, there have been efforts to try to restore these prairies, but it is impossible to rebuild them fully. Currently, they are facing issues like urbanization, land fragmentation, invasive species, fire suppression, and agricultural practices (Steinauer & Collins, 1996).

What is a pocket prairie?

Urban areas are often very uniform and lacking in biodiversity. Just picture the typical side-by-side yards of St. Augustine grass (*Stenotaphrum secundatum*) with landscaped shrubs that make up entire neighborhoods. This is a huge problem, as the land these were built on was biodiverse, and the animals that needed those plants are still here. Prairie-dependent species like the monarch butterfly travel across most of the United States as they migrate from Canada to Mexico and back. Unfortunately, the prairies they rely on are mostly gone, and this is where pocket prairies can provide islands of habitat. Pocket prairies are small-scale, environmentally accurate prairies, less than 1 acre (roughly 4,047 square meters). These areas can create a haven of native plants in an often uniform urban environment (Fig. 1). This can support all types of native wildlife depending on the size and location of the pocket prairie. There is no lower limit to the size of pocket prairies, and even the smallest area can support

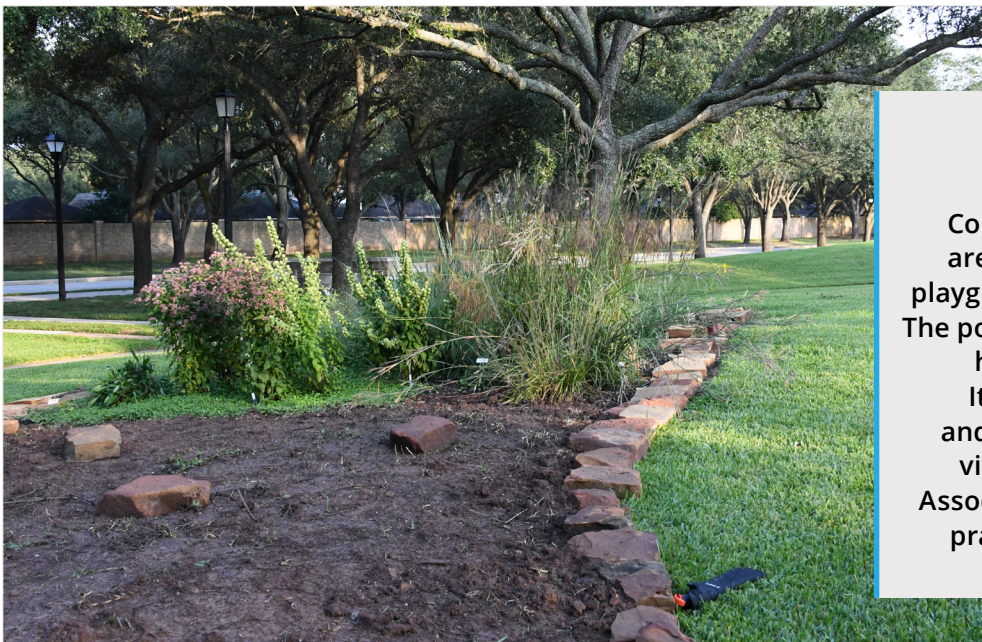


Figure 1. A mature pocket prairie (background) with room for a new expansion (foreground) located at Colony Grant in Sugarland, Texas. This area is primarily a walking park with a playground located in one of the corners. The pocket prairie was planted on a small hill to reduce water and soil erosion. It was modeled after a mixed prairie, and the plants were selected based on visual appeal. The local Homeowners Association (HOA) requested this pocket prairie, as the park is highly trafficked and near a main road.



Figure 2. This pocket prairie was planted in October of 2020 at Colony Grant in Sugarland, Texas. It was added as an expansion to an already existing pocket prairie and is located in the Gulf Coast Prairies and Marshes ecoregion. The photo was taken after the pocket prairie was planted.

native insect populations. On a larger scale, native plants can support birds, mammals, reptiles, and even amphibians. Pocket prairies also help indirectly by giving urban-locked individuals the opportunity to interact with a native environment, even if it is on a small scale. Doing so can allow people to build their knowledge base and feel more connected to the environment. This will influence their beliefs and actions when it comes to environmental protection policies and can possibly inspire them to build their own pocket prairie or even a small garden in their yard.

Pocket prairies can be built with whatever native plants are desired if native habitat plant species are selected for that specific area (Fig. 2). What plants are chosen can vary based on style, maintenance, size, and animals they intend to help. A good example of a specific pocket prairie would be a butterfly garden. These are created with native plants that specifically attract butterflies while potentially excluding other plants. This is not a bad thing, as any pocket prairie is good as long as it has native plants specific to the target ecosystem. Anything is always better than nothing.

Why do pocket prairies matter?

Urbanization

Urbanization is the process of transforming rural lands, rangelands, and prairies into areas of residential, commercial, or industrial development. Due to the encroachment of farmlands and residential

areas on prairies, there has been a massive decline in grasslands. Not only does this development reduce the total area of prairies, but it also causes habitat fragmentation, breaking native areas into small, separate sections that create functionally stunted spaces for native wildlife. This can lead to the disruption of the natural ecological process of the area, which may lead to the death of animals, as well as isolating the habitats of those that still call it home. These smaller habitats cannot support as many animals, and animals that were already in trouble will have more issues surviving. Urbanization also hurts migrating species due to the lack of native habitat along their routes, as these critters must travel longer distances over areas with little to no places to rest and recover. Pocket prairies can counteract this issue by functioning as small refuges or stepping stones for migrating animals, creating a continuous path if properly located near one another.

Another issue caused by urbanization is the edge effect. The edge effect occurs where two different habitats border each other. Urbanization creates a lot of these different habitats, resulting in increased predation or weather exposure and a vulnerability to invasive species. Unfortunately, pocket prairies cannot eliminate the edge effect, but they can mitigate some of their negative effects. Pocket prairies cannot create an interior habitat as they are too small and will always be classified as a 100 percent edge habitat. However, they give native plants a space to fight back against invasives and to create a functional habitat in areas designed to look good, no matter the environmental cost. A small prairie will always be better than no prairie.

Endangered species

According to the Native Prairie Association of Texas, the “tallgrass prairie (is) the most-endangered ecosystem in North America,” with only about 1 percent of its original area remaining. Something must be done to preserve prairies and the animals that live in them. Most animal species rely on the plants found in prairies, and with the current decline, many species have been decreasing in number or have even become endangered.

One relevant and relatable example is the monarch butterfly, which is listed as a threatened species by the Endangered Species Act (ESA) (Fig. 3). The diminishing numbers are largely due to the reduction in crucial milkweed plants that monarch butterflies base their entire lives around. Milkweed has a special milky latex sap that is poisonous to most species, except monarchs, which have evolved to tolerate it. Monarch butterflies lay their eggs on milkweeds, which the larvae eat once they hatch. This diet makes the caterpillars poisonous, helping protect them from predators. The caterpillars also help the milkweed by getting rid of its toxins and allowing it to regrow faster. Due to this relationship, monarch butterflies and milkweed rely on each other, and the decline in prairies has led to a decline in milkweed, which, in turn, has led to a decline in monarch butterflies. The development of pocket prairies, especially ones focusing on milkweed, can repair this relationship and restore monarch butterfly numbers, along with other species that share similar symbiotic relationships with native plants.

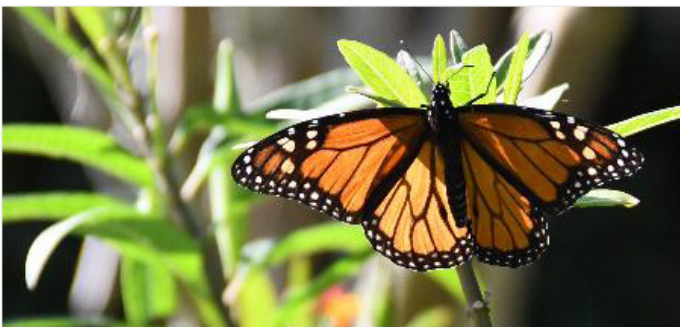


Figure 3. Monarch butterflies are one of the first animals to begin using the pocket prairie. This is largely due to monarch migration, which allows them to discover new locations more easily. Other species may take longer to start utilizing a pocket prairie.

This is not the only way pocket prairies help endangered species, either. Oftentimes, they can act as a safe space for endangered plants where they can be protected and cared for while restoration takes place in the wild. This can even lead to prairies becoming seed banks that supply these restoration efforts. It is not just wildlife that benefits from pocket prairies.

Where to build a pocket prairie

Long answer short: anywhere possible (Fig. 4). However, it is important to first assess the site. Carefully choosing a location and plants to match that specific area will ensure the long-term success of the pocket prairie.



Figure 4. Local park in Sugarland, Texas, before a pocket prairie was added. Some concerns included weekly maintenance and lacking biodiversity or wildlife. The park is mainly made up of St. Augustine grass, creating a monoculture park that is ill-suited for native animals.

Sun

Most plants native to prairies require plenty of sun. So, choosing a location that is exposed to the sun for the majority of the day is crucial. It is still possible to plant pocket prairies in shadier areas, but then it is important to choose plants that thrive in more shade.

Soils

It is helpful to know what soil type is in the area before work begins. The soil type can affect which plants will ultimately be more successful. Factors like drainage, organic matter, root support, and nutrient availability are all dependent on soil type. A great

website to check the soil's properties is the [Web Soil Survey](#), which allows users to input their address and access a variety of data about their soil. This website also gives insight into soil depth, which is important to see how far a plant's roots can go down and what nutrients and water are available at those depths. Another factor to consider is soil pH. Soil pH is not crucial, but it can help a lot with plant selection, although native plants are resilient to different types of soil. Soil pH can be found using a test kit, and once pH is known, suitable plants can be selected based on the site's soil conditions. In addition, the soil could be amended prior to planting with any fertilizers or minerals.

Work with local communities and non-profit organizations

Finding other nearby sites suitable for a pocket prairie can be daunting, but places like schools, churches, HOAs, and city governments are often open to the idea of creating such spaces. Another approach is to contact garden clubs or local conservation groups. There are local chapters of state organizations like native plant societies and national organizations, such as the Xerces Society or the Center for Plant Conservation, in many areas, and they are great resources for locations, information, and contacts. As one example, a pocket prairie and pond were created by working with the neighborhood HOA. A space in a park that was previously a large field was converted into a pocket prairie. The HOA even funded the project, while a volunteer contributed to the physical labor. Currently, that pocket prairie is being maintained by the neighborhood native garden club and is still going strong today!

When trying to reach out to people about projects like this, it is helpful to know who to talk to. If possible, find someone who is also passionate about the environment or even just someone who loves plants. If that is not possible, talk to the person in charge, but be prepared with a detailed and complete plan with photos or sketches highlighting the benefits of a pocket prairie, and include a plan for future maintenance. Having a well-designed and simple plan is going to make the project more manageable for someone who is not familiar with pocket prairies. It is also important to be upfront about the costs and

potential downsides, as fostering a good relationship where both parties understand all aspects of creating and maintaining a pocket prairie will help down the line.

Other pocket prairies

When looking for a location to build a pocket prairie, an important factor to consider is the location of other pocket prairies. It is ideal if they are spread out from one another, as this can impact a larger area. This, of course, only applies if there are other pocket prairies and if there are other spaces available to plant one. A pocket prairie is always better than no pocket prairie, so plant away, even if it will be directly next to an already existing location.

How to build a pocket prairie

Size

Pocket prairies can range in size but are limited to less than 1 acre. Any bigger, and it is basically building a prairie, so choose a size that works for the location. An important factor to consider is that larger pocket prairies will require more labor to manage. Ideally, a pocket prairie should be managed with hand tools only, as powered tools can be very disruptive or destructive. Typically, smaller prairies should focus on pollinators, as they do not require as large an area, unlike other animals. Butterfly gardens are a great example of a small pocket prairie designed to fit a specific purpose. On the other hand, large pocket prairies can support more complex ecological systems.

Preparing the location

It is important to first remove existing plants in the location that will be planted (Fig. 5). There are many ways to do this, depending on the resources available, such as budget and labor. The four approaches of removal methods are organic herbicides, chemical herbicides, soil solarization, and manual removal. For an organic herbicide, mix a gallon of 20 percent vinegar, 2 ounces of orange oil, and 2 ounces of dishwashing soap. Spray this mixture on the plants in the area during the hottest part of the day, making



Figure 5. Prepping an area utilizing cardboard to get rid of the St. Augustine grass. This was done 6 weeks before planting began to allow for plants underneath the cardboard to die and start decomposing.

Before putting down the cover, consider watering the soil and mowing closely to reduce the plant matter under the cover. This will make the solarization process more effective. The area should be covered for 4 to 6 weeks to kill all plants.

Another approach is using cardboard as a sheet mulch cover, which will smother the grass. With cardboard, first remove all stickers and tape, then cover the area with at least one layer of cardboard, and then cover lightly with dirt or compost. Then add a layer of mulch to prevent weeds from growing in the exposed dirt. In this method, the cardboard will break down and provide carbon to the soil, which is incredibly beneficial. Lastly, another method is to physically remove plants, but this is not recommended as it will be very work-intensive and not as thorough as the other methods stated.

sure to cover all of the plants. Then repeat every 2 days or after rain until all plants are dead. One issue with this is that stubborn weeds will survive and may require more work. Purchasing a chemical herbicide is an option, although it should be a last resort. These herbicides kill everything and even harm the soil ecosystem. A healthy prairie is supported by healthy soils, and herbicides can kill worms, fungi, and beneficial bacteria that support plant growth. These herbicides can also stay in the soil for extended periods of time, affecting the plants added later.

A preferred method is soil solarization, which is simply covering the grass with clear plastic and letting the sun increase the soil temperature, killing the grass and other vegetation. Solarization also has many soil benefits as it helps break down organic matter, kills disease-causing pathogens, and increases nutrient availability. Soil solarization is only done with clear plastic, as it allows the sunlight to actually penetrate the cover and reach what is underneath.

Plant selection

The key part of a successful pocket prairie is selecting the correct plants (Fig. 6). Plants need to be native to the exact environment in which the pocket prairie is being built. If not, it is not a true pocket prairie, so take extra care to identify the specific ecoregion and what plants are native to it. Just because a plant is native to the state does not mean it is native to all regions of the state. There are many websites that will find an ecoregion by zip code. Google “ecoregions by zip code” or try bplant.org or the U.S. Environmental Protection Agency (EPA) [ecoregion site](http://ecoregion.site). Once the specific ecoregion is found, then search for the corresponding native plants. A great resource for Texas residents is the [Native Plant Database](http://NativePlantDatabase). This



Figure 6. Pocket prairie expansion conducted by Joseph Court around a small wildlife pond that was previously dug into the park. Mainly, forbs were planted in this area to create a more visually appealing look. This was done to appease the HOA while still maintaining a native focus.

database is managed by the Native Plant Society of Texas, which is a volunteer organization that works for the research, conservation, and utilization of native plants. This website also has a [map of local nurseries](#) that grow and sell native plants in Texas.

After locating a site and learning about plants native to the area, choose plants that fit the desired pocket prairie's aesthetic. For example, the suggested ratio of grasses and forbs is 50:50 in a native pocket prairie for more successful growth and maintenance; however, in nature, it is more like 80:20 grasses to forbs. If a pollinator garden is preferred, choose a higher ratio of forbs, with a specific focus on host or nectar plants best suited for the target pollinators. Another consideration is curb appeal: a smaller pocket prairie in the front yard of a suburban home will likely need to be planted with a careful choice of natives to look more landscaped.

It is important to know what plants are native to the ecosystem and what plants do well in the specific location. Plant hardiness zones are important to factor in when selecting plants for the area. These zones are grouped by areas based on the average annual extreme minimum temperature. Each zone is divided into 10-degree segments that are differentiated by numbers. There are also half zones that are differentiated by letters. For example, College Station, Texas, has a hardiness zone of 9a, which equals an average annual extreme minimum range of 20 to 25 degrees Fahrenheit (F). A great source to find a property's hardiness zone is inputting the zip code into the [USDA Plant Hardiness Zone Map](#). Once the zone is identified, begin selecting perennial plants that will survive in this area.

Pocket prairies with native plants can still be visually appealing. Select plants that are both native and aesthetically desirable. When selecting plants, make sure to check how they will look fully grown and when they will bloom. Choosing plants that bloom at different times will help to prevent gaps when the pocket prairie looks dead or sparse. Another consideration is selecting plants of different heights so that the prairie gives the appearance of depth and levels. Making sure the edges are clean makes it look much neater. Planting in clumps will help the pocket prairie look more coherent and not scattered, so think about putting groups of the same plant in one area to create a pleasing landscape.

Maintaining a pocket prairie

One of the major benefits of pocket prairies for a landowner is the extremely low maintenance required once the plants are established.

Water

During the first year, the plants begin to grow roots and settle into the soil. Watering the plants as they get established is crucial to their success. Make sure to water them frequently, especially during dry periods of the year. This will help the plants become stronger faster. After a year, the plants are established in the soil and can now rely on rainfall for water, so they may not require additional irrigation. For seeded areas, natural precipitation will supply most of their water requirement; however, some supplemental water may be required in extreme drought or to maintain a more attractive appearance. This is mainly a consideration for pocket prairies in yards that need to look a little more landscaped.

Mowing

Once established, a pocket prairie does not require constant attention. Unless there is an unusual weather event, these plants are highly capable of surviving and tolerating the environment. For most of the year, nothing needs to be done. However, once a year, in the spring—when temperatures consistently reach above 50 degrees F (10 degrees Celsius)—it is recommended to prune or cut back the plants. This is done to simulate natural disturbances that normally occur in the prairie, such as grazing or fires. The plants should be cut back to 6 to 12 inches from the ground, which can be done with a mower or by hand. It is recommended to do as much by hand as possible to limit unnatural disturbances. With most of the plants, the dead stems can be broken off by hand, which is very fast and easy. Leave the plant debris behind to provide a natural mulch and cover for any animals living in the pocket prairie. If there is too much plant debris, remove some so it does not hinder the growth of new plants.

Fire

A prescribed fire is also a potential tool for managing a pocket prairie if the size warrants. While it comes with risks, a properly prescribed fire can have great benefits. Fires can act as a natural reset for a pocket prairie because prairies have evolved to tolerate wildfire and even thrive due to the benefits of periodic burning. Conversely, many invasives will not be as resistant, so fire reduces weed abundance as native plants bounce back faster and can then crowd out other species. This can result in a decrease in herbicides or manual weed removal. This reset is also enhanced because fire removes much of the dead litter, which clears space for new growth to occur. Litter burning also helps to improve nutrient cycling, as dead plant matter will often trap nutrients inside, making them unavailable to plants. Under normal circumstances, the breakdown of this plant litter takes a long time to become plant available, but when burned, the dead plant litter releases many of these nutrients in the ashes, which makes it easily absorbed.

It is important to know how to burn a prairie before attempting to burn one. It is recommended to contact the local Soil and Water Conservation District, as they can advise on how to burn and who needs to be informed about the burn. The local fire department needs to be notified so they can stand by if things go awry. It is also recommended to contact the Prescribed Burn Alliance of Texas and find the local chapter, as they can provide help and advice for a specific burn.

Burning will work best in the early spring before growth begins. It is recommended that only half of the pocket prairie be burned at one time. Avoid burning every year, and aim for a burn every 2 to 4 years. A great way to burn is a 2-year cycle that alternates which side of the prairie is burned each time. Creating a firebreak by removing any vegetation between the two halves also helps to control the burn. If the pocket prairie is not large enough to burn only half, then burning the whole area will still be effective, although it may hurt the insect population.

Spring

The spring is a great time to get into the pocket prairie and weed out any undesirable plants. An effective way to get rid of these plants is by cutting them down

or pulling them out when they are not near other young plants. Pulling weeds can potentially cause damage to the root systems of surrounding plants, which during the growing season can stunt their growth, so be careful when pulling them. The spring is also the best time to mulch if desired or needed. If the plants are thick enough, they should act as natural mulch. If not, selecting the right mulch is important. Try to stay away from any dyed mulch, as it often does not decompose as well as organic mulch. Natural mulches can be made up of plant litter found around the yard, like leaves, compost, or pine needles. This is also the time to prune any winter damage on plants. Once the ground warms up, perennials can be planted if desired.

Summer

At this time of year, evaluate how the pocket prairie looks because summer is the time of year to remove any undesired plants. In addition, any plants planted in the spring should be checked on frequently as the temperatures begin to rise. The summer tends to be drier, and supplemental watering may be necessary to help these plants establish more efficiently, making them more successful long-term and giving them a better chance at survival.

Fall

There is not much maintenance needed in the fall. Much of the work that can be done is up to the property manager on whether or not they want it done. Any pressing issues would need to be resolved on a case-by-case basis. One thing that can be done is additional weeding, although there should not be much as the native plants would have been established by now. During the fall and winter, do not remove dead vegetation, as it is vital for animals in the winter months, providing them with food and shelter. Many insects overwinter in the stems of dried plants, so cutting them back too soon will destroy their habitat and likely kill those insects. Mulching can also be done at this time of year if wanted. Another thing to keep in mind is watering the pocket prairie in case of a drought. Just because temperatures are lower does not mean that plants will not suffer from overly dry conditions.

Winter

While plants may look dead in the winter, many of them are not. Even though the above-ground parts are brown, the roots continue to grow. So, continue watering plants if necessary, based on precipitation. For sedges and shrubs, pruning should occur at the end of the winter months, typically around late February to early March, depending on the area. Locations farther south will need to be pruned earlier than more northern prairies. This is done to make way for new plant growth.

Conclusion

Prairies all over the United States are at risk of destruction by development and land fragmentation, causing detrimental effects to ecological systems everywhere. With the widespread urbanization of land, pocket prairies might be the simplest and most accessible solution to the ecological puzzle, providing wildlife with a place to live and allowing everyone to benefit from the advantages of native plants. While these small sections of native plants may not restore large swaths of prairie land, they allow for safe havens for native animals that are not often found in urban areas. Every little bit of prairie matters in this fight as it helps to turn what was an environmental monoculture into a productive mosaic of native plants that not only helps native animals but also creates a healthier ecosystem as a whole. Creating a pocket prairie is not the easiest project to do, but it is definitely achievable, and its benefits far outweigh the cost.

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