

Restoring Your Degraded Grassland to Utility Prairie



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Funding for the development of this restoration guide was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR) through grant LCCMR092C. The Trust Fund is a permanent fund constitutionally established by the citizens of Minnesota to assist in the protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources. Currently 40% of net Minnesota State Lottery proceeds are dedicated to building the Trust Fund and ensuring future benefits for Minnesota's environment and natural resources.

Additional funding for the update and redesign of the guide was provided by a Working Lands Initiative grant from the Minnesota Department of Natural Resources.

Cover photo taken at Sheepberry Fen Preserve by Alison Mickelson, Greater Good Photography.



Restoring Your Degraded Grassland to “Utility Prairie”

In this guide, you will learn the basic steps to restoring a degraded grassland of native and invasive species to a utility prairie. The precise restoration actions will depend on the particular features of your site as well as your budget, preferences and project goals.

When planning your restoration, we recommend that you consult with restoration professionals to evaluate your site’s unique characteristics. Please visit <http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/minnesota/explore/prairie-restoration-guides.xml> for more information on who to contact or other publications that cover site assessment protocols.

What is utility prairie?

Utility prairie is designed to maximize production and palatability for forage, while still supporting basic conservation goals. It is distinguished from conventional hay fields and pasture by its emphasis on native species and greater diversity.

Compatible land uses include:

- Conservation grazing using cattle or bison
- Hay production
- Commercial seed harvest
- Recreational activities (e.g. hunting).

Conservation benefits include improved water quality, soil stabilization, and habitat for birds, animals and insects. Utility prairie can also serve as a buffer for other high-quality native prairies and increase the habitat area for wildlife species that depend on large contiguous areas of grassland.

Why restore degraded grasslands?

Grasslands that have a combination of both desired native species and invasive perennial weeds may be restored to reduce the coverage of invasive species and promote the health of the native prairie community. These sites include:

- Degraded prairie remnants that have never been plowed and have original prairie vegetation
- Low-diversity prairie plantings that have become invaded
- Prairies that were over-seeded with exotic perennials for pasture

The challenge of restoring these sites is to reduce the cover of invasive species while retaining the existing native species and increasing their abundance and diversity.

Selective vegetation control measures are used to reduce the cover of invasive species while avoiding damage to the natives present. This is particularly important on prairie remnants, where preserving original prairie vegetation is of paramount importance.

To enhance existing vegetation and increase native cover and diversity, prairie species are sown into the existing vegetation as opposed to into a prepared seedbed. This planting strategy is referred to as “interseeding” or “overseeding”. Special considerations must be made to species selection to avoid harming existing natives.

As a general guideline, consider using selective vegetation control measures on sites that have 25-75% of native prairie species and 25-75% invasive perennials and other undesired species. If any rare or threatened species are present on a site, selective measures should be used to preserve them. If the existing native species have been planted, are of particularly poor quality, or are of questionable origin (e.g. cultivars, or southern ecotypes), the site may be treated as an invasive-dominated prairie and

non-selective methods of control may be more effective¹.

This guide assumes that your site has moderate to dry soil moisture and has not been drained. Wet sites in particular are often invaded by reed canary grass, which can be particularly difficult to control. It often requires multiple years of repeated treatments. Relatively wet fields that have been drained via drainage tiles or ditches are better suited for restoring to wet meadow. This may require additional steps to restore the hydrology². If invasive trees and shrubs are present on site, additional removal strategies may be required³.

What will it involve?

Prairie restoration typically includes these basic steps:

- **Site Assessment**— Identify the site characteristics and define goals for the restoration.
- **Vegetation Removal** – Remove existing weeds and undesired vegetation from the site to prevent aggressive weedy species from out-competing native prairie plants.
- **Seedbed Preparation** – Prepare a seedbed to ensure good seed-soil contact and promote germination of planted seeds.
- **Seeding/Planting** – Select seed mixes and seeding methods that are well suited to the site and project goals. Or, in the case of small sites of less than half an acre, consider hand-planting plugs for quicker results⁴.

- **Establishment & Aftercare** – Control weeds and promote the establishment and growth of prairie plants through the first few years after seeding.
- **Long-term Management** – Maintain the health and diversity of native prairie into the future.

How long will it take?

Restoring a prairie invaded by exotic perennial weeds requires at least one full growing season of invasive species removal prior to interseeding. The more you invest in weed control up front, the less time and effort you will need to spend controlling weeds in the long term. After the year it's seeded, expect to spend at least three years on aftercare to ensure good establishment of the utility prairie. This period is referred to as the establishment phase of restoration.

After establishment, often around year 4, the long-term management phase begins. Management actions are typically less frequent and intensive than during the establishment phase, but are critical for maintaining the health and diversity of the prairie into the future.



¹ Refer to the restoration guide "Restoring your Invasive Perennial-Dominated Grassland to Utility Prairie" for more information on removing invasive species with non-selective control measures.

² Refer to the restoration guide "Restoring your Crop Field to Utility Wet Meadow" for more information on hydrology restoration.

³ Refer to the restoration guide "Restoring your Woody-Invaded Prairie to Utility Prairie" for more information on removing and controlling invasive trees and shrubs.

⁴ Plugs are young plants sold in 4- or 6-packs. Plugs cost substantially more than seed, but they establish rapidly and can produce a resilient and visually appealing meadow more quickly than seeding, so it is often a preferred option for smaller sites.

What will it cost?

The cost of the restoration will be influenced by:

- Management level required to control weeds
- Species and number of species selected for the seed mix
- Cost of seed, which fluctuates from year to year
- Labor and equipment available for the project

The cost estimate in this document will give you a baseline for what you can expect to spend through the initial establishment phase of your restoration (i.e. through three years after seeding). It may be tempting to cut costs by reducing the number of species planted or the frequency of weed control activities. Be aware that these investments on the front end can actually save costs in the long run. A healthy and diverse prairie will be more resilient to disturbance, invasion by exotic species, and extreme weather events such as drought.



Degraded Grassland to Utility Prairie Restoration Guidelines

Site assessment

A successful prairie restoration is highly dependent on specific characteristics of a site. Important considerations when planning a restoration include:

- Has the site had herbicide treatments that would prohibit seed from germinating?
- Is there a risk of herbicide drift from neighboring cropfields?
- Are the soils dry, moderate or wet?
- Are there steep slopes that may be vulnerable to erosion?
- What types of vegetation are currently present on the site?

If you are new to prairie restoration, we strongly encourage enlisting someone who has restoration experience to help you assess the characteristics of the site and develop a restoration plan suited to your site's specific features and your project goals.

Vegetation removal

When restoring degraded grasslands, the primary challenge of vegetation removal is to control aggressive invasive perennials with minimal harm to the existing native vegetation. If the native vegetation includes only a few very competitive native species, it may also be important to reduce these species to allow new species to grow and increase the site's diversity. Activities prior to seeding typically include a fall burn or mowing and selective vegetation removal to allow interseeded natives to establish.

Recommended protocol:

- Burn the entire site in the spring or fall, or mow/hay in the summer to remove thatch.
- When regrowth of invasive perennials reaches 4-6 in. height, selectively treat with appropriate herbicide such as glyphosate.
 - To minimize damage to natives, herbicide can be "spot-sprayed" into larger patches using ATV-mounted sprayers, applied to smaller patches with backpack sprayers, or applied with a wicking device to individual plants.
 - When possible, dormant-season applications of herbicide can be applied to cool-season exotics without damaging warm-season native grasses. Caution is advised if native cool-season grasses and sedges are present on site.
 - See Smith 2010 (Chapter 4) and Packard and Mutel 2007 (Chapter 16) for lists of recommended herbicides.
- Repeat selective herbicide application when invasive perennial vegetation regrowth again reaches 4-6 in. height.
- Wait at least 2 weeks following last herbicide application to seed.





Native seed mixes should be planted with equipment designed to handle different-sized seeds ©Justin Meissen.

- If invasive woody species are present, saplings < ½ in. diameter can be herbicide-treated along with invasive perennials, but larger trees will require mechanical removal⁵.
- If reed canary grass is present, apply glyphosate in September for maximum effect.⁶
- Cropping is not recommended for degraded grasslands, and native remnants (unplowed prairie) should not be cropped or disked.

Seedbed preparations

Minimal seedbed preparation is recommended when interseeding into existing vegetation. This helps avoid disturbing the native species on site and bringing additional weed seeds and rhizomes to the soil surface. If invasive species are minimal and the site is dominated by a few highly competitive native species, selective disking or tilling (for example, in patches or strips covering 25-50% of the site) is sometimes used to reduce competition from existing natives and create openings for seedling establishment. However, if a diversity of native species are present, we recommend

⁵ Refer to the restoration guide "Restoring your Woody-invaded Prairie to Utility Prairie" for more information on controlling invasive trees and shrubs.

⁶ Refer to the restoration guide "Restoring your Invasive Perennial-Dominated Grassland to Utility Meadow for more detailed information on controlling reed canary grass.

avoiding soil disturbance and instead drilling seeds into newly burned ground after a spring or fall burn. Native remnants (unplowed prairie) should never be tilled or disked.

Recommended protocol:

- Forgo seedbed preparations to minimize soil disturbance and reinvasion.
- Burn, mow or hay prior to seeding to remove thatch (see vegetation removal).

Seeding

The key to establishing a successful prairie is to maximize seed to soil contact during planting.

If planting with a no-till drill, use a seed drill designed specifically to plant prairie grasses and flowers. Drilling into an untilled site can be hard on the drill. If the site is very rough, rocky or has numerous gopher mounds, broadcast seeding may be a better alternative. If broadcasting seed, native-seed broadcasters such as a Vicon seeder should be used. They are designed to spread mixes with different sized seeds.

If the site is remnant (unplowed) prairie, seeding should be undertaken with caution to avoid negatively impacting remnant vegetation, soil communities and wildlife. Seed mixes should exclude aggressive species that may outcompete existing vegetation, and species already present on site should not be planted unless the seed is harvested on site. Whenever possible, locally-harvested seed should be used, and species selection should be based on historical records and/or reference sites.

Recommended protocol:

- How to seed:
 - Drill seeds into existing vegetation with no-till drill such as a Truax following a burn or mowing/haying to remove thatch.
 - An alternative seeding method is to broadcast seeds and incorporate them into the soil with a light drag, such as a piece of chain link fence or a packer pulled behind the tractor/ATV while broadcasting seed.
- When to seed:
 - Planting dates will vary depending on the weather and location within the state. Consult with native seed suppliers or restoration specialists to determine the best planting dates for the year.
 - Growing season plantings should occur May 1 to July 1 OR when the soil temperature is at least 60 degrees F⁷. Spring/early summer seeding promotes warm season grasses.
 - Dormant seeding should occur Dec. 1 to April 30 OR after soil temperatures fall below 50 degrees F for a consistent period of time⁸. When possible, timing the seeding before a snowfall may help

prevent loss of seed that is consumed by wildlife over the winter months. Dormant seeding in late fall, also known as frost seeding, can be done with a seed drill or until the ground is frozen. Seed can also be broadcast over snow in winter/early spring, although results of snow seeding are more variable and dependent on weather conditions. Dormant seeding promotes cool season grasses and flowering plants.

- Seed mixes will vary but should take into account:
 - Consider soil moisture conditions of the site.
 - Choose palatable species that can tolerate grazing or haying.
 - Select a mix of both warm- and cool-season species to ensure availability of forage throughout the season⁹.
 - Avoid adding species that are already dominant on the site as they may out-compete other less common native species and lower diversity.
 - Cover/nurse crops are not recommended for interseeding.
- Design:
 - Seed the mix evenly across the site unless soil moisture is highly variable.
 - If there are wet to wet-mesic soils on the site, select a separate seed mix for wet conditions for these seeding zones¹⁰.

⁷ Summer seeding after July 1 leads to poor seedling survival and is not recommended for prairies.

⁸ Early fall seeding is not recommended for prairies, because seed may germinate too early and not survive over winter.

⁹ See [nature.org/MNPrairieRestorationGuides](https://www.nature.org/MNPrairieRestorationGuides) for more information on seed mix design and an example utility prairie seed mix.

¹⁰ See [nature.org/MNPrairieRestorationGuides](https://www.nature.org/MNPrairieRestorationGuides) for examples of utility meadow seed mixes appropriate for wetter soils.



Prescribed fire is an important tool in maintaining a utility prairie ©Chris Helzer/TNC

- Seed rate:
 - Plant at a minimum of 40 seeds/sq. foot to reduce risk of weed invasion.
 - If there is minimal weed pressure and excellent site preparation, the rate can be reduced to 30 seeds/sq. foot.
 - Increase rate to 50 seeds/sq. foot on steep slopes (3:1 grade).
 - Seeding rates may need to be increased by 25% for dormant seedings to account for lower germination rates and loss of seed to wildlife.

Post-seeding aftercare and long-term management

Utility prairie establishment generally takes 3 to 5 years but will vary depending on soil moisture and climate conditions. Early management (aftercare) is critical to preventing re-invading weeds and woody species from out-competing and displacing establishing natives.

Maintaining control of invasive perennials is the primary management concern in interseeded prairie restorations. However, existing native vegetation should also be carefully managed to promote rapid establishment of planted natives.

Post-seeding aftercare goals include discouraging weeds and encouraging rapid and

robust establishment of native species that can sustain grazing, haying and other uses. Management strategies during the establishment phase include:

- Mowing or haying to reduce competition
- Selective use of herbicide to control invasive perennials
- Prescribed fire to promote native prairie species and discourage further invasion
- Monitoring vegetation to evaluate establishment of prairie seedlings

Throughout the establishment phase and beyond, adjust management plans as necessary, including the option to reseed, to achieve the desired species composition and diversity.

Recommended management protocol:

Year 1:

- Mow vegetation to a height of 4-6 inches when it reaches a height of 12-18 inches to reduce competition from established natives and minimize thatch build-up. Most newly planted prairie plants will not reach this height in first year and will not be damaged by a mower. The frequency of mowing will depend on the height and density of weeds, and how much they are competing with the prairie seedlings for light and moisture.

- OR hay the site two to three times, removing mowed material to prevent thatch build-up. Expect low yields.
- Locate and spot-treat invasive perennials using appropriate herbicides and application methods that minimize damage to natives, such as dormant season application or spot-treatment with backpack sprayer or wick applicator. Avoid applying on windy days to prevent drift.

Year 2:

- Mow/hay field to 12-inch height twice. Once in late spring and again in mid-summer.
- Locate and spot-treat invasive perennials using appropriate herbicides and application methods that minimize damage to natives.

Year 3:

- Begin prescribed burns after three growing seasons or as soon as biomass accumulation is sufficient to carry a burn.
- Begin grazing or haying after three growing seasons, or when native grasses have achieved dominance.
- Mowing should no longer be needed. Spot-treat weeds as necessary using dormant season applications and/or back-pack sprayer/wick applicator to minimize damage to native species.
- Conduct stand evaluation to assess seedling establishment outcomes. If native plant density is less than 1 plant per square foot, interseed to increase cover and diversity.

Year 4 & beyond (long-term management phase):

- Burn at a frequency of every 3-5 years to stimulate productivity of native prairie

plants and prevent invasion of perennial weeds and woody trees and shrubs.

- Burn and hay in rotations, disturbing no more than one half of a field at a given time, to maintain diversity and a local refuge for wildlife. Suggested interval is to burn one-third of the field annually, so that each patch has a 3 year rotation.
- Graze at low to moderate intensities, or at stocking rates prescribed by a grazing management plan written to meet the objectives of the utility prairie. Avoid grazing in saturated conditions.
- Time burning, haying and grazing to allow sufficient biomass accumulation for each activity. For example, an alternating biennial rotation of grazing and haying within a 3-4 year burn rotation.
- Hay in late July or August to promote diversity and avoid grassland bird nesting season. Leave 6-8 inch stubble and regrowth for winter cover/spring nesting habitat.
- Adjust timing and intensity of burning, grazing and haying to maximize diversity and adjust species composition.
 - Grazing in late spring or early summer will favor warm season grasses.
 - Mid-late summer grazing will favor cool season grasses.
- Every 1 to 3 years, monitor vegetation composition and diversity.
 - Interseed as needed to increase native cover and diversity if native species are declining.
 - Adjust management plan, such as frequency and intensity of burning, haying, or grazing, if:
 - cover of native species is declining
 - desired composition is not being maintained

- cover of invasive species or undesired woody species is increasing
- Spot-treat weeds as needed by hand-pulling, back-pack sprayer, wick-applicator or dormant-season application.
- Temporarily increase burn frequency, such as annual burns for 2 years, if woody invasions increase in cover. Note that sustained burn intervals of less than 3 years will negatively impact cool-season natives and wildlife.



Cost estimate

The estimated cost to restore degraded grassland to utility prairie is \$1,306 per acre, based on 2013 prices. Costs associated with site assessment and project planning are excluded from this estimate. This cost estimate assumes vegetation removal includes two selective herbicide applications and one controlled burn (whole site), and the site is seeded with a no-till drill.

Post-seeding management costs include aftercare activities through year 3, specifically: ten mowing treatments, two selective herbicide treatments (spot-spray), and two controlled burns (burning no more than one half of the site per season). Actual project costs will be lower if a less-frequent mowing schedule is required. Long-term management costs are not included in this cost estimate but can be quite variable depending on site needs. Costs assume services and seed are purchased from restoration contractors and native seed nurseries.



Lead plant, white and purple prairie clovers, yarrow, and blue vervain on a restored prairie © TNC/Sue Chaplin

Useful references

Going Native: A prairie restoration handbook for MN Landowners – MN Dept. of Natural Resources
<http://files.dnr.state.mn.us/assistance/backyard/prairierestoration/goingnative.pdf>

Guidelines for inter-seeding to restore or enhance native species diversity – Minnesota Board of Water and Soil Resources
www.bwsr.state.mn.us/native_vegetation/inter-seeding.pdf

Invasive Plant Species Management & Identification – MN Dept. of Natural Resources
www.dnr.state.mn.us/invasives/terrestrialplants

Minnesota Noxious Weeds – MN Dept. of Transportation
www.dot.state.mn.us/roadsides/vegetation/pdf/noxiousweeds.pdf

Native Vegetation / Seed Mixes – MN Board of Water & Soil Resources
www.bwsr.state.mn.us/native_vegetation

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The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands. S. Packard and C. F. Mutel, editors. 2007. Island Press, Washington, D.C.

What's Working: Invasive Species Control – MN Board of Water & Soil Resources
www.bwsr.state.mn.us/practices/whats_working-invasivespecies