

Restoring Your Woody-Invaded Prairie to Utility Prairie



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



Restoring Your Woody-Invaded Prairie to “Utility Prairie”

In this guide, you will learn the basic steps to restoring a degraded prairie invaded by woody species (trees and shrubs) to 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 nature.org/MNPrairieRestorationGuides 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 such as 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 support threatened and endangered plants and animals that depend on large contiguous areas of grassland.

Why restore woody-invaded prairies?

Prairies that are not burned, grazed or mowed are often invaded by woody trees and shrubs. In Minnesota, the prairie-forest border shifts over time in response to changes in climate and fire frequency. Plentiful moisture and no fire favors woody species. Prairies are commonly invaded by red cedar, sumac, ash, boxelder and Siberian elm. As trees and shrubs take over grassland they create shade conditions more suitable for woody species and less suitable for prairie species. Controlling trees and shrubs in prairies is essential to protect and maintain functioning prairie systems.



For the purposes of this guide, we define a woody-invaded prairie as having a canopy cover of more than 10% trees and shrub thickets, and an understory dominated by native species (>75% cover), although this native understory may be sparse as a result of shading by trees and shrubs¹. Prairies are also often invaded by herbaceous (non-woody) perennial weeds. This guide assumes that woody invasion is the greater threat on a site, but if other invasive species are abundant (greater than 25% cover) they will also require control measures.²

Woody seedlings and saplings may be controlled by herbicide applications and fire, in a manner similar to invasive perennial weeds, but larger trees and dense shrub thickets require mechanical removal. The bare or

¹ Woody-invaded prairies are not the same as oak savannas. Oak savannas have a mature oak canopy and a prairie and savanna understory, and are a rare and highly-valued landscape.

² Refer to restoration guide “Restoring your Degraded Grassland to Utility Prairie” for more information on selective control of invasive perennial weeds.

sparsely-vegetated patches left behind after woody species removal are vulnerable to invasion by exotic species. Reintroducing prescribed burns will help promote greater biomass production and cover of prairie species. Interseeding may also prevent the encroachment of invasive plants by more quickly filling in the gaps left behind by tree removal.

This guide assumes that your site has moderate to dry soil moisture and has not been drained. 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 hydrology³.

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 and 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?

Removal of invasive woody species can be accomplished within a single growing season, depending on the extent of the invasion and resources available. Removal should precede interseeding with native species. The more you invest in up front weed control, 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.

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.

³ Refer to the restoration guide "Restoring your Crop Field to Utility Wet Meadow" for more information on hydrologic restoration.

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.



Light cedar invasion of grassland near Ordway Prairie ©TNC\Steve Chaplin



Heavy cedar and sumac invasion of grassland in the Glacial Lakes core area ©TNC\Steve Chaplin

Woody-Invaded Prairie 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

Woody-invaded prairies typically require a combination of mechanical removal, selective herbicide treatments, and prescribed fire to control invasive trees and shrubs and prepare the site for interseeding native prairie species. Tree seedlings and smaller saplings (diameter $\lt; \frac{1}{2}$ in.) can often be managed by reintroducing controlled burns, but larger trees require mechanical removal. In most cases, chemical stump treatment is also needed to prevent re-sprouting.

Equipment options include brush hogs, slashers, brush cutters and chain saws. The most efficient and effective methods of tree and shrub removal will depend on the species, size, density and spatial pattern of the targeted species. Degraded prairies that are invaded by trees and shrubs will often also have some herbaceous invasive perennials and other weed problems as well. If invasion is minimal (as we will assume for this restoration plan), they may also be controlled effectively with prescribed fire. However, if invasive perennials are vigorous and spreading, they may require selective herbicide treatments⁵. In most cases, tree and shrub removal can be carried out in a single season prior to interseeding utility prairie.



Recommended protocol:

- Cut dense brush thickets that are unlikely to be controlled by fire alone.
- Cut trees more than 1 inch in diameter with chainsaws or slashers.
- Treat stumps with appropriate herbicide, e.g. Triclopyr (Garlon 4), Picloram (Tordon), and glyphosate (Roundup).

⁵ Refer to restoration guide "Restoring your Degraded Grassland to Utility Prairie" for more information on selective control of invasive perennial weeds.

- Exception: red cedar does not resprout; stump treatment is not needed.
- Haul and pile woody slash using tractor-mounted skid steers or grapple attachments.
- If woody invasion is more extensive, slash should be piled and burned, or chipped in a woodchipper and removed.
- If woody cover is relatively low (<10%), slash may be distributed and left to rot or burn during a prescribed fire.
- Burn or mow/hay (4 in. height) site to kill woody seedlings and remove thatch (fall or spring prior to seeding).
- Invading stands of clonal species, such as aspen, may be controlled more gradually by girdling.
- Cropping and disking are not recommended for woody-invaded prairies and native remnants (unplowed prairie).

Seedbed preparations

Minimal seedbed preparation is recommended when interseeding into existing vegetation. This will avoid disturbing established natives, and bringing additional weed seeds and rhizomes to the soil surface. If invasive species are minimal, selective disking or tilling (i.e. in

nodes or strips covering 25-50% of the site) is sometimes used to reduce competition from established natives. However, when desired native species are present, we recommend avoiding soil disturbance and instead drilling seeds into newly burned ground after a spring or fall burn. Native remnants (unplowed prairie) should not be disked.

Recommended protocol:

- Forgo seedbed preparations to minimize soil disturbance and reinvasion.
- Burn 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.



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

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 F⁶. 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 time⁷. When possible, timing the seeding before a snowfall may help 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 season⁸.
 - 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 zones⁹.
- 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.

⁶ Summer seeding after July 1 leads to poor seedling survival and is not recommended for prairies.

⁷ Early fall seeding is not recommended for prairies, because seed may germinate too early and not survive over winter.

⁸ See [nature.org/MNPrairieRestorationGuides](https://www.nature.org/MNPrairieRestorationGuides) for more information on seed mix design and an example utility prairie seed mix.

⁹ See [nature.org/MNPrairieRestorationGuides](https://www.nature.org/MNPrairieRestorationGuides) for examples of utility meadow seed mixes appropriate for wetter soils.

- 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. However, this will vary depending on soil moisture and climate conditions. Early management (aftercare) is critical to prevent re-invading woody species and invasive weeds from out-competing and displacing establishing natives.

Maintaining control of reinvading trees and shrubs and other weeds is the primary management concern in interseeded prairie restorations. However, existing prairie 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 include:

- Mowing or haying to reduce competition
- Selective mechanical or chemical control of resprouting woody species
- 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.
- If resprouting woody trees and brush are too dense to control via mowing, spot-control with brush cutters or cut-stump treatments.

Year 2:

- Mow/hay field to 12-inch height twice, once in late spring and again in mid-summer.
- Spot-control resprouting woody species as necessary

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



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

- 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: burn one-third of the field annually, so that each patch has effectively 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; e.g. an alternating biennial rotation of grazing and haying within a 3-4 year burn rotation.
- Hay 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 continue to 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 woody-invaded prairie to utility prairie is \$1,504 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 cutting trees and shrubs, piling and burning the slash, and one controlled burn (whole site). The estimate also assumes the site is seeded with a no-till drill.

Post-seeding management costs include aftercare activities through year 3, specifically: 10 mowing treatments, one selective herbicide treatment of invading exotic perennials and/or woody resprouts that are not effectively controlled by fire, 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.

Useful references

Going Native: A prairie restoration handbook for MN Landowners – MN DNR
<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 DNR www.dnr.state.mn.us/invasives/terrestrialplants

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

Prairie Management: Woody Species Control [Video] – Tallgrass Prairie Center
www.youtube.com/watch?v=Tk_46D46Dg

Prairie Seedling and Seeding Evaluation. Bockenstedt, P. 2006. Bonestroo Rosene Anderlik & Associates.

The Tallgrass Prairie Center Guide to Prairie Restoration in the Upper Midwest. Smith, D. 2010. University of Iowa Press, Iowa City, IA.

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