

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD AND SPECIFICATIONS
RESTORATION AND MANAGEMENT OF RARE OR DECLINING
HABITATS**

(acre)

CODE 643

DEFINITION

Restoring and managing rare and declining habitats and their associated wildlife species to conserve biodiversity.

PURPOSE

Provide habitat for rare and declining species.

CONDITIONS WHERE PRACTICE APPLIES

Sites that previously or currently support the rare and declining habitat targeted for restoration or management.

Below are major native plant communities considered rare or declining in Missouri.

1. Tallgrass prairies of all types – prairie/transitional soils
2. Oak savanna – transitional soils
3. Open Woodland – transitional/timber soils
4. Oak-Shortleaf Pine woodland – landscape position in historic pine range.
5. Wetland prairie/bottomland savannas – hydric soils
6. Bottomland Forest, including southern bottomland hardwood forests – transitional/timber soils.
7. Glades – shallow soils with rocky outcrops
8. Giant Cane

See eFOTG Section II for listing of soil series by timber, grass or transitional.

CRITERIA

Methods used will be designed to protect the soil resource from erosion and compaction.

Undesirable species and noxious weeds will be controlled. When possible, control will be done on a "spot" basis to protect native forbs and legumes that benefit native pollinators and other wildlife.

Species and seeding rate specifications will be prepared to achieve desired habitat condition.

Only high quality and ecologically adapted plant materials will be used.

Vegetation planted will be adapted to soil-site conditions and will be suitable for the planned purpose. Species recommendations will be based on landowner objectives and site potential. Careful consideration is to be given when planting trees and taller shrubs in the historic prairie region of the state. Soils and site potential will guide the plant species selected. eFOTG Section II provides guidance on determining the suitability of soils to support existing/planned plant suitability groups for both herbaceous and woody materials.

Site preparation, planting dates and methods, and plant material care and handling shall optimize vegetation survival and growth.

Quality criteria for animals (wildlife – at least 0.5 index) will be met as measured by the WHAG-Community Models for the respective habitat type restored.

This pretreatment assessment of the targeted habitat will be documented to provide a baseline for comparison with post-treatment habitat assessment and provide a guide for restoration/management activities.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service or download the standard from the electronic Field Office Technical Guide for Missouri.

**NRCS MOFOTG
April 2011**

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Management practices and activities are not to disturb cover during the primary nesting period in Missouri (May 1- July 15). **Exceptions can be granted by the area office staff when necessary to maintain the health and/or vigor of the plant community and to accomplish habitat management objectives.**

Grazing and haying of natural communities can be used to improve habitat conditions or plant diversity for wildlife. This practice is not intended solely as a grazing practice.

If grazing is used as a habitat management tool PRESCRIBED GRAZING (528) minimum grazing heights for native plants will be used. For wildlife purposes these grazing heights will be maintained for the majority of the year, especially in dormant season. Also, see Patch Burn Grazing Information Sheet (*IS-MO528A*) for consideration of incorporating a grazing prescription for wildlife.

Because of the nature of these plant communities many of these habitats are not intended to be a part of a normal grazing rotation. In many cases it may only be feasible to graze once per year or once every 3 to 5 years. In all cases grazing/haying shall not begin until the desired vegetative state has been reached. In some cases it may take several years of active restoration before forage use can be introduced.

Disturbance of these natural communities with the exception of bottomland forest/giant cane is required to maintain quality plant diversity and structure. **Prescribed burning is required as part of any grazing/haying plan.** Refer to PRESCRIBED BURNING (338), Patch Burn Grazing Information Sheet and JS-BIOL-15 Prescribed Burning for Wildlife Job Sheet. To mimic historic grazing patterns grazing may be most beneficial the growing season following a prescribed burn. This may require disturbance during the nesting season. Consult with the area office staff.

If grazing/haying is a planned use or restoration practice, Area Office staff will be consulted for appropriate guidance. A grazing plan will detail the habitat manipulation needed to meet restoration/management goals. Grazing can be an effective component of restoration activities on certain sites.

Use of fertilizers, pesticides and other chemicals shall not compromise the intended purpose of this practice.

CONSIDERATIONS

All necessary local, state, and federal permits shall be obtained by the landowner (or designee) prior to the restoration.

Confer with other agencies and organizations to develop guidelines and specifications for conserving declining habitats.

The site will first be evaluated to determine if the habitat can be restored through management techniques (prescribed burning, woody cover control, etc.); or if it must be established by planting or seeding. In selection and management of plant species, consider long term land owner and land use objectives, and habitat needs of target wildlife species. **Special site conditions may require seeding in addition to restoration techniques. Shallow soils and/or abused site conditions may require seeding. A thorough site investigation should be conducted to determine restoration needs.**

Consider using this practice to enhance the conservation of threatened and endangered species.

When determining the size and location of the restored area, consider the minimum habitat requirements of desired wildlife species, and other species of concern that may be affected.

Follow-up habitat assessments should be performed on a regular basis, and management recommendations made to obtain the desired objectives.

Vegetative manipulations to restore plant and/or animal diversity can be accomplished by prescribed burning or mechanical, biological or chemical methods, or a combination of the four. **Prescribed burning is essential to the restoration and management of prairie, glade, oak-shortleaf pine woodland, savanna and open woodland restoration (bottomland forest/giant cane restoration should be excluded from frequent planned fire). Long term management is not feasible without prescribed burning even if other management methods are used.**

PRESCRIBED BURNING (338) must be a planned companion practice, if appropriate. Fire is typically needed for restoration and management goals. Never conduct a fire without a written prescribed burn plan.

This standard does not attempt to list all possible habitat development, management practices or plant materials for use. A NRCS or MDC Biologist/Forester or other qualified resource planning professional may recommend other practices or plant species for application.

PLANS AND SPECIFICATONS

Prepare site-specific plans and specifications following appropriate related standards and specifications.

Restoration site specific plans and specifications shall be developed based on this standard. A plan includes information about the location and extent, vegetation establishment, management and maintenance requirements.

Specifications will include:

- Management methods needed to restore existing vegetation to the desired condition.
- Site preparation sufficient to establish and grow selected species.
- Species selection and seeding rates to accomplish the planned purpose.
- Planting dates, care, and handling of the seed and other plant materials to ensure that they have an acceptable rate of survival.
- Statement detailing species selection and sources, and that only viable, high quality seed and plant materials will be used.

OPERATION AND MAINTENANCE

A restoration project may require many years to achieve the biological diversity that approximates a native habitat. Proper management of the restored area is essential for the restoration to achieve and

maintain the full potential of the site for the desired habitat type. As the vegetation matures, and goes through successional stages, changes in management practices including introduction of new species may be required to maintain and enhance the desired habitat type.

Haying and grazing (if allowed) and other restoration/management activities will be planned and managed (including exclusion) as necessary to achieve and maintain the intended purpose.

Vegetation management and maintenance activities shall not be conducted during the nesting season except when necessary to achieve the desired habitat condition.

Habitat conditions should be evaluated on a regular basis to adapt the conservation plan and schedule maintenance to ensure the desired habitat condition.

Management and maintenance activities should be rotated across the restoration area to mimic natural disturbance regimes.

REFERENCES

USDI, NBS, Biol. Report 28, Endangered Ecosystems of the United States

NRCS Threatened and Endangered Species Policy

The Endangered Species Act

The Terrestrial Natural Communities of Missouri by Paul W. Nelson

Missouri Savanna Restoration Handbook

Missouri NRCS Practice Information Sheets

Missouri NRCS JS-BIOL Job Sheets

MDC FOREST LAND MANAGEMENT GUIDE – Use of Prescribed Fire

http://www.mdc.mo.gov/documents/forest/fire/presc_fire.pdf

General Specifications Applicable to all Habitats

RESTORATION OF EXISTING DEGRADED HABITATS

For restoration sites that still have some of the characteristic plant species of the pre-settlement habitat type, it is often best to attempt restoration through management methods.

- Remove exotic or aggressive trees and shrubs.
- Remove excessive stocking of trees.
- Burn one third to one-half of the area every year on a rotating schedule until desired vegetative community is established. Maintenance burns may be needed on a less frequent cycle according to site conditions. An aggressive burn regime (burn every 1 to 3 years) on degraded native communities for several years may be necessary to reach the desired vegetative state. Refer to PRESCRIBED BURNING (338), IS-MO338-Prescribed Burning Information Sheet, and JS-BIOL-15 Prescribed Burning for Wildlife Job Sheet.
- If species diversity does not increase to the desired level, interseed desired species into the existing stand.

UPLAND WILDLIFE HABITAT MANAGEMENT (645) will be used for recommended methods/objectives for woody cover manipulation for all habitat type restorations. Woody cover control becomes critical in planning areas to restore prairie/savanna/glade/open woodland. Cut stumps should be treated to prevent sprouting. Amount of woody cover removal will be based on soil and site conditions. End product for: (1) *glade* restoration is 0-30% woody canopy; (2) *savanna* restoration is 10-30% woody canopy; (3) *open woodland* restoration is 30-80%; and (4) *prairie* restoration should have no more than 10% woody canopy remaining. See JS-BIOL-23 Woody Cover Control – Prairie/Glade/Savanna Job Sheet and the individual Information Sheets for Glade, Prairie, and Savanna.

Mechanical methods (chainsaw, burn, disk, or shear/clipper) used alone or in combination with other techniques can successfully manipulate successional stages of habitat.

Bulldozer use is not allowed for any restoration under this practice.

Heavy machinery (clipper) is not an acceptable restoration method for glade, savanna, oak-shortleaf pine woodland or open woodland sites with "suitability for mechanical site preparation – (surface)" less than well suited (MoNRCS eFOTG Section II – county soil information Forestland Interpretations - Forestland Site Preparation). Exceptions can be granted after site evaluation by the area office staff.

ESTABLISHMENT OF VEGETATION

HERBACEOUS -

Seeding dates - Dormant Season Planting Period only of the grass/forb mix. (See VEGETATION ESTABLISHMENT, HERBACEOUS SEEDING (723))

Lime and fertilizer - Soil tests and supplemental fertility are not required for this practice but may be recommended by a resource planning professional based on site conditions and landowner objectives.

For the Prairie component of this practice the following applies: Where remnant/existing prairies are used for hay or grazing and site conditions/landowner's objectives suggest the need for fertility supplement, then soil amendments may be applied after consulting with area office staff. See IS-MO643P-Prairie Information Sheet, CONSERVATION COVER (327), PASTURE PLANTING (512), or VEGETATION ESTABLISHMENT, HERBACEOUS SEEDING (723). Fertility recommendations must take into account the desire to maintain native vegetation stands with minimum encouragement for cool season grass competition and annual weeds.

Seedbed preparation and seeding - NOTE: Previous chemical usage must be determined on croplands as residual carry over can impact success of new herbaceous plantings. Preferred methods are a broadcast seeding on a conventionally prepared seedbed with rolling or cultipacking immediately before and after seeding to ensure good seed/soil contact **OR** use of no-till planting method. See VEGETATION ESTABLISHMENT, HERBACEOUS SEEDING (723) for other recommended methods for herbaceous cover.

TREE/SHRUB/WOODY MATERIAL

See TREE AND SHRUB ESTABLISHMENT (612) for recommended woody planting stock care, planting dates, methods and weed control.

For Additional Information on RESTORATION or ESTABLISHMENT see:

Missouri Savanna Restoration Handbook – NRCS, MDC, UMC, , JS-BIOL-20 Native Forb and Non-native Legume Interseeding Job Sheet, JS-BIOL-30 Controlling Undesirable Species Job Sheet, JS-BIOL-23 Woody Cover Control – Prairie/Glade/Savanna, JS-BIOL-32 Glade, Prairie, and Savanna Herbaceous Establishment Job Sheet, IS-MO643P-Prairie Information Sheet, IS-MO643-Savanna Information Sheet, IS-MO643G-Glade Information Sheet, and IS-MO643-Bottomland Forest Information Sheet.

Species selection and sources

Plant material selection will be based on:

1. The use of Missouri Source Identified Class (herbaceous material) – Missouri source is defined as a native plant that source genetically originated in Missouri; was not introduced; and existed within the state borders prior to arrival of settlers. The location of the wild growing parents must be within Missouri and implies that the geographical location is known.

2. All seed from herbaceous material shall comply with Missouri seed laws including Missouri Crop Improvement Association guidance. All seed will comply with AOSCA (Association of Official Seed Certifying Agencies) certification procedures (including appropriate tagging) to include third-party verification by the Missouri Crop Improvement Association of source, genetic identity, and genetic purity of wildland collected or field or nursery grown plant germplasm materials. Seed must be Missouri origin (grown in Missouri) and certified as Missouri Source Identified Class. If Missouri origin (grown) source Identified class seed is not available Missouri source identified class seed may be obtained only from adjoining states.

Source Identified Certification means:

- Parent seed is collected from natural remnant Missouri populations
- No selection, testing, or breeding for specific traits
- Production fields are inspected to verify species, source, and lack of noxious weeds.
- Seed is certified for purity and germination.

3. Table 1 and 2 of this standard provide appropriate herbaceous species for use. Selections will be based on site evaluation and habitat type to be seeded.

4. Only tree/shrubs native to Missouri will be used in planting woody material. Species recommendations will be based on landowner objectives and site potential. Careful consideration is to be given when planting trees and shrubs in the historic prairie region of the state. Soils and site potential should guide the plant species selected.

No improved/named varieties/cultivars of plant materials will be used in this practice.

SPECIFICATIONS FOR SELECT HABITAT TYPES
OAK SAVANNA

This practice will only be applied on fields with transitional soils that comprise at least 50 percent of the field. Oak savannas occurred primarily in upland landscapes with limited occurrence in bottomland. Savannas typically occurred on summits/ridge tops, southwest facing slopes, and broad dry plains.

Oak savanna once occupied a major part of the landscape of Missouri. This community is characterized by widely spaced, open grown scattered oak trees, occasional groupings of trees of various ages, the almost complete absence of a shrub layer, and herbaceous, prairie-like understory. Tree canopy is 10-30 percent with some shrub thickets on northeast-trending lee side of hills or in upland drainages where fire was less frequent or less intense. Savannas are generally regarded as transition areas where prairie and open woodland intermingle. They are distinguished from woodlands in that savannas are strongly associated with prairies on nearly level to dissected plains and are generally dominated by grasses and forbs. Periodic fires, native herbivores and local conditions of topography, bedrock, and soils influence their development. Very little of this community is present today due to fire suppression and conversion to agriculture.

Soils and woodland site index (<50) will provide a good indicator of savanna potential. Oak savannas will not be planned on fields that are comprised of more than 50 percent prairie derived soils. See IS-MO643-Savanna Information Sheet.

Existing Oak Savanna

Oak Savanna Conversions -

For existing wooded communities of oak dominated stands, reduce current stocking to levels shown in the following chart (Law, Johnson, and Houf 1994):

<i>Average tree diameter (canopy trees only)</i>	<i>Trees per acre (10 % canopy)</i>	<i>Trees per acre (20 % canopy)</i>	<i>Trees per acre (30 % canopy)</i>
4	55	105	160
6	40	60	80
8	20	40	60
10	15	25	40
12	10	20	30
14	7	15	20
16	5	11	16
18	4	8	13
20	3	7	11

NOTE: These numbers represent full crown development.

Following the above guidelines will create approximating a 10, 20, or 30 percent canopy cover for any given average tree diameter (desired result for oak savanna restoration is 10-30% tree canopy). As stands move into larger diameter classes additional removals may be necessary to maintain desired canopy cover (trees/acre). Use UPLAND WILDLIFE HABITAT MANAGEMENT (645) for woody cover manipulation recommendations.

Treat all cut stumps with appropriate chemicals to prevent re-sprouting.

The choice of canopy trees should be based on slope position, aspect, geology, and soil type. See species selection below. See IS-MO643-Savanna Information Sheet for guidelines on "clustering" remaining tree blocks. It is desirable to leave as many "tree clusters" as possible to maintain desirable canopy cover and provide group protection from fire damage.

After the canopy has been adjusted to desired levels, burn the unit on a one to three year cycle. As the stand matures decrease the frequency of fire to maintain community health. Additional thinning may be necessary several years after the initial woody cover control.

The site should first be evaluated to determine if the habitat can be restored through management techniques (prescribed burning, woody cover control, etc.) before recommending seeding the herbaceous component.

New savanna development

Species selection for trees/shrubs

A minimum of two tree species will be used from the species list for savanna. Normally, Bur Oak should be a predominant tree species in the northern 2/3 of Missouri and Post Oak the dominant species in the southern 1/3 of the state. Shrub plantings are optional but will result in a more complete restoration. If desired, plant at least one shrub species from the list below.

Tree/shrub density

In savanna areas plant trees at the rate of 25 trees per planted acre at no less than 30-foot spacing. Tree planted acres will be at least 10 percent but no more than 30 percent of each field. If possible plant the trees in cluster or blocks rather than evenly spaced across a field. This will allow for some parts of the savanna to be more open (greater spacing or small "openings") than other parts. Historically woody vegetation on savannas occurred on the east and/or north slopes or in valleys or along streams. See IS-MO643-Savanna Information Sheet.

Shrub plantings should also be clustered dependent upon site conditions. Shrub plantings, if done, will follow the woody cover requirements in UPLAND WILDLIFE HABITAT MANAGEMENT (645). See TREE AND SHRUB ESTABLISHMENT (612) for recommended planting stock care, planting dates and weed control. Shrubs do not count as part of the woody (tree) canopy coverage requirement.

Stock size and planting dates

Tree planting stock will be at least 3 feet tall and ½ inch caliper or greater or 3-0 to 2-1 stock. The large initial size is required to facilitate their protection from fire, and reduce competition from grass. Seedlings will be planted by hand or using an auger of appropriate size. Soil will be firmly packed around seedling roots.

See TREE AND SHRUB ESTABLISHMENT (612) for recommended planting stock care, planting dates and weed control.

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Trees: At least two tree species will be used at rate of 25 trees per planted acre at at no less than 30 foot spacing.

Black oak	<i>Quercus velutina</i>	Shrubs: ((645) will be used for woody cover requirements.)	Gray/roughleaf dogwood	<i>Cornus spp.</i>
Blackjack oak	<i>Quercus marilandica</i>		Prairie willow	<i>Salix humilis</i>
Bur oak	<i>Quercus macrocarpa</i>		American/Chickasaw plum	<i>Prunus spp.</i>
Chinquapin oak	<i>Quercus muhlenbergii</i>		Choke cherry	<i>Prunus virginiana</i>
Mockernut hickory	<i>Carya tomentosa</i>		Fragrant sumac	<i>Rhus aromatica</i>
Persimmon	<i>Diospyros virginiana</i>		False indigo bush	<i>Amorpha fruticosa</i>
Post oak	<i>Quercus stellata</i>		Hazelnut	<i>Corylus americana</i>
Shagbark hickory	<i>Carya Ovata</i>			
Shingle oak	<i>Quercus imbricaria</i>			
Swamp white oak	<i>Quercus bicolor</i>			
White oak	<i>Quercus alba</i>			

Seeding Mixture

Grasses: 4.0 lbs PLS/ac approved native grass - include a minimum of four grass species in mix:

- Mix must contain little bluestem planted at 2.8# /ac.
- All other grasses will be limited to not more than 0.4#/ac each.
- Additional grass species can be added for diversity to equal the total mix pounds. See Table 1 – for selections.

Forbs (Wildflowers): 3.0 lbs PLS/ac approved native forbs - include a minimum of nine forb species in mix:

- with no single forb species to exceed 15%, or comprise less than 1%, of the 3# forb mix
- with annual/biennial forbs (combined) not to exceed 10% of the forb mix
- see Table 2 – for selections

Long Term Management of Degraded/Reestablished Savannas:

At a minimum, vegetation will be controlled in a three-foot wide band around each planted tree for at least three years with an approved herbicide or tillage. **Fire is essential for the management of savanna communities. PRESCRIBED BURNING (338) is a required management practice for this natural community, but will not be applied to the areas planted in trees until determined by a resource planning professional that the trees have developed sufficient fire resistance. Trees may need to reach 3 to 6 inches diameter at breast height before fire resistant. Never conduct a fire without a written prescribed burn plan.**

For existing habitats in restoration prescribed burning should be conducted every year for 3-5 years. An aggressive burn regime (burn every 1 to 3 years) on degraded native communities for several years may be necessary to reach the desired vegetative state. After this restoration period, maintenance prescribed burning should be on a three or four-year schedule or as recommended by a resource planning professional. For planted habitats prescribed burning will be conducted no earlier than the beginning of the second growing season in areas devoid of trees.

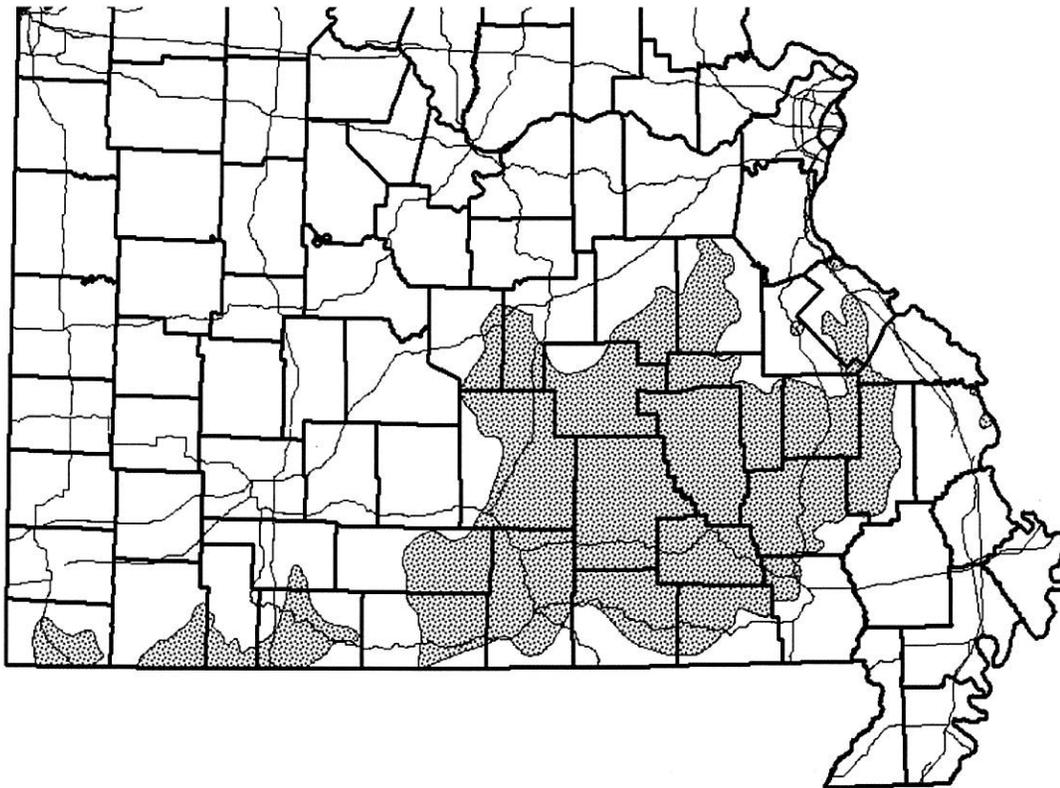
For greatest habitat benefit savannas should only be burned July 16 - March 15. *Prescribed burning beyond March 15 for wildlife management purposes will be based on recommendation of NRCS or MDC wildlife planner.* Late summer/fall/dormant season burns encourage the forb component of herbaceous stands resulting in better and more diverse habitat. Special effort/consideration will need to be followed if burning in areas where trees are actively growing. Undesirable woody vegetation will be controlled. See JS-BIOL-15 Prescribed Burning for Wildlife Job Sheet.

OAK – SHORTLEAF PINE WOODLAND

This practice will only be applied on fields/stands associated with any of the following landscape positions that occur within the historic pine range of Missouri (see pine range map):

- Summits
- Shoulders
- Ridge tops
- Backslopes (135-315 degrees aspect)

HISTORIC SHORTLEAF PINE RANGE



Oak-pine Woodland Conversions

To increase the pine component in an existing oak-pine stand using the on-site pine seed source, follow these steps:

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- Leave 10 to 15 of the best seed producing pines per acre indicated by the presence of cones on the trees after removing some or all of the oak overstory.
- Control unwanted hardwoods in the understory and prepare a suitable seedbed. See "suitability for mechanical site preparation - surface" (MoNRCS eFOTG – county soil information forestland interpretations).
- Harvest the seed trees after sufficient pine seedlings are established. This step may be omitted if old growth characteristics are desired.

To **add a pine component** in an existing oak stand follow these steps:

- Thin stands to 50 to 60 percent stocking.
- Kill all undesirable understory woody stems, 1 to 8 inches in diameter, with herbicide and prescribed burning. Consider landowner objectives and wildlife habitat needs and leave important soft mast species.
- Add a pine component by one or both of the following two means:
 1. Plant shortleaf pine seedlings at a planting rate based on the desired percentage of pine component in the resulting stand. The 100% stocking rate will be 170 trees per acre (16 X 16) spacing. Use a minimum 30% pine stocking rate – for example, if the desired result is a 75% pine to 25% hardwood stocking, reduce the 170 per acre pine planting rate to 128 trees per acre

OR

2. Prepare a suitable seedbed through prescribed burning and/or mechanical means to obtain bare mineral soil (See TREE AND SHRUB ESTABLISHMENT (612), and FOREST SITE PREPARATION (490)) and broadcast pine seed at a planting rate based on the desired percentage of pine component in the resulting stand. Use a minimum 30% pine seeding rate. The 100% stocking rate will be 0.5 pound pine seed per acre. Adjust accordingly for the percentage of pine desired in the resulting stand. Pine seed is best mixed with a carrier such as cat litter when seeding such small amounts on a per-acre basis.
- Remove the desired amount of the remaining oak overstory within 3 years.
 - Begin periodic prescribed burnings 3-5 years after planting or when pines exceed 3 feet in height.

New Pine Stands

Use site preparation before planting. Follow FOREST SITE PREPARATION (490).

Plant shortleaf pine seedlings at the rate of 170 trees per acre (16 x 16 feet spacing). Area to be planted to shortleaf pine will be determined by appropriate landscape features as noted earlier. It is not the intention to plant pines over the complete restoration, only on sites where pine typically occurred. It may be necessary to consult biologist/forester to determine proper planting locations. Follow TREE/SHRUB ESTABLISHMENT (612) guidelines for recommended planting stock care, planting dates, and weed control for use with above planting rates. If a hardwood component (black oak, blackjack oak, scarlet oak, post oak, white oak and hickory spp.) is desired, reduce pine planting rate so that the total rate for all species is no more than the 170 combined rate per acre.

If possible plant the trees in clusters or blocks rather than evenly spaced across a field. When doing so the overall rate will remain at 170 per acre over the whole field. This will allow for some parts of the area planted at a tighter spacing (10' X 10') and others to be more open (greater spacing (20' X 20') or small openings"). If direct seeding is required use the minimum 0.5 pound pine seeding rate and reduce by a corresponding percentage if hardwoods are used in the mix.

Long Term Management:

At a minimum, vegetation competition with the tree plantings will be controlled by an approved method for at least three years after initial planting. Fire is essential for the management of oak - pine communities. Shortleaf pine benefits from burning for many reasons. Burning removes hardwoods, such as small oaks and hickories, decreasing competition for nutrients, moisture and space. Also, shortleaf pine seeds germinate best on bare soils. When forests don't burn frequently, leaf and needle litter accumulates to depths which hinder shortleaf pine establishment. A litter depth greater than about 2.5 inches can prevent a shortleaf pine seed from germinating. Relatively frequent fires keep the litter from becoming too deep for shortleaf pine to regenerate. **PRESCRIBED BURNING (338) is a required management practice for this natural community.** Begin periodic prescribed burnings 3-5 years after planting or when pines exceed 6 feet in height or as recommended by a resource planning professional. **Never conduct a fire without a written prescribed burn plan.** Burning between September and February will favor native forbs, sedges and cool-season grasses. Fall or early winter is a good time to burn cedar slash since dormant season fires are usually not as hot or volatile as spring burns. Late summer to fall burns (August-November) are effective at controlling woody sprouts and will top kill small diameter trees if leaves are green and before frost/dormancy. Prescribed burns conducted in the spring will favor native warm-season grasses and suppress woody vegetation, forbs and cool-season grasses. Spring burns are usually hotter and more intense than dormant season burns because of dry fuels and violate weather conditions. Over time, vary the season when you conduct a prescribed burn to improve plant diversity. Consult with a forester or biologist on when would be the best time to conduct a prescribed burn in your oak-pine woodland. Care must be taken in burning to not reduce the desired level of oak component in the restored oak-pine woodland.

OPEN WOODLAND

This practice will only be applied on fields with transitional/timber soils that comprise at least 50 percent of the field. Open woodlands occur on both upland and bottomland landscapes. Woodlands are a type of wooded community characterized as having a tree canopy cover of 30 – 80%, a poorly developed woody understory, and a diverse herbaceous layer (50-100% ground cover) of forbs, grasses, and sedges. Woodlands contain fire tolerant trees often with wide spreading crowns. Open woodlands most often will occur on lower site index landscapes (55 site index or less). Most woodland communities have been degraded due to extensive logging, fire suppression, overgrazing and other disturbances. In the absence of fire, woodlands may succeed to an overstocked, closed canopy community with little ground flora. Eastern redcedar is a good example of a tree that invades woodlands where natural fire regimes have been suppressed. Degraded woodland will often appear similar to a forest community because of a closed canopy and lack of ground flora.

Upland woodlands on drier, shallower soils will typically have an open canopy (30 to 60% coverage) while mesic and bottomland woodland canopies may range from 50 to 80% coverage. While woodlands are highly variable in canopy structure, the presence of an open understory and a rich herbaceous layer link the variety of expressions of this natural community type. As a rule, woodlands should have a more open canopy on south and west facing slopes, adjacent to glades or savannas and on gently rolling landscapes. Generally, woodlands on north and east facing slopes, in protective ravines, deeply dissected hills and in moist areas should have a more closed canopy. These sites may also be a forest stand within a woodland community and should be managed differently than true woodlands. This practice is not intended to change forestland to a more open condition. A resource planning professional must determine if the plant community has woodland characteristics or if the existing wooded stand should be managed as forest.

Woodland restoration often begins with thinning the existing woodland canopy and reintroducing prescribed fire to restore the once diverse plant community.

Restoration

For existing woodland communities reduce current stocking to levels shown in the following chart:

<i>Average tree diameter (canopy trees only)</i>	<i>Trees per acre (30 % canopy)</i>	<i>Trees per acre (40 % canopy)</i>	<i>Trees per acre (50 % canopy)</i>	<i>Trees per acre (60 % canopy)</i>	<i>Trees per acre (70 % canopy)</i>	<i>Trees per acre (80 % canopy)</i>
4	160	210	260	315	370	420
6	80	110	150	180	210	240
8	60	75	100	120	140	150
10	40	50	60	80	90	100
12	30	35	50	60	70	80
14	20	30	40	45	55	60
16	15	20	30	35	40	45
18	13	15	20	25	30	35
20	11	10	15	20	25	30

NOTE: These numbers represent full crown development.

Guidelines will approximate a 30 - 80 percent canopy cover for any given average tree diameter. As stands move into larger diameter classes additional removals may be necessary to maintain desired canopy cover (trees/acre). Use UPLAND WILDLIFE HABITAT MANAGEMENT (645) for woody cover manipulation recommendations.

Treat all cut stumps with appropriate chemicals to prevent re-sprouting.

The choice of canopy tree species should be based on slope position/percent, aspect, geology, tree health, fire resistance and soil type.

Management recommendations:

Reintroducing prescribed fire is essential to restoring a diverse woodland community. **PRESCRIBED BURNING (338) is required with this natural community.** Fire will suppress small diameter woody vegetation, remove leaf and woody litter and stimulate herbaceous plant growth on the woodland floor. Frequent prescribed burns, on a 1 to 3 year rotation, will be necessary for the first several years to suppress woody sprouts and restore the rich ground flora of forbs, grasses and sedges.

Continue to use prescribed fire on a 2 to 6 year rotation to maintain a diverse woodland community once the desired vegetative response has been achieved. Fire intervals greater than 6 years may allow woody sprouts enough time to out grow fire flame heights and eventually succeed back to closed canopy woodland. **Never conduct a fire in woodland without a written prescribed burn plan.** Historically woodlands burned between September and April, with most fires occurring in late summer through late fall. Burning between September and February will favor native forbs, sedges and cool-season grasses. Fall or early winter is a good time to burn cedar slash since dormant season fires are usually not as hot or volatile as spring burns. Late summer to fall burns (August-November) are effective at controlling woody sprouts and will top kill small diameter trees if leaves are green and before frost/dormancy.

Prescribed burns conducted in the spring will favor native warm-season grasses and suppress woody vegetation, forbs and cool-season grasses. Spring burns are usually hotter and more intense than dormant season burns because of dry fuels and violent weather conditions. Over time, vary the season when you conduct a prescribed burn to improve plant diversity. Consult with a forester or biologist on when would be the best time to conduct a prescribed burn in your woodland.

To assist with prescribed burning, a permanent firebreak or service road can be used for a fire line (See FIREBREAK (394)).

Woodland restoration does not typically require reseeding herbaceous vegetation. There is usually an adequate seed bank in the soil. The site can be assessed by a resource planning professional for seeding needs after the third burn. If seeding is required use the seeding recommendations for "glades" as found in this standard.

PRAIRIE

This practice will only be applied on fields with transitional or herbaceous derived soils that comprise at least 50 percent of the field or on those portions of fields with transitional or herbaceous soils where they comprise less than 50 percent of the field. Prairie will not be planted on sites/fields dominated by timber derived soils. Prairies were a prominent landscape type in many of the counties in Missouri. This plant community has been largely replaced by agricultural practices. Prairies are plant communities largely devoid of trees and shrubs. Native warm season grasses with an interspersed of native forbs dominate prairies. Trees and shrubs that do occur comprise less than 10 percent canopy cover. Missouri has a wide spectrum of prairie types - dry prairie (loess hills/sand prairies), mesic prairie, and wet prairie. Historically, prairie occurred north of the Missouri River and in the southwestern part of the state.

The site should first be evaluated to determine if the habitat can be restored through management techniques (prescribed burning, woody cover control, etc.); or if it must be established by planting or seeding. Control and suppression of undesirable species may be required to restore existing prairie areas. See JS-BIOL-30 Controlling Undesirable Species Job Sheet. If woody cover control is performed, no more than 10% woody cover canopy (trees/shrubs) should remain. No trees greater than 12 feet should be left. Shrub component is the most desirable woody component for prairies. See JS-BIOL-23 Woody Cover Control – Prairie/Glade/Savanna Job Sheet. Prairie restoration may require multiple burns to obtain the desired vegetation composition and structure. An aggressive burn regime (burn every 1 to 3 years) on degraded native communities for several years may be necessary to reach the desired vegetative state then the prescribed burning rotation should be on a three or four-year schedule or as recommended by a resource agency representative. See PRESCRIBED BURNING (338), IS-MO338-Prescribed Burning Information Sheet, IS-MO643P-Prairie Information Sheet and JS-BIOL-15 Prescribed Burning for Wildlife Job Sheet.

Seeding Mixture

Grasses:

Dry/Mesic Prairie

4.0 lbs PLS/ac approved native grass - include a minimum of four grass species in mix:

- Mix must contain little bluestem planted at 2.8# /ac.
- All other grasses will be limited to not more than 0.4#/ac each.
- Additional grass species can be added for diversity to equal the total mix pounds. See Table 1 – for selections.

Wet Prairie

4.0 lbs PLS/ac approved native grass - include a minimum of four grass species in mix:

- Mix must contain big bluestem at 0.8#/ac, and one of the wildrye species - Canada or Virginia at 2.0#/ac.
- All other grasses will be limited to not more than 0.6#/ac each.
- Additional grass species can be added for diversity to equal the total mix pounds. See Table 1 – for selections.

Forbs (Wildflowers): 3.0 lbs PLS/ac approved native forbs - include a minimum of nine forb species in mix:

- with no single forb species to exceed 15%, or comprise less than 1%, of the 3# forb mix
- with annual/biennial forbs (combined) not to exceed 10% of the forb mix
- see Table 2 – for approved forb listing

Shrubs: Shrub plantings should be clustered dependent upon site conditions and be located along streams and draws whenever possible. Shrub plantings, if done, will follow the woody cover requirements in UPLAND WILDLIFE HABITAT MANAGEMENT (645). See TREE AND SHRUB PLANTING (612) for recommended planting stock care, planting dates and weed control.

Shrubs:

Gray/roughleaf dogwood	<i>Cornus spp.</i>	Hazelnut	<i>Corylus americana</i>
Prairie willow	<i>Salix humilis</i>	Fragrant sumac	<i>Rhus aromatica</i>
American/Chickasaw plum	<i>Prunus spp.</i>	False indigo bush	<i>Amorpha fruticosa</i>

Prairie Cord Grass (*Spartina pectinata*) Planting Guidelines:

For 1 gallon containers – this is for a planting on sites adapted to prairie cordgrass – non-erosive wet bottoms or swales. This planting recommendation is for a pure stand in those ecological sites where cord grass occurred as pure stands – wet swales and bottoms.

Plant Medium: 55 - 1 gallon containers/acre or 220 cord grass plugs/acre.

Planting Period: Mid June – Mid July

Site Preparation: Light disking of vegetation, chemical burndown, or mowing of existing vegetation to facilitate a “tree planting” machine.

Planting Method: Use a one or two person tree planting machine for larger tracts, typically a three point hitch behind at least 60 horsepower tractor. The tree planter should have a disc coultter wheel to open the soil and a set of angled press wheels to close the soil back. A two man motorized auger as well as shovel/spade have also been used but not as efficient as the tractor/tree planter equipment set-up.

Planting Technique: Each of the 55 - 1 gallon containers is quartered yielding 220 plugs planted by a tree planter on a 10' (between plants) x 20' (width between rows) grid.

Management recommendations for prairie maintenance: Prairie communities are best managed by the use of prescribed fire and grazing (at some point in the restoration when the desired vegetative state has been reached). Fire and herbivore use of prairies are interactive forces. Prescribed burning will be conducted no earlier than the beginning of the second growing season. (Note: If planning a spring burn at the second growing season check stand to ensure that frost heaving has not exposed the growing points of the new seedlings to damage by fire.) After establishment of the planted vegetation, prescribed burning should be on a rotation to stimulate the prairie plants and control weeds. Recommendations are found in PRESCRIBED BURNING (338) and Upland Wildlife Habitat Management (645). **PRESCRIBED BURNING (338) is required with this natural community.** Burning frequency and timing of burns will be based on a recommendation from a resource planning agency representative. If possible, divide the area into smaller management units and burn part of the area each year. A patchy vegetative structure provides a greater array of habitat niches for wildlife. For greatest habitat benefit prairies should be burned July 16 - March 15. *Prescribed burning beyond March 15 for wildlife management purposes will be based on recommendation of NRCS or MDC wildlife planner.* Late summer/fall/dormant season burns encourage the forb component of herbaceous stands resulting in better and more diverse habitat. ***Never conduct a fire without a written prescribed burn plan.*** Undesirable woody vegetation should be controlled. Late summer to fall burns (August-November) are effective at controlling woody sprouts and will top kill small diameter trees if leaves are green and before frost/dormancy. See IS-MO528A Patch Burn Grazing Information Sheet, IS-MO338-Prescribed Burning Information Sheet, IS-MO643P-Prairie Information Sheet, and JS-BIOL-31 Managing Native Hay Prairie Job Sheet. Mowing the year of establishment may be needed to control competition from weeds. Undesirable woody vegetation will be controlled and not allowed to shade out the prairie plants.

BOTTOMLAND FOREST

This practice will be applied on fields with bottomland timber or bottomland transitional soils that comprise at least 50 percent of the field; or any field located within Missouri Common Resource Areas - 131A.1 Southern Mississippi River Meander Belts and 131A.3 – Black and White River Alluvium – see MO eFOTG, Section I. D.

Bottomland Forest was an important part of the Missouri landscape. These areas are vegetative communities with a mixture of trees and shrubs. These areas provided for landscape diversity and aided in protecting Missouri's stream and rivers. Native bottomland forest in Missouri has largely been cleared for agricultural production. Missouri has a wide spectrum of bottomland forest types, including the southern bottomland hardwood forests (Mississippi Delta). See IS-MO643F-Bottomland Forest Information Sheet.

Restoration Conditions

Where practical, original hydrology conditions will be restored to allow proper vegetative community restoration. NRCS or MDC foresters/biologists will determine if the area will be restored by tree planting, direct seeding, and/or natural regeneration. Establishment completed by planting or seeding will include at least 5 species of native trees and 2 native shrubs. Native tree and shrub list is found in RIPARIAN FOREST BUFFER (391), or eFOTG Section II – Conservation Tree and Shrub Suitability Groups, or any other tree and shrub approved by NRCS/MDC forester/biologist. TREE/SHRUB ESTABLISHMENT (612), RIPARIAN FOREST BUFFER (391), and FOREST SITE PREPARATION (490) will be used for recommended plant materials, planting methods, and management of the area.

Giant Cane Restoration

This component is intended for application in those counties where giant cane/canebrakes were historically found (McDonald, Barry, Stone, Taney, Christian, Douglas, Ozark, Howell, Shannon, Oregon, Reynolds, Carter, Ripley, Madison, Wayne, Butler, St. Genevieve, Perry, Bollinger, Cape Girardeau, Stoddard, Scott, Mississippi, New Madrid, Pemiscot, and Dunklin). RIPARIAN FOREST BUFFER (391) will be used for establishing the appropriate buffer and planting materials/methods and maintenance. The Giant Cane restoration will be a component of either an existing riparian buffer or newly applied one.

Plant: 98 giant cane root balls (minimum 1 foot diameter)/acre.

Planting Period: January – April

Site Preparation: Mechanical or chemical removal of existing vegetation in root ball planting areas.

Planting Method: Small backhoe or hand planting of root balls.

Planting Technique: 98 root balls/acre will be planted in 14 thickets – each with 7 root balls per thicket. Root balls will be planted on 3X3 foot spacing within each thicket. Spacing may need to be varied due to irregular shaped planting areas. Planting areas should emulate locations where natural stands occurred. Consult area staff for recommendations. 30# of 13-13-13 will be applied to each thicket at time of planting. Thickets should be planted no closer than 50 feet spacing in buffer area. Tops should be trimmed back to one-half of original height.

Management: After establishment planted stands and adjacent areas may be lightly disked to encourage rhizome development into open ground areas.

GLADE

This practice will only be applied on fields with shallow soils (<20 inches) or rocky outcrops that comprise at least 50 percent of the field.

Glade communities historically occurred south of the Missouri River on south and west facing slopes or on the high summits of ridges, knobs and domes where soils are thin and moisture conditions favor drought tolerant species. These areas are open, rocky barren areas dominated by drought adapted forbs, warm-season grasses and a specialized fauna. Trees and shrubs occur on glades (30% canopy or less) but are not dominant unless overgrazing and/or disruption of natural fire regimes have resulted in invasion by woody species like red cedar.

Glades commonly have shallow soils and exposed bedrock. Soil depth is very shallow, ranging from zero to 20 inches deep interspersed with copious rock fragments. Limestone, dolomite, chert, sandstone, shale and igneous glades occur throughout the state. Glades may occur as large

complexes sometimes over 100 acres or as inclusions in prairies, savannas, and open woodlands. Some forb species are endemic to Missouri glades. Periodic fires, native herbivores and local conditions of topography, bedrock, and soil influence glade development. Glade communities have been degraded by overgrazing, cedar encroachment, and fire suppression.

The site should first be evaluated to determine if the habitat can be restored through management techniques (prescribed burning, woody cover control, etc.) before recommending seeding the herbaceous component. Glade restoration almost never requires reseeding herbaceous vegetation. There is usually an adequate seed bank in the soil. The site can usually be assessed by a resource planning professional for seeding needs after the third burn.

RESTORATION CONDITIONS

In areas where glade restoration is feasible tree densities will be reduced to 0 to 30 percent canopy. See IS-MO643G-Glade Information Sheet.

Seeding Mixture

Grasses: 3.0 lbs PLS/ac approved native grass - include a minimum of three grass species in mix:

- Mix must contain one of the following (Sideoats grama or broom sedge) at 1.4#/ac, and Little bluestem at 1.2#/ac.
- All other grasses will be limited to not more than 0.4#/ac each.
- Additional grass species can be added for diversity to equal the total mix pounds. See Table 1 – for selections.

Forbs (Wildflowers): 3.0 lbs PLS/ac approved native forbs - include a minimum of nine forb species in mix:

- with no single forb species to exceed 15%, or comprise less than 1%, of the 3# forb mix.
- with annual/biennial forbs (combined) not to exceed 10% of the forb mix.
- see Table 2 – for approved forb listing.

Management recommendations for glade maintenance: Reseeding is only necessary on under rare circumstances, and only after the need is verified based on an on-site evaluation conducted after prescribed burning has been applied to the site. Consider the site's past uses and history before planning new seeding or over-seeding. Woody vegetation should be removed before seeding the area. Woody vegetation should be left to burn or stacked in piles and burned before seeding the area. Recommend leaving cut cedars for 6 to 12 months before conducting a prescribed burn to reduce fuel load.

Glade communities are best managed by the use of prescribed fire. **PRESCRIBED BURNING (338) is required with this natural community.** An aggressive burn regime (burn every 1 to 3 years) on degraded native communities for 10 to 20 years may be necessary to reach the desired vegetative state. Prescribed burning will be conducted no earlier than the beginning of the second growing season. After establishment of the planted vegetation, prescribed burning should be conducted on a three or four-year schedule or as recommended by a resource agency representative. See PRESCRIBED BURNING (338), IS-MO338-Prescribed Burning Information Sheet, IS-MO643G-Glade Information Sheet. Burn frequency and timing of

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burns will be based on a recommendation from a resource agency representative. For greatest habitat benefit glades should only be burned July 16 - March 15. Prescribed burning beyond March 15 for wildlife management purposes will be based on recommendation of NRCS or MDC wildlife planner. Late summer/fall/dormant season burns on glades encourage the forb component of herbaceous stands resulting in better and more diverse habitat. Undesirable woody vegetation should be controlled. Late summer to fall burns (August-November) are effective at controlling woody sprouts and will top kill small diameter trees if leaves are green and before frost/dormancy. **Never conduct a fire without a prescribed burn plan.**

TABLE 1 – APPROVED GRASS/GRASS LIKE – species selection will only be made from appropriate habitat type based on planting site evaluation.

Common Name	Scientific Name	Habitat Type *
GRASSES/GRASS LIKE		
Winter bent grass	<i>Agrostis hyemalis</i>	S, DP, MP, WP
Big bluestem	<i>Andropogon gerardii</i>	S, DP, MP, WP, G
Splitbeard bluestem	<i>Andropogon ternarius</i>	DP, G
Broomsedge	<i>Andropogon virginicus</i>	S, DP, MP, WP, G
Sideoats grama	<i>Bouteloua curtipendula</i>	S, DP, MP, G
River oats	<i>Chasmanthium latifolium</i>	S, MP, WP
Canada wildrye	<i>Elymus canadensis</i>	S, MP, WP
Virginia wildrye	<i>Elymus virginicus</i>	S, MP, WP, G
Cluster fescue	<i>Festuca paradoxa</i>	S, DP, MP, WP
Junegrass	<i>Koeleria cristata</i>	S, DP, MP
Switchgrass	<i>Panicum virgatum</i>	S, DP, MP, WP, G
Beaked rush	<i>Rhynchospora globularis</i>	MP, WP
Little bluestem	<i>Schizachyrium scoparium</i>	S, DP, MP, G
Tall nutgrass	<i>Scleria triglomerata</i>	S, DP, MP, WP, G
Indian grass	<i>Sorghastrum nutans</i>	S, DP, MP, G
Prairie cordgrass	<i>Spartina pectinata</i>	WP
Tall dropseed	<i>Sporobolus compositus</i>	S, DP, MP, G
Prairie dropseed	<i>Sporobolus heterolepis</i>	S, DP, MP, G
Porcupine grass	<i>Stipa spartea</i>	DP, MP
Purple top	<i>Tridens flavus</i>	S, MP
Eastern gamagrass	<i>Tripsacum dactyloides</i>	S, DP, MP, WP
Short's sedge	<i>Carex shortiana</i>	S, MP, WP
Six weeks fescue	<i>Vulpia octoflora</i>	S, DP, MP, G

* S = Oak Savanna, DP = Dry Prairie, MP = Mesic Prairie, WP = Wet Prairie, G = Glade

TABLE 2 – APPROVED FORBS - species selection will only be made from appropriate habitat type based on planting site evaluation.

Common Name	Scientific Name	Habitat Type *
FORBS		
Yarrow	<i>Achillea millefolium</i>	MP
Leadplant	<i>Amorpha canescens</i>	S, DP, MP, G
Meadow anemone	<i>Anemone canadensis</i>	WP
Marsh milkweed	<i>Asclepias incarnata</i>	WP
Purple milkweed	<i>Asclepias purpurascens</i>	S, DP, MP
Common milkweed	<i>Asclepias syriaca</i>	DP, MP, WP
Butterfly milkweed	<i>Asclepias tuberosa</i>	S, DP, MP, G
Whorled milkweed	<i>Asclepias verticillata</i>	S, DP, MP, G
Spider milkweed	<i>Asclepias viridis</i>	DP, MP
Fascicled false foxglove	<i>Agalinis fasciculata</i>	DP, MP
Sky blue aster	<i>Aster azureus</i>	S, DP
Smooth aster	<i>Aster laevis</i>	S
New England aster	<i>Aster novae-angliae</i>	WP
Aromatic aster	<i>Aster oblongifolius</i>	DP, MP, G
Purple daisy aster	<i>Aster patens</i>	
Willow aster	<i>Aster praealtus</i>	WP
Silky aster	<i>Aster sericeus</i>	DP, G
Canada milk vetch	<i>Astragalus Canadensis</i>	MP
White wild indigo	<i>Baptisia alba</i>	S, DP, MP, WP, G
Blue wild indigo	<i>Baptisia australis</i>	S, DP, MP, WP, G
Cream wild indigo	<i>Baptisia bracteata</i>	DP, MP, G
Tickseed Sunflower	<i>Bidens Aristosa</i>	MP
Beggar tick (A)	<i>Bidens frondosa</i>	WP
Fringed poppy mallow	<i>Callirhoe digitata</i>	DP, MP
Purple poppy mallow	<i>Callirhoe involucrata</i>	DP, G
Prairie hyacinth	<i>Camassia angusta</i>	MP, WP
Wild hyacinth	<i>Camassia scilloides</i>	S, DP, MP, G
Partridge pea (A)	<i>Cassia fasciculata</i>	S, DP, MP, G
Indian paintbrush (A)	<i>Castilleja coccinea</i>	DP, MP, WP, G
New Jersey tea	<i>Ceanothus americanus</i>	S, DP, MP, G
Sensitive Pea	<i>Chamaecrista nititans</i>	S
Grandiflora coreopsis	<i>Coreopsis grandiflora</i>	DP, MP
Coreopsis	<i>Coreopsis lanceolata</i>	DP, MP, G
Finger/Prairie Coreopsis	<i>Coreopsis palmata</i>	S, DP, MP, G
Plains coreopsis	<i>Coreopsis tinctoria</i>	DP, G
Tickseed coreopsis	<i>Coreopsis tripteris</i>	S, DP, MP, WP, G
Rattlebox	<i>Crotalaria sagittalis</i>	DP, G
White prairie clover	<i>Dalea candida</i>	S, DP, MP, G
Purple prairie clover	<i>Dalea purpurea</i>	S, DP, MP, G
Illinois bundle flower	<i>Desmanthus illinoensis</i>	MP, WP, G
Showy tick trefoil	<i>Desmodium canadense</i>	S, DP, MP, WP, G
Beggar's lice	<i>Desmodium canescens</i>	S, DP, MP, G
Shooting star	<i>Dodecatheon meadia</i>	S, DP, G

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Common Name	Scientific Name	Habitat Type *
Pale purple coneflower	<i>Echinacea pallida</i>	S, DP, MP, G
Yellow coneflower	<i>Echinacea paradoxa</i>	S, DP, G
Purple coneflower	<i>Echinacea purpurea</i>	S, MP, WP, G
Ozark glade coneflower	<i>Echinacea simulata</i>	S, DP, MP, G
Rattlesnake master	<i>Eryngium yuccifolium</i>	S, DP, MP, G
Boneset	<i>Eupatorium perfoliatum</i>	WP
Flowering spurge	<i>Euphorbia corollata</i>	S, DP, MP, G
Rose verbena	<i>Glandularia canadensis</i>	S, DP, G
Curly cup gum plant	<i>Grindelia lanceolata</i>	S, DP, MP, G
Large-flowered Gaura,	<i>Gaura longiflora</i>	DP, MP, WP, S
Sawtooth sunflower	<i>Helianthus grosseserratus</i>	DP, MP, WP, G
Ashy Sunflower	<i>Helianthus mollis</i>	DP, MP, G
Western sunflower	<i>Helianthus occidentalis</i>	DP, MP, G
Willowleaf Sunflower	<i>Helianthus salicifolius</i>	WP, MP, DP
Woodland sunflower	<i>Helianthus strumosus</i>	S
Ox-eye/false sunflower	<i>Heliopsis helianthoides</i>	S, DP, MP, G
Alum root	<i>Heuchera richardsonii</i>	DP, G
Copper flag	<i>Iris fulva</i>	MP, WP
Blue flag	<i>Iris virginica shrevei</i>	WP
Roundhead lespedeza	<i>Lespedeza capitata</i>	S, DP, MP, G
Lespedeza hirta	<i>Lespedeza hirta</i>	S, DP, MP, G
Postrate lespedeza	<i>Lespedeza procumbens</i>	DP, G
Slender lespedeza	<i>Lespedeza virginica</i>	S, DP, MP, G
Violet lespedeza	<i>Lespedeza violacea</i>	S
Rough blazing star	<i>Liatris aspera</i>	S, DP, G
Glade blazing star	<i>Liatris mucronata</i>	S, DP, G
Blazing star	<i>Liatris pycnostachya</i>	DP, MP, WP, G
Squarrosa blazing star,	<i>Liatris squarrosa</i>	S, DP
Squarrolosa blazing star,	<i>Liatris squarrolosa</i>	S, DP, MP, G
Yellow flax	<i>Linum medium</i>	DP, MP
Cardinal flower	<i>Lobelia cardinalis</i>	WP
Blue lobelia	<i>Lobelia siphilitica</i>	WP
Seed box	<i>Ludwigia alternifolia</i>	WP
Barbara's button	<i>Marshallia caespitosa</i>	DP, MP, WP
Bunchflower	<i>Melanthium virginicum</i>	MP, WP, S (Wet)
Sensitive briar	<i>Mimosa nuttalli</i>	S, DP, MP, G
Savanna bergamot	<i>Monarda bradburiana</i>	S, DP, G
Bergamot	<i>Monarda fistulosa</i>	S, DP, MP, WP, G
Evening primrose	<i>Oenothera biennis</i>	MP
Missouri primrose	<i>Oenothera missouriensis</i>	DP, G
Sampson's snakeroot	<i>Orbexilum pedunculatum</i>	S, MP, WP
Spanish needles	<i>Palafoxia callosa</i>	S, DP, G
Wild quinine	<i>Parthenium integrifolium</i>	S, DP, MP, G
Lousewort/Wood betony	<i>Pedicularis canadensis</i>	DP, MP, G
Purple beardtongue	<i>Penstemon cobaea</i>	S, DP, G
Beardtongue	<i>Penstemon digitalis</i>	DP, MP, WP, G
Prairie beardtongue	<i>Penstemon tubaeflorus</i>	S, DP, MP
Narrow-leaved false dragonhead	<i>Physostegia angustifolia</i>	S, DP, MP
Obedient plant	<i>Physostegia virginiana</i>	S, MP, WP, G

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Common Name	Scientific Name	Habitat Type *
Prairie parsley	<i>Polytaenia nuttallii</i>	DP, MP, WP
Prairie cinquefoil	<i>Potentilla arguta</i>	DP, MP, G
Scurfy pea	<i>Psoralidium tenuiflorum</i>	MP, WP
Slender mountain mint	<i>Pycnanthemum tenuifolium</i>	S, DP, MP, WP, G
Mountain mint	<i>Pycnanthemum virginianum</i>	WP
Prairie coneflower	<i>Ratibida columnifera</i>	DP, MP, G
Gray-head coneflower	<i>Ratibida pinnata</i>	S, DP, MP, G
Pasture rose	<i>Rosa carolina</i>	DP, MP, S
Prairie rose	<i>Rosa setigera</i>	MP
Black-eyed Susan (B)	<i>Rudbeckia hirta</i>	S, DP, MP, G
Missouri Black-eyed Susan	<i>Rudbeckia missouriensis</i>	DP, G
Sweet coneflower	<i>Rudbeckia subtomentosa</i>	MP, WP
Brown-eyed Susan	<i>Rudbeckia triloba</i>	WP
Wild petunia	<i>Ruellia humilis</i>	DP, G
Pitchers sage	<i>Salvia azurea</i>	DP, MP, G
Downy skullcap	<i>Scutellaria incana</i>	S (S. MO), MP
Maryland senna	<i>Senna marilandica</i>	S, MP, WP
Royal catchfly	<i>Silene regia</i>	S, DP, MP
Rosinweed	<i>Silphium integrifolium</i>	S, DP, MP, WP, G
Compass Plant	<i>Silphium laciniatum</i>	DP, MP, WP, G
Cup plant	<i>Silphium perfoliatum</i>	WP
Prairie dock	<i>Silphium terebinthinaceum</i>	S, DP, MP, WP, G
Blue-eyed grass	<i>Sisyrinchium campestre</i>	DP
Gray goldenrod	<i>Solidago nemoralis</i>	S, DP, MP, G
Savanna goldenrod	<i>Solidago petiolaris</i>	S, DP, G
White upland aster	<i>Solidago ptarmicoides</i>	S, MP, DP, G
Riddell's goldenrod	<i>Solidago riddellii</i>	WP
Rigid/Stiff goldenrod	<i>Solidago rigida</i>	S, DP, MP, WP, G
Showy goldenrod	<i>Solidago speciosa</i>	S, DP, MP
Bean, Small Fuzzy	<i>Strophostyles leiosperma</i>	DP, MP, S
Goat's rue	<i>Tephrosia virginiana</i>	S, DP, MP, G
Ohio spiderwort	<i>Tradescantia ohiensis</i>	S, DP, MP, WP
Blue vervain	<i>Verbena hastata</i>	WP
Hoary vervain	<i>Verbena stricta</i>	DP, MP
Yellow ironweed	<i>Verbesina alternifolia</i>	S, BF, WP
Wingstem sunflower	<i>Verbesina helianthoides</i>	S, DP, MP
White wingstem	<i>Verbesina virginica</i>	S, BF
Ironweed	<i>Vernonia missurica</i>	MP, WP
Giant ironweed	<i>Vernonia gigantea</i>	S (Wet), WP
Culver's root	<i>Veronicastrum virginicum</i>	S, MP, WP
Golden alexander	<i>Zizia aurea</i>	S, DP, MP, WP, G

* S = Oak Savanna, DP = Dry Prairie, MP = Mesic Prairie, WP = Wet Prairie,
 G = Glade, BF = Bottomland Forest
 A = Annual B = Biennial

