NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD AND SPECIFICATIONS

RESTORATION AND MANAGEMENT OF RARE OR DECLINING HABITATS

(acre)

CODE 643

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DEFINITION

Restoring and conserving rare or declining native vegetated communities and associated wildlife species

PURPOSE

- Restore land or aquatic habitats degraded by human activity.
- Provide habitat for rare and declining wildlife species by restoring and conserving native plant communities.
- Increase native local ecotype plant community diversity.
- Management of unique or declining native habitats.

CONDITIONS WHERE PRACTICE APPLIES

On any landscape which once supported or currently supports rare and declining habitat to be restored or managed.

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

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

See eFOTG Section II – G 1 for listing of soil series by tree, grass or transitional.

CRITERIA

Methods used will be designed to protect the soil resource from erosion. Soil loss will be maintained at or below tolerable limit (T).

Vegetative manipulation to maximize plant and/or wildlife diversity can be accomplished by prescribed burning, mechanical, biological, chemical methods, or a combination of the four.

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

Maintenance measures must be provided to control severe outbreaks of noxious weeds and other invasive species in order to comply with state noxious weed laws. Control of noxious weeds will be done on a “spot” basis to protect forbs and legumes that benefit native pollinators and other wildlife.

Management practices and activities are not to disturb cover during the primary nesting period in Missouri (May 1- July 15). Exceptions (area office staff) can be granted for periodic burning or mowing during establishment or when necessary to maintain the health and/or vigor of the plant community.

Where feasible prescribed burning will be utilized instead of mowing and will follow PRESCRIBED BURNING (338).

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 should guide the plant species selected.

Seeding rates will be adequate to accomplish the planned purpose. Only viable, high quality and adapted seed will be used. Planting dates, care in handling, site preparation and planting of the seed will ensure that planted materials have an acceptable rate of survival.

Haying and grazing (if allowed) will be managed as necessary to achieve and maintain the intended purpose.

CONSIDERATIONS

When developing site specific plans, confer with resource agency specialists that are experienced in restoration of the desired habitat type.

The site should first be evaluated to determine if the habitat can be restored through management techniques (prescribed burning, brush control, etc.); or if it must be established by planting or seeding as in the case of a recently cultivated field.

In selection and management of plant species, consider long term land use objectives and habitat needs of target wildlife species.

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.

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 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 practices 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.

REFERENCES

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

NRCS Threatened and Endangered Species Policy

The Endangered Species Act

Missouri Savanna Restoration Handbook

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General Specifications Applicable to all Habitats

RESTORATION OF EXISTING DEGRADED HABITATS

For sites that are not cultivated and still have some of the characteristic species of the pre-settlement habitat type, it is often best to attempt restoration through management techniques such as prescribed burning, woody cover control, and interseeding with desired species.

- Remove exotic or aggressive trees and shrubs.
- Remove excessive stocking of trees.
- Use site adapted seed in areas opened up as woody cover is controlled.
- 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.
- If species diversity does not increase to the desired level after several years, interseed missing species into the existing stand. For more information see: *Missouri Savanna Restoration Handbook – NRCS, MDC, UMC*

For existing tree stands FOREST STAND IMPROVEMENT (666) will be used for recommended methods for woody cover manipulation.

ESTABLISHMENT OF VEGETATION

Seed dates and sequence

Herbaceous seeding will be performed within the seeding dates listed in CONSERVATION COVER (327).

Dormant seeding of the grass/forb mix is the recommended method.

Split seeding is the next best seeding method. It is recommended that the forbs be planted first during late fall and early winter when soil and air temperatures will remain cold enough to prevent germination. It is recommended that the grass component be seeded one year after the forb seeding using the no-till method. This allows the forbs to establish without competition from aggressive tall grass species. Split seeding provides the greatest opportunity for quickest restoration. Spring seeding is the least desirable seeding period and should be avoided if possible.

Lime and fertilizer

Soil tests and supplemental fertility are not required for this practice.

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 Information Sheet IS-MO643P-Restoring or Recreating a Tallgrass Prairie – eFOTG Section IV. D, and CONSERVATION COVER (327) and PASTURE PLANTING (512). 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

See CONSERVATION COVER (327) for recommended methods for herbaceous cover, as needed. See TREE AND SHRUB ESTABLISHMENT (612) for recommended planting stock care, planting dates and weed control.

Species selection and sources

Three options exist for plant material selection:

1) The use of local genotype herbaceous plant material (150 mile radius of planting site). Herbaceous seed/plants of local origin are especially desirable when restoration occurs adjacent/or in near proximity to existing native/natural sites.

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2) The use of Missouri native seed/plant. Missouri native is defined as a plant that originated in Missouri; was not introduced; and existed within the state borders prior to arrival of settlers.

OR

3) Plant material from outside Missouri as long as its genetic origin is within the same Ecotype Zone as the restoration site (see zone map at the end of this standard).

Herbaceous/plant material tags must show a) genetic origin; b) production location; and c) (applicable for herbaceous material) - the % mix composition (scientific and common names of species) and amounts to verify requirements as detailed by seed mix guide sheet – all species in mix must be detailed on tag. A certified seed testing lab must test the seed for germination and purity (and be shown on seed tag) to obtain a current seed test for PLS of the species.

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

It is preferable to utilize native seed from similar/local sites if possible.

Develop a specific grass list for each habitat type selecting a minimum of four grasses **with the total amount of grass seed in the mix to equal five pounds (PLS) per acre (except for glades requiring 3 pounds (PLS) per acre).**

A minimum of ten forb species will be selected. **The forb mixture will be seeded at a minimum of one-half pound (PLS) per acre, except for glades requiring one pound (PLS) per acre.**

No improved varieties of grasses, trees, shrubs, or forbs will be used in establishing this practice. **Only native tree/shrubs 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.

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SPECIFICATIONS FOR SELECT HABITAT TYPES
OAK SAVANNA

This practice will only be applied on fields with transitional or woodland derived soils that comprise at least 50 percent of the field. Oak savannas occurred primarily in upland landscapes with limited occurrence in bottomland. Oak savannas will not be planned on fields that are comprised of more than 50 percent prairie derived soils. (Transitional soil areas can also be restored to prairie.) See Information Sheet IS-MO643-Designing an Oak Savanna for additional guidance – eFOTG Section IV. D.

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):

Average tree diameter (canopy trees only)	***Trees per acre (40 % canopy)***	***Trees per acre (30 % canopy)***	***Trees per acre (20 % canopy)***
4	210	160	105
6	110	80	60
8	75	60	40
10	50	40	25
12	35	30	20
14	27	20	15
16	22	16	11
18	17	13	8
20	14	11	7

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Following the above guidelines will create approximating a 20, 30, or 40 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).

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

The choice of canopy trees should be based on landowner's objectives, slope position, aspect, geology, and soil type. See species selection below.

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.

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 50 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.

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.

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.

Oak savanna communities once occupied a major part of the landscape of Missouri. This community is characterized by widely spaced, open grown oak trees, the almost complete absence of a shrub layer, and herbaceous, prairie-like understory. The canopy cover created by the trees ranges from 10% to as high as 50%. This community was present throughout much of Missouri. Savannas are generally regarded as transition areas where prairie and forest intermingle. 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.

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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	*Quercus velutina*
Blackjack oak	*Quercus marilandica*
Bur oak	*Quercus macrocarpa*
Chinquapin oak	*Quercus muhlenbergii*
Mockernut hickory	*Carya tomentosa*
Persimmon	*Diospyros virginiana*
Post oak	*Quercus stellata*
Shagbark hickory	*Carya Ovata*
Shingle oak	*Quercus imbricaria*
Swamp white oak	*Quercus bicolor*
White oak	*Quercus alba*

Shrubs: ((645) will be used for woody cover requirements.)

Gray/roughleaf dogwood	*Cornus spp.*
Prairie willow	*Salix humilis*
American/Chickasaw plum	*Prunus spp.*
Choke cherry	*Prunus virginiana*
Fragrant sumac	*Rhus aromatica*
False indigo bush	Amorpha *fruticosa*

Grasses: A total of 5 pounds PLS of any combination of at least 4 species. Switchgrass, big bluestem, indiangrass, eastern gamagrass, tall dropseed, prairie dropseed each being limited to not more than .25 pound PLS per acre. Sideoats grama will be limited to not more than 1 pound PLS per acre. All other grasses will be planted at not less than 1 pound PLS per acre when counting towards the 4 species requirement. Additional grass species can be added at lesser amounts for diversity to equal the 5 pound mix.

Big bluestem	*Andropogon gerardii*
Canada wildrye	*Elymus canadensis*
Indian grass	*Sorghastrum nutans*
Little bluestem	*Schizachyrium scoparium*
Prairie dropseed	*Sporobolus heterolepis*
Tall dropseed	*Sporobolus compositus*
Sideoats grama	*Bouteloua curtipendula*
Switchgrass	*Panicum virgatum*
Virginia wildrye	*Elymus virginicus*
River oats	*Chasmanthium latifolium*
Broomsedge	*Andropogon virginicus*
Eastern gamagrass	*Tripsacum dactyloides*
Purple top	*Tridens flavus*
Winter bent grass	*Agrostis hyemalis*

Forbs (Wildflowers): A minimum of ten forb species at 0.5 PLS per acre with no single species to exceed 15% of the mix and the mix having no more than 15% annuals/biennials species combined. Annuals **(A)** and Biennials **(B)** are shown in the following table, all else are considered perennial.

Bergamot	*Monarda fistulosa*
Black-eyed Susan **(B)**	*Rudbeckia hirta*
Butterfly milkweed	*Asclepias tuberosa*
Cream wild indigo	*Baptisia leucophaea*
White wild indigo	*Baptisia alba*
Finger Coreopsis	*Coreopsis palmata*
Flowering spurge	*Euphorbia corollata*
Goat's Rue	*Tephrosia virginiana*
Golden alexander	*Zizia aurea*
Gray goldenrod	*Solidago nemoralis*
Grayhead coneflower	*Ratibida pinnata*
Leadplant	*Amorpha canescens*
Lousewort	*Pedicularis canadensis*
Maryland senna	*Senna marilandica*
New Jersey tea	*Ceanothus americanus*
Obedient plant	*Physostegia virginiana*
Ozark coneflower	*Echinacea paradoxa*
Ox-eye sunflower	*Heliopsis helianthoides*
Prairie dock	*Silphium terebinthinaceum*
Pale purple coneflower	*Echinacea pallida*
Purple coneflower	*Echinacea purpurea*
Purple milkweed	*Asclepias purpurascens*
Purple prairie clover	*Dalea purpurea*
Rattlesnake master	*Eryngium yuccifolium*
Rigid goldenrod	*Solidago rigida*
Rosinweed	*Silphium integrifolium*
Roundhead lespedeza	*Lespedeza capitata*
Sampson's snakeroot	*Psoralea pedunculata*
Sensitive briar	*Schrankia uncinata*
Shooting star	*Dodecatheon meadia* L
Showy goldenrod	*Solidago speciosa*
Partridge pea **(A)**	*Cassia fasciculata*
Showy tick trefoil	*Desmodium canadense*
Sky blue aster	*Aster azureus*
Slender lespedeza	*Lespedeza virginica*
Slender mountain mint	*Pycnanthemum tenuifolium*
Smooth aster	*Aster laevis*
Tickseed coreopsis	*Coreopsis tripteris*
Violet lespedeza	*Lespedeza violacea*
White beardtoungue	*Penstemon albidus*

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White prairie clover	*Petalostemon candidus*	Woodland aster	*Aster divaricatus*
Wild hyacinth	*Camassia scilloides*	Woodland sunflower	*Helianthus strumosus*
Wild quinine	*Parthenium integrifolium* L.		

Management:
At a minimum, vegetation will be controlled in a three-foot wide band around each 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, but will not be applied to the areas planted in trees until determined by a resource 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. For existing habitats in restoration prescribed burning should be conducted every year for 3-5 years. After this time, prescribed burning should be on a three or four-year schedule or as recommended by a resource agency representative. For planted habitats prescribed burning will be conducted no earlier than the beginning of the second growing season in areas devoid of trees. If the field cannot be burned the second year it should be mowed in early spring. Burning will take place in the dormant season (late fall to early spring) to encourage the native forbs and reduce damage to trees.

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
- Exposed backslopes (135-315 degrees aspect)

<u>Oak-pine Woodland Conversions</u>

To increase the pine component in an existing oak-pine stand follow these steps:

- 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.
- 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 understory woody stems, 1 to 8 inches in diameter, with herbicide and/or prescribed burning.
- Plant shortleaf pine seedlings at the rate of 302 trees per acre (12 x 12 feet spacing).
- Remove remaining oak overstory within 3 years.
- Beginning periodic prescribed burnings 3-5 years after planting or when pines exceed 3 feet in height.

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New stands

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

Plant shortleaf pine seedlings at the rate of 302 trees per acre (12 x 12 feet spacing). Follow TREE/SHRUB ESTABLISHMENT (612) guidelines for recommended planting stock care, planting dates, and weed control. If a hardwood component (black oak, blackjack oak, scarlet oak, post oak, white oak and hickory spp.) is desired, increase planting by 134 trees to the acre and plant pines and hardwoods on a 10 x 10 feet spacing. 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. If direct seeding is required, seeding rate will be determined after an on-site visit by MDC or NRCS forester. Follow TREE/SHRUB ESTABLISHMENT (612) for direct seeding rates.

Management:
At a minimum, vegetation competition with the tree plantings will be controlled by an approved method for at least three years. Fire is essential for the management of oak pine communities. PRESCRIBED BURNING (338) is a required management practice. Begin periodic prescribed burnings 3-5 years after planting or when pines exceed 3 feet in height or as recommended by a resource planning professional.

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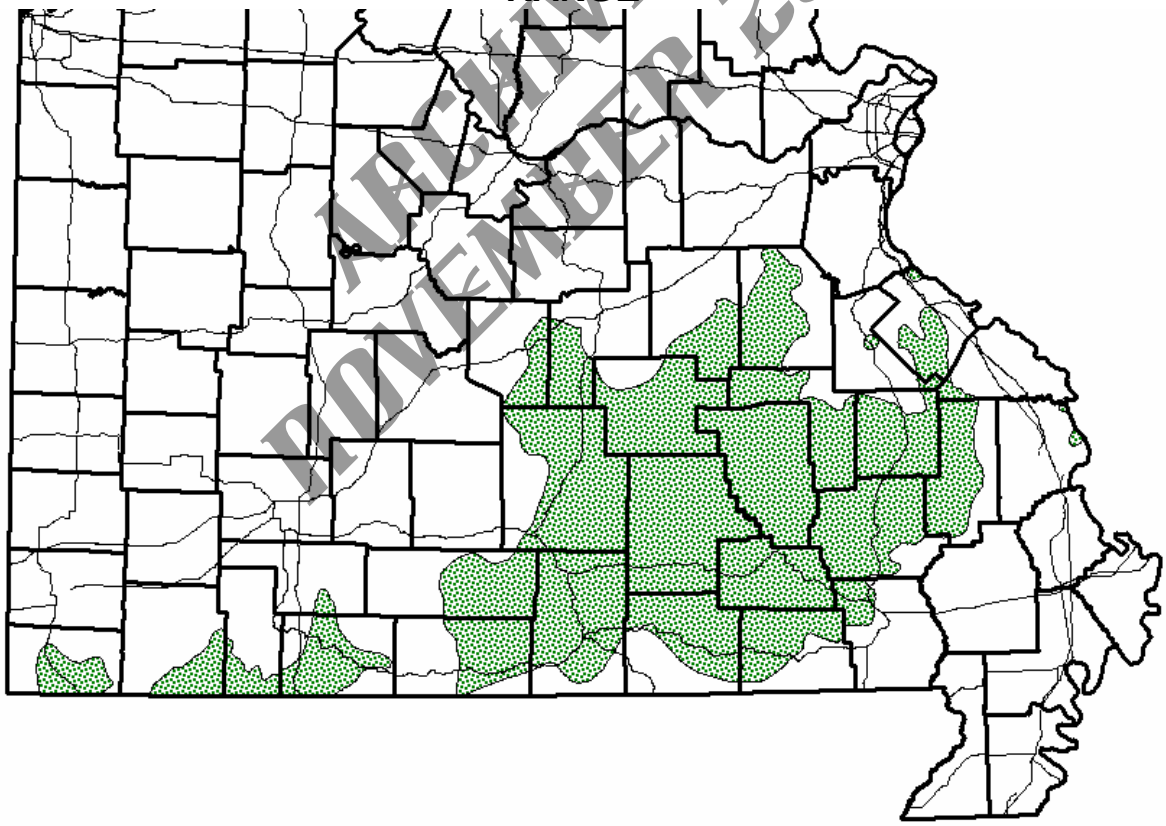
HISTORIC SHORTLEAF PINE RANGE



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 those portions of fields with transitional or herbaceous soils comprising less than 50 percent of the field. Prairie will not be planted on woodland 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 interspersion 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, brush control, etc.); or if it must be established by planting or seeding as in the case of a recently cultivated field.

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Seeding Mixture

Grasses: **For dry and mesic prairies a** total of 5 pounds PLS of any combination of at least 4 species. Switchgrass, big bluestem, indiangrass, eastern gamagrass, tall dropseed, prairie dropseed each being limited to not more than .25 pound PLS per acre. Sideoats grama will be limited to not more than 1 pound PLS per acre. All other grasses will be planted at not less than 1 pound PLS per acre when counting towards the 4 species requirement. Additional grass species can be added at lesser amounts for diversity to equal the 5 pound mix.

Wet prairies will require specific seeding mix as recommended by area office staff.

Forbs (Wildflowers): A minimum of ten forb species at 0.5 PLS per acre with no single species to exceed 15% of the mix and the mix having no more than 15% annuals/biennials species combined. Annuals **(A)** and Biennials **(B)** are shown in the following table, all else are considered perennial.

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Shrubs: Shrub plantings should 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 PLANTING (612) for recommended planting stock care, planting dates and weed control.

Shrubs:

Gray/roughleaf dogwood	*Cornus spp.*	Choke cherry	*Prunus virginiana*
Prairie willow	*Salix humilis*	Fragrant sumac	*Rhus aromatica*
American/Chickasaw plum	*Prunus spp.*	False indigo bush	*Amorpha fruticosa*

PRAIRIE - DRY

Dominant Grasses

Little bluestem *Schizachyrium scoparium*
Sideoats grama *Bouteloua curtipendula*

Other Grasses

Big bluestem *Andropogon gerardii*
Prairie dropseed *Sporobolus heterolepis*
Tall dropseed *Sporobolus compositus*
Indian grass *Sorghastrum nutans*
Switchgrass *Panicum virgatum*
Splitbeard Bluestem Andropogon ternarius (sand prairie in SE Missouri)
Eastern gamagrass *Tripsacum dactyloides*

Common Forbs and Legumes

Leadplant *Amorpha canescens*
Aromatic aster *Aster oblongifolius*
Sky blue aster *Aster oolentangiensis*
Silky aster *Aster sericeus*
White wild indigo *Baptisia alba*
Blue wild indigo *Baptisia australis*
Cream wild indigo *Baptisia bracteata*
Purple poppy mallow *Callirhoe involucrata*
Indian paintbrush **(A)** *Castilleja coccinea*
New Jersey tea *Ceanothus americanus*
Partridge pea **(A)** *Cassia fasciculata*
Coreopsis *Coreopsis lanceolata* or *grandiflora*
Prairie coreopsis *Coreopsis palmata*
Rattlebox *Crotalaria sagittalis*
Purple prairie clover *Dalea purpurea*
White prairie clover *Dalea candida*
Tick trefoils *Desmodium spp.*
Pale purple coneflower *Echinacea pallida*
Yellow coneflower *Echinacea paradoxa*
Flowering spurge *Euphorbia corollata*
Gumweed **(B)** *Grindelia lanceolata*
Ashy Sunflower *Helianthus mollis*
Sawtooth sunflower *Helianthus grosseserratus*
Western sunflower *Helianthus occidentalis*
Roundhead bushclover *Lespedeza capitata*
Slender bush clover *Lespedeza virginica*
Blazing stars *Liatris spp.*
Sampson's snakeroot *Orbexilum pedunculatum*
Wild quinine *Parthenium integrifolium*
Wood betony *Pedicularis canadensis*
Scurf pea *Pediomelum argophyllum*
Beardtongue *Penstemon digitalis*
Pale beard tongue *Penstemon pallidus*
Prairie cinquefoil *Potentilla arguta*
Scurfy pea *Psoralidium tenuiflorum*
Slender mountain mint *Pycnanthemum tenuifolium*
Hairy mountain mint *Pycnanthemum verticillatum*
Prairie coneflower *Ratibida columnifera*
Gray-head coneflower *Ratibida pinnata*
Black-eyed Susan **(B)** *Rudbeckia hirta*
Missouri black-eyed Susan *Rudbeckia missouriensis*
Wild petunia *Ruellia humilis*
Pitchers sage *Salvia azurea*
Rosinweed *Silphium integrifolium*
Compass Plant *Silphium laciniatum*
Prairie Dock *Silphium terebinthinaceum*
Blue-eyed grass *Sisyrinchium campestre*
Grass-leaved goldenrod *Solidago gymnospermoides*
Gray goldenrod *Solidago nemoralis*
Stiff goldenrod *Solidago rigida*
Goat's rue *Tephrosia virginiana*

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PRAIRIE - MESIC (MOST COMMON PRAIRIE IN MISSOURI)

Dominant Grasses

Little bluestem *Schizachyrium scoparium*
Sideoats grama *Bouteloua curtipendula*
Big bluestem *Andropogon gerardii*

Other Grasses

Indian grass *Sorghastrum nutans*
Eastern gamma grass *Tripsacum dactyloides*
Prairie dropseed *Sporobolus heterolepis*
Tall dropseed *Sporobolus compositus*
Switchgrass *Panicum virgatum*
Canada wild rye *Elymus Canadensis*
Purple top *Tridens flavus*
Junegrass *Koeleria cristata*
Winter bent grass *Agrostis hyemalis*
Porcupine grass *Stipa spartea*

Common Forbs and Legumes

Yarrow *Achillea millefolium*
Leadplant *Amorpha canescens*
Indian plantains *Arnoglossum spp.*
Butterfly milkweed *Asclepias tuberosa*
Spider milkweed *Asclepias viridis*
Aromatic aster *Aster oblongifolius*
Sky blue aster *Aster oolentangiensis*
White wild indigo *Baptisia alba*
Cream wild indigo *Baptisia bracteata*
Wild hyacinth *Camassia scilloides*
Indian paintbrush **(A)** *Castilleja coccinea*
New Jersey tea *Ceanothus americanus*
Partridge pea **(A)** *Cassia fasciculata*
Coreopsis *Coreopsis lanceolata* or *grandiflora*
Prairie coreopsis *Coreopsis palmata*

Tall coreopsis *Coreopsis tripteris*
Purple prairie clover *Dalea purpurea*
White prairie clover *Dalea candida*
Illinois bundle flower *Desmanthus illinoensis*
Tick trefoils *Desmodium spp.*
Pale purple coneflower *Echinacea pallida*
Purple coneflower *Echinacea purpurea*
Rattlesnake master *Eryngium yuccifolium*
Flowering spurge *Euphorbia corollata*
Sawtooth sunflower *Helianthus grosseserratus*
False sunflower *Heliopsis helianthoides*
Ashy sunflower *Helianthus mollis*
Western sunflower *Helianthus occidentalis*
Roundhead bushclover *Lespedeza capitata*
Slender bush clover *Lespedeza virginica*
Blazing stars *Liatris spp.*
Sensitive briar *Mimosa quadrivalvis*
Bergamot *Monarda fistulosa*
Wild quinine *Parthenium integrifolium*
Scurf pea *Pediomelum argophyllum*
Beardtongue *Penstemon digitalis*
Wood betony *Pedicularis canadensis*
Obedient plant *Physostegia virginianna*
Prairie parsley *Polytaenia nuttallii*
Hairy mountain mint *Pycnanthemum verticillatum*
Slender mountain mint *Pycnanthemum tenuifolium*
Prairie cinquefoil *Potentilla arguta*
Sampson's snakeroot *Psoralea pedunculata*
Scurfy pea *Psoralidium tenuiflorum*
Prairie coneflower *Ratibida columnifera*
Gray-head coneflower *Ratibida pinnata*
Prairie rose *Rosa setigera*
Sweet coneflower *Rudbeckia subtomentosa*
Rosinweed *Silphium integrifolium*
Compass Plant *Silphium laciniatum*
Prairie Dock *Silphium terebinthinaceum*
Black-eyed Susan *Rudbeckia hirta*
Pitchers sage *Salvia azurea*
Sensitive brier *Schrankia uncinata*
Maryland senna *Senna marilandica*
Royal catchfly *Silene regia*
Showy goldenrod *Solidago speciosa*
Stiff goldenrod *Solidago rigida*
Grass-leaved goldenrod *Solidago gymnospermoides*
Gray goldenrod *Solidago nemoralis*
Goat's rue *Tephrosia virginiana*
Ohio spiderwort *Tradescantia ohiensis*
Ironweeds *Vernonia spp.*
Golden Alexander *Zizia aurea*

PRAIRIE - WET

Dominant Grasses

Big bluestem	*Andropogon gerardii*
Prairie cordgrass	*Spartina pectinata*
Canada wild rye	*Elymus canadensis*
Virginia wild rye	*Elymus virginicus*
Native sedges	*Carex spp.*
Native bulrushes	*Scripus spp.*
Native rushes	*Juncos spp.*

Other Grasses

Swichgrass	*Panicum virgatum*
River oats	*Chasmanthium latifolium*
Eastern gamagrass	*Tripsacum dactyloides*

Common Forbs and Legumes

Meadow anemone *Anemone canadensis*
Indian plantains *Arnoglossum spp.*
Marsh milkweed *Asclepias incarnata*
New England aster *Aster novae-angliae*
Willow aster *Aster praealtus*
White wild indigo *Baptisia alba*
Spanish needles **(A)** *Bidens spp.*
Wild hyacinth *Camassia scilloides*
Tall coreopsis *Coreopsis tripteris*
Illinois bundle flower *Desmanthus illinoensis*
Tick trefoils *Desmodium spp*
Purple coneflower *Echinacea purpurea*
Bonesets *Eupatorium spp.*
Joe pye weeds *Eupatorium spp.*
Sawtooth sunflower *Helianthus grosseserratus*
False sunflower *Heliopsis helianthoides*
Blazing stars *Liatris spp.*
Cardinal flower *Lobelia cardinalis*
Blue lobelia *Lobelia siphilitica*
Blue flag *Iris virginica*
Bergamot *Monarda fistulosa*
Beardtongue *Penstemon digitalis*
Obedient plant *Physostegia virginianna*
Prairie parsley *Polytaenia nuttallii*
Sampson's snakeroot *Psoralea pedunculata*
Slender mountain mint *Pycnanthemum tenuifolium*
Hairy mountain mint *Pycnanthemum verticillatum*
Brown-eyed Susan *Rudbeckia triloba*
Sweet coneflower *Rudbeckia subtomentosa*
Maryland senna *Senna marilandica*
Prairie Dock *Silphium terebinthinaceum*
Cup plant *Silphium perfoliatum*
Riddell's goldenrod *Solidago riddellii*
Stiff goldenrod *Solidago rigida*
Ohio spiderwort *Tradescantia ohiensis*
Blue vervain *Verbena hastata*
Culver's root *Veronicastrum virginicum*
Ironweeds *Vernonia spp.*
Golden alexander *Zizia aurea*

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Prairie Cord Grass (Spartina pectinata) Planting Guidelines:

For 1 gallon containers

Plant Medium: 55 - 1 gallon containers.

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

Planting Technique: Each of the 55 - 1 gallon containers are 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. Prescribed burning will be conducted no earlier than the beginning of the second growing season. If the field cannot be burned the second year it should be mowed in early spring. After establishment of the planted vegetation, prescribed burning can be conducted every year, if there is enough fuel to carry a fire, to stimulate the prairie plants and control weeds. Recommendations are found in PRECRIBED BURNING (338) and Upland Wildlife Habitat Management (645). Burning frequency and timing of burns will be based on a recommendation from a resource 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. Dormant season (late fall to early spring) burns are preferred to encourage forb component. 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.

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BOTTOMLAND FOREST

This practice will be applied on fields with bottomland woodland 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. C.

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).

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, 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) - Table 1, or eFOTG Section II - B 1 – 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.

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. Glades commonly have shallow soils and exposed bedrock. Limestone, dolomite, chert, sandstone, shale and igneous glades occur throughout the state. Drought tolerant forbs and grasses are common on glades. Some forb species are endemic to Missouri glades. A few trees, such as eastern red cedar, and shrubs also occur on glades. Periodic fires, native herbivores and local conditions of topography, bedrock, and soil influence glade development. Glade communities have been degraded by overgrazing and cedar encroachment.

The site should first be evaluated to determine if the habitat can be restored through management techniques (prescribed burning, brush control, etc.); or if it must be established by planting or seeding as in the case of a recently cultivated field.

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RESTORATION CONDITIONS

In areas where glade restoration is feasible tree densities will be reduced to 10 to 30 percent woody canopy.

Seeding Mixture

Grasses: A total of 3 pounds PLS of any combination of at least 2 species. Switchgrass being limited to not more than .25 pound PLS per acre. Sideoats grama will be limited to not more than 1 pound PLS per acre. All other grasses will be planted at not less than 1 pound PLS per acre when counting towards the 2 species requirement. Additional grass species can be added at lesser amounts for diversity to equal the 3 pound mix.

Big bluestem	*Andropogon gerardii*
Sideoats grama	*Bouteloua curtipendula*
Indian grass	*Sorghastrum nutans*
Switchgrass	*Panicum virgatum*
Little bluestem	*Schizachyrium scoparium*

Forbs (Wildflowers): A minimum of ten forb species at 1.0 PLS per acre with no single species to exceed 15% of the mix and the mix having no more than 15% annuals/biennials species combined. Annuals **(A)** and Biennials **(B)** are shown in the following table, all else are considered perennial.

Fall glade onion	*Allium stellatum*
Butterfly weed	*Asclepias tuberosa*
Aromatic aster	*Aster oblongifolius*
Silky aster	*Aster sericeus*
White wild indigo	*Baptisia alba*
Blue wild indigo	*Baptisia australis*

Cream wild indigo	*Baptisia bracteata*
Fringed poppy mallow	*Callirhoe digitata*
Wild hyacinth	*Camassia scilloides*
Indian paintbrush **(A)**	*Castilleja coccinea*
Lanceleaf coreopsis	*Coreopsis lanceolata*
Plains coreopsis	*Coreopsis tinctoria*
Tall coreopsis	*Coreopsis tripteris*
White prairie clover	*Dalae candida*
Purple prairie clover	*Dalae purpurea*
Shooting star	*Dodecatheon meadia*
Pale-purple coneflower	*Echinacea pallida*
Glade coneflower	*Echinacea simulata*
Yellow coneflower	*Echinacea paradoxa*
Western sunflower	*Helianthus occidentalis*
Ox-eye sunflower	*Heliopsis helianthoides*
Alum root	*Heuchera richardsonii*
Rough blazing star	*Liatris aspera*
Bottlebrush blazing star	*Liatris mucronata*
Agave	*Manfreda virginica*
Barbara's button	*Marshallia caespitosa*
Wild bergamot	*Monarda fistulosa*
Missouri Primrose	*Oenothera macrocarpa*
Wild Quinine	*Parthenium integrifolium*
Purple beard tongue	*Penstemon cobea*
Smooth penstemon	*Penstemon pallidus*
Slender mountain mint	*Pycnanthemum tenuifolium*
Long-head coneflower	*Ratibida columnifera*
Gray-head coneflower	*Ratibida pinnata*
Black-eyed Susan **(B)**	*Rudbeckia hirta*
Missouri black-eye Susan	*Rudbeckia missouriensis*
Wild petunia	*Ruellia humilis*
Blue sage	*Salvia azurea*
Sensitive briar	*Schrankia nuttallii*
Rosinweed	*Silphium integrifolium*
Compass plant	*Silphium laciniatum*
Prairie dock	*Silphium terebinthinaceum*
Golden alexander	*Zizia aurea*
Rattlesnake master	*Eryngium yuccifolium*

Management recommendations for glade maintenance: 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. A dormant, broadcast seeding may be the only practical method of establishing vegetation. If feasible, the area should be raked or dragged to improve seed to soil contact. Glade communities are best managed by the use of prescribed fire. 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 every other year, if there is enough fuel to carry a fire, to stimulate the glade plants and control woody vegetation and weeds. Recommendations are found in PRESCRIBED BURNING (338). Burn frequency and timing of burns will be based on a recommendation from a resource agency representative. Dormant season (late fall to early spring) burns are preferred to encourage forb component. Undesirable woody vegetation should be controlled.

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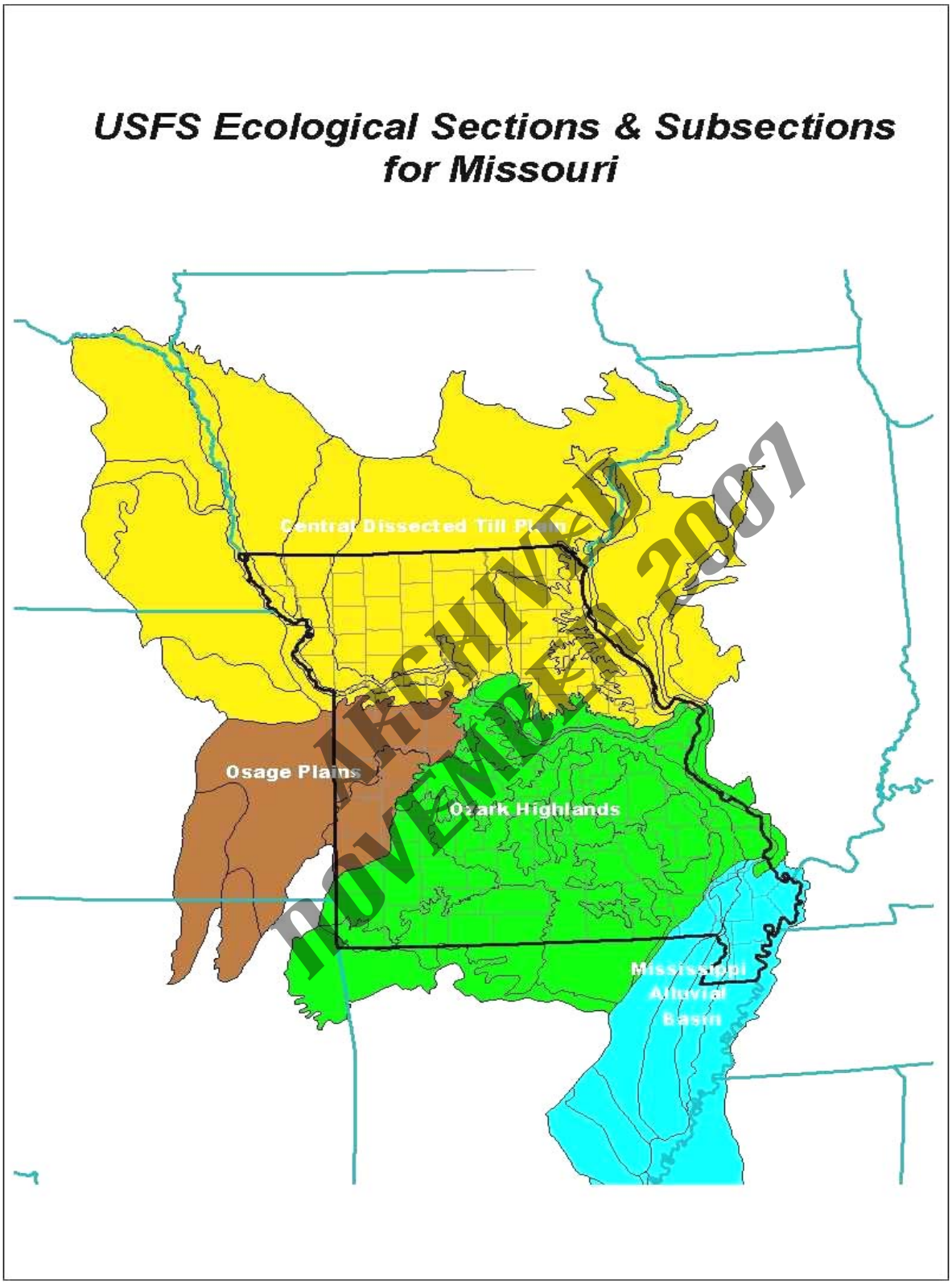

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