



EXTENSION



**Converting Introduced
Grasses to Rangeland**
E-1056



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Table of Contents

Introduction.....	1
Benefits of Native Species	1
Is Replanting Necessary?	2
Planning for Conversion	2
Control or Eradication Options for Introduced Grasses.....	3
Herbicide Application.....	4
Soil Erosion Considerations	8
Establishing Rangeland	9
Managing Rangeland.....	12
Weed Control.....	14
Summary	18
For Additional Information	19

Introduction

Introduced (not native) grasses have been widely planted throughout the Southern Great Plains for livestock forage and soil erosion control. Pastures planted to introduced grasses (hereafter IG) are typically dense with little plant diversity, offering limited value to many wildlife species. Additionally, IG grasses can invade rangelands and outcompete native plants. Rangelands are grasslands/shrublands dominated by native plants that are not managed with supplemental fertility or irrigation. Rangeland includes sites that were never converted to IG and sites that are converted from IG back to native dominated plant communities. This results in lower structural and species diversity, affecting wildlife and livestock grazing potential. Land managers who have multi-use goals may want to reduce or eliminate IG, as they can be detrimental to management goals.

The purpose of this document is to provide guidance for eliminating common IG in Oklahoma, such as bermudagrass (*Cynodon dactylon*), tall fescue (*Festuca arundinacea*), and Old-World bluestem (hereafter OWB) species such as yellow bluestem (AKA plains bluestem, King Ranch bluestem, KR bluestem, *Bothriochloa ischaemum*) and Caucasian bluestem (AKA WW-BDahl bluestem, *B. bladhii*). Once converted, areas formerly dominated with IG can be managed to promote a diversity of native grasses and forbs (non-woody, broadleaf plants). While the recommendations in this guide are focused on Oklahoma, most of the information contained here is broadly applicable in other areas where these IG species occur.

Benefits of Native Species

Restoring rangelands can provide numerous benefits to land managers. A diversity of native grasses and forbs can offer high-quality livestock forage, an extended grazing period, enhanced aesthetics, and wildlife habitat (including pollinating insects). Moreover, native rangelands are less expensive to maintain since they do not require the inputs (e.g. fertilizers) necessary to maintain IG pastures.

One of the primary reasons that native grass species are preferred by wildlife over IG is that many grow in bunches, which creates a more open structure for ground-dwelling wildlife to move through the vegetation and allows more room for forbs to grow. Big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*) and Indiangrass (*Sorghastrum nutans*) are common bunchgrasses in Oklahoma.

It is important to note that rangeland historically had many species of forbs and shrubs, in addition to grasses. A variety of native grasses, forbs and shrubs provides food and cover for birds such as northern bobwhite (*Colinus virginianus*), wild turkey (*Meleagris gallopavo*), and many species of songbirds. Additionally, white-tailed deer (*Odocoileus virginianus*) primarily feed on forbs and woody plants (vines and shrubs). The presence of diverse species of forbs and shrubs also increases the abundance and diversity of many insect species, including the monarch butterfly (*Danaus plexippus*) and various native bee species, which have seen population declines in recent years.

Is Replanting Necessary?

Often, land managers assume they will have to replant a pasture after eliminating IG, and they spend time and money doing so without evaluating the natural plant response or without considering what plants they want/need to meet their land management goals. Because native seeds and rhizomes (roots) can remain viable in the soil for decades and some seeds are readily dispersed from adjacent sites by wind, flooding, and animals, rangeland can often be reestablished without planting following removal of IG.

Many forbs, particularly annual forbs, will germinate from the seed bank within the first year and early pioneering grasses, such as broomsedge bluestem (*A. virginicus*), will typically show up within the first 2-3 years. For some land managers, especially those with predominantly wildlife goals, allowing natural plant succession to occur without replanting may be sufficient to meet goals. Make no mistake, sites that have been dominated by IG for decades have been under cultivation for crops, or have had repeated herbicide applications are degraded. These sites may never return to historic vegetation within your lifetime. Some perennial plants, including many grass and forb species and some shrubs, may take many years (if ever) to colonize the site depending on past management. This does not mean that the plant community response (plant succession) will be unsatisfactory to your specific goals.

While you may only get 60-70% of the historic plant community to return to a site, this will work fine for many species of wildlife. However, subject to goals, personal patience and the plant response observed on a site, replanting or overseeding may be desired in some cases. This is particularly true if the goal requires specific perennial forbs or shrubs or if the land manager desires highly palatable native forage grasses.

Planning for Conversion

Prior to any treatment, land managers interested in conversion should determine their ultimate management goals for the property and why they are interested in removing IG. Livestock production and wildlife habitat can certainly coexist, but livestock production on rangeland will not be the same as on highly fertilized IG pasture. Yet, input costs will be dramatically reduced, so there is a tradeoff. Changes in forage production, input costs, and stocking rates should be carefully considered and discussed with livestock and rangeland professionals. Resources to help with these determinations are included in 'Additional Information' at the end of this document.

As previously mentioned, many desirable plants, including forbs, will often respond from the native seedbank and replanting may not be needed. In situations where replanting is required or desired, recognize that native seed mixes can be costly. Technical and financial assistance programs are available to help identify appropriate species to include in mixes and cover the costs of converting an IG pasture to a native mix of grasses and forbs. A land manager interested in wildlife will want a high diversity of forbs in the seed mix—perhaps 30-50% of the mix. This percentage could be even higher in plantings of less than 20 acres (given the higher cost) where monarch butterfly or pollinator habitat is the goal. Forb seeds are typically more expensive than grass seed but are essential for wildlife and often valuable for livestock.

Conversion of IG pastures to rangeland can be successful if the proper steps are followed. Shortcuts generally waste time and money. Many failed conversions are due to inadequate eradication of the IG and rushing the process. Plan on 2-3 years minimum. Before starting a conversion project, it is important to recognize which IG species are present, as this will determine what steps are needed

to convert the pasture. Also, the land manager should anticipate what undesirable plants are likely to show up and how to control them. Therefore, you need to become fluent in plant identification and understand which plants are beneficial to your specific goals. Finally, consider the maintenance measures that will be needed to keep the converted pasture in a desired state. Rangelands require maintenance or they may convert back to IG or eventually become a forest (in areas of higher rainfall).

Natural resource managers can help with the preliminary assessment of the property and development of management plans and timelines for the project. Local Cooperative Extension offices, Natural Resources Conservation Service (NRCS) field offices, wildlife department private lands biologists, or wildlife biologists with various conservation groups are good resources for land managers interested in converting IG and promoting a diversity of native plants for target wildlife. Typically, these technical services are provided free to the land manager. See 'Additional Information' at the end of this document for further information on how to contact a local biologist.

Control or Eradication Options for IG

Depending upon the dominant species present, different treatments or combinations of practices may be most effective. Below are some common control measures, generally listed from least to most effective.

- Soil solarization (covering the field with plastic) is not practical for conversions of more than 1/2 acre. While this has limited application on home lawns and small gardens, it is not recommended for pasture conversions.
- Disking can suppress IG for a limited time, but the grasses quickly dominate the site by the next season and disking may even increase IG spread. This practice is not recommended.
- Heavy cultivation (plowing) can kill IG, but they will typically come back from seed, and plowing can cause soil erosion concerns on erodible soil types. Generally this practice is not recommended.
- Grazing, mowing, and haying can be a viable options for Johnsongrass (*Sorghum halepense*), but are not recommended for any other IG covered in this publication, as they tolerate, and often thrive with, heavy grazing and cutting.
- Cropping can be used to eliminate IG from a site. The combination of cultivation and weed control from herbicides can effectively remove IG after a few years of cropping a field. If you choose this method, contact your local NRCS office for specific recommendations.
- Prescribed fire is a management tool that is useful for site preparation before applying herbicide. However, fire alone does not control most IG. An exception to this is that summer fire (June-October) can be highly effective at killing yellow bluestem. This can be useful to convert pastures or to suppress yellow bluestem invasions in established rangeland. Note: Yellow bluestem will come back from seed, so follow-up management (e.g., additional



Figure 1. Yellow bluestem can be killed using growing season fire. This site was burned 3 months prior.

growing season fire and/or spot herbicide application) will be needed. The similar Caucasian bluestem also can be killed with summer fire, but there is some evidence it may not be as vulnerable as yellow bluestem.

- Herbicide application is often the best option to eradicate IG species at large scales. This is the primary recommendation for conversion and details are provided below for specific IG. For best results, apply herbicide when the target plants are actively growing and prepare the site before application (see details below). Regardless of the herbicide used, be sure to carefully follow the herbicide label, including personal safety precautions and weather thresholds. For example, most herbicide applications are not recommended when air temperature is above 90°F or under windy conditions (greater than 10 mph), which can cause herbicide drift.

Herbicide Application



Figure 2. Prescribed fire is an excellent method to prepare a field for herbicide application as it removes litter, helping herbicide make better contact with growing vegetation.

Site preparation will be necessary on many IG pastures that are dense and have thick litter layers that will intercept the herbicide, making it difficult to kill the target plant. Before applying any herbicide treatments to a field, leaf litter and dead plant matter from previous seasons must be removed to expose the actively growing vegetation to herbicide application. Litter can be removed by haying, grazing, or burning. Regardless of the preparation method used, allow sufficient time for plant regrowth before spraying (usually about 6 inches of growth).

The timing of site preparation will vary depending on the target grass. Prepare the site ahead of the growing season of the target species. In areas where more than one introduced grass is abundant, target the most prevalent grass first.

- Tall fescue areas should be prepped for herbicide treatment in late summer/early fall since it is best controlled in the fall.
- Bermudagrass areas should be prepped in late winter/early spring for best results, as it is controlled during the summer.
- OWB should be prepped in late winter/early spring for best results, as it is controlled during the summer.

Bermudagrass is a perennial (regrows every year), warm-season grass from tropical Africa. It is widely distributed in Oklahoma and beyond, where it is cultivated for turf, livestock grazing, erosion control, and hay production. Despite its many attributes, it provides limited grazing during the cooler months of the year. Additionally, this sod grass can form dense monocultures and offers minimal food or cover for most species of wildlife. Bermudagrass can be killed by applying herbicide when the grass is actively growing. It starts growing when the soil temperatures increase in late spring or early summer.



Figure 3. Bermudagrass forms dense mats of vegetation that suppress desirable native plants.

Typically, the best time to spray bermudagrass in Oklahoma is in late May-early June, before it has set seed and air temperatures climb (generally herbicides are less effective in hot weather). In wet, cool summers bermudagrass can be sprayed through late September or early October. Bermudagrass should not be sprayed when drought-stressed or dormant, as herbicide efficacy will be reduced. Multiple herbicide applications are almost always needed to remove bermudagrass. Even with proper herbicide application,



Figure 4. *Herbicides can be highly effective at eliminating IG from fields. By choosing the appropriate product and applying it according to directions with the correct rate and timing, land managers can successfully begin the conversion process.*

some residual patches will show up later in the converted pasture. These patches can be spot sprayed (see below); however, once the new rangeland is well established (>3 years), competition from shading can often keep small patches of bermudagrass suppressed. Areas which receive heavy grazing or frequent livestock travel may also reestablish bermudagrass. This is especially common near stock ponds and along minimal traffic roads. The land manager may wish to leave these isolated patches of bermudagrass in areas of heavy use to protect the soil. If you choose to retain these patches, be vigilant about bermudagrass spreading into adjacent areas.

- **Glyphosate:** Glyphosate is not soil active and is a good choice when relying on the existing native seedbank to quickly reestablish the field. Apply this herbicide at a rate of 4-5 quarts per acre or spray plants till wet with a 3% solution (when using a product with 41% active ingredient). Use a non-ionic surfactant (ask your herbicide salesperson for product options) to increase herbicide efficacy. Multiple applications of glyphosate will be needed to eliminate bermudagrass. Depending on the weather, it may be possible to spray bermudagrass twice in the same growing season (at least 4-6 weeks apart); however, spraying in two consecutive growing seasons will typically yield the best results. Spot-spraying (3% solution when using a product with 41% active ingredient) may be needed to clean up residual patches of bermudagrass or newly germinated/sprouted bermudagrass.
- **Imazapyr:** Imazapyr is highly effective at killing bermudagrass and prepping a pasture for conversion to native plants. Imazapyr remains soil active for up to 18 months and will continue to kill germinating plants. This can be helpful in controlling reseeding IG, but it will also kill many germinating native plants for a period and the site will be slower to revegetate. Imazapyr may not be the most appropriate choice on highly erodible soils due to the length of time without new plant growth. This herbicide should be applied at a rate of about 48 ounces per acre or spray plants till wet with a 3% solution (when using a product with 28% active ingredient). Be sure to use a non-ionic surfactant (ask your herbicide salesperson for product options) to increase herbicide efficacy. Imazapyr has the potential to eradicate bermudagrass with only one application but do not count on this as follow-up spot-spraying will likely be needed. Allow 18 months after the last imazapyr herbicide application before planting. Ideally, apply imazapyr in late May to early June and spot-spray in early to mid-July, so the area can be planted in a native seed mix 18 months later at the appropriate time: late-November-December. Glyphosate (3% solution when using a product with 41% active ingredient) can be used for any follow-up spot-spraying of bermudagrass during the native establishment phase.

Tall fescue is a perennial, cool-season grass native to Europe. It can form dense thatch that inhibit other plants from growing and makes a good turf grass in areas that receive more rainfall (e.g. eastern Oklahoma). While it provides forage during the fall and spring in Oklahoma, fescue has limited forage value during the summer. Also, most fescue is infected with a fungal endophyte that can cause many livestock health issues including lower weight gains, reduced milk production, abortion, and sloughed hooves and tails. The dense growth structure of fescue inhibits other plants which can be problematic if managing for wildlife. For these reasons, conversion is desirable in many situations.

As with other grasses, the herbicide should be applied when the plant is actively growing (before drought or high temperatures cause tall fescue to go dormant). While it can be sprayed in the late spring, herbicide application in early fall (October in Oklahoma) typically results in better fescue control. This timing also minimizes impacts to grasses and some forbs, as many native plants will be dormant. With proper herbicide application timing and periodic treatment, a pasture dominated by tall fescue can be converted to native grasses and forbs within two growing seasons.



Figure 5.1 and 5.2. Tall fescue is a cool season grass that is widespread in the eastern US and provides little value for wildlife.

- Glyphosate is an effective herbicide to treat tall fescue. When the grass reaches >6 inches, apply 2 quarts per acre of glyphosate or spray till wet with a 2% solution (when using a product with 41% active ingredient). Be sure to use a non-ionic surfactant (ask your herbicide salesperson for product options) to increase herbicide efficacy. Follow-up application will likely be needed the following spring. Be prepared to spot-spray (2% solution when using a product with 41% active ingredient) to control residual plants.
- Imazapic is another great herbicide choice for eliminating tall fescue. Once the grass reaches >6 inches, it is ready for treatment. Fall treatments are best. Apply 12 oz per acre of imazapic (when using a product with 23% active ingredient). Be sure to use a non-ionic surfactant (ask your herbicide salesman for product options) to increase herbicide efficacy. While imazapic is highly effective on tall fescue, if the pasture contains imazapic-tolerant grasses such as Kentucky bluegrass (*Poa pratensis*) or orchardgrass (*Dactylis glomerata*), either use the 2 quart per acre of glyphosate recommended above or mix 1 quart per acre of glyphosate with the 12 oz per acre of imazapic. Be prepared to spot-spray (2% solution of glyphosate when using a product with 41% active ingredient) to control residual plants.
- Clethodim may be an option for land managers wanting to treat fescue growing within (but not dominating) a pasture of established grasses and native forbs, since this grass-specific herbicide does not kill forbs and is tolerated by many native perennial grasses. At rates of 8-10 oz per acre, with an added quart of crop oil per acre, clethodim can reduce tall fescue when it is actively growing, but it will generally require multiple treatments over at least 2-3 years to remove most fescue.

Old World bluestems (OWB) are perennial, warm-season bunchgrasses that were introduced from Eurasia, Africa, and Australia. They were planted commonly for erosion control and livestock forage. OWB provide good erosion control and good livestock forage quantity but only fair quality. Yellow bluestem (*B. ischaemum*) and Caucasian bluestem (*B. bladhii*) are the two most common OWB in Oklahoma. There are many cultivars of these species that are encountered throughout the Southern Great Plains leading to confusion as various cultivar names might be used. For example, yellow bluestem is often called plains bluestem and King Ranch (KR) bluestem. Caucasian bluestem is often called WW Spar, Iron Master, or WW-B. Dahl bluestem. These introduced “bluestem” grasses should not be confused with native bluestem species such as big bluestem, little bluestem, broomsedge bluestem, bushy bluestem (*A. glomeratus*),



Figure 6. OWB grasses form monotypic pastures with little plant or animal diversity.

silver bluestem (*B. laguroides*), or split-beard bluestem (*A. ternarius*). OWB are prolific seed producers and will often form dense, monotypic (single species) pastures unlike native bluestems. Furthermore, seeds can remain viable in the seedbank for several years.

Herbicide should be applied when OWB is actively growing, which is typically early summer (June or early July in Oklahoma). As mentioned above, summer fire is effective at killing yellow bluestem. Therefore, a combination of herbicide and summer prescribed fire is an option to remove yellow bluestem.

- **Glyphosate:** Glyphosate is not soil active and will only kill the actively growing plants it contacts. This herbicide is non-selective and will kill or damage other grass species that may be intermixed with the OWB. If possible, OWB should be sprayed with glyphosate prior to seed production, which can be as early as June in Oklahoma. Expect OWB to come back from prior years' seed, requiring follow-up treatments. This herbicide should be applied at a rate of about 3 quarts per acre or spray till wet with a 2-3% solution (when using a product with 41% active ingredient). Be sure to use a non-ionic surfactant (ask your herbicide salesperson for product options) to increase herbicide efficacy.
- **Imazapyr:** Imazapyr is highly effective at killing OWB and prepping a pasture for conversion to native plants. Imazapyr remains soil active for up to 18 months and will continue to kill germinating plants. This can be helpful in controlling reseeding IG, but it will also kill germinating native plants for a period of time and the site will be slower to revegetate. It may also not be the most appropriate choice on highly erodible soils due to the length of time without new plant growth. This herbicide should be applied at a rate of about 48 ounces per acre or at a 3% solution (when using a product with 28% active ingredient). Be sure to use a non-ionic surfactant (ask your herbicide salesman for product options) to increase herbicide efficacy. Imazapyr has the potential to eradicate OWB with only one application but do not count on this as follow up spot spraying will likely be needed. Glyphosate (3% solution when using a product with 41% active ingredient) can be used for any follow up spot spraying. Allow 18 months after the last imazapyr herbicide application before planting. Ideally, apply imazapyr in late May to early June and spot-spray in early to mid-July, so the area can be planted in a native seed mix 18 months later at the appropriate time: late November through early December.



Figure 7. Yellow and Caucasian bluestem (pictured here) are both widespread throughout Oklahoma.

Mixed pastures with multiple IG may require varied application times and chemicals to eradicate all non-native target species. It is important for land managers with a mixed pasture of IG to correctly identify what species are present and if they are warm-season or cool-season grasses. Start by targeting the dominant IG, then use additional spot treatments or whole-field treatments as needed.

Table 1. The primary species of introduced grasses found in Oklahoma. Chemical control options of these grasses are provided with recommended herbicides, timing, and application rates.

Common Name	Scientific Name	Growing Season	Oklahoma Distribution	Primary Herbicide Recommendations	Recommended Rates	Application Timing
Bermudagrass	<i>Cynodon dactylon</i>	Warm	Statewide	Imazapyr Glyphosate	48oz per acre 4-5qt per acre	Late May, Early June
Tall Fescue	<i>Festuca arundinacea</i>	Cool	Primarily Eastern Oklahoma	Imazapic Glyphosate	12oz per acre 2qt per acre	October
Old World Bluestems	<i>Bothriochloa</i> spp.	Warm	Statewide	Imazapyr Glyphosate	48oz per acre 3qt per acre	Late May through Early July

Less common IG may also warrant control. While bermudagrass, tall fescue, and Old-World bluestems are the most common, widespread, and problematic IG in Oklahoma (see Table 1), there are others that are present in Oklahoma and especially problematic in adjacent states. Information and herbicide recommendations for these are included in Table 2.

Table 2. Additional invasive grasses that are problematic in portions of Oklahoma and adjacent states. Chemical control options of these grasses are provided with recommended herbicides, timing, and application rates.

Common Name	Scientific Name	Growing Season	Oklahoma Distribution	Primary Herbicide Recommendations	Recommended Rates	Application Timing
Bahiagrass	<i>Paspalum notatum</i>	Warm	Central and Southeast	Metsulfuron-methyl	0.33-0.50z per acre	Early Summer
Johnsongrass	<i>Sorghum halepense</i>	Warm	Statewide	Sulfosulfuron Imazapic	0.75oz per acre 12oz per acre	Early Summer
Kentucky Bluegrass	<i>Poa pratensis</i>	Cool	Scattered, most common in the north	Imazapyr Glyphosate	1.5pt per acre 6oz per acre	Fall or Spring
Smooth Brome	<i>Bromus inermis</i>	Cool	North-central	Imazapyr	1.5pt per acre	Fall or Spring
Weeping Lovegrass	<i>Eragrostis curvula</i>	Warm	Statewide; most common in the west	Imazapyr Glyphosate	2-3pt per acre 0.75-1pt per acre	Early-mid summer

Soil Erosion Considerations

When converting an IG field to a rangeland, soil erosion is often a concern of land managers. While there is some potential for erosion, it is often much less than expected. The residual litter from the dead, standing grass following herbicide application helps to protect the soil surface from rain impact and runoff and it takes months for this residual litter to decompose. Furthermore, the roots from the dead grasses hold the soil together. Also, except when using a soil-active herbicide, other plants quickly germinate, providing additional soil protection. Pastures that are relatively flat and outside of a floodplain have minimal risk of erosion during the conversion period. Highly erodible sites may not be ideal for long-lasting soil-active herbicides, such as imazapyr.

Establishing a new cover crop may minimize soil erosion potential on highly erodible soils and/or steep slopes. Cover crops can also be used to provide forage for livestock and wildlife during the conversion process. Disking to plant a crop requires more time and expense and can be detrimental on steep slopes or highly erodible soils. Using a no-till drill is an option if the soil is not too compacted to allow the drill to penetrate. This would greatly reduce soil disturbance and maintain residual soil cover. Overseeding/broadcasting seed without breaking the soil surface is another option to provide a cover crop without soil disturbance. Germination rates are typically reduced with this method due to the lack of soil disturbance and poor seed to soil contact, but adequate germination and cover can be achieved with judicious crop selection and increased seeding rates. Sunflower (*Helianthus annuus*), chicory (*Cichorium intybus*), clover (*Trifolium* spp.), and cereal grains

[wheat (*Triticum aestivum*), oats (*Avena sativa*), or cereal rye (*Secale cereale*)] are all potential choices for overseeding to provide some added level of soil protection without breaking up the existing IG roots that hold the soil in place.

If warm-season IG (e.g., bermudagrass, Old World bluestems, weeping lovegrass, bahiagrass) are being treated, cool-season cover crops (planted in late summer or early fall) would be best since herbicide will be applied during the summer, eliminating any warm-season cover crops. Possible cool-season cover crops include various clovers, chicory wheat, oats or cereal rye.

If cool-season IG (e.g., tall fescue, Kentucky bluegrass, smooth brome) are being treated, a summer cover crop would be most practical during the conversion. Potential cover crops include sunflower, soybean (*Glycine max*), grain sorghum (*Sorghum bicolor*) or corn (*Zea mays*). Remember that the residual growth from the cover crop will make subsequent herbicide applications in year two more difficult unless the field is prepped again. When a cover crop is planted after the first herbicide application, it will need to be terminated and the field prepped (burned, grazed, mowed, shredded, etc.) to remove residual growth so subsequent herbicide applications are more effective. Planting cover crops is an extra expense and is not necessary in many situations; indeed, with some long-lasting herbicides it may not even be feasible.

Establishing Rangeland

Natural plant succession is the progression of plants reoccupying the site. Often this results in a desirable composition of native species since a variety of native seeds and rhizomes can remain viable in the soil for many years, or even decades. The native seedbank/rhizome bank is often suppressed by IG that outcompete native plants. With removal of these IG, many pastures will experience a resurgence of native grasses, forbs, and shrubs following treatment. Prescribed burns are a great way to remove residual debris from plants killed by herbicides and stimulate the seedbank for natural plant succession or prepare the seedbed for planting. Treated pastures can be burned a few



Figure 8. Following herbicide application, annual plants immediately begin to populate the treated area as shown here 3 months after spraying. Not all these plants are desirable, but many are and may meet land manager goals without the need to plant anything.

months after the final herbicide application. If a site was sprayed during the summer, consider waiting till the following spring to burn the area so that the residual dead plant material protects the soil during the winter.

For sites where wildlife is the primary goal, allow native plant succession to progress for 2-3 years before expending resources on planting. The volunteer plant response is often acceptable, especially if annual plants will meet initial expectations. These early pioneering plants are often labeled as weeds, and in a crop field they certainly are; however, if you are trying to produce wildlife, some of these “weeds” are highly desirable.

Common desirable plant species typically found early in succession include the following wildlife-beneficial species: broomsedge bluestem, ragweed (*Ambrosia* spp.), Spanish needles (*Bidens bipinnata*), croton

(*Croton* spp.), broomweed (*Gutierrezia sarothrae*), sunflower (*Helianthus* spp.), American pokeweed (*Phytolacca americana*), and ground cherry (*Physalis pumila*). There are multiple plant apps and field guides that can help you learn to identify most plants on your property and understand their benefits or detriments (see ‘Additional Information’ at the end of this document). Likewise, it is important to be able to identify undesirable plants so that they can be treated before they become a bigger problem (refer to ‘Weed Control’ section).

Management practices such as prescribed burning, prescribed grazing, and shallow strip disking will be needed periodically to manage for the desired plant community. (Note: disking should not be used on sites that have never been broken with the plow.) On former IG areas, these practices can dramatically increase forb composition and diversity—key, if wildlife is a goal. See ‘Maintaining Rangeland’ section below for details.

Interseeding or Overseeding may be considered on a site where natural plant succession, followed by prescribed burning, prescribed grazing, and shallow strip-disking, have not resulted in the desired plant response over several years. This may be the situation on sites where repeated herbicide applications over many years has reduced the potential for perennial plant community response, such as intensely managed pastures or former crop fields. Interseeding with native forbs could increase plant diversity on a site for improved aesthetics and wildlife habitat. The species selected for interseeding should be native to the area and sourced locally, if possible. Ideally work with a resource professional to determine the most beneficial plants, appropriate timing and proper seeding rate for your site.

Prior to interseeding, use a combination of prescribed fire, prescribed grazing, haying, herbicide spot-spraying and spot-mowing to prepare the site for planting. A resource with guidance on interseeding and site prep is included in ‘Additional Information’ at the end of this document. Reseeding may be desired when many native perennial plants are required to meet goals, such as livestock grazing. If cattle grazing is a primary goal, the producer may wish to plant a mix of native, perennial grasses, as it can take several years for these to naturally reestablish and dominate a converted site. If wildlife is a primary goal, the grass proportion could be as low as 50% of the mix (even less if providing habitat for pollinating insects or monarch butterflies is a goal) to minimize the likelihood that the site will be dominated by dense native grass over time. A livestock producer with interest in wildlife could achieve both goals with a grass:forb seed mix of 60-70:30-40. Besides being vital for wildlife, many forb species are high in protein and readily grazed by cattle (<https://extension.okstate.edu/fact-sheets/checklist-of-prairie-shrubland-forest-understory-plants-of-oklahoma-characteristics-and-value-to-deer-quail-turkey-cattle.html>). Note that reseeded native plantings will require cattle exclusion until the plants establish—typically 2-3 years.

As the forb proportion of the mix increases, so does the price, since forb seeds are generally more expensive than grass seeds. Furthermore, perennial forb seed is typically more expensive than annual forb seed. While a cost-conscious customer may be more inclined towards annual forbs, remember that many of these annual forbs will establish from the seed bank for free. Having a converted field with a mix of annual and perennial forbs is generally desired. Therefore, if including annual forbs in the mix, choose species that are especially beneficial for your desired goals. Perennial forbs (and grasses) take more time to establish, and annual forbs will provide much needed cover and food for wildlife during the initial stages, while protecting the soil. The species selected for planting should be native to the area and sourced locally, if possible. Your local NRCS office or Quail Forever biologist can design a seed mix based on your goals and planting location.

The cost for a native seed mix may be mitigated through financial assistance programs or reducing the size of the area planted in forb-rich mixes. For example, a planting of pollinator habitat could be an acre or less and still provide resources for these important insects. The remaining area could be planted in a mix suitable for other goals. Another option is planting a lower rate of grasses and a few key perennial forb species and allowing the seed bank to fill in the gaps with annual forbs. Note that not all these volunteers will be desirable, and you will need to control undesirable plants (refer to ‘Weed Control’ section).

Preparation: For the highest likelihood of planting success, the site must be prepared. Broadcast seeding or using a no-till drill are the recommended planting methods as this minimizes erosion and maintains higher soil moisture when planting.

1. Prescribed fire can be used to clear the area of vegetation, making drilling seed easier and more successful. An additional advantage is that burning the field leaves the soil surface intact as compared to disking. This approach may be taken if planting will be done with a seed drill or when broadcast seeding.
2. If the land manager chooses to disk, the area should be disked shallowly (ideally just the top 1 inch) and twice (in opposite directions) to prepare the seedbed for increased seed to soil contact. Prior to planting, seedbeds should be firm such that walking across them will not leave tracks more than ½ inch deep. Therefore, a cultipacker is useful to slightly firm the seedbed. This approach is appropriate if planting will be done by broadcast seeding.

Planting and Establishment:

1. Plant seed mix from November to February to expose seeds to cold temperatures and damp conditions necessary for germination.
2. Since seed may naturally separate based upon weight and size in transit or storage, be sure to mix the seed well prior to planting to ensure an even distribution of the various plants across the unit.
3. Mixing seeds with a carrier, such as sand or rice hulls, can prevent seeds sifting by size.
4. Most native seeds should be planted shallow: 1/4 to 3/4 inches deep.
5. A native forb/grass seed mix can either be drilled or broadcast.
 - a. The most efficient way to plant a large area is with a native seed drill, which may be available for rent or loan from a local conservation district office. Whenever possible, the drill should be equipped with double disk openers having depth bands, followed by a cultipacker, press wheels or drag chains to get good seed-soil contact. Rows should be less than 12 inches apart.
 - b. Broadcast using a drop or cyclone spreader followed by lightly raking, dragging, or rolling to ensure good seed-to-soil contact. A higher seeding rate will be needed if using broadcast seeding. A resource professional can assist you with planning.
6. Fertilizer is not recommended for rangeland and may be detrimental to some plant species.
7. Establishment typically takes 2-3 years. Defer grazing until the grass has successfully established. Shrub establishment may be needed on sites depending on land manager goals. Shrubs are a natural and vital component to rangeland throughout Oklahoma. If wildlife is your primary goal, this may be the best money you can spend on a conversion project, second only to that spent to eliminate IG. Many wildlife species depend upon shrubs for thermal and protective cover and often eat the fruit/seed or browse new growth from these plants. Livestock may also use shrubs for thermal cover and food. Plums (*Prunus* spp.), roughleaf dogwood (*Cornus drummondii*), sumac (*Rhus* spp.) and blackberry (*Rubus* spp.) all provide essential cover for wildlife. Blackberry and sumac are often quick to establish without planting on many sites. At a minimum, consider allowing fencerows and pasture edges to grow up in shrubs to provide shrub cover for wildlife. But if you are trying to maximize habitat for species that require them [e.g. northern bobwhite and cottontail rabbit (*Sylvilagus floridanus*)] you will want a lot of shrub cover available in the converted pasture.



Figure 9. This field in western Oklahoma was replanted with a mix of native grasses and forbs and is now providing habitat for many wildlife species.



Figure 10.1, 10.2, 10.3 and 10.4. Regardless of whether natural plant succession or replanting is implemented, it takes several years to develop. **BE PATIENT.** In the first couple of years following herbicide application, the site is often highly productive for many wildlife species due to the open growth form of annual plants that pioneer the site. Take careful note of this as it may influence your future management decisions. This series of photos illustrates the development of a converted pasture over time.



Since some shrub species are slow to establish, it may be necessary to plant. Plum is a good example as it establishes slowly, and the seed is not as readily dispersed. The selection of shrub species will be determined by the region of the state and the soils present. Web Soil Survey (<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>) and a plant field guide showing the native distribution of shrub species are helpful resources. Good choices for Oklahoma are sand plum (*P. angustifolia*; in sandy and loamy soils) and aromatic sumac (*R. aromatica*; in clay-based soils). Oklahoma Forestry Services (<https://ag.ok.gov/shop/>) can be a good source to purchase these shrubs at a nominal cost.

When planting shrubs, clearing vegetation from the planting spot can reduce competition and help with establishment of the new plantings. Also, using landscape fabric or mulch (at least 1 sq. yard around each shrub) not only reduces competition from other vegetation but can also help retain soil moisture for newly planted shrubs in more arid locations. This can be a critical feature for far western Oklahoma including the panhandle and is often worth the expense. The recommended planting density is 100 plants per mottle (group of shrubs) planted approximately 3 feet apart, in a 27-foot x 27-foot arrangement. If managing for northern bobwhite, mottes should ideally be planted <200 yards from each other. It is likely that 10-30% of the planted shrubs will not survive through Year 1, but the neighboring shrubs will fill in the gaps over time. You may consider protecting newly established shrubs from fire (by disking around them) and from cattle (with temporary fencing) for a few years until they are well established. Once established, periodic fire in the shrub thickets is acceptable and can even improve their structure.

Managing Rangeland

Grazing on rangelands converted from IG should be deferred until plants are well established (2-3 years). A proper stocking rate is essential. Heavy, prolonged grazing pressure over several years can slow regrowth, lower root energy reserves, and increase the susceptibility to unwanted plant invasion. Key grazing management decisions include using a proper stocking rate, limiting repeated heavy use in preferred areas (i.e., near streams, creeks, and water troughs), and providing periodic rest during the growing season through deferment, herding, or patch burn-grazing. Managers should be careful not to stress the developing grass by taking too much forage. Calculating an appropriate stocking rate for each pasture will prevent this from happening. For help calculating an appropriate stocking rate, ask the local NRCS office, refer to fact sheets (<https://extension.okstate.edu/fact-sheets/stocking-rate-determination-on-native-rangeland.html>), or use online tools like the Rangeland Analysis Platform (<https://rangelands.app/production-explorer>), which provides estimates of forage production and calculates stocking rates for any areas outlined.

Adjusting stocking rates based on each year's productivity is key to maintaining desired grass height. Eighty to ninety percent of grass growth in Oklahoma occurs by the beginning of August. If growing-season precipitation is below average, August 1st is an ideal time to reevaluate stocking rate. Native warm season grasses grow quickly in the late spring and early summer but productivity declines as plants grow seed heads and fall approaches. Providing rest from grazing from late summer through the first frost every couple of years allows grasses to develop strong root reserves for winter. Online tools like the GrassCast (<https://grasscast.unl.edu/>) can help you estimate how much above or below the average productivity the current year's grass growth may be. Grazing use can be heavy at certain areas, even when stocking rates are correct, if grazing distribution is uneven. Areas near water are often repeatedly overused. Placing mineral or protein supplements far from water, periodically burning portions of pastures, and limiting livestock access with electric fencing are all strategies livestock producers can use to move animals away from continually heavily used areas. However, temporary heavy use of areas of the pasture within a given year followed by subsequent rest the following year(s) is a management strategy to increase pasture plant diversity and improve wildlife habitat.

Prescribed fire (also called controlled burns) can be an effective management tool for converted pastures. The season of burn, intensity, and frequency all affect how fire influences vegetation. Note: for newly planted rangeland, allow at least 2-3 years after planting before burning. Plan to burn on a 2- to 4-year rotation, as appropriate to the site (generally more frequent in eastern Oklahoma). Burning one-quarter to one-half of the pasture during a given year provides wildlife with a variety of cover and food to meet all their needs. If managing for northern bobwhite, keep individual burn units under 50 acres and scattered over the property, if possible. Also, using a mix of dormant season (November – March) and late growing season (July-September) burns is desirable for many wildlife and livestock goals.

Burning stimulates plant growth, recycles nutrients, and targets some undesirable plants when timed properly. For example, frequent growing season burns (every 2-3 years) can be effective at reducing woody plant encroachment. Burning in the late summer or early fall may reduce grass density and increase forb cover the next growing season on some sites. Summer burning can help keep yellow bluestem from increasing. Conversely, frequent dormant-season fire tends to favor dense grass. This reduces bare ground that is vital for ground-dwelling birds and insects but can be highly effective at providing high quality forage for summer stocker cattle.

Shallow Strip-Disking may be necessary if grass becomes so dominant that forbs are limited, hindering wildlife and pollinator goals. This approach temporarily increases bare ground and allows annual forbs to increase. This can be a good management strategy to periodically use in areas that are not too rocky. Disking should be fairly shallow (1-2"). The amount of the pasture that is disked at any one time depends on the target wildlife. If managing for bobwhite, consider disked up to 1/3 of the area. Leaving some of the pasture in denser grass provides cover for small mammals and ground nesting birds. Disking can be done in a rotation so that the entire pasture is disturbed over a 3-4-year period. Shallow strip-disking in the fall and winter (October – February) typically promotes desirable forbs, such as ragweed, croton, and sunflower. Avoid shallow disked during the spring and summer (April – August) as this tends to favor undesirable grasses such as Johnsongrass, crabgrass and sandbur (*Cenchrus* spp.). Disking is NOT recommended for sites that have never been tilled, plowed, cropped, or converted to IG. This is only recommended for highly altered sites where IG or crop fields were converted to rangeland and have subsequently become too dense to meet management goals.

Spot-Spraying Herbicide may be necessary if dense grass excludes other plant types. In areas that are rocky, and when grazing and prescribed fire are not enough to reduce grass dominance, herbicides may be used to reduce grass dominance. A dense pasture of native grass may not be much better than a dense pasture of introduced grass, depending on your goals. Rank grasses can stifle the growth of forbs, reduce insect abundance, and limit the movement of wildlife. (Similarly, some woody

plants such as blackberry and sumac [while excellent wildlife plants] can become dominant over time in converted pastures.) Management will be required to maintain converted sites in the desired condition and to control problem plants that show up. Glyphosate at a rate of 1-2 qt per acre (when using a product with 41% active ingredient) or imazapyr at a rate of 24-48 oz per acre (when using a product with 28% active ingredient) will reduce grass and allow forbs to respond. Expect a higher kill on grass and a larger and longer forb response at the higher rates. If this treatment is needed, consider treating portions of the pasture to create forb-rich areas while maintaining other areas with denser grass cover. This diversity will be beneficial to more species of wildlife.

Weed Control

Once the IG have been removed, other problem species may take advantage of the increased availability of resources and space. A weed is simply a plant out of place, or an unwanted plant. There will always be weeds in converted pastures that will require control. Diligent weed control is key to ensuring that new problem species do not encroach on areas following treatment. Undesirable plants can often reproduce quickly and outcompete native plants, enabling them to monopolize resources and limit vegetation diversity. There are multiple plant guides and plant apps that can be helpful in plant identification (see 'Additional Information' at the end of this document). Take the time to use these resources to ensure you are controlling problem plants and retaining desirable plants based on your goals. A natural resource professional can help you with this.

Spot spraying reinvading IG should be a top priority for managers to avoid a reinfestation. The eradication of IG will require monitoring for reemergence of treated species. The methods and herbicides recommended above can be used in smaller, more precise applications to efficiently spot-treat any remaining IG grasses.

When assessing weed control options, it is important to remember that most broadleaf plants can be controlled with broadleaf-specific herbicides that do less damage to grasses. Likewise, controlling undesirable grasses with herbicides that target grasses, reduces harm to forbs. It is important to consider management goals and the pasture's current plant composition before selecting weed treatment options. Below are some common problem species that can be found in converted pastures in Oklahoma and methods that can be used to control them. Note that the herbicide recommendations below are not exhaustive; other herbicide options exist. Always consult the herbicide label for complete information.

Cheatgrass (*Bromus* spp.) – Introduced from Europe and eastern Asia, these annual grasses are aggressive invaders following disturbance. The primary species in Oklahoma are Japanese brome (*Bromus japonicas*), cheatgrass (*B. tectorum*), rye brome (*B. secalinus*), soft brome (*B. hordeaceus*), and rescuegrass (*B. catharticus*). Glyphosate and clethodim can be used to chemically control cheatgrass. Spot-treat using a 0.5-2% solution of glyphosate in the fall or early spring. Clethodim is a grass-specific herbicide and can be a safer alternative for managers worried about killing non-target forbs. Clethodim, at a rate of 6-8 oz per acre, is especially effective on annual grasses and many perennial grasses are tolerant. If cheatgrass or other annual bromes infest a field after treatment of IG, treat with clethodim. Annual bromes can be easily identified by their early green growth (January) and prolific hairy stems.

Crabgrass (*Digitaria* spp.) – Various crabgrass species can be a weed issue when large areas of bare ground are exposed. While they tend to decrease over time in the presence of perennial grasses since they grow low and are suppressed by overhead shade, these warm-season annual grasses can take up space that more desirable forbs could occupy. Imazapic (8 oz per

acre) is a good option to manage crabgrass, and this herbicide is tolerated by many desirable forbs and perennial grasses. Clethodim, a grass specific herbicide, can also be used at a rate of 6-8 oz per acre.

Dock (*Rumex* spp.) – A variety of dock species may be undesirable colonizers of pastures treated for removal of IG. Curly dock (*Rumex crispus*) is one of the most widely distributed and seeds can remain dormant for decades. It can be toxic to livestock when consumed in large quantities. Seedlings can be reduced by spring herbicide applications, but once established, fall applications are more effective on mature plants. Multiple herbicides will kill dock including metsulfuron-methyl (0.1-0.4 oz pre acre) and aminopyralid (3-7 oz per ac). Spot treatments with glyphosate at 2-3% solution is also effective. While this plant is not desired in high abundance, the seed is consumed by many bird and small mammal species.

Field bindweed (*Convolvulus arvensis*) – Capable of spreading through an extensive rootstock and from seed, field bindweed is a vine that can be difficult to eradicate. It is important to spot treat new plants so that this species does not limit other plants. Bindweed will often be most prevalent along pasture edges. Spot spraying during the early summer when bindweed is blooming is best at a rate of 1.5% solution of glyphosate. As glyphosate is non-selective, it can kill native grasses and should be used cautiously if desirable plants are actively growing. A fall spraying when other plants are dormant is possible, but herbicide effectiveness is reduced during this time. An alternative herbicide choice that can suppress field bindweed and is more selective towards broadleaf plants is 2,4-D at a rate of 1-2 pt per acre. Expect repeated applications to remove this tough vine.

Johnsongrass (*Sorghum halepense*) - Native to the Mediterranean, this warm-season, perennial grass was introduced as a forage due to its high palatability and competitiveness. Johnsongrass seed is readily consumed by many birds, but it's tendency to form monotypic pastures makes it undesirable across the wetter eastern 2/3 of Oklahoma. It is sometimes cultivated as a forage or hay for cattle, as it is highly palatable to livestock, particularly if it is grazed before its reproductive stage. Later in the season, when stressed by drought in late summer or frost in the fall, it can lead to nitrate and prussic acid toxicity issues. Johnsongrass is susceptible to heavy grazing and being highly preferred by livestock, it is generally well controlled in grazed pastures. In ungrazed areas, johnsongrass is a major weed that should be controlled immediately upon detection as it will spread rapidly. For small, isolated patches, hand pulling when the soil is moist can remove the rhizomes; pulling when the ground is dry only breaks off rhizomes, ensuring future reemergence. For larger areas, johnsongrass can be controlled with various herbicides. It is best controlled early in the summer when it is actively growing and before it is drought-stressed. Spot spraying glyphosate at a 3% solution with a surfactant (ask your herbicide salesperson for specific products) works well. For larger areas where desirable plants are mixed throughout, sulfosulfuron at 0.75-2 ounces per acre or imazapic (12 oz per acre) are both highly effective and are tolerated by many native grasses (both herbicides) and forbs (when using imazapic).



Figure 11. Johnsongrass is one of the more problematic grassy weeds in ungrazed grasslands. Identify this plant by its broad leaves, white midvein, and open pyramid shaped panicle of flowers. Control this grass before it spreads.

Marestail (*Conyza canadensis*) – This potential problem species is native throughout much of North America. Marestail is a warm-season forb that has developed a resistance to herbicides and can be difficult to kill. This plant will probably be one of the first to appear post-treatment of IG and

its abundance can be worrisome to land managers; however, in most situations this plant does not need to be controlled in pasture conversions. It will be abundant in the initial couple of years but will dramatically decline as other plants become established. Additionally, it provides good cover for various species of wildlife during the summer months. Manually pulling or removing plants can be effective for small areas. If maretail is a problem over a large area and control is necessary, apply herbicides such as aminopyralid at a rate of 3-7 oz per acre or metsulfuron-methyl at 0.1 oz per acre. Herbicides should be applied in early spring for best results. Note that maretail is increasingly herbicide resistant and presents a significant weed to crop producers. While it is not desirable to have growing adjacent to crop fields, needless herbicide application in pastures only increases its potential for herbicide resistance.



Figure 12. *Sericea lespedeza* is one of the most problematic weeds in Oklahoma. This plant requires repeated control efforts to keep it suppressed.

Sericea Lespedeza (*Lespedeza cuneata*) – Sericea is a warm-season, perennial legume (part of the pea family). It is native to eastern Asia but has become naturalized throughout the eastern United States. This legume is an aggressive invader. It will outcompete native plants and, once established, control can be difficult. While it seldom can be eliminated from a field, it can be kept at tolerable levels. Triclopyr or metsulfuron-methyl (MSM) can be used to chemically control sericea and should be used with a surfactant. Both herbicides (at the proper rate) are safe for most grasses. Triclopyr should be applied to the plant before flowering in early summer once sericea is at least 6 inches tall, while MSM should be

applied once sericea starts flowering (typically September in Oklahoma). Triclopyr at a rate of 1-3% provides excellent control but will kill many desirable broadleaf plants as well; therefore, it is best used for spot-spraying isolated patches of sericea. Treatments applied late in the growing season, when many native forbs are dormant, can help reduce injury to non-target plant species. MSM at the rate of 0.5 ounces per acre or 1 gram per gallon for spot-spraying is tolerated by many desirable forbs. Therefore, sericea can be controlled with less collateral damage to broadleaf plants using MSM rather than triclopyr. One herbicide application is rarely enough. Multiple years of treatment are usually required to sufficiently reduce sericea lespedeza. Early spring grazing, late summer burning (August-September), and burning prior to herbicide application are other practices that could be used in combination with herbicide. Note that the similar slender lespedeza (*Lespedeza virginica*) is a desirable plant. These two plants can be most reliably identified by examining the leaf veins. Slender lespedeza leaf veins are highly branching, whereas sericea lespedeza leaf veins run parallel to each other. Hold the leaf up to the sky to view the veins.

Thistle – Some thistle species are native to Oklahoma, such as wavyleaf thistle (*Cirsium undulatum*), yellowspine thistle (*C. ochrocentrum*), tall thistle (*C. altissimum*), and yellow thistle (*C. horridulum*). These native thistles are not normally problematic because of their susceptibility to insects and disease. In fact, native thistles offer many benefits, as they are attractive to pollinators and provide seeds for birds. Before controlling thistles, it is important to correctly identify which species of thistles are present. A good way to distinguish between native and non-native thistle species in Oklahoma is by the coloring of the plant's leaves. If the leaves have white undersides or if the top of the leaf is silver in color, the species is native. The leaves of non-native thistles are typically green on both sides, although some native species are also only green. In addition, most of the invasive thistles bloom in April and May while our native thistles typically bloom mid to late summer. Fact Sheet PSS-2776 'Thistle Identification' (<https://extension.okstate.edu/fact-sheets/thistles-in-oklahoma-and-their-identification.html>) has more information about differentiating between thistle species. Several non-native thistle species can encroach on pastures treated for IG. Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans* L.), and scotch thistle (*Onopordum acanthium* L.) are all introduced thistle

species that are considered noxious weeds (landowner is legally required to control) in Oklahoma. Other non-native and problematic thistle species, such as bull thistle (*Cirsium vulgare*), are not mandated by law to be controlled but should be. Preventing the spread of and eradicating non-native thistle species before they become an infestation should be a priority. Thistles can be controlled with herbicides such as 2,4-D (1-2 qt per acre) or metsulfuron-methyl (1 oz per acre). Spot treatment with 2% glyphosate is also effective. Applications should be done in the fall or spring when the plant is in the rosette stage. Once the plant bolts with a flower stalk in April or May, it is more difficult to kill. Small areas can be controlled by hand-pulling if the soil is moist. Additionally, a biological control used to decrease musk thistle infestations is the musk thistle flower weevil (*Rhinocyllus conicus*). Contact your local Cooperative Extension office for information on thistle weevil introduction. When introduced to pastures infested with musk thistle, weevils have shown to be an excellent option for decreasing musk thistle abundance. For more information about controlling thistle species, refer to Fact Sheet EPP-7318 'Integrated Management of Invasive Thistles in Oklahoma' Fact Sheet (<https://extension.okstate.edu/fact-sheets/integrated-management-of-invasive-thistles-in-oklahoma.html>).

Vetch (*Vicia* spp.) – Hairy vetch (*Vicia villosa*) is a herbaceous plant that was introduced as an ornamental, a cover crop, and for erosion control. It was also used as a smother crop to help eliminate weeds from agriculture fields, which emphasizes why this plant may become a problem. There are multiple ways to control hairy vetch, especially if it is not a large infestation. Manually pulling plants, as well as close mowing during its peak flowering season, can help reduce hairy vetch. Chemical treatment for larger infestations includes spring applications of 2,4-D (2-4 pt per acre) or clopyralid (0.3-1.3 pt per acre). Another common vetch species that can become a troublesome invader is crownvetch (*Securigera varia*). It can quickly form a monoculture and decrease vegetation diversity. Large areas of crownvetch can be controlled with triclopyr using a rate of 1 qt per acre, metsulfuron-methyl at a rate of 0.5 oz per acre, or aminopyralid with rates of 5-7 oz per acre. Both vetch species can be controlled with spot treatments of glyphosate using a 1.5% solution or triclopyr at a 2% solution. Herbicide should be applied when the plant is actively growing during early spring. Damage to desirable warm-season plants (forbs and grass) should be minimal, as many species will be dormant during this period.

Summary

Conversion of IG to rangeland has many benefits to land managers. The process of conversion takes time and requires follow-up management, especially in the first few years. The timeline for restoration will vary based on the IG species and what methods were used for control. It is important that land managers carefully plan conversion of IG to rangeland so that time and money is not wasted. Clearly identify and determine management goals and reasons for IG removal prior to any treatments. With patience and diligence, land managers can successfully remove IG that may be detrimental to their management goals.

The benefits of conversion for wildlife and pollinating insects cannot be overstated. The proliferation of IG pastures has eliminated enormous areas formerly usable by various wildlife species. A loss of flowering plants eliminates the use of the area by pollinating insects and birds relying upon insects for their diet. Additionally, converting to rangeland can be beneficial to livestock producers, depending on their grazing strategy.

A variety of control options can be used, but herbicide is often most successful for large-scale conversions. Land managers should carefully consider IG treatments based on the site's vegetation composition, potential for soil erosion, desired timeline for conversion, and land management goals. Follow-up management should include assessments of plant succession, control of undesirable plants, and periodic disturbance including prescribed fire, grazing, and disking. Grazing can be introduced once plants are well established.

The following summary guidelines can help managers interested in removing IG get started:

1. Determine land-use goals
2. Identify non-native species that are present
3. Plan desired treatment methods
4. Prepare site for treatment applications
5. Apply treatment as outlined in plan
6. Evaluate treatment effectiveness and spot treat undesirable plants
7. Reassess vegetation community in relation to goals
8. Interseed/reseed, if needed, to meet goals
9. Use additional practices to maintain the desired plant composition

We thank M. Sams, L. Lowe, and B. Baker for their review of and suggestions for this document.

For Additional Information

Assistance (technical and financial) Programs and Contacts

Oaks and Prairies Joint Venture (OPJV) – Grassland Restoration Incentive Program
<http://www.opjv.org/grip>

Oklahoma Department of Wildlife Conservation (ODWC) Landowner Programs
<https://www.wildlifedepartment.com/lands-and-minerals/landowner-programs>

Pheasants Forever Inc. and Quail Forever Biologists (partners with ODWC, OPJV, NRCS)
<https://pheasantsforever.org/Habitat/findBiologist.aspx>

Oklahoma Prescribed Burn Association
<https://www.ok-pba.org/>

USDA Natural Resources Conservation Service (NRCS) Local Service Centers Directory:
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/contact/local>

Benefits of Native Plants

A Checklist of Prairie, Shrubland, and Forest Understory Plants of Oklahoma Characteristics and Value to Deer, Quail, Turkey, and Cattle (OSU Extension)
<https://extension.okstate.edu/fact-sheets/checklist-of-prairie-shrubland-forest-understory-plants-of-oklahoma-characteristics-and-value-to-deer-quail-turkey-cattle.html>

Native Warm-Season Grasses and Wildlife (NRCS)
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010044.pdf

Old Field Management for Wildlife (University of Tennessee)
<https://extension.tennessee.edu/publications/Documents/PB1855.pdf>

Plant Identification

Apps: iNaturalist, PictureThis, PlantNet

Field Guide to Oklahoma Plants (OSU Extension)
<https://www.shopokstate.com/p-451-field-guide-to-oklahoma-plants.aspx>

Guide to Plants Important for Quail (OSU Extension)
https://extension.okstate.edu/fact-sheets/images/a-guide-to-plants-important-for-quail-in-oklahoma/e_1047_plants_for_quail.pdf

100 Native Forage Grasses in 11 Southern States
<https://extension.wvu.edu/files/d/31acd202-4ee6-4c02-b148-2f25e89d9e48/100-native-grasses-southern-states.pdf>

Structures Used to Identify Grasses (Penn State Extension)
<https://kingsagriseeds.com/wp-content/uploads/2014/12/Penn-State-Grass-Identification-Matrix.pdf>

Plant ID in 3D
<https://www.plantidin3d.com/>

Kansas Wildflower and Grasses
<https://www.kswildflower.org/>

Range Planting, Reseeding, and Overseeding

Interseeding Wildflowers to Diversify Grasslands for Pollinators

<https://xerces.org/publications/guidelines/interseeding-wildflowers-to-diversify-grasslands-for-pollinators>

Oklahoma Forestry Services

<https://ag.ok.gov/shop/>

Range Planting Job Sheet

https://efotg.sc.egov.usda.gov/api/CPSFile/16239/550_OK_IR_Range_Planting_2013

Reseeding Marginal Cropland to Perennial Grasses, Forbs, and Legumes (OSU Extension)

<https://extension.okstate.edu/fact-sheets/reseeding-marginal-cropland-to-perennial-grasses-forbs-and-legumes.html>

Range Planting: Adding Forbs and Legumes

https://efotg.sc.egov.usda.gov/api/CPSFile/16240/550_OK_IR_Range_Planting-Adding_Forbs_and_Legumes_2016

Prairie Restoration Site Preparation

<https://youtu.be/LdYm1Lf7XaA>

Prairie Restoration Update (1-year post-establishment)

<https://youtu.be/vrnLMaoghGU>

Prairie Restoration Update (2-years post-establishment)

<https://youtu.be/igOwLAtEYM>

Interactive Seed Mix Calculator

<http://www.range.colostate.edu/seed.shtml>

Stocking Rates and Forage Production

Beef, Grass, and Bobwhites (National Bobwhite Conservation Initiative)

<https://bringbackbobwhites.org/beef-grass-bobwhites/>

GrassCast (Forage Forecaster)

<https://grasscast.unl.edu>

Management Strategies for Rangeland and Introduced Pastures (OSU Extension)

<https://extension.okstate.edu/fact-sheets/management-strategies-for-rangeland-and-introduced-pastures.html>

Rangeland Analysis Platform (Productivity and stocking rate calculator)

<https://rangelands.app/production-explorer/>

Stocking Rate Determination on Native Rangeland (OSU Extension)

<https://extension.okstate.edu/fact-sheets/stocking-rate-determination-on-native-rangeland.html>

Weed or Noxious Species Control

Guide to Effective Weed Control (OSU Extension)

<https://extension.okstate.edu/fact-sheets/guide-to-effective-weed-control.html>

Integrated Management of Invasive Thistles in Oklahoma (OSU Extension)

<https://extension.okstate.edu/fact-sheets/integrated-management-of-invasive-thistles-in-oklahoma.html>

Thistle Identification (OSU Extension)

<https://extension.okstate.edu/fact-sheets/thistles-in-oklahoma-and-their-identification.html>

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