Chapter 6

Managing native warm-season grasses and associated early-succession habitat

Succession will take over an old-field or a field of planted nwsg if it is not managed. Management is especially critical in the Mid-South, where average annual precipitation exceeds 40 inches and growing seasons are relatively long. Management is needed not just to set back succession, but also to create the vegetative composition and structure desired. Prescribed fire and disking are strongly recommended for managing fields of nwsg and associated early-succession vegetation. When used correctly (with respect to timing, frequency and intensity), fire and disking not only set back succession, but also determine plant species composition and structure, which directly influence habitat quality and forage quality. Other methods of managing nwsg fields include grazing, haying, the use of herbicides and bushhogging (mowing).

Fig 6.1 In the Mid-South, a field can turn into a young forest in just a few years. Management is necessary to set back succession.

NOTE: When managing nwsg established under government programs, most notably the Conservation Reserve Program, there are established guidelines and timeframes for "mid-contract management practices" (such as disking, burning and herbicide applications). Landowners and managers should consult the appropriate agency prior to managing lands under an active contract to ensure desired management activities meet program guidelines and are included in the conservation plan.

Prescribed fire

The word "fire" typically elicits fear in many people because of an association with damage and destruction. As Dale Wade wrote in his publication, ***A Guide for Prescribed Fire in Southern Forests***, "Wildland fire is neither innately destructive nor constructive. It simply causes change." This change can be positive or negative, depending on the use of fire and the landowner's objectives. Prescribed fire is the controlled application of fire under specified environmental conditions that allows the fire to be managed at a desired intensity within a confined area to meet predetermined vegetation management objectives. **Simply put, prescribed fire is *not* wildfire. When used properly, it is very safe and achieves specific objectives.** Prescribed fire, or controlled burning, can be used to reduce litter buildup, set back succession, increase nutrient availability and stimulate herbaceous growth, all of which have real implications for wildlife management. Although prescribed fire is used to manage forests (including upland hardwoods!), this discussion will concentrate on its use in fields of nwsg and old-field habitats. Proper burning permits should be obtained from the state forestry agency before using fire and all burns should be conducted and/or overseen by properly trained and experienced personnel.

Fig 6.2 Prescribed fire not only consumes litter buildup and sets back succession, it also exposes seed and various invertebrates, such as snails and beetles, which provide calcium for young turkeys and quail.

The effect of prescribed fire varies greatly with fire frequency, fire intensity, season of burn, amount and type of litter (vegetative debris), moisture and temperature, wind speed and method of burning. **It is important to understand how fire behaves under various conditions and to burn only when conditions are suitable to meet stated objectives.**

Fig 6.3a and 6.3b Burning in late March/early April stimulates quick growth from nwsg. This field was burned April 8, 2002. By April 15 (left), 3–4 inches growth is evident from individual nwsg bunches. By April 22 (right), the nwsg are growing rapidly.

Dormant-season burning

Most often, fields are burned in late winter/early spring, just before green-up. However, when a landowner has considerable acreage that needs to be burned, it cannot all be done at once. Burning throughout the season to meet burned acreage objectives is fine. Nonetheless, burning in March/early April reduces winter cover for only a short time before spring green-up and does not disrupt the wildlife nesting seasons. When nwsg are burned in late March/early April, the heat of the fire often stimulates rapid new growth, which is usually apparent within 5 – 7 days after burning. Depending on conditions, increased nitrogen and other nutrients may be available the growing season after burning. If burning coincides with warm daily temperatures (60 – 70 F) and adequate precipitation, accelerated plant growth is possible. Soil fertility is usually increased after burning grasslands, as nutrients from the ash are translocated downward into the upper soil horizons. Nitrogen, phosphorus, potassium, calcium and magnesium are all released from organic material during a fire, and that which is not volatilized is readily soluble after burning. In addition, the hydrogen ion concentration in the top few inches of soil usually decreases after burning, which may raise soil pH slightly. These increases in soil fertility and pH may persist for 1 – 2 years after burning.

Fig 6.4 Available nutrition may be increased after burning as nutrients are leached by rainfall from ash down into the upper soil layer. Fuel moisture and fire intensity are related and can influence the amount of ash and nutrient availability post burning.

Fig 6.5–6.9 This series of photos shows expected response from old-field vegetation when burned in the dormant season. Dormant-season burning is normally recommended when the desired plant composition is present and/or when additional grass is desired. This field was burned using a strip-heading fire. Fig 6.5 clearly shows the backing fire moving slowly against the wind to the right and the strip-heading fire moving more quickly with the wind to the left. Wind direction is evident from the smoke column.

Fig 6.5 March 2005

Fig 6.6 March 2005

Fig 6.7 May 2005

Fig 6.8 August 2005

Fig 6.9 November 2005

Dormant-season burning is best accomplished on "bluebird days" when atmospheric stability is slightly unstable or neutral, which allows for rapid smoke dispersal. Good winter-burning conditions often exist for several days after the passage of a cold front that has brought light to moderate rainfall. During this time, a persistent wind, low relative humidity, cool temperatures and clear skies can be expected. The preferred specific conditions for burning fields are a clear day with temperatures between 40 and 70 F, a relative humidity of 25 – 45 percent and a steady wind of 3 – 10 mph. Ideally, fuel moisture should be 10 – 20 percent and soil moisture should be damp. This helps ensure the fire consumes the vegetation and litter layer, yet leaves a thin layer of organic material and ash, which is a source for added nutrients. Normally, burns are best prescribed from mid-morning through mid-afternoon. It is seldom desirable to burn into the evening and

night because an increase in relative humidity along with the possibility of a temperature inversion increases the likelihood of smoke problems. This is a most-important consideration when burning large acreage and when burning near roads.

Growing-season burning

Fig 6.10 Growing-season fire can produce considerable smoke because much of the vegetation is still green. Nonetheless, burning in September is effective at reducing undesirable woody encroachment. In fact, September burning was as effective at killing woody stems as applications of imazapyr and triclopyr (see Fig. 6.17).

Once spring green-up begins, burning can be more difficult because of leaf moisture content. Burning fields after spring green-up increases smoke production dramatically, which is undesirable. Nonetheless, growing-season fire is still useful, especially in late summer/early fall. While some sources present conflicting evidence, most lightning-induced fire in the Mid-South occurred during late April through mid-May and August/September. Native Americans, however, burned year-round and had an uncanny ability to know how to use fire during different seasons to achieve specific objectives (normally to improve habitat or drive game). Without question, the activity of Native Americans must be considered a natural influence on the plant and animal communities throughout the region.

One of the greatest advantages of growing-season fire is its ability to reduce woody succession. Young trees and shrubs are most susceptible to fire when leaves are present. While the tops may be killed with a dormant-season fire, the root system remains alive, resulting in prolific sprouting the following spring. Burning during the growing season is more likely to kill the entire tree, including the root system. Growing-season burns are most often implemented in the Mid-South during spring (soon after leaf-out) or during late summer when conditions are usually drier and more favorable for burning. When the leaves and twigs are consumed during the growing season and/or the temperature exceeds 145 F in the crown of the tree or shrub, top-kill is imminent. These temperatures are much more easily reached (at levels 10 – 15 feet above ground) when burning in late summer (September) than in spring. It is also during late summer that trees begin to prepare for fall senescence (much like nwsg), transporting carbohydrates, amino acids and other compounds down from the leaves and twigs to the root system. By burning in August – early October, nutrient reserves needed in the root system to start growth the following spring are drastically reduced. This increased stress is often enough to kill the root system and eliminate future sprouting. Another benefit to late growing-season fire is that the wildlife nesting seasons are not impacted. Also, fire intensity is normally less intense during late summer as much of

Fig 6.11 March burn

Fig 6.12 September burn

Fig 6.13 Imazapyr

Fig 6.14 Triclopyr

Fig 6.15 Mow

Fig 6.16 Control

Fig 6.11 – 16 This series of photos shows the effect of various treatments in reducing woody encroachment one growing season after treatment. These treatments were replicated in a CRP field planted to tall fescue, which had been mowed annually the previous 10 years. September burning reduced woody encroachment as well as the herbicide treatments (data presented in Fig 6.17). In addition, September burning was cheaper to implement than any other treatment, promoted more native legumes than any other treatment and reduced cover of undesirable cool-season grass better than any other treatment. Partridge pea, beggar's-lice and native lespedezas comprised more than 50 percent of the vegetation cover following September burning in this field.

the fuels are still green. This also reduces the chance for spot fires. Disadvantages, however, include a considerable increase in smoke production and reduction of winter cover.

Over time, the density and coverage of nwsg bunches often increase to a level where forb coverage is reduced and there is significantly less bare ground space, which reduces germination of the seedbank, restricts travel and makes the field less attractive to many wildlife species. Repeated burning in late summer/early fall (August through early October) when moisture content is relatively low may reduce grass density and increase forb coverage the following growing season. Disking (as discussed on page 120), however, is much more effective at reducing grass density and increasing forb coverage than burning.

Burning techniques

Before burning a field, a firebreak should be created to contain the fire. Disking a strip one or two tractor-widths wide around the field is sufficient. It is a good idea to create the firebreak in advance of the planned burn. Disking in September – November is sensible, as it is relatively dry then and disking prior to March normally stimulates desirable forb growth the following spring. A firebreak disked in the fall also facilitates planting a cool-season forage (see ***Firebreak management*** on page 113). Disking firebreaks in the fall has two drawbacks. If leaves from adjacent trees fall into the firebreak, it will need re-disking before burning. Also, if firebreaks need to be created on soils prone to erosion or on slopes, erosion problems may occur before vegetation reestablishes. During some years, there are relatively few opportunities to burn when conditions permit. Creating a firebreak just prior to burning may not be possible – often because the soil is too wet for disking in March/April. Anything in the field that needs to be protected from fire (such as a

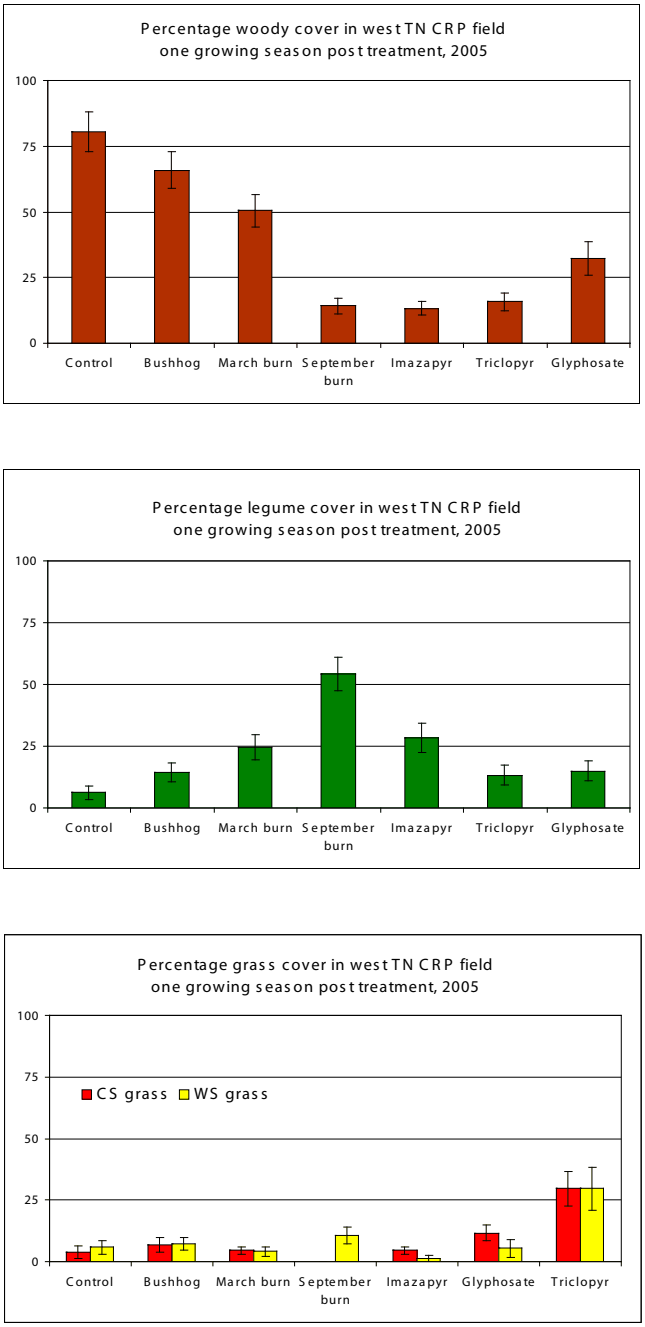

Fig 6.17 Growing-season fire can be just as effective as herbicides in reducing woody encroachment into a field (Gruchy and others 2007). An added benefit is the increase of native legumes from the seedbank and the decrease in cool-season grass coverage.

Fig 6.18 It is foolish and irresponsible to try and burn fields without a firebreak. By disking a strip one or two tractor-widths wide around the field, a sufficient barrier is put in place to contain prescribed fire when used sensibly.

Fig 6.19 When burning fields, it is important to identify areas that shouldn't be burned and disk around them. Here, valuable food and cover for bobwhites and other wildlife has been protected by disking the firebreak in front of a plum thicket instead of around it.

plum thicket) should be disked around also when the firebreak is created.

The recommended method of burning is dependent on the weather conditions and the amount and structure of litter on the field. A *backing fire* moves against the wind. A *heading fire* moves with the wind. A *flanking fire* moves at right angles to the wind.

Fields are normally burned with the aid of a drip torch. Burning a field is always initiated with a backing fire, lit on the downwind side of the field adjacent to and along the firebreak. A blackline is created by allowing the fire to back into the field, creating a safe zone should the wind shift or if a heading fire is used later. Very flammable fuels adjacent to the firebreak can be mowed before burning to slow the rate of burn. A backing fire

Fig 6.20 Fields should be burned by first creating a blackline (burned area) with a backing fire before using a strip-heading fire or flanking fire. Notice in the picture how the fire is moving against the wind. This fire was correctly started adjacent to the firebreak, placed between the field and the white pines, which do not tolerate fire when young. At this point, a strip-heading fire or flanking fire can be used (if desired) to burn the field more quickly than waiting on a backing fire to slowly move across the field.

consumes material on the field very effectively and has relatively low flame heights. Depending on conditions, flame heights might range from a few inches to a few feet. Because it is moving against the wind, a backing fire moves quite slowly. If there is a large amount of litter present or if the wind is a little strong, a backing fire or strip-heading fire is probably the best method to use over the entire field.

If the process can be safely and effectively quickened, a *strip-heading fire* may be used (see Fig 6.5). This involves lighting a series of lines of fire progressively upwind of the initial backing fire. Strips should be narrow enough so the fire does not reach a high energy level before it reaches a backing fire or a blackline. Initially, strips might only be 20–50 feet wide until it is obvious how the fire will behave. Although the same techniques used with dormant-season burning apply with growing-season fire, strip-heading fires with *persistent* winds may be required (depending on moisture levels) to burn a field during the growing season.

When conditions warrant, a field can be burned with a *ring fire*. This is best accomplished by two people (with assistance from others). To begin,

a blackline is created on the downwind side of the field. From the blackline, two people walk in opposite directions around the field, setting fire adjacent to the firebreak. This technique actually involves a backing fire (initially), a flanking fire (as the sides burn perpendicular to the wind) and a heading fire (when the two burners finally come together at the opposite end of the field from where they began). Coordination is required to implement a ring fire safely and effectively. The process should begin slowly and be monitored carefully to ensure an adequate blackline is created on both sides before the fire starts to converge. Wildlife in the field should be considered before using a ring fire. There is no safe escape for many species once the two burners meet.

Fig 6.21 The possibility of killing wildlife is increased when using a ring fire, as opposed to backing fire, flanking fire or strip-heading fire. This rabbit was killed when fire from opposite sides of the field converged during a ring fire. There was no escape. Nonetheless, even with ring fires, direct mortality when burning fields is not as high as when mowing fields (bushhogging).

Burning on rotation

While burning is highly desirable and can be used to enhance fields of nwsg and associated old-fields for wildlife, only a portion of a management area should be burned each year. **Creating a mosaic of habitat conditions across the management area is very important in meeting the needs of different wildlife species and the various requirements of a particular species throughout the year.** For example, a field burned in late winter may provide excellent brooding habitat for quail and turkeys the following summer. Nesting cover within the field, however, is greatly diminished. It is not until the second summer after burning that nesting cover is most attractive for some birds, including bobwhite quail. In the third or fourth year after burning, escape cover for many species may be present. Therefore, the needs of various species and life requirements are met in a field for at least three to four years after burning. For this reason, it is widely recommended that one-third to one-fourth of an area be burned each year. Thus, where few fields are present, sections of a given field may be burned on rotation. This is particularly applicable with relatively large fields (>10 acres). Where several fields are present and in proximity, whole fields may be burned on rotation.

Fig 6.22 If wildlife is a concern, it is imperative not to burn all the cover at once. Leaving sections for winter cover and subsequent nesting structure will help increase wildlife populations. In this photo, a 100-acre field in West Tennessee has been broken up into sections approximately 100 feet wide, with alternate sections burned every 2 – 3 years. Disked firebreaks promote forbs from the seedbank and can be planted if desired. Note the brushy cover in the nwsg strip. Leaving quality winter cover for bobwhites is just as important as providing nesting or brooding cover. This shrub thicket was used as a covey headquarters.

The exact burning rotation, of course, depends upon landowner objectives and constraints, site conditions, focal species, the existing seedbank and the rate of woody encroachment. The primary objective is to keep succession in check and meet the various needs of focal wildlife species by influencing vegetation structure and composition.

Season of burn should also be considered when burning on rotation. Consistent burning over time in late winter/early spring may shift composition of the field to increased grass cover and reduced forb cover. While this may be desirable when managing nwsg for haying/grazing, it is

Fig 6.23 Sometimes there are patches in a field that don't burn. Perhaps the fuels weren't continuous, perhaps bare ground space precluded a patch from burning, or perhaps a low-lying spot was too moist to burn. That's OK; it only adds to the diversity of cover and may later provide nesting or escape cover.

Burning and disking to increase invertebrate availability

Periodic burning and/or disking consumes the thatch layer and stimulates fresh growth. This has a dramatic effect on invertebrate populations. Many invertebrates are associated with the thatch layer. When that layer is consumed by fire or broken down by disking, those invertebrate populations are reduced. However, as the seedbank germinates and perennial plants sprout after the disturbance, another assemblage of invertebrates establishes. Most importantly for upland gamebirds, such as quail, turkeys and grouse, the structure at ground level is more open and allows young broods to move about freely and feed upon this new invertebrate population under a protective canopy of forbs and grasses. The invertebrates present within the field now are *available*. Before burning or disking, insects and other invertebrates present may not have been available, depending on the structure at ground level and the ability of broods to navigate through the field. Thus, disturbing fields through burning or disking does not necessarily increase invertebrate *abundance*, but it can increase invertebrate *availability*. The importance of forbs to provide this structure cannot be overstated. Research in Tennessee (Fettinger and coworkers, 2002) found invertebrate biomass within fields of pure nwsg (0.0388 g/m^2) was no different from that in pure fields of tall fescue/orchardgrass (0.0386 g/m^2). Fields containing a significant forb component harbor considerably more invertebrates.

Fig 6.24 Providing favorable structure and cover through burning and disking makes invertebrates available. Invertebrate abundance is of no value if birds cannot travel throughout the field under a protective canopy.

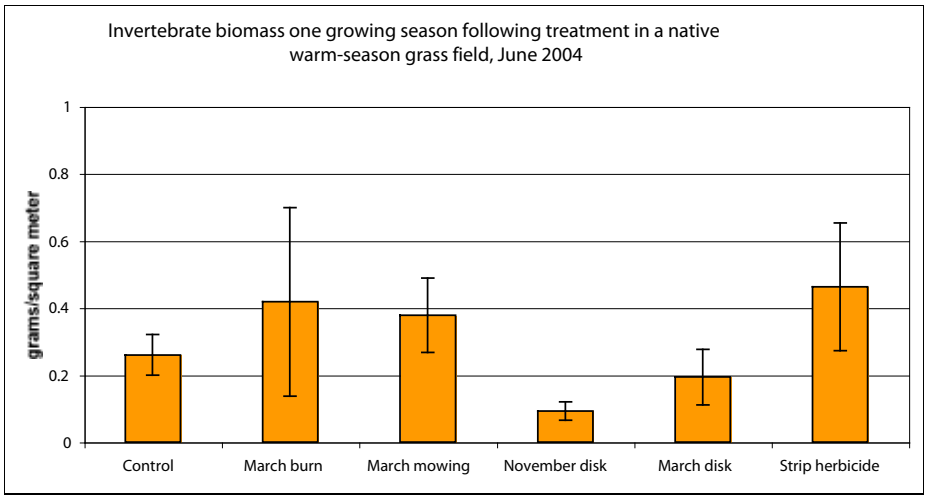

Fig 6.25 Research in North Carolina (Palmer 1995) suggested bobwhite chicks require more than 3 grams of invertebrate mass per day during the first 2 weeks of life. Disking treatments in Tennessee (above) contained 0.10 – 0.20 grams of invertebrates per square meter (Gruchy 2007). Therefore, sufficient invertebrate biomass for a 10-chick bobwhite brood was present within less than 0.10 acre. Obviously, a brood would not be able to prey upon every invertebrate within this area, but the point is that invertebrates are plentiful. The main consideration is whether the brood can travel through the field and if there is protective overhead cover while feeding.

not desirable from a wildlife perspective. Conducting a September burn in between dormant-season burns when and where appropriate will help maintain a diversity of forbs and grass.

Firebreak management

The primary role of firebreaks is to contain fire within a field. They also can be managed to provide additional food for wildlife. Firebreaks can be sown to warm-season plantings, cool-season plantings or left fallow to stimulate the seedbank and establish naturally occurring legumes and other forbs. Warm-season plantings well-suited for firebreaks include small grains (such as grain sorghum and millets), other seed producers (such as sunflowers, buckwheat, partridge pea and annual lespedezas) and forages that also produce seed (such as cowpeas and soybeans). Cool-season plantings include annual grains (particularly wheat and oats), clovers (such as crimson, arrowleaf, ladino and red), and other legumes (such as Austrian winter peas and birdsfoot trefoil). Warm-season plantings are normally planted in late April/May and provide forage and/or seed through summer and autumn. Cool-season plantings are normally planted in late August/September and provide green forage during the fall/winter months and into the following spring/summer. Both types of plantings can be a source of invertebrates for young quail and turkeys and other birds. Before planting any firebreak, soil should be amended with lime and fertilizers as recommended from a soil test.

Fig 6.26 and 6.27 Fallow firebreaks can provide outstanding cover, as well as a quality food source. Here, ragweed provides a protective overhead canopy (left) for young quail and there will be plenty of ragweed seed present in the fall. Below the ragweed canopy (right) open ground space allows broods to move about freely.

Managing firebreaks for year-round food resources is often desirable. This is possible when a section of firebreak is sown to a warm-season mixture, a section to a cool-season mixture and a section left fallow for annual forb production and dusting. Because warm-season plantings are annual, they may be left fallow the year following planting, depending upon burning objectives. Cool-season forages may be annual or perennial. Annual clovers (such as crimson and arrowleaf) are excellent re-seeders and may be maintained the following year by disking in August. Annual cool-season legumes also may be followed with warm-season grains because of the added nitrogen fixed on the site by the legumes. Perennial forages (especially ladino clover) should be planted only on those sites with adequate moisture to sustain them through the summer when hot, dry periods are not uncommon. **Introduced perennial grasses (such as orchardgrass and tall fescue) should never be planted to a firebreak** because over time they will produce sufficient thatch to allow fire to creep across the firebreak, can spread into nwsg, will out-compete clovers and other wildlife-friendly plantings, offer poor forage for wildlife and provide poor structure at ground level for small animals (see sidebar on pages 37–38).

Annual plantings are often recommended for firebreaks. This facilitates the need to re-disk the firebreak before burning again. Perennial plantings can be used if the field is not going to be burned for another 3 – 4 years. The problem with perennial firebreaks is they accumulate dead leaves (if adjacent to woods) and dead plant material over time. Thus, perennial mixtures usually need disking prior to burning.

Construction and placement of firebreaks are other important considerations when managing fields for wildlife. If adjacent to woods or a line of trees, firebreaks should be established approximately 30 – 50 feet from the woods to allow a soft edge to develop between the woods and the firebreak. Getting

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Fig 6.28 Firebreaks adjacent to woods should be created at least 30 – 50 feet from the woods' edge to facilitate a soft edge between the woods and the firebreak. The soft edge provides additional nesting and escape cover, as well as forage and soft mast (blackberries).

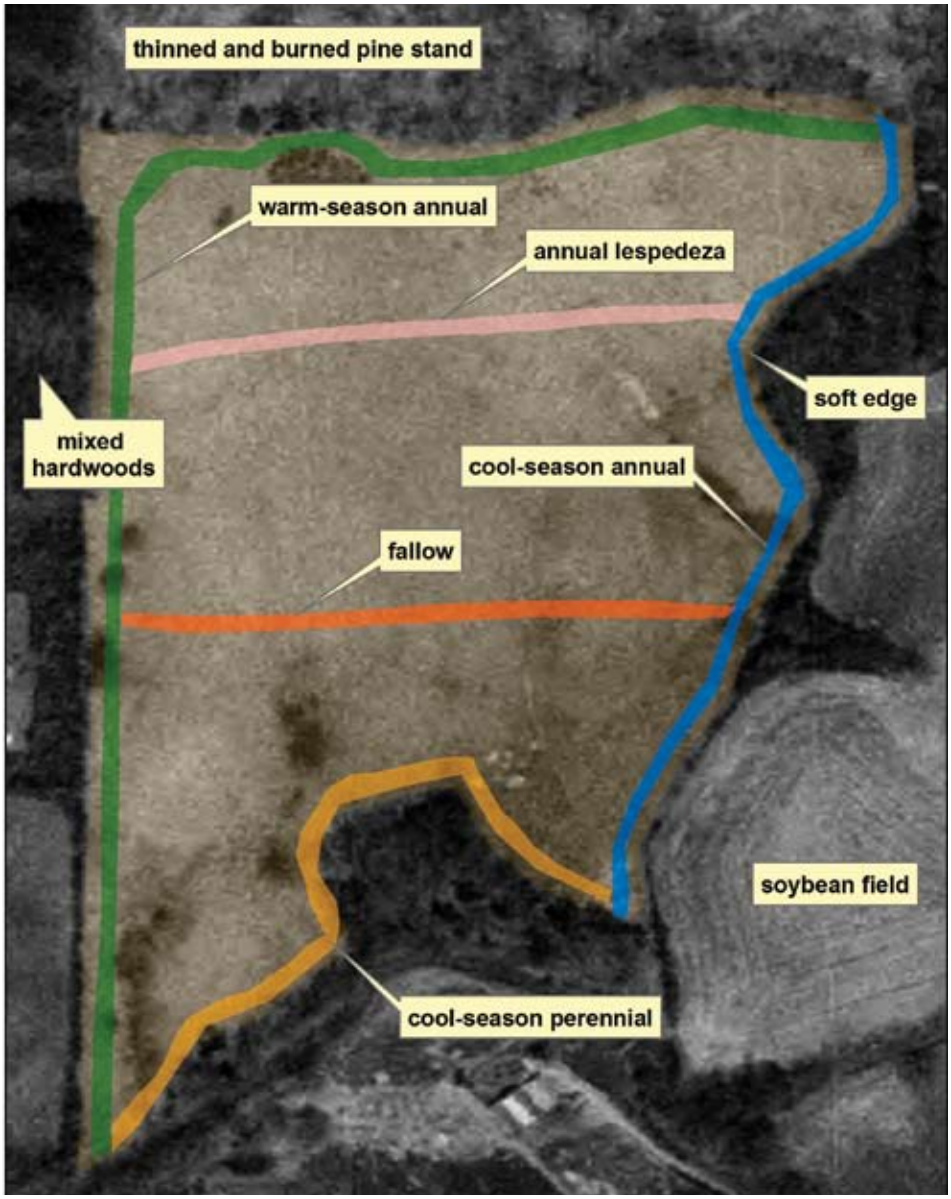


Fig. 6.29 Firebreaks can be managed in various ways. Various sections may be planted to provide supplemental forage and grain through the year. Other sections may be left fallow to provide brood-rearing habitat and seed production. Firebreaks should be established outside the drip-line of adjacent trees to avoid competition for nutrients and sunlight and to allow soft edge to develop between the field and woods.

away from the trees also allows planted firebreaks to grow better because of less competition with trees for sunlight and nutrients. Over time, woody encroachment into the soft edge can be set back by bushhogging, controlled with an herbicide application or reduced to a desirable level by thinning. Also, anytime a firebreak is close to a woods' edge, the possibility of a tree or limb falling into the firebreak exists. Prior to burning, firebreaks should be checked for fallen debris that might allow the fire to creep across the break.

If the field is surrounded on one or more sides by woods, the area can be made more attractive for many wildlife species by thinning 50 – 100 feet into the woods from the field. Those trees not favored for wildlife (such as sweetgum, maples, elms, sourwood) should be selected for removal to reduce canopy closure to 50 percent or less. Sometimes, it is preferable to kill selected trees and leave them standing, which later provide snags for cavity-nesting

birds. The recommended procedure is to girdle the tree with a chainsaw or open the bark to the cambium layer using a hatchet or machete. If using a hatchet or machete, leave no more than 1 inch in between hacks around the tree. A few squirts of herbicide are then sprayed into the wound via spray bottle. Garlon 4™ and Arsenal AC™ are excellent herbicides for this use. Their labels provide rates and mixing instructions for various applications.

If a field or section(s) of a field is to be burned annually or every other year, one strategy for managing firebreaks is to maintain a rotating firebreak. This involves disking (which may or may not be planted) an initial firebreak. The following year (or two years later), another firebreak is disked just inside and adjacent to the initial firebreak. The following year (or two years later), the initial firebreak is disked again, while the second firebreak remains fallow. This rotating design continuously provides either a planted strip and a fallow strip, or two fallow strips in two different successional stages. The firebreaks are juxtaposed with perennial grass and forb cover within the field as well as a soft edge outside the firebreak and, where woods are adjacent to the field, a thinned wooded area. Thus, habitat is available for a wide range of activity by a variety of wildlife species, including cover/area for nesting, brooding, escape, feeding and dusting.

Planting recommendations for firebreaks

A wide variety of plantings can be used when planting firebreaks. Two cool-season and three warm-season mixtures that have been used successfully are listed below (adapted from Harper 2007). Rates are per acre.

Cool-season forage mixture (annual)

15# crimson clover
30# wheat

If planting on poor ground and/or cost is a concern, this is the mixture to use. It's cheap, easy, will grow most anywhere and provides high-quality forage for deer, turkeys, quail and rabbits, as well as other species, such as groundhogs and ruffed grouse.

Crimson clover is an excellent re-seeder. It can be retained for many years without replanting if it is not overgrazed and is allowed to flower and produce seed. A few weeks after the crimson clover dies and produces seed (late May), the firebreak should be mowed. A few weeks later (mid-June), the firebreak should be sprayed with a glyphosate herbicide (1 – 2 quarts per acre) to kill weeds. Weeds should be sprayed before they flower to realize a better kill and to help reduce the seedbank. Depending on

Fig 6.30 A lush firebreak containing crimson clover and wheat provides nutritious forage for many wildlife species at a time (Nov.–Feb.) when green forage is limited.

the seedbank and precipitation, weeds may need to be sprayed a couple of times through the summer. After the weeds have died, the firebreak should be top-dressed with lime and fertilizer as recommended from a soil test and disked in early to mid-August. This will effectively re-seed the crimson clover. If desired, additional wheat and/or oats can be sown prior to incorporating the lime and fertilizer or drilled afterwards.

A variation of this mixture is to add red clover (8 pounds) and reduce the crimson clover to 10 pounds. Red clover is relatively slow to establish, but will persist throughout the summer, providing an additional 3 – 4 months of high-quality forage. As the red clover declines in productivity (early September), the firebreak should be disked lightly to stimulate the crimson clover. Additional wheat or oats can be drilled into the plot if desired.

There is nothing wrong with planting a firebreak to wheat *only* (80 – 100 pounds). It is cheap and easy to plant; doesn't require high nutrient levels; provides nutritious forage fall through spring; provides seed through the following summer; and in the second summer after planting (depending upon the seedbank), a productive fallow site results.

Fig 6.31 Perennial clovers and chicory can be maintained for several years with proper weed control and soil amendment.

Fig 6.32 Seed-producing grasses are not as susceptible to deer damage as the peas and beans.

Cool-season forage mixture (perennial)

4# ladino white clover
5# red clover
2# chicory
40# oats or wheat

This is an excellent perennial mixture that provides quality forage and a source of invertebrates for brooding quail and turkeys. The clovers and chicory can easily be maintained for three to four years (for a 3 – 4-year burn rotation) provided the site is top-dressed according to a soil test and weeds are controlled. After the annual grains have produced seed and died, grass weeds can be controlled with 10 ounces of Select™ postemergence and many broadleaf weeds can be controlled with 4 ounces of Pursuit™ postemergence. This mixture should be mowed after the clovers and chicory have flowered and produced seed and as often as necessary (usually 2 – 3 times per year) to help with weed control and stimulate fresh growth.

Warm-season seed mixture (annual)

7# white proso millet
7# foxtail millet
5# Egyptian wheat
4# grain sorghum

Deer eat very little grass during summer; thus, this mixture does well even where there is a high deer density. An abundance of seed is produced for a variety of birds, including quail, doves and turkeys, as well as many songbirds, including cardinals, several species of sparrows, juncos, flickers and others. Non-desirable broadleaf weeds can be controlled with 2,4-D, Clarity™ or Banvel™.

Warm-season forage mixture

60# iron-clay cowpeas
OR
30# Quail Haven soybeans
3# peredovik sunflowers

Fig 6.33 Iron-clay cowpeas and QH soybeans withstand grazing pressure from deer much better than soybeans. Nonetheless, if the peas/beans are not destroyed by deer, a highly nutritious seed source is provided for quail/turkeys in fall.

This forage mixture contains plenty of crude protein (25 – 30 percent) and digestible nutrients (<30 percent Acid Detergent Fiber). Sunflowers are not added necessarily for forage, but as structure for the legumes to climb and grow upon later in the season. This allows the peas/beans to produce additional forage per acre. Prowl™ or Treflan™ can be sprayed and incorporated prior to planting to help control various forb and grass weeds. Select™ can be sprayed postemergence to control grass weeds. Quail Haven soybeans reseed quite well if disked in late winter following good seed production. If deer density is low and weeds are especially problematic, Roundup Ready™ soybeans (70 pounds) may be used instead of iron-clay cowpeas or Quail Haven soybeans.

Warm-season reseeding mixture (annual)

10# Kobe or Korean lespedeza
2# partridge pea

Bobwhites relish seed from these lespedezas and partridge pea, which are available through winter, making firebreaks planted to this mixture primary feeding spots from December through February. The best time to plant is late winter (mid-February – March), which coincides with dormant-season burning. The lespedezas and partridge pea are good re-seeders, which allows them to be retained by disking in March.

Fig 6.34 Annual lespedezas and partridge pea provide a good seed source for quail into late winter.

Fig 6.35 Disking sets back succession, stimulates the seedbank, facilitates organic matter decomposition, incorporates nutrients into the soil and provides an open structure at ground level. Plant composition can be influenced by timing and intensity of disking.

Disking

Disking is another technique highly recommended to set back succession and influence plant composition in fields. In fact, disking can provide many of the same positive attributes as burning. This is especially important in those areas where burning may not be possible. In terms of historical relevance, it has been proposed disking mimics, to some extent, the same disturbance effect of large ungulate herd migrations, exposing soil, reducing grass dominance and stimulating the seedbank. Disking also promotes decomposition of thatch, which improves soil nutrient availability and creates a more open structure at ground level. Two primary factors influence the effect of disking: timing and intensity.

Timing of disking

Disking at different times of the year influences vegetation composition, depending on site conditions and seedbank composition. In the Mid-South, disking in the fall and winter generally produces a different suite of plants than disking in the spring. Disking prior to March normally stimulates more desirable forbs, while disking after March may stimulate less desirable grasses, such as johnsongrass, crabgrass and broadleaf signalgrass, if they are present in the seedbank. A good way to determine the preferred time to disk and the seedbank response in a particular field is to disk a strip every month, especially from October through May.

Disking intensity —"light" or "heavy"?

A question often asked is "How many passes are required when disking early-succession habitat?" Disking intensity is influenced primarily by equipment, soil texture and soil moisture. A heavy offset disk (or "bog disk") penetrates and breaks the soil much better than a lighter tandem disk (or "farm disk"). Thus, only one or two passes may be needed by an

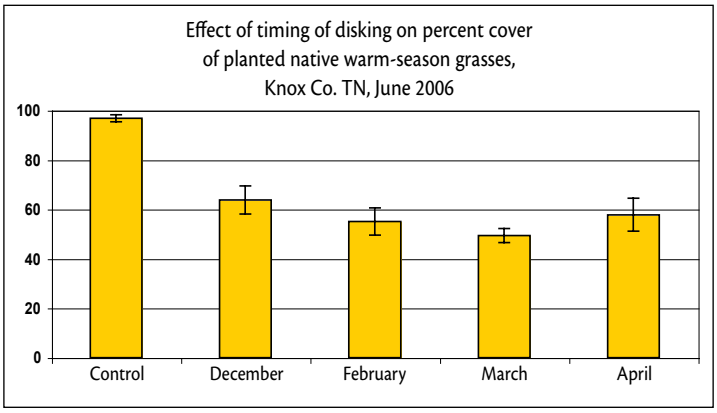


Fig 6.36a Moderate disking reduced native grass density to 50 – 60 percent coverage, regardless of whether disking occurred in winter or spring.

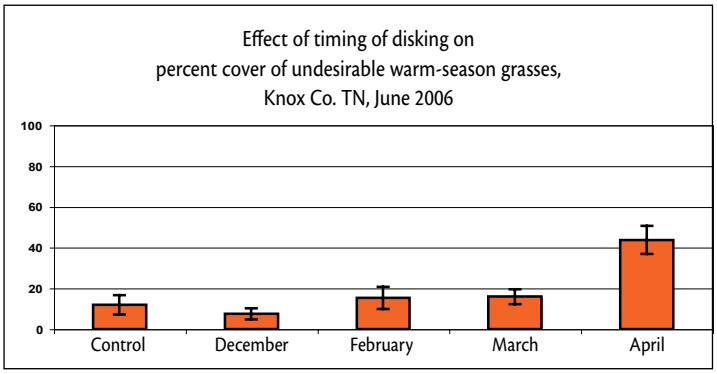


Fig 6.36b Disking in April led to increased coverage of undesirable warm-season grasses, such as johnsongrass, crabgrass, goosegrass and broadleaf signalgrass.

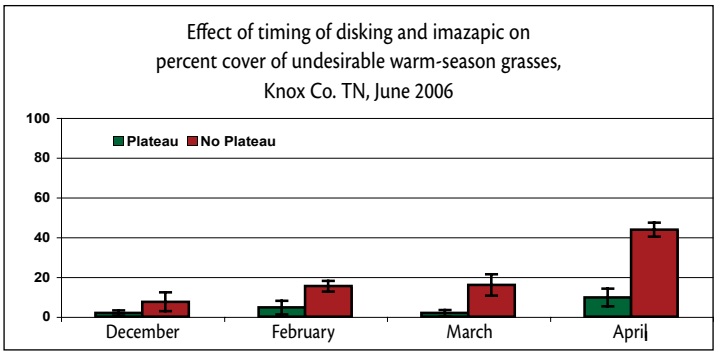
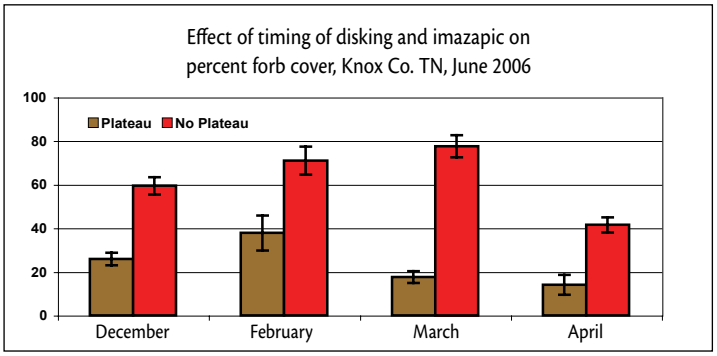


Fig 6.36c A preemergence application of imazapic (12 ounces per acre of Plateau®) suppressed germination and growth of undesirable warm-season grasses. If disking cannot be accomplished until April, this is an important consideration.



(Gruchy and Harper 2006)

Fig 6.36d Disking in winter promoted more forb cover than disking in April. A preemergence application of imazapic (12 ounces per acre of Plateau®) also influenced forb germination and growth. If undesirable species are expected to arise from the seedbank following disking, this is an important consideration.

Fig 6.37 A single pass of a heavy offset disk without mowing may be all that is necessary (according to site conditions) to reduce grass density and increase forb cover.

offset disk to cut the existing vegetation and thatch layer and expose some soil. Tandem disks often require 5 – 10 passes just to cut a few inches into the soil, particularly heavy clays. Indeed, trying to disk a field of heavy clay, especially when it is dry, with a tandem disk is akin to disking pavement. And regardless of soil texture, if the field is covered with tall rank vegetation, it is often not possible to use a tandem disk unless the field is previously burned or mowed. In fact, more than one pass may be required even with an offset disk if thick native grass is present. This problem is accentuated if it has been a few years since the field was disturbed and rank growth has accumulated. Waiting 1 – 2 weeks after mowing rank nwsg will facilitate decomposition and make disking these stands easier.

The goal is to cut the existing vegetation, incorporating at least half of it into the soil, and expose a considerable amount of soil, which creates open space at ground level and stimulates the seedbank. That probably describes "light" disking. However, if native grasses have become too dense and increased forb cover is needed, additional passes may be required to cut the top of the grass root systems. This may describe "heavy" disking. However, even at this level, there is still a considerable amount of vegetative material on top of the ground. It is never necessary to disk to the extent it resembles a seedbed ready to plant.

Burning or mowing prior to disking

As mentioned, it may be necessary to burn or mow prior to disking, especially if the only disk available is a light tandem disk. Burning not only makes disking much easier, but the clean structure created makes

herbicide applications more efficient, especially those that require incorporation. Preemergence applications also are more efficient following burning than if applied with debris on the ground, which can block the herbicide spray. Burning prior to disking also creates a clean field for planting additional forbs where few (or none desirable) are present in the seedbank. Light disking after burning creates the perfect seedbed for top-sowing most light-seeded forbs.

Fig 6.38 If a tandem disk ("farm disk") is all that is available, multiple passes will be required to adequately disturb the soil, and it may be necessary to mow a field or sections of a field prior to disking.

Disking on rotation

Rotational disking is recommended just as rotational burning. Rotational disking can be accomplished by disking entire fields every 3 – 4 years or by disking different strips or portions of a field every year. If strips or blocks within a field are disked, approximately one-fourth to one-third of a field should be disked each year to accomplish the 3 – 4-year rotation. This method creates a perpetual mosaic of habitat conditions that favor a variety of wildlife species. Strip disking, in particular, provides a break in vegetation while stimulating increased forb growth. Disked strips, like firebreaks, also can be planted to provide a supplemental food source adjacent to the cover provided within the field. Disked strips across a field can serve as firebreaks, allowing sections of a field to be burned at different times. If possible, strips should be disked along the contour of the field to minimize the potential for soil erosion.

The decision of whether to disk entire fields or strips is largely dependent upon field size and the number of fields in the area. If field size is relatively large (>10 acres), disking 2 – 4 acres each year in strips or sections is recommended. If the field is small and there are several fields in the area, the entire field can be disked while others are disked in following years.

Disking a section of the field every year has many benefits. Not only is brood habitat provided and a mosaic created, quality forage is stimulated as well. Select plants for white-tailed deer, for example, increase dramatically the growing season following fall/winter disking (see Table 2.1 on page 18). Coverage of these plants may decrease significantly by the second year. Thus, disking a different section or strips within a field each year may be necessary to stimulate preferred deer forage plants.

Fig 6.39 Strip disking helps set back succession and provides diverse structure and composition across the field. Five passes with a tandem disk were necessary to disk a strip and stimulate some ragweed and other forbs to germinate in this pure native grass field after it was burned.

Concerns with erosion and Highly Erodible Land (HEL)

Although disking is a highly desirable management practice, it is important to adhere to local soil and water conservation standards. For fields managed under USDA programs (such as CRP and EQIP), this is a requirement. Local standards can be found in the USDA Field Office Technical Guide (FOTG). The FOTG requirements for minimum soil loss vary from county to county. Annual soil loss is influenced by several factors, including soil type, average rainfall, slope and groundcover management. According to the NRCS, average annual soil erosion should not exceed the soil loss tolerance (t-value); those values usually range from 1 – 3 tons per acre per year. This figure should not be alarming. Three tons of soil over an acre is not as thick as a dime. When organic matter decomposition and soil fauna decay are taken into consideration, it is easy to see how a 1 – 3-ton-per-acre soil loss may not be a loss at all. Recent research determined soil loss from "heavy" disking conducted on established nwsg fields was negligible and did not approach unacceptable levels because of the extensive root systems of nwsg. Switchgrass, for example, produces 6.5 times more root biomass than non-native perennial cool-season grasses; 15.5 times more root biomass than corn; and 46 times more root biomass than soybeans. Disking in strips along field contours with slopes less than 18 percent should not be a concern for landowners, as this will not result in soil loss if proper techniques are used in fields with established nwsg.

Herbicides

Fig 6.40 Fields containing extensive coverage of non-native perennial cool-season grasses should be broadcast-sprayed in the fall. Cool-season grasses are storing carbohydrates in preparation for winter dormancy and are most effectively killed at this time.

Herbicide applications are often necessary when managing planted nwsg and other old-field sites. Herbicides are often required to reduce coverage of undesirable forbs and grasses, eliminate/reduce woody species or reduce nwsg coverage where the grasses have become too dense. Herbicides may be applied across the entire field, applied in strips or spot-sprayed. Broadcast-spraying is normally used when undesirable plants occur over the entire field. Common examples include spraying for field invaders, such as crabgrass, johnsongrass, sericea lespedeza or small trees (such as winged elm, red maple, green ash and sweetgum). Broadcast-spraying is also used to combat non-native cool-season grasses when they are not controlled adequately prior to planting.

Using herbicides in strips across the field is similar to strip disking where transition zones in vegetative cover are created. This can be accomplished with two different methods. A strip one or two tractor-widths wide can be sprayed (similar to strip disking) or wider strips (or the whole field) can be sprayed with every two out of three nozzles on the spray boom closed (Fig 6.41–43). Strip spraying can be used to reduce nwsg coverage where they have become too dense in an effort to release forbs from the seedbank. A grass-selective herbicide (such as Select™) can be used to thin grasses if desirable forbs are present; if not, glyphosate can be used. To thin nwsg, they should be sprayed when they are actively growing, usually in late April when the grasses are 12–18 inches tall. If the grasses are taller when sprayed, the forb response may be limited, and burning or disking will be necessary to allow germination.

Spot spraying is commonly used to control woody encroachment into a field, but is also effective in controlling problem areas where unwanted invasive plants (such as bermudagrass and thistles) have persisted and need "another shot." Several herbicides are listed in Appendix 4 with the appropriate rates and applications.

As a general rule, herbicides are applied in a mixture with water and a surfactant at a rate of 10 – 30 gallons per acre using flat-fan nozzles (numbers 002 or 003) at 20 – 40 pounds of pressure per square inch (psi). **In all cases, herbicide labels should be read and followed closely before use with regard to restrictions, precautions, rates, recommended tank mixtures, surfactants and sprayer cleaning recommendations.**

Fig 6.41–43 Strip-spraying can be accomplished by closing off every other or every third nozzle on the spray boom. This method can be used to effectively reduce grass density and intersperse forb cover.

To reference herbicide labels, visit the Crop Data Management Systems, Inc. Web site (www.cdms.net/manuf/manuf.asp).

In most cases, the use of herbicides is the only way to gain control of a field after invasive non-native plants have become established. Mechanical and cultural methods simply do not work to eradicate many non-native plants. **Unfortunately, many managers and agencies resist the use of herbicides. Most often, this only delays or completely precludes habitat improvement or restoration because so many non-native invasive plants resist other control methods.** While it is true herbicide treatments may also kill some native plants, with the exception of rare species, they can be restored to the site after the invasive non-native plants have been eradicated by stimulating the seedbank, sowing seed and/or transplanting individual plants. Thorough eradication of problem plants prior to

planting nwsg and associated forbs is the most successful way to minimize long term management problems.

Herbicide treatment usually requires patience and repeated applications. Some competitors of nwsg are controlled relatively easily (such as crabgrass in bluestem and indiangrass plantings); however, others are more difficult and require patience and persistence. Recommendations for controlling grass competitors (such as tall fescue, bermudagrass, johnsongrass) prior to planting are provided in the ***Competition control*** section on page 80. Listed below are specific competitors that are particularly problematic in the Mid-South and the appropriate control techniques.

Sericea lespedeza

Sericea lespedeza is a non-native warm-season perennial legume introduced into the United States primarily as a possible forage from Japan in the late 1890s. It is an invasive leguminous forb that outcompetes native vegetation and can dominate a field in a relatively short time. Ironically, it is for these very traits that many private contractors and even some state and federal agencies still promote sericea lespedeza for erosion control. This is most unfortunate and completely illogical when there are so many native alternatives (especially nwsg) that also can provide erosion control as well as attractive wildlife habitat.

While sericea lespedeza can provide cover for some species (such as rabbits), it has little food value for wildlife. It is not a preferred forage for white-tailed deer, rabbits or groundhogs because of high lignin and tannin contents and the seed produced has little value for quail or other birds because they are extremely hard and relatively indigestible. Sericea lespedeza should be eradicated wherever it is found.

Invading colonies of sericea (as well as other problematic plants) should be spot-sprayed before whole-field treatment is required. When an entire field is treated for sericea, many of the forbs in the field may be killed before the sericea lespedeza is controlled. Killing desirable forbs is not a real problem when sericea growth is excessive because the sericea will uptake the majority of the herbicide. If desirable forbs are killed after treating sericea, it may be necessary to re-establish the forb component by planting after burning or by disking and stimulating the seedbank. Planting desirable forbs is **not** recommended, however, until the sericea has been **eradicated**. This may take a few years because the hard sericea seed in the seedbank may continue to germinate over time. Disking is strongly encouraged *after* killing existing sericea with an herbicide application to stimulate sericea seed in the seedbank. Yes, that is correct, to stimulate

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Fig 6.44 Sericea lespedeza spreads quickly and can be a serious problem. It should be sprayed before it becomes prevalent and adds to the seedbank.

it! This is the only way to get rid of it. If it is not stimulated on purpose, it will be stimulated later when the field is managed by burning or disking. **Landowners shouldn't be afraid of sericea (or any other undesirable non-native plant). They should be excited to finally get rid of it!**

Sericea is susceptible to spraying through most of the growing season, but different herbicides may be used during different growth stages. Once sericea is about 12 inches tall, it has enough leaf surface area to translocate the herbicide to the root system. Younger plants may not translocate enough herbicide to kill the root system. Triclopyr™ (such as 1 quart per acre of Garlon 3-A™ with non-ionic surfactant added) does not harm nwsg and performs quite well at killing sericea while it is actively growing. Triclopyr will, however, kill other forbs that may be desirable (such as ragweed, blackberry, various legumes). Triclopyr with fluroxypyr (1.5 – 2.0 pints per acre PastureGard™ with non-ionic surfactant) is very

effective in killing sericea and may be less damaging to desirable forbs. Metsulfuron methyl (such as 1 ounce per acre of Cimarron™ or Escort™ with non-ionic surfactant added) kills sericea quite well if sprayed when sericea is flowering. This usually occurs late August through early October in the Mid-South. Similar to triclopyr, metsulfuron methyl does not harm nwsg. Metsulfuron methyl may also kill desirable legumes (such as native lespedezas and partridge pea); however, if sericea is sprayed in early fall, other desirable forbs may have already flowered and produced seed and thus achieved dormancy and are not affected by the herbicide. Cimarron™ or Escort™ may be tank-mixed with 2,4-D, Garlon 3-A™ or dicamba (Banvel™, Clarity™, Overdrive™) to control a variety of other problematic forbs growing with sericea. Herbicide labels should be referenced for appropriate mixing rates and species controlled.

Sicklepod

Sicklepod (sometimes called coffeeweed) is an annual warm-season legume native to tropical America. It is a major contaminant in grain shipments in the US, as it has highly toxic compounds associated with the leaves, stems and seeds. The entire plant is toxic to livestock, humans and wildlife. It has no food value. While not as invasive as sericea, it can present problems in fields by crowding out desirable species. Sicklepod can be killed with a variety of broadleaf herbicides; however, many desirable forbs (such as native legumes) are also susceptible to these herbicides. Sicklepod can be controlled by spot-spraying with glyphosate or heavy infestations can be killed by broadcast spraying 2,4-D and/or dicamba (Banvel™, Clarity™, Overdrive™). Refer to herbicide labels for appropriate mixing rates. Following eradication of sicklepod, which may take a couple of years, desired forbs can be replanted after burning in March or early April. Seasonal disking will stimulate the seedbank and encourage additional forb growth.

Thistles and sowthistles

There are several species of thistles and sowthistles, including Canada thistle, bull thistle, annual sowthistle, spiny sowthistle and perennial sowthistle. These bristle-tipped forbs can be dif-

Fig 6.45 Thistles can be a real problem when managing fields. If thistles are allowed to get to this growth stage, they should be mowed to prevent them from producing seed. Later, herbicide applications will be necessary.

Fig 6.46 Spraying and/or burning over-wintering rosettes of biennial and perennial thistles while nwsg and forbs are dormant is a good way to control these problem plants.

ficult to control, especially when they occur on neighboring properties and are allowed to flower and produce seed, which are dispersed widely by the wind. In many cases, thistles become prevalent in a field after establishing nwsg using imazapic. Thistles are not controlled by imazapic, except with postemergence applications during the rosette or early bolt stage. Thistles also may be spot-sprayed with glyphosate, 2,4-D, dicamba (Banvel™, Clarity™, Overdrive™), metsulfuron methyl (Cimarron™ or Escort™), thifensulfuron methyl (Harmony Extra™), sulfometuron methyl (Oust™) and/or imazapyr (Arsenal AC™). Fall/winter treatment of rosettes with 2,4-D may be the cheapest and easiest method and precludes damage to desired warm-season forbs. Persistence, patience and cooperation among adjacent landowners are often required to get thistles under control.

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Fig 6.47 Shrub lespedeza can provide good cover and a seed source for quail; however, it can become quite problematic. It seems more and more landowners are seeing this problem—shrub lespedeza escaping from the hedgerow (left) out into the field.

Shrub lespedezas (Bi-color, Thunbergii and VA-70 varieties)

Shrub lespedezas, most commonly referred to as "Bicolor" because Bicolor 101 was the original commercially produced variety, are warm-season perennial shrubs that have long been planted for bobwhites. Shrub lespedezas produce seed fed upon by bobwhites and the shrub cover provides protection from predators throughout the year. In many areas, however, shrub lespedezas have become problematic by sprouting up throughout fields. In isolated patches, they are easily controlled with an application of glyphosate; however, isolated patches are not usually problematic. When entire fields are being invaded by shrub lespedeza, broadcast spraying is necessary. Applications of triclopyr (Garlon 3-A™ or Remedy™) and metsulfuron methyl (Cimarron™

Fig 6.48 Native alternatives, such as this blackberry field border, offer outstanding cover and food resources for many wildlife species. Wild plum, hawthorn and elderberry are other shrubs that should be considered.

or Escort™) have been successful in reducing bicolor coverage and gaining control of an invasive problem. Labels should be referenced for appropriate rates for foliage treatments and broadcast applications. Shrub lespedeza can be sprayed anytime while actively growing. Because of the invasive nature of shrub lespedeza, other plantings should be considered when managing for quail. Blackberries, wild plum, elderberry, hawthorn and crabapple are alternatives that can be equally attractive to bobwhites.

Fig 6.49 During the year of establishment, horseweed can proliferate and shade out native grass seedlings on some sites. Mowing no lower than the top of the native grass seedlings will reduce shading, allow the native grasses to develop and allow other more desirable forbs to develop in the field as well.

Horseweed

Horseweed (often called marestail) is an annual warm-season forb that can explode out of the seedbank and present serious competition to nwsg. Horseweed is resistant to imazapic, therefore it is often a dominant forb in the field. Sparse horseweed is not a problem when the field is managed for wildlife. In fact, the structure presented can be favorable for brooding quail and turkeys. However, dense stands can preclude optimum growth of nwsg, especially in the year of establishment or following disking in established stands. A single mowing in June or July (just above the height of the nwsg seedlings) usually will solve the problem.

When spraying horseweed amongst nwsg, an application of metsulfuron methyl (Cimarron™ or Escort™ at 1/10 ounce per acre) should suppress horseweed sufficiently to allow nwsg to come through and establish. Any ap-

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plication over 1/10 ounce per acre may be injurious to nwsg. If sprayed postemergence, horseweed is best controlled when sprayed early, well before flowering. Dicamba (Banvel™, Clarity™, Overdrive™), sulfosulfuron (OutRider™) and 2,4-D™ can be used to control horseweed, but desirable forbs growing in association with nwsg may be killed. The exception is when horseweed is apparently taking over the stand during the year of establishment. In this situation, most other forbs in the seedbank may be suppressed by the excessive growth of horseweed and relatively little herbicide comes in contact with them. Afterward, a response from other forbs should be evident fairly soon after the horseweed is controlled.

Cool-season annuals and recurring cool-season grasses

Henbit, purple deadnettle, chickweeds and ground ivy are common cool-season annual weeds that often become prevalent after perennial ground cover (such as tall fescue) has been removed or after a warm-season row-crop (such as corn or soybeans) has been harvested. These cool-season weeds are not normally major competitors with nwsg, but can suppress the seedbank and reduce available nutrition to favorable plants, depending on density and growth. In addition, these plants can make dormant-season burning more difficult and can increase smoke management problems.

Henbit, chickweed, purple deadnettle and ground ivy can be controlled with an application of a glyphosate herbicide at two quarts per acre (with surfactant). This application should be made before the plants begin to flower. Other forb-specific herbicides – such as thifensulfuron methyl (Harmony Extra™), 2,4-D™ and dicamba (Banvel™, Clarity™, Overdrive™) – can be used to control these weeds after nwsg have emerged; however, efficacy and control will be reduced because the weeds will have flowered and already produced seed by this time. In this situation, a dormant-season burn is recommended to reduce coverage of cool-season plants and enable better germination of desirable forbs from the seedbank.

Recurring non-native cool-season grasses (such as tall fescue, orchardgrass, bromegrasses) can be a problem beginning the fall after planting nwsg. When not controlled adequately prior to planting, it is common for these grasses to appear once again across a field. The best control method is an application of a glyphosate herbicide at 2 quarts per acre (with surfactant) after the nwsg have gone into dormancy. This is best accomplished by burning the field in September and allowing the residual cool-season grasses to regrow 6 – 10 inches before spraying in late October/early November.

Fig 6.50 Tall fescue was sprayed in this field before planting nwsg. The second fall after planting nwsg, tall fescue germinated from the seedbank in some areas of the field. If not controlled, conditions for wildlife will be compromised as the tall fescue thickens, limiting openness at ground level and suppressing desirable species in the seedbank. Residual tall fescue and other non-native cool-season grasses are easily removed from nwsg by burning in late September, allowing the csg to regrow 6–10 inches (usually by early November), then spraying a glyphosate herbicide.

Woody competitors

Woody encroachment is often a problem when managing fields of nwsg and old-field habitats for wildlife. As discussed under ***Growing-season burning*** on page 105, burning can be very effective at reducing and/or eliminating woody competition, especially smaller stems. However, where burning is not possible, herbicides such as triclopyr (Garlon™ or Remedy™) and imazapyr (Arsenal AC™) are necessary to re-gain control of a field and reduce/eliminate woody cover or limit woody encroachment. Mowing alone is an inadequate method to reduce woody competitors because mowing woody sapling stems simply encourages multiple resprouting.

Depending upon objectives, fields may be broadcast-sprayed, strip-sprayed or spot-sprayed. If all woody growth is to be killed and woody coverage is extensive, a broadcast application may be used. Strip-spraying may be used when some woody growth is desired. This is particularly applicable (only if desirable woody species are present) when managing for bobwhites and a variety of songbirds, especially scrub/shrub species, such as prairie warblers, yellow-breasted chats, indigo buntings, blue grosbeaks, chipping sparrows and loggerhead shrikes. Spot-spraying is most often used when woody coverage is not extensive. Spot-spraying also allows removal of individual unwanted species (such as sweetgum, ashes, elms), while desirable species (such as wild plum, hawthorn, black cherry, persimmon, oaks) may be retained. Sprayers mounted on the back of a 4-wheeler are quite efficient when spraying fields only a few acres in size and when woody growth is less than 3 feet high. Otherwise, a tractor-mounted or pull-behind sprayer is recommended for larger fields and taller growth.

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Fig 6.51 Unless woody competition is severe, spot-spraying using a spray gun attached to a tractor-mounted sprayer is an excellent way to control problem species, such as winged elm.

Several herbicides are available that will control woody competitors. Herbicide selection should be based on the amount of woody cover present and landowner objectives. If the goal is to reduce woody cover and retain nwsg, landowners should consider an herbicide that does not harm the grasses, such as triclopyr (Garlon 4™). Triclopyr will, however, kill a variety of forbs, including legumes. If additional forb growth is a primary objective, imazapyr (Arsenal AC™) should be considered. Nonetheless, if woody competition is not extensive, a broadcast application is not necessary.

If the field is completely covered in woody growth, a broadcast application is warranted and a mixture of herbicides may be required to ensure control. Herbicide labels should be referenced for a list of species controlled. For example, black locust, honey locust, redbud and winged elm are not controlled by imazapyr, but are controlled by triclopyr and metsulfuron methyl. On the other hand, yellow poplar, sourwood, sweetgum, red maple, hickories and Chinese privet may not be controlled with triclopyr or metsulfuron methyl, but are controlled with imazapyr. For broadcast applications, a mixture of 16 ounces of Arsenal AC™ and 16 – 48 ounces of Forestry Garlon 4™ (OR a mixture of 16 ounces of Arsenal AC™ and 2 ounces of Escort™), along with one quart of MSO per acre or 0.25 percent NIS is recommended to control most woody species. When spot-spraying foliage with a backpack sprayer, 4 ounces of Arsenal AC™ and 16 ounces of Roundup™ per 4 gallons of solution works well. One percent solution of MSO or 0.25 percent NIS should be added to the herbicide mixture.

Mowing and haying

The least-preferred method of managing fields of nwsg and associated old-field habitats is mowing (bushhogging). While mowing does set back succession, it leaves a tremendous amount of debris at ground level, which limits mobility of bobwhites and other birds and suppresses the seedbank. Over time, thatch increases, bare-ground space is eliminated and seed, soft mast production and availability may be reduced significantly. Haying, which removes debris from the field, is preferred over bushhogging. The timing of haying, however, is a real concern as nesting and brood-rearing cover is removed when it is needed most (May through July). Where nwsg are hayed for livestock and there is interest in wildlife, the field should be cut only once per growing season (see ***Maximizing forage production and wildlife habitat*** on page 51).

If a field cannot be burned or disked, and mowing is the only option, it should be done in late winter. At this time, there is much less impact on wildlife, especially if completed just before spring green-up so winter cover is eliminated for only a short time. In addition, mowing is much easier at this time as there is considerably less biomass in the field, conditions are much more comfortable and there is no worry of stirring up yellowjackets! As with prescribed fire and disking, mowing also should be completed on a rotational schedule. It is important that all available habitat is not cleared during one year. Blocks may be set aside in a 2- or 3-year rotation, providing cover for brooding, nesting and escape all in the same field or general area. Problematic woody succession should be controlled by spot-spraying specific herbicides.

Fig 6.52 Fields should not be managed by mowing. Mowing increases the thatch layer, inhibits mobility, reduces availability of seeds and invertebrates and limits germination from the seedbank. Further, when completed during the growing season, mowing destroys reproductive cover along with the nests, nestlings and young wildlife within.

Fig 6.53 In fields where forb coverage is extensive and additional grass coverage is desired, mowing strips during mid-summer can help increase grass density for nesting structure and fine fuel to facilitate burning. This field was completely dominated with goldenrod, dewberry and several other asters. A few strips were mowed in the field in late July to stimulate broomsedge bluestem.

Benefits of mowing

Mowing can be effective in reducing weed competition during the year of establishment for nwsg, especially when herbicide applications are not possible. Several species that are difficult to control during the year of establishment can be effectively "knocked back" by mowing before the competition flowers. This is especially true with annual forbs (such as horseweed and cocklebur) where pure stands of nwsg are being established for haying/grazing and/or where herbicide options are limited. Unwanted vegetation should be mowed to a height of approximately 12 inches and repeated as necessary.

Fig 6.54 Strips also can be mowed in fall to provide sight lanes to facilitate rabbit hunting. However, mowing in the fall can stimulate cool-season grasses, such as tall fescue. Residual cool-season grasses can easily be sprayed and killed in mowed strips; nonetheless, this once again highlights the importance of eradicating non-desirable plants before planting.

When managing old-field habitats, mowing can be used to increase grass cover where the field is completely dominated by forbs. Not only is some grass cover desirable for nesting, but it is also needed to help carry a fire. Fields containing little or no grass can be difficult to burn unless there is considerable wind, which can make burning more dangerous. Mowing strips in the field during mid-summer will reduce forb density and increase grass density if grass is present in the seedbank.

Final thoughts on management

Managing nwsg for livestock forage is much easier than managing for wildlife habitat. Cutting and grazing at the proper time and height combined with the proper soil amendments and a weed control strategy (which usually means spraying all forbs with a forb-selective herbicide) is all that's necessary. Managing early-succession habitat for wildlife is much more involved. Attention must be given to species composition and the structure of cover available. Woody cover is an important component, but it adds another dimension in the correct use of fire, disking and/or herbicide applications. Timing of management is critical to influence plant species composition. Arranging successional stages to juxtapose various cover types and food resources is most important if the goal is maximizing carrying capacity and minimizing home ranges and associated movements of wildlife.

Unfortunately, many landowners and wildlife managers have thought that by simply planting nwsg that they have created desirable wildlife habitat and that they don't have to worry with it anymore. How untrue! With few exceptions, managing wildlife habitat means managing succession. Succession marches forward. Desirable early-succession habitat is short-lived; it passes by in just a few years. **Managing wildlife habitat must not be thought of as a one-time event, but a way of life!**