12-1-2004

PB1746 A Landowner's Guide to Native Warm-Season Grasses in the Mid-South

The University of Tennessee Agricultural Extension Service

UT Extension
PB 1746

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THE UNIVERSITY of TENNESSEE

Contents

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Native warm-season grasses (nwsg) are grasses historically native to an area that grow during the warm months of the year and are dormant during autumn and winter. They differ from cool-season grasses, which make their active growth during spring and fall. There are many warm-season grasses native to the Mid-South region; however, seven species are most commonly promoted as cover for wildlife and/or forage for livestock. These are big bluestem, little bluestem, broomsedge bluestem, indiangrass, switchgrass, sideoats grama and eastern gamagrass. Not all of these, however, have the same quality for wildlife habitat or livestock forage. For example, broomsedge offers excellent nesting habitat for bobwhites, but poor forage for livestock.

IDENTIFICATION AND DESCRIPTION

Big bluestem may reach 8–9 feet, depending on cultivar and site conditions. One of the best features used to identify this grass before flowering is the presence of fine silky hairs dispersed near the base of the upper leaf surface. The seedhead has three racemes that resemble a turkey's foot. Seed are relatively dark and hairy. Big bluestem grows on a wide variety of soils and is extremely drought-tolerant, with root systems that may grow 12 feet deep. Big bluestem provides excellent wildlife habitat and quality forage for livestock. 'Rountree,' 'Kaw' and 'Oz-70' are cultivars suited for the Mid-South.


Big bluestem


Little bluestem

Little bluestem grows 2–4 feet in height. The stem is flattened at the base and often red or purplish during early growth. Mature plants are reddish-brown. Little bluestem seed also appear hairy. Little bluestem grows on a wide variety of soils and is one of the most attractive grasses in summer and fall. Little bluestem provides quality wildlife habitat and has great potential for landscaping and erosion control on poor, droughty soils. The 'Aldous' cultivar is best suited for the Mid-South.

Broomsedge bluestem grows 2–4 feet in height and is commonly seen throughout the Mid-South. The stem is flattened at the base and smooth. Mature plants are tannish-brown and somewhat resemble little bluestem; however, broomsedge is lighter in color than little bluestem, which usually has a reddish hue. When dormant, broomsedge appears quite orange, while little bluestem is distinctly more reddish-brown. Broomsedge grows on a wide variety of soils and is renowned for growing in fields low in fertility. Broomsedge provides quality nesting habitat for many birds, but its forage quality is low.

Broomsedge bluestem

Indiangrass is typically 4–7 feet in height. Leaves are flat and narrow at the base, growing 10–24 inches long. The seedhead is golden bronze-to-yellow, 6–12 inches long, and usually formed in late August. The seed are tan and very fluffy. Indiangrass produces a deep root system and is quite drought-tolerant. Indiangrass provides quality wildlife habitat and quality forage for livestock. ‘Newberry,’ ‘Osage’ and ‘Rumsey’ are cultivars best-suited for the Mid-South.

Indiangrass

Switchgrass typically reaches 3–6 feet in height. Switchgrass is an early-maturing warm-season grass, flowering in early to mid-June. Switchgrass is adapted to a wide variety of soils and site conditions. With an extensive root system, switchgrass is extremely drought-tolerant, but also does well on relatively wet sites with at least one cultivar (‘Kanlow’) tolerant of extended flooding. Seed from switchgrass are small, smooth and hard, somewhat resembling millet in size and color. There are many cultivars of switchgrass. In the Mid-South, ‘Kanlow’ (uplands and lowlands) and ‘Cave-in-Rock’ (uplands) are well-suited for wildlife cover and livestock forage. ‘Durham’ and ‘Blackwell’ are well-suited for wildlife habitat.

Switchgrass

Sideoats grama grows to a height of 1–3 feet. Seedstalks begin to appear in June and July. The oat-like seeds hang down uniformly along one side of the slender rachis, thus the name “sideoats.” Leaf blades are fine and have single hairs evenly spaced along the edges of the blade. Sideoats grama grows well on well-drained uplands and shallow ridges, but is not well-adapted to lowlands. ‘El Reno’ and ‘Trailway’ are cultivars best-suited for the Mid-South.

Sideoats grama

Eastern gamagrass may reach 6–8 feet in height, producing conspicuous stools up to 4 feet in diameter. Over time, stool size increases with age and the center will lack stems and leaves. Eastern gamagrass will grow to 5–9 feet tall. The seedhead is comprised of two or three terminal spikes 6–10 inches long. Seed somewhat resemble corn kernels. It is highly recommended to use cold-stratified seed when planting to maximize germination. Eastern gamagrass is extremely deep-rooted and drought-tolerant. It grows best on relatively moist, well-drained fertile soils, but does not tolerate standing water for long periods. 'Highlander,' 'Pete' and 'Iuka' are cultivars well-suited for the Mid-South.

Eastern gamagrass

Other nwsg found in the Mid-South include splitbeard bluestem, Elliot's bluestem, bushy bluestem, purpletop, giant cane, beaked panicum, Scribner's panicum, Florida paspalum, silver plumegrass, knotroot bristlegrass and lovegrass. Their value to wildlife varies, but their value as forage is minimal.

USING NATIVE WARM-SEASON GRASSES FOR WILDLIFE HABITAT

Native grasslands are the most endangered ecosystem in the Mid-South. Historically, the region contained vast acreages of native grassland and savannas with scattered trees and shrub cover, which was maintained by fire. Today, that acreage has been replaced with non-native grasses (e.g., tall fescue, orchardgrass and bermudagrass), agricultural crops, forest cover and suburban development. As a result, several wildlife species dependent upon quality early successional habitat have experienced significant declines in population.

Historically, mixed grassland savannas were prevalent across the Mid-South. This scene in southeast Tennessee was a high-graded oak-hickory stand through most of the 20th century until it was cleared of all but a few select trees. After timber removal, the area has been maintained with fire. Note the big and little bluestem – they were **not** planted, but arose naturally from the seedbank, remaining viable after at least 80 years. In addition, this site has never been sprayed. When invasive, non-native species (e.g., tall fescue, crabgrass, johnsongrass, bermudagrass) are not present, native plants can colonize an area easily and herbicide applications are often not necessary.

Nwsg can be used to enhance early successional cover for species such as bobwhite quail, cottontail rabbit, field sparrow, Henslow's sparrow, grasshopper sparrow, indigo bunting, prairie warbler, dickcissel, eastern meadowlark, loggerhead shrike, American kestrel, northern harrier and others. Fields of nwsg and associated forbs (broadleaf herbaceous plants) are also used by wild turkeys for nesting and brood rearing and by white-tailed deer for bedding and escape cover. **Nwsg are established for wildlife primarily because of the structure of cover provided**. Suitable cover is more often a limiting factor for species such as quail, rabbits and grassland songbirds than food. Nwsg are not planted as food plots.

Importance of open structure

Because most nwsg grow in "bunches," open space at ground level can be provided when bunches are not too dense. An open structure at ground level allows mobility for small wildlife (e.g., quail, rabbits, sparrows and young turkeys) through the field. Dense vegetation and thatch build-up (such as that presented by perennial cool-season grasses) inhibits movement and makes finding food (seed and invertebrates) difficult. When these conditions prevail, the number of animals an area can support is reduced, leading to stagnant or declining populations.

Sparse stands of nwsg with an open structure at ground level are obviously attractive for brood rearing, but they are also used for nesting – one bunch of nwsg represents a potential nesting site – if the field has not been burned or disced in the past year. Birds and rabbits use senescent (dead) leaves of previous years' growth to construct and line nests. An attractive characteristic of nwsg is that senescent leaves and stems remain erect into the following growing season. This reduces thatch build-up, provides protective cover through winter and allows birds, such as Henslow's and field sparrows, dickcissels and indigo buntings, to nest above ground amongst the senescent stems the following spring.

Although moderately dense stands of nwsg may not be as attractive for brooding, they are used for nesting and escape cover. Obviously, these stands may have more potential as nesting sites than sparse stands, but they also offer more protective cover, especially during winter. Extremely dense stands, however, inhibit movement of some small animals and become less attractive. At this point, management is needed to thin the stand.

This is what a field planted for wildlife should look like in early June. Sparse nwsg, abundant forbs (ragweed, partridge pea) and open ground space provide the optimum structure for brooding and a seed source for fall and winter.

Bobwhite quail nest situated at the base of a 2-year-old bunch of broomsedge. Note how the senescent leaves from last year are used to construct the nest.

Importance of forbs and shrubs

An open structure at ground level also enables the seedbank (seed in the top few inches of soil) to germinate. Arising from the seedbank are plants such as ragweed, blackberry, partridge pea, beggar's-lice, pokeweed, native lespedezas and annual sunflowers. Forb cover is critical in making a field of nwsg most attractive to wildlife. These plants provide an excellent canopy of brood-rearing cover for quail and wild turkeys; quality forage for deer, rabbits and groundhogs; and later produce seed and soft mast that is an important source of energy through summer and into fall and winter for many wildlife species. Scattered brush and small trees also can make a field of nwsg and associated forbs more attractive to wildlife, particularly bobwhites and several spe-

Forbs (e.g., blackberries, partridge pea and ragweed) provide excellent brooding cover and a source of seed for bobwhites and other species.

cies of songbirds. Bobwhites often use brushy cover as a "covey headquarters" during fall and winter. Indigo buntings, dickcissels, yellow-breasted chats, cardinals, prairie warblers, white-eyed vireos, eastern kingbirds, loggerhead shrikes and others use scattered clumps of shrubs and small trees for perching and nesting. Many of these shrubs and small trees also offer a valuable food source for many birds and mammals. Examples include American crabapple, wild plum, hawthorn, sumac, wild cherry, persimmon, elderberry, hazelnut, witch-hazel, dogwoods, Carolina buckthorn, viburnums and devil's walkingstick.

Winter cover

Nwsg provide quality cover during winter if the grasses are not previously bushhogged or otherwise destroyed. Fields of nwsg are often magnets for rabbits, over-wintering songbirds and deer. This can be especially critical for small wildlife at a time when quality cover is at a premium. Tall nwsg, such as big bluestem, indiangrass and switchgrass, are especially valuable as their stems "lodge" (remain somewhat upright, leaning against each other), continuing to provide cover even after winter rains, snow and wind. Deer seek out nwsg fields on cold, clear days because they can remain hidden in the tall grasses, yet are able to absorb the sun's warm rays. In low-lying bottomlands that periodically flood in winter, fields of switchgrass (especially the Kanlow variety) can attract large numbers of ducks when shallowly flooded.

Taller nwsg species (e.g., big bluestem, indiangrass and switchgrass) provide excellent cover in winter because their stems "lodge," creating usable space for wildlife. Here, a rabbit finds a winter home. This type of structure is not available in cool-season grass fields.

PROBLEMS ASSOCIATED WITH TALL FESCUE AND OTHER PERENNIAL COOL-SEASON GRASSES

There are many problems associated with tall fescue and other perennial cool-season grasses, both for wildlife and livestock. Problems for livestock are associated with an endophyte fungus found within tall fescue that is highly toxic. Cattle consuming tall fescue (either grazing or as hay) often experience poor weight gains, reduced conception rates, intolerance to heat, failure to shed the winter hair coat, elevated body temperature and loss of hooves. Problems with horses are more severe, especially 60–90 days prior to foaling. Fescue toxicity in horses often leads to abortion, prolonged gestation, difficulty with birthing, thick placenta, foal deaths, retained placentas, reduced (or no) milk production and death of mares during foaling. As a forage, tall fescue and other perennial grasses (e.g., orchardgrass) are

Fields of tall fescue are common throughout the Mid-South. This is poor wildlife habitat and, for many species, it might as well be covered in asphalt.

least preferred by white-tailed deer among cool-season forages. Cottontail rabbits had lower weights and smaller litters in tall fescue habitats. When fed a diet of tall fescue seed, bobwhites exhibited cloacal swelling, which ultimately led to increased mortality. Undoubtedly, many of the toxic effects from tall fescue on wildlife that consume the seed or foliage are unknown.

This is the structure presented in a field of tall fescue (and other perennial cool-season grasses) for a quail chick, sparrow, turkey poult or young rabbit 4–5 inches tall. If you were 5 inches tall and had to travel through this, where would you go? To the edge – and that's where small wildlife are forced to go. Tall fescue has displaced more wildlife habitat in the Mid-South than any other practice.

Known problems of tall fescue for wildlife are associated more with the structure created by the growth habit. Other introduced cool-season perennial grasses (e.g., orchardgrass, bromegrasses, timothy and Kentucky bluegrass) also develop sub-optimal growing conditions (dense growth and deep thatch) near ground level, making travel and foraging difficult for many wildlife species (especially ground birds). The dense growth structure and thatch layer not only prevent birds from picking seed up off the ground, but also prevent seeds in the seedbank from germinating. Thus, vegetative diversity and weed seed available as food are drastically reduced. Cool-season grasses also provide poor winter cover for wildlife because of a lack of overhead structure.

Cool-season perennial grasses (especially tall fescue and bromegrass) are very competitive. When grown in association with nwsg, perennial cool-season grasses will, over time, lead to reduced coverage of nwsg and make the field less attractive to wildlife. When grown in association with clovers in a firebreak or forage food plot, tall fescue, orchardgrass and bromegrasses will dominate the site within 18 months, leaving little or no clover available for forage.

MANAGING NATIVE WARM-SEASON GRASS FIELDS FOR WILDLIFE

A field of nwsg is no better than the technique(s) used to manage it. If not managed correctly, nwsg can become rank and unattractive to many wildlife species. Management is needed to set back succession and create the vegetative composition and structure desired. **An open structure at ground level within a nwsg field is determined largely by the density of grass bunches and stand management, especially burning**. If the field is not disturbed periodically by prescribed burning or discing, an open structure at ground level will not be maintained.

Burning

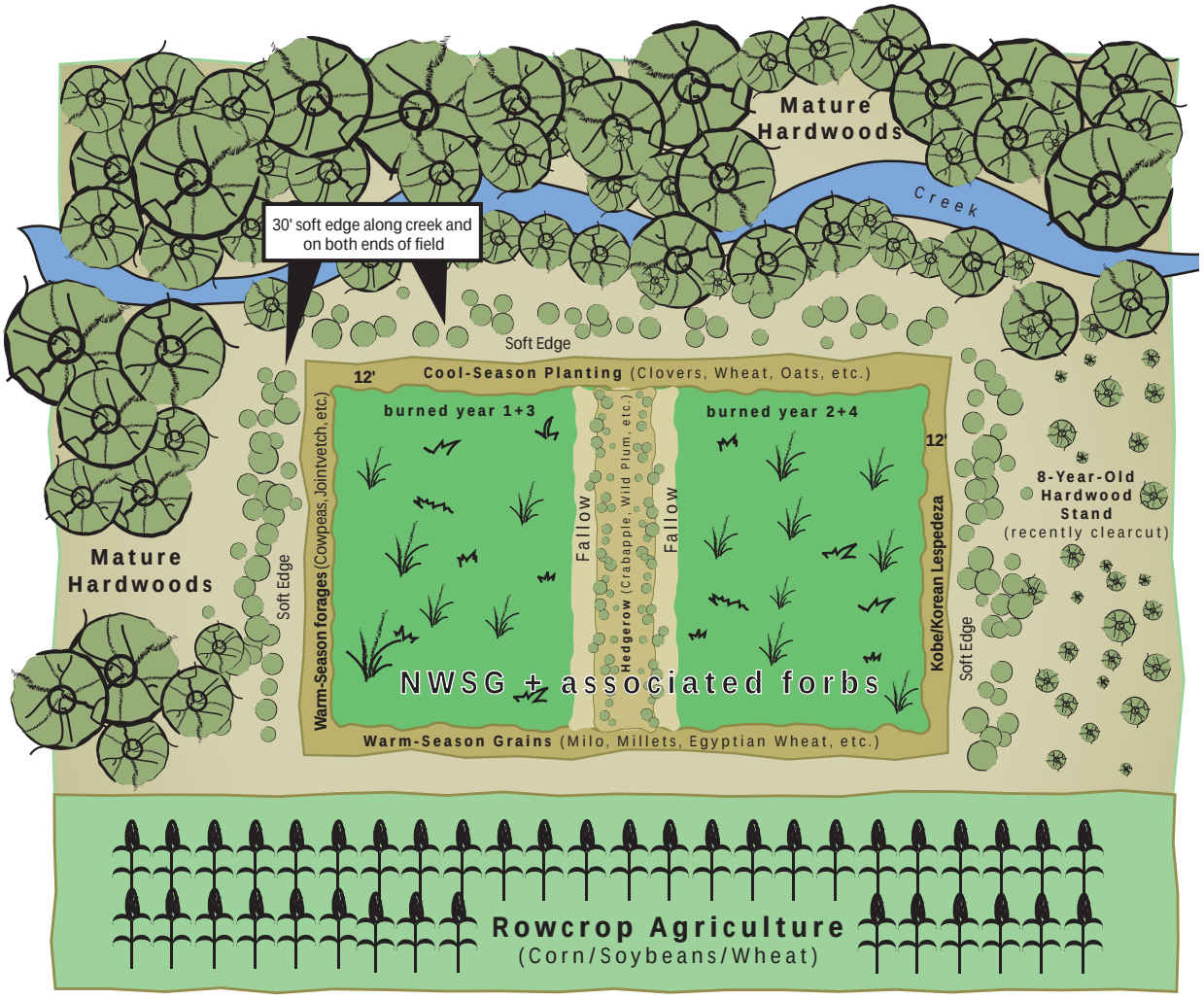
Prescribed fire reduces litter buildup, sets back succession, increases nutrient availability and stimulates herbaceous growth. Fields are most often burned in late winter, just before spring green-up. This reduces winter cover only for a short time and does not disrupt nesting birds and rabbits. If woody succession is a problem, fields can be burned just after bud break to kill woody competition. Prescribed fire in late summer/early fall can be used when nwsg have become too dense and additional forb growth is desired. Burning at this

time also can be used to reduce woody succession, if completed before leaf senescence. Using prescribed fire is efficient, effective, cheap and easy; however, planning and experience are necessary. Burning is controlled and objectives are met only when conducted under the appropriate conditions. State wildlife and forestry agencies and/or local chapters of Quail Unlimited often help landowners who need burning assistance.

Prescribed fire is contained by creating firebreaks (disced strips 10–30 feet wide) around the area to be burned. Firebreaks should be planted for increased food resources around nwsg fields. By planting various mixtures in different sections of the firebreak, a supplemental food source is available year-round. Other sections can be left fallow for weed growth. Examples of mixtures for firebreaks are on page 10. [For additional mixtures and planting information, refer to ***Growing and Managing Successful Wildlife Food Plots in the Mid-South***, UT Extension PB 1743.] Regardless of the mixture used, introduced perennial grasses (e.g., orchardgrass and tall fescue) should never be planted to a firebreak because of reasons stated previously.

Burning is strongly recommended to manage fields of nwsg. This series of pictures shows a nwsg field just before, during, immediately after and the growing season after burning. Burning stimulates growth, recycles nutrients to the soil and creates excellent early successional habitat.

Planting Mixtures for Firebreaks (rates are per acre)	
Cool-season mixture (annual) 25# wheat or oats 20# Austrian winter peas 10# crimson clover 3# arrowleaf clover **Cool-season mixture (perennial)** 25# wheat or oats 6# red clover 5# ladino white clover 2# birdsfoot trefoil	**Warm-season mixture (annual)** 20# soybeans 15# iron-clay cowpeas 10# buckwheat 5# browntop millet 5# grain sorghum (milo) **Warm-season mixture (annual)** 15# Kobe or Korean lespedeza 2# partridge pea



This diagram shows a field of nwsg and how it might be placed in arrangement with other cover types. Note how the firebreak is planted in different sections with various plantings to provide a supplemental food source throughout the year.

Discing

In some areas, it is difficult to burn because of smoke-management issues. Also, many landowners are reluctant to burn because of inexperience. In these situations, nwsg fields should be managed by discing. Discing sets back succession, increases open space at ground level, facilitates litter decomposition and stimulates the seedbank. Discing can be completed in blocks (≥ 1 acre) or strips (≥ 50 feet wide) oriented with the contour of the field (to prevent erosion). Undisced strips should be about twice as wide as disced strips. This allows one-third of the field to be disced each year.

This field is being managed by discing alternate strips in winter. This will provide brooding cover adjacent to nesting cover.

Discing at different times of the year affects vegetation composition, depending on site conditions and the seedbank present. For example, discing in the fall may produce a different suite of forbs than discing in spring. Discing in the fall also creates walking and shooting lanes for hunting quail or rabbits. A good way to determine the preferred time to disc and the seedbank response within individual fields is to disc strips at various times through the year. Disced areas can be interseeded with legumes and other forbs if needed. **Bushhogging (without burning or discing) is not a recommended practice for managing nwsg** because it increases the litter layer, makes travel through the field difficult for small wildlife and inhibits the seedbank from germinating. It is usually necessary, however, to bushhog before discing is possible. Bushhogging along a firebreak prior to burning also may be used to reduce flame heights.

Herbicide applications

Another management practice often necessary is herbicide applications. Strip spraying a grass-selective herbicide (e.g., Select♦) in late April using alternate spray nozzles can decrease grass density, create additional open space at ground level and stimulate the seedbank. Strip spraying should be conducted in patterns similar to those recommended for discing. Spot spraying or broadcast spraying other selective herbicides (see Appendix 1) may be necessary to reduce several problem grasses (e.g., crabgrass, tall fescue) and forbs (e.g., sericea lespedeza, thistles), as well as woody competition (e.g., sweetgum, winged elm). In all cases, herbicide labels should be read before use and followed closely with regard to restrictions, precautions, rates, recommended tank mixtures, surfactants and sprayer-cleaning recommendations.

Managing on rotation

Because structural requirements vary among wildlife species and among seasons, it is not recommended to set back succession on an entire field (depending upon field size) or on all fields (depending upon the number of fields and their proximity on a property) in one year. Instead, fields (or portions of) should be burned or disced on a 2- to 4-year rotation. For example, if brood habitat and forage quality are prime in a field the summer after a winter burn and nesting habitat is prime two or three years after a burn, then it is undesirable to burn all available habitat every year. Escape cover may be best three or four years after burning. Large individual fields can be managed by discing firebreaks and creating smaller sections within the field. Sections then can be managed on rotation. Smaller fields can be burned or disced entirely.

This landowner has gone out of his way to juxtapose different successional stages. Burning in a checkerboard fashion ensures quality brooding cover is adjacent to nesting cover. While burning half the field one year and the other half the following year is fine, burning sections such as this provides a very diverse structure across the field.

MANAGING THE ARRANGEMENT

When a property is managed specifically for wildlife, the most important consideration is matching the habitat types available to the preferred habitat composition and arrangement for the targeted species (see Appendix 2). Arranging cover, food and water in close proximity helps minimize travel and exposure for animals. Size, shape and *placement* of the field in the arrangement should be considered. When managing for bobwhites and other species with small home ranges (e.g., rabbits), all habitats needed to meet various seasonal requirements should be within a 40–50-acre area and, optimally, should be *juxtaposed* in close proximity. While the amount of nwsg acreage needed varies among wildlife species, quality early successional habitat should be well interspersed across the entire property.

Another important consideration is the surrounding properties (i.e., the surrounding landscape), especially for properties or landowner cooperatives less than 1,000 acres. If suitable habitat is lacking on surrounding properties for animals to immigrate to and emigrate from, it is possible the local population may become stagnant or begin to decline. It is also in these situations where predation can become a limiting factor. Predators are fully capable of identifying areas with an abundance of prey. Once located, predation rates can become artificially increased and limit small game populations, even where quality habitat exists.

Using nwsg when wildlife is a secondary objective to farming

Nwsg can be an integral part of a productive, profitable and environmentally sound farm operation. Most producers are interested in conserving natural resources, which includes providing adequate wildlife habitat. Sites not suitable for cropping can be targeted for nwsg establishment. Highly erodible soils, rocky soils, riparian buffers, field corners and other unproductive areas can be managed for wildlife, while dedicating better soils for production agriculture.

Recent research has shown creating field borders around crop fields can increase bobwhite and songbird populations. In fact, even on farms where exhaustive predator removal took place, bobwhite populations remained steady or declined, **unless field borders were established**. Researchers at North Carolina State University showed *predator* control alone did not work, unless *predation* was controlled by providing quality nesting and brood-rearing cover. Wildlife populations weren't the only things to increase – so did farm profits! By taking field borders out of production, lime, fertilizer, fuel, seed and herbicide costs were reduced. This coupled with the fact that borders along wooded areas naturally produce less yield (because of competition for nutrients and sunlight), helped increase crop profit margins.

Establishing nwsg borders (>30 feet wide) can provide excellent nesting, brooding and escape cover around fields. Using this practice alone will help increase local populations of quail and various songbirds.

Planting field borders (>50–120 feet wide) and "odd areas" to nwsg not only provides enhanced cover for wildlife, but also reduces runoff and increases infiltration, which improves water quality by trapping and preventing sediments, fertilizers, animal waste and pesticides from entering creeks and rivers. Interested landowners should contact their county USDA-NRCS office to learn of the many programs that provide cost-share and technical assistance to establish nwsg buffers, hay, pasture and wildlife habitat.

USING NATIVE WARM-SEASON GRASSES FOR LIVESTOCK FORAGE

Nwsg can provide excellent forage for livestock and, when properly managed, can still provide quality nesting and brood-rearing habitat. Nwsg are attractive as a forage crop because nwsg produce the majority of their growth during the summer, when cool-season grasses produce relatively little. Yields of two to five tons per acre of nwsg forage can be expected, depending on rainfall, soil type and other conditions. Crude protein can be as high as 16–17 percent, but normally is 8–12 percent at optimum harvest. Just as with any forage species, nutrient content of nwsg is influenced by plant maturity. As plants mature, percent protein and digestible energy decrease, while fiber content increases. Maximum tonnage and high forage quality do not occur at the same time. From a practical standpoint, all grass hay should be cut just before seedheads begin to emerge, whether warm- or cool-season.

Haying

Delayed harvest and exposure to the environment are major factors influencing hay quality; thus, nwsg have fewer problems in hay production than cool-season grasses because rain is less likely during summer. Once hay is cut, higher temperatures enable faster drying, resulting is less nutrient loss from respiration. Nwsg are similar in available protein and digestible nutrients as cool-season grasses, but the weather provides better haymaking conditions.

Nwsg can provide excellent hay for livestock. Here, Gene Hartman harvests approximately 7,000–8,000 pounds per acre of big bluestem and indiangrass hay. Gene makes sure to cut his hay just before it begins to seed out, ensuring optimum nutrition with the highest yield. One cutting per year allows plenty of grass re-growth before fall, leaving ample cover for wildlife during winter.

Excellent hay can be produced from single-species plantings or mixtures. Switchgrass and eastern gamagrass are often planted in pure stands and cut for the first time in June. Big and little bluestem are often planted with indiangrass and hayed for the first time in early July, which is advantageous to wildlife species nesting in May and June.

Grazing

The advantage of nwsg for grazing is similar to their advantage as a hay crop. During summer, high temperatures and limited rainfall cause cool-season grasses to be relatively unproductive, and pastures can be overgrazed. Overgrazing stresses the pasture even further, resulting in stand loss and increased weed pressure. By converting 25 percent of the pasture acreage to nwsg, animals may be grazed on actively growing forage during the summertime, which can provide higher-quality forage while allowing cool-season grasses to rest. This strategy reduces the need for hay, which can be required to supplement cool-season pasture during mid-summer.

Nwsg can offer excellent grazing opportunities for livestock. Grazing nwsg during summer can produce daily weight gains for cattle of more than 2 pounds. Grazing nwsg also allows cool-season paddocks to rest and minimize overgrazing. Nwsg should not be grazed regularly below 4 or 5 inches.

Cutting and grazing heights

Nutrient reserves can be limiting for nwsg if an adequate stubble height is not maintained or if overgrazing occurs. Nwsg should not be consistently grazed or cut below 4 or 5 inches; otherwise, yield and persistence may be reduced and increased weed problems will occur. If a stubble height of 6 inches is left, more leaf area will be present for rapid re-growth. If cut or grazed after early August, the ability of nwsg to rebuild carbohydrate reserves is limited, which can reduce next year's growth. This can lead to increased weed pressure, es-

pecially winter annuals. A controlled grazing program should be used to prevent overgrazing. Big bluestem, indiangrass, switchgrass and eastern gamagrass should be grazed when they reach approximately 12–18 inches or hayed when they reach 30 inches in height.

Fertilization, burning and weed control

Soil fertility is very important and soil testing is key to knowing lime and fertilizer requirements. Although nwsg are adapted to poor soil fertility, they will respond to lime and fertilizer applications when appropriate (see ***pH and fertilizer recommendations*** on page 17). Burning rejuvenates nwsg and improves forage quality. Burning in late March and early April can help reduce invasion of cool-season grasses while stimulating nwsg growth. When managing pure grass stands, forb-selective herbicides (e.g., 2,4-D, Banvel®, Overdrive®) will help control problem broadleaf weeds. Local Extension offices can provide specific recommendations for herbicide applications. Read and follow all herbicide label recommendations and restrictions.

Maximizing forage production and wildlife habitat

Nwsg are hayed and grazed when many wildlife species are nesting and rearing young. Waiting until after the nesting season to hay or graze will result in poor-quality forage, especially if switchgrass or eastern gamagrass is used. Because big and little bluestem and indiangrass flower later in the growing season (July through early August), they may be most appropriate to use when wildlife is a primary consideration. Including little bluestem in the mixture is especially important for nesting cover.

Another important consideration for wildlife is to cut or graze the stand only once per year. A second cutting can reduce winter cover for wildlife and render the field similar to a field of cool-season grasses. Rotational haying and grazing is another way to improve wildlife habitat in an nwsg forage system. By resting (i.e., excluding livestock and refraining from haying) a different portion of a field every year, additional wildlife habitat is made available.

Top five reasons establishment efforts fail:

1) Planted too deep
   - bluestems, indiangrass, switchgrass and sideoats grama should not be planted any deeper than ¼ inch
2) Inadequate weed control
   - existing sod must be killed prior to planting; post-emergence competition can be limiting factor
3) Planted too late
   - mid-April to early June is the ideal planting window
4) Drill not calibrated and/or PLS not calculated
   - these are absolutely necessary
5) No patience!
   - landowners often have a perfect stand, but just don't realize what it should look like

ESTABLISHING NATIVE WARM-SEASON GRASSES

The benefits of nwsg cannot be realized until establishment is successful. Unfortunately, some landowners' attempts to establish nwsg have failed and it is widely acknowledged that establishing nwsg can be slow, especially if certain steps are not taken. Reasons for inconsistent success vary, but the most common include drilling (or covering) seed too deep (> ¼ inch), inadequate weed control and planting too late in the growing season. Recent equipment innovations and information concerning the use of various herbicides have helped increase the success of establishment efforts.

Competition control

Nwsg do not compete well with non-native grasses (e.g., tall fescue, bermudagrass, crabgrass, johnsongrass), so it is critical to control these competitors (as well as problem broadleaf plants) prior to planting. Most often, a glyphosate herbicide (e.g., Roundup♦, Gly-4 Plus♦) is used to kill existing cover.

Perennial cool-season grasses (e.g., tall fescue and orchardgrass) – spray in the fall prior to planting with a glyphosate herbicide (two quarts per acre).

Roundup♦-only applications in the spring have been less than successful. However, by tank-mixing 2 quarts of Roundup♦ with 8 ounces of Plateau♦ and 2 pints of Methylated Seed Oil (or 22 ounces of Journey♦ with 1 1/2 quarts of Roundup♦), a spring herbicide application can be successful. Before existing sod is sprayed, the field should be burned, hayed, grazed or mowed and allowed to re-grow 6–10 inches. This ensures the herbicide comes in contact with an actively growing plant, not dead thatch from the previous year's growth. After killing cool-season grasses, expect warm-season competitors (e.g., johnsongrass, crabgrass) to emerge from the seedbank.

Herbicide applications are often necessary when establishing nwsg. Existing sod must be sprayed before planting. Pre-emergence applications are usually necessary at planting. Post-emergence applications are often necessary for adequate weed control.

Johnsongrass, crabgrass and broadleaf control – Spray during the growing season prior to planting with a glyphosate herbicide or a grass-selective herbicide. This will help reduce the seedbank, but there will be some residual growth the following growing season. Thus, **a pre-emergence application of an imazapic herbicide, such as Plateau♦ (6–8 ounces per acre) or Journey♦ (16–20 ounces per acre), is strongly recommended when planting bluestems, indiangrass or sideoats grama to provide adequate control for several weeks after planting. When planting switchgrass or eastern gamagrass, a pre-emergence application of OutRider® (2 ounces per acre) should control johnsongrass and many broadleaf competitors**.

Bermudagrass control – Burn the field in late winter and allow bermudagrass to re-grow. Spray bermudagrass as it begins to flower with imazapyr (24 ounces of Arsenal® AC per acre with two pints of Methylated Seed Oil). Research by the Georgia Department of Natural Resources found imazapyr very effective in controlling bermudagrass; however, it is virtually impossible to eliminate bermudagrass entirely with a single spraying. Patience and persistence are required. The field should be checked for bermudagrass re-growth through the *following* growing season after the initial treatment and spot-sprayed as necessary. The next growing season (two years after initial treatment), the field should be ready to plant nwsg.

Mechanical control – Another practice is to mow non-desirable broadleaf weeds before they flower and seed. Shading limits growth of nwsg considerably and prolonged shading can kill them. The mower (or bushhog) should be set relatively high so nwsg are not clipped any more than necessary. Mowing weeds is less successful than herbicide applications, but nwsg (including switchgrass and eastern gamagrass) will often out-compete non-desirable plants during the second growing season.

Seedbed preparation

Once the competition has been controlled, the seedbed should be prepared before planting. If the seed is to be drilled, a firm and "clean" seedbed, free of deep thatch and other material, is desired. This is best accomplished by burning. If the dead material on the field is sparse and only a few inches high, no preparation may be necessary. If the seed is to be topsown, the seedbed should be prepared by conventional tillage techniques. If the soil needs amending, it is best to do so before plowing/discing to ensure the lime and fertilizer are well-incorporated.

pH and fertilizer recommendations

Although nwsg are adapted to nutrient-deficient soils low in pH, soil fertility is important and soil testing is recommended to determine pH and nutrient availability. This is particularly important when growing nwsg for livestock forage. For optimum growth on pasture or hayfields, pH should be raised to 6.0–6.5, P and K brought to medium or high levels (31–120 and 161–320 pounds available per acre, respectively) and up to 60 pounds of N should be applied in April/May and after cutting hay or after removing livestock from the paddock. An application of N at planting is not necessary (when growing nwsg for wildlife) or recommended (when growing nwsg for livestock forage) because of weed competition. However, if bluestems and/or indiangrass are planted and an imazapic herbicide is applied pre-emergence, 15–30 pounds of N per acre may be added once the grasses are 4–6 inches high if adequate moisture is available. When planting pure stands of switchgrass or eastern gamagrass, N should not be applied until the stand is established and weeds controlled. When planting nwsg solely for wildlife, lime and fertilizer are not normally needed unless pH is below 5.0.

Seed quality and estimating PLS

Buying quality seed is an important consideration when establishing nwsg. Seed purity commonly runs 50–70 percent because of an inordinate amount of inert material (stems, leaves and other debris) and the germination rate may be only 50–60 percent. Therefore, it is critical to plant according to percentage of pure live seed (PLS), which is determined from information on the seed tag.

PLS is calculated as follows:

Seed: Indiangrass (Osage)

Pure seed: 67.62%	Germination: 64.00%
Other crop: 0.05%	Firm/Dormant: 22.00%
Weed Seed: 0.42%	Total Germination: 86.00%
Inert: 26.23%	Noxious Weeds: NONE
Origin: MISSOURI	Test date: 28 December 2003

[67.62% (pure seed) □ 86.00% (total germination)] √ 100 = 58.15% PLS. To plant 6 lbs. PLS per acre: [6 lbs (desired rate) √ 58.15 (PLS)] □ 100 = 10.32. Therefore, approximately 10 lbs of bulk material from the seed bag should be planted.

Seed dormancy

Switchgrass and eastern gamagrass tend to have a high dormancy rate. Germination can be improved by treating the seed. Switchgrass seed can be wet-chilled by soaking it in a mesh sack overnight and allowing it to drip-dry the following morning. The seed then should be stored in a cool location (e.g., a cellar or walk-in cooler set at approximately 40–45^0 F) for at least two weeks. For best germination, remove seed from chill treatment and allow to air dry with a fan blowing over the seed until seed flows freely. Plant immediately. Eastern gamagrass requires a six-week chilling process. The best option for planting eastern gamagrass is to buy cold-stratified seed direct from a seed dealer and plant immediately upon receiving shipment.

Planting date and methods

Nwsg should be planted mid-April through early June. Later plantings can be successful, but germination and growth may be reduced, as rain is less dependable in June and July. Seed may be top-sown or drilled, but **should not be planted any deeper than ¼ inch**. In fact, when drilled, at least one-third of the seed should be obvious on top of the planting furrow. The exception to this rule is eastern gamagrass, which should be planted approximately 1 inch deep. Drilling is usually the preferred method for planting nwsg (especially larger fields). As mentioned under ***Competition control*** on page 15, **a pre-emergence herbicide application at planting is strongly recommended** to ensure adequate weed control.

Planting with a no-till drill designed for nwsg seed is highly recommended. Do not drill seed any deeper than ¼ inch! In fact, as much as 30 percent of the seed should be obvious on top of the planting furrow.

Drilling – For even grass distribution and a continuous, solid stand, nwsg planted for haying or grazing should be planted with a drill. When drilling bluestems or indiangrass, a drill with a specialized seed box containing "picker wheels" is necessary or the fluffy seed of these grasses lodge in the seed chute. These drills often are available for use through state wildlife agencies, soil conservation districts, the Natural Resources Conservation Service and some local chapters of Quail Unlimited. Switchgrass can be planted with a conventional drill. Any drill, however, must be calibrated before planting. Eastern gamagrass is usually planted with a corn planter in rows 18–24 inches apart, but some producersß like to plant rows only 12 inches apart to reduce stool size and make stems more upright so haying is easier.

Broadcasting – Nwsg fields intended for wildlife habitat can be established successfully by broadcast seeding. When planting bluestems and indiangrass, a broadcast seeder with picker wheels (similar to those found in drills designed for fluffy seed) is helpful; otherwise, some type of carrier (pelletized lime, fertilizer, cracked corn, cottonseed hulls) is needed to distribute the seed. Prior to broadcasting, it is **critical** to thoroughly prepare the seedbed and cultipack after seeding to ensure firm seed-to-soil contact and improve germination rate.

Seeding rates and mixtures

Seeding rates depend upon landowner objectives. If sown for wildlife, a sparse stand of grasses with abundant forbs and adequate bare ground is desired. If sown for hay or pasture, a denser stand without forbs and less bare ground is desired. Thus, a relatively light seeding rate (4–6 pounds PLS per acre) is recommended when establishing nwsg for wildlife and a heavier seeding rate (8–12 pounds PLS) is recommended when establishing hayfields or pasture.

Tall mixtures provide cover for ground-nesting birds, as well as those that nest above-ground (e.g., dickcissel, field sparrow, Henslow's sparrow and red-winged blackbird). Tall mixtures also provide excellent cover for brood rearing and escaping predators. In addition, sufficient structure is present in tall nwsg fields for deer to bed during the day and excellent cover is available through winter for many wildlife species. Short mixtures provide quality nesting cover for ground-nesting birds and can provide attractive brood-rearing cover. Selected forbs should be added to wildlife mixtures to enhance brood habitat, invertebrate availability, seed production, forage and/or aesthetic value. Planted forbs are intended to complement the forb community that should arise naturally from the seedbank. Forbs most often added to nwsg mixtures include partridge pea, Illinois bundleflower, roundhead lespedeza, perennial sunflowers, purple prairieclover, purple coneflower, black-eyed susan, blazing star and lance-leaved coreopsis.

Tall mixtures of nwsg usually include some combination of big bluestem, indiangrass and switchgrass. These stands can provide excellent cover for nesting, brooding and foraging, as well as winter and escape cover.

Seeding mixture (lbs PLS per acre)	**Objectives & Considerations**
Wildlife – tall grass mixture 1.5 lbs big bluestem 1.5 lbs indiangrass 1.0 lb little bluestem 0.5 lb switchgrass 1.0 lb native forbs	Nesting cover Brooding cover Winter cover
Wildlife – short grass mixture 3.0 lbs little bluestem 1.0 lb sideoats grama 0.5 lb indiangrass 1.0 lb native forbs	Nesting cover Brooding cover
Forage – 3.5 lbs big bluestem 3.5 lbs indiangrass 3.0 lbs little bluestem	Hayed after primary nesting season Imazapic can be used for competition control
Forage – 8–10 lbs switchgrass	Wet-chill seed before planting Seed with conventional equipment
Forage – 10–12 lbs eastern gamagrass	Buy cold-stratified seed Plant with corn planter with rows 12–24 inches apart

Species and mixtures for livestock forage are generally determined by preference and potential problems with competitive weeds. For example, pure stands of switchgrass or eastern gamagrass can provide excellent forage for livestock. However, if crabgrass and/or johnsongrass are prevalent, a mixture of big and little bluestem and indiangrass might be a better choice, because an imazapic herbicide can be used to help ensure successful establishment.

Short mixtures of nwsg usually are dominated by little bluestem, broomsedge and/or sideoats grama. These stands can provide excellent cover for nesting, brooding and foraging.

Evaluating success – what to expect

Nwsg develop relatively slowly during the year of establishment. Most of the first-year plant growth is root development. Leaf and stem growth may not reach more than 2 feet high by the end of the first growing season. Typically, it is not until the second growing season that most nwsg develop considerable aboveground biomass, flower and produce seed. However, if the correct planting procedures are followed and soil moisture is not limiting, excellent growth will occur during the year of establishment, with considerable aboveground biomass and extensive flowering.

This is what you are looking for! This is a big bluestem seedling with its characteristic "fountain" appearance. Note the bare ground and lack of weeds germinating around the seedling. This is what should be expected from a properly applied pre-emergence herbicide.

Nwsg planted for wildlife **should be very sparse** during the year of establishment. Remember, bare ground space between bunches is desirable! "Weeds" may be numerous and should be expected. Many, hopefully most, of the "weeds" will be desirable forbs (as described earlier). Landowners planting nwsg should not expect the field to look like a field planted to cool-season grasses. Patience is necessary!

This field was planted in May 2000. By July, most people would consider this effort a failure. However, this rate of development is not unusual, especially with little rainfall in soil that has not been amended with lime and fertilizer. Remember, the structure will become more dense in the second year and bare ground space is desired!

Even with little rain and low nutrient availability, this amount of growth should be expected by the end of the first growing season (with proper weed control).

By the second growing season, excellent cover for wildlife was available and quail were found in the field regularly.

With adequate rainfall and nutrient availability, this amount of growth can be expected by the end of the first growing season.

CONCLUSION

Nwsg can provide excellent wildlife habitat. Converting perennial cool-season grass acreage to nwsg and establishing field borders around crop fields will help increase wildlife populations dependent upon early successional habitats. Nwsg also can produce high-quality forage for livestock. For producers interested in wildlife, nwsg are a much better alternative than non-native, warm-season grasses, such as bermudagrass, sorghum-sudan and the Old World bluestems.

Establishing and managing nwsg is quite different from cool-season grasses. However, **landowners should not be skeptical**. The advantages for wildlife and the quality of forage produced have been proven time and again throughout the Mid-South and in other regions as well. Technical assistance is as close as the county NRCS or Extension office. Advice and assistance is also available through state wildlife resources agencies. For comprehensive and detailed information on establishing and managing nwsg, ask for a copy of ***Native Warm-Season Grasses: Identification, Establishment and Management for Wildlife and Forage Production in the Mid-South***, available through UT Extension.

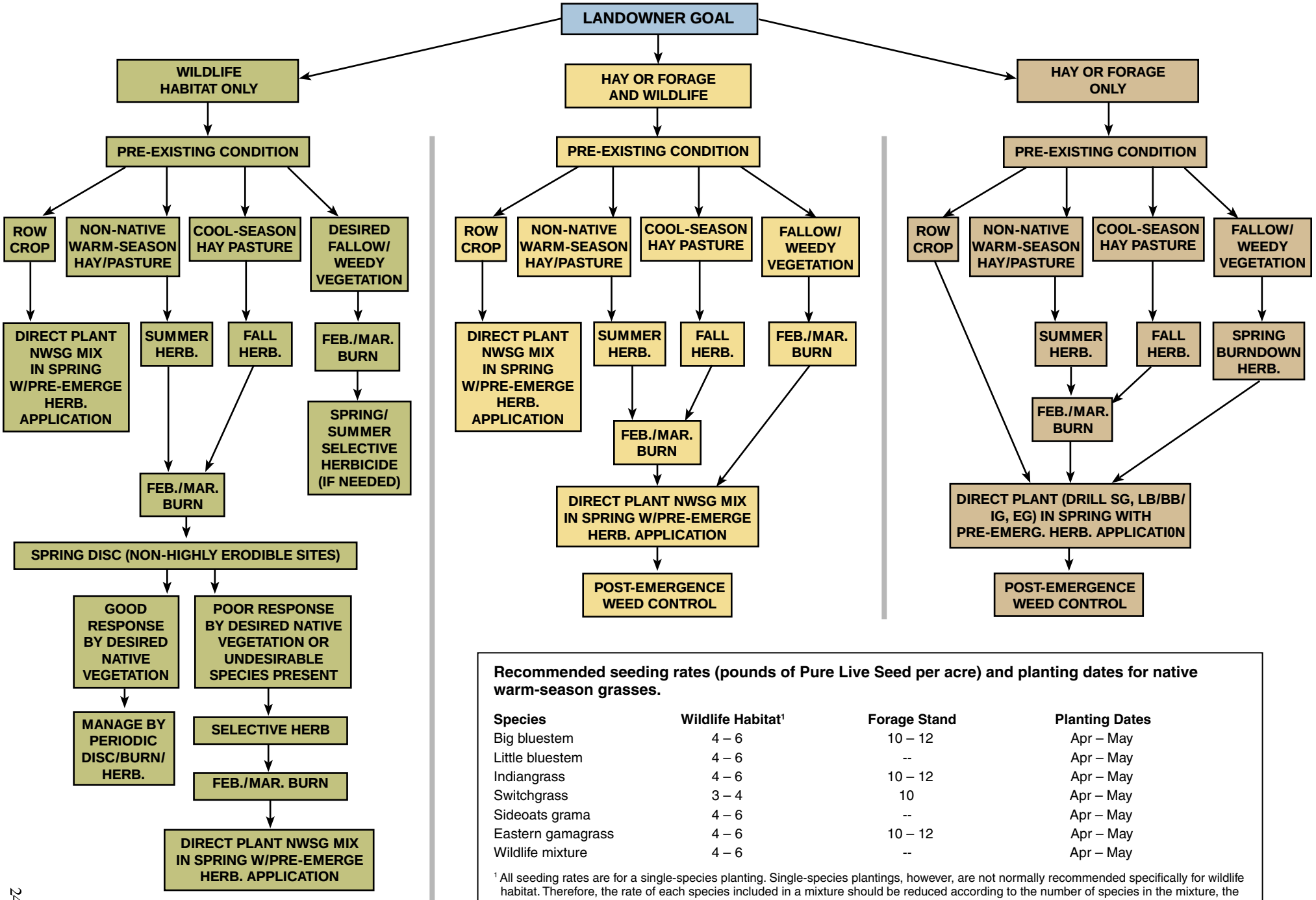
Appendix 1. Herbicide use guide for common native warm-season grass applications.

Herbicide	Use	Application Rate	Objectives/Considerations
Glyphosate (Roundup, Accord, Gly-4, others)	Eradicating tall fescue and other existing cover prior to nwsg establishment, or while nwsg are dormaant.	Fall – 1.5-2.0 qts/ac Spring – 2.0 qts/ac	Broad spectrum herbicide, not selective. Post-emergence only – no soil activity or residual control.
	Controlling woody saplings, sericea lespedeza, thistles, bermudagrass, dallisgrass, yellow nutsedge	2.5 – 4.0 qts/ac	Additional applications may be necessary. Better control may be realized by tank mixing with other herbicides.
Imazapic (Plateau)	Pre-emergence weed control when planting bluestems, indiangrass and sideoats grama.	6 – 8 oz/ac	Residual weed control for approximately 60 days. Contact state wildlife agency if unavailable through private distributor. Check label for tolerance of specific nwsg and select forbs.
	Eradicating tall fescue and other select cover to allow the seedbank to respond.	12 oz/ac	
	Post-emergence weed control of johnsongrass, crabgrass, cocklebur and others in established nwsg.	6-8 oz/ac	
Imazapic + Glyphosate (Journey)	Pre-emergence weed control when planting bluestems, indiangrass and sideoats grama. Also for eradicating tall fescue and other existing cover prior to nwsg establishment, or while nwsg are dormant.	11 – 32 oz/ac	May damage nwsg and forbs if applied after greenup. Residual weed control for approximately 60 days. Additional glyphosate is necessary to effectively kill tall fescue when using lower rates of Journey.
	Post-emergence weed control of johnsongrass, crabgrass, cocklebur and others in established nwsg.	11 oz/ac	
2,4-D	Controlling unwanted broadleaf plants, such as thistles & cocklebur.	1 – 4 pts/ac Post-emergence application	Will also kill desired legumes and other broadleaf plants. May damage nwsg seedlings.
Dicamba (Banvel, Clarity)	Controlling unwanted broadleaf plants and woody species.	2 – 4 pts/ac Pre- or post-emergence application	Will also kill desired legumes and other broadleaf plants.
Sulfosulfuron (OutRider)	Pre- and post-emergence control of johnsongrass and other weeds in nwsg (including switchgrass).	0.75 – 2.0 oz/ac Pre- or post-emergence application	Groundwater may be contaminated when used in areas where soils are permeable or shallow water table.
Triclopyr (Garlon 3A)	Controlling sericea lespedeza and other broadleaf plants in established nwsg.	1.0 qt/ac Post-emergence application	Apply in early summer when sericea is in early vegetative stage. Does not damage nwsg, but kills most broadleaf plants. Refer to label for rates to control other species.
	Controlling woody saplings	1 – 5 gal/ac; see label for various applications	High-volume and low-volume treatments require different rates.
Metsulfuron methyl (Escort, Cimarron)	Control of sericea lespedeza, bicolor lespedeza and other broadleaf plants.	0.1 – 2.0 oz/ac Post-emergence application	For sericea control, apply in bloom stage (August – September). Fall application may provide spring residual control. Does not affect grasses.
Imazapyr (Arsenal)	Control of woody saplings. Sometimes best accomplished with tank mixes of other herbicides.	See label for selected woody plants, application rates & mixes	Use as spot treatment where tree or shrub seedlings are invading.
Sethoxydim (Poast Plus)	Controlling undesirable cool-season grasses before nwsg emerge in spring. Reducing nwsg coverage when growth becomes too dense.	2 pts/ac Post-emergence application	When reducing nwsg density, use only every third spray nozzle (i.e., 1 open/2 closed).
Clethodim (Select)	Controlling undesirable cool-season grasses before nwsg emerge in spring. Reducing nwsg coverage when growth becomes too dense.	10 oz/ac Post-emergence application	When reducing nwsg density, use only every third spray nozzle (i.e., 1 open/2 closed).
Imazethapyr (Pursuit)	Controlling undesirable grass and broadleaf plants, including yellow nutsedge.	1 – 2 oz/ac Pre- or post-emergence application	Will not control legumes; thus, Pursuit can be sprayed over desirable legumes to control non-leguminous forbs.

Appendix 2. Major habitat types and arrangement preferred by selected wildlife.

Primary species managed	Percent nwsg and associated forbs	Arrangement of nwsg	Percent cool-season legumes and annual grains	Percent row cropland	Percent mast-producing hardwoods	Percent brushy cover (incl. 0–3-year-old hardwood and pine stands)
Bobwhite quail	20 – 80	Blocks ≥ 2 acres or strips ≥ 50’ wide	2; In firebreaks	5 – 50	5 – 20	20 – 50
Cottontail rabbit	10 – 80	Blocks 1 – 5 acres or strips ≥ 50’ wide	2; In firebreaks or small fields	5 – 50	10 – 40	20 – 50
Wild turkey	10 – 30	Blocks ≥ 2 acres	2 – 5; In firebreaks or fields	5 – 50	30 – 60	10 – 30
White-tailed deer	5 – 30	Blocks ≥ 2 acres	2 – 5; In firebreaks or fields	5 – 50	30 – 60	20 – 40
Grass/shrub songbirds (field sparrow, blue grosbeak, indigo bunting, yellow-breasted chat)	30 – 70	Blocks ≥ 5 acres or strips ≥ 50’	In firebreaks	<10	0	50 – 70
Grassland songbirds (grasshopper sparrow, Henslow’s sparrow, eastern meadowlark, dickcissel)	70 – 100	Blocks or complexes ≥ 100 acres	In firebreaks	<10	0	<20

Appendix 3. Flow chart for landowners planning to plant native warm-season grasses.



Recommended seeding rates (pounds of Pure Live Seed per acre) and planting dates for native warm-season grasses.

Species	Wildlife Habitat[1]	Forage Stand	Planting Dates
Big bluestem	4 – 6	10 – 12	Apr – May
Little bluestem	4 – 6	--	Apr – May
Indiangrass	4 – 6	10 – 12	Apr – May
Switchgrass	3 – 4	10	Apr – May
Sideoats grama	4 – 6	--	Apr – May
Eastern gamagrass	4 – 6	10 – 12	Apr – May
Wildlife mixture	4 – 6	--	Apr – May

[1] All seeding rates are for a single-species planting. Single-species plantings, however, are not normally recommended specifically for wildlife habitat. Therefore, the rate of each species included in a mixture should be reduced according to the number of species in the mixture, the composition preferred and the desired structure of the resulting stand.

Disclaimer: Use of brand or trade names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others, which may be of similar, suitable composition. Always be sure to read, understand and follow directions and precautions on herbicide labels before use. As herbicides, herbicide labels and their availability and recommendations may change, it is best to consult your local Extension agent for the latest recommendations on herbicide use.

Acknowledgements: The authors would like to thank Dan Beran (BASF Market Development Specialist), Greg Brann (Grazing Lands Specialist, NRCS), Steve Capel (Farm Wildlife Supervisor, Virginia Department of Game and Inland Fisheries), Steve Clubine (Grassland Biologist, Missouri Department of Conservation) and Wanda Russell (Senior Publication Editor, UT Institute of Agriculture) for reviewing a previous manuscript and providing constructive comments for improvement.

Photo credits:
Craig Harper, Mike Hansbrough, Steve Capel, Jimmy May and Dick Conley

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Funding for this project provided by University of Tennessee Forestry, Wildlife, and Fisheries, UT Extension, Tennessee Wildlife Resources Agency, Wildlife and Fisheries Enterprises Program through the Mississippi State University Extension Service, and Quail Unlimited.

December 2004

05-0026 PB1746-35M-12/04 E12-4915-00-006-05