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Author(s): Craig A. Harper

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## Strategies for Managing Early Succession Habitat for Wildlife

Craig A. Harper\*

Early succession plant communities consisting of a diverse mixture of grasses, forbs, and scattered shrubs are required by a variety of wildlife species. Early seral stages follow some form of disturbance but can become dominated by shrubs and trees rather quickly, especially in areas with abundant rainfall and relatively long growing seasons, such as the southeastern United States. In the absence of natural disturbance regimes, the quality and maintenance of these plant communities for wildlife is largely dependent upon management. Prescribed fire, disk, herbicide applications, and mowing are practices commonly used to maintain early succession plant communities for various wildlife species throughout this region. Prescribed fire consumes vegetative debris, provides open structure at ground level, and facilitates travel and foraging for wildlife throughout the field. Burning during the dormant season may promote cool-season grasses if they are present in the field. Burning in late March or early April generally promotes warm-season grasses and forbs. Late growing-season fire (September) will reduce woody encroachment and may encourage additional forb cover. Disking promotes vegetation decomposition, provides open structure at ground level, and generally promotes annual plant species. Disking in the fall and winter stimulates more forb growth than disk in the spring, which will stimulate undesirable nonnative warm-season grasses if present in the seedbank. Selective herbicides can influence plant composition and can be used to encourage grasses where forbs dominate, to promote forbs where grasses dominate, and to reduce woody cover. Mowing during midsummer encourages additional grasses in fields dominated by forbs but is not recommended for field maintenance because mowing produces thatch, which limits the ability of several wildlife species to travel and forage through the field, suppresses the seedbank, and destroys nests and young wildlife. Several practices can be used in combination to meet specific objectives. Succession should be set back every 2 to 4 yr, depending on plant response and focal wildlife species. It is important to intersperse disturbance in space and time, so that a variety of cover types are always available, even to those animals with small home ranges.

**Key words:** Disking, early succession plant communities, grassland songbirds, mowing, native warm-season grasses, northern bobwhite, prescribed fire.

Changing land-use practices and the suppression of fire has drastically altered the landscape of the American South, as well as other regions of the United States. These changes have led to a net loss of native early succession plant communities required by many wildlife species (Brennan 1991). As a result, wildlife populations dependent on these communities have suffered (Hunter et al. 2001). Efforts to restore native early succession plant communities (most notably several programs offered through the Farm Bill) have been successful in many areas and increases in wildlife populations have been recorded (Delisle and Savidge 1997; Gill et al. 2006; Marcus et al. 2000). However, through this process, landowners and managers have recognized early succession plant communities (dominated by herbaceous species) become midsuccession communities (dominated by woody species) rather quickly if some disturbance regime is not implemented to set back succession (Dykes 2005; Lorimer 2001). This is especially true in areas with relatively long growing seasons and abundant precipitation (> 30 inches of rainfall per year) and where winged-seeded woody species, [e.g., sweetgum (*Liquidambar styraciflua* L.), green ash (*Fraxinus pennsylvanica* Marsh.), winged elm (*Ulmus alata* Michx.), red maple (*Acer rubrum* L.)], are present. As succession marches forward, habitat quality declines for many wildlife species.

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\* Associate Professor, Department of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, TN 37996. Corresponding author's E-mail: charper@utk.edu

The quality of early succession wildlife habitat is dependent on the composition and structure of the plant community (Harper et al. 2007). For a few wildlife species, such as eastern meadowlarks (*Sturnella magna* Linnaeus) and Henslow's sparrows (*Ammodramus henslowii* Audubon), a field composed primarily of native grasses, such as broomsedge bluestem (*Andropogon virginicus* L.) and little bluestem [*Schizachyrium scoparium* (Michx.) Nash], may represent quality habitat (Giocomo 2005). However, for many other wildlife species, a more diverse vegetative community provides optimum habitat conditions (Burger et al. 1990; Millenbah et al. 1996).

The presence of forbs and scattered brambles and shrubs, along with native grasses, enhances nesting and brooding cover and produces a quality food source for many wildlife species. The importance of these plants cannot be overstated. Forbs, such as common ragweed (*Ambrosia artemisiifolia* L.), pokeweed (*Phytolacca americana* L.), beggar's lice [*Hackelia virginiana* (L.) I.M. Johnston], partridge pea [*Chamaecrista fasciata* (Michx.) Greene], and native lespedezas, such as slender [*Lespedeza virginica* (L.) Britt] and hairy lespedeza [*Lespedeza hirta* (L.) Hornem.], provide forage and seed used by many wildlife species. These forbs also provide a protective umbrella canopy of cover that is open underneath and used extensively by northern bobwhite quail (*Colinus virginianus* Linnaeus) and wild turkey (*Meleagris gallopavo* Linnaeus) broods, as well as many ground-feeding songbirds (Burger 2000; Roseberry and Klimstra 1984). Scattered thickets of blackberries (*Rubus* spp.), wild plum (*Prunus* spp.), and the occasional sumac (*Rhus* spp.) motte offer diverse nesting cover

for dickcissels (*Spiza americana* J. F. Gmelin), field sparrows (*Spizella pusilla* Wilson), and other birds that may nest in shrub cover (Giocomo 2005). These woody shrubs also provide critical winter cover and a quality food source for many wildlife species.

Maintaining early succession and balancing the composition of grass, forbs, and shrubby cover in a field is not necessarily easy. Managing for 30 to 70% native grass cover and 30 to 70% forb cover, with shrub cover no more than 100 yards apart, may be the ideal composition for a diversity of wildlife dependent on early succession plant communities. However, continued management, knowledge of successional patterns, persistence, and a different perspective by the traditional landowner are required.

## Management Techniques

Several management practices enable landowners to set back succession; however, not all practices are equal in the quality of the resulting habitat (Harper et al. 2007). The type of disturbance practice and its timing, frequency, and intensity influences plant composition, structure, and successional trajectory, which strongly influence habitat quality for wildlife.

Most landowners manage fields by mowing (Dykes 2005). Relatively few are willing to burn fields because of liability and the general fear of fire. Few landowners manage fields by disking because they are unaware of the benefits. Most property owners are reluctant to use herbicides because of their fear of chemicals and their ecological concerns. In the South, there is little native grass and forb acreage managed by grazing because almost all livestock producers in the region use nonnative forages (Ball et al. 2002; Fribourg et al. 1988).

**Mowing.** Mowing (or bushhogging) is the traditional practice used to maintain early succession habitat, which is unfortunate because mowing creates undesirable conditions for wildlife. When vegetation is cut and not removed from the field, a deep thatch layer is created at ground level (McCoy et al. 2001). Deep thatch restricts travel for game bird chicks and limits the ability of broods to feed on seed and invertebrates (Burger et al. 1990; Hurst 1972). Vegetative diversity is also reduced when the seedbank is suppressed by thatch (Gruchy 2007), which acts as an effective blanket over the field.

To compound the negative effects of mowing, most landowners mow during summer and again in the fall just before winter. These are the worst possible times for wildlife! When fields are mowed in the summer, nests and nestlings are destroyed, white-tailed deer (*Odocoileus virginianus* Zimmermann) fawns and young cottontail rabbits (*Sylvilagus floridanus* J. A. Allen) are often killed, and reproductive cover is destroyed at a time when it is needed most. Ironically, many of these same landowners then blame predators, such as red-tailed hawks (*Buteo jamaicensis* J. F. Gmelin), for reducing wildlife populations, such as bobwhites, as they wipe clear available cover for nesting and brood rearing. When fields are mowed in the fall, protective cover that would be used through winter is removed, drastically reducing usable space for many wildlife species. If fields must be managed by

mowing, the job should be completed in late winter, just before spring green-up, which would provide cover throughout winter and not disrupt the nesting season.

Another irony associated with field mowing is that mowing is not effective in reducing woody competition, which is the main reason landowners mow fields. Mowing generally stimulates sprouting, and overall, woody encroachment is not reduced (Gruchy et al. 2007; Johnstone 1990).

Mowing can be a useful tool for meeting certain objectives but should not be considered the primary method of maintaining an early succession plant community. Fields primarily composed of perennial forbs, such as goldenrods (*Solidago* spp.) and blackberry, can be improved for several ground-nesting birds by mowing strips in midsummer. Mowing at that time will encourage warm-season grass growth (Hazell 1965). Native warm-season grasses, such as broomsedge bluestem, provide critical nesting cover for bobwhites (Dimmick 1971). Although mowing may disrupt the nesting activity of various songbirds in those strips, the whole field is not mowed, only a small percentage of the overall acreage (certainly no more than one-fourth). The increase in grass will not only provide additional nesting cover in the future for other species but also enable the landowner to implement the most desirable management practice—prescribed fire.

**Burning.** As recently as the early 20th century, it was common practice in the American South to burn fields and woods in an effort to increase the palatability of vegetation for grazing and to expose chestnuts and acorns in the woods for ranging hogs and game (Pyne 1982). Unfortunately, prescribed fire is no longer implemented as in yesteryear, partly the result of misguided propaganda sponsored by the U.S. Forest Service from 1927 to 1930 (“Dixie Crusaders”) and partly a lack of understanding and knowledge of how to use fire and its effects on natural communities (Donovan and Brown 2007; Johnson and Hale 2000; Riebold 1971).

Unlike mowing, fire cleans the field of debris, creates an open structure at ground level, and stimulates the seedbank to germinate (Buckner and Landers 1979; Gruchy 2007; Komarek 1963), increasing vegetative diversity and making seed and invertebrates available for game bird broods (Hurst 1972). Prescribed fire enables upland wildlife, often perceived as needing edge habitats (see Guthery 1997), to travel *throughout* the entire field, not just the field edges. Burning can also increase nutrient availability as rain carries nutrients from the ash down into the top layer of soil (Wright and Bailey 1982).

Despite the benefits of burning, fire must be used with care, and practitioners should be familiar with, and adhere to, state prescribed fire laws (see Sun 2006). Disked firebreaks of exposed soil must be established around the area to be burned, and burning should be undertaken by experienced personnel and under proper environmental conditions. Landowners who wish to manage their fields with fire should contact their state’s forestry and wildlife agencies for possible assistance. Forestry and wildlife professionals will help landowners prepare a management plan. Some forestry agencies (and private operators) will implement a burn for a fee; some will help for free. Another source of assistance is the local volunteer fire department. It is not uncommon for these

volunteers to come out and assist landowners when burning a field or woodlot. And it is always important to inform the local fire department before burning even if they are not assisting with the burn.

Timing of burning is most important to meet certain objectives. Most fields are burned January through March. This may not be desirable timing for a few reasons. Burning early in the dormant season can stimulate and increase nonnative cool-season grasses by clearing the field just before those grasses begin active growth (March) (Ewing and Engle 1988). A primary objective of landowners wanting to improve early successional cover should be to eradicate nonnative perennial cool-season grasses [e.g., tall fescue (*Festuca arundinacea* Schreb.), orchardgrass (*Dactylis glomerata* L.), bromegrasses (*Bromus* spp.), and velvetgrass (*Holcus lanatus* L.)], which displace desirable native grasses and forbs, reduce vegetative diversity by inhibiting seedbank germination, and limit travel and food availability for young game birds and ground-feeding songbirds (Barnes et al. 1995). Burning early in the dormant season also reduces cover at a time when it may already be limited.

Burning later in the dormant season (late March to early April) stimulates warm-season grasses (Gruchy 2007; Towne and Owensby 1984) and helps reduce cool-season grasses that have already started growing (Howe 2000). Burning in the late dormant season or early growing season (through mid-April) not only stimulates desirable warm-season grasses and forbs (Buckner and Landers 1979) but also allows wildlife to use the cover in the field throughout winter before spring green-up. This is also before the nesting season, which begins in late April to early May for birds that nest in the field (Giocomo 2005). Burning in the late growing season (September) effectively reduces woody encroachment equal to various herbicide applications (Gruchy et al. 2007). Burning at this time top-kills woody stems before carbohydrates are transported from the leaves to the root system in preparation for senescence. Therefore, root systems are depleted of the energy needed to resprout.

Frequency of burning should be dictated by desired vegetation response. Fire return interval will determine the composition and structure of the subsequent plant community. Annual prescribed fire will shift the plant community to a more grass- and forb-dominated composition, whereas a 2- to 3-yr burning rotation generally produces an herbaceous community with scattered shrubs. A 3- to 4-yr fire-return interval will create a mixed grass and forb community with a substantial shrub component. A fire-return interval that maintains grasses and forbs for nesting and brood rearing, allows soft mast production from blackberries and other species, and provides winter cover will enhance habitat conditions for a wide variety of wildlife species.

**Disking.** The savannas and oak (*Quercus* spp.) woodlands once present across the South were regularly set back by fire. They were also disturbed by the action of hooves, primarily those of buffalo (*Bison bison* Linnaeus) and elk (*Cervus elaphus* Linnaeus). This hoof action is also evident in modern-day pastures with domestic cattle (*Bovidae* spp. Gray) and horses (*Equus caballus* Linnaeus).

Disking can be used to mimic the natural disturbance of buffalo and elk and provide multiple benefits. Unlike mowing, disking creates an open structure at ground level and facilitates decomposition (Gruchy 2007). The soil disturbance stimulates the seedbank to germinate and increases vegetative diversity (Buckner and Landers 1979). Readily stimulated by disking, and particularly attractive for bobwhites, are several annual forbs, such as partridge pea, common ragweed, tropic croton (*Croton glandulosus* L.), Florida pusley (*Richardia scabra* L.), and annual sunflowers (*Helianthus* spp.). Several perennial species, including the native lespedezas, beggarslice, pokeweed, and spurred butterfly pea [*Centrosema virginianum* (L.) Benth.], can also be stimulated by light disking, especially if preceded by prescribed fire (Rosene and Freeman 1988). Disturbed soil enables birds to dust themselves, which helps reduce external parasites.

Fields planted to native warm-season grasses often become dominated with grass over time (Dykes 2005; Millenbaugh et al. 1996). This is not desirable for wildlife because of the importance of forbs. Disking is the best management practice to stimulate additional forb cover (Buckner and Landers 1979; Gruchy 2007). Disking at different times, however, can influence vegetation composition (Gruchy and Harper 2006; Smith 2006). Dormant-season disking, before April, generally encourages increased forb cover, whereas disking into April and May encourages undesirable nonnative grasses, such as johnsongrass [*Sorghum halepense* (L.) Pers.], crabgrass (*Digitaria* spp.), and broadleaf signalgrass [*Brachiaria platyphylla* (Munro ex Wright) Nash], if they are present in the seedbank (Gruchy and Harper 2006). When undesirable species are suspected, a selective PRE herbicide application (such as imazapic) following diskling may be used to control undesirable species.

Heavy offset disks are more efficient at reducing native grass cover than lighter tandem disks. Burning or mowing is often necessary before diskling with a light tandem disk because the disk will not cut through the grasses. Burning is recommended. Disking following burning is much easier than trying to break down thatch left by mowing. Many passes may be necessary to break up and incorporate 25 to 50% of the vegetation following mowing.

Disking on rotation is an important consideration. Depending on vegetation response, fields can be managed in thirds or fourths by diskling strips approximately 50 feet wide each year and leaving two or three 100- to 150-feet-wide strips undisked in between.

**Herbicides.** Early succession plant communities should not be maintained with herbicides, but the use of herbicides is important in managing vegetation composition, especially when nonnative, invasive species are present. This is most critical when restoring fields covered with nonnative grasses, such as tall fescue or bermudagrass [*Cynodon dactylon* (L.) Pers.]. It is necessary to eradicate this "blanket" of cover before a composition of desirable plant species and structure can be established. Spraying glyphosate in the fall is recommended to kill cool-season grasses (Fribourg et al. 1988; Gruchy 2007; Smith 1989; Vogel and Waller 1990), and imazapic has been used successfully to eradicate

bermudagrass just before or when it flowers (Bond et al. 2005).

Careful attention should be given to the seedbank after eradicating undesirable grass cover. Often, desirable vegetation establishes without the need for planting (Gruchy 2007). Burning and/or disking after the undesirable grass cover is controlled will stimulate germination of the seedbank. Planting native warm-season grasses is not needed for early succession wildlife habitat when some, such as broomsedge bluestem, are already present on the site.

Herbicide applications may be broadcast full, with alternate nozzles closed, or spot-sprayed. Full-broadcast applications are necessary when restoring fields covered with nonnative grasses. However, alternate (or one out of three) nozzles can be closed when spraying a field that has become too dense with native grass (70 to 100% cover). Best results are realized when native grasses are sprayed when they are only 6 to 12 inches tall, usually in mid- to late April, and *if undesirable grasses have been eradicated*. Spraying grasses taller than 12 inches will increase problems with thatch. If undesirable grasses are waiting in the seedbank, they will be released by alternate-nozzle spraying. If undesirable grasses have been eradicated, alternate-nozzle spraying will kill strips of dense native grass across the field and enable desirable warm-season forbs (such as pokeweed, ragweed, and partridge pea) to germinate and establish among the grass.

Spot applications are especially useful for eradicating unwanted, woody growth. Winged elm, sweetgum, green ash, locusts (e.g., *Robinia pseudoacacia* L.), and red maple can be problematic and take over a field quickly if not controlled. Imazapyr and triclopyr have been used successfully to reduce woody encroachment in early succession plant communities. Problem species and objectives for vegetation composition may dictate which herbicide to use. For example, imazapyr does not effectively control legumes or winged elm. Triclopyr may not effectively control yellow poplar (*Liriodendron tulipifera* L.), sourwood (*Oxydendrum arboreum* L.), hickories (*Carya* spp.), or Chinese privet (*Ligustrum sinense* Lour.). Further, triclopyr kills forbs but does not kill native warm-season grasses. Imazapyr promotes blackberries and legumes but may kill native warm-season grasses (Bond et al. 2005; Gruchy et al. 2007).

**Grazing.** Wildlife associated with early succession plant communities throughout the South evolved with grazing ungulates. Grazing can be used to effectively manage native grasses and associated vegetation. Managing grazing intensity, however, is critical. Grazing should be initiated before flowering when native warm-season grasses reach approximately 24 inches in height, depending upon species. Cattle should be removed once the grasses are grazed down to 10 to 12 inches. If native grasses are overgrazed, grass density will decline. Desirable winter cover for wildlife will be reduced or eliminated if native warm-season grasses are grazed past early August (Harper et al. 2007).

Another strategy is patch-burn grazing, whereby 1/4 to 1/3 of the pasture is burned annually (late dormant season) on rotation. Livestock are free to use the entire pasture during the growing season, but selectively graze the section most recently burned. Unburned sections provide nesting cover for various

songbirds and upland game birds, while the burned and grazed section is used for brooding.

## Management Strategies

To have a positive influence on early successional wildlife populations, management strategies must go beyond single-field applications and involve multiple fields on a landscape level. Landowners must do their part by providing as much usable space on their property as possible and doing so in an arrangement that necessitates less travel by wildlife to meet their habitat requirements. There are specific strategies to improve the arrangement and condition of habitat within and across fields.

**Managing Within the Field.** Most fields are managed as a single unit; that is, the entire field is managed the same way at the same time. Depending on the species of interest, the number of fields, and amount of acreage present in early succession, whole-field management may not be desirable. Where fields are fairly large ( $> 4$  ha) and relatively square in shape, breaking the field into two or more units may be desirable, depending upon the focal wildlife species and the management practice used. Grassland songbirds, especially grasshopper sparrows (*Ammodramus savannarum* J. F. Gmelin), typically prefer larger fields ( $\geq 40$  ha) (Dykes 2005; Giocomo 2005), whereas other species, such as bobwhite quail and cottontail rabbits, do not necessarily require large fields, and positive population responses can be realized by establishing field borders around crop fields and managing whole fields of 2 to 4 ha.

If a field is managed by disking in thirds, breaking the field into sections may not be a real benefit (depending upon field size and the width of disked strips). However, if the field is managed with prescribed fire, breaking the field into sections allows different sections to be managed on a different rotation. Whole sections may also be disked on rotation, which would be similar to very wide disked strips (150 feet) if a large field was managed by disking in thirds. As an example of managing in sections, a 4-ha field with four 1-ha sections allows one section to be burned or disked each year on a 4-yr rotation, providing diverse structure across the 4-ha field. This is important if there are few fields on the property or if there is relatively little acreage overall in early succession cover. According to vegetation composition within the field, structure may be diversified by establishing hedgerows containing desirable shrubs [e.g., wild plum sumac and elderberry (*Sambucus canadensis* L.)] to distinguish field sections.

**Managing Across Fields.** On properties that contain several fields, instead of dividing the field and managing sections, whole fields may be burned or disked on rotation. However, proximity of fields should be considered carefully when deciding whether to manage whole fields or sections. Early succession plant communities should be well interspersed throughout the property for maximum benefit for wildlife dependent upon this seral stage. If fields are widely separated, managing whole fields should be discouraged. Juxtaposing fields or sections of fields burned or disked recently with those

in the middle of a rotation is most important. It is critical that all available cover is never set back in one year.

The other major consideration when managing for early successional wildlife is the availability of native early succession plant communities in the surrounding landscape. This is especially important for grassland songbirds and bobwhite quail. Grassland songbirds, such as grasshopper sparrows, prefer a considerable percentage (roughly 50%) of the surrounding landscape in grassland habitat. Quail and rabbits also benefit greatly if the surrounding landscape is comprised largely of quality early succession habitat, as opposed to fields of nonnative perennial cool-season grasses or forest. It is important for landowners to realize, providing an island of attractive habitat in a sea of nonhabitat will not produce a positive long-term effect for many early succession obligates. Landowners interested in these species should form area cooperatives with common goals and objectives with regard to providing and maintaining high-quality early succession habitats.

## Conclusions

Populations of many wildlife species associated with early succession plant communities have declined precipitously across the eastern United States over the past 50 yr. These declining species vary greatly with respect to reproductive and feeding strategies. These species include birds, mammals, reptiles, amphibians, and even invertebrates. They are found in various physiographic provinces, from the coastal plain, to the highest elevations in the Appalachians. Many specific habitat types are included in their ranges, but there is one common theme—all of them rely on an early seral stage. And native early succession plant communities are disappearing without proactive management.

Several management practices can be used to maintain early succession plant communities. Nonetheless, there are two primary threats—nonnative species and landowner perspectives. Before native early succession plant communities can be created or restored, it is critical that many nonnative plants be eradicated from the site. This often requires extended effort and persistence. Landowners wishing to improve conditions for wildlife that require early seral stages must change the way they view “weeds” and tall grass. What has been regarded “unkempt” over the years must be seen as desirable, managed habitat. Quality early succession wildlife habitat does not appear clean and even as the nonnative pastures and hayfields established through much of the twentieth century.

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