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Restoration of Native Warm Season Grasses to Improve Migratory Bird Habitat

SHANNON ALLEN

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Restoration of Native Warm Season Grasses to Improve Migratory Bird Habitat: Final Report

Legacy Project 07-354

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Shannon Allen

Cultural and Natural Resource Branch,
Environmental Management Division, USAG - Redstone Arsenal

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Introduction

Historically, the southeastern United States included large tracts of native grasslands and savannahs kept open by natural fire events. Over the last century, most of these areas have been replaced with non-native grasses, agricultural crops, forest cover (due to suspension of fire regime), and urban/suburban development (Collar et al. 1992, DeSante and George 1994, Herkert et al. 1996, Knopf 1994, Stotz et al. 1996, Vickery et al. 1999, Heard et al. 2000). Because of this habitat loss, many wildlife species which depend on grasslands are experiencing population declines, including at least a 65% decline in Northern Bobwhite Quail (*Colinus virginianus*) populations (Peterjohn and Sauer 1999, Dimmick et al. 2002). Native warm season grasses (NWSG) are important for many species of migratory birds and other wildlife because their clumpy growth form provides structural cover for nesting and brood rearing and their abundant seed production provides ample foraging (Delisle and Savidge 1997, Fletcher and Koford 2002, Juliano and Daves 2006). NWSG bunchy growth form creates openings though which bird and small mammals can safely travel, forage, and nest. Native forbs, such as partridge pea, clovers, and annual sunflowers, that germinate between bunches provide additional canopy cover and forage. NWSG also provides structural cover in the winter because their stems remain upright. Nonnative pastures and hay fields, on the other hand, provide little wildlife benefit (Barnes et al. 1995, Bond et al. 2005).

Throughout North America, efforts are underway to restore native grasslands and other essential habitats for migratory birds through private-public partnerships. As one of the largest landholders in the Tennessee River Valley, the Army is in the unique position to demonstrate leadership by implementing management practices which improve habitat quality for migratory songbirds without compromising mission activities. Showing support for regional conservation actions with other federal agencies and corporations indicates the Army's willingness to cooperate with local and regional partnerships. To facilitate cooperative conservation efforts, the North American Bird Conservation Initiative created geographic Bird Conservation Regions (BCRs) that address bird conservation needs and works with the Wildlife Habitat Council (WHC) to foster public-private partnerships for restoration work on corporate lands and surrounding areas to create a large network of migratory bird habitat. Redstone Arsenal (RSA) lies within the Central Hardwoods BCR (CHBCR), Southern Interior Low Plateau Focus Area, and Tennessee River Migratory Bird Focus Group. One of the first projects to come out of the partnership focuses on an approximate 25 mile corridor of land along the Tennessee River in North Alabama. The land in the corridor is owned by several corporations, Wheeler National Wildlife Refuge (WNWR), the Tennessee Valley Authority (TVA), the City of Decatur, and RSA. The primary focus of the partnership is improving habitat on private, as well as public, lands for priority grassland bird species such as Dickcissels, Grasshopper Sparrows, Field Sparrows, Prairie Warblers, Northern Bobwhite Quail, Loggerhead Shrikes, and Eastern Meadowlarks. In 2003, initial corporate participants in the Decatur partnership included 3M, BP, Vulcan Materials, and Nucor Steel.

In addition to ensuring compliance with the Sikes Act, the Migratory Bird Treaty Act, and Section 3 of Executive Order 13186, regional partnerships designed to improve habitat for declining species may prevent the need for future listings under the Endangered Species Act. This project improves migratory bird habitat in the region and helps promote the DoD in a

leadership role for regional conservation by setting an example for neighboring corporate landholders. Other CHBCR partners have converted roughly two hundred acres of fescue to native warm season grasslands and eight acres of pine savannahs on corporate lands. Public education and outreach projects such as wildlife viewing areas and walking trails have been constructed in some locations. New partners since 2004 are NASA, Morgan County Regional Landfill, Solutia Inc., and the Boeing Company.

Two hundred and twenty acres of nonnative pasture (some with 2007 DoD Program Legacy funding and some with additional funding) were converted to native warm season grasses on RSA. Big bluestem (*Andropogon gerardii*), side oats grama (*Bouteloua curtipendula*), switchgrass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), indian grass (*Sorghastrum nutans*), and a mix of native forbs and wildflower species were planted. For this report, we will focus only on three NWSG planted areas, Patton (31 acres), East Line (6 acres), and Redstone (67 acres) along with three nonnative pasture areas, Rideout (138 acres), Anderson (55 acres), and Buxton (90 acres).

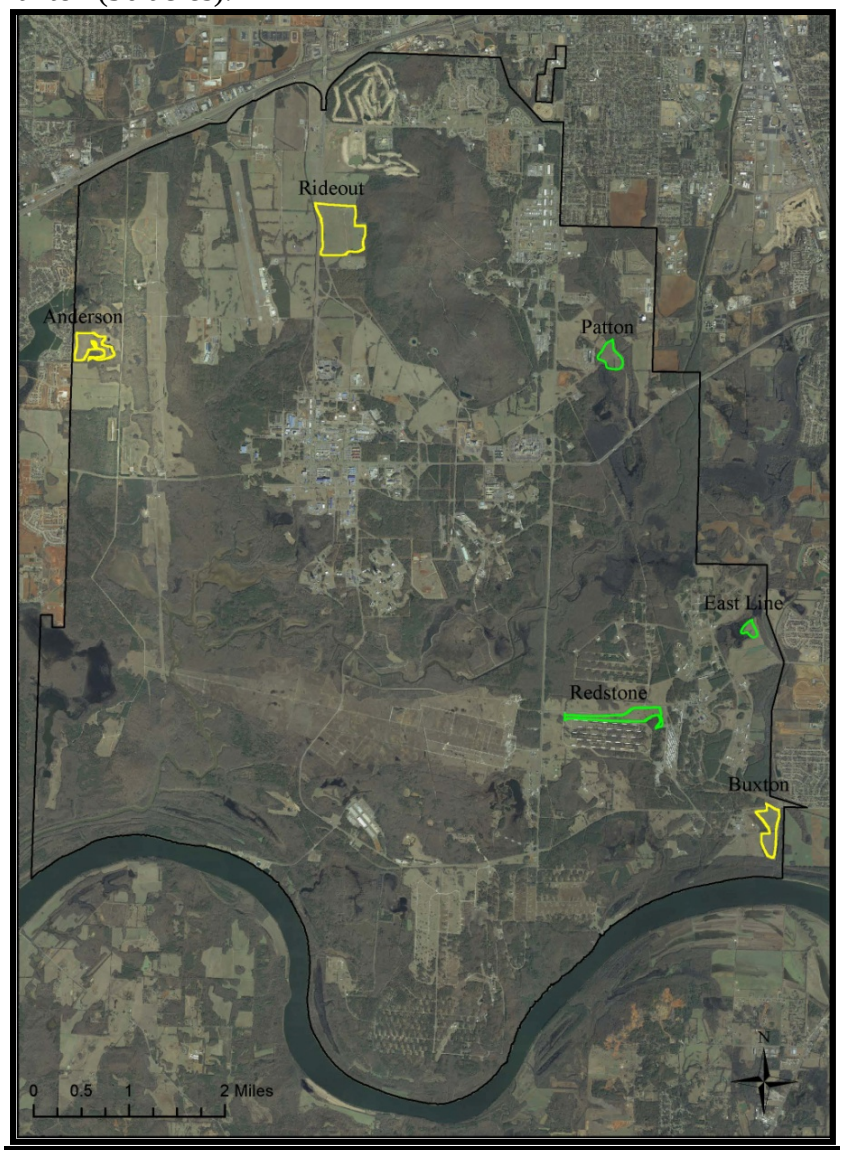

Figure 1. Locations of NWSG areas (green) and nonnative pasture areas (yellow) on Redstone Arsenal, Alabama

Methods

Site Selection

Sites on RSA for NWSG planting were chosen using a combination of three criteria; site was not planned for development in foreseeable future, site is in undeveloped area where it would be beneficial for wildlife, and site is in an area or is adjacent to an area which already is burned annually for hazard reduction or wildlife management. Nonnative pasture sites were chosen for use in our comparison by our ability to control their management (timing of haying).

Site Preparation

Because our sites were previously agriculture fields, non-native grasses (tall fescue (*Schedonorus phoenix*), bermuda grass (*Cynodon* sp.), crabgrass (*Digitaria* sp.), and johnsongrass (*Sorghum halepense*)) were the dominant plant species. To prepare the sites for planting, these species must be controlled and the areas made suitable for NWSG seeds. Area to be planted in 2008 was called Patton. Areas to be planted in 2009 were called Redstone and Eastline. These areas were prescribed burned in January and February 2008 or February 2009 and then sprayed with 57 oz. of glyphosate per acre and 38.5 oz. of Journey ® per acre in March 2008 or Match 2009. To remove the dead non-native vegetation in preparation for planting of NWSG, the areas were prescribed burned again in April 2008 or 2009. The nonnative pasture areas used for comparison in this project are called Anderson, Rideout, and Buxton.

Figure 2: Prescribed burn used for site preparation of nonnative pasture prior to NWSG planting on Redstone Arsenal, Alabama

Planting

A no-till drill method was chosen for planting because it is capable of shallow planting (1/4 inch) necessary for successful NWSG establishment. Planting occurred during the last two weeks of May and the first two weeks of June 2008 or the last week of May 2009. Upon post-planting site inspection, there were some seeds above ground level indicating correct planting depth. We chose a grass seed mix consisting of big bluestem, side oats grama, switchgrass, little bluestem, and indian grass. In addition, we included a forb/wildflower mixture which included native partridge pea (*Chamaecrista fasciculata*), lanceleaf coreopsis (*Coreopsis lanceolata*), native white prairie clover (*Dalea candida*), purple prairie clover (*Dalea purpurea*), Illinois bundle flower (*Desmanthus illinoensis*), purple coneflower (*Echinacea purpurea*), false ox-eye sunflower (*Heliopsis helianthoides*), grey head coneflower (*Ratibida pinnata*), black-eyed Susan (*Rudbeckia hirta*), and compass plant (*Silphium laciniatum*). Seeding rate was 8 lbs per acre (above the recommended rate to try and compensate for a multi-year drought).

Monitoring

***Vegetation*:** Vegetation in three NWSG areas (Redstone, Eastline, and Patton) and three nonnative pastures (Anderson, Rideout, and Buxton) were monitored in August 2012, three or four years post NWSG planting. Given adequate rainfall and appropriate management, NWSG would be thriving by this timeframe. A one m^2 quadrat was used to determine percent cover of all plant species and bare ground. All NWSG areas were burned at least twice since planting. All nonnative pasture were hayed at least twice in the past 4 years, but were not hayed at the time of monitoring.

***Birds*:** Bird point counts were conducted in NWSG areas and nonnative pasture within three years of NWSG planting (in 2009, 2010, or 2011). Temperature, wind speed, general weather conditions, date, time, and observer also were recorded. Counts began approximately 15 minutes after local sunrise and were completed within 3-4 hours, generally by 10AM. Once an observer was at the observation site, the observer waited 5 minutes to begin the survey to allow the area to recover from intrusion. Activity (calls, songs, visual sightings) were recorded using a bulls-eye datasheet over three time periods. Time periods were 0-3, 3-6, and 6-10 minutes resulting in a total surveying time of 10 minutes. Evidence of breeding activity, such as active nests, nest building, presence of adult female in the territory of a male, and presence of dependent young, also were recorded. Point counts were not conducted on days when inclement weather hindered detection of birds.

Evaluation

***Vegetation*:** Analysis of variance (ANOVA) was performed to determine differences between NWSG areas and nonnative pasture in % cover of native plant species, % cover of nonnative plant species, and % cover of bare ground, and number of plant species per site. Shannon Diversity Index was calculated for NWSG areas and nonnative pasture; high values of H would be representative of a more diverse plant community. A t-test was performed to determine if there was a difference in plant diversity between the two habitat types. A 0.05 significance level was used for all tests.

***Birds*:** ANOVA was performed to determine differences between NWSG areas and nonnative pasture in number of bird species, number of priority bird species, or percent of priority bird species. Priority bird species are defined as a species of concern or priority listed by either the State of Alabama or the CHBCR. Shannon Diversity Index was calculated for NWSG areas and nonnative pasture; high values of H would be representative of a more diverse bird community. A t-test was performed to determine if there was a difference in bird diversity between the two habitat types. A 0.05 significance level was used for all tests.

Results

***Vegetation*:** NWSG areas had significantly greater % cover of native plant species (F (1, 19) = 25.27, p = 7.48E^{-05}), number of plant species per site (F (1, 19) = 15.21, p = 0.001) and less % cover of nonnative plant species than nonnative pasture (F (1, 19) = 13.73, p = 0.0015), but not % cover of bare ground (F (1, 19) = 0.000957, p = 0.98).

The NWSG areas had a Shannon Diversity Index of 3.20 while the nonnative pasture areas had a Shannon Diversity Index of 2.99. The t-test showed that NWSG areas had significantly greater plant diversity than nonnative pasture.

***Birds*:** There was no difference between NWSG areas and nonnative pasture areas in number of bird species, number of priority bird species, or percent priority bird species.

The NWSG areas had a Shannon Diversity Index of 3.32 while the nonnative pasture areas had a Shannon Diversity Index of 3.21. The t-test showed that there was no difference between NWSG areas and nonnative pasture areas in bird diversity.

Discussion

NWSG are typically be very sparse the year of establishment and for one year afterwards, but with appropriate management native plants should quickly establish their dominance over nonnative species in the area. This pattern is supported by our results because the NWSG areas have greater % cover of native species and less % cover of nonnative species than the nonnative pasture areas. NWSG areas also have greater species diversity which should make the areas attractive to wildlife due to the complex nature of the stand structure for nesting, bedding, escape, and foraging. Research has shown increases in wildlife populations when native forbs and grasses replace non-native cover (Palmer et al. 2005).

However, our analysis shows that the NWSG areas do not have a greater percentage of bare ground than the nonnative pasture. This is a concern because one reason why many wildlife species prefer NWSG areas over nonnative pasture areas is due to the more open structure for mobility, especially important for foraging turkey and quail broods (Dykes 2005). In addition, dense grass coverage reduces the amount of forbs and growth of scattered shrubs which provide an additional food source and structure for wildlife (Barnes et al. 1995, Bond et al. 2005). It is recommended that NWSG areas have about 50% grass coverage, but ours have an average of only 27%, the same as the nonnative pasture areas (Harper and Moorman 2006). This result indicates either that our seeding rate was too high and/or that we need to adjust our management practices in the NWSG areas.

Of a larger concern is the lack of difference between NWSG areas and nonnative pasture in number of bird species, number or percentage of priority bird species, or diversity of bird species. These results could be due to a number of factors. First, at the time of bird point counts, there may not have been enough time since planting for the NWSG areas to become established enough for birds to prefer them. Second, our NWSG areas may be too small to support some grassland bird species. Though many species use small grasslands for breeding habitat (ex. Bobolinks, Meadowlarks, and Northern Bobwhite), some like Grasshopper Sparrows rarely use blocks of habitat smaller than 247 acres (Vickery et al. 1994, Mitchell et al. 2000). Third, our management of the NWSG areas may not have been intensive enough to create more suitable habitat for birds. Lastly, it could be a combination of all three.

In conjunction with the bare ground results, it appears that our management thus far may be the major limiting factor in complete success of the NWSG areas. A more intensive management of the NWSG areas will be implemented to include more frequent prescribed burning (annual instead of biennial) and will include periodic disking in the spring to create a more open structure at ground level (Gruchy and Harper 2006, Gruchy et al. 2009).

Management Reccomendations

Management of NWSG open structure is crucial to successful establishment and maintenance and timing of management techniques is highly influential on vegetation composition and invertebrate availability (Harper et al. 2007). Prescribed fire is the most effective method for managing NWSG and is the preferred method on RSA. Prescribed fire reduces litter buildup, sets back succession, increases nutrient availability, and stimulates herbaceous growth in NWSG habitats. Vegetation composition is determined by the season in which a prescribed burn is conducted. Late winter/early spring burns typically favor NWSG over forbs. Use of fire in late summer/early fall opens grass plantings that have become too dense, stimulates forb production, and reduces woody succession. However, the latter type of burn season is not acceptable on RSA due to local air quality concerns. On RSA, fields are typically burned in late winter (February through March), though the burn season can extend into early April.

Disking is an alternative management technique to prescribed burning, but offers the additional benefit of breaking up thick stands of NWSG for meeting the 50% bare ground recommendation. Disking in late winter/early spring will promote desirable forbs, while disking in summer may promote nonnative grasses found in the seedbank such as johnsongrass or crabgrass.

NWSG can successfully be utilized as a hay or forage crop. However, because wildlife habitat is RSA's primary goal, mowing will not be utilized as a NWSG management strategy. Mowing NWSG, especially at the wrong time of year, kills young wildlife and results in accumulated thatch which reduces an open ground structure, limits germination from the seedbank and growth of forbs and desirable shrubs (McCoy et al. 2001)

Conclusion

The Natural Resources staff at RSA is pleased with the results of our NWSG planting and plan to continue converting stands of non-native grasses to native grasses as funding becomes available

because restoration of native grasses has both economic and ecologic benefits. Maintenance costs are reduced because once they are well established, native grasses do not require regular mowing or pesticide-herbicide treatments, but are managed and maintained through prescribed burning. The extensive root systems of native grasses provide erosion control, are drought tolerant, and increase soil fertility by regular regeneration of the root system. The use of native grass species will help the installation meet its goals for sustainability with regards to natural resources and for the present and future Army mission. Native warm season grasses are beneficial for wildlife because their clumpy growth form provides structural cover for nesting and brood rearing and their abundant seed production provides ample foraging opportunity. However, more intensive management will be implemented to promote healthier stands of NWSG on RSA

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