CONSERVATION BUFFERS

United States Department of Agriculture

Natural Resources Conservation Service

August 2009

# Maximizing the Benefits of Field Borders for Bobwhite and Early Successional Songbirds:

## What is the Best Design for Implementation?


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## Acknowledgments and disclaimer

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Acknowledgments

Information in this publication was adapted from the Ph.D. research of Jason D. Riddle working under the direction of Dr. Christopher E. Moorman, Department of Forestry and Environmental Resources, North Carolina State University, Box 7646, Turner House, Raleigh, NC 27695-7646. This research was conducted in the Coastal Plain region of North Carolina. Funding for this project was provided by the USDA NRCS Agricultural Wildlife Conservation Center (AWCC), NCSU Department of Forestry and Environmental Resources, North Carolina Wildlife Resources Commission, and Murphy-Brown, LLC.

Photos were provided by Jason D. Riddle, Department of Forestry and Environmental Resources, North Carolina State University and the North Carolina Wildlife Resources Commission.

USDA Nondiscrimination Statement

# Maximizing the Benefits of Field Borders for Bobwhite and Early Successional Songbirds:

## What is the Best Design for Implementation?

Northern bobwhite and many early successional songbirds have experienced severe population declines in recent decades. Generally, these declines have been the result of habitat loss. Field borders can increase and enhance early successional habitat for birds in agricultural landscapes. However, field border characteristics, such as their shape, and the landscape context in which they occur may determine their effectiveness for bird conservation. Researchers established linear and nonlinear upland habitat buffers (field borders) on farms in agriculture-dominated and forest-dominated landscapes in the Coastal Plain of North Carolina. Prior to field border establishment in 2004, they collected pretreatment data on focal songbird species' density, nest success, frequency of brood parasitism, summer bobwhite abundance, and fall bobwhite covey abundance. After field borders were established (2005 and 2006), they continued to collect data on the aforementioned variables, as well as on artificial bobwhite nest success and field border vegetation characteristics. Following establishment of field borders, summer bobwhite abundance increased on farms in agriculture-dominated landscapes by 87 percent and on farms with nonlinear habitats by 57 percent. However, summer abundance did not increase on farms with linear field borders in forest-dominated landscapes. There was a positive but nonsignificant trend toward higher numbers of fall coveys/count on farms in agriculture-dominated landscapes and lower numbers on farms in forest-dominated landscapes after field border establishment. The proportion of depredated artificial bobwhite nests was similar across all treatments, as were the major vegetation characteristics of the field borders themselves. Focal songbird species' density, probability of nest success, and frequency of brood parasitism were unaffected by the establishment of field borders. Focal species' density (with red-winged blackbirds included) was 55 percent higher on farms in agriculture-dominated landscapes than in forest-dominated landscapes. Indigo bunting/blue grosbeak nest success probability was 129 percent higher on farms in agriculture-dominated landscapes than in forest-dominated landscapes. Brood parasitism frequency for indigo bunting/blue grosbeak was 33 percent, but did not differ between landscapes. The results suggest that linear and nonlinear field borders can be used to increase bobwhite populations on farms in agriculture-dominated landscapes. Nonlinear field borders can be used to increase bobwhite populations in forest-dominated landscapes. Early successional songbirds did not respond to field borders in the study. However, the same landscapes that were most conducive to bobwhite management were also the highest quality landscapes for early successional songbirds. Land managers should strongly consider a focal area approach to allocating field borders, especially for northern bobwhite. Specifically, land managers have much flexibility for bobwhite management in agriculture-dominated landscapes because both linear and nonlinear field borders increased quail populations.

TECHNICAL NOTE

CONSERVATION BUFFERS

# Maximizing the Benefits of Field Borders for Bobwhite and Early Successional Songbirds:

## What is the Best Design for Implementation?

Abundance of northern bobwhite (*Colinus virginianus)* (fig. 1) and many early successional songbirds [e.g., indigo bunting (*Passerina cyanea*), grasshopper sparrow (*Ammodramus savannarum*), and dickcissel (*Spiza americana*)] have declined severely in recent decades. On agricultural lands, many of these declines are believed to be due to the loss and degradation of early successional habitats (i.e., disturbance-maintained habitats comprised primarily of grasses, forbs, and shrubs). These early successional habitats are less common on many modern farms for a number of reasons, including increased field sizes, advances in farming machinery and herbicides, cultural attitudes about farm appearance, and the end of tenant farming.

*Figure 1. Male bobwhite with chicks. (Photo credit North Carolina Wildlife Resources Commission)*

Upland habitat buffers have been promoted as a way to establish early successional habitat for bobwhite and grassland songbirds on field margins. Also called "field borders," upland habitat buffers are areas of noncrop vegetation usually dominated by herbaceous and/or grassy species that are intentionally managed for wildlife (Field Border, CPS Code 386 and Early Successional Habitat Development/Management, CPS Code 647). Upland habitat buffers are typically maintained in the early successional stage by disking or burning approximately every 3 years.

Research studies have shown that upland habitat buffers can increase bobwhite and breeding songbird populations, as well as provide valuable winter habitat for sparrows (fig. 2). However, little is known about how upland habitat buffer characteristics, such as their shape or the landscape context in which they are established, influence their quality as bobwhite or songbird habitat. Narrow, linear upland habitat buffers may negatively affect nesting bobwhite and songbirds because they may function as travel lanes for nest predators such as raccoons. Nonlinear upland habitat buffers may alleviate this potential negative edge effect because of their relatively low edge-to-area ratios.

*Figure 2. Linear upland habitat buffer between pine stand and young soybean field. (Photo credit Jason Riddle)*

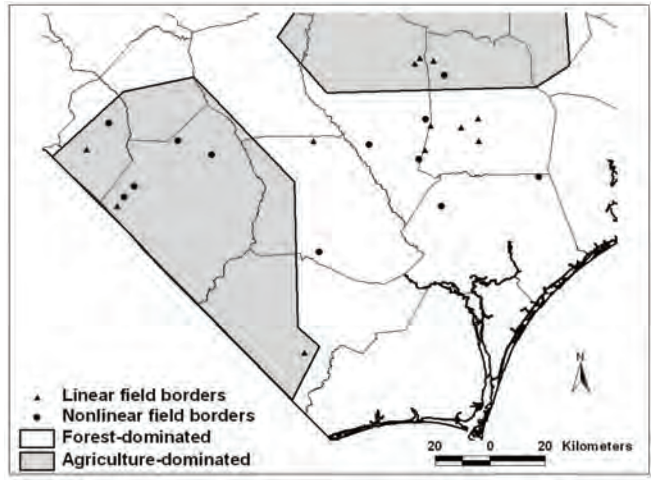


*Figure 3. Study farm locations (with treatment assignments) used in this study.*

Furthermore, previous research has suggested that bobwhite management should be focused in agriculture-dominated (rather than forest-dominated) landscapes because bobwhite often already are present to respond to management in these landscapes. The objectives were to evaluate the importance of upland habitat buffer shape (narrow linear vs. nonlinear) and landscape context (agriculture-dominated vs. forest-dominated) to northern bobwhite and early successional songbird conservation.

The study was conducted on 24 commercial hog farms in the southern Coastal Plain of North Carolina in Bladen, Columbus, Duplin, Pender, Sampson, Scotland, and Robeson Counties (fig. 3). All farms were owned and operated by Murphy-Brown, LLC. Study sites were selected from a pool of more than 200 company farms to minimize the potentially confounding differences among farms (e.g., crop rotations, recent timber activity, etc.). Each hog farm had one or more hog houses, which were confinement areas for hog production. Hog waste was collected into lagoons adjacent to the hog house(s). This waste was applied to row crop and hay fields as a form of nutrient management. Most farms were on a crop rotation of corn, soybeans, and wheat, although some farms also grew cotton.

Twelve farms in agriculture-dominated landscapes and 12 farms in forest-dominated landscapes were chosen. The 5,000-acre area surrounding each farm in agriculture-dominated landscapes was 49 percent row crop and 18 percent forest, whereas the 5,000-acre area surrounding each farm in forest-dominated landscapes was 20 percent row crop and 44 percent forests. In 2004, areas were delineated for upland habitat buffers on each farm. Location of all upland habitat buffers was based on patterns of waste application and advice given by farm managers and other Murphy-Brown, LLC, personnel. On half of the farms in each landscape, upland habitat buffers were linear and 10 feet wide. Whenever possible, linear upland habitat buffers were oriented so that they were parallel to crop rows to facilitate farm machinery operation within the fields. On the other half of the farms in each landscape, upland habitat buffers were nonlinear blocks located at the ends or corners of fields (fig. 4). To minimize loss of crop production, the most unproductive field ends, corners, and odd areas for nonlinear upland habitat buffers were identified. Upland habitat buffers were not planted, but instead were revegetated through natural colonization and succession. Farms varied by size, but the relative amount of row crop that came out of production on each farm was approximately

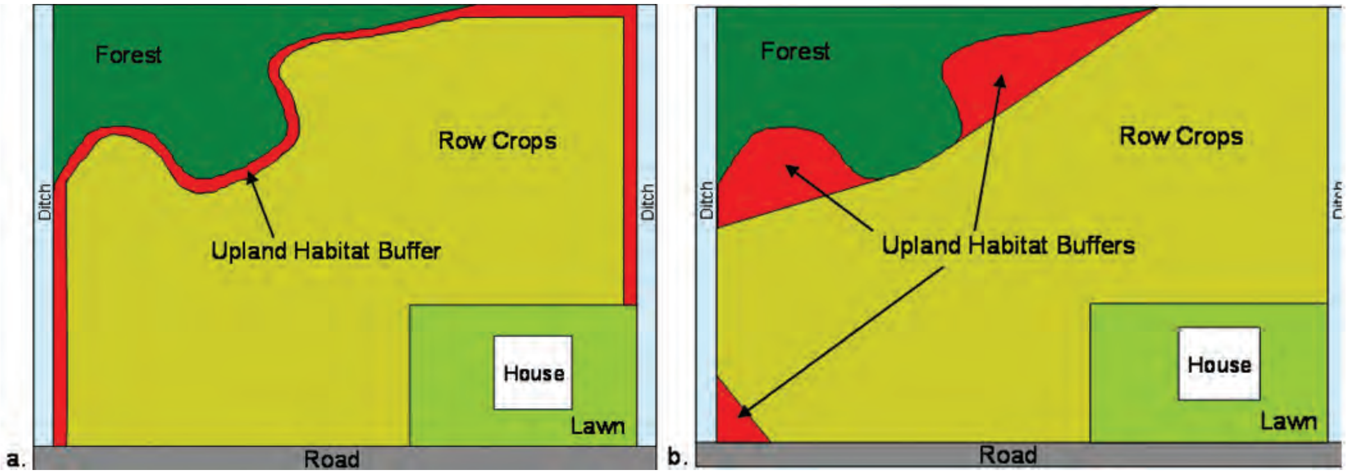


*Figure 4. Overhead representation of two identical farms with upland habitat buffers of approximately equal area, but different shapes. One farm has a linear upland habitat buffer (a), and the other farm has nonlinear upland habitat buffers (b).*

2 to 3 percent. Farm operators were not permitted to disturb upland habitat buffers (e.g., no mowing, herbicide application, turning of farm machinery) during the study.

## Upland Habitat Buffer Characteristics

Linear upland habitat buffers ranged from 218 to 6,360 feet in length and averaged 1,559 feet long. Individual nonlinear upland habitat buffers varied by shape and ranged from 0.12 to 6.13 acres, but most were about 0.5 to 0.6 acre.

The single plant species that most typified each upland habitat buffer, as well as the percent cover of woody vegetation, herbaceous vegetation, and open ground within upland habitat buffers was estimated. The cone of vulnerability (exposure of quail to aerial predators) and the zone of vulnerability (exposure of quail to ground predators) was also measured.

Upland habitat buffers on 22 of 24 farms were dominated or co-dominated by dogfennel (*Eupatorium capillifolium*) (fig. 5). Linear and nonlinear upland habitat buffers had remarkably similar vegetation characteristics in both landscapes. Linear and nonlinear upland habitat buffers did not differ by the percent coverage of herbaceous vegetation or open ground (fig. 6). Although woody vegeta-

*Figure 5. Nonlinear upland habitat buffer dominated by dog fennel (Eupatorium capillifolium). (Photo credit Jason Riddle)*

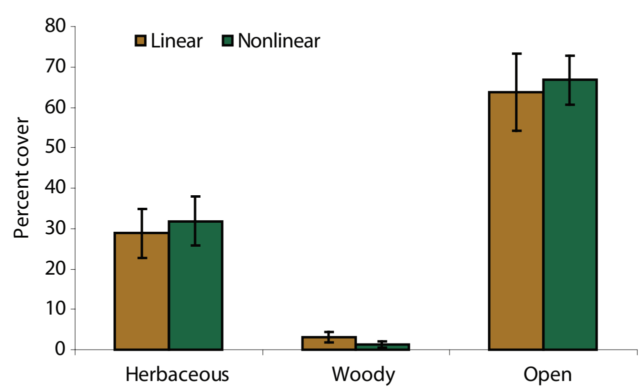


*Figure 6. Average percent cover and 95 percent confidence intervals of herbaceous vegetation, woody vegetation, and open ground for linear and nonlinear upland habitat buffers (2005 and 2006 data combined).*

tion was a minor component of all upland habitat buffers (overall average = 2.24%), linear upland habitat buffers had more than twice as much woody vegetation as nonlinear upland habitat buffers. The amount of herbaceous vegetation in the field borders was within an acceptable range for bobwhite nesting habitat. The cone of vulnerability and zone of vulnerability did not differ between linear and nonlinear upland habitat buffers (fig. 7). Both of these measures were within recommended ranges for bobwhite habitat.

### Northern Bobwhite Response

In 2004, prior to the establishment of buffers, baseline abundance of bobwhite by conducting breeding season point counts (May and June) and fall covey counts (October and November) were estimated. Breeding and fall surveys at the same points in 2005 and 2006 after upland habitat buffers were established were subsequently repeated. Additionally, in 2005 and 2006, an artificial bobwhite nest experiment, which was designed to identify important potential nest predators and gauge relative predation pressures in linear and nonlinear upland habitat buffers in both landscapes, was conducted.

The establishment of upland habitat buffers increased breeding season bobwhite abundance by approximately 45 percent. However, the increase was not consistent across treatments. Breeding season bobwhite populations increased on farms in agriculture-dominated landscapes by 87 percent and on farms with nonlinear upland habitat buffers by 57 percent (fig. 8). Bobwhite decreased by 2 percent on farms with linear upland habitat buffers in forest-dominated landscapes.

Fall coveys increased by 0.27 coveys/farm in agriculture-dominated landscapes and decreased by 0.50 coveys/farm forest-dominated landscapes, but these trends were not statistically significant.

Artificial quail nest success rates were similar across treatments with an overall average of 68 percent success over a 2-week exposure period. The most common identifiable nest predator was raccoon (*Procyon lotor*), which did not appear to be more influential in any particular treatment. Assuming that artificial nest success is an indicator of potential real nest success, it does not appear that bobwhite nests are more vulnerable to predation in narrow, linear upland habitat buffers than in nonlinear upland habitat buffers.

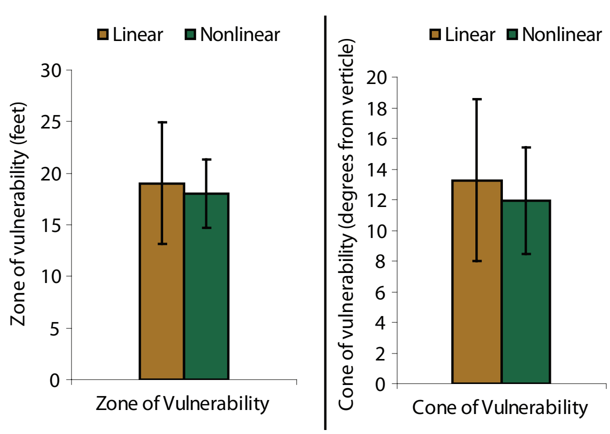


*Figure 7. Average cone and zone of vulnerability with 95 percent confidence intervals for linear and nonlinear upland habitat buffers (2005 and 2006 data combined).*

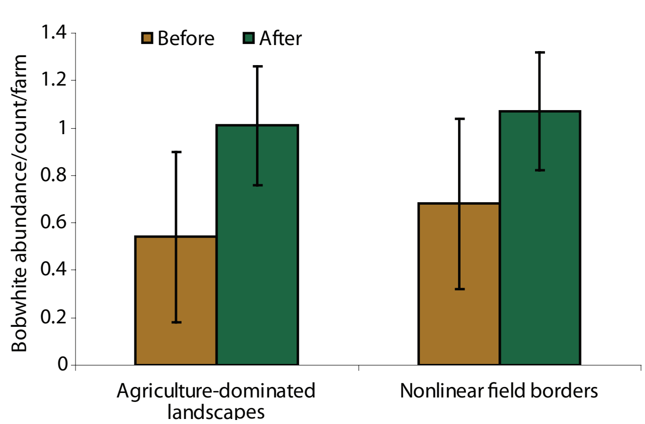


*Figure 8. Breeding season bobwhite abundance with 95 percent confidence intervals before and after (2005 and 2006 data combined) the establishment of upland habitat buffers.*

### Songbird Response

Point counts were conducted during the breeding season of 2004 (May and June) to get baseline estimates of the density of several focal songbird species (indigo bunting, blue grosbeak (*Passerina caerulea*), red-winged blackbird (*Agelaius phoeniceus*), common yellowthroat (*Geothlypis trichas*), grasshopper sparrow, field sparrow (*Spizella pusilla*), and eastern meadowlark (*Sturnella magna*)). In 2004, indigo bunting and blue grosbeak nests (May, June, and July) were also located and monitored to get baseline estimates of nest success and frequency of brood parasitism by brown-headed cowbirds. In 2005 and 2006 after the upland habitat buffers were established, breeding season data on focal species' density, as well as indigo bunting and glue grosbeak nest success and frequency of brood parasitism were collected. All focal species were combined for density estimates, and indigo bunting and blue grosbeak nests were combined for nest success and brood parasitism estimates.

The establishment of upland habitat buffers had no measurable effect on focal species density, indigo bunting/blue grosbeak nest success, or brood parasitism frequency (figs. 9 and 10). Very few nests (<15%) were actually located in upland habitat buffers, probably because woody nest substrates were uncommon in these habitats. Focal species density was 55 percent higher in agriculture-dominated landscapes than in forest-dominated landscapes, most likely because red-winged blackbirds were extremely abundant on several farms in agriculture-dominated landscapes. Indigo bunting/blue grosbeak nest success was more than twice as high on farms in agriculture-dominated landscapes (39%) than forest-dominated landscapes (17%). Brown-headed cowbird parasitism frequency did not differ by landscape, but was high overall (33%).

### Summary

In agriculture-dominated landscapes, landowners have greater flexibility because both narrow, linear and nonlinear upland habitat buffers can increase bobwhite populations. However, landowners in forest-dominated areas still may be able to increase bobwhite on their farms, but it will require larger blocks of nonlinear upland habitat buffers or wide, linear upland habitat buffers to do so. The linear upland habitat buffers were relatively narrow (10 ft), which is consistent with practice standard Field Border (CPS Code 386), but well below the minimum average width required for upland habitat buffers practice CP33 (30 ft). It was recognized that

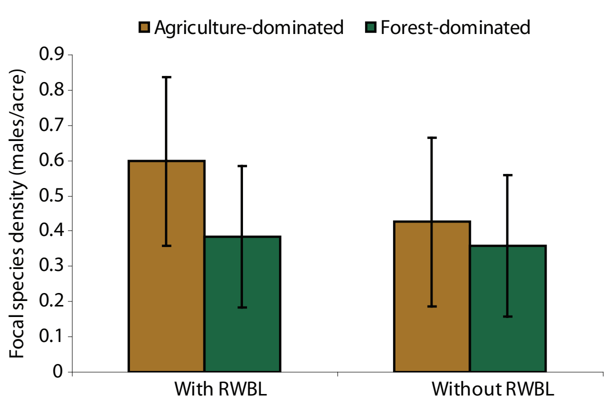


*Figure 9. Combined focal species density averages with 95 percent confidence intervals in agriculture- and forest-dominated landscapes (all years combined).*

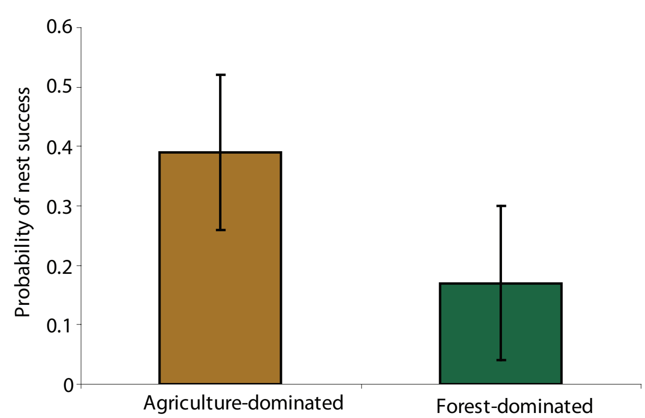


*Figure 10. Indigo bunting/blue grosbeak nest success estimates with 95 percent confidence intervals in agriculture- and forest-dominated landscapes (all years combined).*

wider (mean ≥30 ft) linear upland habitat buffers may provide the same or even greater benefits than nonlinear upland habitat buffers, regardless of landscape context. The use of wide, linear and nonlinear upland habitat buffers in agriculture-dominated landscapes is recommended whenever possible. It is also recommended that narrow, linear, upland habitat buffers be considered for use in agriculture-dominated landscapes where wider buffers may not fit production objectives. Even if cost-share by Farm Bill conservation programs is not possible, some landowners may be willing to allow 10-foot-wide field borders without financial support. The landowner, Murphy-Brown, LLC, was able to allow borders of this width without accepting subsidies and without compromising commercial hog or row crop production.

Because of the timing of bobwhite increase on these farms, it is believed that the initial gains were by spring-dispersing individuals. The population increased quickly in 2005 and additional gains were not observed in 2006. This indicated that bobwhite quickly colonized and saturated the new habitat. Additional gains on the farms would have been unlikely without adding more upland habitat buffers or significantly improving the surrounding woodlands with thinning and burning. Landowners who have previously experienced quail increases under CP33 or other Conservation Practices and desire additional population increases may be willing to manage timberlands and areas not in production in such a way as to add more suitable bobwhite habitat.

The upland habitat buffers did not result in greater focal songbird density, higher indigo bunting/blue grosbeak nest success, or reduced brood parasitism frequency. The lack of upland habitat buffer effect on songbirds probably was because only 2 to 3 percent of the total row-cropped area on each farm was converted to upland habitat buffers. Other studies have documented increases in early successional birds such as indigo bunting and dickcissel with 6 percent of row-cropped area converted to upland habitat buffers. Therefore, 6 percent as a minimum is recommended for a songbird response. Additionally, the upland habitat buffers probably contained too little woody nesting substrate for primary nesters (indigo bunting and blue grosbeak). Depending on site conditions, managers should promote more woody growth in some upland habitat buffers. Conversion of all upland habitat buffers on a farm to shrubby, woody habitat is not recommended, but more than 2 to 3 percent woody cover is needed to impact the nesting ecology of birds like indigo bunting and blue grosbeak.

The landscapes best suited for quail management (agriculture-dominated landscapes) also supported the highest densities and nest success probabilities for early successional songbirds. Therefore, tremendous potential exists for multispecies management with upland habitat buffers in agriculture-dominated landscapes. It is recommended that landscape context be considered as a critical factor for enrollment into CPS Code 386, CPS Code 647, CP33, or similar practices. Specifically, more acres could be allocated to States, watersheds, or counties predominated by agriculture-dominated landscapes. Alternatively, higher rental rates or sign-up bonuses could be allowed to encourage landowner enrollment in these landscapes.

## Technical References

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## North Carolina State University
## Wildlife and Water Quality on North Carolina Farms Workshop
## August 16, 2006

Dr. Chris Moorman (associate extension professor) and Jason Riddle (Ph.D. candidate) from North Carolina State University (NCSU) hosted their USDA NRCS Bobwhite Restoration Project Field Day on August 16, 2006, at Jones Lake State Park in Bladen County, North Carolina. The Wildlife and Water Quality on North Carolina Farms Workshop featured a morning field tour of one of several study sites used in their research evaluating the effects of field border shape and surrounding landscape context on bobwhite and songbird populations. Just under 100 natural resource professionals and private landowners participated in the workshop (fig. 1). Topics covered in the field tour included native warm-season grass (NWSG) establishment (fig. 2), vegetation management with herbicides, riparian buffers, field border shape and landscape context (figs. 3 and 4), and cost-share programs. The afternoon session consisted of classroom presentations on old-field habitat management, maximizing success of field border implementation, riparian buffer basics, cost-share program implementation, and landscape-level quail management. Displays and educational materials were present from Quail Unlimited, North Carolina Wildlife Resources Commission, and NSCU.

| Attendance | |
|---|---|
| NRCS Personnel | 27 |
| Private Landowners/Farmers | 16 |
| Soil and Water Conservation District Staff | 14 |
| University Faculty and Staff | 13 |
| Quail Unlimited | 10 |
| North Carolina Wildlife Resources Commission | 9 |
| County Cooperative Extension Agents | 3 |
| NC Department of Agriculture | 3 |
| US Fish and Wildlife Service | 2 |
| Mississippi State University | 1 |
| Total | 98 |

*Figure 1. Terry Sharpe (NCWRC) provide introductory remarks at the Wildlife and Water Quality on NC Farms Workshop. Nearly 100 resource professionals and private landowners attended.*

*Figure 2. Benjy Strope (NCWRC) provides an overview of the equipment required to establish native warm-season grasses.*

*Figure 3. Jason Riddle (Ph.D. candidate at NCSU) and Dr. Chris Moorman (Associate Extension Professor at NCSU) demonstrate how landscape context may influence bobwhite and songbird use of field border habitats.*

*Figure 4. Bill Edwards (NC-NRCS) and Terry Sharpe (NCWRC, not pictured) discuss the importance of field borders in providing habitat for bobwhite.*

## Evaluation

All attendees were asked to complete an evaluation form that was included in their packets.

| | Attendance | Returned Forms | Response Rate (%) |
|---|---|---|---|
| **NRCS/SWCD staff** | 41 | 23 | 56 |
| **Private** | 16 | 10 | 63 |
| **Other** | 40 | 18 | 45 |
| **Total** | 97 | 51 | 53 |

Attendees were asked to rank the overall value of the workshop in increasing their knowledge of the topic. On a scale from 1 to 5 (5 is highest), participants gave the workshop an average score of 4.32.

Percentage of participants ranking overall workshop value from highest to lowest.

| | NRCS/ SWCD | Private | Quail Unlimited | University | Other |
|---|---|---|---|---|---|
| **High** | 35 | 20 | 67 | 75 | 38 |
| | 65 | 80 | 17 | 25 | 38 |
| | 0 | 0 | 17 | 0 | 25 |
| | 0 | 0 | 0 | 0 | 0 |
| **Low** | 0 | 0 | 0 | 0 | 0 |

Attendees were asked if the workshop format was suitable, if the information would be useful in their work, and if they would like to attend more NCSU/NRCS workshops.

Percentage of participants that answered yes"

| Format Suitable | Information Useful in Work | Attend More Events |
|---|---|---|
| 100 | 98 | 100 |

Attendees were asked by which means they would like to receive information about future NCSU/NRCS project results.

| Work-shop | Newsletter | E-mail | CD Rom | Fact Sheet | Other |
|---|---|---|---|---|---|
| 59 | 61 | 47 | 20 | 45 | 2 |

Percentage of participants preferring future information in various formats.

Samples of general recommendations for workshop improvement follow:

- Landowner presentations/testimonials
- Discuss benefits of conservation programs to farmers
- Include more information on forest management and prescribed burning