MISSISSIPPI STATE UNIVERSITY EXTENSION

Natural Resource Conservation in Agriculture: A Landowner's Guide for Environmental Stewardship in Mississippi

Mississippi Land Stewardship

Global concern for water security continues to grow alongside expanding water resource regulation in many regions of the world. Efforts to avoid regulation require local governments and stakeholders to take a proactive approach to conserving local water resources. Throughout many regions of the U.S., including Mississippi, there is a continued need for

- all landowners and operators to have a foundational understanding of how conservation supports their agricultural resources and local watersheds.
- increased adoption of stewardship practices.
- documentation of how on-the-ground conservation programs and practices protect natural resources and provide ecosystem services to the general public or toward added-value agricultural products.

The Mississippi Land Stewards (MSLS) program was developed by the Mississippi State University Extension Service to address those needs and provide education and outreach to Mississippi landowners and operators.

Mississippi Water Resources

Surface Water Overview

Mississippi's surface water resources are defined by a diverse network of rivers, streams, lakes, reservoirs, wetlands, and coastal waters that sustain communities, agriculture, and industry across the state. The state is divided into five major river basins: Pearl River, Big Black River, Yazoo River, Tombigbee River, and Pascagoula River. Each of these basins, along with numerous smaller watersheds, plays a critical role in shaping the state's economy, culture, and natural environment.

The Mississippi River and its delta tributaries historically deposited fertile alluvial soils that support one of the most productive agricultural regions in the country. The Yazoo Basin, lying entirely within the state, is a focal point for row crop production and is closely linked to water quantity and quality concerns. In the northeast, the Tombigbee Basin is central to transportation, forestry, agriculture, and aquaculture, while in the south, the Pascagoula Basin contains the largest unimpounded river system in the contiguous United States—an ecological treasure that supports coastal wetlands and estuaries.

Threats to Mississippi's Water Resources

With the global population projected to grow by 2 billion people over the next 40 years, the demand for water for domestic use and for producing food and fiber is only going to increase. To meet production demands, it has become necessary to apply fertilizers at increasing rates over the last 50 years. When storm events occur, sediment and nutrients are washed from production fields to downstream water bodies. Runoff from agricultural fields has been identified as the primary source of nutrient loading to riverine systems and the Gulf of America (Gulf of Mexico). As such, there is an urgent need to better protect water resource quality.

Areas of intense agricultural production consume vast freshwater resources across the globe. Irrigation for agriculture consumes the greatest amount of water (70 percent), while in the U.S., irrigation accounted for 38 percent of freshwater withdrawals in 2010. In the Mississippi Delta, irrigation accounts for 98 percent of water use from the Mississippi Alluvial aquifer. The Mississippi Alluvial Valley receives more rainfall than many regions of the U.S., averaging 59 inches in the south and 45 inches in the north annually. Despite high annual rainfall, regional water withdrawals typically exceed groundwater recharge. Consequently, there is an opportunity (and a need) to ensure the longevity of Mississippi's water resources to support the state's citizens and agricultural commerce.

In addition to impacting water availability, agricultural production practices impact water quality as a primary source of non-point source pollution. Throughout the Mississippi River Basin, sediments and nutrients impact freshwater streams, rivers, lakes, and reservoirs, and ultimately flow to the gulf. These nutrients and sediments from agricultural practices accumulate throughout the Mississippi River Basin from Minnesota to Louisiana and are released into the gulf. While the Delta region supports a $7.51 billion agricultural industry, the Mississippi coastal seafood industry was estimated to contribute $347 million in sales annually to the state economy as of 2020.

Water Stewardship

Finding a way to secure a sustainable future for agriculture is critical to the livelihood of Mississippians and crucial for global food and water resources. Paramount to non-point source pollution mitigation and the protection of Mississippi's water resources and the gulf ecosystem is the voluntary adoption of best management or conservation practices on private lands.

Mississippi Soil Resources

Soils Overview

Mississippi boasts a diversity of soils, ranging from rich alluvial deposits of the Mississippi River floodplain, silty upland soils of the Loess Hills, chalky sediments and fine-textured shrink-swell clays of the Blackland Prairie region, to older and more highly weathered soils of the upper coastal plain. These different soils and associated ecoregions support a diversity of agriculture and forestry activities that serve as the backbone of Mississippi's economy. In addition to crop productivity, soils store and filter water and support a variety of wildlife populations.

Major Soil Threats in Mississippi

There are several key threats to soil resources in Mississippi.

- **Erosion (water and wind)** remains a primary concern, particularly during intense rainfall events, when bare or poorly protected soils can be detached and moved off fields. Water erosion risk is highest in upland, sloping areas, while wind erosion risk is higher in areas with flat, lighter textured soils.
- **Compaction** can be driven by equipment traffic, tillage, and livestock pressure, leading to surface sealing and a decline in soil structure that reduces pore space and aeration, limits root growth, and decreases water infiltration.
- **Loss of organic matter** from intensive annual crop production and topsoil erosion can reduce aggregate stability and the soil's ability to store water and cycle nutrients, making fields less resilient to both drought and heavy rain.
- **Drainage and runoff challenges** in low-lying or fine textured soils, as found throughout the Delta region, can increase ponding, delay field operations, and lead to gully erosion that carries sediment and nutrients in runoff to ditches and streams.

Taken together, these threats pose various risks to topsoil resources and agricultural productivity and may exacerbate impacts from extreme weather events like floods and drought. Soil stewardship provides a multitude of services that simultaneously benefit the production system and the environment, safeguarding the farm from threats.

Conservation and Best Management Practices

To address looming environmental issues and move agricultural production in the U.S. toward sustainability while also increasing productivity, conservation practices will need to be effective and properly implemented. Moreover, greater adoption at large scale will be necessary, especially throughout intensely farmed agricultural areas, to conserve soil, water, and habitat resources.

Strategies to reduce the environmental impacts of agriculture often focus on three complementary approaches—**avoid**, **control**, and **trap**—implemented through best management practices applied in-field, edge-of-field, and across the broader landscape. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) commonly groups conservation practices into these three broad strategies based on how they reduce risk and protect soil, water, and habitat resources. Many of the practices used to control and trap potential pollutants also provide meaningful benefits for upland and aquatic species.

The following sections offer information regarding some of the more effective and readily adopted conservation practices throughout Mississippi. This list is not exhaustive but meant to provide practical ways to enhance natural resource stewardship on working lands. See Table 1 for a summary of conservation practices and the primary resource concerns they address.

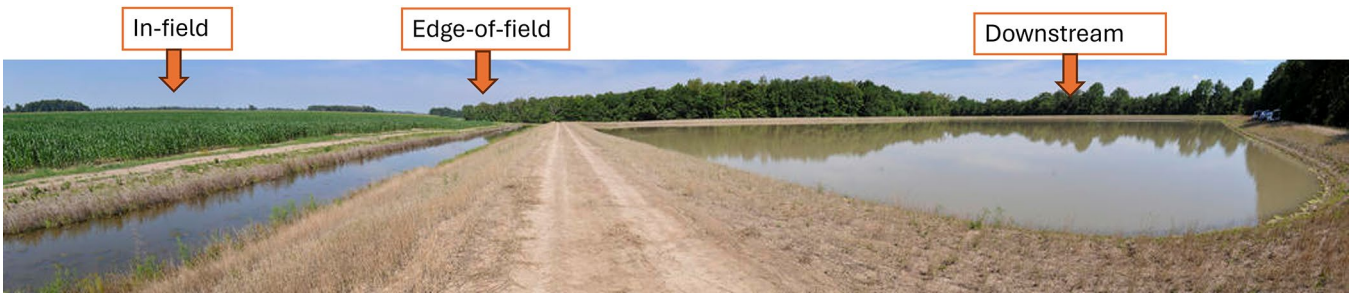

Figure 1. A farm system, indicating where best management practices aim to enhance stewardship.

Avoid

Avoid means reducing the chance of a problem before it starts. These practices focus on keeping valuable inputs working in place rather than becoming losses or liabilities. The BMPs listed below are source-focused options that improve efficiency and resilience on the front end, often supporting productivity, soil condition, and habitat at the same time.

Nutrient Management

Nutrient management (NRCS conservation practice standard 590) is an approach that aims to maximize plant productivity while minimizing environmental consequences. With this practice, producers manage the amount, source, placement, and timing of plant fertilizer amendments, typically as prescribed in a plan that accounts for available nutrient sources and production practices. Together, these variables influence available nutrients, crop yields, and environmental stewardship.

Nutrient management planning is a best management practice that is applied to all forms of fertilizer applications, from inorganic to manure. Nutrient management plans are farm-specific, tailored to available inputs, soils, natural ecosystem features, and management objectives. Nutrient management planning follows a few basic principles:

- Know what you have.
- Know what you need.
- Manage wisely.
- Document the management.

Managing fertilizer inputs may save money because you apply only what is necessary and you target amendments where they are most needed to meet crop yields. Nutrient management also has substantial benefits for the environment, as strategic fertilizer applications reduce nutrient loss from fields to downstream waters and protect surface and groundwater resources.

Practicing the 4Rs

The most basic approach to nutrient management is to adopt the 4R nutrient stewardship concept: right source, right rate, right time, and right place for nutrient application. This concept helps producers optimize nutrient management, increase crop yields, improve fertilizer efficiency, and minimize impacts to the environment. Nutrient management is a logical first step to providing economically, environmentally, and sustainable crop nutrition.

Proper Chemical Use, Storage, and Disposal

One of the simplest ways to enhance stewardship is to optimize the efficiency of agrochemicals and fertilizers by following label instructions for mixing and application. In addition, always store chemicals and fuel in covered areas, on concrete pads, and away from waterways. Always label containers and follow maintenance, safety, and disposal procedures. Properly dispose of outdated or unused chemicals by contacting your local MSU Extension office to find a pesticide waste disposal event near you.

Figure 2. Corn on a collaborating research farm.

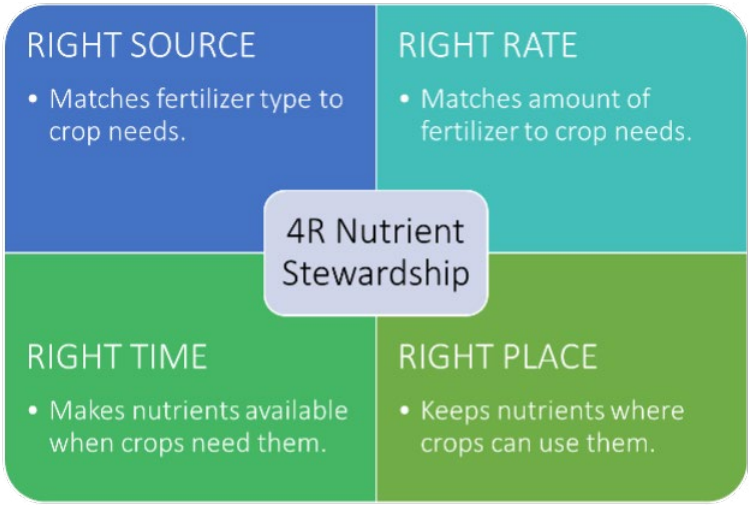

Figure 3. The 4R nutrient stewardship principles. Adapted by Beth Baker.

Control

Control means managing how forces move sediment and fertilizers across the field and farm. These practices guide, slow, or distribute flow—whether that's water, wind, equipment traffic, or other sources of stress—so they do less damage and cause fewer unintended impacts. The BMPs below emphasize controlling conditions so resources stay stable and usable, protecting soil structure, field function, and surrounding areas.

Irrigation Water Management

Irrigation water management (NRCS conservation practice 449) increases irrigation efficiency by determining and controlling the volume, frequency, and application rate of irrigation water. This approach is primarily used to manage soil moisture to promote plant growth, but it also optimizes water use and minimizes irrigation-induced erosion. It can be implemented on all irrigated lands and adapted for site conditions (e.g., slope, crop, soil, water quantity, water quality).

This practice requires an irrigation water management plan, developed in collaboration with an NRCS technical service provider, which will guide proper management of irrigation water. Programs available through the Mississippi State University Extension Service, such as PHAUCET (Pipe Hole and Universal Crown Evaluation Tool) and RISER (Row-crop Irrigation Science and Extension Research), have been developed to further assist producers in increasing their irrigation efficiency.

Figure 4. Polypipe irrigation used in the PHAUCET program.

Fencing and Stream Crossings

Install exclusion fencing (NRCS practice 382) to prevent livestock from directly accessing sensitive areas like streams or ponds. Adding a stream crossing (NRCS practice 578) to a pasture provides a stabilized area constructed across a stream to provide controlled access for people, livestock, equipment, or vehicles. Exclusion fencing and stream crossings improve water quality by reducing sediment, nutrient, and organic matter from entering water bodies and reducing erosion of streambeds and streambanks.

Figure 5. Stream crossing with exclusion fencing in a cattle pasture.

Residue and Tillage Management

Residue and tillage management (NRCS conservation practice 329) also includes no-till, strip till, and direct seeding. These practices address the amount, orientation, and distribution of crop and other plant residue covering soil year-round. Reduced tillage operations can provide a balance of soil conservation and improved seed bed conditions at planting. Implementing reduced tillage can also help incorporate fertilizer or reduce nutrient stratification within the surficial soils.

Residue and tillage management benefits soil organic matter, moisture, aeration, aggregation, and productivity. Decomposition of residue on the soil surface supports a healthy population of earthworms and other organisms. Increased water infiltration helps to reduce sheet erosion and chemical runoff, improving water quality for humans and wildlife. Crop residues also provide food and shelter for wildlife such as waterfowl. This practice can also be paired with a conservation cover crop (below) to remedy soil compaction.

Figure 6. Daikon radishes planted as a cover crop on a collaborating demonstration farm.

Conservation Crop Rotation and Cover Crops

Conservation crop rotation (NRCS conservation practice 328) involves growing a planned sequence of various crops on the same piece of land to improve soil, reduce erosion, or help break insect, disease, or weed cycles. Selecting compatible crop species that are not host to similar pathogens is an important decision when planning crop rotation sequences.

Cover crops (NRCS conservation practice 340) are planted as a soil management tool that can provide multiple benefits to a cropping system. Cover crops include grasses, legumes, or brassicas planted in fall and terminated before planting. Benefits of cover crops to cropping systems include reducing erosion, increasing above- and belowground biomass, reducing nitrate transport, suppressing weeds, improving soil moisture efficiency, and minimizing soil compaction or surface crusting.

Prescribed Grazing

Prescribed grazing (NRCS conservation practice 528) is the planned management of the amount and timing of livestock grazing to protect soil, water, and vegetation resources. By rotating animals among pastures and allowing for adequate rest and regrowth of forage, landowners can maintain healthy plant communities, reduce erosion, and improve nutrient cycling.

This practice reduces non-point source pollution by limiting bare ground and minimizing runoff of sediments and nutrients into streams and ponds. Healthy forage stands also improve water infiltration, reduce compaction, and sequester carbon in the soil. In addition to water quality benefits, prescribed grazing supports biodiversity by providing habitat for pollinators, ground-nesting birds, and other wildlife species that depend on grassland ecosystems.

Economic benefits include improved forage quality, better animal performance, and reduced feed costs. When implemented with assistance from NRCS or Extension, prescribed grazing helps Mississippi's cattle and livestock producers balance profitability with stewardship of land and water resources.

Slotted Pipes

Slotted inlet pipes (NRCS conservation practice 410) or slotted board riser pipes (NRCS conservation practice 587) are used in surface-drained fields. Water leaving the field is directed through a fixed-elevation pipe into a drainage outlet. The pipe is typically set beneath a perimeter pad (earthen dike; NRCS conservation practice 356). The slot on the field end of the pipe slows water flow and encourages sediment accumulation and retention.

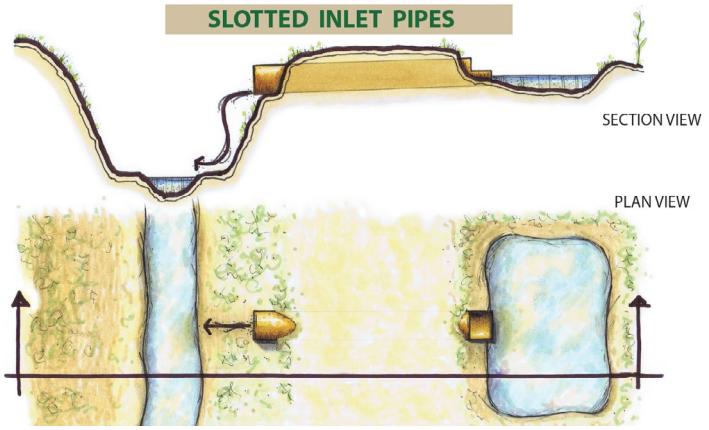

Figure 7. Illustration of slotted inlet pipes. Adapted from Kröger et al. (2015).

Figure 8. A slotted inlet pipe beneath a levee for grade stabilization and erosion control in the Mississippi Delta.

Slotted inlet pipes minimize soil loss and decrease sediment in runoff by reducing gully erosion. Preliminary research shows that between 7.3 and 41.6 pounds of phosphorus are retained per pipe. Maintenance of pipes is required to ensure their effectiveness. Preliminary data suggest cleaning sediment out from behind pipes every 396 days or about once a year.

Drainage Water Management

Drainage water management (NRCS conservation practice 554) is implemented to manage drainage volume to reduce pollutant loading or improve crop productivity. This practice is most often implemented in the Delta region, where the topography is flat to very gently sloping and uniform. In this case, fields are engineered in a manner that enables producers to manage drainage water, which may include field leveling, installation of pads or levees around field borders, and installation of drainage pipes and ditches to efficiently drain water off fields to mitigate flooding. In

some cases, drainage water may be conveyed to a tailwater recovery ditch or on-farm storage reservoir.

Seasonal Water Management for Wildlife

Post-harvest flooding of agricultural fields (NRCS practice 646) in fall and winter in regions like the Mississippi Alluvial Valley can provide critical temporary habitat for migratory birds. This is often achieved by using boards within slotted board risers to capture and hold surface water within agricultural fields. Field flooding provides important food resources for waterfowl and water birds. Waste grain such as rice has been shown to be valuable and desirable for migrating birds. Short-term flooding can improve soil condition and reduce early weed competition. Foraging waterfowl add nutrients and help break down organic matter, improving soil nutrient loads. Waterfowl also provide recreational value that can be both aesthetically pleasing and economical.

Trap

Trap means creating backstops that capture or buffer what still escapes despite your best prevention and control. These practices add storage, filtering, or settling zones where material can be retained, stabilized, or processed naturally instead of spreading further. The BMPs below are interception tools that help protect field edges, sensitive areas, and downstream resources.

Grassed Waterway

A grassed waterway (NRCS conservation practice 412) is a graded and vegetated channel that conveys concentrated runoff to a stable outlet, preventing gully erosion by slowing water velocity and improving water quality. This practice is suitable for landscapes with natural slopes and topography, where preferential flow paths already exist.

Buffers

Buffers offer many benefits:

- improve or provide habitat for aquatic, semiaquatic, and terrestrial organisms
- provide a source of debris habitat for aquatic organisms
- improve and protect water quality, stream bank stabilization, and carbon storage in the biomass and soil

Riparian forest buffers (NRCS conservation practice 391) are areas of trees and/or shrubs that are adjacent to flowing or standing bodies of water. The vegetation extends a specified distance from the body of water to provide sufficient protection from non-point source runoff. This practice is designed to serve as a buffer between agricultural fields and environmentally sensitive areas such as streams, lakes, wetlands, oxbows, or other downstream waters. Riparian buffers serve as protection for waterways from erosion and degradation, and they enhance wildlife habitat. Tree roots stabilize stream banks and slow water flow, thus reducing soil loss to erosion. Tree canopies provide shade, keeping water temperatures cool for aquatic life. Bats forage along riparian zones, feeding on flying insects and reducing agricultural pests.

Figure 9. Riparian herbaceous cover established between field borders and an adjacent drainage channel. Photo by Wes Burger.

Alternatively, if a forest buffer isn't feasible or desired, establishing a riparian herbaceous cover (NRCS conservation practice 390) is an option. This practice refers to a buffer of grasses, grass-like plants, and/or forbs that are tolerant of intermittent flooding or saturated soils. These are established between agricultural areas and aquatic habitats to slow runoff and interrupt sediment transport.

Field borders are cost-effective ways to create wildlife habitat while protecting adjacent waterways. This can be accomplished by removing low crop-yield areas like field corners or woodland edges from production. Research shows 30-foot buffers of native herbaceous vegetation can provide important habitat for pollinator insects and insect-eating birds. Periodic disturbance with light disking or prescribed fire will maintain good grassland structure and composition and prevent woody invasion.

Figure 10. A field buffer in Clay County, Mississippi. Photo by Wes Burger.

Figure 11. A drainage ditch that has undergone construction to widen the channel and create floodplain benches to create a two-stage ditch.

Similarly, filter strips planted along contour lines, ditches, streams, and other water bodies can prevent soil and agricultural chemicals from leaving crop fields while providing habitat for grassland species of birds and beneficial invertebrates.

Wetland and bottomland hardwood restoration is also possible in many places in the state. Incentive programs are available to landowners to offset the associated costs of implementation and management. Pursuit of these options can remove marginal land from production, reduce crop loss to flooding events, benefit water and soil conservation, diversify economic enterprises via hunting leases, and restore native habitats for wildlife.

Two-Stage Ditches

Two-stage ditches (NRCS conservation practice 582, Open Channel) are a drainage management approach designed to incorporate floodplain benches into a typical drainage channel. This practice can be used in both tile-drained and surface-drained acreage. Creating a two-stage ditch requires widening a channel to increase the amount of water the ditch can capture. The design mimics natural floodplains, allowing water to spread out and slow down, improving channel stability and sustainability. It was developed by observing stable streams and rivers and the associated natural processes that reduce erosion, allow more time for sediment and nutrient removal, and prevent flooding. Widening the channel and capturing more water also maintains conditions more suitable for vegetation, insects, and wildlife.

Two-stage ditches improve typical drainage functions while also improving ecological function. Two-stage ditches also reduce the need for maintenance, saving producers labor and money. In some cases, economic benefits were found to offset the (minimal) loss of productive land due to widening the channel.

Low-Grade Weirs

Low-grade weirs (NRCS conservation practices 410 and 587) are small check dams or impoundments placed at intervals within a channel (dependent on the channel slope and length to hold a certain volume). These structures are constructed by creating an earthen berm, which is overlaid with a fabric mesh for stability and then reinforced with an interlocking, prefabricated concrete structure or riprap (or both, depending on the size of the channel).

Functionally, low-grade weirs increase the water-holding ability of a drainage ditch and retain that water longer to enhance processes that remove sediment and nutrients. Research has shown that weirs can alter flow velocities and nutrient runoff. Weirs have also been shown to trap sediment and reduce nutrient runoff.

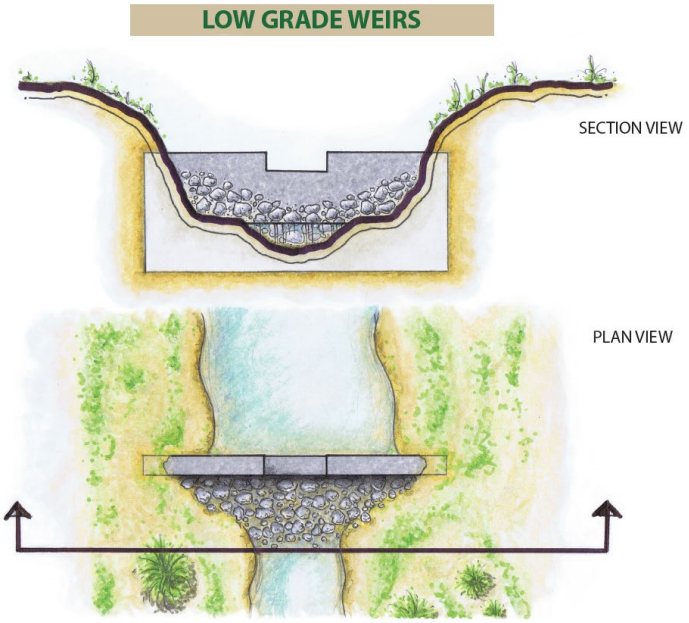

Figure 12. Illustration of a low-grade weir. Adapted from Kröger et al. (2015).

Figure 13. An interlocking, prefabricated low-grade weir reinforced with riprap retaining water on a working farm in the Mississippi Delta. Photo by Austin Omer.

Figure 14. A low-grade weir made of riprap covering an earthen berm. The structure was monitored for water quality improvements on a working farm in the Mississippi Delta.

Agricultural Conservation for Wildlife Habitat and Biodiversity

Mississippi has long been known for its hunting, fishing, and outdoor recreation opportunities. Generations of Mississippians have depended on its bottomland hardwoods, wetlands, pine forests, pastures, rivers, and coastlines for game species and other wildlife, as well as the outdoor experiences those landscapes provide. Today, most of that use occurs on farms and forests, so wildlife conservation and agricultural production must function together on the same lands.

Well-planned conservation on private lands can maintain or improve yields while also supporting white-tailed deer, wild turkey, waterfowl, songbirds, pollinators, and many other species. In most cases, this means using existing conservation practices such as buffers, cover crops, residue management, and drainage water management in ways that also add food resources and cover for wildlife, especially in areas that are already difficult or unprofitable to farm.

Wildlife in Agricultural Landscapes

The abundance and diversity of wildlife on a property are largely determined by how food, water, and cover are distributed across the landscape. In much of Mississippi, especially the Mississippi Alluvial Valley, those resources now occur in a mix of ditches, field edges, levees, remnant forest tracts, altered water bodies, pastures, hay fields, timberlands, and crop fields. Under these conditions, wildlife are no longer an automatic byproduct of production. Habitat often must be planned, provisioned, and managed.

On farms and forests, wildlife often benefit when landowners and producers:

- **Use edges and low-yield areas for habitat.** Retire marginal corners, low-elevation areas, ditch margins, and awkward field edges from production and establish native grasses and forbs or other herbaceous vegetation to provide nesting and escape cover.
- **Manage cropland to leave structure and food on the ground.** Reduced- or no-till systems, residue left on the soil surface, and diverse cover crops can supply waste grain, seeds, and insects that support birds and other wildlife while improving soil health.
- **Take advantage of wet areas and drainage features**. Problem wet spots, shallow flood-prone areas, and drainageways can be managed as grassed waterways, shallow wetlands, or seasonally flooded fields that provide both water and foraging habitat for waterfowl, wading birds, and other species.
- **Include woody and shrubby cover where compatible.** Retaining small thickets, scattered shrubs, and mast-producing trees in non-cropped areas adds important structure for deer, turkeys, rabbits, and many songbirds without removing large acreages from production.

Figure 15. Flooded bottomland hardwood forest in Mississippi. Photo credit: Kara Hall

Wildlife response to these practices will depend on how much suitable habitat already exists on and around the farm. Where new habitat is added to a landscape that already contains some woods, wetlands, or grasslands, relatively small changes can lead to noticeable improvements in farmland wildlife.

Linking Practices to Wildlife Species

Many landowners are most interested in how specific conservation practices relate to familiar game species such as white-tailed deer, waterfowl, bobwhite quail, and wild turkeys, as well as non-game species such as songbirds and pollinators. Here are some general points:

- **Field borders and native grass or forb strips.** These areas provide nesting and brood-rearing cover for bobwhites and wild turkeys, fawning cover for white-tailed deer, and important structure and seeds for many farmland songbirds. Flowering forbs in these plantings also supply nectar and pollen for pollinators.
- **Cover crops, crop residue, and waste grain.** Cover crops and crop residue left on the surface provide green forage and waste grain for white-tailed deer and wild turkeys, as well as invertebrates and seeds for bobwhites and songbirds.

- **Shallow flooded fields, grassed waterways, and small wetlands.** Seasonally flooded grain fields, grassed waterways that hold shallow water, and small restored wetlands provide feeding areas for waterfowl and wading birds. The moist-soil plants and invertebrates produced in these areas also support shorebirds, amphibians, and many insect-eating songbirds.
- **Woody thickets, hedgerows, and mast-producing trees.** Brushy draws, hedgerows, and clumps of oaks, plums, persimmons, and other mast-producing trees offer browse, hard mast, and soft fruit for white-tailed deer and wild turkeys, as well as escape cover for bobwhites, rabbits, and a variety of songbirds.
- **Flowering plantings and reduced insecticide use in key areas.** Patches of flowering forbs in borders, around garden plots, or in other small areas, combined with careful timing and placement of insecticides, provide nectar, pollen, and insect prey for pollinators, bobwhites, wild turkey broods, and many songbirds.

These patterns will vary from farm to farm, but thinking in terms of which species you care most about and which practices serve them best can help landowners prioritize where to start.

Disturbance and Habitat Management

Disturbance is a normal part of healthy plant communities. On working lands, planned disturbance can be used to keep vegetation in a condition that benefits wildlife and fits the operation. The type, timing, and frequency of disturbance all matter. Here are some common disturbance tools:

- **Prescribed fire.** Carefully planned burns can remove dead plant material, set back brush, and encourage a mix of grasses and forbs that benefit bobwhites, wild turkeys, deer, and many songbirds. Fire should be used only under the right weather conditions and with proper safety planning.
- **Herbicide treatments.** Spot spraying or strip treatments with appropriate herbicides can be used to control invasive plants or overly dense cover and to release desirable grasses, forbs, or shrubs. Always follow the label and consider how treatments might affect the plants and insects that wildlife use.
- **Disking or tillage in selected areas.** Light disking in strips or patches can create bare ground and stimulate annual plants that produce seeds and insect resources for bobwhites, waterfowl, wild turkeys, and other ground-feeding birds. Only a portion of a field or cover area should be disked at a time so that some undisturbed cover is always available.
- **Tree removal and thinning.** Selective removal or thinning of trees can open the canopy and allow sunlight to reach the ground, promoting grasses, forbs, and shrubs that provide food and cover. This can include thinning dense pine stands or feathering wood edges where trees meet open fields.

Because these tools can affect both vegetation and wildlife, landowners should seek technical support from a local private land wildlife biologist, Extension agent, or other conservation professional before using prescribed fire or making major herbicide, disking, or tree removal decisions.

Landscape and Resource Connectivity

In addition to the amount of habitat available, the way those resources are connected across the property can influence how useful they are to wildlife. Many species move daily or seasonally among feeding, loafing, nesting, and escape cover. When food, water, and cover are linked rather than isolated, animals can use them more effectively.

Practical ways to improve this connectivity on working lands include:

- **Riparian and ditch buffers.** Establish or maintain strips of trees, shrubs, or herbaceous cover along streams, ditches, and drains to link upland fields with wetter areas and provide continuous movement routes, shade, and bank stability.
- **Continuous field edges and strips.** Use field borders, filter strips, and grassed waterways so that patches of cover are connected instead of being small islands surrounded by bare soil or closely cropped ground.
- **Stepping-stone habitat patches.** Create or retain small patches of cover such as brush piles, thickets, grass strips, or small wetlands between larger forest blocks, grasslands, wetlands, or ponds so that wildlife can move between them in short steps.

Not every species requires long-distance movement to benefit, but thinking about how resources connect across the farm and with neighboring lands can make existing conservation practices more effective for wildlife.

A Growing Need for Wildlife Conservation

Roughly 70 percent of land in the lower 48 states is privately owned. There simply is not enough public land, especially in the southeast U.S., to provide sufficient wildlife habitat for long-term sustainability. This means the way private land is managed has a major influence on wildlife.

Wildlife response to conservation practices on a farm will depend on how much habitat is available, its quality, and how it is arranged on and around the property, as well as which practices are used. When new habitat is added in a landscape that already contains abundant, high-quality woods, wetlands, or grasslands, landowners can often see large gains in farmland wildlife while giving up only a small amount of production area. In contrast, farms located in landscapes where wildlife resources are scarce or of generally

Figure 16. Common buckeye butterfly.

low quality are less likely to show major changes from minor habitat improvements alone and may require more extensive or targeted conservation to produce a strong response.

The conservation and best management practices described in this publication provide specific tools that landowners can use to supply food, cover, and connectivity while maintaining productive agricultural operations.

Role of NRCS and Resource Conservation Planning

Why Do I Need a Plan?

In the same fashion any business would lay out a 5- or 10-year plan, it is important for producers to have a business plan that includes reinvestment in the most critical resource they have—their land. Ensuring the operation can persist for generations will require a view toward conservation of the resources necessary for sustainability. This planning process bridges producers' economic needs and societal benefits with the natural ecosystem to sustain resources for the long term.

What Does the Plan Look Like?

Conservation planning involves nine steps.

1. Identify problems and opportunities based on readily available information.
2. Determine landowner objectives and develop a way to meet them while accounting for ecological protection.
3. Inventory resources, including natural and economic information for the target area.
4. Analyze the resource data to clearly define existing natural resource conditions. This is a crucial step to developing plans that will work for landowners and their land.
5. Formulate alternatives or options for achieving the plan objectives that solve all identified problems and take advantage of opportunities.
6. Evaluate alternatives to determine their effectiveness.
7. Select a plan or project that best works for the landowner.
8. Implement the selected plan.
9. Evaluate the outcomes of the plan and adjust as needed.

Conservation planning is an ongoing process, and evaluation allows you to see what's working to move your land management in the desired direction.

Who Can Help Me with the Plan?

To learn more about the planning process or to get in touch with someone who can start the process with you, visit your local NRCS field office. At the field office, a staff conservationist will work with you to discuss your goals and develop a conservation plan. Once the plan is complete, technical assistance is available to help you with implementing conservation practices.

You also may be eligible for financial assistance. Following the development of a plan, NRCS staff will assist you with the completion of an application for financial assistance programs. All applications are then ranked in eligibility by NRCS according to local resource concerns.

Farm Bill and Financial Assistance

The Agriculture Improvement Act of 2018 (commonly known as the 2018 Farm Bill), as extended, is the most recent farm bill to be enacted. Title II – Conservation continues to provide the framework for federally funded conservation programs on privately owned lands. Conservation efforts are organized around four broad categories:

1. retirement of environmentally sensitive land from production
2. environmental enhancements on working lands
3. purchase of easements to protect natural resources for agriculture and the environment
4. partnerships to address regional environmental concerns

The 2018 Farm Bill reaffirmed Congress's emphasis on active conservation, maintaining support for land retirement programs while strengthening initiatives focused on easements and partnerships. As in prior legislation, eligibility for crop insurance premium support remains tied to conservation compliance, reinforcing the link between farm safety net programs and the expectation that landowners and operators contribute to environmental stewardship.

The 2018 Farm Bill continued the consolidation of conservation programs into five primary tools: Conservation Reserve Program, Conservation Stewardship Program, Environmental Quality Incentives Program, Agricultural Conservation Easement Program, and Regional Conservation Partnership Program. Each program was reauthorized and modified to provide flexibility, broaden participation, and target outcomes important to both agricultural productivity and environmental quality.

Conservation Reserve Program (CRP)

Established by President Ronald Reagan in 1985, CRP is the largest private-lands conservation program in the U.S. The program is administered through the U.S. Department of Agriculture's Farm Service Agency and provides annual rental payments to enrolled farmers who agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental quality.

The long-term goals of CRP are to improve water quality, prevent soil erosion, and reduce wildlife habitat loss through the reestablishment of valuable land cover. Contracts provide support for 10–15 years. The CRP was reauthorized through fiscal year 2023 and will gradually expand to a cap of 27 million acres—down from a high of 32 million acres in fiscal year 2014.

Conservation Stewardship Program (CSP)

CSP helps eligible producers maintain and improve existing conservation practices and adopt new ones—using a whole-farm approach—while maintaining agriculture production. Participants earn annual financial rewards based on their conservation performance.

The 2018 Farm Bill shifted CSP away from an acreage-based enrollment cap toward annual funding limits, with $700 million in 2019 rising to $1 billion annually by 2023. Contracts remain 5 years in length, offering payments for both new practices and enhancements to existing ones.

Environmental Quality Incentives Program (EQIP)

EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to plan and implement conservation practices to address environmental concerns.

Under the 2018 Farm Bill, EQIP was authorized with funding that grows to $2.025 billion annually by 2023. Key updates included increasing flexibility for livestock operations, expanding support for irrigation efficiency, and designating 10 percent of EQIP funds for practices that benefit wildlife habitat.

Agricultural Conservation Easement Program (ACEP)

ACEP provides financial and technical assistance for conservation on agricultural lands and wetlands. Land easements contracted through ACEP protect the long-term viability of the nation's food supply by preventing conversion of productive working lands to non-agricultural uses. Additional public benefits of protected land include environmental quality, historic preservation, wildlife habitat, and protection of open space.

The 2018 Farm Bill strengthened ACEP by authorizing $450 million annually and refining eligibility for agricultural land easements, including provisions to support grasslands of special environmental significance. Wetland reserve easements continue to prioritize projects that enhance habitat for migratory birds and wildlife while sustaining agricultural viability.

Regional Conservation Partnership Program (RCPP)

RCPP builds partnerships between producers, states, tribes, nonprofits, and private organizations to address regional and watershed-scale conservation priorities.

The 2018 Farm Bill significantly expanded RCPP, providing $300 million in annual funding and streamlining program administration. The legislation increased flexibility for partners and broadened eligible activities, enhancing RCPP's role as a vehicle for locally led, collaborative conservation projects. Notable examples include the Lower Mississippi Valley Joint Venture, which focuses on migratory birds, and the Mississippi Basin Healthy Watersheds Initiative, which is designed to target nutrient reductions in the basin through conservation practices on working lands.

Table 1. Conservation practices and the key soil, water, and habitat benefits they provide.

Resource Concern	Practice (NRCS)	Key Impacts/Outcomes
Nutrient loss, water quality	Nutrient Management (590) (4R approach)	Optimizes source–rate–time–place to reduce nutrient loss risk; improves input efficiency
Chemical contamination risk	Proper Chemical Use, Storage, Disposal (309, 590)	Reduces spill/misapplication risk; improves safety and compliance
Soil erosion, sediment loss	Residue & Tillage Management (329)	Maintains soil cover; reduces erosion; improves infiltration/soil structure over time
Soil erosion, sediment loss	Cover Crops (340)	Protects soil, adds biomass/roots, improves infiltration; can reduce sediment and nutrient transport
Soil erosion, gully formation (concentrated flow)	Grassed Waterway (412)	Stabilizes flow path; prevents gullies; safely conveys runoff without scouring
Soil health, compaction, crusting	Cover Crops (340)	Improves soil aggregation and rooting; can reduce surface crusting and compaction risk
Soil health, pest–weed–disease cycles	Conservation Crop Rotation (328)	Diversifies crops/management; disrupts pest/disease/weed cycles; supports soil function
Excess water, drainage and field trafficability	Drainage Water Management (554)	Controls drainage outflow timing/volume; can improve field conditions and reduce off-site losses
Irrigation efficiency, runoff risk	Irrigation Water Management (449)	Improves application efficiency; reduces runoff/erosion risk tied to overwatering
Streambank erosion, livestock impacts	Exclusion Fencing (382) + Stream Crossing (578)	Reduces direct trampling and bank damage; limits direct manure inputs; stabilizes access points
Riparian filtering, sediment and nutrient interception	Riparian Forest Buffer (391)	Filters runoff, stabilizes banks, provides shade/habitat; improves stream corridor function
Riparian filtering, sediment interception	Riparian Herbaceous Cover (390)	Slows runoff; traps sediment; provides protective cover adjacent to waterways
Drainage-channel erosion, sediment loss	Slotted Inlet Pipes (410) + Slotted Board Riser (587)	Reduces headcutting and ditch erosion; lowers sediment delivery from field inlets
Sediment, nutrient transport in drainage network	Low-Grade Weirs (410)	Increases water residence time; promotes sediment settling; reduces downstream sediment transport
Channel stability, flashy flows, sediment transport	Two-Stage Ditches (582, Open Channel)	Adds bench/floodplain function; improves stability; can reduce maintenance and improve settling/processing
Forage condition, bare ground runoff risk	Prescribed Grazing (528)	Maintains vegetative cover; improves pasture condition; reduces runoff/erosion from overuse
Wildlife habitat (working lands)	Seasonal Water Management for Wildlife (646)	Provides seasonal habitat; water control can support wildlife objectives (and some ancillary field benefits)

References

Burger Jr., L. W., Barbour, P. J., Hamrick, R., & Smith, M. (2006). Conservation buffers: Wildlife benefits in Southeastern agricultural systems. Forest and Wildlife Research Center, Mississippi State University.

Congressional Research Service (CRS). (2019). The 2018 Farm Bill (Agriculture Improvement Act of 2018): Summary and key provisions (Report No. R45525). https://www.congress.gov/crs-product/R45525

Kröger, R., Moore, M. T., Farris, J. L., & Gopalan, M. (2011). Evidence for the use of low-grade weirs in drainage ditches to improve nutrient reductions from agriculture. Water, Air, and Soil Pollution, 221(1), 223–234. https://doi.org/10.1007/s11270-011-0785-x

Kröger, R., Prince Czarnecki, J. M., Tank, J. L., Christopher, S. F., & Witter, J. D. (2015). Implementing innovative drainage management practices in the Mississippi River Basin to enhance nutrient reductions. JAWRA Journal of the American Water Resources Association, 51(4), 1020–1028. https://doi.org/10.1111/1752-1688.12342

Maupin, M. A., Kenny, J. F., Hutson, S. S., Lovelace, J. K., Barber, N. L., & Linsey, K. S. (2014). Estimated use of water in the United States in 2010. U.S. Geological Survey Circular 1405. https://pubs.usgs.gov/circ/1405/

Posadas, B. C. (2023, August 17). Comparative economic contributions of Mississippi and Alabama seafood industry in 2020. Mississippi–Alabama Sea Grant Consortium. https://masgc.org/article/comparative-economic-contributions-of-mississippi-and-alabama-seafood-indus

Reneicke, K. J., & Loesch, C. R. (1996). Integrating research and management to conserve wildfowl (Anatidae) and wetlands in the Mississippi Alluvial Valley, USA. In M. Birkan (Ed.), Anatidae 2000: An international conference on the conservation, habitat management, and wise use of ducks, geese, and swans (pp. 927–940). https://pubs.usgs.gov/publication/5210970

The Nature Conservancy. (2015). The two-stage ditch is a win-win for agriculture and conservation.

United States Department of Agriculture Natural Resource Conservation Service (USDA–NRCS). (n.d.). Soil health. https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/

Usborne, E. L., Kröger, R., Pierce, S. C., Brandt, J., Goetz, D. (2013). Preliminary evidence of sediment and phosphorus dynamics behind newly installed low-grade weirs in agricultural drainage ditches. Water, Air, and Soil Pollution, 224, 1520. https://doi.org/10.1007/s11270-013-1520-6

Publication 3050 (POD-04-26)

Revised by **Beth Baker**, PhD, Associate Extension Professor and Assistant Director, Wildlife, Fisheries, and Aquaculture; **James Callicutt**, Extension Instructor I, Wildlife, Fisheries, and Aquaculture; **Brendan Zurweller**, PhD, Associate Professor, Plant and Soil Sciences; and **Mark J. Hill**, Extension Associate, Wildlife, Fisheries, and Aquaculture; from an earlier version by Beth Baker; Austin Omer, former Extension Associate, Wildlife, Fisheries, and Aquaculture; Larry Oldham, PhD, Extension Professor (retired), Plant and Soil Sciences; and Leslie Burger, PhD, Associate Teaching Professor, Wildlife, Fisheries, and Aquaculture.

MISSISSIPPI STATE UNIVERSITY EXTENSION

Produced by Agricultural Communications.

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. ANGUS L. CATCHOT JR., Director