

Draft Compatibility Determination

Draft Compatibility Determination for Cooperative Farming, Pee Dee National Wildlife Refuge

Refuge Use Category

Agriculture, Aquaculture, and Silviculture

Refuge Use Type

Farming (Cooperative)

Refuge

Pee Dee National Wildlife Refuge

Refuge Purpose and Establishing and Acquisition Authority

Managed by the U.S. Fish and Wildlife Service (USFWS, Service), Pee Dee National Wildlife Refuge (NWR, refuge) was established by Congress in October 1963, under authority of the Migratory Bird Conservation Act [16 United States Code (USC) §715d, as amended].

The purpose of the refuge is “...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.”

National Wildlife Refuge System Mission

The mission of the National Wildlife Refuge System, otherwise known as Refuge System (NWRS), is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (Public Law 105-57; 111 Statute 1252).

Description of Use

Is this an existing use?

Yes.

Cooperative farming has been conducted on the refuge since the 1960s. The use was previously analyzed in the Environmental Assessment (EA, USFWS 2008a) for the refuge's Comprehensive Conservation Plan (CCP, USFWS 2008b); the Finding of No Significant Impact (FONSI) for the CCP's EA was signed in September 2008 (USFWS 2008b). At that time, the cooperative farming use was found to be appropriate and compatible at Pee Dee NWR (USFWS 2008b). The 2013 Habitat Management Plan

(HMP) for the refuge stepped down the CCP, providing additional information and clarification for management of refuge habitats, including cooperative farming (USFWS 2013). Service policy requires the regular re-evaluation of the use [603 FW 2.11(H)].

The use was evaluated in conjunction with the Service's Programmatic Environmental Assessment for Use of Genetically Engineered Agricultural Crops for Natural Resource Management on National Wildlife Refuges in the Southeastern United States (GEC PEA) and FONSI (USFWS 2020). Under this 2020 decision (USFWS 2020), the Service has the flexibility to consider the use of GECs and non-GECs in rotation, as appropriate and guided by the overall NWR purposes; refuge goals and objectives; and other policy, guidance, and decision documents.

Tiering a Categorical Exclusion (CatEx) / Environmental Action Statement (EAS) from the 2008 CCP/EA/FONSI (USFWS 2008a, 2008b) and the 2020 GEC/PEA/FONSI (USFWS 2020), the current action would replace the existing Pee Dee NWR Cooperative Farming Compatibility Determination (CD) with this CD, once finalized.

What is the use?

Farming is a habitat management tool used on NWRs in the Southeast Region to provide high-energy food sources for millions of wintering ducks, geese, cranes, swans, and other migratory bird species, to serve landscape level goals and objectives [e.g., outlined in the North American Waterfowl Management Plan (NAWMP), U.S. Department of the Interior (US DOI), Environment Canada (EC), and Environment and Natural Resources Mexico (ENRM) 2018] and refuge management purposes, goals, and objectives (USFWS 2008b). Farming is the practice of agriculture, especially mechanically disturbing the soil and artificially introducing seeds or other plant parts periodically to produce stands of plants, for use primarily as food for wildlife, domestic animals, or humans. This includes water delivery, irrigation, and drainage.

Cooperative farming on NWRs is a tool used by the Service whereby agricultural practices are employed with substantial involvement of the Service to supplement natural ecosystem processes to meet Service-desired biological outcomes. Cooperative farming is used on NWRs in situations where the Service cannot otherwise meet its resource management objectives (e.g., through the maintenance, management, or mimicry of natural ecosystems processes or functions). More specifically, cooperative farming is a refuge management economic use whereby a farmer, under a Cooperative Agriculture Agreement (CAA) with the Service, produces crops on a refuge, and in lieu of a rental payment, leaves an agreed upon share of the unharvested planted crops for wintering waterfowl and other wildlife species, supporting refuge purposes, goals, and objectives.

The cooperative farmer (cooperator) is responsible for all equipment, fuel, seed, fertilizer, Service approved pesticides, and labor necessary to produce a crop on the NWR. Refuge staff are responsible for identifying the type(s) and location(s) of crops

to be planted, providing the farmer with an approved list of pesticides for use, and identifying the refuge's crop share that will contribute to refuge management goals and objectives. The amount of crop planted by cooperative farmers varies somewhat from year to year relative to the effects of rainfall and flooding, thus the NWR's share varies. The unharvested share of the planted crop is often flooded to make it more attractive for wintering waterfowl. As part of the cooperative farming contract, the refuge retains the crops on 25% of the acreage. This use is a long-standing practice on NWRs and is outlined in the Service's Cooperative Agricultural Use policy ([620 FW 2](#)) and addressed in 50 CFR §§29.1-29.2 (addressing economic uses and cooperative land management). Other key policies include 601 FW 3 Service Biological Integrity, Diversity, and Environmental Health; 569 FW 1 Service Integrated Pest Management; and 517 DM 1 DOI Pesticide Use Policy.

Associated facilities

Existing roadways support refuge management access and multiple public uses, including cooperative farming. Existing water control structures support refuge habitat management activities, including flooding agricultural fields following harvest activities. While these facilities support the cooperative farming use, they are maintained for multiple management needs and public uses and would be maintained irrespective of cooperative farming.

Is the use a priority public use?

No

Where would the use be conducted?

Cooperative farming on the refuge would be conducted within the existing 1,061 acres of croplands on the refuge, located in Anson and Richmond counties, North Carolina (Figure 1). Approximately 980 acres would be planted in crops each year, meaning the use would occur on approximately 12 percent of the refuge's total acres. Future acquisition of property within the approved refuge boundary could include additional croplands that could be managed using cooperative farming to serve refuge purposes, goals, and objectives. Refuge croplands are located within three distinctive units, as described below.

Arrowhead Unit: The Arrowhead Unit is situated in Anson County, NC and includes all refuge fields south of Grassy Island Road. This unit includes 19 upland fields which comprise 346 acres.

Pee Dee Unit: The Pee Dee Unit is situated in Anson County, NC and includes all refuge fields from Grassy Island Road north to the Pee Dee River. This unit includes 37 fields which comprise 589 acres. Pee Dee Unit includes 12 upland fields comprising approximately 263 acres and 25 bottomland fields comprising approximately 326 acres.

Richmond Unit: The Richmond Unit is situated entirely in Richmond County, NC.

This unit includes seven refuge fields which comprise 126 acres. Richmond Unit includes three upland fields comprising approximately 58 acres and four bottomland fields comprising approximately 69 acres.

Approximately 37 percent of refuge croplands are located within the Pee Dee River floodplain. These fields are mostly surrounded by bottomland hardwood forests. The remaining 63 percent of refuge croplands are in uplands, mostly adjacent to Grassy Island and Pinkston River Roads. These fields are surrounded by pine forests and mixed pine-hardwood forests. Future acquisition of property for the refuge could include additional croplands that could be managed under cooperative farming for an interim period or for the long term to serve refuge purposes, goals, and objectives.

When would the use be conducted?

Cooperative farming activities (e.g., preparing fields, planting, and harvesting) generally occur during daylight hours between March 25 and November 10. Potential management techniques would include drawdowns, disking, mowing, and planting, which could begin as early as mid-March and as late as the end of July. Crop preparation activities can be delayed by impoundment draw-down and spring rainfall. The harvest of crops normally begins in September and extends into early November. Fall rains can delay harvest past the preferred November 10 deadline. Winter wheat and other cover crops are normally planted between early September and November 25; these are present throughout the winter months. Winter wheat treatments (e.g., fertilization) may occur from November through February, but generally occur when plants begin to grow in the late winter or early spring. Wheat harvest generally occurs in late May and early June. Active management in field borders and vegetative buffers will generally occur between October 1 and March 31, prior to bird nesting season, and does not include bottomland areas where waterfowl may be present. Treatment of invasive species generally occurs between April and October where needed in the farming units.

How would the use be conducted?

Supporting refuge purposes, and goals and objectives outlined in the CCP (USFWS 2008b) and stepped down from NAWMP (USDOI EC ENRM 2018, Hagy et al. 2020), cooperative farming is administered under the terms and conditions of a Special Use Permit (SUP) and associated Cooperative Agriculture Agreement (CAA) issued by the Refuge Manager. The terms of the permit and agreement ensure that all current Service and refuge guidelines and restrictions are followed. Permittee selection and associated determinations of costs and/or shares follow relevant guidance (including 50 CFR §§29.1-29.2 and 620 FW 2) and Southeast Region-specific guidance for cooperative farming.

Annual or short-term (no longer than 5-year) CAAs are established with farmers prior to the planting season. Within the CAA, an Annual Work Plan outlines the

crop(s), location(s), and acreages to be planted during the coming year and is signed by the cooperative farmer (cooperator) and the refuge manager or designee. The cooperator is responsible for all equipment, fuel, seed, fertilizer, chemicals, and labor necessary to produce the crop. Cooperative farmers are required to perform soil tests to determine nutrient needs (fertilizer and lime applications) according to the North Carolina Agriculture Extension Service. Cooperators may use a variety of farming and conservation practices (e.g., till, no-till, and organic) recommended by the North Carolina State Extension and Natural Resources Conservation Service, U.S. Department of Agriculture (USDA), as they pertain to land use and the culture of the various crops being grown on the refuge. These practices will be approved in advance by the Service during the development of the Annual Work Plan.

The agricultural crops now commonly planted on the refuge include corn, rice, soybean, grain sorghum, millet, and wheat. These crops provide nutritious seeds consumed by most species of waterfowl, cranes, and/or other wildlife and vegetative material of wheat (green browse) that is considered a desirable food for geese. Other crops that may be planted for specific wildlife management purposes are sunflower, cover crops (e.g., rye, clover), and canola, but their use is uncommon in the southeast.

The Service will take its shares as unharvested corn or will specifically designate additional crop(s) and acres to be accepted as rent shares (e.g., millet, sorghum, and/or other crop or combination). Shares are acreage-based. At Pee Dee NWR, the cooperators have an 80% share, and the refuge has a 20% share. Cooperators will also plant winter wheat for green browse, with an annual target of 75 acres. The vegetative buffers will be adaptively managed to produce robust cover in an early successional stage by mowing and/or disking every three years or as needed. Refuge staff will monitor these buffer strips and modify management in the CAA as needed to promote the desired mix of vegetation and wildlife responses.

Cooperative farming is a component of the refuge's annual habitat management program, and activities conducted by the cooperative farmer support the accomplishment of refuge goals and objectives. Best management practices (BMPs) are followed in the implementation of cooperative farming. Forested, planted, or undisturbed (fallow) vegetative buffer strips are established between all farm fields and any adjacent wetlands and streams. Refuge staff prepare and submit pesticide use proposals (569 FW 1 and 7 RM 14) for application of all pesticides; the Service approves only those PUPs that will not have undue negative impacts to non-target plants, fish, and wildlife resources under the proposed application methods.

Inputs typically associated with crop production include rotation of genetically engineered crops (GECs) and non-GECs, fertilizer (including synthetic fertilizers, manures, and composts containing nitrogen, phosphorus, and potassium), application of pesticides (including insecticides, herbicides, and fungicides; Olson and Sander 1988, Hoeft et al. 2000, McLeod and Studebaker 2006), and/or use of irrigation.

In June 2020, the Service issued a decision to allow the use of GECs on NWRs in Department of the Interior Regions 2 and 4 for natural resource management in agricultural practices to cultivate supplemental foods for wildlife, manage invasive species, and provide opportunities for wildlife-dependent public recreation, such as wildlife observation (USFWS 2020). GEC use will be part of an Integrated Pest Management (IPM) approach to manage pests, weeds, and invasive species that combines biological, cultural, physical/mechanical, and chemical tools in a way that minimizes economic, health, and environmental risks (USFWS 2020). IPM combines pest, weed, and invasive species biology, environmental information, and available technology to prevent unacceptable levels of damage through the most economical means, while posing the least possible risk to people, property, resources, and the environment. The underlying philosophy of IPM is that pest, weed, and invasive species control is most effective when a range of measures is deployed in a manner that diminishes the likelihood that the pest, weed or invasive species will become resistant to the measures. IPM allows the use of a system to combat weeds and pests that minimizes the use of pesticides, increases conservation practices, and strives to decrease any effects to air, water, or soil quality. The integration and use of GECs with other IPM practices would allow the Service to be more effective in meeting refuge purposes. GECs and non-GECs would be used in rotation, as appropriate and guided by the overall NWR purposes; refuge management goals and objectives; and other policies, guidance, and decision documents.

Interior Regions 2&4 use a tiered analysis to determine whether a GEC can be used on a NWR based on the following:

1. U.S. Department of Agriculture, Animal and Plant Health Inspection Service's (APHIS's) specific NEPA analysis and de-regulation or exemption of the GEC;
2. The Region's programmatic NEPA analysis of GEC use (GEC PEA; USFWS 2020);
3. NEPA analysis of farming on the Pee Dee NWR through the CCP and HMP (USFWS 2008b and 2013) and GEC use (see associated Categorical exclusion Environmental Action Statement Catex/EAS); and
4. Analysis of whether such GEC use would meet the essentialness requirement of the BIDEH Policy.

The GEC PEA FONSI concluded that the use of GECs as analyzed presented no significant impacts to the physical, biological, and socio-cultural environments (USFWS 2020). Tiering from the GEC PEA and FONSI (USFWS 2020) (which is the second tier above), the EA and FONSI for the CCP and EAS/HMP for Pee Dee NWR (USFWS 2008b and 2013), and this associated EAS would serve the third tier listed above for the use of GECs to help meet refuge purposes, goals, and objectives. The fourth tier of analysis from above will only occur for GEC use on a NWR that met the first three tiers.

Pesticide use by the refuges' cooperative farmers generally include pre-planting

burndown in conservation tillage operations, pre-emergence treatments to prevent dormant pests from becoming established, and post emergence treatments to control existing pests that exceed economic threshold levels. Pesticide use may include insecticides, herbicides, and fungicides.

Recently, the Service clarified four tiers of analysis to support NEPA compliance related to the use of pesticides on units of the Refuge System to support refuge purposes, goals, and objectives, as listed.

- Pesticide specific analysis by the U.S. Environmental Protection Agency (EPA)
- Pesticide specific analysis through the Service's Pesticide Use Proposal (PUP) system
- General pesticide analysis for a specific refuge, group of refuges, or refuge complex through an EA/FONSI or Environmental Impact Statement (EIS)/Record of Decision (ROD)
- General pesticide analysis through a periodic Environmental Action Statement that documents the pesticide use/treatment planned for a specific refuge, group of refuges, or refuge complex.

The Service only permits the use of EPA-registered pesticides to control crop pests, in conjunction with other control measures as needed, to protect crops and enhance production to meet economic thresholds for cooperative farmers. All pesticides distributed or sold in the United States must be registered (licensed) by EPA. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA, 7 USC §136 et seq.) provides for federal regulation of pesticide distribution, sale, and use. Before EPA may register a pesticide under FIFRA, the applicant must show, among other things, that using the pesticide according to specifications "will not generally cause unreasonable adverse effects on the environment." EPA conducts ecological, human health, and cumulative risk assessments to evaluate the potential for health and ecological effects of each pesticide proposed to be sold in the U.S. Before allowing a pesticide product to be sold on the market, EPA ensures that the pesticide will not pose any unreasonable risks to plants, wildlife, and the environment through an ecological risk assessment. EPA also conducts a human health risk assessment, which is the process to estimate the nature and probability of adverse health effects in humans who may be exposed to chemicals in contaminated environmental media, now or in the future. In addition, EPA conducts a cumulative risk assessment to evaluate the risk of a common toxic effect associated with concurrent exposure by all relevant pathways and routes of exposure to a group of chemicals that share a common mechanism of toxicity.

Application of pesticides must follow the Department of Interior's Pesticide Use Policy (517 DM 1) and the Service's Integrated Pest Management policy (569 FW 1). The Service also conducts annual analysis of pesticide usage through the Service's Pesticide Use Proposal (PUP) System and approves only those PUPs that will not have undue negative impacts to non-target plants, fish, and wildlife resources under the

proposed application methods. Intra-Service Section 7 Endangered Species Act (ESA) consultations are also completed on the application of all pesticides in coordination with preparing and submitting the PUPs. Best Management Practices (BMPs) are also utilized, in addition to label restrictions imposed by EPA, to reduce the chances of any negative effects on non-target species, including bats, pollinators, and threatened and endangered species. Example BMPs include a minimum buffer distance to water and restricting a pesticide to one application per field. Pesticides are generally used on Service farmland due to expected pest densities and/or when pest densities reach economic threshold levels. Pesticide use by the refuges' cooperative farmers generally include pre-planting burndown; seed treatments to protect seeds and emerging crops from disease and/or insects; pre-emergence treatments to prevent dormant pests from becoming established; and post emergence treatments to control existing pests that exceed economic threshold levels. A list of pesticides and associated BMPs approved for use through the PUP process for that calendar year must be attached to the CAAs for Pee Dee NWR. In almost all cases, Service pesticide use restrictions are more restrictive than the EPA-registered pesticide label restrictions. Any Service use of pesticides is to help the Service support refuge purposes, goals, and objectives. The Service prepared the Pee Dee NWR CCP and associated EA (USFWS 2008) and HMP/Categorical Exclusion Environmental Action Statement (USFWS 2013) to analyze the effects of the farming program, including the use of pesticides. A list of pesticides approved by the Service for use on the Refuges through the PUP System will be provided each year to the cooperative farmers.

The cooperator assumes responsibility for all associated costs for crops grown. Modifications to the original CAA, or that year's Annual Work Plan may occur throughout the farming season through addendums that have been agreed upon and signed by both the cooperator and Service. The Refuge Manager or designee will administer the cooperative farming program and be required to prepare CAAs, meet with farmers, submit PUPs for approval, verify crop plantings, and negotiate any necessary addendums during the year. The above-listed tiers related to pesticide analysis and use have been satisfied at Pee Dee NWR.

The refuge's purposes, goals, and objectives must be the priority over any concern for economic gain; however, profitability is essential to the sustainability of cooperative farming as a management tool. Advancements in seed technology and pesticide use have resulted in a more sustainable agriculture system that is producing greater yields per unit area. This growth in yield is essential with the ever-increasing demands influencing land uses. For cooperative farming to remain a profitable and viable management tool on NWRs, we must utilize the best available tools and technology, while at the same time protecting and prioritizing environmental resources.

Why is this use being proposed or reevaluated?

Cooperative farming has occurred on Pee Dee NWR since the 1960s. The Service

requires the regular re-evaluation of uses of NWRs to ensure that they continue to meet compatibility requirements [see 603 FW 2.11(H)]. As a use that should be re-evaluated every 10 years and with the most recent approval in 2008, this existing use is being reevaluated due to this ten-year re-evaluation period [603 FW 2.11(H)].

At Pee Dee NWR, cooperative farming supports refuge purposes, refuge management goals and objectives expressed in the CCP (USFWS 2008b) and landscape-level goals and objectives (particularly the NAWMP, USDOJ EC ENRM 2018). The key goal and objectives served by cooperative farming at Pee Dee NWR are Wildlife and Habitat Management Goal IV and objectives IV.C (flooded crop impoundments) and IV.H (croplands) (CCP, USFWS 2008b) and objectives 5.1 (wetlands management) and 7.1 (croplands) (HMP, USFWS 2013), as listed.

- Wildlife and Habitat Management CCP Goal IV. Protect, manage, and enhance the refuge's diverse natural habitats to ensure that fish and wildlife populations remain naturally self-sustaining.
 - CCP Objective IV.C. Over the life of the plan, work to convert 25 percent of the flooded crop impoundments to moist-soils units.
 - HMP Objective 5.1. Continue to maintain approximately 214 acres of flooded crop impoundments as indicated by annual refuge waterfowl use data by providing 80 acres of unharvested corn to meet minimum population goals for 15,000 waterfowl.
 - CCP Objective IV.H. During the life of the plan, continue to maintain approximately 1,161 acres (470 hectares) of croplands under the cooperative farming program to benefit wildlife species.
 - HMP Objective 7.1. Continue to maintain approximately 1,080 acres of croplands (grains and soybeans) under the cooperative farming program where 20 percent of crop is left unharvested to benefit wildlife species.

With changing human use and development of the landscape, cooperative farming on NWRs, along with moist-soil units, supports meeting landscape-scale objectives for migratory birds. Waterfowl habitats are ranked with a value that describes the amount of energy they provide in food resources, known as "duck-energy-days" or "waterfowl-energy-days" (WED). A WED is defined as the number of ducks that can be energetically sustained in one acre of foraging habitat for one day (LMVJV 2016). Waterfowl energy needs are modeled for an overwintering period of 110 days, representing early November to late February (Reinecke and Loesch 1996). The universal utilization of WED for habitat management objectives across the Refuge System allows for optimal management of waterfowl habitat on both a continental and site-specific scale. Pee Dee NWR is included in the Atlantic Flyway, and

Midwinter Surveys have shown over 4 million waterfowl utilizing managed habitats, including moist soil and cooperative farmland located along the Atlantic Flyway (USFWS 2015). The total wintering duck population objective in North Carolina, as stepped down by the Atlantic Coast Joint Venture (ACJV), is 1.9 million ducks, which includes most diving and dabbling ducks, but does not include Canada or light geese, dark geese, or swans (ACJV 2020).

Within the lower Atlantic Flyway, which includes Pee Dee NWR, these food resources are key to each refuge's ability to successfully meet goals and objectives set by the ACJV (ACJV 2020), as stepped down from NAWMP (US DOI EC ENRM 2012, 2018) and the respective Comprehensive Conservation Plans (CCPs) and Habitat Management Plans (HMPs) developed for each refuge in this landscape. On winter waterfowl surveys since 2004, refuge staff have consistently counted 5,000–10,000 ducks and geese on the refuge. On some counts more than 11,000 wintering waterfowl were recorded (Walmsley 2021). To meet stepped down objectives from the NAWMP, Pee Dee NWR has a current objective to annually provide 3,106,503 WEDs during the 110-day wintering period (Hagy et al. 2020).

A key purpose for cooperative farming on NWRs is to ensure that waterfowl can satisfy their foraging needs, which enhances their body condition and supports reproductive output. Female ducks that are in good physical condition when leaving the wintering grounds, nest earlier, and have larger clutch sizes than those in poor condition (Ringelman 1990, Dzus and Clark 1998). Early nests and larger clutch sizes produce a greater number of fledgling ducks than late nests and smaller clutches (Krapu 1981, Heitmeyer 1988). Thus, availability of high-quality foraging habitat on the wintering grounds, especially in disturbance-free areas (i.e., sanctuary), is positively related to the reproductive output of waterfowl during breeding season.

The use of agricultural crops as a waterfowl habitat management technique is well documented (Bellrose 1980; Baldassarre and Bolen 1984; Delnicki and Reinecke et al. 1989; Ringelman 1990; Combs and Fredrickson 1996; Heitmeyer 2006). Remaining wetlands within the Lower Mississippi Alluvial Valley have been significantly altered by the construction of major dams and deforestation of most of the bottomland forest. The remnant habitat resources must be intensively managed to continue to support target waterfowl populations.

The refuge uses a combination of farming, moist-soil, and forested wetlands to provide suitable wintering waterfowl habitat. Studies have documented that wintering waterfowl prefer regions composed of 50% cropland, 20% moist-soil wetlands, 20% forested wetlands, and 10% open water habitats (Strickland et. al 2009). The agricultural crops planted on Pee Dee NWR typically include corn, millet, wheat, and soybeans (mainly for crop rotation). These crops provide nutritious seeds consumed by most species of waterfowl and other wildlife. Vegetative material of

wheat (green browse) is also considered a desirable food for geese. Other crops that may be planted for specific wildlife management purposes include sunflower, grain sorghum, and cover crops (typically annual grasses to prevent soil erosion).

Hundreds of acres of naturally occurring forested wetlands and open water are present on the refuge and the adjacent Pee Dee River. These acres of natural food and open water, in conjunction with farming and moist-soil management, allow the refuge to mimic the preferred composition of wintering waterfowl habitats suggested by Strickland et al. (2009). Based on past and current research, long time management of the refuge, and best professional judgement, cooperative farming is the most feasible option for supporting refuge management goals and objectives.

Availability of Resources

Estimated annual costs to continue to implement cooperative farming on Pee Dee NWR are \$9,600, including administration, maintenance, and monitoring. The need for staff time for the development and administration of cooperative farming is already committed and available. Most of the needed work to prepare for this use is completed as part of routine habitat management and administrative duties. Maintenance needs include the upkeep of refuge facilities, including roads and water control structures. These maintenance tasks are routine staff operations which occur annually with or without a cooperative farming program. Table 1 outlines the Service's costs to administer and manage the cooperative farming use at Pee Dee NWR; the cooperative farmers' costs are not included in this analysis or in Table 1.

Table 1. Costs to Administer and Manage Cooperative Farming at Pee Dee NWR

Category and Itemization	One-time Cost	Recurring Annual Expenses
Develop and update CD/SUP/CAA/PUPs	\$0	\$2,600
Staff time (administration and management)	\$0	\$2,000
Maintenance (road maintenance & access)	\$0	\$3,500
Monitoring (checking fields, checking crops)	\$0	\$1,500
Total one-time expenses	\$0	\$0
Total recurring annual expenses	\$0	\$9,600
Total expenses	\$0	\$9,600

The bulk of the annual costs associated with the use support administration and management, monitoring, and maintenance. While no offsetting revenues are associated with the use, in accordance with the CAA, the cooperative farmer leaves an unharvested share of the crops for the benefit of wildlife to serve refuge purposes, goals, and objectives. Existing refuge resources are adequate to administer the use properly and safely.

Anticipated Impacts of the Use

Potential impacts of a proposed use on the refuge's purposes and the Refuge System mission

Two NEPA documents address the direct, indirect, short-term, long-term, and cumulative impacts associated with cooperative farming on Pee Dee NWR, including the 2008 CCP/EA/FONSI (USFWS 2008a and 2008b, respectively), and the 2020 GEC PEA/FONSI (USFWS 2020). The analyses of impacts associated with the cooperative farming use from these documents are incorporated herein by reference; only summary impacts are provided here. Further, the Service relies on multiple tiers of analysis in the assessment, review, and approval of any pesticides or GECs to be potentially used on a unit of the Refuge System. This use was previously analyzed; was previously found to not have significant impacts; was previously found to be compatible; was previously determined to not materially interfere with or detract from the purposes of the refuge or the Refuge System mission; and was previously found to not conflict with maintaining the biological integrity, diversity, or environmental health of the refuge. As outlined in this CD and the associated CatEx/EAS, continuation of the use on the refuge would not change these findings.

The Section 7 Biological Evaluation for the CCP and Section 7 Biological Evaluations for annual PUPs all support the findings of the CCP's FONSI (USFWS 2008b).

The Service's 2020 GEC PEA and FONSI (USFWS 2020) provides a thorough evaluation and analysis of the use of GECs on NWRs in the southeast, including Pee Dee NWR, in order to help meet wildlife management objectives and achieve the specific goals of a NWR's CCP and HMP, and other national and international conservation initiatives, including the NAWMP (USDOI EC ENRM 2018). In addition, the GEC PEA/FONSI also evaluates policies governing these uses on NWRs, such as the Service's Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3), the Department of the Interior's Pesticide Use Policy (517 DM 1), and the Service's Integrated Pest Management Policy (569 FW 1). The Section 7 Evaluation for the GEC PEA also supports the 2020 FONSI (USFWS 2020).

Environmental conditions and the use have not changed substantially since the use was most recently evaluated and approved in 2008 (USFWS 2008b). The 2022 CatEx/EAS and CD provide summary discussions of the expected direct, indirect, short-term, long-term, and cumulative impacts associated with the use. Further, the

Section 7 Biological Evaluation prepared with this CD supports continued implementation of the use at Pee Dee NWR. The effects and impacts of cooperative farming on refuge resources, whether adverse or beneficial, are those that are reasonably foreseeable and have a reasonably close causal relationship to the use. Adapting to changing conditions, the Refuge Manager may, at any time, modify or eliminate the use to address resource concerns, unacceptable impacts, or public safety needs.

Short-term impacts

As outlined above, previous analyses found no significant short-term impacts of the use on physical, biological, socioeconomical, or cultural resources, including environmental justice, and refuge administration.

Short-term impacts from cooperative farming operations include soil disturbance by disking and the loss of standing cover of weed species caused by mowing, disking, and herbicide application. Service policy directs that the long-term productivity of the soil will not be jeopardized to meet wildlife objectives (6 RM 4). Soil disturbance is likely to occur when some areas are disked during the spring planting season, but these impacts will be reduced by the implementation of no-till and conservation tillage farming methods. A combination of cover crops and vegetative buffer strips adjacent to waterways and sensitive areas will help trap sediments and hold agricultural run-off. Sown crops quickly cover the soil disturbed by tillage and produce crops selected to supplement natural habitats. Winter wheat is often sown into harvested soybean fields which minimizes soil disturbance. Farmers will be encouraged to consider all farming conservation practices (e.g., rotating crops, no-till, and organic) as practical and in consultation with North Carolina State Agricultural Extension. Other farming practices include applications of nutrients and pesticides that enhance crop production but could cause non-point source pollution if BMPs are not utilized. Nutrient management, in accordance with soil test reports specifying the rates, timing, and formulations of nutrients, should not cause runoff or percolation of nutrients. These disturbances would temporarily displace wildlife but will occur across a portion (~33%) of the buffer strip acres, providing some continuous areas of cover for wildlife travel corridors, feeding, and resting areas.

Pesticide use is regulated to reduce the chances of negative effects on non-target species, including pollinators. A list of pesticides, approved through the Service's PUP System, are supplied to the cooperator, along with BMPs for each pesticide. The application of pesticides to crops should only occur after scouting for pests is accomplished. Farmers will be encouraged to first assess pest problems and consider mechanical and cultural techniques prior to the application of chemical techniques to control pests. The minimum effective volume of pesticide will be applied, in accordance with label directions and BMPs to minimize drift, runoff, and percolation of pesticides into the environment. As part of the PUP process, an Intra-Service Section 7 Biological Evaluation is conducted for each pesticide, evaluating any

possible impacts to threatened or endangered species that are near or adjacent to the spray area.

Croplands on the refuge provide an accessible, high-energy food source during the wintering period for migratory waterfowl. Most waterfowl are opportunistic feeders and some species, such as Canada geese, snow geese, mallards, Northern pintails, and teal, have learned to capitalize on the abundant foods produced by agriculture (Bellrose 1980). During the last century, migration routes and wintering areas have changed in response to availability of these foods (Fredrickson and Drobney 1979). Some species have developed such strong migratory traditions that many populations are now dependent on agricultural foods for their migration or winter survival (Ringleman 1990). However, during breeding and molting periods, waterfowl require a balanced diet with high protein content. Agricultural foods, most of which are neither nutritionally balanced nor high in protein, are seldom used during these periods. Moist-soil and forested wetlands on the refuge help bridge this gap and will contribute to a larger wetland habitat complex crucial to waterfowl completing their annual cycle. During fall, winter, and early spring, when vegetative foods make up a large part of their diet, agricultural foods are preferred forage except in arctic and subarctic environments (Sugden 1971).

Refuge farming practices, while designed for the benefit of waterfowl (ducks and geese) and other waterbirds, will also provide additional wildlife benefits. A variety of other wildlife species will benefit directly or indirectly from refuge crops. Red-winged blackbirds and other blackbird species will forage on crop seeds and perch on standing crop vegetation. Northern harriers routinely hunt prey around farming areas. Northern bobwhite, wild turkey, white-tailed deer, raccoons, and Eastern fox squirrels will forage on crops and use crop vegetation for hiding cover. A variety of other migratory birds (including mourning doves, field sparrows and indigo buntings) will forage on crop seeds and utilize standing crop vegetation for protective cover and perching.

No significant short-term impacts of the use to socioeconomic and cultural resources, including Environmental Justice are anticipated.

Long-term impacts

As outlined above, previous analyses found no significant long-term or cumulative impacts of the use to physical, biological, socioeconomic, or cultural resources.

Refuge management recognizes the benefits for providing supplemental forage for migratory waterfowl and waterbirds within the Atlantic Flyway. Refuge farming practices are designed for the benefit of waterfowl (e.g., ducks and geese); however, many other species benefit directly or indirectly from refuge crops, including wild turkey (*Meleagris gallopavo*), Northern bobwhite (*Colinus virginianus Linnaeus*), and grassland birds. Croplands on the refuges provide an accessible, high-energy food source during the wintering period of migratory waterfowl. Many waterfowl are

opportunistic feeders, and some species such as Canada geese (*Branta canadensis*), snow geese (*Chen caerulescens*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and teal (*Anas crecca*) have learned to capitalize on the abundant foods produced by agriculture (Bellrose 1980). During the last century, migration routes and wintering areas have changed in response to availability of these foods and other factors (Fredrickson and Drobney 1979). Long-term benefits of the farming program include providing a consistent source of high-energy foods to waterfowl over a number of years. Unlike surrounding private farmlands, only crops with potential food benefit would be grown on refuges, ensuring a reliable food source for wintering waterfowl and other wildlife. The flexibility to use GECs would also provide higher crop yields, which would increase the chances of meeting WED objectives despite crop loss to weather or wildlife depredation and increase the amount of conservation tillage which would increase residual cover habitat, providing cover and prey species for wildlife. This consistency should result in long-term benefits for migratory waterfowl in the form of improved body condition and greater reproductive success.

The long-term adverse impacts of cooperative farming on the refuge should be neutral to minor related to normal mechanical, cultural, and chemical applications. Most soils within the refuge cropland areas are designated as “prime farmlands” by the Natural Resources Conservation Service (USDA 1999, 2005). This designation describes soils that are very productive for farm production and not highly erodible. This means that soils should be very sustainable over a long period of time with proper farm management. Cooperative farmers are allowed to use EPA-registered pesticides after getting approval through the Service-wide PUP System. Use of BMPs imposed by the Service would ensure that pesticides would be expected to have no significant effects on water quality. The use of GECs, if approved for this refuge and as part of a holistic IPM system, would allow the Service to increase conservation tillage and use fewer and more benign pesticides, leading to an improvement in soil health including preservation of soil organic matter, beneficial biota, and nutrients; improvement in water retention capacity; and reduction in soil run-off (USFWS 2020). Increased conservation tillage would result in an increase in residual plant cover, thereby providing habitat for rodents, rabbits, snakes, and grassland birds that in turn maintain a prey base for bobcats and birds of prey. This would result in minor benefits to these species. The Refuge Manager or designee will closely monitor the Cooperator to ensure that BMPs are being utilized for the long-term health of the program.

Croplands would continue to occupy what would otherwise be native plant communities on the refuge, thus maintaining an on-going adverse impact for native vegetation. However, requiring vegetative buffers would result in an increase of approximately 10 acres of early successional, native vegetation. Restoring refuge croplands in the floodplain to native wetland vegetation present prior to human disturbance is not practical across the whole area because of changes in hydrology and subsidence. Due to these changes, wetlands in the farming areas are dependent on active water management. With cooperative farming, the refuge can optimize

landscape changes induced by humans to meet refuge objectives.

Impacts on other refuge uses are expected to be positive. Food and cover created through cooperative farming are attractive to wildlife and bring wildlife to an area accessible for public viewing from the refuge's public roads. Cooperative farming areas are popular sites for visitors wanting to see waterfowl, songbirds, and other wildlife. Farming areas are also open to hunting (though restricted by dates and species to manage impacts to wildlife populations). These sites are some of the most popular and successful hunting areas on the refuge.

While cooperative farming should cause minor to neutral short-term and long-term adverse impacts, the long-term benefits contribute to the fulfillment of the mission of the Refuge System and the purpose, goals, and objectives of the refuge, including waterfowl objectives stepped down from the NAWMP.

Public Review and Comment

Robust public outreach and Tribal and agency coordination was conducted during the development of the refuge's CCP/EA/FONSI, which included cooperative farming. For more information regarding public involvement and consultation for the CCP, please see Appendix D Public Involvement and Appendix K Consultation and Coordination in the final CCP (USFWS 2008b). The Service also conducted public review of the GEC/PEA; for more information regarding public involvement for this process, see Appendix F in the GEC/PEA/FONSI (USFWS 2020).

Building on the previous outreach, this Draft CD was available for public review and comment for 15 days, from August 23, 2022, to September 7, 2022. The public was notified of this opportunity to comment on the refuge website (https://www.fws.gov/refuge/pee_dee/) and through local newspapers. Notices were posted at the local library and on the refuge kiosk. A hard copy of this document was also posted at Pee Dee NWR Headquarters, 5770 US Hwy 52 N, Wadesboro, NC 28170. Substantive concerns expressed during the public review and comment period will be considered in the development of the final CD.

Determination

Is the use compatible?

Yes

Stipulations Necessary to Ensure Compatibility

Beyond the laws, policies, and processes referenced above, the cooperative farming program is regulated through cooperative farming agreements, addendums, and special use permits that specify the fields, crops to be grown, acceptable farming practices, approved pesticides and use procedures, and other conditions and

restrictions. Failure of the cooperator to comply with the terms and provisions of the CAA, any addendums, or special use permit can result in the termination of the CAA, addendums, and special use permit. To ensure that cooperative farming on Pee Dee NWR continues to remain compatible and serve refuge management goals and objectives, the listed stipulations will be strictly enforced.

1. The cooperative farming program will adhere to general conditions for cooperative farming programs as listed in the Service's Cooperative Agricultural Use Policy (620 FW 2). The use must align and comply with 50 CFR §§29.1-29.2 (addressing economic uses and cooperative land management); 601 FW 3 Service Biological Integrity, Diversity, and Environmental Health; 569 FW 1 Service Integrated Pest Management; and 517 DM 1 DOI Pesticide Use Policy. Cooperating farmers will be subject to applicable laws, policies, and regulations regarding all aspects of the farming program.
 - a. The CAA and any associated addendums and special use permits will outline additional restrictions and conditions.
 - b. Cooperative farmers must abide by the conditions established in the CAA, special use permit, and all addendums. Special conditions of CAAs will address unique local conditions as applicable.
2. Cooperative farming use must be carried out in accordance with Service policies and procedures, with 1- to 5-year CAAs that specify the fields, crops to be grown, rent shares, approved pesticides, and other conditions and restrictions.
 - a. Crop types and acreages will be determined on an annual basis through the development of an Annual Work Plan to the CAA.
3. The refuge will direct cooperative farming operations towards supplementing local natural habitats.
4. The Service will evaluate the impacts of croplands, revise CAAs, and carry out cropland management operations in a manner that will accomplish the refuge's cropland management objectives for migratory birds and resident wildlife.
5. The Service will apply and work to increase regionally consistent BMPs, soil conservation practices, and other measures to reduce the likelihood of adverse impacts associated with the implementation of cooperative farming.
6. Cooperative farming operations must adhere to IPM requirements, conservation tillage practices, conservation buffers, crop type rotations, and crop monitoring and scouting to detect and avoid resistance development.
 - a. Thirty foot (30') vegetative buffer strips will be maintained as prescribed by the CAA and Annual Work Plans.
7. The Service will continue to use the latest information regarding BMPs and IPM

strategies to address pest resistance, and will continue to consult with North Carolina State University Extension agents concerning best control options for pest species.

8. The Service will meet with cooperative farmers on an annual basis to determine the crops to be planted and methods for addressing pest issues.
9. Pesticide use is restricted by type and economic threshold limitations. Annually, all pesticides to be used on the refuge must be submitted to and approved by the Refuge Manager, Regional Integrated Pest Management (IPM) Coordinator, and/or National IPM Coordinator. No pesticide will be used on the refuge without prior approval from the Refuge Manager for the year in question. Only pesticides with a current, approved PUP are allowed on refuge lands.
 - a. Cooperative farmers may only use Environmental Protection Agency (EPA) registered pesticides that have been approved for use on the refuge in the particular year through the Service's Pesticide Use Proposal System. Refuge staff will provide the cooperator with the list of pesticides that may be used on the refuge, as well as any PUP conditions, restrictions, and BMPs that must be followed.
 - b. All pesticide label restrictions and other conditions or restrictions must be met by the cooperators, including meeting any additional requirements or conditions from the PUP.
 - c. All pesticide containers will be cleaned and disposed of off the refuge, and in accordance with EPA regulations.
 - d. The cooperator must meet state of North Carolina Department of Agriculture pesticide applicator license and certification requirements.
 - e. Cooperators must notify the refuge office 24 hours in advance of any proposed application of pesticide. Notification will include the location(s) and name of the pesticide(s) to be applied.
 - f. The cooperator will provide the refuge with an annual report to include the name and quantity of pesticides used, acreage of land treated, pest species targeted, and efficacy of treatment no later than November 15 of each year.
10. Any proposed seed treatments are required to be entered into the PUP database and sent in for review. No seed treatments will be used without prior required Service approval for the year in question.
11. The cooperator will follow lime and nutrient recommendations of the North Carolina Department of Agriculture. Crops will be fertilized, and fields limed according to recommendations based on current NC State University soil testing laboratory analysis. At a minimum, soils tests must be completed by the

- cooperators every 3 years and results must be submitted to the refuge.
12. Manure or composting materials may not be used on the refuge.
 13. The Farm Services Agency (FSA) or cooperator will provide the Refuge Manager a Report of Commodities so that certification can be signed and dated by both refuge staff and the cooperator and submitted to FSA prior to the crop certification deadline.
 14. Cooperator will notify the refuge manager at least 2 days in advance of any intended harvesting operation.
 15. By No, the cooperators will annually provide the Refuge Manager a crop yield report for every crop to assist with refuge management and evaluation of croplands.

Justification

Cooperative farming on NWRs generally, and at Pee Dee NWR specifically, is a longstanding proven resource management tool that serves refuge purposes and supports landscape-level and refuge management goals and objectives. The use has occurred on Pee Dee NWR since the 1960s. The use was previously analyzed and found appropriate and compatible through the refuge's CCP/EA/FONSI (USFWS 2008a, 2008b).

While cooperative farming is not a priority public use as outlined in the NWRS Improvement Act, it is an important wildlife habitat management tool and a long-standing practice on NWRS to help meet refuge purposes, goals, and objectives. Further, through the concentration of wildlife on and around the cooperative farming areas, the use supports priority public uses on the refuge, including hunting, wildlife observation, photography, environmental education, and interpretation.

In summary, the refuge lacks sufficient staff, equipment, and land area needed to manage and maintain the acreage needed to meet its waterfowl energy day objectives without the assistance of the cooperative farming program. From a practical standpoint, as past management has shown and current research and professional judgement support, the optimum means to achieve refuge goals and objectives related to migratory bird support is through cooperative farming along with moist-soil unit production. The refuge uses a combination of farming, moist soil, and forested wetlands to provide suitable wintering waterfowl habitat. Studies have documented that wintering waterfowl prefer regions composed of 50% cropland, 20% moist soil wetlands, 20% forested wetlands, and 10% open water habitats. (Strickland et. al 2009). Cooperative farmers have the capability to manage the desired acreages and can do so efficiently and economically. In many cases, cooperative agriculture will attain our desired outcome at little cost to the refuge, which is important due to small staff size and reduced capacity. It allows staff to concentrate on managing moist-soil units and other habitat types for migratory birds

and other wildlife species.

As outlined in this CD and in accordance with the stipulations outlined above, based on best professional judgement and available science, the Service has determined that continuation of the cooperative farming use at Pee Dee NWR will not materially detract from or interfere with the fulfillment of the NWRs mission or the purposes of the refuge; will contribute to the NWRs mission and refuge purposes, meeting the standard or threshold established in [50 CFR §29.1](#) for economic uses of NWRs; satisfies the four tiers of analysis for the use of pesticides; satisfies the four tiers of analysis for the use of GECs; and will not conflict with the national policy to maintain the biological integrity, diversity, and environmental health of the refuge.

Signature of Determination

Refuge Manager Signature and Date

Signature of Concurrence

Assistant Regional Director Signature and Date

Mandatory Reevaluation Date

10 years after final signature(s).

Literature Cited/References

Atlantic Coast Joint Venture (ACJV). 2020. Population Objectives.
<https://acjv.org/our-science/population-objectives>

Bellrose, F.C. 1980. Ducks, geese, and swans of North America, Third ed. Stackpole Books, Harrisburg, PA. 540 pp.

Dzus, E.H. and R.G. Clark. 1998. Brood survival and recruitment of mallards in relation

- to wetland density and hatching date. *Auk* 115(2): 311-318.
- Fredrickson, L.H. and R.D. Drobney. 1979. Habitat utilization by post breeding waterfowl. Pages 119-131 in: T.A Bookhout, ed. *Waterfowl and wetlands-an integrated review*. La Crosse, WI: La Crosse Printing.
- Hagy, H., R. Wilson, J. Stanton, and Z. Cravens. 2020. A Process for Establishing Waterfowl Conservation Objectives for National Wildlife Refuges in the Southeast Region. U.S. Fish and Wildlife Service.
<https://ecos.fws.gov/ServCat/DownloadFile/171947>.
- Heitmeyer, M.E. 1988. Body composition of female mallards in winter in relation to annual cycle events. *Condor* 90:669-680.
- Krapu, G.L. 1981. The role of nutrient reserves in mallard reproduction. *Auk* 98(1): 29-38.
- Lower Mississippi Valley Joint Venture (LMVJV). 2007. MAV Waterfowl Stepdown State Summaries. LMVJV Waterfowl Working Group c/o Lower Mississippi Valley Joint Venture, Vicksburg, MS.
- Lower Mississippi Valley Joint Venture (LMVJV). 2016. MAV Waterfowl Stepdown State Summaries. LMVJV Waterfowl Working Group c/o Lower Mississippi Valley Joint Venture, Vicksburg, MS.
- Ringelman, J.K. 1990. Managing agricultural foods for waterfowl. Pp. 35-38 in *Waterfowl Habitat Management Handbook for the Lower Mississippi River Valley*. eds. Strickland, Mississippi State University, Mississippi, 31 pp.
- Reinecke, K.J., and C.R. Loesch. 1996. Integrating Research and Management to Conserve Wildfowl (Anatidae) and Wetlands in the Mississippi Alluvial Valley, U.S.A. Pages 927-940 in M. Birkan, editor. *Anatidae 2000: an international conference on the conservation, habitat management and wise use of ducks, geese and swans*: Strasbourg, France, December 5-9, 1994. *Gibier Faune Sauvage, Game and Wildlife* 13(3).
- Reinecke, K.J., R.M. Kaminski, D.J. Moorhead, J.D. Hodges, and J.R. Nassar. 1989. Mississippi Alluvial Valley. Pp.203-247 in *Habitat management for migrating and wintering waterfowl in North America*, eds. L.M Smith, R.L. Pederson, and R.M. Kaminski. 1989. Texas Tech University Press. 560 pp.
- Strader, R.W., and P.H. Stinson. 2005. *Moist-Soil Management Guidelines for the U.S.*

- Fish and Wildlife Service, Southeast Region. Division of Migratory Birds, U.S. Fish and Wildlife Service. Jackson, MS. 17 pp plus appendices.
- Strickland, B.K, R.M. Kaminski, and A. Tullos. 2009. Waterfowl Habitat Management Handbook for the Lower Mississippi River Valley. Mississippi State University, Mississippi, 31 pp.
- Sugden, L.G. 1971. Metabolizable energy of small grains for mallards. *Journal of Wildlife Management* 35:781-785.
- Tiner, R.W., Jr. 1984. Wetlands of the United States: current status and recent trends. United States Fish and Wildlife Service, National Wetland Inventory Washington, D.C.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 1999. Soil Survey of Richmond County, North Carolina. USDA Natural Resources Conservation Service, Washington, DC.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2005. Soil Survey of Anson County, North Carolina. USDA Natural Resources Conservation Service, Washington, DC
- U.S. Department of the Interior, Environment Canada, and Environment and Natural Resources Mexico (USDOI EC ENRM). 2012. North American Waterfowl Management Plan 2012: People Conserving Waterfowl and Wetlands. U.S. Department of the Interior, Washington, DC.
<https://nawmp.org/document/2012-nawmp-plan-people-conserving-waterfowl-and-wetlands>
- U.S. Department of the Interior, Environment Canada, and Environment and Natural Resources Mexico (USDOI EC ENRM). 2018. 2018 North American Waterfowl Management Plan (NAWMP) Update: Connecting People, Waterfowl, and Wetlands. U.S. Department of the Interior, Washington, D.C., USA.
<https://nawmp.org/timeline/2018-update>,
https://nawmp.org/sites/default/files/2018-12/6056%202018%20NAWMP%20Update_EN16.pdf
- U.S. Fish and Wildlife Service. 2008a. Draft Comprehensive Conservation Plan and Environmental Assessment for Pee Dee National Wildlife Refuge. April 2008. U.S. Fish and Wildlife Service, Southeast Region. Atlanta, GA. 218 pp.
- U.S. Fish and Wildlife Service. 2008b. Pee Dee National Wildlife Refuge Comprehensive Conservation Plan. October 2008. U.S. Fish and Wildlife

- Service, Southeast Region. Atlanta, GA. 179 pp.
<https://ecos.fws.gov/ServCat/DownloadFile/18966>
- U.S. Fish and Wildlife Service. 2013. Habitat Management Plan for Pee Dee National Wildlife Refuge. Southeast Region. Atlanta, GA. 177 pp.
<https://ecos.fws.gov/ServCat/DownloadFile/48959>
- U.S. Fish and Wildlife Service (USFWS). 2015. Migratory Bird Data Center.
<https://migbirdapps.fws.gov>
- U.S. Fish and Wildlife Service (USFWS). 2020. Draft Programmatic Environmental Assessment for Use of Genetically Engineered Agricultural Crops for Natural Resource Management on National Wildlife Refuges in the Southeastern United States. Atlanta, Georgia.
- U.S. Fish and Wildlife Service (USFWS). 2020. U.S. Fish and Wildlife Service Programmatic Environmental Assessment for Use of Genetically Engineered Agricultural Crops for Natural Resource Management on National Wildlife Refuges in the Southeastern United States. June 2020. U.S. Fish and Wildlife Service, South Atlantic – Gulf, Mississippi Basin. Atlanta, GA. 168 pp.
<https://ecos.fws.gov/ServCat/DownloadFile/171732>
- Walmsley, G. 2021. Pee Dee National Wildlife Refuge Ground Waterfowl Surveys for 2004-2021. U.S. Fish and Wildlife Service.
<https://ecos.fws.gov/ServCat/Reference/Profile/95572>

Figure(s)

Figure 1: Crop Units on Pee Dee NWR

