BIOMASS CROP ASSISTANCE PROGRAM

Environmental Assessment

Proposed BCAP Giant Miscanthus (*Miscanthus X giganteus*) Establishment and Production in Georgia, North Carolina, and South Carolina

United States Department of Agriculture
Farm Service Agency

May 2012

FINAL

MITIGATED FINDING OF NO SIGNIFICANT IMPACT

United States Department of Agriculture - Farm Service Agency

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Proposed Biomass Crop Assistance Program (BCAP) Giant Miscanthus (*Miscanthus x giganteus*) Establishment and Production in Georgia, North Carolina, and South Carolina

May 2012

The United States Department of Agriculture Farm Service Agency (FSA) on behalf of the Commodity Credit Corporation (CCC) has prepared a Final Environmental Assessment (EA) to evaluate the environmental consequences associated with establishing Biomass Crop Assistance Program (BCAP) project areas that support the establishment and production of giant miscanthus (*Miscanthus x giganteus*) on up to 58,000 acres within the combined proposed project areas by 2013. After reviewing all comments received on the Draft EA and consulting with USFWS, NRCS and APHIS, FSA shall approve a BCAP project area limited to up to 6,000 acres of miscanthus and switch grass in North Carolina, reducing the scope and potential impacts. The impact analysis in the EA covers a larger area of impact with the potential impacts of the approved reduced project adequately examined.

The BCAP is a new program authorized by the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill) that provides financial assistance to contract producers in approved project areas for the establishment and production of perennial bioenergy crops and annual bioenergy crops that show exceptional promise for producing bioenergy or biofuels that preserve natural resources and that are not primarily grown for food or animal feed.

The purpose of the Proposed Action is to support the establishment and production of giant miscanthus as a crop for energy production to be grown by BCAP participants in the project areas proposed in Georgia, North Carolina, and South Carolina. The need for the Proposed Action is to provide renewable biomass feedstock to a Biomass Conversion Facility (BCF) for use in energy production within and potentially outside the immediate region.

PROPOSED ACTION

The EA covers a proposed project area establishing BCAP project areas that support the establishment and production of Freedom™ giant miscanthus on up to 58,000 total acres by 2013, with crop longevity of up to 20+ years. The acreage expected to be enrolled within the proposed project areas are marginal croplands, pasturelands, and abandoned or previously cleared timberlands. The proposed project areas are located in three states in four distinct proposed project areas, East Georgia (15,000 acres); Middle Georgia (20,000 acres), Lowcountry (5,000 acres) in Georgia and South Carolina, and North Carolina (18,000 acres). The approved project area would be one of these proposed project areas: up to 6,000 acres of switch grass and miscathusin 30 possible counties of North Carolina. This proposed action differs, from the MFA Oil Biomass LLC and Aloterra Energy LLC giant miscanthus projects, approved by FSA in May 2011, in that (1) Freedom would be the variety of giant miscanthus planted within the proposed project areas, and (2) there would not be the development of propagation acres at the individual contract producer level. The project area contains at least one BCF that would accept giant miscanthus for a direct bioenergy feedstock or conversion into an intermediary product for bioenergy production. Additionally, there are other BCFs in varying stages of development for various end products that could use giant miscanthus as a feedstock in the proposed project areas. The approved project area was developed in proximity to the foundation acreage located in Soperton, Georgia and to sub-licensed registered acreage for efficient transportation of the certified rhizome stock to the participating producers and efficient transportation alternatives to the BCF(s) within each proposed project area. All rhizome stock planted on contract acreage within the proposed project areas would be certified rhizomes from the foundation acreage or from the sub-licensed registered acreage. All rhizomes would be pre-processed following the methods developed by the Project Sponsor prior to planting and establishment on contract acreage.

Equipment expected to be used to establish giant miscanthus would be modified equipment from existing agricultural industries located in the Southeastern United States, such as tobacco and forage/hay. Equipment used to harvest and bale giant miscanthus would be similar to existing types of agricultural machinery used for hay crops to produce large square bales.

REASONS FOR MITIGATED FINDING OF NO SIGNIFICANT IMPACT

In consideration of the analysis documented in the EA and the reasons outlined in this Mitigated Finding of No Significant Impact (FONSI), the Proposed Action would not constitute a major Federal action that would significantly affect the human environment. Therefore, an environmental impact statement will not be prepared. The determination is based on the following:

1. The Proposed Action as outlined in the EA would provide minor beneficial effects to socioeconomics, soil resources, and water quality and quantity of the local areas due to a diversified agricultural production, establishment of perennial vegetation on highly erodible soils, and estimated higher water use efficiency of the species to be established.

2. The Proposed Action could result in minor negative effects from land use changes associated with marginal and idle croplands, pasturelands, and cleared/abandoned timber lands returning to agricultural production; vegetation composition on pasturelands, which in turn could alter wildlife habitat, and water quantity due to increased water use of the species when compared to annual species, such as traditional row crops. These potential negative effects would be minimized through the use of the mandatory site-specific Conservation Plan or Forest Stewardship Plan required for all contract acreage with the inclusion of the Mitigation and Monitoring Plan, as described in the EA.

3. The Proposed Action would require site specific environmental screening for each producer contract initiated with FSA for inclusion as a producer within the proposed project areas, which would identify field level resources that would need to be avoided or the effects could be minimized through mitigation efforts as described in the EA.

4. Potential beneficial and adverse impacts of implementing the Proposed Action have been fully considered within the EA. No significant adverse direct or indirect effects were identified, based on the resource analyses provided.

5. The Proposed Action would not involve effects to the quality of the human environment that are likely to be highly controversial.

6. The Proposed Action would not establish a precedent for future actions with significant effects and does not represent a decision in principle about a future consideration.

7. The Proposed Action does not result in cumulative significant impacts when considered with other actions that also individually have insignificant impacts. Cumulative impacts of implementing the Proposed Action were determined to be not significant.

8. The Proposed Action would not have adverse effects on threatened or endangered species or designated critical habitat since site specific analyses would be undertaken for each producer contract within each proposed BCAP project area to avoid adverse effects to these protected species.

9. The Proposed Action does not threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

OVERVIEW OF THE MITIGATION AND MONITORING PLAN

To avoid more than minor adverse effects to the human and natural environment, a mitigation and monitoring plan was developed to address each of the resource areas analyzed in detail within the EA. One of the primary components of the Mitigation and Monitoring Plan (MMP) is producer education. This education component, to be held twice a year for active producers with an orientation program for new producers, outlines best practice standards across an array of resource areas and topics to ensure effective establishment and management of the giant miscanthus fields. In addition to the educational components, producers would be required to submit annual reports to the Project Sponsor detailing many aspects of production and allows for a greater understanding of how this species will grow in a production setting. More specifically, FSA with cooperation from the Natural Resources Conservation Service (NRCS), the Agricultural Research Service (ARS) and the Project Sponsor are proposing the following mitigation and monitoring measures. These monitoring and mitigation measures have been developed based on the prevailing literature and in some cases, conservative estimates relating to existing standards for other conservation programs and practices, but not specific to giant miscanthus.

- Semi-annual Producer meetings to discuss new developments in production, management, pest/disease treatment, and eradication;

- New Producer orientation to discuss production methods, management activities, potential for spread of giant miscanthus, treatment methods, and responsibilities,

pest/disease identification, treatment methods, and responsibilities, eradication methods, if necessary, and reporting requirements;

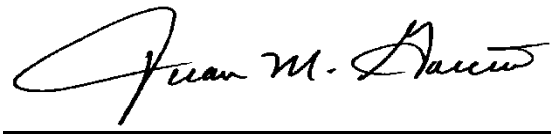
- Producer Conservation Plans to include site specific best management practices (BMPs), which could include, but not be limited to, NRCS Conservation Practice Standards (CPS) for soil erosion, pesticide use and application, fertilizer use and application, and other relevant areas for each specific site and which could include, but not be limited to,NRCS Technical Note No. 4 *Planting and Managing Giant Miscanthus as a Biomass Energy Crop*;
- Setbacks/buffers to manage the giant miscanthus stand and to prevent unintentional spread of the giant miscanthus shall follow all local, State, or Federal regulations for containment of biomass plantings in existence at the time of the development of the producer's mandatory site-specific Conservation Plan or through an amendment of the Conservation Plan initiated by the producer and approved by FSA and NRCS, if determined appropriate for the site-specific conditions. If no such guidance exists, minimum procedures to prevent unintentional spread of giant miscanthus shall include:
    - Establish or maintain a minimum 25 feet of setback/border around a giant miscanthus stand, unless the field is adjacent to existing cropland or actively managed pasture with the same operator.
    - Setback/border areas may be planted to an annual row crop such as corn or soybeans; may be planted to a site-adapted, perennial cool-season or warm-season forage or turf grass; may be kept in existing vegetation; or kept clear by disking, rotovating, or treating with a non-selective burn down herbicide at least once a year. The method used may be dependent on slope and the potential for erosion.
- The use of only the sterile variety of giant miscanthus, known as Freedom™ Giant Miscanthus, for producers included within the proposed project areas; all Freedom rhizomes must be appropriately tagged and have meet the certification conditions for both the plant and the acreage by REPREVE® Renewables and the Georgia Crop Improvement Association minimum standards for miscanthus;

- The initiation of a seed sampling program to determine the on-going sterility of seeds produced from the acres within the BCAP project areas. The seed sampling program includes recommended actions, including eradication, if a seed sample returns viable seed.
- Exclusion of planting giant miscanthus on certain acreage within approximately 1,300 feet from any known *Miscanthus sinensis* or *Miscanthus sacchariflorus* to limit the potential for cross-pollination resulting in viable seed.
- Exclusion of planting giant miscanthus on certain acreage within the project areas, depending upon certain site-specific conditions, like those lands subject to frequent flooding events;
- Monitoring program developed to identify (1) spread of giant miscanthus outside of planted fields with notification provided to both USDA and the Project Sponsor as soon as possible after identification of the issue, (2) identification of diseases and pests with notification provided to the Project Sponsor as soon as possible after identification of the issue; and (3) wildlife use or changes in use, all to be included in the annual producer reporting; a USDA representative will conduct an annual field visit to monitor the site and to look for potential spread of giant miscanthus beyond the site; the USDA will work with local weed control districts to provide additional monitoring/evaluation of these sites as appropriate;
- Equipment sanitizing with power-washing and rigorous inspection to ensure that no unintentional release of rhizomes would occur during or after transport of live rhizomes would occur on each property, as part of the agreement with the Georgia Crop Improvement Association for Quality Assurance. All rhizomes would be contained within closed shipping containers for any shipments that leave the property destined for any other location.
- Annual producer reporting, which would include land use tracking with the average and total size of enrolled fields; prior land use; rationale for land use change; spread of giant miscanthus outside of planted fields; any pests/diseases identification; the use of pesticides/herbicides to control unwanted spread of giant miscanthus or pests/diseases;

BMP and CPS incorporated into field management, such as erosion control structures or materials, vegetative barriers, etc.; fertilizer usage and application methods; and cost data.

Determination

In accordance with the National Environmental Policy Act and FSA's environmental regulations at 7 Code of Federal Regulations (CFR) part 799 implementing the regulations of the Council on Environmental Quality, 40 CFR parts 1500-1508, I find that the approved BCAP Project Area, as a smaller component of the Proposed Action and associated mitigation measures, does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, no environmental impact statement will be prepared.



05/31/2012

Juan M. Garcia **Date**
Deputy Vice President,
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EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND

The U.S. Department of Agriculture (USDA) Commodity Credit Corporation (CCC) implements the Biomass Crop Assistance Program (BCAP) authorized by the Food, Conservation, and Energy Act of 2008 (the 2008 Farm Bill). On October 27, 2010, the CCC published the Record of Decision (ROD) for the BCAP Final Programmatic Environmental Impact Statement (PEIS) and the BCAP Final Rule (7 Code of Federal Regulations [CFR] Part 1450) in the Federal Register (FR 75:207, 65995-66007; 66202-66243). As part of the mitigation measures detailed in the ROD, each project proposal is subject to a National Environmental Policy Act (NEPA) (Public Law [PL] 91-190, 42 U.S. Code [USC] 4321 *et seq*.) analysis prior to approval of the project area proposal. The initial environmental evaluation (pre-NEPA documentation) of a project area proposal is developed through the completion of Forms BCAP-1, AD-1047, BCAP-20, BCAP-21, and BCAP-22 and supporting information. After this initial evaluation of the project area proposal FSA can conclude that (1) no additional environmental analyses are applicable due to (a) the activity being specifically addressed and analyzed within the BCAP Final PEIS, and/or (b) no potential for the proposed BCAP activity to significantly impact the environment or (2) that additional environmental analyses in the form of an environmental assessment (EA) or environmental impact statement (EIS) are necessary, depending upon the potential level of significance.

All project area proposals undergoing NEPA documentation, subsequent to the BCAP Final PEIS, must adhere to the findings and conditions established in the BCAP Final PEIS. The BCAP Final PEIS was a broad national-level program document; therefore, according to the Council on Environmental Quality (CEQ) NEPA guidance (40 CFR 1508.28) “tiering” from the BCAP Final PEIS is allowable. CEQ guidance defines tiering as, “the coverage of general matters in broader EIS with subsequent narrower statements or environmental analyses incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared (40 CFR 1508.28). CEQ identifies tiering as appropriate to assist the lead agency on focusing on the issues of importance and exclude from consideration those issues, which have been previously decided or “not yet ripe” for a decision.

If a project area proposal is approved by FSA, then producers can apply to FSA to become BCAP contract producers with acreage within the approved project area(s). As part of the process for approving contract acreage, the producer must provide an on-site environmental

evaluation for the proposed acreage. The initial environmental evaluation will require the completion of the Natural Resources Conservation Service (NRCS) environmental evaluation worksheet, CPA-52. If through the completion of CPA-52, there is an indication for the potential for environmental impacts additional environmental evaluation would be required following the FSA NEPA guidance for an EA or EIS. However, FSA could determine after the completion of CPA-52 not to enroll those acres into the BCAP project area due to the potential level of significant effects. If acreage is approved, then all contract producers must develop a BCAP Conservation Plan or Forest Stewardship Plan for their contract acreage, in addition to any project area specific mitigation and monitoring measures (Section 6 of this document), which would be included within the BCAP contract details or incorporated into the BCAP Conservation Plan or Forest Stewardship Plan.

In Fiscal Year (FY) 2011, the FSA approved nine BCAP project areas with the following species: native prairie grass (two project areas totaling 40,000 acres); giant miscanthus, Illinois clone (four project areas totaling 19,182 acres, which underwent an EA and received a mitigated finding of no significant impact [FONSI] in May 2011); camelina (two project areas totaling 51,000 acres); and hybrid poplar (one project area totaling 7,002 acres).

This EA analyzes the proposed establishment of BCAP project areas supporting the proposed establishment and production of giant miscanthus hybrid (*Miscanthus X giganteus)* by REPREVE Renewables LLC (Project Sponsor) in Georgia, North Carolina, and South Carolina. The information developed from this EA and from public comments received on the Draft EA will provide the FSA decisionmakers the information necessary to determine if this project area proposal would meet the requirements of the NEPA environmental evaluation of the BCAP or would require further environmental evaluations under an EIS.

PURPOSE AND NEED

The primary purpose of BCAP is to promote the cultivation of perennial bioenergy crops and annual bioenergy crops that show exceptional promise for producing bioenergy or biofuels that preserve natural resources and that are not primarily grown for food or animal feed, which would help alleviate dependence on foreign oil for energy production.

As such, the FSA accepts project area proposals from potential sponsors of BCAP project areas and then determines whether to accept and establish those project areas, which then creates opportunities for producers to receive funding for crop establishment and production

under BCAP. Project area proposals are submitted by proposed sponsors and include a specific dedicated bioenergy crop or crops and the proposed location for the project area or areas. FSA does not determine which crop(s) or methods would be the most economically viable or most environmentally suited for an area(s), but rather is tasked with determining that a project area proposal fully meets the requirements set forth in the BCAP Final Rule and the appropriate environmental evaluation for the proposal is completed and enough information is available for the decisionmakers to make an informed decision.

The FSA would determine from the initial environmental evaluation of a project area proposal whether that proposed project area should (1) be granted approval as a BCAP project area (e.g., a species analyzed within the Final BCAP EIS or an existing non-Title I crop species) or (2) that further environmental evaluation would be required. This EA provides the initial step for the further environmental evaluation of the proposed project area proposal by FSA. At the conclusion of this EA process, FSA will determine based on the finding of the EA to provide a FONSI or mitigated FONSI or that more environmental evaluation in the form of an EIS is necessary to determine the extent of environmental effects.

The purpose of the Proposed Action is to support the establishment and production of giant miscanthus as a crop for energy production to be grown by BCAP participants in the project areas proposed in Georgia, North Carolina, and South Carolina. The need for the Proposed Action is to provide renewable biomass feedstock to a Biomass Conversion Facility (BCF) for use in energy production within and potentially outside the immediate region(s).

ALTERNATIVES

As part of the BCAP Project Area Selection Process, the Project Sponsor develops a proposal application for submittal to FSA. Prior to this submittal, the Project Sponsor has likely determined the economic feasibility of their proposal, including developing alternatives for location and crop species. The Project Sponsor developed selection criteria to meet the overall purpose and need for the Proposed Action, the establishment and production of giant miscanthus as a dedicated energy crop for energy production under the incentives of the BCAP. As part of the alternatives development process, the Project Sponsor analyzed both alternative locations and alternative crops for the proposed project areas; however, each of these was determined not to be feasible. As such, this EA is analyzing the implementation of the Proposed Action or the selection of the No Action Alternative, that FSA would not

establish the proposed project areas supporting the establishment and production of giant miscanthus.

PROPOSED ACTION

REPREVE℠ Renewables LLC (Project Sponsor) are proposing that FSA establish BCAP project areas that support the establishment and production of Freedom™ giant miscanthus on up to 58,000 total acres by 2013, with crop longevity of up to 20+ years. The acreage expected to be enrolled within the proposed project areas are marginal croplands, pasturelands, and abandoned or previously cleared timberlands. The proposed project areas are located in three states in four distinct proposed project areas, East Georgia (15,000 acres); Middle Georgia (20,000 acres), Lowcountry (5,000 acres) in Georgia and South Carolina, and North Carolina (18,000 acres). This proposed action differs, from the MFA Oil Biomass LLC and Aloterra Energy LLC giant miscanthus projects, approved by FSA in May 2011, in that (1) Freedom would be the variety of giant miscanthus planted within the proposed project areas, and (2) there would not be the development of propagation acres at the individual contract producer level.

Each proposed project area contains at least one BCF that would accept giant miscanthus for a direct bioenergy feedstock or conversion into an intermediary product for bioenergy production. Additionally, there are other BCFs in varying stages of development for various end products that could use giant miscanthus as a feedstock in the proposed project areas. Each proposed project area was developed in proximity to the foundation acreage located in Soperton, Georgia and to sub-licensed registered acreage for efficient transportation of the certified rhizome stock to the participating producers and efficient transportation alternatives to the BCF(s) within each proposed project area. All rhizome stock planted on contract acreage within the proposed project areas would be certified rhizomes from the foundation acreage or from the sub-licensed registered acreage. All rhizomes would be pre-processed following the methods developed by the Project Sponsor prior to planting and establishment on contract acreage.

Equipment to be used to establish giant miscanthus would be modified equipment from existing agricultural industries located in the Southeastern United States, such as tobacco and forage/hay. Equipment used to harvest and bale giant miscanthus would be similar to existing types of agricultural machinery used for hay crops to produce large square bales.

ENVIRONMENTAL CONSEQUENCES

Table ES-1 provides a tabular summary of the potential effects from both the Proposed Action and No Action Alternative. Implementing the Proposed Action would result in minor positive and negative effects to the local and regional area; however, many of these effects would be minimized through the use of the Mitigation and Monitoring Plan. FSA has a framework for defining the components of the Mitigation and Monitoring Plan. The Mitigation and Monitoring Plan is included in **Section 6.0** of this document.

Table ES-1. Comparison of the Alternatives

Resource Area	Proposed Action	No Action Alternative	Cumulative Effects
Socioeconomics	Minor +/0	0	Minor +/0
Land Use	0/Minor -	0	0/Minor -
Coastal Zone Management Consistency	0	0	0
Biological Resources			
Vegetation	0/Minor -	0	0/Minor -
Wildlife	0/Minor-	0	0/Minor-
Protected Species	0	0	0
Soil Resources	+/Minor -	0/Minor -	+/Minor-
Water Quality/Quantity			
Water Quality	Minor +/0	0/Minor -	Minor +/Minor-
Water Quantity	Minor +/0	0/Minor -	Minor +/Minor-
Air Quality	0/Minor -	0	0/Minor-
Outdoor Recreation	Minor +/Minor -	0	Minor +/Minor-
Environmental Justice	Minor +/0	0/Minor -	Minor +/Minor-

Note: (+)=positive (-)=negative (0)=neutral

The Proposed Action would result in additional diversified income for participating producers, as well as technical assistance from the Project Sponsor in the production and harvesting of giant miscanthus. The Project Sponsor has located at least one BCF in each of the proposed project areas ensuring that producers will have a demand for their products. Also, ancillary agricultural services should expect an increase due to the Project Sponsor goal of primarily contracting economically marginal, idle acres, or abandoned acres. The Proposed Action would result in a changed local landscape with the addition of the giant miscanthus fields.

The Mitigation and Monitoring Plan (see Section 6), which would be a mandatory component of the producer contract with FSA, would be used to ensure that adverse effects from this new crop are minimized or avoided. Similarly, minor negative effects would be anticipated for biological diversity as pastureland is converted into giant miscanthus croplands. The Mitigation and Monitoring Plan would be essential to provide mechanisms

such as reasonable and economically feasible buffers and field edges to provide for continued wildlife and vegetative diversity in these areas. Recent research has indicated that giant miscanthus is susceptible to some plant pests; the Mitigation and Monitoring Plan monitoring and buffer efforts would be essential to ensure that any occurrence is identified and treated early to avoid transmission to local croplands, such as corn.

Giant miscanthus, which has an extensive perennial root system, would be anticipated to have beneficial effects on soil retention, soil organic matter, and soil carbon sequestration. Water quality should improve relative to other crops typically grown in the project areas due to improved nutrient uptake, low fertilizer requirements, and reduced sediment transport. Also, due to its growth patterns, giant miscanthus would be anticipated to require more water than corn grown for grain, but less water than grass hay and improved pasture. The majority of the acres that enroll in the program are expected to be economically marginal cropland, pastureland, idle cropland, and previously harvested/abandoned forestland/timberland. The project may also see some conversion of irrigated lands to the non-irrigated miscanthus, which will reduce regional water use from those irrigated acres, though this would be expected to be on limited acreage. The plant has much higher water use efficiency, generating high amounts of biomass per volume of water consumed, indicating it uses rainfall efficiently.

The No Action Alternative would result in no adverse effects to the local and regional area since there would be no giant miscanthus planted in any of the proposed project areas as described in this BCAP Project Proposal. However, the No Action Alternative would not assist in meeting the overall goal of BCAP, which is to develop dedicated energy crops for conversion to bioenergy.

Cumulatively, within the proposed project areas, cumulative effects would be minor and dependent upon the site specific acreage potentially enrolled within the proposed project areas. Under the proposed project, up to 58,000 acres could be enrolled under BCAP to establish and produce Freedom giant miscanthus. The cumulative effects analysis was defined as activities related to existing cropland production, projected future cropland production, existing Conservation Reserve Program acreage, and the potential for additional BCAP project areas with the proposed project areas for this action.

- Cumulatively, socioeconomic effects could be minor and beneficial or neutral to existing conditions. Direct and indirect socioeconomics effects from the proposed action would account for an increase in employment numbers of less than 0.05

percent across all proposed project areas. Producers are anticipated to derive a positive cash flow by the harvest date in Year 3 after initial plantings with the BCAP assistance rather than in Year 8 or later compared to without BCAP. More than likely woody biomass would be the primary bioenergy feedstock developed in the Southeastern United States given the large amount of land use currently in timberland and forest cover and the relative value of timber in relation to livestock production. The addition of smaller acreages of Freedom giant miscanthus could diversify the producer portfolio and provide an annual revenue stream to supplement the production of other traditional row crops or the longer term production of timber.

- Conversion of traditional row crops into Freedom giant miscanthus would be anticipated to be a small percentage of the proposed acreage due to the current commodity prices, large acreage in forestland and timber production, and the relatively small amount of acreage to be potentially converted into Freedom giant miscanthus under this proposed project, which would limit the cumulative effects associated with the proposed action.

- Cumulative effects to biological resources would be minimized through the use of the mandatory contract level Conservation Plans or Forest Stewardship Plans in combination with the Mitigation and Monitoring Plan developed as part of the Proposed Action. Like traditional row crops, a monoculture establishment of Freedom giant miscanthus would reduce local level biodiversity; however, field buffers and wildlife corridors in association with mandatory site-specific Conservation Practices including in the Conservation Plan would provide mechanisms for continued wildlife movement and use. Overall anticipated land use conversion to Freedom giant miscanthus would be limited in any of the proposed project areas, which when combined with other on-going agricultural and forestry activities would produce changes to biodiversity, but the effects would be highly dependent upon the site-specific conditions.

- Reduced soil erosion would be anticipated from the establishment and production of a perennial herbaceous species. Soil erosion could increase in some site-specific areas dependent upon soil type and texture; however, the mandatory Conservation Plan or Forest Stewardship Plan in association with the Mitigation and Monitoring Plan would develop appropriate erosion control methods to minimize soil loss during the establishment phase of this dedicated bioenergy crop. Also a large perennial

herbaceous species would likely increase soil organic matter and below-ground carbon sequestration due to the high volume of root mass. However, these cumulative effects would be minimized from the small amount of acreage proposed for Freedom giant miscanthus establishment within the proposed project areas associated with all other agricultural and forestry activities.

- Freedom giant miscanthus has a greater water use efficiency (amount of biomass produced per volume of water consumed) than annual crops, but would be anticipated to require more water than permanent pasture, rangeland, or annual crops grown for grain production. However, for most acreage water would be anticipated to come from precipitation, rather than irrigation. Water quality would be anticipated to improve in watersheds with high soil erosion potential and existing nutrient leaching or runoff from traditional crops once Freedom giant miscanthus becomes established. Cumulatively, the water quantity and quality effects from the production of Freedom giant miscanthus, in association with other agricultural and forestry activities, would be minimal given the relatively low amount of acreage to be converted.

- Cumulative effects to air quality would be avoided due the limited use of agricultural machinery for the establishment and production of giant miscanthus. Even at the maximum amount of acreage tilled at one point in time, the amount of small airborne particulate matter ($PM_{2.5}$) would be less than 0.1 percent of the projected total emissions in 2012. Tillage would only occur during the establishment year, with the addition of harvesting equipment included in the on-farm mobile sources each year thereafter. Overall, emissions from agricultural equipment and tractor trailers for transportation of products would be limited and only create minor, temporary increases in emissions during initial establishment, periodic crop maintenance, and annual harvest across all proposed project areas.

- The potential cumulative effects of establishment of a biomass crop would impact wildlife as habitats are fragmented, degraded, or destroyed from dedicated energy crop establishment; however, the amount of acreage within any of the proposed project areas would be minor when compared to existing agricultural and forestry activities. Overall, effects to biodiversity would be minimized, to the extent, possible through the use of the mandatory contract producer Conservation Plan or Forest Stewardship Plan in association with the Mitigation and Monitoring Plan, which

should provide on-going opportunities for both consumptive and non-consumptive outdoor recreation.

DATA GAPS IN CURRENT UNITED STATES ESTABLISHMENT AND PRODUCTION

Giant miscanthus is a new agronomic crop species in the United States, and also still relatively new in Europe, where the oldest cultivation areas are approximately 30 years old or less. The *Miscanthus* genus was introduced to the United States over 100 years ago in ornamental plantings and was first described by Beal in 1896 in the *Grasses of North America*. Several universities (i.e., University of Illinois, Mississippi State University [MSU], University of Wisconsin, Michigan State University [MSU2], and the University of Georgia [UGA]) in the United States are currently cultivating giant miscanthus on a trial basis or conducting research on giant miscanthus or the *Miscanthus* genus. Additionally, large-scale acreages of giant miscanthus have not been cultivated in the United States; although commercial production of giant miscanthus for bioenergy production in co-fired systems have been established within the last few years in the United Kingdom. Given, that giant miscanthus has only been grown in large-scale trials in Europe; the data on giant miscanthus planting in the United States is limited. As mentioned previously, FSA approved four BCAP project areas for the production of giant miscanthus totaling 19,182 acres in the Midwestern United States in FY 2011.

In light of the lack of data applicable to the proposed project areas, an adaptive Mitigation and Monitoring Plan has been developed, which includes best management practices (BMPs) for the establishment and production of giant miscanthus. These BMPs are designed to ensure avoidance and/or minimization of potential effects to the immediate environment and the larger landscape. The Mitigation and Monitoring Plan is a living document that is highly dependent on routine monitoring of the fields to determine the success of giant miscanthus plantings, its overall effects to the immediate environment, and any potential effects to the larger landscape based on observation and measurement. This document contains information on appropriate and effective eradication methods that would be updated over time as new data become available. Likewise, other metrics or observable measurements will be adapted over time based on past observations, new research findings, and new regulations.

The following information related to the growth and production of giant miscanthus in the United States has been found to be lacking complete detail. .

- Potential effects to socioeconomics are focused on the information provided in the pro forma analyses of the Project Sponsor. Data from Europe indicates a high cost of establishment due to the vegetative propagation of the species; however, the BCAP combined with the production methods undertaken by the Project Sponsor and technical assistance to be provided to producers addresses most of these concerns.
- Landscape scale analyses of giant miscanthus are generally lacking since there have not been any commercial-scale field trials in the United States.
- Literature documenting the potential for invasiveness of the fertile species of the *Miscanthus* genus has been discussed along with documentation supporting that giant miscanthus should not be considered invasive due to its sterility and slow rhizome spread within the United States. The growth and management of giant miscanthus has been studied extensively by the University of Illinois and commercial-scale production has been implemented and monitored in the United Kingdom, but commercial-scale production of the plant has not yet been implemented in the United States. Although the preponderance of evidence indicates that the plant is sterile and slow spreading, documentation of sterility and spread is needed for commercial-scale operations in United States' environments.
- Literature discussing potential plant pests has been recently published relating to the western corn root worm, several species, of aphids, and rust; those studies along with recommendations have been included.
- There is little peer-reviewed literature concerning the effects of giant miscanthus plantings on biological diversity in the United States; however, some specific studies have been published in Europe. These studies are primarily focused on bird species with some small mammal observations. These studies also looked at young-aged giant miscanthus stands, so there was little information available on biodiversity found in mature stands.
- Information concerning the nutrient uptake, nutrient addition trials, and root structure has been included to discuss the potential for soil erosion, soil organic matter, and soil carbon sequestration based on the available literature.

Literature concerning nutrient uptake, water use efficiency, and irrigation needs during establishment has been discussed based on the available literature.

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ACRONYMS AND ABBREVIATIONS

AEC	Areas of Environmental Concern
APHIS	USDA Animal and Plant Health Inspection Service
ARS	USDA Agricultural Research Service
AQCR	Air Quality Control Region
BCAP	Biomass Crop Assistance Program
BCF	biomass conversion facilities
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BMP	best management practice
C	carbon
CAA	Clean Air Act
CCC	Commodity Credit Corporation
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter
CMPA	Coastal Marshland Protection Act
CO	carbon monoxide
CPS	Conservation Practice Standard
CREP	Conservation Reserve Enhancement Program
CRD	Coastal Resources Division
CRP	Conservation Reserve Program
CWA	Clean Water Act
EA	environmental assessment
EI	Erodibility Index
EIA	Economic Impact Analysis
EIS	environmental impact statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERS	Economic Research Service
ESA	Endangered Species Act
ET	evapotranspiration
et seq	*et sequentes* (and the following)
FAO	Food and Agricultural Organization
FONSI	finding of no significant impact

FR	Federal Register
FS	USDA Forest Service
FSA	USDA Farm Service Agency
g	gram
GCIA	Georgia Crop Improvement Association
GDNR	Georgia Department of Natural Resources
GHG	greenhouse gases
HEL	highly erodible lands
HILD	high-input low diversity
HUC	hydrologic unit
Ibid.	*Ibidem* (the same place)
IPM	integrated pest management
ISO	International Standards Organization
kg	kilograms
kPA	kilo Pascal
LIHD	low-input high diversity
$\mu g/m^3$	micrograms per cubic meter
m	meter
m^2	square meter
MSU	Mississippi State University
MSU2	Michigan State University
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NASS	National Agricultural Statistics Service
NCDENR	North Carolina Department of Environmental and Natural Resources
NCNHP	North Carolina Natural Heritage Program
NEPA	National Environmental Policy Act
NISC	National Invasive Species Council
NO_X	nitrous oxides
NOAA	National Oceanic and Atmospheric Administration
NRCS	USDA Natural Resources Conservation Service
NZERMA	New Zealand Environmental Risk Management Authority
O_3	ozone
Pb	lead

PEIS	Programmatic Environmental Impact Statement
PL	Public Law
$PM_{2.5}$	particulate matter of less than 2.5 microns
PM_{10}	particulate matter of less than 10 microns
PPA	Plant Protection Act
QAP	Quality Assurance Program
RES	Renewable Energy Standard
ROD	Record of Decision
ROI	Region of Influence
SCDHEC	South Carolina Department of Health and Environmental
SCDNR	South Carolina Department of Natural Resources
SHPO	State Historical Preservation Offices
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPA	Shore Protection Act
SWAT	Soil Water Assessment Tool
tpy	tons per year
TSP	Technical Service Providers
UGA	University of Georgia
USACE	U.S. Army Corp of Engineers
USC	U.S. Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
WRA	Weed Risk Assessment
WRP	Wetland Reserve Program

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1 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION AND BACKGROUND

The U.S. Department of Agriculture (USDA) Commodity Credit Corporation (CCC) implements the Biomass Crop Assistance Program (BCAP) authorized by the Food, Conservation, and Energy Act of 2008 (the 2008 Farm Bill). This legislation, which was passed into law on June 18, 2008, creates the BCAP and authorizes the program through September 30, 2012. BCAP is intended to assist agricultural and forestland owners and operators with the establishment and production of eligible crops including woody biomass in selected project areas for conversion to bioenergy, and the collection, harvest, storage, and transportation of eligible material to designated biomass conversion facilities (BCF) that produce or intending to produce heat, power, biobased products, or advanced biofuels. The BCAP is administered by the Deputy Administrator for Farm Programs of the Farm Service Agency (FSA) on behalf of the CCC with the support of other Federal and local agencies. On October 27, 2010, the CCC published the Record of Decision (ROD) for the BCAP Final Programmatic Environmental Impact Statement (PEIS) and the BCAP Final Rule (7 Code of Federal Regulations [CFR] Part 1450) in the Federal Register (FR 75:207, 65995-66007; 66202-66243).

As part of the mitigation measures detailed in the ROD, each project proposal is subject to a National Environmental Policy Act (NEPA) (Public Law [PL] 91-190, 42 U.S. Code [USC] 4321 *et seq*.) analysis prior to approval of the project area proposal. The initial environmental evaluation of a project area proposal is developed through the completion of Forms BCAP-1, AD-1047, BCAP-20, BCAP-21, and BCAP-22 and supporting information. After this initial evaluation of the project area proposal FSA can conclude that (1) no additional environmental analyses are applicable due to (a) the activity being specifically addressed and analyzed within the BCAP Final PEIS, and/or (b) no potential for the proposed BCAP activity to significantly impact the environment or (2) that additional environmental analyses in the form of an environmental assessment (EA) or environmental impact statement (EIS) are necessary, depending upon the potential level of significance.

If a project area proposal is approved by FSA, then producers can apply to FSA to become BCAP contract producers with acreage within the approved project area(s). Only after a project area has been approved can producers start the process of applying for specific contract acreage for inclusion into the BCAP project area. As part of the process for approving contract acreage, the producer must provide an on-site environmental evaluation

for the proposed acreage. The initial environmental evaluation will require the completion of the Natural Resources Conservation Service (NRCS) environmental evaluation worksheet, CPA-52. If through the completion of CPA-52, there is an indication for the potential for environmental impacts additional environmental evaluation would be required following the FSA NEPA guidance for an EA or EIS. However, FSA could determine after the completion of CPA-52 not to enroll those acres into the BCAP project area due to the potential level of significant effects. If acreage is approved, then all contract producers are required to develop a BCAP Conservation Plan or Forest Stewardship Plan for their contract acreage, in addition to any project area specific mitigation and monitoring measures (Section 6 of this document), which would be included within the BCAP contract details or incorporated into the BCAP Conservation Plan or Forest Stewardship Plan. All components included within the Mitigation and Monitoring Plan included within the EA (Section 6 of this document) are mandatory minimum requirements on all producer contract acreage that is accepted by the FSA into the BCAP project area.

In Fiscal Year (FY) 2011, the FSA approved nine BCAP project areas with the following species: native prairie grass (two project areas totaling 40,000 acres); giant miscanthus, Illinois clone (four project areas totaling 19,182 acres, which underwent an EA and received a mitigated finding of no significant impact [FONSI] in May 2011); camelina (two project areas totaling 51,000 acres); and hybrid poplar (one project area totaling 7,002 acres).

This EA analyzes the proposed establishment of BCAP project areas supporting the proposed establishment and production of giant miscanthus hybrid (*Miscanthus X giganteus)* by REPREVE Renewables LLC (Project Sponsor) in Georgia, North Carolina, and South Carolina. The information developed from this EA and from public comments received on the Draft EA will provide the FSA decisionmakers the information necessary to determine if this project area proposal would meet the requirements of the NEPA environmental evaluation of the BCAP or would require further environmental evaluations under an EIS.

REPREVE Renewables LLC, headquartered in Soperton, Georgia, is a commercial grower of Freedom™ giant miscanthus. It was founded three years ago to participate in the research and commercialization of viable non-food biomass solutions. The company's variety, Freedom giant miscanthus, is superior in vigor and yield for the Southeastern United States, as detailed by the experience of Mississippi State University (MSU), where the variety was developed. By offering a high-yielding, low maintenance energy crop, the

Project Sponsor feels that growers can make a profit and contribute to America's foreign fuel independence. The Project Sponsor has the exclusive license to commercialize Freedom giant miscanthus, an energy crop that has the potential to significantly out-produce the current sources of biomass in the Southeast. REPREVE Renewables LLC was formed in 2010 by a joint venture between certain affiliates of Unifi, Inc. and SunBelt Biofuels, LLC. The new company was formed with capital sufficient to advance the commercialization of bioenergy crops, including research and development around feedstocks, planting, and harvesting and conversion technologies. The company is primarily owned and operated jointly by Phillip Jennings and a subsidiary of Unifi, Inc. Phillip Jennings is the owner operator of Phillip Jennings Turf Farms, LLC, as well as other related business, engaged in the development and commercialization of turf grass. Unifi, Inc. is a $700 million annual revenue textile company that is publicly traded company on the NYSE under the symbol UFI.

1.2 USDA NEPA GUIDANCE/AUTHORITY

This EA is being prepared in accordance with the NEPA (PL 91-190, 42 USC 4321 *et seq*.); implementing regulations adopted by the Council on Environmental Quality (CEQ) (40 CFR 1500-1508); and FSA implementing regulations, Environmental Quality and Related Environmental Concerns – Compliance with NEPA (7 CFR 799). According to CEQ guidance, an EA is a "concise document for which a Federal agency is responsible that serves to (1) briefly provide sufficient evidence and analysis for determining whether to prepare an EIS or a FONSI (40 CFR 1508.9)." Additionally, since this document falls under the guidance of the BCAP Final PEIS, which was a broad national-level program document, CEQ guidance allows for "tiering." CEQ guidance defines tiering as, "the coverage of general matters in broader EIS with subsequent narrower statements or environmental analyses incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared (40 CFR 1508.28). CEQ identifies tiering as appropriate to assist the lead agency on focusing on the issues of importance and exclude from consideration those issues, which have been previously decided or "not yet ripe "for a decision.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

The primary purpose of BCAP is to promote the cultivation of perennial bioenergy crops and annual bioenergy crops that show exceptional promise for producing bioenergy or biofuels

that preserve natural resources and that are not primarily grown for food or animal feed, which would help alleviate dependence on foreign oil for energy production.

As such, the FSA accepts project area proposals from potential sponsors of BCAP project areas and then determines whether to accept and establish those project areas, which then creates opportunities for producers to receive funding for crop establishment and production under BCAP. Project area proposals are submitted by proposed sponsors and include a specific dedicated bioenergy crop or crops and the proposed location for the project area or areas. FSA does not determine which crop(s) or methods would be the most economically viable or most environmentally suited for an area(s), but rather is tasked with determining that a project area proposal fully meets the requirements set forth in the BCAP Final Rule and the appropriate environmental evaluation for the proposal is completed and enough information is available for the decisionmakers to make an informed decision.

The FSA would determine from the initial environmental evaluation of a project area proposal whether that proposed project area should (1) be granted approval as a BCAP project area (e.g.,, a species analyzed within the Final BCAP EIS or an existing non-Title I crop species) or (2) that further environmental evaluation would be required. This EA provides the initial step for the further environmental evaluation of the proposed project area proposal by FSA. At the conclusion of this EA process, FSA will determine based on the finding of the EA to provide a FONSI or mitigated FONSI or that more environmental evaluation in the form of an EIS is necessary to determine the extent of environmental effects.

The purpose of the Proposed Action is to support the establishment and production of giant miscanthus as a crop for energy production to be grown by BCAP participants in the project areas proposed in Georgia, South Carolina, and North Carolina. The need for the Proposed Action is to provide renewable biomass feedstock to a Biomass Conversion Facility (BCF) for use in energy production within and potentially outside the immediate region(s).

1.4 ORGANIZATION OF THE DOCUMENT

This EA assesses the potential impacts of the Proposed Action and No Action Alternatives on the potentially affected environmental and socioeconomic resources.

- **Section 1** provides background information relevant to the Proposed Action, and discusses its purpose and need.
- **Section 2** describes the alternatives, including the Proposed Action, and compares the alternatives.
- **Section 3** describes the baseline conditions (i.e., the conditions against which potential impacts of the Proposed Action and alternatives are measured) for each of the potentially affected resources.
- **Section 4** describes potential environmental consequences on these resources.
- **Section 5** includes analysis of cumulative impacts and irreversible and irretrievable resource commitments.
- **Section 6** discusses mitigation measures.
- **Section 7** is a list of references cited in the EA.
- **Section 8** lists the preparers of this document.
- **Section 9** contains a list of persons and agencies receiving this document and contacted during the preparation of this document.

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2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 ALTERNATIVES DEVELOPMENT

As part of the BCAP Project Area Selection Process, the Project Sponsor developed a proposal application for submittal to the FSA. Prior to this submittal, the Project Sponsor has determined the economic feasibility of their proposal, including developing alternatives for location and crop species. The Project Sponsor developed selection criteria to meet the overall purpose and need for the Proposed Action, the establishment and production of giant miscanthus as a dedicated energy crop for energy production under the incentives of the BCAP. As part of the alternatives development process the Project Sponsor analyzed both alternative locations and alternative crops for the proposed project areas. The following sections describe each of these processes that were under taken by the Project Sponsor during the planning phases and why certain aspects were eliminated as unfeasible alternatives.

2.1.1 Proposed Project Area Locations – Alternatives Analyzed and Eliminated

The Project Sponsor utilized several criteria to determine the proposed project locations. These selection criteria included:

(1) Location Near the Project Sponsor - The Southeastern United States is the location of the Project Sponsor's foundation facilities, so proposed project areas were developed in a regional area in reasonable proximity to Soperton, Georgia.;

(2) Location Near Foundation Acreage – The Project Sponsor has several hundred acres of rhizome production in Soperton, Georgia which offers readily available rhizome distribution from a centralized point to all proposed project areas.

(3) Proximity of Infrastructure for Market Transportation – Due to the heavy agricultural and timber production in the Southeastern United States, multiple transportation options exist for moving large-scale plant materials efficiently. The proposed project areas have convenient access to Interstate highways, rail hubs, inland distribution ports, and major sea ports, such as Savannah, Georgia; Charleston, South Carolina; and Wilmington, North Carolina.

(4) Proximity to Multiple Potential BCFs – the Project Sponsor chose proposed project areas that could support multiple types of BCFs from local electricity generation, cellulosic ethanol, advanced biofuels, to pellet mills for export of

biomass materials. This approach would provide contract producers with greater options to market their feedstock and lessen the risk of only having one demand source for their product.

(5) Amount of Available Marginal Croplands, Pasturelands, and Abandoned/Previously Cleared Timberlands – The Project Sponsor understands the underlying food versus fuel debate and the uncertainty over indirect land uses changes, as such, the Project Sponsor is targeting marginal croplands, pasturelands, and, where economically available, previously cleared/abandoned timberlands.

(6) Need for Rural Development – The Project Sponsor being an agricultural producer in Georgia, was acutely aware of the current economic conditions within the rural areas of the Southeastern United States, primarily Georgia, North Carolina, and South Carolina. The Project Sponsor focused the proposed project areas in agricultural regions with a need for a more diversified profile of agricultural products to meet the fluctuating demand shifts in the traditional agricultural crops of these areas, such as loss of tobacco acreage and the increase in high cost input crops such as cotton.

(7) Economic Feasibility of the Project – The Project Sponsor determined through internal economic analyses that the production of Freedom giant miscanthus could provide sufficient return on economic investment to undertake the efforts.

2.1.2 Proposed Crop Alternatives – Alternatives Analyzed and Eliminated

The Project Sponsor determined the ideal feedstock to be grown in the Southeastern United States based upon their experience in agriculture and their work with university energy crop experts. The following detail the selection criteria that were developed through the process of selecting Freedom giant miscanthus.

(1) Testing of Several Herbaceous Energy Crop Species – MSU performed trials of energy sorghums (*Sorghum* spp.), napier grass (*Pennisetum purpureum*), switchgrass (*Panicum virgatum*), and giant miscanthus. Switchgrass and giant miscanthus were selected for further study based on yields and their ability to grow in Southeastern United States conditions and on marginal lands.

(2) Testing of Switchgrass versus Giant Miscanthus – MSU performed side-by-side trials and determined that the most efficient use of land for energy crops

would be in growing giant miscanthus, based on yields that were more than double that of switchgrass.

(3) Selection of Most Efficient Variety of Giant Miscanthus – Through repeated selections of the most vigorous plants, and through serial propagation, a superior variety was identified for growing in the Southeast. This variety was named Freedom, tested for genetic differences, licensed as a commercial variety, and is patent pending.

(4) Land Use Efficiency versus Existing Biomass Feedstocks – In the Southeast, southern yellow pine (*Pinus* spp.) is the predominant biomass crop for renewable energy. Freedom giant miscanthus was chosen as the ideal alternative feedstock as it produces more tons per acre than plantation pine stands, can grow on similar lands, and is an equally usable cellulosic feedstock for both power and liquid fuels.

(5) Economic Feasibility for Growers – In the Southeast, the Project Sponsor believes that growers can produce more cellulosic feedstock per acre, and with more profit per acre, with giant miscanthus than other alternative energy crops. They foresee the revitalization of rural economies based on growing energy crops and producing renewable energy. With BCAP funding, growers will be able to help create these economies faster and, with the growth incentivized by BCAP, enjoy economies of scale making the model even more efficient.

2.2 ALTERNATIVES TO BE ANALYZED

Alternatives considered to be reasonably expected to meet the purpose and need for action include the Proposed Action. Even though the No Action Alternative would not meet the purpose and need for the proposed action, it is included as the baseline for which the Proposed Action is compared to determine the potential effects to the human and natural environment and the potential significance of those effects, both positive and negative.

2.2.1 No Action Alternative

Under the No Action Alternative, the FSA would not establish the proposed project areas supporting the establishment and production of giant miscanthus. This alternative would leave existing agricultural production practices in place in the proposed project areas. Producers would have the ability, if market conditions exist, to convert acreage into traditional crops, leave as is, or provide their acreage for non-agricultural development. This

alternative would not meet the goals and objectives of the BCAP, as the Project Sponsor would not enter the voluntary program for the incentive to produce dedicated bioenergy crops. Also, the No Action Alternative would not meet the purpose and need for the Action as described in Section 1.3.

2.2.2 Proposed Action

REPREVE Renewables LLC (Project Sponsor) is proposing that FSA establish four separate BCAP project areas to establish and produce Freedom giant miscanthus on up to 58,000 total acres over the life of the project. The acreage targeted for enrollment into the proposed project areas are economically marginal and idle croplands, current pastureland, and abandoned/previously cleared timberland; however, it would not exclude producers with acreage in traditional row crops from enrolling those acres. Liu et al. (2011) has summarized marginal lands from the following sources with the following definitions (**Table 2-1**).

Table 2-1. Definitions of Marginal Lands

Organization	Definition of Marginal Lands
Committee on World Food Security (2003)	In farming, poor-quality land that is likely to yield a poor return. It is the last land to be brought into production and the first land to be abandoned.
USDA-NRCS (1995)	Land is restricted by various soil physical/chemical properties, or environmental factors, for crop production. Land classes IV-VIII defined as the marginal land based on NRCS State Soil Geographic database.
European Environmental Agency	Low quality land the value of whose production barely covers its cultivation costs
Organization for Economic Development Co-operation and Development (2001)	Land of poor quality with regard to agricultural use and unsuitable for housing and other uses.
Asia-Pacific Economic, Cooperation Energy Working Group (2009)	Marginal lands are characterized by poor climate, poor physical characteristics, or difficult cultivation. They include areas with limited rainfall, extreme temperatures, low quality soils, steep terrain, or other problems for agriculture. Examples include deserts, high mountains, land affected by salinity, waterlogged or marshy land, barren rocky areas, and glacial areas. Evidently not all of the areas are suitable for agriculture.
Ministry of Agriculture, the People's Republic of China (2008)	Marginal land is winter-followed paddy land and waste land that may be used to cultivate energy crops.
Agriculture and Agri-Food Canada (2008)	Classifying Land Class 4-7 as marginal based on the Canada Land Inventory.

Source: Liu et al. 2011

As per the BCAP statute and regulatory guidance, native sod would be excluded from any project area. All Federal and State-owned land are considered to be ***ineligible*** for participation in the BCAP program. Other lands considered ***ineligible*** to be enrolled under a BCAP contract include native sod; and land that is already enrolled in CCC's CRP, Wetlands Reserve Program, or Grassland Reserve Program. Native sod within the proposed BCAP rules is land on which the plant cover is composed principally of native grasses, grass like plants, forbs, or shrubs suitable for grazing and browsing; and that has never been tilled for the production of an annual crops as of the date of the publication of the BCAP Final Rule in the FR.

The proposed project areas are located in three states in four proposed project areas (**Figure 2-1**). Three of the proposed project areas are within Georgia with one being combined with counties in South Carolina, and one proposed project area in North Carolina. The Project Sponsor deems the proposed project economically feasible based on discussions with BCFs and projected economic models, which are part of the Project Sponsor's confidential project area proposals; however, no specific contract acreage has been developed. As such, the proposed project areas have some approximate locations of acreage to be included, but those acres are not committed; therefore, the level of analysis for this EA is based at the combined county proposed project area level.

Each proposed project area contains at least one BCF that would accept giant miscanthus for a direct bioenergy feedstock or conversion into an intermediary product for bioenergy production. Additionally, there are other BCFs in varying stages of development for various end products that could use giant miscanthus as a feedstock in the proposed project areas. Each proposed project area was developed in proximity to the foundation acreage located in Soperton, Georgia and to sub-licensed registered acreage for efficient transportation of the certified rhizome stock to the participating producers and efficient transportation alternatives to the BCF(s) within each proposed project area. All rhizome stock planted on contract acreage within the proposed project areas would be certified and originate from the foundation acreage or from sub-licensed registered acreage. All rhizomes would be pre-processed following the methods developed by the Project Sponsor prior to planting and establishment on contract acreage. The specific methods for rhizomes processing are a trade secret process developed by the Project Sponsor and have been described further in the confidential project area proposals.

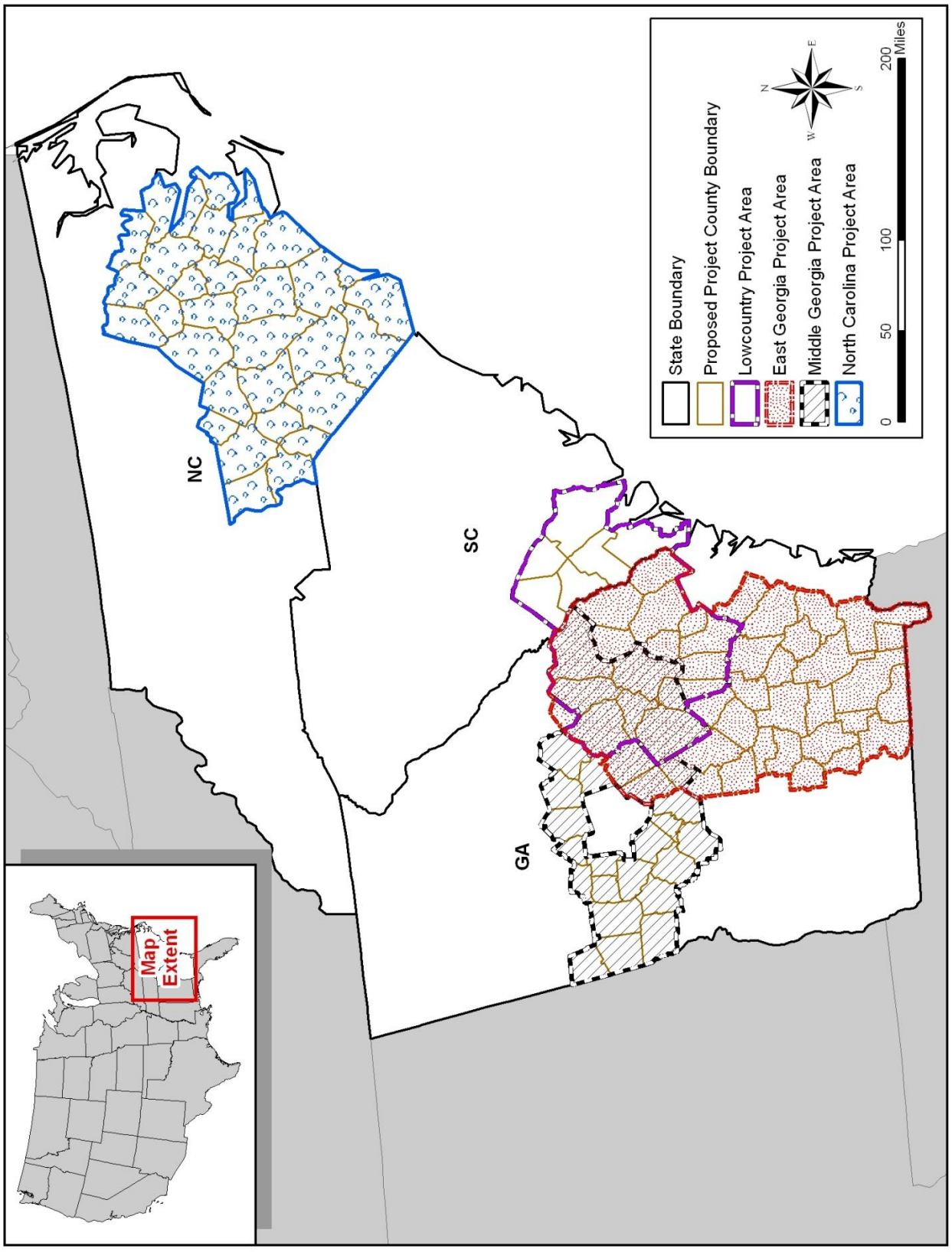


Figure 2-1. Proposed Project Area Locations.

The Project Sponsor reserves the right to decline any acres within the eligible project area that the Project Sponsor, the FSA, or the FSA technical partners' determine cannot produce giant miscanthus effectively without substantial environmental effects. This would be determined through one of the following: the Project Sponsor's initial site evaluations, the environmental screening process for each participating contract, or through the conservation or forest stewardship planning processes. The environmental screening process for each project proposal begins with the completion of Form BCAP-22 Environmental Screening for - the Project Proposal. The conservation planning process for each participating producer includes the preparation of the NRCS worksheet NRCS-CPA-052 by either NRCS field personnel or a certified technical service provider (TSP). The CPA-52 worksheet is provided to FSA for completion and determination by FSA, as the lead Federal agency for BCAP, of any need for further environmental evaluation through the development of an EA or EIS. The CPA-52 provided to FSA also notes any required consultation or coordination under any applicable Federal environmental law, Executive Order (EO), or agency policy that FSA would need to complete for the site-specific acreage.

Additionally, per the BCAP Final PEIS and BCAP Final Rule, the collection, harvest, storage, and transportation of biomass from the proposed project areas to the BCF are included within the provisions of the BCAP Matching Payments Program; therefore, those activities are not being analyzed as part of the Proposed Action (BCAP Final PEIS Chapter 1.3.2, page 1-6). The Matching Payment Program was determined not to be a major Federal action per the NEPA definition since (1) there was no discretionary authority to implement the program terms; it was implemented per the direct language of the 2008 Farm Bill and (2) that the materials collected during the Matching Payment Program were currently being utilized in the marketplace for a similar, if not the same, purpose.

2.2.2.1 Methods for Establishment and Production of Giant Miscanthus

Figure 2-2. Freedom Giant Miscanthus, April 2011 Planting, Soperton Georgia.

The establishment and production of giant miscanthus (**Figure 2-2**) within the proposed project area began with the establishment of Freedom giant miscanthus on the foundation acreage in Soperton, Georgia. The Project Sponsor has developed proven, proprietary protocols based on experience with other herbaceous species and with Freedom giant miscanthus for the establishment and production of this species within the proposed project areas. These protocols are shared with licensed growers to help ensure the most successful growth and production. The Project Sponsor will target land that is well suited or easily modified to become suitable for Freedom giant miscanthus. All state and Federal soil conservation rules, best management practices (BMPs), and other applicable conditions as developed within the mandatory site-specific producer Conservation Plan or Forest Stewardship Plan will be implemented during land preparation and planting.

Giant miscanthus is a triploid hybrid perennial warm-season grass developed through the crossing of *Miscanthus sinensis* (diploid species) with *M. sacchariflorus* (tetraploid species), both of which are native to Southeast Asia. One species, *M. sinensis* was introduced to the United States, as an ornamental; other species are not frequently being used, including varieties of giant miscanthus, which is currently being developed as a biofuel feedstock.

Freedom giant miscanthus was developed at MSU beginning in 2001. Field testing of giant miscanthus from greenhouse propagated stock began in 2002 at both MSU and a replicate site in Oklahoma. The Freedom giant miscanthus variety was selected in 2005 after field testing. Freedom giant miscanthus has been grown and/or tested in California, Georgia, Iowa, Missouri, North Carolina, Ohio, Oklahoma, South Carolina, and Texas by universities, USDA, and private industry.

The only visual (morphological) difference between Freedom giant miscanthus and the other widely tested variety is in the leaf angle as measured above the node, to the upper surface of the leaf; however, genetic lab testing revealed enough genetic variability to allow for a pending patent. The Freedom giant miscanthus variety, as mentioned above, was developed by MSU and has been licensed to REPREVE Renewables. MSU is currently in the process of patenting the crop, licensing the crop, and is the original license owner of Freedom giant miscanthus. REPREVE Renewables is currently the sole licensee for this variety from MSU. An official MSU release of Freedom giant miscanthus was unnecessary due to the licensing; however, MSU has a pending release for Freedom giant miscanthus.

Yields in North American research trials have reached a range between 15 to 23 dry tons per acre per year with minimal inputs. The species is a sterile hybrid which does not produce viable seed and is therefore propagated vegetatively by rhizome division (Jørgensen 2011, Gordon et al 2011). Mechanical planting equipment for turfgrass or specialty crops has been used to successfully establish giant miscanthus in Southeastern United States. Harvesting is done in a manner similar to traditional hay crops, but the equipment must be able to handle high-yield crops. **Table 2-2** summarizes best practices for the establishment and management of giant miscanthus.

Figure 2-3. Freedom Giant Miscanthus, Rhizomes on Plant Root Ball.

Successful establishment of Freedom giant miscanthus within the proposed project areas begins with viable, appropriately processed rhizomes (**Figure 2-3**). All rhizomes to be used on contract acreage within the proposed project areas will be harvested with proven, proprietary protocols that protect rhizomes from destruction with equipment designed specifically for giant miscanthus. Each rhizome will be processed with minimum bruising or splitting. The rhizome processing methods are a proprietary process that the Project Sponsor developed and are further described in the confidential project area proposals.

Table 2-2. Proposed Establishment and Production Methods for Giant Miscanthus

Former Land Use		
Traditional Crops	**Currently Idle or Pasture**	**Harvested Timberland**
Crop Establishment Year One		
Deep tillage to disrupt any hard pan that may inhibit deep rooting.	A non-selective herbicide will be applied during the fall or early spring prior to land preparation to control unwanted herbaceous species that may be present.	Leftover timber harvest residue will be removed by V-blading, chopping, mulching, piling and burning, or a combination thereof. Debris will be removed to allow mechanical planters to pass over and place rhizomes at a depth of three inches at an equally distributed rate.
Protocols for the GCIA land certification of Freedom giant miscanthus will be followed.	Deep tillage to disrupt any hard pan that may inhibit deep rooting.	Deep tillage to disrupt any hard pan that may inhibit deep rooting.
Prior to planting, harrowed or finished for a prepared seedbed followed by row bedding.	Protocols for the GCIA land certification of Freedom giant miscanthus will be followed.	Protocols for the GCIA land certification of Freedom giant miscanthus will be followed.
Soils will be amended to correct any deficiencies of nutrients and/or Ph according to soil analysis recommendations.	Prior to planting, harrowed or finished for a prepared seedbed followed by row bedding.	Prior to planting, harrowed or for a prepared seedbed followed by row bedding.
Pre-emergent herbicide will be applied at the time of planting and on 45-day increments for a total of three applications.	Soils will be amended to correct any deficiencies of nutrients and/or Ph according to soil analysis recommendations.	Soils will be amended to correct any deficiencies of nutrients and/or Ph according to soil analysis recommendations.
	Pre-emergent herbicide will be applied at the time of planting and on 45-day increments for a total of three applications.	Pre-emergent herbicide will be applied at the time of planting and on 45-day increments for a total of three applications.
Crop Maintenance Year Two		
After successful planting of rhizomes and first-year growth, soils will be amended to correct any deficiencies of nutrients and/or Ph according to soil analysis recommendations.		
Pre-emergent herbicides will be applied prior to plant emergence in late winter/early spring. A second application of herbicide may be necessary if weeds emerge. Crop canopy will hinder weed germination and competition during the second and succeeding years.		
Crop Maintenance (Years 3+)		
Soils will be amended to correct any deficiencies of nutrients and/or Ph according to soil analysis recommendations		
Pre-emergent herbicides will be applied as necessary to control competition from weeds. Crop canopy will hinder weed germination and competition in succeeding years, reducing and even eliminating the need for herbicides.		
Crop Removal		
Following final biomass harvest, till or harrow to destroy rhizome mass. Upon emergence of existing rhizomes in late winter/early spring, apply non-selective herbicide.		
Plant glyphosate tolerant crop and apply glyphosate during growing season when giant miscanthus shoots appear. At least two treatments are recommended, with monitoring to occur for two to three growing seasons after no additional resprouting of Freedom giant miscanthus.		

This process increases rhizome viability by allowing it to retain more stored energy, which enables rhizomes to survive longer under stress periods after planting. Rhizomes will be harvested after all energy and nutrients have been naturally translocated to the root system, thus increasing viability. Rhizomes should be processed with proven protocols to preserve

their viability from harvest until planting time. Specialized equipment will be used to separate and remove the smaller feeder roots from the rhizomes so that they will flow with accuracy through various types of planters. Rhizomes will be stored in a controlled environment, with temperature and humidity monitored daily to ensure predetermined storage parameters are met. It has been found that rhizomes of giant miscanthus desiccate rapidly outside of climate-controlled conditions.

Rhizome processing would occur either in an existing Freedom giant miscanthus field where the rhizomes are cleaned, sorted, cut, and then packaged for off-site transportation for field planting or storage or live rhizomes would be transported without processing from an existing Freedom giant miscanthus field in covered, enclosed containers and transported to a processing facility. Live rhizomes would leave the processing center in a sealed container under climate-controlled conditions to ensure that no live plant materials are unintentionally disbursed along transportation routes following all state and local requirements, as applicable.

Figure 2-4. Field Preparation and Planting of Rhizome Harvest Foundation Acreage, Freedom Giant Miscanthus.

Within the Southeastern United States giant miscanthus would be planted in early spring (majority of acreage) or early fall (**Figure 2-4**). Climatic historical ranges of soil moisture balance, soil temperature, and ambient temperatures will be considered when determining optimum time to plant in various regions. Rhizomes will be planted in a prepared seedbed approximately three inches deep with a density of 5,000 rhizomes per acre. Mechanical planters will be used to precisely distribute each rhizome at a predetermined rate per area (**Figure 2-5**). A post-planting roller may be required to ensure good soil to rhizome contact. All planters and other equipment that comes in contact with live plant materials will be pressure-washed and inspected for residual plant materials prior to movement from one property to the next to ensure that no live plant materials are unintentionally disbursed along transportation routes.

Figure 2-5. Mechanical Planting of Freedom Giant Miscanthus Rhizomes on Foundation Acreage.

Harvest time for giant miscanthus is anytime between full dormancy, which is usually mid-December in the Southeast to before new growth in early spring, but could occur as early as November, depending on climatic conditions by proposed project area. Biomass will be harvested prior to succeeding year's emergence with mower/conditioner type equipment that cuts and swaths material into a narrow row, which will then be compacted and removed from field in 4'x4'x8' large bales (**Figure 2-6**) or more conventional small bales. Other harvest methods could include a smaller materials processing and then blown into a transport truck for field removal. The harvest and removal method selected would be dependent upon the most efficient manner for the site specific conditions and the requirements of the BCF where the end product would be processed.

Most bale storage will be within the property, thus minimizing transportation until the BCF is ready for delivery. All harvesting equipment and other equipment that comes in contact with live plant materials will be pressure-washed and inspected for residual plant materials prior to movement from one property to the next to ensure that no live plant materials are unintentionally disbursed along transportation routes. Glyphosate and traditional tillage have been found to be effective eradication methods for giant miscanthus though it may require more than one growing season for complete eradication (Caslin et al. 2010, Anderson et al. 2009, Anderson et al. 2011). Caslin et al. (2010) recommend an application of glyphosate after

Figure 2-6. Baling of Freedom Giant Miscanthus.

emergence followed by tillage. Anderson et al. (2009) recommend a tillage depth of at least 10 centimeters to remove any living rhizomes after herbicide treatment.

2.2.2.2 East Georgia Proposed Project Area

The East Georgia proposed project area contains all or parts of 45 counties including the primary population centers of Dublin, Statesboro, Tifton, Valdosta, Waycross, Vidalia, and Swainsboro. There are multiple potential BCFs located within the proposed project area. **Figure 2-1** illustrates the proposed project areas, **Table 2-3** lists the counties within each proposed project area, and **Figure 2-7** illustrates the existing, proposed, and under construction facilities that could utilize biomass within the proposed project area. There is currently over 500 acres of Freedom giant miscanthus established in the East Georgia proposed project area with an anticipated planting schedule of the remaining up to 14,500 acres by 2012.

Table 2-3. Counties and Proposed Acreage within Each Proposed Project Area

	East Georgia	Middle Georgia	Lowcountry	North Carolina
Counties	Appling, Atkinson, Bacon, Ben Hill, Berrien, Bleckley, Brantley, Bulloch, Burke, Candler, Charlton, Clinch, Coffee, Cook, Dodge, Echols, Effingham, Emanuel, Evans, Glascock, Irwin, Jeff Davis, Jefferson, Jenkins, Johnson, Lanier, Laurens, Long, Lowndes, Montgomery, Pierce, Pulaski, Screven, Tattnall, Telfair, Tift, Toombs, Treutlen, Twiggs, Ware, Washington, Wayne, Wheeler, Wilcox, Wilkinson	Baldwin, Bleckley*, Burke*, Butts, Crawford, Emanuel*, Hancock, Harris, Heard, Houston, Jasper, Jefferson*, Johnson*, Lamar, Laurens*, Macon, Meriwether, Peach, Pike, Putnam, Spalding, Talbot, Taylor, Treutlen*, Troup, Twiggs*, Upson, Washington*, Wilkinson*	*Georgia:* Bulloch*, Burke*, Candler*, Effingham*, Emanuel*, Evans*, Jefferson*, Jenkins*, Johnson*, Laurens*, Montgomery*, Screven*, Tattnall*, Toombs*, Treutlen*, Washington* *South Carolina:* Allendale, Bamberg, Barnwell, Colleton, Hampton, Jasper	Beaufort, Bladen, Brunswick, Columbus, Craven, Cumberland, Duplin, Edgecombe, Greene, Harnett, Hoke, Johnston, Jones, Lee Lenoir, Martin, Montgomery, Moore, Nash, New Hanover, Onslow, Pamlico, Pender, Pitt, Richmond, Sampson, Scotland, Wayne, Wilson
Existing Acreage	500	500	500	0
Proposed Acreage	15,000	20,000	5,000	18,000

Note: * = Counties that have occurred in a previous proposed project area

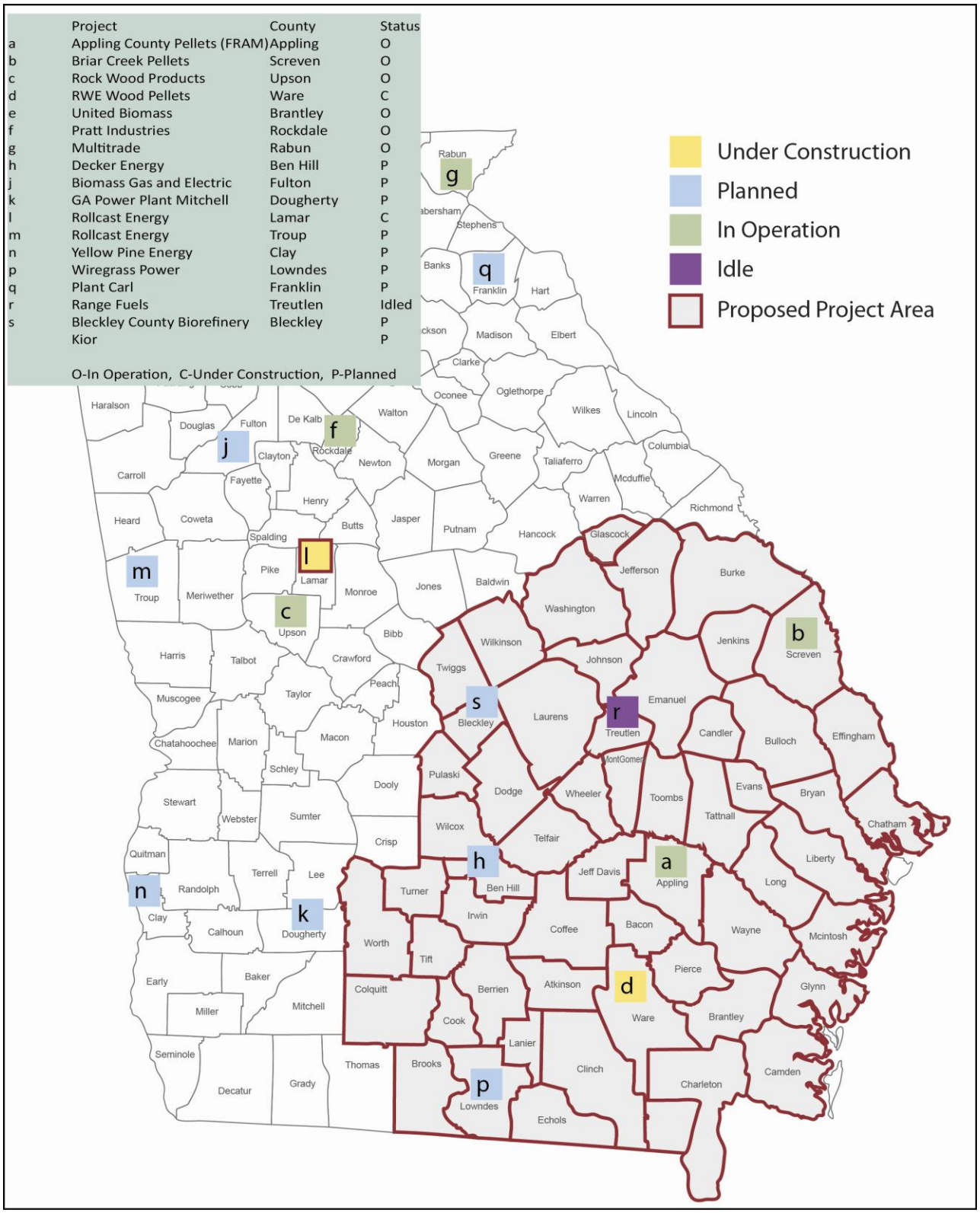


Figure 2-7. Biomass Conversion Facilities of Varying Stages of Operation within the East Georgia Proposed Project Area.

2.2.2.3 Middle Georgia Proposed Project Area

The Middle Georgia proposed project area contains all or parts of 27 counties including the primary population centers of LaGrange, Griffin, Dublin, and Milledgeville. There are multiple potential BCFs located within the proposed project area. **Figure 2-1** illustrates the proposed project areas, **Table 2-3** lists the counties within each proposed project area, and **Figure 2-8** illustrates the existing, proposed, and under construction facilities that could utilize biomass within the proposed project area. There is currently over 500 acres of Freedom giant miscanthus established in the Middle Georgia proposed project area with an anticipated planting schedule of the remaining up to 19,500 acres by 2013 with up to 11,700 acres proposed for 2012 and up to 7,800 acres proposed for 2013.

2.2.2.4 Lowcountry Proposed Project Area

The Lowcountry proposed project area contains all or parts of 16 counties in Georgia and six counties in South Carolina. There are multiple potential BCFs located within the proposed project area. **Figure 2-1** illustrates the proposed project areas, **Table 2-3** lists the counties within each proposed project area, and **Figure 2-9** illustrates the existing, proposed, and under construction facilities that could utilize biomass within the proposed project area. There is currently 500 acres of Freedom giant miscanthus established in the Lowcountry proposed project area with an anticipated planting schedule, which includes the remaining up to 4,500 acres by 2012.

2.2.2.5 North Carolina Project Area

The North Carolina proposed project area contains all or parts of 30 counties. There are multiple potential BCFs located within the proposed project area. **Figure 2-1** illustrates the proposed project areas, **Table 2-3** lists the counties within each proposed project area, and **Figure 2-10** illustrates the existing, proposed, and under construction facilities that could utilize biomass within the proposed project area. The anticipated planting schedule includes up to 18,000 acres by 2013 with up to 9,000 acres planted in both 2012 and 2013.

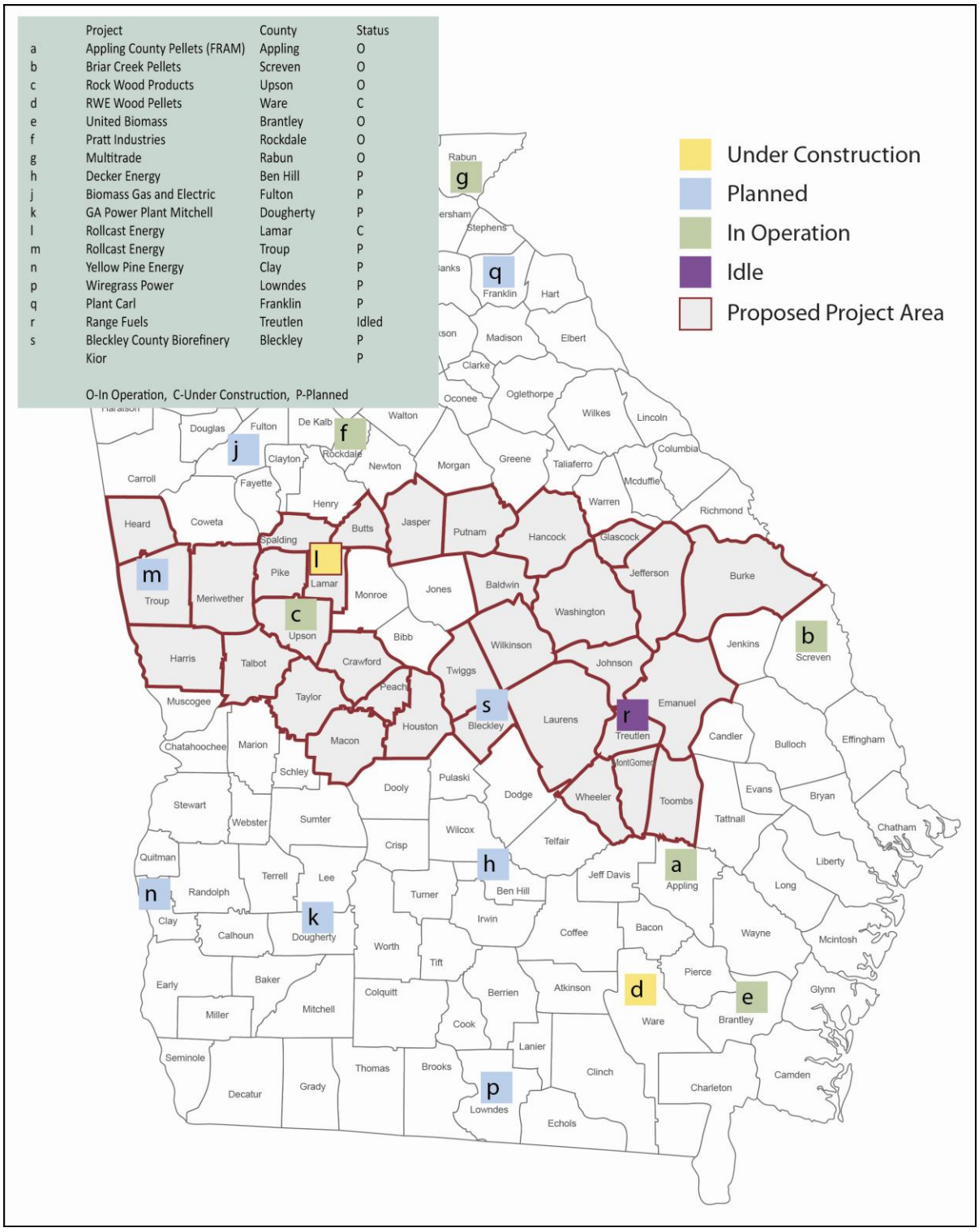


Figure 2-8. Biomass Conversion Facilities of Varying Stages of Operation within the Middle Georgia Proposed Project Area.

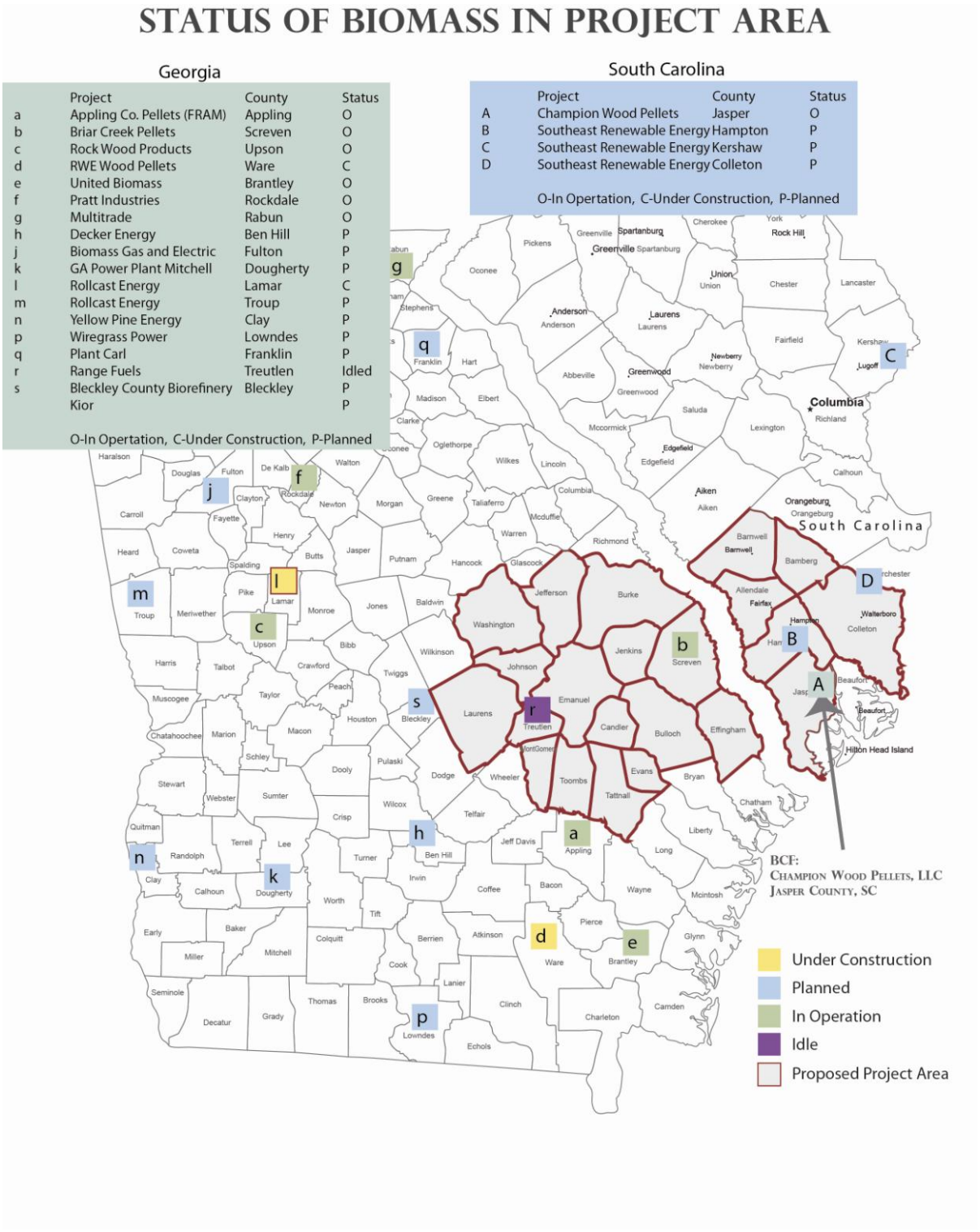


Figure 2-9. Biomass Conversion Facilities of Varying Stages of Operation within the Lowcountry Proposed Project Area.

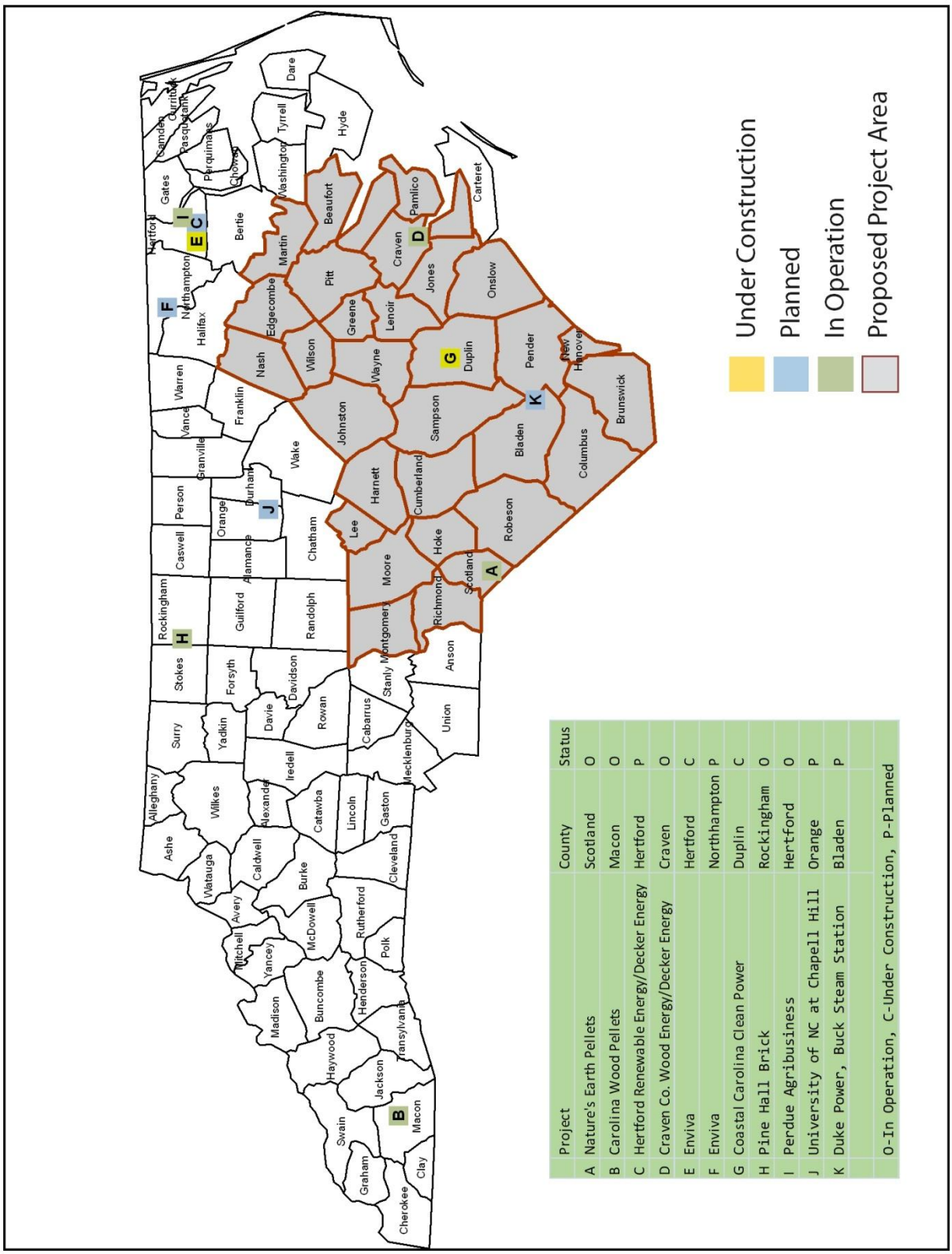


Figure 2-10. Biomass Conversion Facilities of Varying Stages of Operation within the North Carolina Proposed Project Area.

2.3 RESOURCES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

As mentioned previously, this EA is being tiered from the BCAP Final PEIS, as such certain resource areas are being excluded from this analysis consistent with the BCAP Final PEIS, due to little or no affects to these resource areas due to their absence within the proposed project areas or limitations on effects by program guidelines. Those resource areas being excluded from this analysis include:

- **Wetlands** – were eliminated from detailed analysis in this EA since the conversion of wetlands is prohibited under BCAP;
- **Floodplains** – were eliminated from detailed analysis in this EA, since there is little potential for effect from traditional agricultural production practices in floodplains. The Project Sponsor would also exclude or buffer certain areas, depending upon the site-specific conditions associated with each individual producer contract with a minimum buffer distance established in the mandatory Mitigation and Monitoring Plan, which is included as part of each producer's Conservation Plan or Forest Stewardship Plan. Giant miscanthus, once established, provides a tight below ground root mass with a low likelihood of floodwater movements. Additionally, practices, included as part of the Mitigation and Monitoring Plan, and the individual mandatory site-specific Conservation Plan or Forest Stewardship Plan would minimize the potential for vegetative transport of giant miscanthus through flooding;
- **Prime and Unique Farmland** – were eliminated from detailed analysis in this EA, since they are exempt from coordination with the NRCS due to the continued agricultural production of these areas rather than conversion into other land uses;
- **Cultural Resources** – was eliminated from detailed analysis in this EA due to the site specific nature of this resource. No cultural resources analysis (Section 106 of the National Historic Preservation Act compliance) will be required if the project area will be on crop land and the planting of the giant miscanthus will not disturb below the current plow zone. If disturbance will occur below the plow zone, or if the project area has never been plowed, then the Section 106 process will be addressed during the completion of the environmental evaluation as part of the conservation or forest stewardship planning requirement for each individual producer BCAP contract; and

- **Noise** – was eliminated from detailed analysis in this EA, since the effects would be minor, only temporarily occurring during activities, and would be similar to agricultural activities currently taking place within the proposed project areas.

2.4 COMPARISONS OF THE ALTERNATIVES

Table 2-4 provides a tabular summary of the potential effects from both the Proposed Action and No Action Alternative. As described previously, the No Action Alternative would not meet the purpose and need as described, but is the baseline to which the Proposed Action is compared to determine effects to the analyzed environmental resource areas.

Table 2-4. Comparison of the Alternatives

Resource Area	Proposed Action	No Action Alternative	Cumulative Effects
Socioeconomics	Minor +/0	0	Minor +/0
Land Use	0/Minor -	0	0/Minor -
Coastal Zone Management Consistency	0	0	0
Biological Resources			
Vegetation	0/Minor -	0	0/Minor -
Wildlife	0/Minor-	0	0/Minor-
Protected Species	0	0	0
Soil Resources	+/Minor -	0/Minor -	+/Minor-
Water Quality/Quantity			
Water Quality	Minor +/0	0/Minor -	Minor +/Minor-
Water Quantity	Minor +/0	0/Minor -	Minor +/Minor-
Air Quality	0/Minor -	0	0/Minor-
Outdoor Recreation	Minor +/Minor -	0	Minor +/Minor-
Environmental Justice	Minor +/0	0/Minor -	Minor +/Minor-

Note: (+)=positive (-)=negative (0)=neutral

3 AFFECTED ENVIRONMENT (BY RESOURCE AREA)

3.1 SOCIOECONOMICS

3.1.1 Definition of the Resource

Socioeconomic analyses generally include detailed investigations of the prevailing population, income, employment, and housing conditions of a community or Region of Influence (ROI). The socioeconomic conditions of a ROI could be affected by changes in the rate of population growth, changes in the demographic characteristics of a ROI, or changes in employment within the ROI caused by the implementation of the proposed action.

Socioeconomic resources within this document include general population characteristics; general trends in income, employment, and poverty level; general agricultural characteristics associated with number of farms, acres of primary field crops, and revenues generated from primary field crops. Additionally, a brief analysis of rural population trends is discussed.

3.1.2 Existing Conditions – General Population Characteristics

3.1.2.1 Population and Demographics

3.1.2.1.1 General Population Change

Between 2000 and 2010, all states within the proposed project areas had population growth that averaged less than two percent per year (U.S. Census Bureau [USCB], 2002; 2011). Population growth within Georgia and North Carolina was slower than in the previous decade when Georgia had an average annual population growth rate of 2.6 percent and North Carolina had an average annual population growth rate of 2.1 percent. Overall, between 2000 and 2010, the South had the largest percentage regional growth in the United States at 14.3 percent with Texas and the Southeastern states (Florida, Georgia, North Carolina, and South Carolina) all contributing to the rapid regional growth (*Ibid.*). The counties within the proposed project areas generally followed a similar annual average population growth rate as the state, except in South Carolina, where the combined counties only had an average annual population growth of 0.2 percent with four of the six counties experiencing population losses over the decade (*Ibid*.).

3.1.2.1.2 Minority Population

Overall, minority populations accounted for 44.1 percent of the total population in Georgia, 33.8 percent of the population in South Carolina, and 34.7 percent of the population in North Carolina (**Table 3-1**) (USCB 2011). The largest population increase in any group occurred in the Hispanic and Latino populations across all states with Georgia having a total growth rate of 96.1 percent, North Carolina a total growth rate of 111.1 percent, and South Carolina a total growth rate of 147.9 percent (*Ibid.*).

Table 3-1. 2010 Select Minority Populations within the States

State	Total Population	Percent Minority	Hispanic or Latino	Percent Hispanic or Latino	Black or African American	Percent Black or African American
Georgia	9,687,653	44.1	853,689	8.8	2,910,800	30.0
North Carolina	9,535,483	34.7	800,120	8.4	2,019,854	21.2
South Carolina	4,625,364	33.8	235,682	5.1	1,290,684	27.9

Source: USCB 2011

Within the proposed project areas, minorities accounted for 36.5 percent of the total population in the East Georgia proposed project area, 40.0 percent in the Middle Georgia proposed project area, 42.9 percent in the Lowcountry proposed project area, and 41.1 percent in the North Carolina proposed project area (**Table 3-2**) (*Ibid.*). The largest minority group across all counties within the proposed project areas was Black or African American. As a percentage of total population, this minority group accounted for approximately 27.8 percent of the population within the East Georgia proposed project area, 36.0 percent of the population within the Middle Georgia proposed project area, 39.3 percent of the population within the Lowcountry proposed project area, and 28.0 percent of the population within the North Carolina proposed project area (*Ibid.*).

Table 3-2. 2010 Select Minority Populations within the Proposed Project Areas

Proposed Project Area	Total Population	Percent Minority	Hispanic or Latino	Percent Hispanic or Latino	Black or African American	Percent Black or African American
East Georgia	939,584	36.5	52,667	5.6	269,274	28.7
Middle Georgia	765,943	40.0	26,718	3.5	258,824	33.8
Lowcountry	512,380	42.9	23,551	4.6	185,576	36.2
North Carolina	2,600,445	41.1	224,589	8.6	682,910	26.3

Source: USCB 2011

Figures 3-1 and **3-2** illustrate the county minority population percentages across the proposed project areas. As indicated from the figures, certain counties have a minority population at or in excess of 50 percent. Overall 7 counties in the East Georgia proposed project area (24.1 percent of counties), 3 counties in the Middle Georgia proposed project area (6.7 percent of the counties), 7 counties in the Lowcountry proposed project area (33.4 percent of the counties), and 7 counties in the North Carolina proposed project area (23.4 percent of the counties) have a minority population percentage at or in excess of 50 percent (*Ibid.*).

3.1.2.2 Income

The Bureau of Economic Analysis (BEA) defines personal income as the income received by all persons from all sources, including net earnings by place of residence, rental income of persons, personal dividend income, personal interest income, and personal current transfer receipts (BEA 2011a). Net earnings, as defined by BEA, are the earnings by place of work (sum of wages and salary disbursements, supplements to wages and salaries, and proprietors' income) less contributions for government social insurance, plus an adjustment to convert earnings by place of work to a place-of-residence basis.

Total personal income increased across all states within the proposed project areas by greater than 35 percent between 2001 to 2009 with values ranging from $335.5 billion in Georgia to $148.3 billion in South Carolina (**Table 3-3**) (*Ibid.*). Earnings growth from Government and Government Enterprises far outpaced Private earnings during the period with growth more than double across all three states. Earnings from Federal, Civilian employment and Local Government employment contributed the highest percentage change in earnings during the period in all three states. Government and Government Enterprise earnings accounted for, on average, across all three states, 15.5 percent of total personal income. Private earnings accounted for, on average, across all three states, 55.6 percent of total personal income. Farm earnings accounted for less than one percent of total personal income across all states. Farm earnings was the only category to show a consistent decline across all states.

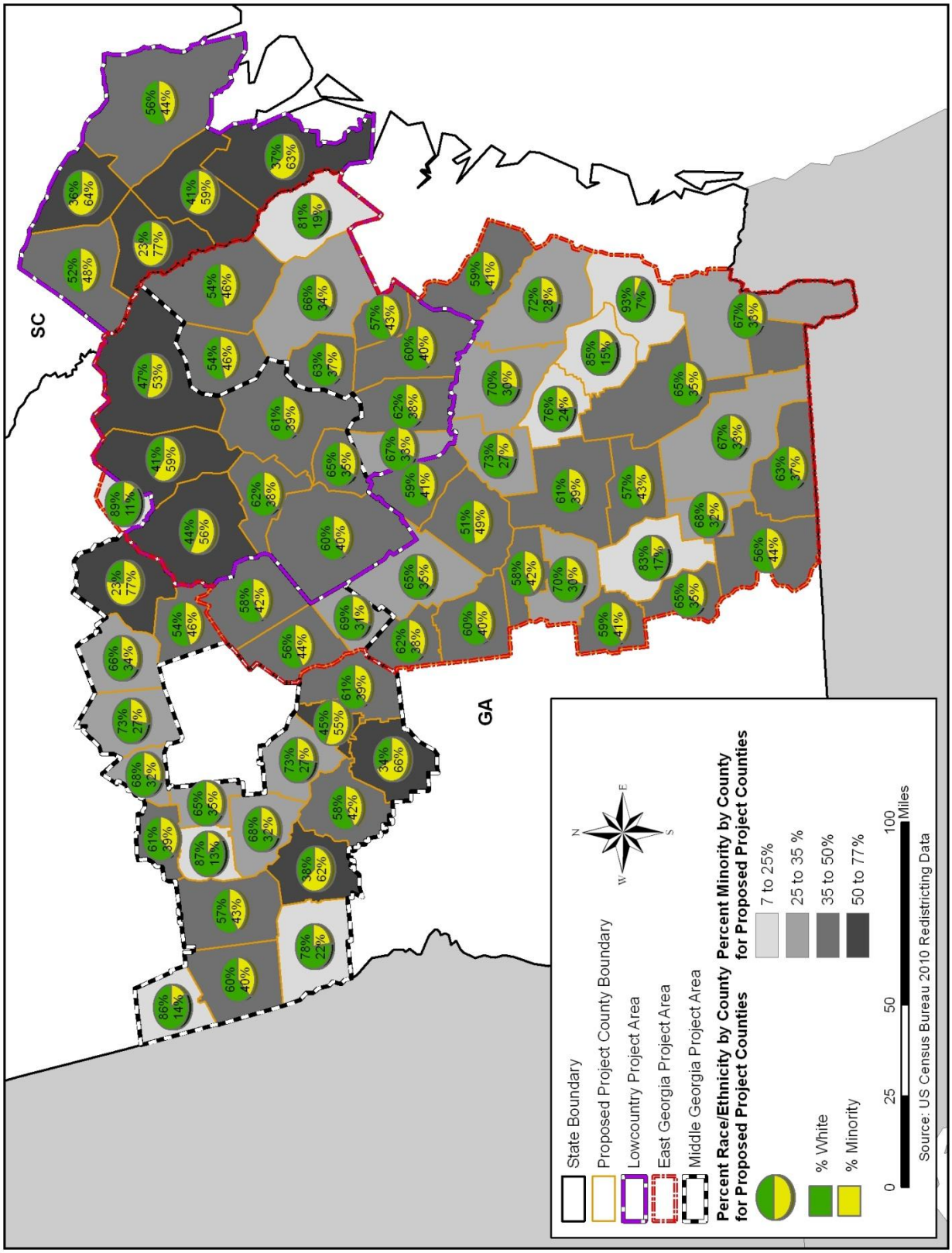


Figure 3-1. Percent Minority by County for Proposed Project Areas in Georgia and South Carolina.

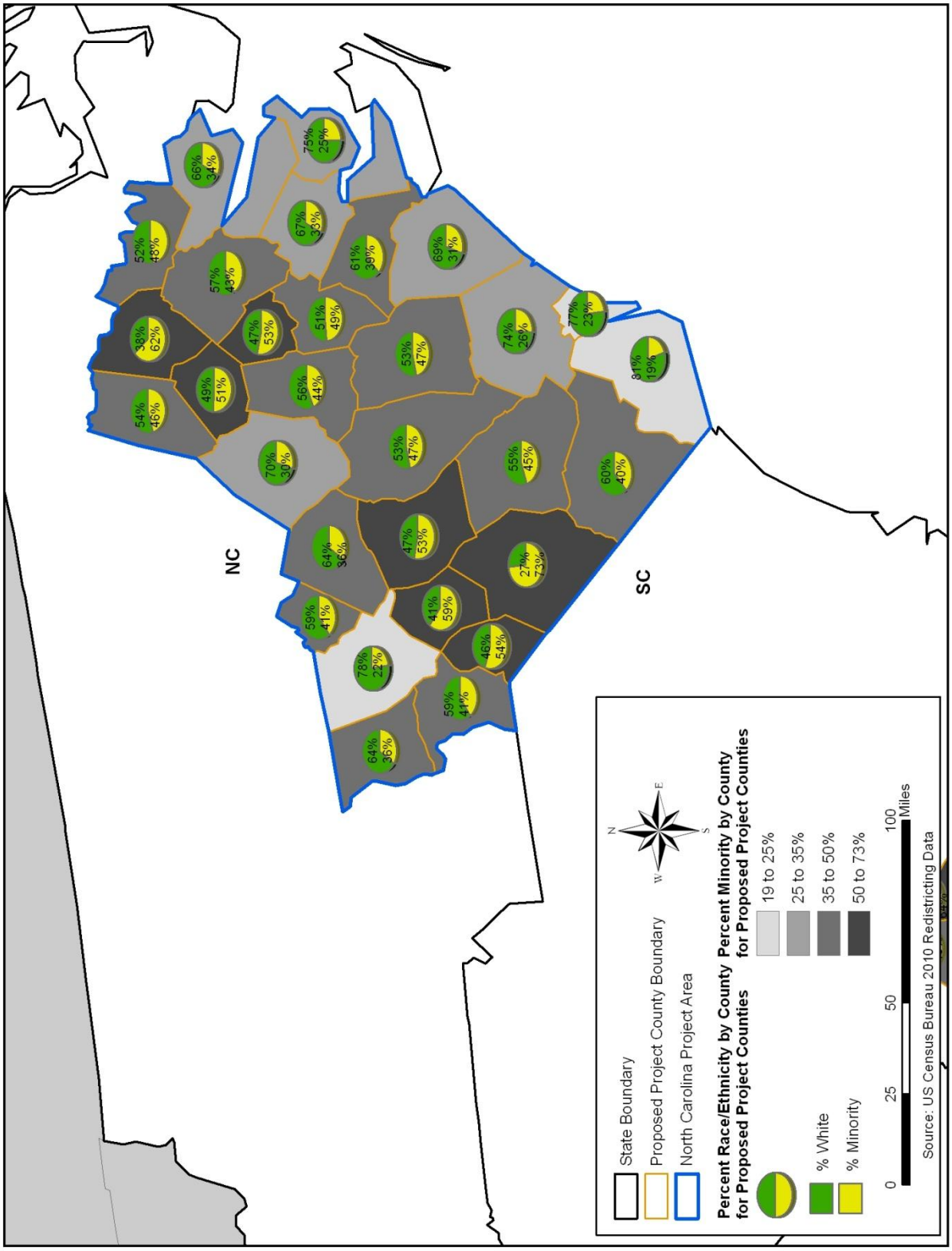


Figure 3-2. Percent Minority by County for the North Carolina Proposed Project Area.

Table 3-3. 2009 Total Personal Income and Earnings by Select Industries by State

Metric	Total Personal Income	Farm Earnings	Non-Farm Earnings	Private Earnings		Government and Government Enterprises			
				Total	Forestry & Logging	Total	Federal Civilian	State	Local
GEORGIA									
Earnings ($1,000s)	335,465,861	2,104,086	250,865,903	202,390,689	383,247	48,475,214	9,938,520	8,456,148	21,150,660
Percent Change 2000 - 2009	36.5%	-4.9%	27.9%	22.5%	9.6%	56.7%	51.1%	37.6%	51.1%
NORTH CAROLINA									
Earnings ($1,000s)	327,199,075	2,440,667	232,631,116	180,605,136	228,445	52,025,980	6,148,522	10,955,931	21,892,820
Percent Change 2000 - 2009	40.5%	-21.7%	31.1%	23.6%	-7.5%	66.3%	56.3%	57.8%	46.1%
SOUTH CAROLINA									
Earnings ($1,000s)	148,264,684	450,526	99,919,350	76,144,719	194,993	23,774,631	2,901,715	5,215,082	11,297,512
Percent Change 2000 - 2009	42.3%	-30.4%	31.1%	24.8%	6.1%	56.1%	57.5%	30.6%	57.3%

Source: BEA 2011a

Total personal income also increased across the combined counties within each proposed project area with a range in 2009 from $84.9 billion in the North Carolina proposed project area to $13.4 billion in the Lowcountry proposed project area (**Table 3-4**) (*Ibid.*).

Earnings from Government and Government Enterprises had the greatest percentage increase across all proposed project areas, averaging over 50 percent, which was highly influenced by the 85.4 percent increase in earnings in this sector within the North Carolina proposed project area. Earnings from Government and Government Enterprises accounted for 16.0, 20.8, 14.2, and 27.4 percent of total personal income in the proposed project areas, respectively. Local Government earnings account for 52.5, 35.6, 56.3, and 27.0 percent of the Government and Government Enterprises earnings, by proposed project area, respectively. Only in the North Carolina proposed project area, do earnings from Military account for a substantial percentage (51.3 percent) of Government and Government Enterprises earnings.

Private earnings across all proposed project areas increased by at least 19 percent over 2001 earnings. Earnings from Forestry and Logging increased in all the proposed project areas, except North Carolina, where earnings from this industry fell over 38 percent. Farm

Table 3-4. 2009 Total Personal Income and Earnings by Select Industries by Proposed Project Area

Metric	Total Personal Income	Farm Earnings	Non-Farm Earnings	Private Earnings		Government & Government Enterprises			
				Total	Forestry & Logging	Total	Federal Civilian	State	Local
East Georgia									
Earnings ($1,000s)	24,273,542	674,661	13,461,784	9,498,336	57,636	3,963,448	348,884	954,724	2,082,165
Percentage of State Earnings	7.2%	32.1%	5.4%	4.7%	15.0%	8.2%	3.5%	11.3%	9.8%
Percent Change 2000 -2009	37.7%	13.2%	26.4%	19.2%	35.4%	47.9%	44.0%	25.0%	49.3%
Middle Georgia									
Earnings ($1,000s)	22,106,812	217,178	12,906,404	8,300,423	24,783	4,605,981	1,658,684	782,931	1,640,197
Percentage of State Earnings	6.6%	10.3%	5.1%	4.1%	6.5%	9.5%	16.7%	9.3%	7.8%
Percent Change 2000 -2009	37.1%	-0.8%	29.2%	21.8%	6.7%	45.0%	63.2%	22.4%	41.5%
Lowcountry									
Combined Georgia Counties Earnings ($1,000s)	10,086,045	286,589	5,158,753	3,715,848	25,483	1,442,905	166,318	443,079	775,337
Percentage of State Earnings	3.0%	13.6%	2.1%	1.8%	6.6%	3.0%	1.7%	5.2%	3.7%
Percent Change 2000 -2009	42.1%	17.7%	30.1%	25.3%	42.0%	44.1%	52.7%	25.1%	49.3%
Combined South Carolina Counties Earnings ($1,000s)	3,455,999	19,189	1,789,628	1,305,486	32,516	484,142	53,138	93,195	310,019
Percentage of State Earnings	2.3%	4.3%	1.8%	1.7%	16.7%	2.0%	1.8%	1.8%	2.7%
Percent Change 2000 -2009	35.9%	-39.1%	24.1%	21.3%	50.2%	32.3%	29.3%	4.8%	37.3%
North Carolina									
Earnings ($1,000s)	84,943,430	1,278,813	55,809,201	32,551,186	50,813	23,258,015	2,587,637	2,413,877	6,319,482
Percentage of State Earnings	26.0%	52.4%	24.0%	18.0%	22.2%	44.7%	42.1%	22.0%	28.9%
Percent Change 2000 -2009	49.6%	-10.9%	44.8%	25.1%	-38.4%	85.4%	67.0%	55.4%	43.8%

Source: BEA 2011a

earnings increased or only marginally declined in the combined Georgia counties, but declined in the combined South Carolina and North Carolina counties over the period. Farm earnings in the North Carolina proposed project area accounted for over 52 percent of Farm earnings in the state. The East Georgia proposed project area accounted for approximately 32.1 percent of the Farm earnings in the State of Georgia.

3.1.2.3 Employment

Following income is employment, the primary source of earnings, which depending upon the metric includes either full-time and part-time positions or full-time equivalent employment. The BEA employment figures use both full-time and part-time positions to account for persons that may hold multiple part-time positions or a full-time and part-time position.

At the state level, between 2001 and 2009 the total number of employment opportunities increased less than 10 percent across all states with the employment gain primarily from nonfarm proprietors (**Table 3-5**). Wage and salary opportunities declined by less than one percent in both Georgia and South Carolina; however, both states showed substantial increases in proprietors employment (66.4 and 77.6 percent increase, respectively). For wage and salary opportunities in Georgia and North Carolina, positions in government organizations increased at a faster rate than in private industries with an average growth of 13.8 percent with private industry growth averaging 7.4. In South Carolina, employment in government organizations increased 6.2 percent during the period, while private industry employment increased 10.3 percent. Farm proprietors and farm employment declined in all states from 2001 to 2009.

Table 3-5. 2009 Employment by State by Select Categories

			Proprietors Employment		Non-Proprietors Employment		Private Employment		Government Employment			
Metric	Total	Wage & Salary	Farm	Nonfarm	Farm	Nonfarm	Total	Forestry, Fishing, & Related	Total	Federal Civilian	State	Local
GEORGIA												
Number Employed	5,269,998	4,093,208	39,520	1,137,270	56,779	5,213,219	4,414,957	21,742	798,262	98,755	168,900	427,789
Percentage Change 2001-2009	8.5%	-0.7%	-21.3%	66.4%	-13.7%	8.8%	8.1%	0.0%	12.9%	5.9%	12.5%	16.4%
NORTH CAROLINA												
Number Employed	5,201,929	4,163,274	43,229	995,426	63,909	5,138,020	4,282,392	23,483	855,628	67,749	205,146	440,018
Percentage Change 2001-2009	7.5%	2.1%	-23.2%	41.0%	-22.8%	8.0%	6.7%	4.9%	14.7%	12.2%	15.9%	12.3%
SOUTH CAROLINA												
Number Employed	2,453,442	1,910,702	22,492	520,248	30,313	2,423,129	2,022,051	10,211	401,078	31,420	97,120	216,828
Percentage Change 2001-2009	9.4%	-0.8%	-10.1%	77.6%	-6.6%	9.6%	10.3%	-2.3%	6.2%	12.4%	-4.6%	12.9%

Source: BEA 2011b

Within the proposed project areas, wage and salary employment opportunities declined in all areas, except North Carolina (5.5 percent increase) between 2001 and 2009 (**Table 3-6**). Proprietors' employment increased considerably across all proposed project areas, which lead to increased overall total employment. There was a decline in farm proprietors across all proposed project areas and in farm employment, except in the combined South Carolina counties, which had an 11.8 percent increase in farm employment. Employment in Forestry, Fishing, and Related declined across all proposed project areas.

Table 3-6. 2009 Employment by Proposed Project Areas by Select Categories

Metric	Total	Wage & Salary	Proprietors Employment		Non-Proprietors Employment		Private Employment		Government Employment			
			Farm	Nonfarm	Farm	Nonfarm	Total	Forestry Fishing, & Related	Total	Federal Civilian	State	Local
East Georgia												
Total Combined Counties	406,290	307,116	11,466	87,708	16,451	389,839	307,042	5,229	82,797	4,143	21,927	48,494
Percentage of State	7.7%	7.5%	29.0%	7.7%	29.0%	7.5%	7.0%	24.1%	10.4%	4.2%	13.0%	11.3%
Percentage Change 2009 -2001	4.2%	-3.2%	-23.3%	52.6%	-16.1%	5.3%	4.2%	-4.1%	9.4%	1.5%	5.8%	11.1%
Middle Georgia												
Total Combined Counties	341,829	255,409	7,044	79,376	9,020	332,809	253,514	1,160	79,295	17,006	18,880	37,236
Percentage of State	6.5%	6.2%	17.8%	7.0%	15.9%	6.4%	5.7%	5.3%	9.9%	17.2%	11.2%	8.7%
Percentage Change 2009 -2001	6.7%	-2.8%	-15.9%	61.0%	-12.3%	7.3%	7.5%	-10.4%	6.6%	16.8%	4.9%	7.5%
Lowcountry												
Total Combined Georgia Counties	159,754	118,012	5,007	36,735	7,043	152,711	121,403	2,008	31,308	1,834	10,098	18,201
Percentage of State	3.0%	2.9%	12.7%	3.2%	12.4%	2.9%	2.7%	9.2%	3.9%	1.9%	6.0%	4.3%
Percentage Change 2009 -2001	6.6%	-1.6%	-23.3%	57.2%	-14.1%	7.8%	7.8%	9.2%	8.1%	9.0%	6.2%	9.4%
Total Combined South Carolina Counties	56,038	39,917	1,655	14,466	2,472	53,566	43,271	663	10,295	617	2,008	7,099
Percentage of State	2.3%	2.1%	7.4%	2.8%	8.2%	2.2%	2.1%	6.5%	2.6%	2.0%	2.1%	3.3%
Percentage Change 2009 -2001	5.9%	-5.8%	-7.6%	64.8%	11.8%	5.6%	8.8%	16.7%	-5.8%	-4.9%	-14.1%	-2.9%
North Carolina												
Total Combined Counties	1,306,335	1,057,949	11,576	236,810	21,839	1,284,496	950,656	3,543	333,840	30,764	49,172	130,789
Percentage of State	25.1%	25.4%	26.8%	23.8%	34.2%	25.0%	22.2%	15.1%	39.0%	45.4%	24.0%	29.7%
Percentage Change 2009 -2001	9.7%	5.5%	-21.9%	36.8%	-23.7%	10.6%	8.6%	-21.9%	16.4%	12.0%	14.4%	11.0%

Source: BEA 2011b

The Bureau of Labor Statistics (BLS) in the May 2010 State Occupational and Wage Estimates and the National Occupational and Wage Estimates indicated that the national mean hourly wage was $21.35 per hour and the mean annual salary was $44,410 (BLS 2010a, b). Georgia had a mean hourly wage of $20.32 (95.2 percent of national mean), followed by North Carolina at $19.47 (91.2 percent), then South Carolina at $18.23 (85.4 percent) (*Ibid.*). The mean annual salary in Georgia was $42,270, in North Carolina it was $40,500, and in South Carolina $37,920 (*Ibid.*).

As indicated in **Tables 3-5** and **3-6**, total employment opportunities increased across all states and all proposed project areas between 2001 and 2009. However, as the number of opportunities increased, so did the labor force in each of these areas with the labor force growing at a considerably faster rate than the number of employment opportunities available. On average in the three states, the number employed between 2001 and 2010 increased, on average 3.3 percent; however, the labor force within these three states increased, on average, 9.9 percent during the period (BLS 2011).

Table 3-7 illustrates the data by state and by the proposed project areas for labor force, employed, and unemployment rate. In the United States, the annual average unemployment rate in 2001 was 4.7 percent, while in 2010 the annual average unemployment rate was 9.6 percent. Overall, the unemployment rate within these states and within the proposed project areas, exceed the United States average. **Figure 3-3** illustrates the trend for the unemployment rate within each of the proposed project areas from 2001 through 2010. **Figure 3-4** illustrates the unemployment rate by county within each of the three states as of June 2011. As of June 2011, the United States unemployment rate was 9.2 percent.

3.1.2.4 Poverty Levels

The Southern United States has a persistent history with higher than the national average poverty rates and lower than the national average median household incomes (University of Georgia [UGA] nd). Between 2000 and 2010, all three states had their poverty rates climb to higher than 16 percent, at least two percentage point higher than the national poverty rate of 14.3 percent (**Table 3-8**). Two of the proposed project areas had poverty rates in excess of 20 percent, with the other two proposed project areas having poverty rates in excess of 18 percent. Within the proposed project areas, the East Georgia proposed project area had 41 counties out of the 45 that had poverty rates between 20 to 40 percent, one county had a poverty rate greater than 40 percent, and three counties had a poverty rate less than 20 percent. The Middle Georgia proposed project area had 21 of the 28 counties with a poverty rate greater than 20 percent; the remaining counties were below 20 percent. The Lowcountry proposed project area had 21 out of 22 counties with a poverty rate greater than 20 percent. The North Carolina proposed project area had 16 of 30 counties with a poverty rate in excess of 20 percent. **Figures 3-5** and **3-6** illustrate the 2010 poverty rates by county within the proposed project areas.

Table 3-7. Labor Force, Employed, and Unemployment Rate by State and Proposed Project Area, 2001 and 2010

Year	Labor Force	Employed	Unemployment Rate
GEORGIA			
2001	4,283,156	4,112,868	4.0%
2010	4,693,711	4,213,719	10.2%
NORTH CAROLINA			
2001	4,164,911	3,929,977	5.6%
2010	4,512,770	4,036,343	10.6%
SOUTH CAROLINA			
2001	1,935,614	1,834,871	5.2%
2010	2,164,612	1,922,815	11.2%
PROPOSED PROJECT AREAS			
East Georgia			
2001	374,205	355,495	5.0%
2010	402,072	356,655	11.3%
Middle Georgia			
2001	300,960	286,722	4.7%
2010	322,579	286,925	11.1%
Lowcountry			
2001	204,165	193,508	5.2%
2010	221,707	195,456	11.8%
North Carolina			
2001	1,034,730	968,413	6.4%
2010	1,148,194	1,026,217	10.6%

Source: BLS 2011

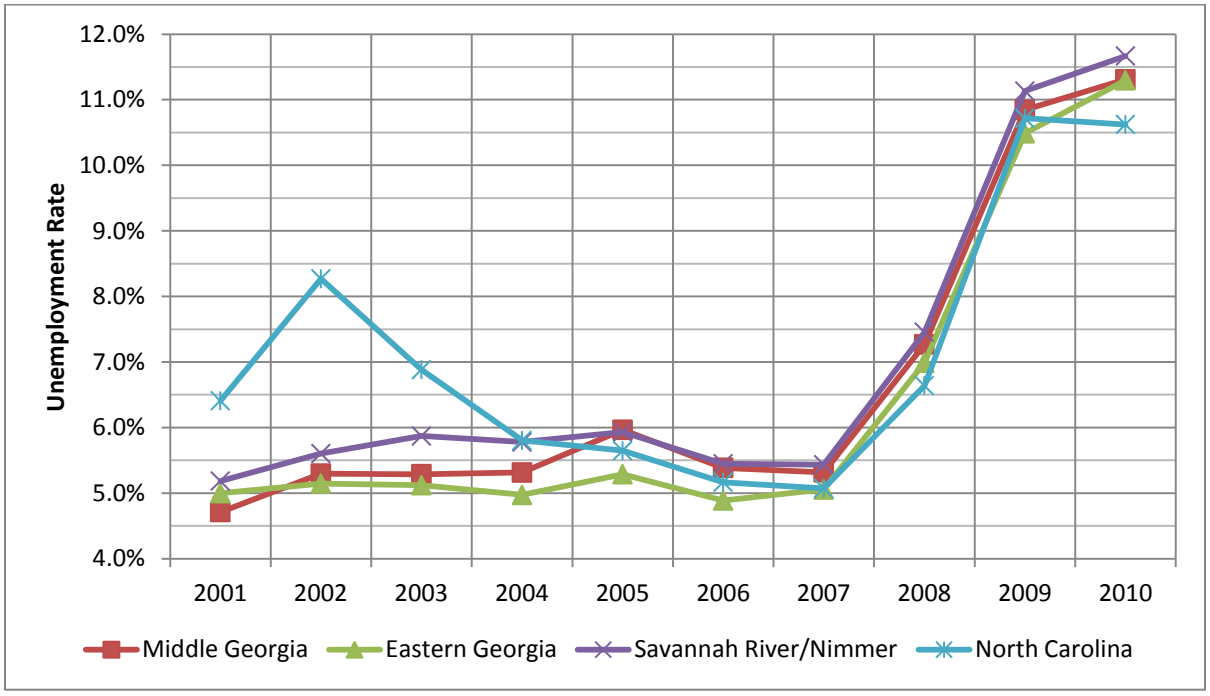


Figure 3-3. Annual Changes in the Unemployment Rate for the Combined Counties within Each Proposed Project Area, 2001 through 2010.

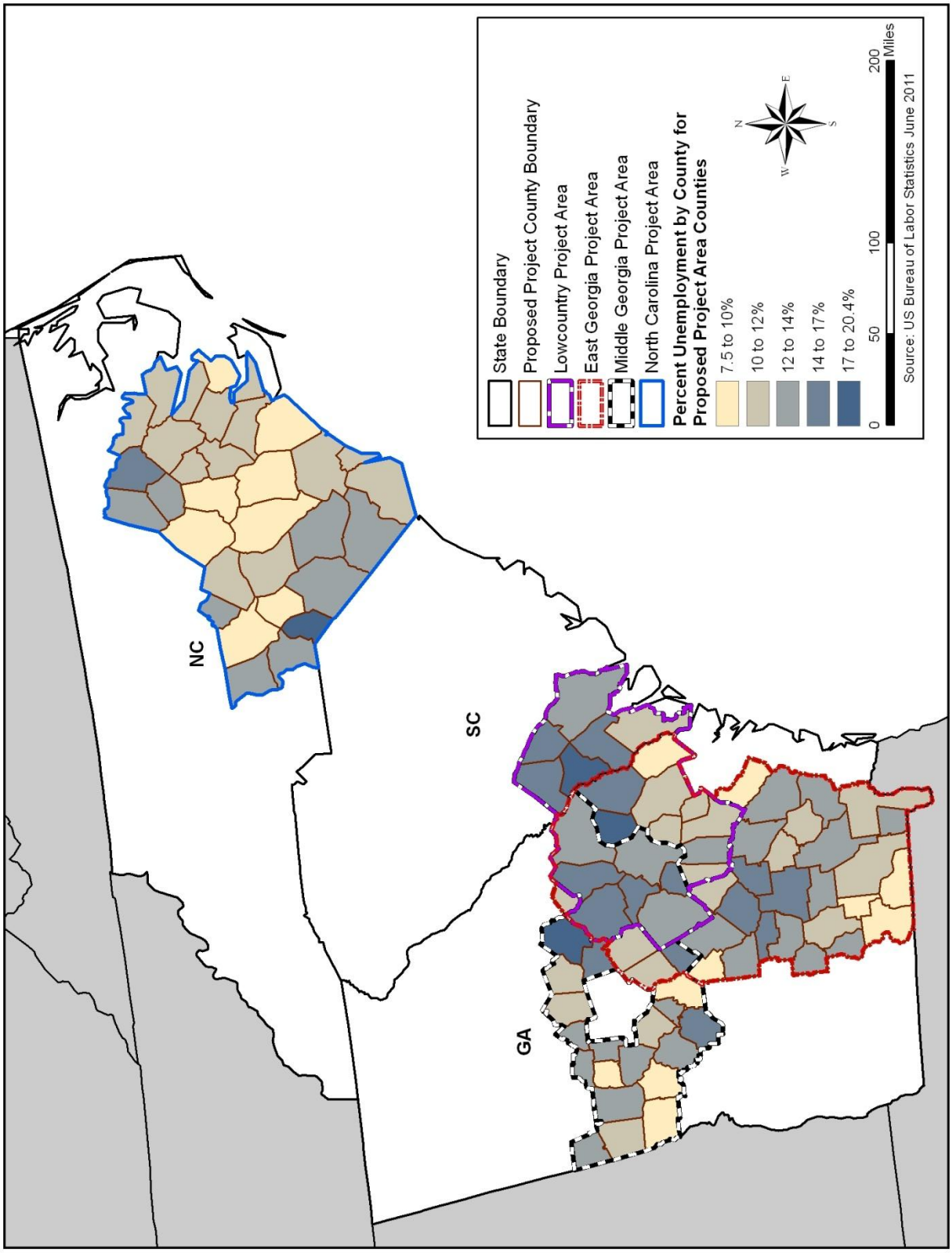


Figure 3-4. June 2011 Unemployment Rates by County within Each Proposed Project Area

Table 3-8. Poverty Rate and Median Household Income by State and by Proposed Project Areas, 2000 and 2010

Year	Poverty Rate	Median Household Income	Percent of National Median Household Income
UNITED STATES			
2001	12.4%	$41,994	
2010	15.1%	$50,221	
GEORGIA			
2001	13.0%	$42,433	101.0%
2010	16.6%	$47,469	94.5%
NORTH CAROLINA			
2001	12.3%	$39,184	93.3%
2010	16.2%	$43,754	87.1%
SOUTH CAROLINA			
2001	14.1%	$37,082	88.3%
2010	17.1%	$42,580	84.8%
East Georgia			
2001	18.0%	$29,402	70.0%
2010	22.1%	$32,833	65.4%
Middle Georgia			
2001	15.1%	$33,037	78.7%
2010	18.4%	$37,102	73.9%
Lowcountry			
2001	18.8%	$28,527	67.9%
2010	23.5%	$32,212	64.1%
North Carolina			
2001	14.6%	$33,617	80.1%
2010	18.2%	$37,934	75.5%

Source: USCB 2011b

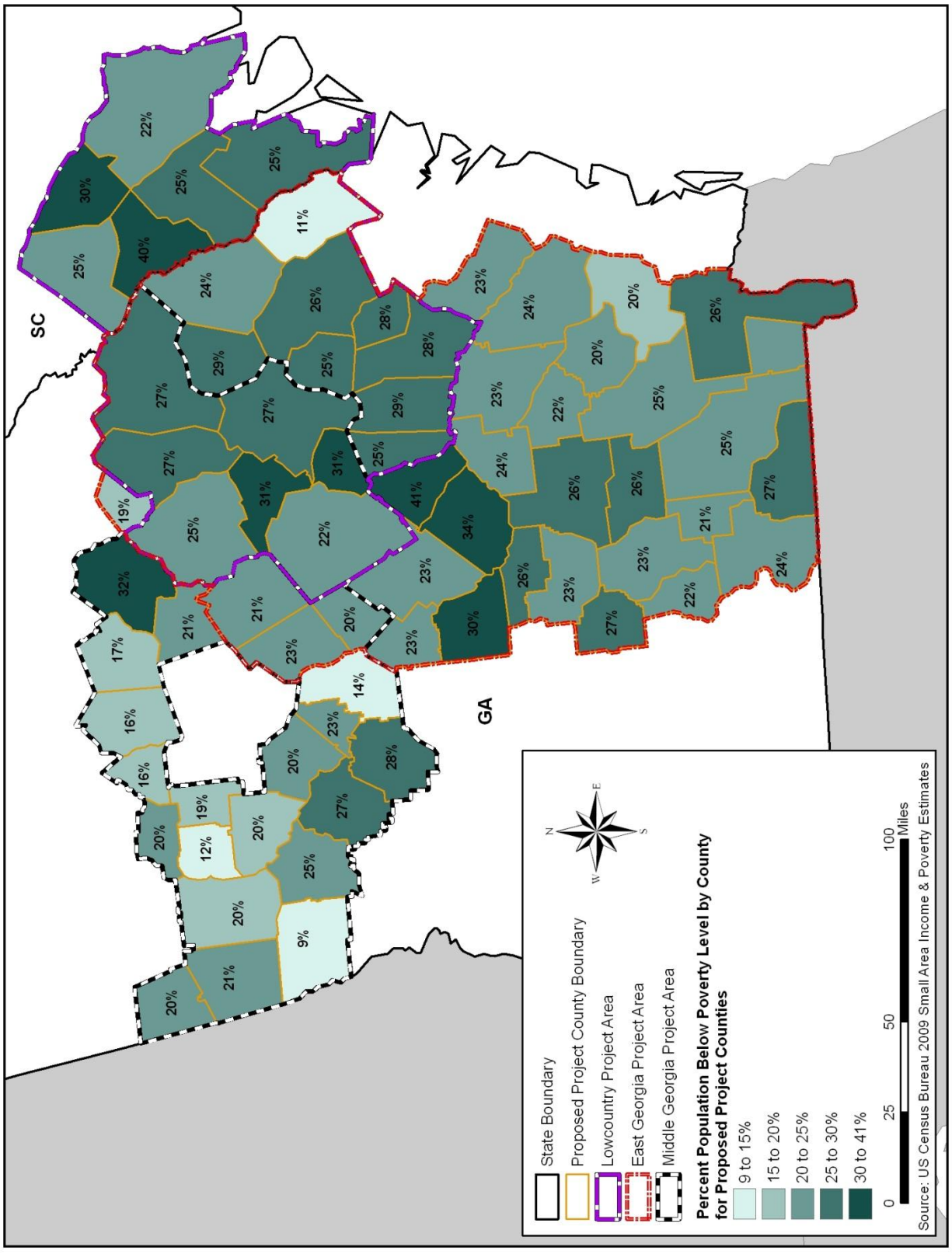


Figure 3-5. Percent of the Population Below the Poverty Threshold by County for Proposed Project Areas in Georgia and South Carolina.

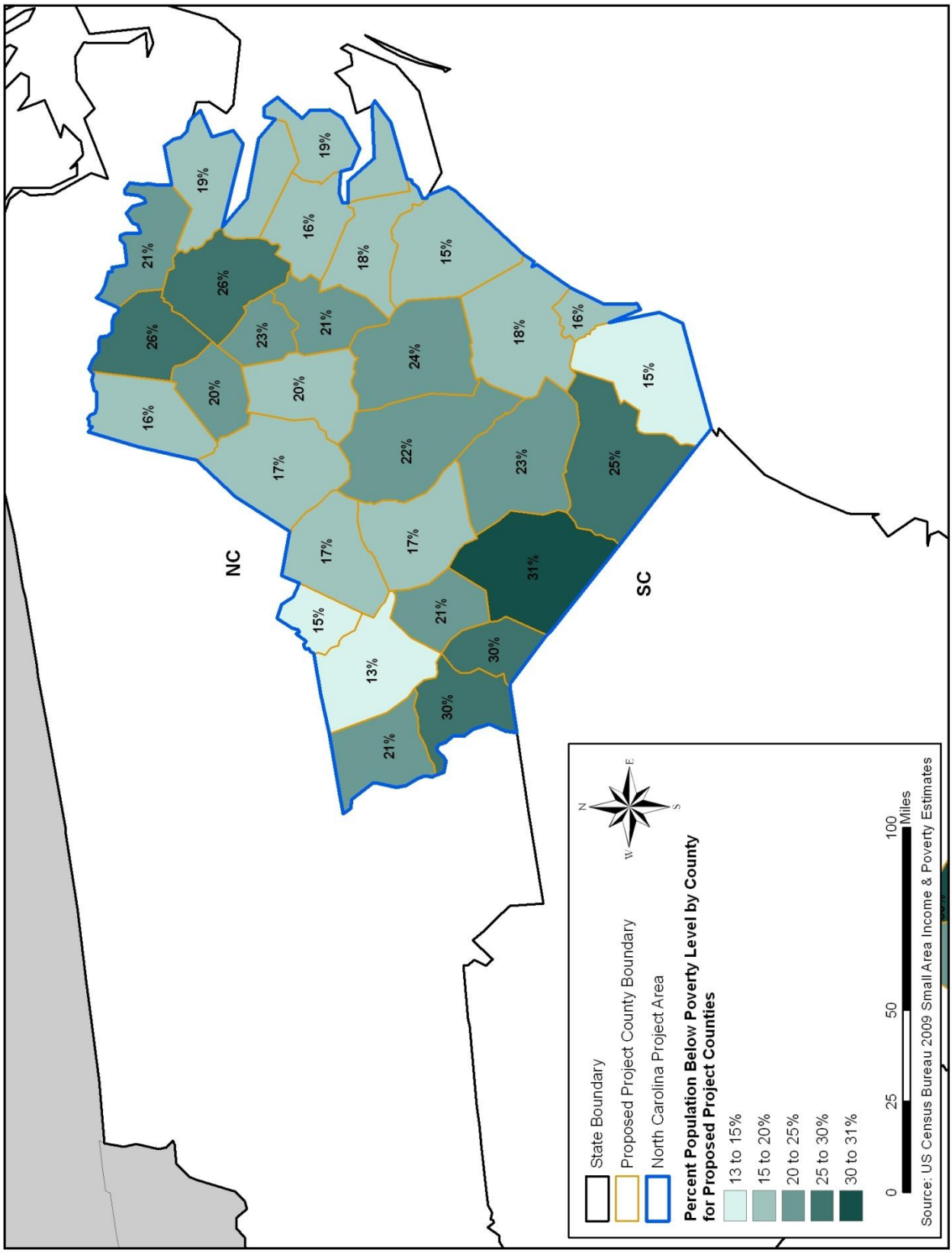


Figure 3-6. Percent of the Population Below the Poverty Threshold by County for the North Carolina Proposed Project Area.

3.1.3 Existing Conditions – Agricultural Enterprises

3.1.3.1 Rural Population Trends

The USDA Economic Research Service (ERS) found that by 2006 non-metro counties in the United States accounted for a population of approximately 50.2 million persons, which is approximately 16.8 percent of the total United States population (ERS 2008; USCB 2008). The general trend in these counties was a decline in the population with over 51 percent of the non-metro counties experiencing population declines of approximately 0.5 percent per year from 2000 to 2006.

3.1.3.2 Number of Farms and Land in Farms

From 1997 to 2007, the number of farms in the United States declined 0.5 percent (USDA National Agricultural Statistics Service [NASS] 2009). Most farm categories declined from 1997 to 2007, with the number of acres in farms declining 3.4 percent, the average size of farms declining by 3.0 percent, the amount of cropland declining by 8.7 percent, and the amount of harvested cropland acreage declining by 2.9 percent (*Ibid.*). The average market value of land and buildings increased approximately 90.2 percent for the average farm and approximately 95.7 for the average acre (*Ibid.*). Farm production expenses also showed an increase of approximately 52.8 percent over the decade. When compared by type of farm, the largest number of farms in the United States falls within the small family farm – residential or lifestyle farm.

For the majority, the largest number of farms in the proposed project areas fall within the small family farm – residential or lifestyle farm (**Table 3-9**). Small family farms comprise the vast majority of farms within the three states and within the proposed project areas. Residential/lifestyle farms contribute the greatest percentage across all areas. The North Carolina proposed project area is the only region that has greater than 15 percent of the farms being large farms.

3.1.3.3 Minority Operators

Minority operators account for approximately six percent of all operators within Georgia, North Carolina, and South Carolina. North Carolina had the least minority operators as a percentage of total operators (4.8 percent), while South Carolina had the most at 8.6 percent. Within the proposed project areas, minority operators account for

Table 3-9. Farm Typology by State and Proposed Project Area

		Small Family Farms															
		Limited resource		Retirement		Residential/ lifestyle		Farming occupation/ lower sales		Farming occupation/ higher sales		Large family		Very large family		Non-family	
Location	Total	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Georgia	47,846	7,112	14.9	11,367	23.8	17,514	36.6	4,611	9.6	1,401	2.9	1,134	2.4	3,030	6.3	1,677	3.5
North Carolina	52,913	8,622	16.3	11,712	22.1	17,917	33.9	5,704	10.8	1,236	2.3	1,751	3.3	4,114	7.8	1,857	3.5
South Carolina	25,867	4,596	17.8	6,561	25.4	9,824	38.0	2,535	9.8	329	1.3	305	1.2	865	3.3	852	3.3
Proposed Project Areas																	
East Georgia	13,808	2,106	15.3	3,216	23.3	5,012	36.3	1,418	10.3	554	4.0	381	2.8	630	4.6	491	3.6
Middle Georgia	8,478	1,291	15.2	2,292	27.0	3,287	38.8	830	9.8	153	1.8	135	1.6	236	2.8	254	3.0
Lowcountry	7,922	1,338	16.9	1,805	22.8	3,055	38.6	731	9.2	239	3.0	161	2.0	281	3.5	312	3.9
North Carolina	14,545	1,956	13.4	2,735	18.8	3,850	26.5	1,596	11.0	489	3.4	774	5.3	2,416	16.6	729	5.0

Source: USDA NASS 2009

approximately eight percent of all operators. Within the proposed project areas, the East Georgia and Middle Georgia proposed project areas had just over seven percent of operators being a minority, while the Lowcountry proposed project area just over nine percent. **Table 3-10** lists the minority operator by race and/or ethnicity by state and proposed project area. **Figure 3-7** illustrates the number of minority operators within the counties of the proposed project areas.

Table 3-10. 2007 Minority Operators by State and by Proposed Project Areas

	Total		Operator Race or Ethnicity								Total Minority Operators
			American Indian or Alaska Native		Asian		African American		Spanish		
Location	Farms	Operators	Farms	Operators	Farms	Operators	Farms	Operators	Farms	Operators	
Georgia	47,846	69,060	451	572	268	385	2,160	2,647	484	547	4,151
North Carolina	52,913	76,832	729	887	157	232	1,563	1,801	648	738	3,658
South Carolina	25,867	37,082	181	217	67	85	2,159	2,605	243	277	3,184
Proposed Project Areas											
East Georgia	13,808	19,099	113	155	41	61	853	1,043	104	117	1,376
Middle Georgia	8,478	12,107	75	93	67	94	550	668	71	76	931
Lowcountry	7,922	10,849	36	41	19	21	705	850	63	77	989
North Carolina	14,993	21,217	479	597	43	61	730	855	204	232	1,745

Source: USDA NASS 2009

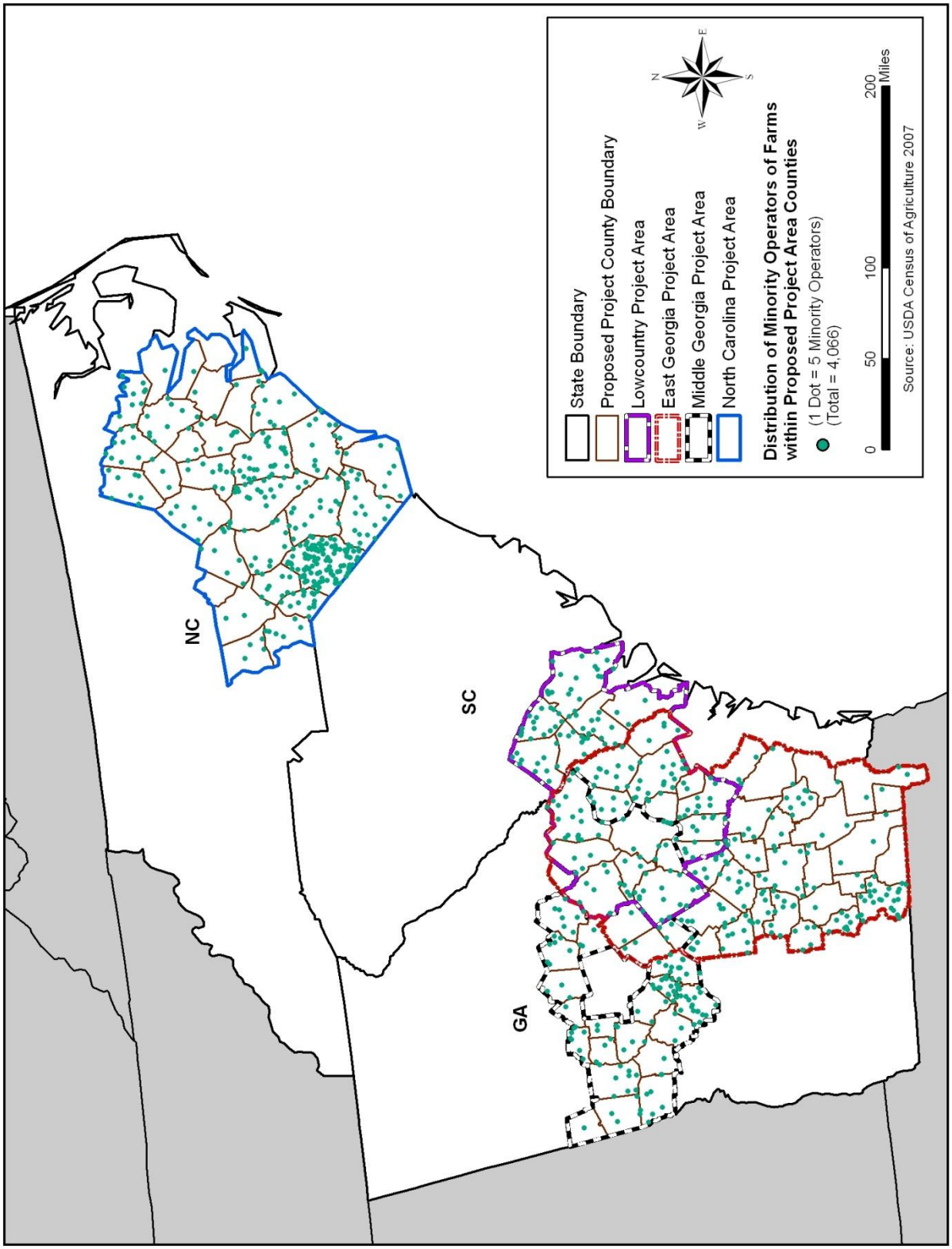


Figure 3-7. Minority Operators within the Proposed Project Areas

3.1.3.4 Primary Field Crops

The 2003 National Resources Inventory indicates that approximately 368 million acres within the United States is cultivated cropland and 58 million acres is uncultivated cropland. In 1992, those figures were 334 million acres of cultivated cropland and 47 million acres of uncultivated cropland. **Table 3-11** illustrates the amount of acreage planted of select primary field crops in 2010, along with harvested acres of those crops, and total production of the crops (USDA NASS 2009). The East Georgia proposed project area accounted for 25.8 percent of corn grain production, 30.1 percent of upland cotton, 36.6 percent of soybeans, 20.9 percent of wheat production, and 57.1 percent of tobacco production in Georgia during those periods. The Middle Georgia proposed project areas accounted for less statewide production, which would be mainly attributable to fewer counties. The North Carolina proposed project area accounted for greater than 50 percent of corn grain production and upland cotton within the state and just under 50 percent of soybeans and wheat production. The counties in the North Carolina proposed project area accounted for all of the tobacco production and 28.8 percent of hay production. The following counties did not have reportable or discloseable acres: Baldwin, Brantley, Butts, Charlton, Clinch, Crawford, Glascock, Hancock, Harris, Heard, Jasper, Long, Lowndes, Meriwether, Pierce, Putnam, Spalding, Talbot, Tift, Treutlen, Troup, Twiggs, Upson, Wilkinson, Georgia and Montgomery and New Hanover, North Carolina.

3.1.3.5 Primary Livestock Industries

The primary livestock industries across the proposed project areas are cattle for all states in addition to hogs and pigs in North Carolina. **Table 3-12** lists the most recent data on livestock numbers by type and by county. Butts, Crawford, Hancock, Harris, Heard, Houston, Lamar, Macon, Meriwether, Peach, Pike, Putnam, Spalding, Talbot, Taylor, Troup and Upson Counties, Georgia did not contain any reportable or discloseable level of cattle, as well as New Hanover, North Carolina. The Middle Georgia proposed project area contributed approximately six percent of all cattle in Georgia. The East Georgia proposed project area contributed approximately 25 percent of all cattle in Georgia. The Lowcountry proposed project area contributed approximately 11 percent of all cattle in Georgia and six percent of all cattle in South Carolina. The North Carolina proposed project areas contributed approximately 21 percent of all cattle in North Carolina and 92 percent of all hogs and pigs.

Table 3-11. Planted Acres, Harvested Acres, and Production of Select Field Crops in the States and Proposed Project Areas

Crop Type	Planted Acres	Harvested Acres	Production
GEORGIA			
Corn (Grain) (2010)	295,000	245,000	35,525,000
Cotton, Upland (2008)	940,000	920,000	1,600,000
Soybeans (2010)	270,000	260,000	6,760,000
Wheat All (2008)	480,000	400,000	22,400,000
Tobacco (2005)		16,000	27,760,000
NORTH CAROLINA			
Corn (Grain) (2010)	910,000	840,000	76,440,000
Cotton, Upland (2008)	550,000	545,000	951,000
Soybeans (2010)	1,580,000	1,550,000	40,300,000
Wheat All (2008)	820,000	720,000	43,200,000
Tobacco (2004)		19,400	42,680,000
Hay All, Dry (2007)		699,000	1,050,000
SOUTH CAROLINA			
Corn (Grain) (2010)	350,000	335,000	30,485,000
Cotton, Upland (2008)	135,000	134,000	246,000
Soybeans (2010)	465,000	455,000	10,465,000
Hay All, Dry (2007)		330,000	561,000
East Georgia			
Corn (Grain) (2010)	77,900	65,200	9,169,900
Cotton, Upland (2008)	281,600	276,100	482,200
Soybeans (2010)	93,900	92,340	2,473,400
Wheat All (2008)	98,300	87,800	4,684,000
Tobacco (2005)		9,070	15,858,000
Middle Georgia			
Corn (Grain) (2010)	35,400	24,750	3,928,600
Cotton, Upland (2008)	55,300	53,600	83,200
Soybeans (2010)	62,600	61,030	1,409,300
Wheat All (2008)	75,000	68,900	3,847,000
Lowcountry			
Corn (Grain) (2010)	76,300	68,600	7,746,000
Cotton, Upland (2008)	112,300	109,850	171,300
Soybeans (2010)	101,800	99,520	2,590,500
Wheat All (2008)	76,500	68,400	3,702,000
Tobacco (2005)		500	720,000
Hay All, Dry (2007)		13,500	37,000
North Carolina			
Corn (Grain) (2010)	485,000	474,000	39,059,500
Cotton, Upland (2008)	281,700	279,200	497,300
Soybeans (2010)	854,000	839,900	18,679,000
Wheat All (2008)	394,900	357,600	20,018,000
Tobacco (2005)		19,400	42,680,000
Hay All, Dry (2007)		161,400	302,500

Source: USDA NASS 2011

Table 3-12. Primary Livestock Activities by County within the Proposed Project Areas

Livestock	Number of Head
GEORGIA	
Cattle All (2011)	1,060,000
SOUTH CAROLINA	
Cattle All (2011)	385,000
NORTH CAROLINA	
Cattle All (2011)	780,000
Hogs and Pigs (2009)	9,600,000
East Georgia	
Cattle All (2011)	259,800
Middle Georgia	
Cattle All (2011)	66,800
Lowcountry	
Cattle All (2011)	133,000
North Carolina	
Cattle All (2011)	161,600
Hogs and Pigs (2009)	8,799,900

Source: USDA NASS 2011

3.1.3.6 Farm Income and Cost

The ERS (USDA ERS 2011a) indicated that net farm income in 2011 is projected to be above the 2010 forecast by 19.8 percent. Net farm income was estimated to be approximately $94.7 billion in 2011 with net cash income of $98.6 billion (*Ibid.)*. Total expenses in the agricultural sector are anticipated to increase by $20.2 billion, exceeding $300 billion for the first time. Crop receipts were estimated to increase to $24.1 billion (*Ibid.*).

At the household level, the average family farm household income for 2010 was estimated to be $83,021, an increase of 7.6 percent from 2009 (USDA ERS 2011b). The ERS anticipates that in 2011 approximately 12.9 percent of average family farm household income was generated from on-farm sources with an average of approximately $75,178 of household income generated from off-farm sources (*Ibid.*).

3.2 LAND USE

3.2.1 Definition of the Resource

Land use analysis primarily details the interactions of humans and their environment, both natural and human-induced. Such analyses address how different land uses currently interact and if there would be conflict between new and existing land uses. In urban areas, land uses are primarily controlled for public health and safety concerns through land use zoning mechanisms. In rural areas, land use restrictions may be developed at a county or regional scale, or land use restrictions may not exist or be limited to special public health and safety concerns. Land use within this document is being described as the acreage within cropland and permanent pasture since these lands uses are being proposed for conversion into a dedicated energy crop land use.

3.2.2 Existing Conditions

3.2.2.1 Agricultural Land Uses

The 2007 Agricultural Census estimates the amount of land in agricultural land uses in the United States. **Tables 3-13** and **3-14** illustrate the agricultural lands defined by land use categories and sub-categories in the proposed project area. At the state level, cropland accounted for approximately 44.1 percent of total land in farms in Georgia, 57.8 percent in North Carolina, and 44.0 percent in South Carolina. Woodland accounted for 36.6 percent of total farmland in Georgia, 26.0 percent in North Carolina, and 37.4 percent in South Carolina. Permanent pasture and rangeland, excluding woodland pastured and cropland pastured, accounted for 13.2 percent of the total land in farms in Georgia, 11.1 percent in North Carolina, and 12.6 percent in South Carolina.

The East Georgia proposed project area accounted for 36.6 percent of the total land in farms in Georgia, with Middle Georgia accounting for 18.7 percent, and the North Carolina proposed project area accounting for 40.5 percent of the total land in farms in North Carolina. The East Georgia proposed project area accounted for 40.2 percent of harvested cropland in the state, while the North Carolina proposed project area accounted for 50.1 percent. These two proposed project areas also accounted for 42.5 percent and 33.7 percent, respectively in marginal croplands for their states.

Table 3-13. 2007 Land Use Types by State, acres

Land Use Type	Georgia	North Carolina	South Carolina
Land in farms	10,150,539	8,474,671	4,889,339
Approximate land area	36,798,743	31,113,828	19,255,034
Total cropland	4,478,168	4,895,204	2,151,219
Total woodland	3,712,672	2,201,609	1,827,191
Permanent pasture and rangeland, other than cropland and woodland pastured	1,341,985	941,609	617,136
Land in farmsteads, buildings, livestock facilities, ponds, roads, wasteland, etc.	617,714	436,249	293,793
Total cropland			
Harvested cropland	3,390,437	4,188,658	1,551,670
Cropland used only for pasture or grazing	587,428	338,605	1,551,670
Other cropland	500,303	367,941	335,500
Cropland on which all crops failed	118,512	95,333	81,018
Cropland idle or used for cover crops or soil improvement, but not harvested and not pastured or grazed (see text)	328,998	225,038	223,039
Cropland in cultivated summer fallow	52,793	47,570	31,443
Total woodland			
Woodland not pastured	3,191,085	1,914,066	1,607,555
Woodland pastured	521,587	287,543	219,636
Pastureland, all types	2,451,000	1,567,757	1,100,821
Permanent pasture and rangeland, other than cropland and woodland pastured	1,341,985	941,609	617,136
Cropland used only for pasture or grazing	587,428	338,605	1,551,670
Woodland pastured	521,587	287,543	219,636
Conservation Acres - CRP, WRP, Farmable Wetlands, and CREP	331,166	163,676	264,950

Source: USDA NASS 2009

Within the proposed project areas, the dominant land use type for land in farms in East Georgia and North Carolina was cropland with woodland being dominant in Middle Georgia, and approximately equally split in the Lowcountry proposed project area. Less than 10 percent of the land use was for permanent pasture or rangeland in all the proposed project areas, except Middle Georgia, where permanent pasture or rangeland accounted for 13.7 percent.

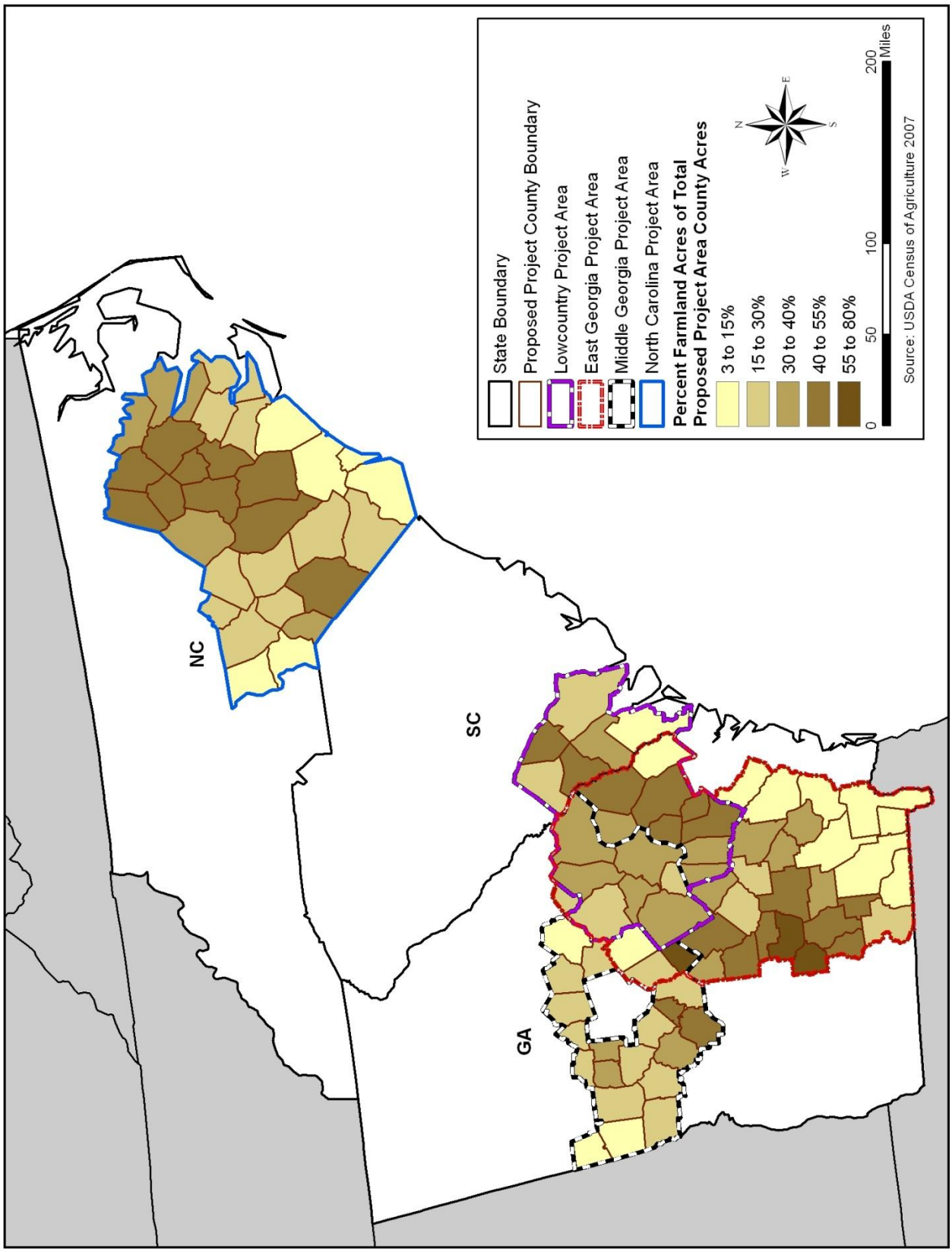
Marginal croplands in the proposed project areas accounted for a relatively small percentage of total land in farms. Values ranged from 3.6 percent in the North Carolina proposed project area to 7.1 percent in the Lowcountry proposed project area. **Figure 3-8** provides an illustration of percentage of total farmland in each of the proposed project areas, while **Figures 3-9** and **3-10** illustrate the percentage of cropland and pastureland within the proposed project areas.

Table 3-14. 2007 Land Use Types by Proposed Project Areas, acres

Land Use Type	East Georgia	Middle Georgia	Lowcountry	North Carolina
Land in farms	3,717,921	1,896,166	2,412,162	3,428,776
Approximate land area	12,547,314	7,222,217	7,229,088	11,487,711
Total cropland	1,787,113	730,236	1,049,647	2,324,025
Total woodland	1,443,765	796,852	1,048,227	771,540
Permanent pasture and rangeland, other than cropland and woodland pastured	274,858	259,064	158,477	158,512
Land in farmsteads, buildings, livestock facilities, ponds, roads, wasteland, etc.	208,521	110,014	155,811	173,457
Total cropland				
Harvested cropland	1,362,838	499,353	730,712	2,098,694
Cropland used only for pasture or grazing	211,871	126,457	38,476	100,674
Other cropland	212,404	104,426	170,922	124,076
Cropland on which all crops failed	44,988	16,266	31,940	32,440
Cropland idle or used for cover crops or soil improvement, but not harvested and not pastured or grazed (see text)	141,198	77,992	120,548	73,139
Cropland in cultivated summer fallow	25,155	8,567	18,434	17,487
Total woodland				
Woodland not pastured	1,287,368	690,375	982,120	718,268
Woodland pastured	120,368	106,477	66,107	53,272
Pastureland, all types	623,189	491,998	372,597	312,939
Permanent pasture and rangeland, other than cropland and woodland pastured	274,858	259,064	158,477	158,512
Cropland used only for pasture or grazing	211,871	126,457	148,013	100,674
Woodland pastured	120,368	106,477	66,107	53,272
Conservation Acres - CRP, WRP, Farmable Wetlands, and CREP	132,181	62,837	126,655	47,536

Source: USDA NASS 2009

When land use data from the 2002 Agricultural Census and the 2007 Agricultural Census are compared by geographic area, some changes in land use become apparent across all areas. The number of farms decreased in all states, except South Carolina, which had an increase of less than one percent. Also, acres in farms declined in all states, except South Carolina, which had a less than one percent increase in land in farms. The average size of farm declined in all states, mirroring observations across the United States that the overall decline in farm is leveling off and new entrants are younger than the average producer with smaller farms. Average farm size within these states ranged from 160 acres in North Carolina to 212 acres in Georgia. All states had a decline in cropland and an increase in permanent pasture and rangeland.



1 **Figure 3-8. Percent of Farmland Acres by County in the Proposed Project Areas.**

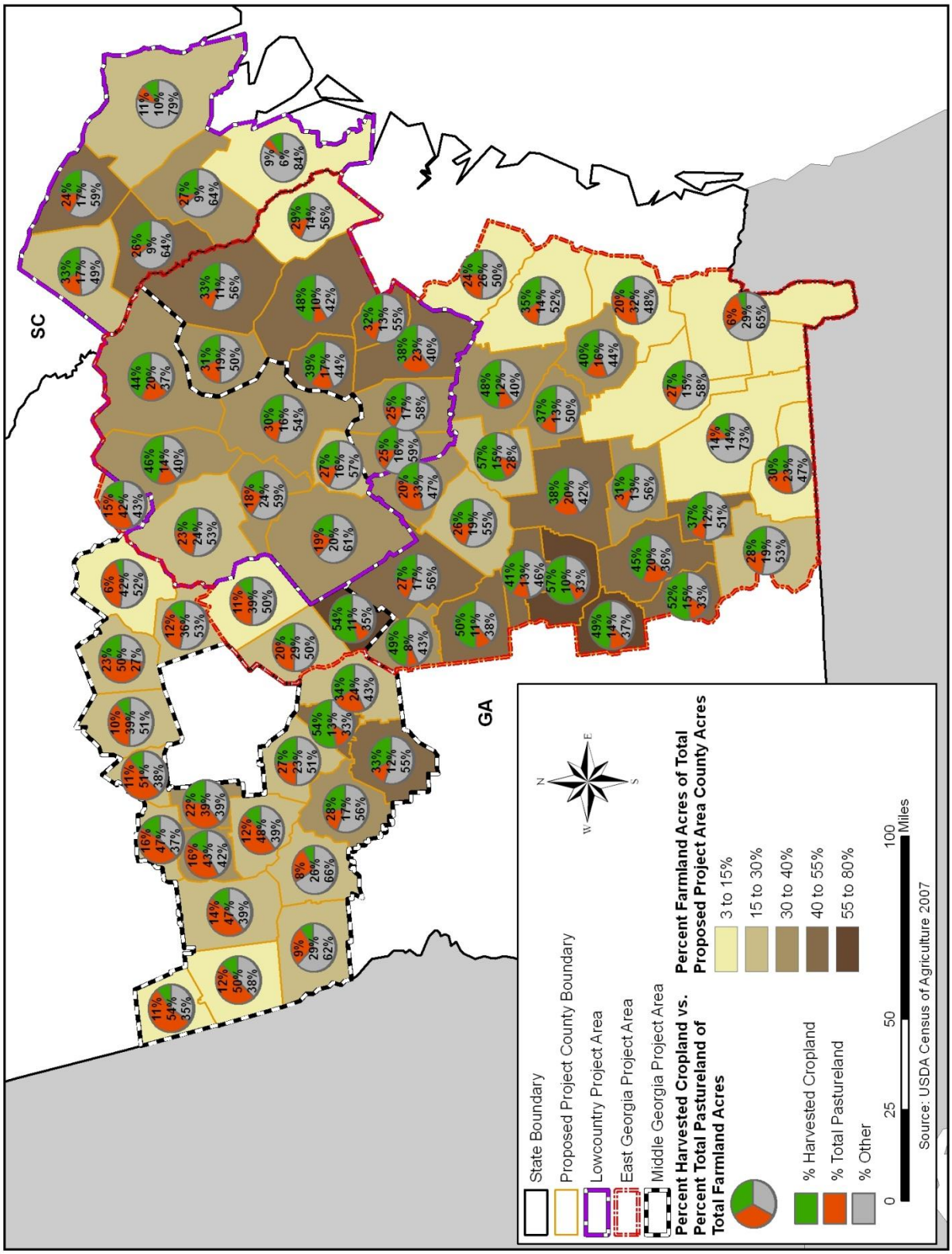


Figure 3-9. Comparison of the Percentage of Harvested Cropland and Total Pastureland in the Georgia and South Carolina Proposed Project Areas.

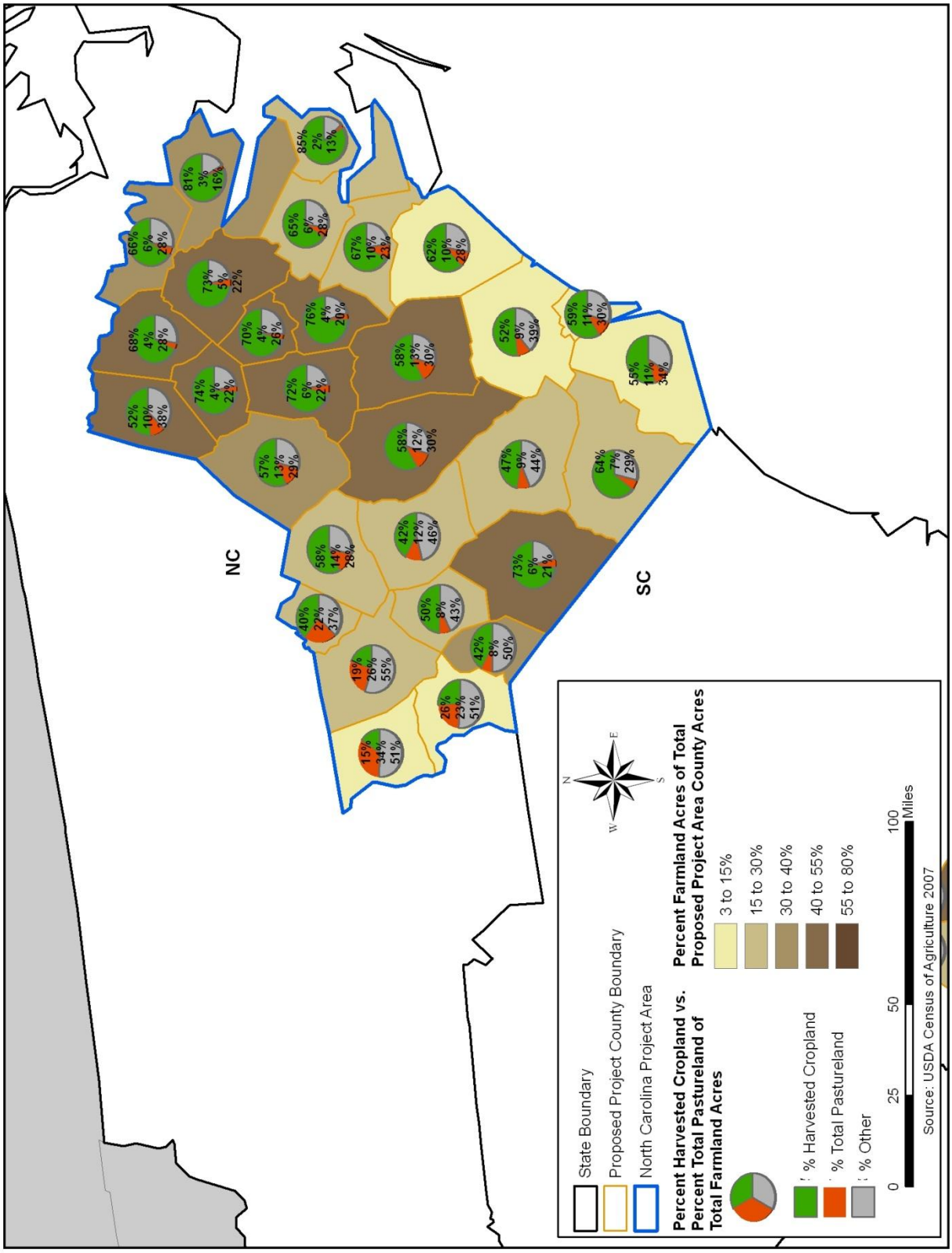


Figure 3-10 Comparison of the Percentage of Harvested Cropland and Total Pastureland in the North Carolina Proposed Project Area.

At the county level, the South Carolina counties within the Lowcountry proposed project area had an average increase in the number of farms by six percent, which was greater than the state level increase of one percent. Pamlico County, North Carolina had the greatest increase in farm numbers (25.0 percent) amongst the proposed project area counties. However, a majority of the counties within Georgia had a decrease in farm numbers and land in farms.

3.2.2.2 Conservation Acreage

Table 3-15 and **Figure 3-11** illustrates the farmland Enrolled in Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP) and other Continuous sign-up CRP acres in the proposed project areas. CRP acreage accounted for 3.1 percent of total land in farms in Georgia, 1.4 percent in North Carolina, and 3.2 percent in South Carolina. Approximately 44.2 percent of the CRP acres in Georgia were enrolled in new tree plantings (Conservation Practice [CP] 3 or 3A), as of July 2011 (USDA FSA 2011a). Georgia CRP in CP3 or CP3A accounts for approximately 14.7 percent of all acreage in CP3 or 3A. There were approximately 135,870 acres within the East Georgia proposed project area enrolled into conservation programs, 54,734 acres within the Middle Georgia proposed project area, 108,785 acres within the Lowcountry proposed project area, and 45,535 acres within the North Carolina proposed project area as of the end of July 2011 (USDA FSA 2011a).

Table 3-15. Farmland Enrolled in CRP, Total Acres by State and by Proposed Project Area.

Area	Acres Enrolled in Conservation Practices	Percent of State Total
Georgia	318,529	
North Carolina	117,557	
South Carolina	156,487	
Proposed Project Areas		
East Georgia	135,870	42.7%
Middle Georgia	54,734	17.2%
Lowcountry	108,785	22.9%
North Carolina	45,535	38.7%

Source: USDA FSA 2011b

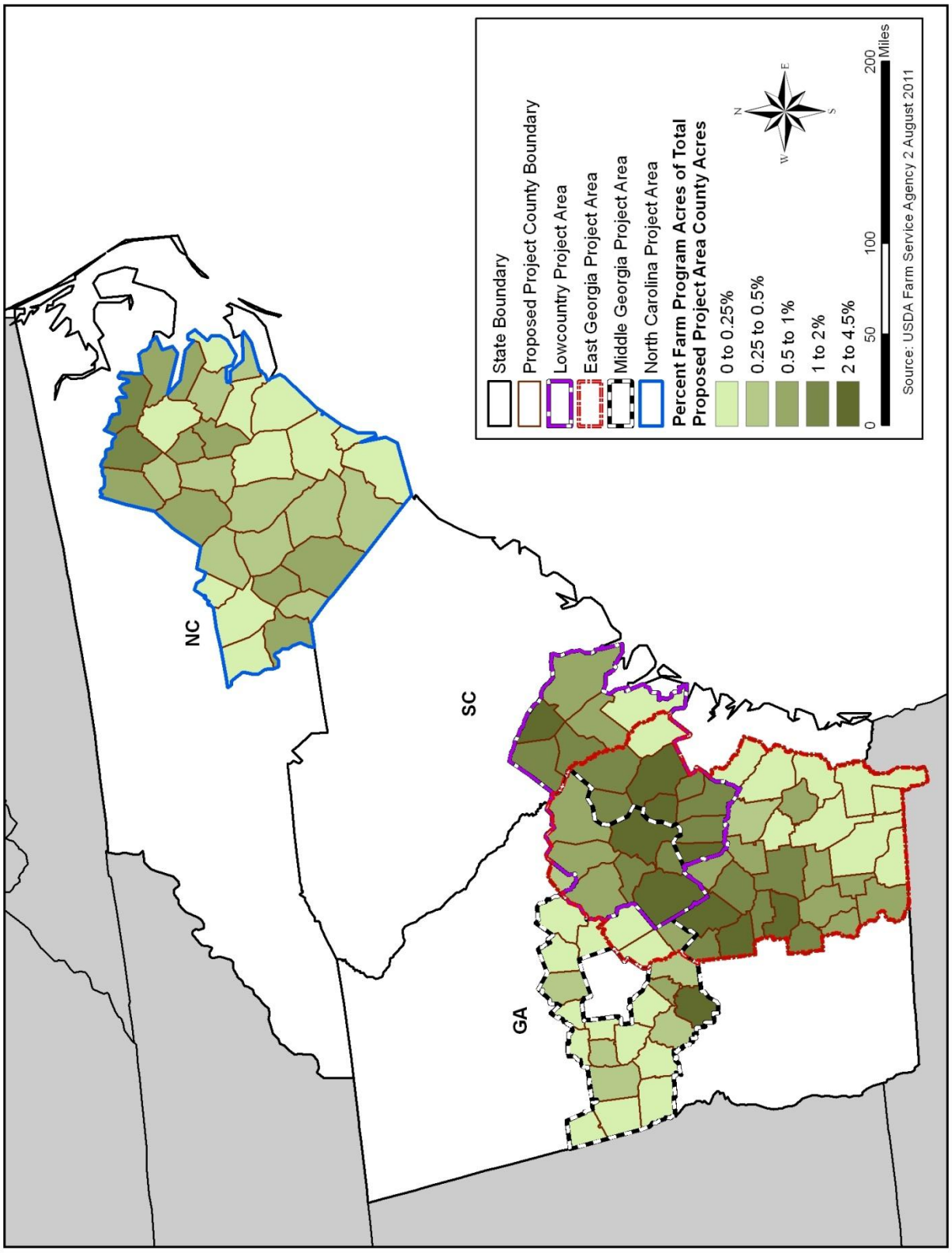


Figure 3-11. Percent of Total Acres Enrolled in the Conservation Reserve Program, Total Acres, July 2011.

3.2.2.3 Forestlands

According to the USDA Forest Service (FS), Forest Resources of the United States, in 2007 there were approximately 24.8 million acres of forestland in Georgia, 18.4 million acres of forestland in North Carolina, and 12.7 million acres of forestland in South Carolina (USDA FS 2009a, b). Of those total forest areas, the majority of the land was private forestland. Georgia had 90.5 percent private forestland, North Carolina had 84.0 percent private forestland, and South Carolina had 87.8 percent private forestland. Both Georgia and South Carolina had a small increase in the acres of forestland from 1997 to 2007 (1.5 percent and 0.7 percent, respectively) while North Carolina had a small decrease in forest area (*Ibid.*). The USDA FS and state forestry agencies complete forest inventories on cyclic basis, with the last year's data in all states from 2010 (**Table 3-16** and **Figure 3-12**). Forestland in all three states account for almost or more than 60 percent of total acreage in the state. Within the proposed project areas, forestland acreage accounts for more than 70 percent of total acres except for the North Carolina proposed project area.

Table 3-16. Forestland and Non-Forestland Acres by State and by Proposed Project Areas

Location	Total Acres	Forestland	Non-Forestland	Percent Forestland
Georgia	38,031,355	24,785,061	12,086,170	66.9%
North Carolina	34,443,688	18,601,251	12,368,696	59.7%
South Carolina	20,492,874	13,101,231	6,077,194	67.9%
Proposed Project Areas				
East Georgia	12,867,344	9,496,017	3,178,863	74.5%
Middle Georgia	7,300,014	5,391,040	1,810,875	74.6%
Lowcountry	7,379,934	5,236,635	1,969,738	72.2%
North Carolina	12,145,887	6,946,785	4,461,489	60.5%

Source: USDA, FS 2011

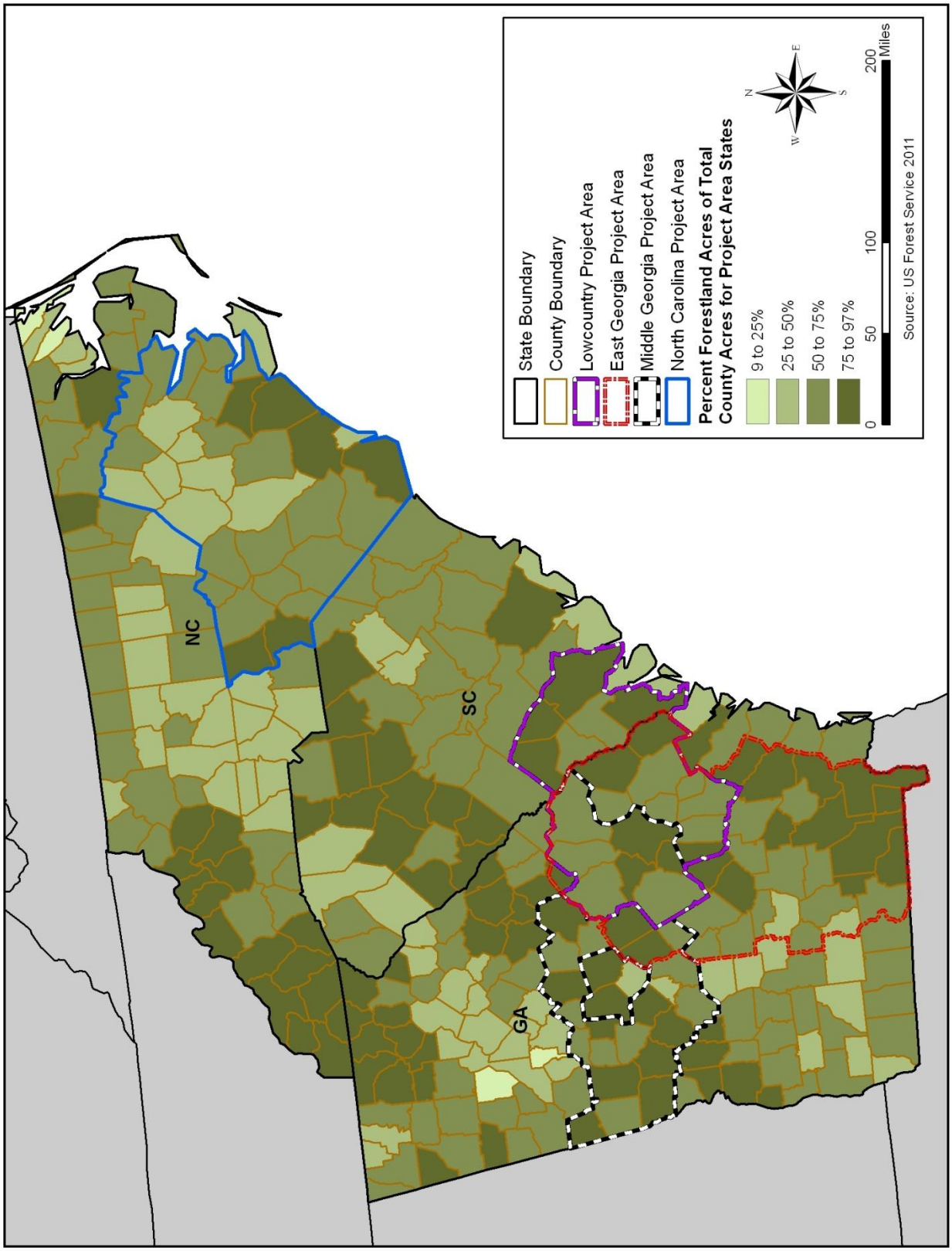


Figure 3-12. Forestland as a Percentage of Total Land Areas by Proposed Project Areas

3.3 MANAGED COASTAL ZONE

3.3.1 Definition of the Resource

The Coastal Zone Management Act of 1972 encourages the management of coastal zones areas including the protection and restoration of these areas. The act defines coastal zones as the coastal waters and the adjacent shorelands, strongly influenced by each other and in proximity to the shorelines of the several coastal states, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches. Each coastal state is responsible for developing a coastal zone management program and submitting the program for review and approval.

3.3.2 Existing Conditions

3.3.2.1.1.1 East Georgia Proposed Project Area

The Georgia Coastal Management Act of 1998 authorized the creation of the Georgia Coastal Program with Georgia's Department of Natural Resources (GDNR), Coastal Resources Division (CRD) serving as the lead agency. Georgia's state coastal zone includes the 11 counties that border tidally-influenced water or have economies that are closely tied to coastal resources. Of the coastal zones counties, there are five counties within the East Georgia proposed project area; Brantley, Charleston, Effingham, Long, and Wayne counties (National Oceanic and Atmospheric Administration [NOAA] 2011) (**Figure 3-13**).

Georgia's Coastal Management Program addressed the economic development and natural resource issues identified in Georgia. The Coastal Marshland Protection Act (CMPA) and the Shore Protection Act (SPA) limits certain activities and structures in tidal wetland or jurisdictional areas and requires permits for other activities and structures. Under the CMPA, jurisdiction is established mainly using tidal indicator plants. Under the SPA, jurisdiction is established using vegetation, structures, and the western boundary of the dune field. Any agricultural or silvicultural activities that directly alter lands within the jurisdictional areas of the CMPA or SPA must be permitted by the GDNR CRD. Lands outside these jurisdictional areas, but within the designated counties, do not require permitting.

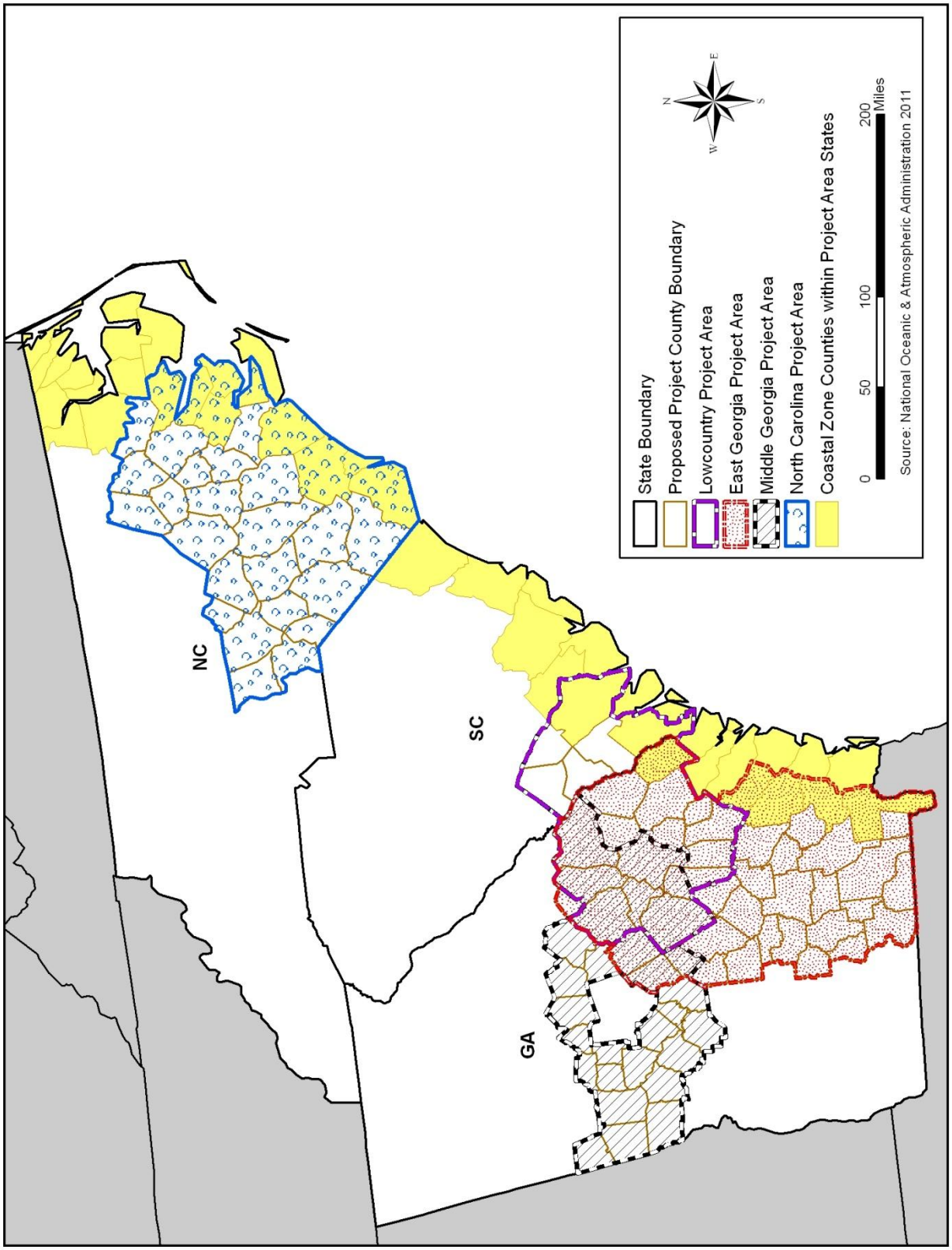


Figure 3-13. Coastal Zone Management Areas by Proposed Project Areas

3.3.2.1.1.2 Middle Georgia Proposed Project Area

There are no counties within the Middle Georgia proposed project area that are within the Georgia coastal zones.

3.3.2.1.1.3 Lowcountry Proposed Project Area

The South Carolina Coastal Program is lead by the South Carolina Department of Health and Environmental Control (SCDHEC) and was approved by NOAA in 1979. The South Carolina coastal zone includes all lands and waters in the counties of the State which contain any one or more "critical areas" which are defined as coastal waters, tidelands, beaches, and primary oceanfront sand dunes (NOAA 2011). Within the Lowcountry proposed project area there are two counties that would be within the designated coastal zone counties, Jasper and Colleton (SCDHEC 2011) (**Figure 3-13**). Within this proposed project area, one county, Effingham, is within the Georgia coastal zone counties.

3.3.2.1.1.4 North Carolina Proposed Project Area

The North Carolina Coastal Management Program is lead by the Division of Coastal Management within the North Carolina Department of Environment and Natural Resources (NCDENR) and was approved by NOAA in 1978. North Carolina's coastal zone includes the 20 counties that in whole or in part are adjacent to, adjoining, intersected by, or bounded by the Atlantic Ocean or any coastal sounds. There are two tiers within the coastal zone boundaries. The first tier is comprised of Areas of Environmental Concern (AEC). The AECs includes coastal wetlands, estuarine waters, public trust areas, estuarine shorelines, ocean beaches, frontal dunes, ocean erosion areas, inlet lands, small surface water supply watersheds, public water supply well-fields, and fragile natural resource areas. The second tier includes land uses, which have potential to affect coastal waters even if they are not located within the AEC (NOAA 2011). Of those 20 coastal zone counties, seven are within the North Carolina proposed project area; Beaufort, Brunswick, Craven, New Hanover, Onslow, Pamlico, and Pender (NCDENR 2011) (**Figure 3-13**). Section 103(5)(b) of the Coastal Area Management Act exempts agricultural or forestry production that does not involve the excavation or filling of estuarine or navigable waters or coastal marshland.

3.4 BIOLOGICAL RESOURCES

3.4.1 Vegetation

3.4.1.1 Definition of the Resource

Vegetation refers to the plants, both native and introduced, of a specific region.

3.4.1.2 Existing Conditions

3.4.1.2.1 Ecoregions

For this project, the Level III Ecoregions will be used to illustrate the natural vegetation of each proposed project area. **Table 3-17** describes each ecoregion within the proposed project areas. **Figure 3-14** illustrates the ecoregions within and adjacent to the proposed project areas.

Table 3-17. Level III Ecoregions Descriptions by Proposed Project Areas

Proposed Project Area	Level III Ecoregion
East Georgia Lowcountry	The **Southern Coastal Plains** are mostly flat plains and contains barrier islands, coastal lagoons, marches, and swampy lowlands. The land cover in the region is mostly slash and loblolly pine forests with some oak-gum-cypress stands in the low lying areas.
East Georgia Middle Georgia Lowcountry North Carolina	The **Southeastern Plains** ecoregion is a mosaic of cropland, pastureland, woodland, and forest. The natural vegetation is dominated by oak-hickory-pine and southern mixed forests.
Middle Georgia North Carolina	The **Piedmont** ecoregion is a transitional zone between the mountainous areas to the northwest and the relatively flat coastal plains to the southeast. This area that was once largely cultivated has now reverted to pine and hardwood woodlands.
Lowcountry North Carolina	The **Middle Atlantic Coastal** consists of low elevation, flat plains, and many swamps, marches, and estuaries. Forest cover in the region is dominated by loblolly and some shortleaf pine, with patches of oak, gum, and cypress near major streams.

Source: Adapted from Griffith et al. 2001, 2002

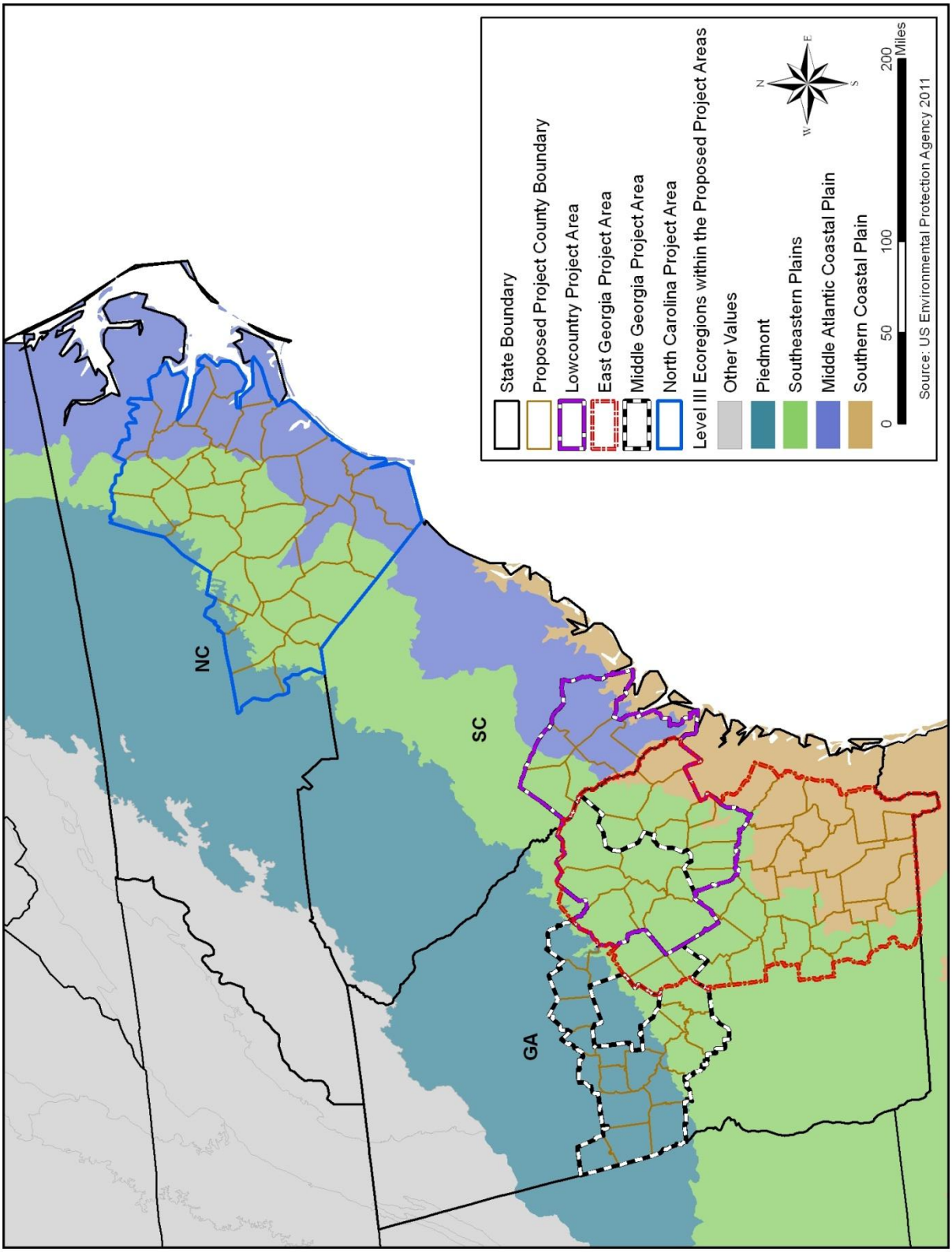


Figure 3-14. Level III Ecoregions within and adjacent to the Proposed Project Areas.

3.4.1.2.1 Invasive and Noxious Plant Species

Current agricultural and conservation practices include the planting of native and introduced species and control or eradication of invasive or noxious species. The Executive Order (EO) 13112, Invasive Species, directs Federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause unless the benefits of the introduction or spread of the invasive species clearly outweigh potential harms. In addition, the Plant Protection Act (PPA), which became law in June 2000 as part of the Agricultural Risk Protection Act, consolidated all or part of 10 existing laws, applicable to USDA activities, into one comprehensive law, including the authority to regulate plants, plant products, certain biological control organisms, noxious weeds, and plant pests (USDA Animal and Plant Health Inspection Service [APHIS] 2002). EO 13112 defines native species as a species that, with respect to a particular ecosystem, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. An alien or non-native species is any species, with respect to a particular ecosystem, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem; an invasive species is a nonnative "species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (EO 13112). The PPA defines a noxious weed as any plant or plant product that can directly or indirectly bring harm to agriculture, the public health, navigation, irrigation, natural resources, or the environment; this Act expands the definition of noxious weed from the definition in the 1974 Federal Noxious Weed Act, which included only weeds that were of foreign origin, new to, or not widely prevalent in the United States (APHIS 2002). Noxious weeds are identified and listed on State and Federal lists.

Invasive plant species can have significant negative impacts on biological resources including decreases in native wildlife and plant species populations, alterations to rare plant communities, or changing ecological processes that native plant species and other desirable plants and wildlife depend on for survival (including impacts upon native pollinators) (National Invasive Species Council [NISC] 2008). Invasive plant species could potentially cause or vector decimating plant diseases, prevent native and agricultural species from reproducing, suppress the growth of neighboring plants, out-compete desirable species for nutrients, light, moisture or other vital resources; and adversely impact erosion rates, hydrologic regimes and soil chemistry such as pH and nutrient availability. Natural wildfire cycles could also be altered; invasions by fire-promoting grasses could alter entire plant

communities, eliminating or sharply reducing populations of many native plant species (*Ibid.*).

Eradication or control of invasive and noxious species can be an arduous task often including multiple methods of treatment to be effective. The application of herbicide, grazing, burning, mechanical or manual control (cutting, excavating), and mowing are all methods that can be used to control and eradicate invasive species. While it may not be possible to fully eradicate an invasive plant species, management activities can control further spread or takeover. Some species of invasive plants require timed treatment for eradication or control such as when the plant is dormant, young, or prior to flowering/seeding. Additionally, vegetation may become accustomed to certain methods of control and other methods may be required to aid in management (NRCS Conservation Practice Standard [CPS] 595, Pest Management).

Giant miscanthus is not listed on any of the proposed project areas states' (North Carolina or South Carolina) list of noxious weeds as of August 2011 located through the USDA PLANTS database (Georgia does not have a state noxious weed list). This may be partially due to the fact that this species has not had widespread distribution in a localized or regional level; however, this is the most recent listing for these states. This species is also not listed on the Federal Noxious Weed List as of the 2006 list.

Two species of *Miscanthus (M. floridulus* and *M. sinensis*), one of which is a parent species of the hybrid being proposed by the Project Sponsor, are listed on the U.S. Weeds species list per the USDA PLANTS database. Additionally, the other parent species (*M. sacchariflorus*) is listed as a noxious weed in Massachusetts. The Early Detection and Distribution Mapping System (EDDMapS) developed by the UGA Center for Invasive Species and Ecosystem Health has compiled distribution records for invasive and exotic species down to the county level for the United States. These distribution records do not indicate an infestation, rather just a record of occurrence on an exotic species known to have infestations in the United States. The distribution maps indicate records for *M. sinensis* in 16 counties in Georgia (including Echols), 12 counties in South Carolina (no counties within the proposed project area), and 42 counties in North Carolina (including Beaufort, Craven, Harnett, Lee, Moore, Nash, and Scotland). There were no distribution records for *M. sacchariflorus* in any of the states within the proposed project areas.

3.4.2 Wildlife

3.4.2.1 Definition of the Resource

Wildlife refers to the animal species (mammals, birds, amphibians, reptiles, invertebrates, and fish/shellfish), both native and introduced, which characterize a region.

3.4.2.2 Existing Conditions

3.4.2.2.1 East Georgia Proposed Project Area

Major wildlife species in this area include white-tailed deer (*Odocoileus virginianus)*, wild pig (*Sus scrofa*), coyote (*Canis latrans)*, striped skunk (*Mephitis mephitis*), northern raccoon (*Procyon lotor*), American black bear (*Ursus americanus*), Virginia opossum (*Didelphis virginiana*), western cottontail (*Sylvilagus floridanus*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), barn owl (*Strix varia*), snapping turtle (*Chelydra serpentina*), and American alligator (*Alligator mississipiensis)* (UGA 2008).

3.4.2.2.2 Middle Georgia Proposed Project Area

Major wildlife species in this area include white-tailed deer, wild pig, coyotes, striped skunk, northern raccoon, American black bear, Virginia opossum, western cottontail, wood duck, mallard, barn owl, snapping turtle, and American alligator (UGA 2008).

3.4.2.2.3 Lowcountry Proposed Project Area

Major wildlife species in this area include bobwhite quail (*Colinus virginianus)*, dove (*Zenaida macroura)*, oyster catcher (*Haematopus palliates*), turkey (*Meleagris* sp.), beavers (*Castor canadensis)*, American black bear, coyote, muskrat (*Ondatra zibethicus)*, and American alligator. Freshwater fish species that are common in the area include blue catfish (*Ictalurus furcatus)*, largemouth bass (*Micropterus salmoides)*, striped bass (*Morone saxatilis*), and white crappie (*Pomoxis annularis)* (South Carolina Department of Natural Resources [SCDNR] 2011).

3.4.2.2.4 North Carolina Proposed Project Area

Major wildlife species in this area include dove, snowy egret (*Egretta thula)*, Canada goose (*Branta canadensis)*, wild turkey, American black bear, cougar (*Felis concolor)*, coyote, white-tailed deer, gray fox (*Urocyon cinereoargenteus)*, corn snake (*Elaphe guttata)*, and eastern box turtle (*Terrapene carolina carolina)*. Fish species include largemouth bass, striped bass, bluegill (*Lepomis macrochirus)*, crappie, and trout (*Salvelinus sp.)* (NCDENR 2001).

3.4.3 Protected Species

3.4.3.1 Definition of the Resource

Protected species are those Federally designated as threatened or endangered under the Endangered Species Act of 1973 (ESA) (7 USC 136, 16 USC 1531 *et seq.*) or species that are considered candidates for being listed as threatened or endangered. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

3.4.3.2 Existing Conditions

Tables 3-18 through **3-20** list the Federally-listed threatened and/or endangered species that could be present in the proposed project area counties by each state. **Figures 3-15** through **3-18** illustrate the potential ranges of Federally-listed species within the proposed project areas. A table of the State-listed species that could potentially occur within the proposed project areas is included in **Appendix A**.

3.4.3.2.1 East Georgia Proposed Project Area

A review of the Federally-listed protected (threatened and/or endangered) species based on the U.S. Fish and Wildlife Service (USFWS) data indicate that 12 Federally-listed endangered species and two Federally-listed threatened species have the potential to occur in the counties within the East Georgia proposed project area.

A review of the GDNR Rare Species and Natural Community Data, indicates that there 30 State-listed threatened species and 21 State-listed endangered species. Of those species, 1 is a State-listed threatened insect, 4 are State-listed endangered fish, 1 is a State-listed threatened fish, 16 are State-listed threatened plants, 10 are State-listed endangered plants, 4 are State-listed threatened reptiles, 1 is a State-listed threatened bird, 2 are State-listed endangered birds, 2 are State-listed endangered mammals, 2 are State-listed threatened mammal, 3 are State-listed threatened mollusk and crustaceans, 3 are State-listed endangered mollusk and crustaceans, and 2 are State-listed threatened amphibians within

Table 3-18. Federally Listed Threatened and Endangered Species that Could Potentially Occur within Georgia

Category	Scientific Name	Common Name	T/E	County
Amphibian	*Ambystoma cingulatum*	Frosted Flatwoods Salamander	T	Evans, Lanier, Long, Screven
	Notophthalmus perstriatus	Striped Newt	C	No County Level Data Available
Bird	*Mycteria americana*	Wood Stork	E	Appling, Bacon, Ben Hill, Berrien, Bleckley, Brantley, Bulloch, Burke, Chandler, Charlton, Clinch, Coffee, Cook, Dodge, Echols, Effingham, Emanuel, Evans, Glascock, Houston, Irwin, Jeff Davis, Jefferson, Jenkins, Johnson, Lanier, Laurens, Long, Lowndes, Macon, Montgomery, Pierce, Pulaski, Screven, Tattnall, Telfair, Tift, Toombs, Treutlen, Twiggs, Ware, Washington, Wayne, Wheeler, Wilcox
	Picoides borealis	Red-cockaded Woodpecker	E	Appling, Ben Hill, Brantley, Charlton, Effingham, Evans, Emanuel, Laurens, Long, Montgomery, Putnam, Talbot, Tattnall, Ware, Washington, Wheeler, Wilcox
	Haliaeetus leucocephalus	Bald Eagle	DL	No County Level Data Available
Fish	*Acipenser brevirostrum*	Shortnose Sturgeon	E	Appling, Ben Hill, Bulloch, Burke, Coffee, Effingham, Jeff Davis, Jenkins, Long, Montgomery, Screven, Tattnall, Telfair, Toombs, Wayne, Wheeler, Wilcox
Invertebrate	Medionidus penicillatus	Gulf Moccasin shell	T	Spalding, Pike, Meriwether, Taylor, Harris
	Elliptoideus sloatianus	Purple Bankclimber	T	Pike, Taylor, Macon, Upson, Talbot, Harris, Crawford, Peach
	Hamiota subangulata	Shinyrayed Pocketbook	E	Spalding, Pike, Meriwether, Taylor, Macon, Upson
	Pleurobema pyriforme	Oval Pigtoe	E	Spalding, Pike, Meriwether, Talbot
	Lampsilis altilis	Finelined Pocketbook	T	Heard
	Elliptio spinosa	Altamaha spinymussel	E	Appling, Ben Hill, Coffee, Jeff Davis, Long, Montgomery, Tattnall, Toombs, Wayne, Wilcox
Mammal	*Balaenoptera physalus*	Finback Whale	E	No County Level Data Available
	Megaptera novaengliae	Humpback whale	E	No County Level Data Available
	Trichechus manatus	Manatee	E	Effingham
Plant	*Baptisia arachnifera*	Hairy Rattleweed	E	Brantley, Wayne, Pierce
	Isoetes melanospora	Black-spored Quillwort	E	Butts, Heard, Troup
	Isoetes tegetiformans	Mat-forming Quillwort	E	Hancock, Putman, Washington
	Oxypolis canbyi	Canby Dropwort	E	Burke, Emanuel, Houston, Jenkins, Pulaski, Screven
	Ptilimnium nodosum	Harperella	E	Putnam, Houston, Hancock
	Silene polypetala	Fringed Campion	E	Bleckley, Crawford, Harris, Houston, Pulaski, Talbot, Taylor, Upson, Twiggs
	Trillium reliquum	Relict Trillium	E	Bleckley, Butts, Crawford, Harris, Houston, Jasper, Laurens, Macon, Pulaski, Talbot, Taylor, Twiggs, Upson, Wilkinson
	Lindera melissifolia	Pondberry/Pond Spicebush	E	Dodge, Effingham, Jeff Davis, Screven, Telfair, Taylor, Wheeler
	Schwalbea americana	American Chaffseed	E	Lamar, Pike, Spalding, Tift, Upson
	Amphianthus pusillus	Little Amphianthus/Pool Sprite	T	Butts, Harris, Hancock, Heard, Meriwether, Pike, Putnam
	Rhus michauxii	Michaux's Sumac	E	Butts, Crawford, Harris, Hancock, Heard, Lamar, Meriwether, Pike, Putnam, Spalding, Talbot, Troup, Upson

Category	Scientific Name	Common Name	T/E	County
Reptile	*Drymarchon corais couperi*	Eastern Indigo Snake	T	Appling, Atkinson, Bacon, Berrien, Bulloch, Charlton, Clinch, Coffee, Echols, Emanuel, Evans, Irwin, Jeff Davis, Lanier, Long, Lowndes, Tattnall, Telfair, Wayne, Wheeler
	Lepidochelys kempii	Kemp's Ridley Sea Turtle	E	No County Level Data Available
	Alligator mississippiensis	American Alligator	T (S/A)	No County Level Data Available
	Gopherus poluphemus	Gopher Tortoise	C	No County Level Data Available

Source: USFWS 2011

Table 3-19. Federally Listed Threatened and Endangered Species that Could Potentially Occur within North Carolina

Category	Scientific Name	Common Name	T/E	County
Birds	*Mycteria americana*	Wood Stork	E	Brunswick, Columbus, Sampson, New Hanover
	Picoides borealis	Red-cockaded Woodpecker	E	Beaufort, Bladen, Brunswick, Columbus, Craven, Duplin, Edgecombe, Green, Garnett, Hoke, Johnston, Jones, Lee, Lenoir, Montgomery, Moore, Nash, New Hanover, Onslow, Pamlico, Pender, Pitt, Richmond, Robeson, Sampson, Scotland, Wayne, Wilson
	Charadrius melodus	Piping Plover	T	Brunswick, New Hanover, Onslow, Pender
	Haliaeetus leucocephalus	Bald Eagle	DL	No County Level Data
Fish	*Notropis mekistocholas*	Cape Fear Shiner	E	Harnett, Lee, Moore
	Acipenser brevirostrum	Shortnose Sturgeon	E	Richmond, Brunswick, New Hanover, Onslow, Pamlico, Scotland
	Menidia extensa	Waccamaw Silverside	T	Columbus
Invertebrate	*Lasmigona decorata*	Carolina Heelsplitter	E	Richmond
	Alasmidonta heterodon	Dwarf Wedgemussel	E	Johnston, Nash, Wilson
	Neonympha mitchellii francisci	Saint Francis' Satyr	E	Cumberland, Hoke
	Elliptio steinstansana	Tar River Spinymussel	E	Edgecombe, Johnston, Nash, Pitt
Mammals	*Trichechus manatus*	West Indian Manatee	E	Beaufort, Brunswick, Craven, New Hanover, Onslow, Pamlico, Pender, Pit
	Canis rufus	Red Wolf	E, XN E	Beaufort, No Other County Level Data Available
	Balaena glacialis	North Atlantic Right whale	E	No County Level Data Available
	Balaenoptera physalus	Finback Whale	E	No County Level Data Available
	Megaptera novaengliae	Humpback whale	E	No County Level Data Available
Plants	*Oxypolis canbyi*	Canby's Dropwort	E	Scotland
	Schwalbea americana	American Chaffseed	E	Bladen, Cumberland, Hoke, Moore, Pender, Scotland
	Thalictrum cooleyi	Cooley's Meadowrue	E	Brunswick, Columbus, New Hanover, Onslow, Pender
	Carex lutea	Golden Sedge	E	Onslow, Pender
	Ptilimnium nodosum	Harperella	E	Lee
	Rhus michauxii	Michaux's Sumac	E	Cumberland, Hoke, Johnson, Moore, Nash, Richmond, Robeson, Scotland, Wilson
	Lindera melissifolia	Pondberry	E	Bladen, Cumberland, Onslow, Sampson
	Lysimachia asperulifolia	Rough-leaf Loosestrife	E	Beaufort, Bladen, Brunswick, Columbus, Craven, Cumberland, Harnett, Hoke, , New Hanover, Onslow, Pamlico, Pender, Richmond, Scotland
	Helianthus schweinitzii	Schweinitz's Sunflower	E	Montgomery
	Amaranthus pumilus	Seabeach Amaranth	T	Brunswick, New Hanover, Onslow, Pender
	Aeschynomene virginica	Sensitive Jointvetch	T	Beaufort, Craven, Lenoir
	Echinacea laevigata	Smooth Coneflower	E	Montgomery
Reptile	*Alligator mississippiensis*	American Alligator	T (S/A)	No county level data
	Chelonia mydas	Green Sea Turtle	T	Beaufort, Brunswick, New Hanover, Onslow, Pender, Pamlico
	Lepidochelys kempii	Kemp's Ridley Sea Turtle	E	Beaufort, Brunswick, Pamlico
	Dermochelys coriacea	Leatherback Sea Turtle	E	Beaufort, Brunswick, Craven, New Hanover, Onslow, Pamlico, Pender
	Caretta caretta	Loggerhead Sea Turtle	T	Beaufort, Brunswick, New Hanover, Onslow, Pender, Pamlico
	Eretmochelys imbricata	Hawksbill Sea Turtle	E	Beaufort, Brunswick, New Hanover, Onslow, Pamlico, Pender

Source: USFWS 2011

Table 3-20. Federally Listed Threatened and Endangered Species that Could Potentially Occur within South Carolina

Category	Scientific Name	Common Name	T/E	County
Amphibian	*Ambystoma cingulatum*	Frosted flatwoods salamander	T	Jasper
Birds	*Charadrius melodus*	Piping plover	T	Colleton, Jasper
	Haliaeetus leucocephalus	Bald eagle	Delisted due to Recover	Allendale, Barnwell, Colleton, Hampton, Jasper
	Mycteria americana	Wood stork	E	Allendale, Bamberg, Barnwell, Colleton, Hampton, Jasper
	Picoides borealis	Red-cockaded woodpecker	E	Allendale, Bamberg, Barnwell, Colleton, Hampton, Jasper
	Dendroica kirtlandii	Kirtland's Warbler	E	Colleton, Jasper
Fish	*Acipenser brevirostrum*	Shortnose sturgeon	E	Allendale, Barnwell, Colleton, Hampton, Jasper
Invertebrate	*Toxolasma pullus*	Savannah Lilliput	C	No County Level Data
Mammals	*Balaena glacialis*	North Atlantic Right whale	E	No County Level Data
	Balaenoptera physalus	Finback Whale	E	No County Level Data
	Megaptera novaengliae	Humpback whale	E	No County Level Data
	Trichechus manatus	West Indian manatee	E	Colleton, Jasper
	Canis rufus	Red Wolf	E	No County Level Data
Plant	*Echinacea laevigata*	Smooth coneflower	E	Allendale, Barnwell
	Lindera melissifolia	Pondberry	E	Barnwell, Colleton, Jasper
	Oxypolis canbyi	Canby's dropwort	E	Allendale, Bamberg, Barnwell, Colleton, Hampton, Jasper
	Schwalbea americana	American chaffseed	E	Barnwell, Jasper
	Ptilimnium nodosum	Harperella	E	Barnwell
Reptile	*Caretta caretta*	Loggerhead sea turtle	T	Colleton, Jasper
	Chelonia mydas	Green sea turtle	T	Colleton, Jasper
	Dermochelys coriacea	Leatherback sea turtle	E	Colleton, Jasper
	Lepidochelys kempii	Kemp's ridley sea turtle	E	Colleton, Jasper
	Eretmochelys imbricata	Hawksbill Sea Turtle	E	Colleton, Jasper
	Alligator mississippiensis	American Alligator	T (S/A)	No County Level Data

Source: USFWS 2011

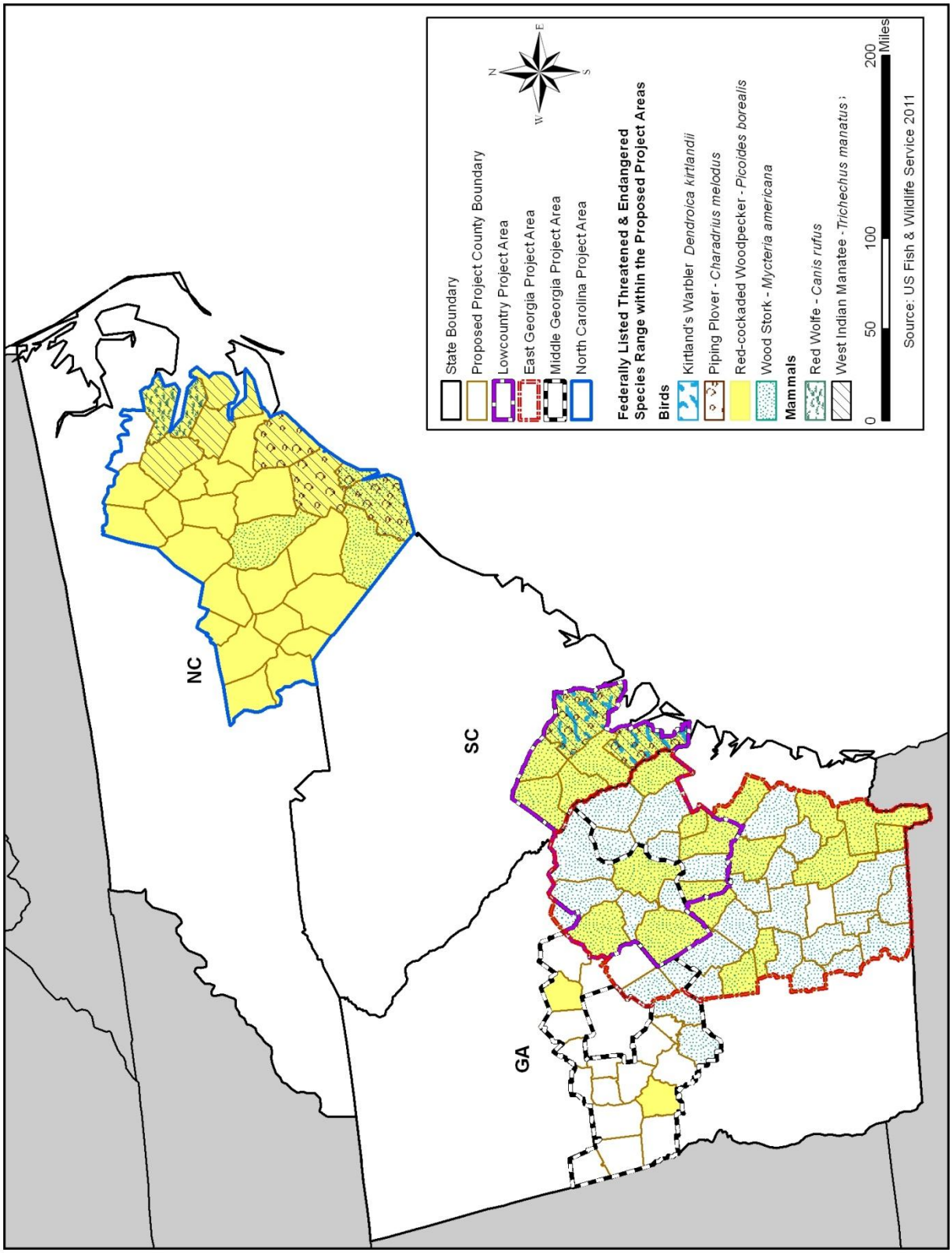


Figure 3-15. Potential Ranges of Federally-listed Threatened and/or Endangered Birds, Insects and Mammals within and adjacent to the Proposed Project Areas.

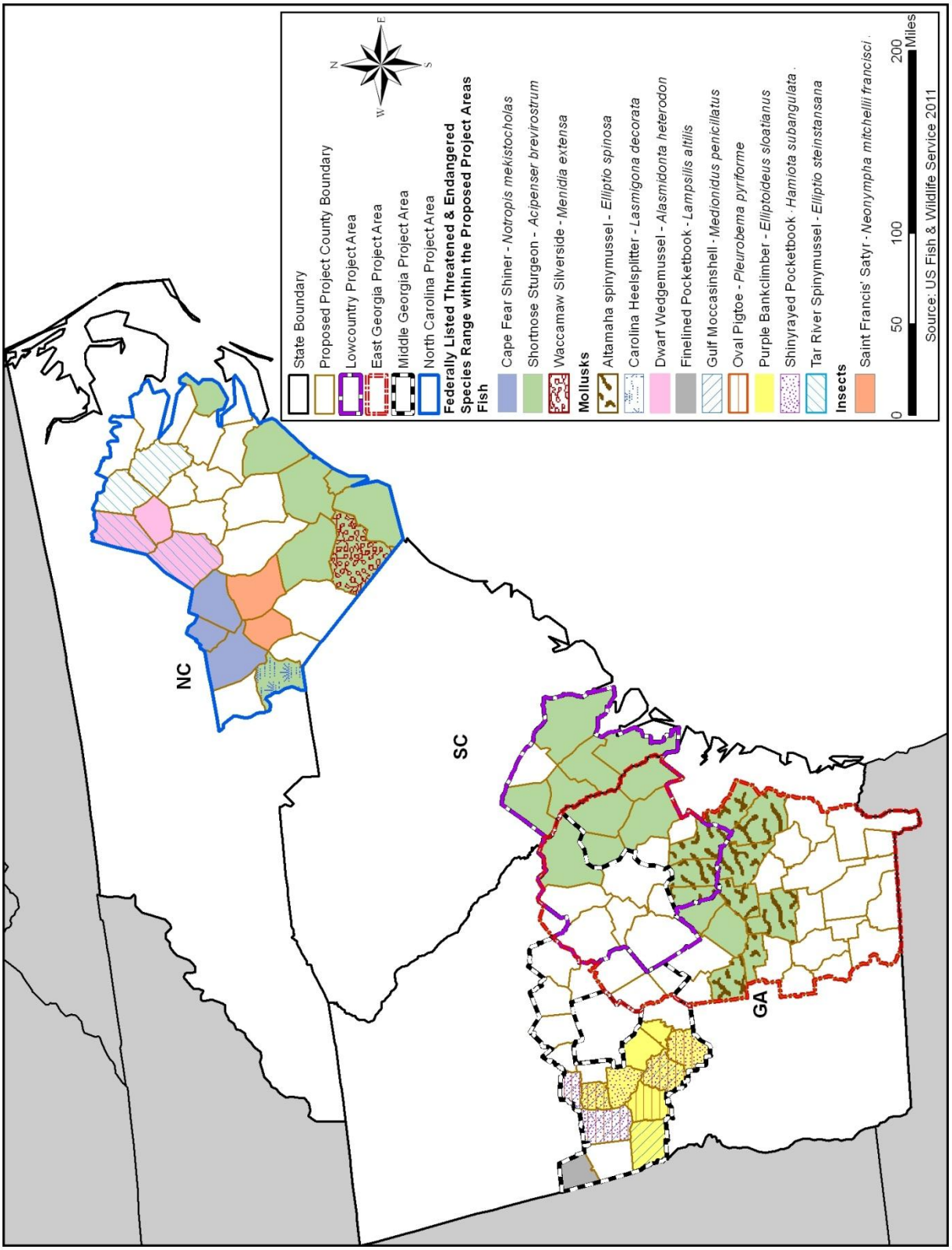


Figure 3-16. Potential Ranges of Federally-listed Threatened and/or Endangered Invertebrates and Fish within and adjacent to the Proposed Project Areas.

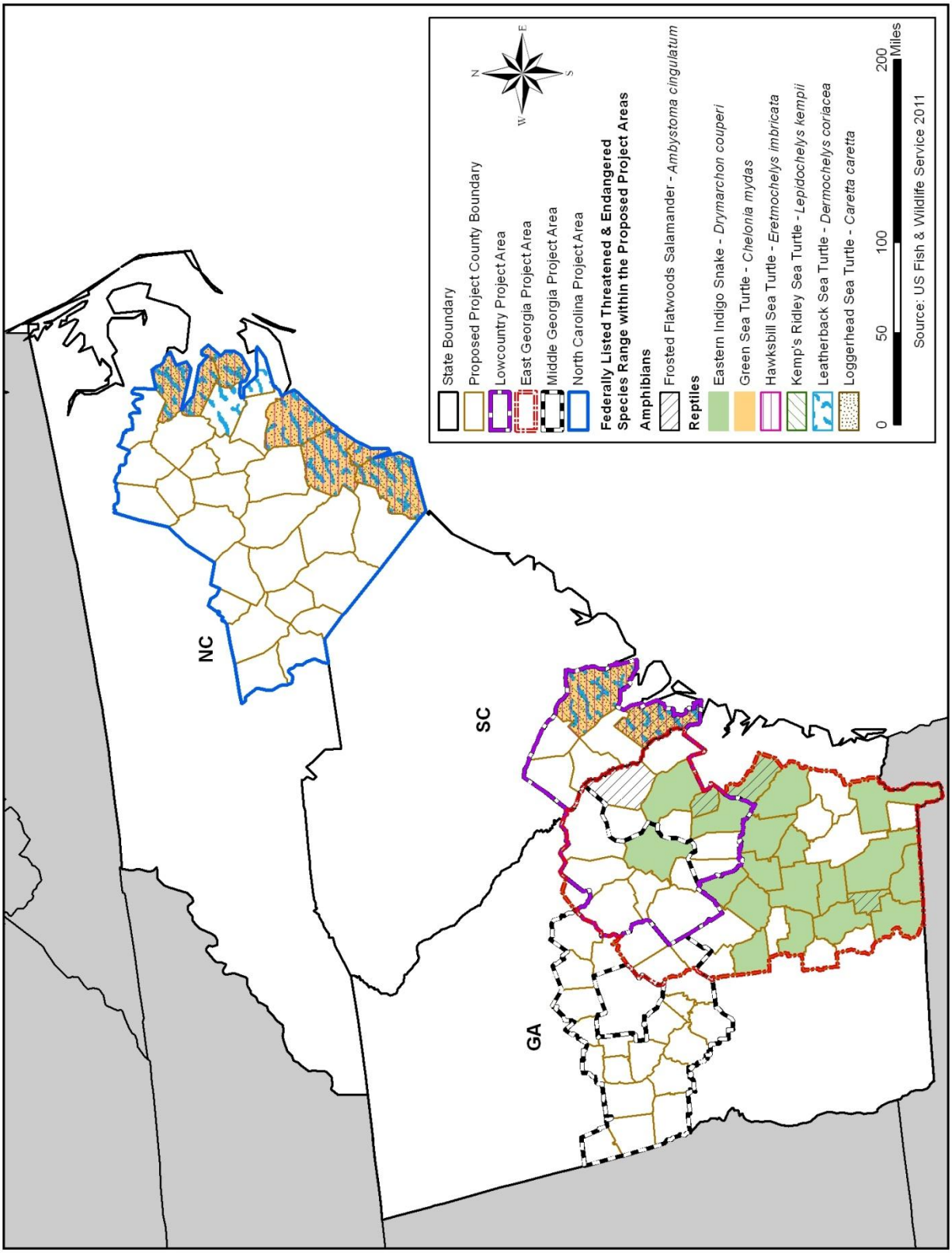


Figure 3-17. Potential Ranges of Federally-listed Threatened and/or Endangered Reptiles and Amphibians within and adjacent to the Proposed Project Areas.

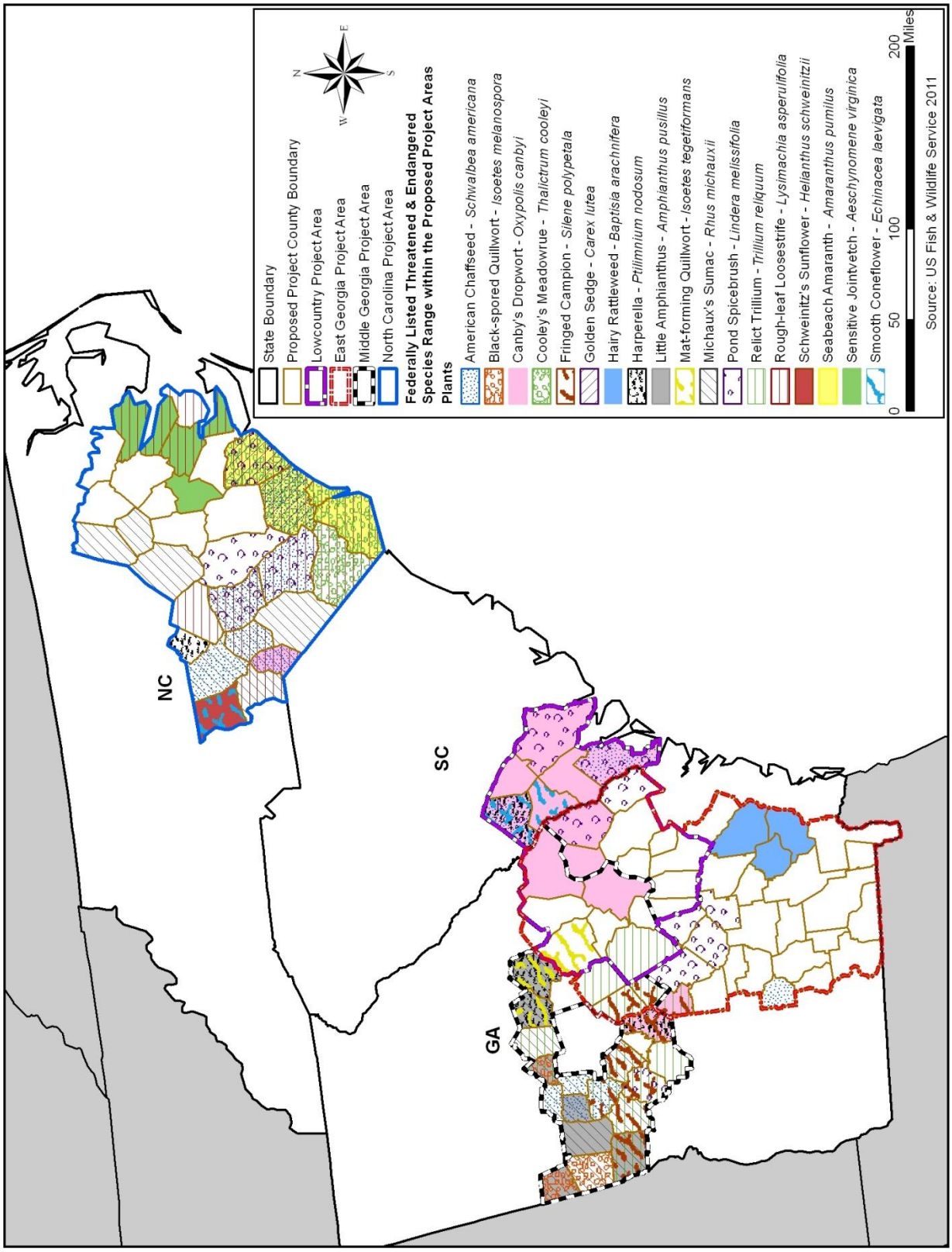


Figure 3-18. Potential Ranges of Federally-listed Threatened and/or Endangered Plants within and adjacent to the Proposed Project Areas.

the Georgia counties in the East Georgia proposed project area. The search also indicates that there are 25 species listed as rare (a species which may not be endangered or threatened by which should be protected because of its scarcity) and five species are listed as unusual and thus deserving of special consideration.

3.4.3.2.2 Middle Georgia Proposed Project Area

A review of the Federally-listed protected (threatened and/or endangered) species based on the USFWS data indicate that 13 Federally-listed endangered species and five Federally-listed threatened species have the potential to occur in the Middle Georgia proposed project area.

A review of the GDNR Rare Species and Natural Community Data, indicates that there 42 State-listed threatened species and 26 State-listed endangered species. Of those species, 1 is a State-listed threatened insect, 3 are State-listed endangered fish, 2 are State-listed threatened fish, 23 are State-listed threatened plants, 14 are State-listed endangered plants, 5 are State-listed threatened reptiles, 1 is a State-listed threatened bird, 1 is a State-listed endangered bird, 1 is a State-listed endangered mammal, 1 is a State-listed threatened mammal, 7 are State-listed threatened mollusk and crustaceans, 8 are State-listed endangered mollusk and crustaceans, and 2 are State-listed threatened amphibians within the Georgia counties in the Middle Georgia proposed project area. The search also indicates that there are nine species listed as rare (a species which may not be endangered or threatened by which should be protected because of its scarcity) and one species is listed as unusual and thus deserving of special consideration.

3.4.3.2.3 Lowcountry Proposed Project Area

A review of the Federally-listed protected (threatened and/or endangered) species based on the USFWS data indicate that 15 Federally-listed endangered species and five Federally-listed threatened species have the potential to occur in the counties within the Lowcountry proposed project area.

A review of the GDNR Rare Species and Natural Community Data, indicates that there 23 State-listed threatened species and 15 State-listed endangered species. Of those species, 1 is a State-listed threatened insect, 3 are State-listed endangered fish, 15 are State-listed threatened plants, 6 are State-listed endangered plants, 3 are State-listed threatened reptiles, 1 is a State-listed threatened bird, 2 are State-listed endangered birds, 2 are State-listed endangered mammals, 1 is a State-listed threatened mammal, 3 are State-listed

threatened invertebrates, and 2 are State-listed endangered invertebrates, within the Georgia counties in the Lowcountry proposed project area. The search also indicates that there are 18 species listed as rare (a species which may not be endangered or threatened by which should be protected because of its scarcity) and four species are listed as unusual and thus deserving of special consideration.

A review of the SCDNR Rare, Threatened and Endangered Species Inventory, indicates that there five State-listed threatened species and eight State-listed endangered species within the South Carolina counties in the Lowcountry proposed project area. Of those species, 1 is State-listed endangered fish, 2 are State-listed threatened reptiles, 1 is a State-listed threatened reptile, 2 are State-listed threatened birds, 3 are State-listed endangered birds, 1 is a State-listed endangered mammal, 1 is State-listed threatened amphibian, and 2 are State-listed endangered amphibians, within the South Carolina counties in the Lowcountry proposed project area. The search also indicates that there are 47 species listed as S1 (Critically imperiled state-wide because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation), 44 species are listed as S2 (Imperiled state-wide because of rarity or factor(s) making it vulnerable), and 23 species are listed as S3 (Rare or uncommon in state).

3.4.3.2.4 North Carolina Proposed Project Area

A review of the Federally-listed protected (threatened and/or endangered) species based on the USFWS data indicate that 26 Federally-listed endangered species and seven Federally-listed threatened species have the potential to occur in the North Carolina proposed project area.

A review of the North Carolina Natural Heritage Program (NCNHP), indicates that there 96 State-listed threatened species and 111 State-listed endangered species. Of those species, 11 are State-listed endangered mollusks, 10 are State-listed threatened mollusks, 6 are State-listed threatened fish, 4 are State-listed endangered fish, 70 are State-listed threatened plants, 85 are State-listed endangered plants, 3 are State-listed threatened reptiles, 4 are State-listed endangered reptiles, 3 are State-listed threatened birds, 3 are State-listed endangered birds, 1 is a State-listed threatened mammal, 1 is a State-listed endangered mammal, and 2 are State-listed threatened amphibians within the North Carolina counties in the proposed project area. The search also indicates that there are 52 species listed as Special Concern (Any species of wild animal native or once-native to North Carolina which is determined by the Wildlife Resources Commission to require monitoring

but which may be taken under regulations adopted under the provisions in Article 25.), 111 species listed as significantly rare (Any species which has not been listed by the North Carolina Wildlife Resources Commission as an Endangered, Threatened, or Special Concern species, but which exists in the State in small numbers and has been determined by the NCNHP to need monitoring.), 43 plant species listed as Special Concern-Vulnerable (Any species or higher taxon of plant that occurred in North Carolina at one time, but for which all known populations are currently considered to be either historical or extirpated), 13 plant species listed as Special Concern-Historical (Any species or higher taxon of plant that occurred in North Carolina at one time, but for which all known populations are currently considered to be either historical or extirpated), 13 plant species listed as Limited (The range of the species is limited to North Carolina and adjacent states [endemic or near endemic]. These are species, which may have 20 to 50 populations in North Carolina, but fewer than 100 populations rangewide. The preponderance of their distribution is in North Carolina and their fate depends largely on conservation here), 32 plant species listed as Throughout (The species is rare throughout its range [fewer than 100 populations total].), 12 plant species listed as disjunct (The species is disjunct to North Carolina from a main range in a different part of the country or world), 76 plant species listed as peripheral (The species is at the periphery of its range in North Carolina. These species are generally more common somewhere else in their ranges, occurring in North Carolina peripherally to their main ranges, mostly in habitats which are unusual in North Carolina), and 17 plant species listed as Other (The range of the species is sporadic or cannot be described by the other Significantly Rare categories) within the North Carolina counties in the proposed project area.

3.5 SOIL RESOURCES

3.5.1 Definition of the Resource

Soils are a natural body made up of weathered minerals, organic matter, air and water. Soils are formed mainly by the weathering of rocks, the decaying of plant matter, and the deposition of materials such as chemical and biological fertilizers that are derived from other origins. Soils are differentiated based on characteristics such as particle size, texture and color, and classified taxonomically into soil orders based on observable properties such as organic matter content and degree of soil profile development (Brady and Weil 1996). Soil taxonomy was established to classify soils according to the relationship between soils and the factors responsible for their character (USDA NRCS 1999). For the purpose of this project, the soil resources will be discussed based on the soil classification in the particular proposed project area.

Soil erosion is a naturally occurring event and the erosion rates are relatively slow; however, human activity can greatly accelerate the rate of erosion. Poor farming practices, loss of vegetation through deforestation, overgrazing and the maintenance of agricultural land are some of the factors that make soils more susceptible to erosion. For the purpose of this document, highly erodible lands (HEL) were used to evaluate the potential for erosion within the proposed project areas (**Figure 3-19**). For more information about HEL, refer to the BCAP Final PEIS (Chapter 3.4).

HEL are those lands with a soil erodibility index (EI) 8 or greater. The EI provides a value to determine the potential for a soil to erode considering the physical and chemical properties of the soil and the climatic conditions where it is located. The higher EI score, the more investment is necessary to maintain crop production. The EI is calculated from a portion of the Universal Soil Loss Equation (USLE) as the maximum of (R*K*LS)/T or from the Wind Erosion Equation as (C*I)/T (from the Wind Erosion Equation).

R	= measure of rainfall and runoff;	C	= windspeed and surface soil moisture characterization;
K	= soil erodibility (water);	I	= soil erodibility (wind); and
L	= slope length;	T	= soil loss tolerance.
S	= slope steepness;		

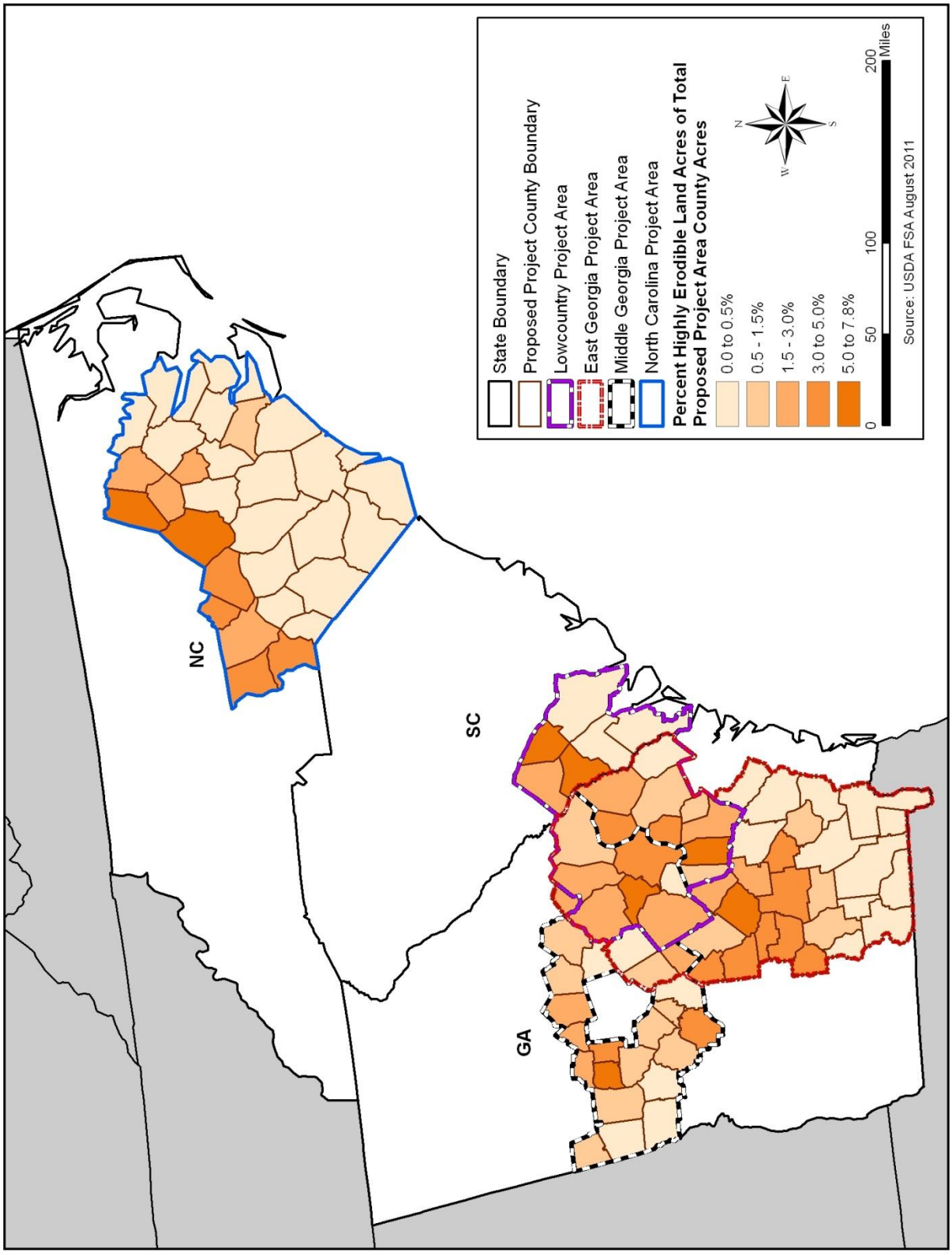


Figure 3-19. Percent of Total Land Classified as Highly Erodible by County within the Proposed Project Areas.

3.5.2 Existing Conditions

3.5.2.1 Existing Conditions

For this project, the Major Land Resource Area (MLRA) will be used to illustrate the soils of each proposed project area. **Table 3-21** describes each MLRA within the proposed project areas. **Figure 3-20** illustrates the MLRA within and adjacent to the proposed project areas.

Table 3-21. Major Land Resource Area Soils Information for Each Proposed Project Area

Proposed Project Area	MLRA Soils
Middle Georgia East Georgia Lowcountry North Carolina	**Southern Coastal Plain** – Soils in this region are generally very deep, somewhat excessively drained to poorly drained and loamy. They are also dominated by a thermic soil temperature regime with udic or aquic soil moisture. The dominant soil orders in this region are Ultisols, Entisols, and Inceptisols.
Middle Georgia Lowcountry North Carolina	**Atlantic Coast Flatwood –** Soils in this region are generally very deep, well drained to very poorly drained, and loamy or clayey. They are also dominated by a thermic soil temperature regime with udic or aquic soil moisture. The dominant soil orders in this region are Spodosols and Ultisols.
East Georgia Lowcountry North Carolina	**Carolina and Georgia Sand Hills** – Soils in this region are very deep, well drained to excessively drained and loamy or sandy. They are also dominated by a thermic soil temperature regime with udic soil moisture. The dominant soil orders in this area are Ultisols and Entisols.
East Georgia North Carolina	**Southern Piedmont** – Soils in this region are shallow to very deep, generally well drained and loamy or clayey. They are also dominated by a thermic soil temperature regime with udic soil moisture. The dominant soil orders in this region are Ultisols, Inceptisols, and Alfisols.
Lowcountry North Carolina	**Tidewater Area** – The soils in this region area characterized by restricted drainage, a thermic soil temperature regime and an aquic soil moisture regime. The soils are very deep and loamy to clayey. The dominant soil orders in this region are Alfisols and Entisols.

Source USDA NRCS 2006

3.5.2.2 Soil Erosion

3.5.2.2.1 East Georgia Proposed Project Area

There was approximately 221,459 acres of HEL within the counties of the East Georgia proposed project area (USDA FSA 2011c). Within this proposed project area, Coffee County had the highest acres of HEL, covering 4.8 percent of the county.

3.5.2.2.2 Middle Georgia Proposed Project Area

There was approximately 124,668 acres of HEL within the counties of the Middle Georgia proposed project area (USDA FSA 2011c). Within this proposed project area, Laurens County had the highest acres of HEL, covering 2.7 percent of the county.

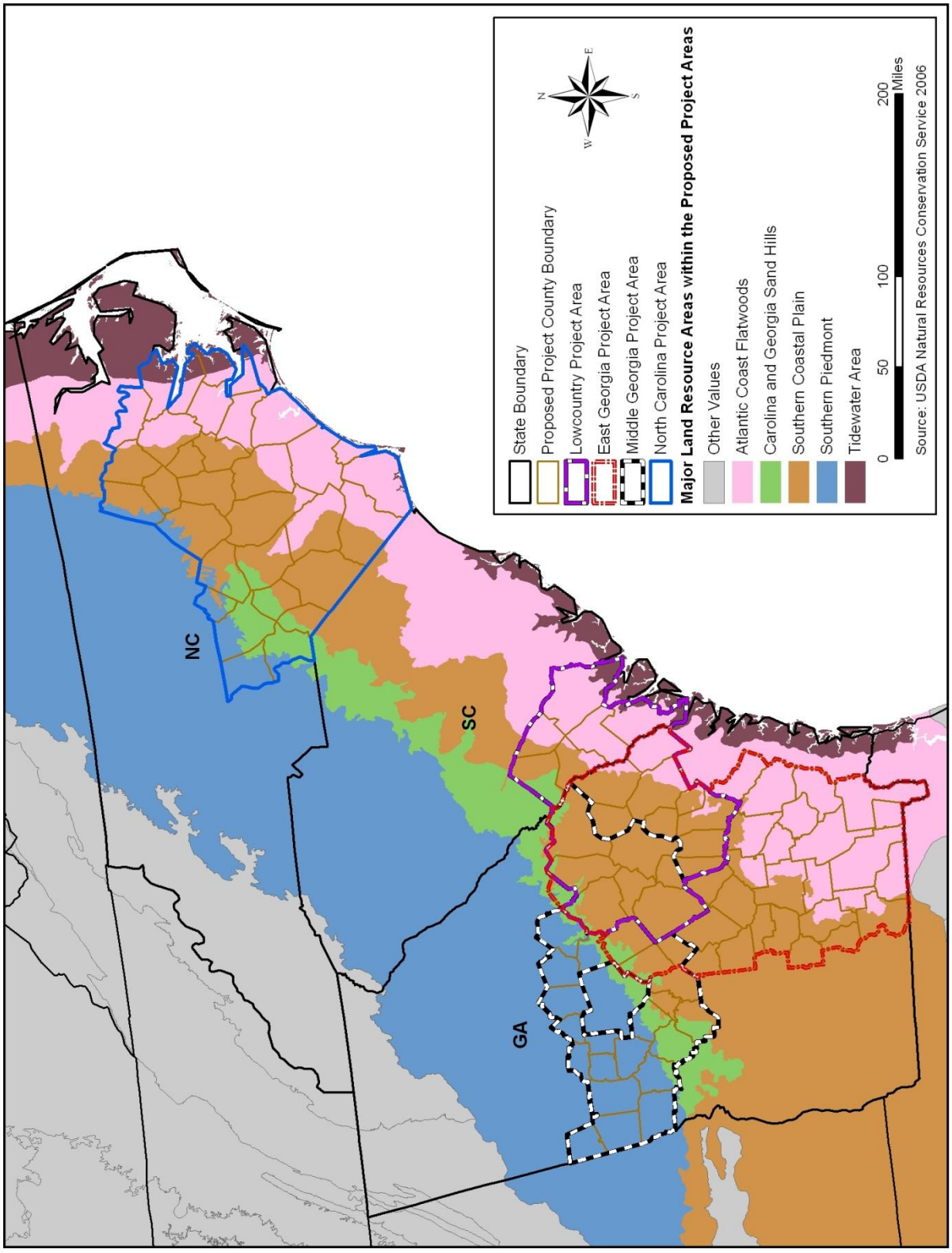


Figure 3-20. MLRA Contained within the Proposed Project Areas

3.5.2.2.3 Lowcountry Proposed Project Area

There was approximately 150,327 acres of HEL within the counties of the Savannah River proposed project area (USDA FSA 2011c). Within this proposed project area, Allendale County had the highest acres of HEL, covering 5.6 percent of the county.

3.5.2.2.4 North Carolina Proposed Project Area

There was approximately 144,167 acres of HEL within the counties of the North Carolina proposed project area (USDA FSA 2011c). Within this proposed project area, Johnston County had the highest acres of HEL, covering 7.8 percent of the county.

3.6 WATER QUALITY AND QUANTITY

3.6.1 Water Quality

3.6.1.1 Definition of the Resource

Freshwater is necessary for the survival of most terrestrial organisms, and is required by humans for drinking and agriculture, among other uses; however, less than one percent of Earth's water is in the form of freshwater that is not bound in ice caps or glaciers. The Water Pollution Control Act of 1972, or Clean Water Act (CWA), Safe Drinking Water Act, and the Water Quality Act are the primary Federal laws that protect the nation's waters. The principal law governing pollution of the nation's surface water resources is the CWA. The Act utilizes water quality standards, permitting requirements, and monitoring to protect water quality. The U.S. Environmental Protection Agency (EPA) sets the standards for water pollution abatement for all waters of the United States under the programs contained in the CWA but, in most cases, delegates the authority to issue and enforce permits to qualified States. For this analysis, water resources include surface water quality (including lakes, rivers and associated tributaries, and estuaries), groundwater quality, and water use/quantity of both surface and groundwater.

Surface water, as defined by the EPA, are waters of the United States, such as rivers, streams, creeks, lakes, and reservoirs, supporting everyday life through uses such as drinking water and other public uses, irrigation, and industrial uses. Surface runoff from rain, snow melt, or irrigation water, can affect surface water quality by depositing sediment, minerals, or contaminants into surface water bodies. Surface runoff is influenced by meteorological factors such as rainfall intensity and duration, and physical factors such as vegetation, soil type, and topography.

Groundwater is the water that flows underground and is stored in natural geologic formations called aquifers. It is ecologically important because it sustains ecosystems by releasing a constant supply of water into wetlands and contributes a sizeable amount of flow to permanent streams and rivers (USDA FSA 2003).

3.6.1.2 Existing Conditions

The 303(d) List of Waters reports on streams and lakes identified as impaired for one or more pollutants and do not meet one or more water quality standards. The term, "303(d) list," is short for the list of impaired waters (stream segments, lakes) that the CWA requires all states to submit for EPA approval every two years. The states identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem (EPA 2008). **Figure 3-21** illustrates the impaired streams and water bodies within each state containing the proposed project areas.

3.6.1.2.1 East Georgia Proposed Project Area

According to the 303(d) list, there are 188 impaired stream segments within the East Georgia proposed project area for a total of 291.4 miles of impaired streams. There is also a total of 0.1 square miles of impaired lakes and reservoirs (EPA 2010a).

3.6.1.2.2 Middle Georgia Proposed Project Area

According to the 303(d) list, there are 74 impaired stream segments within the Middle Georgia proposed project area for a total of 86.1 miles of impaired streams. There is also a total of 0.2 square miles of impaired lakes and reservoirs (EPA 2010a).

3.6.1.2.3 Lowcountry Proposed Project Area

According to the 303(d) list, there are 291 impaired stream segments within the Lowcountry proposed project area for a total of 347.9 miles of impaired streams. There is also a total of 0.9 square miles of impaired lakes and reservoirs (EPA 2010a).

3.6.1.2.4 North Carolina Proposed Project Area

According to the 303(d) list, there are 1,238 impaired stream segments within the North Carolina proposed project area for a total of 886.3 miles of impaired streams. There is also a total of 6.5 square miles of impaired lakes and reservoirs (EPA 2010a).

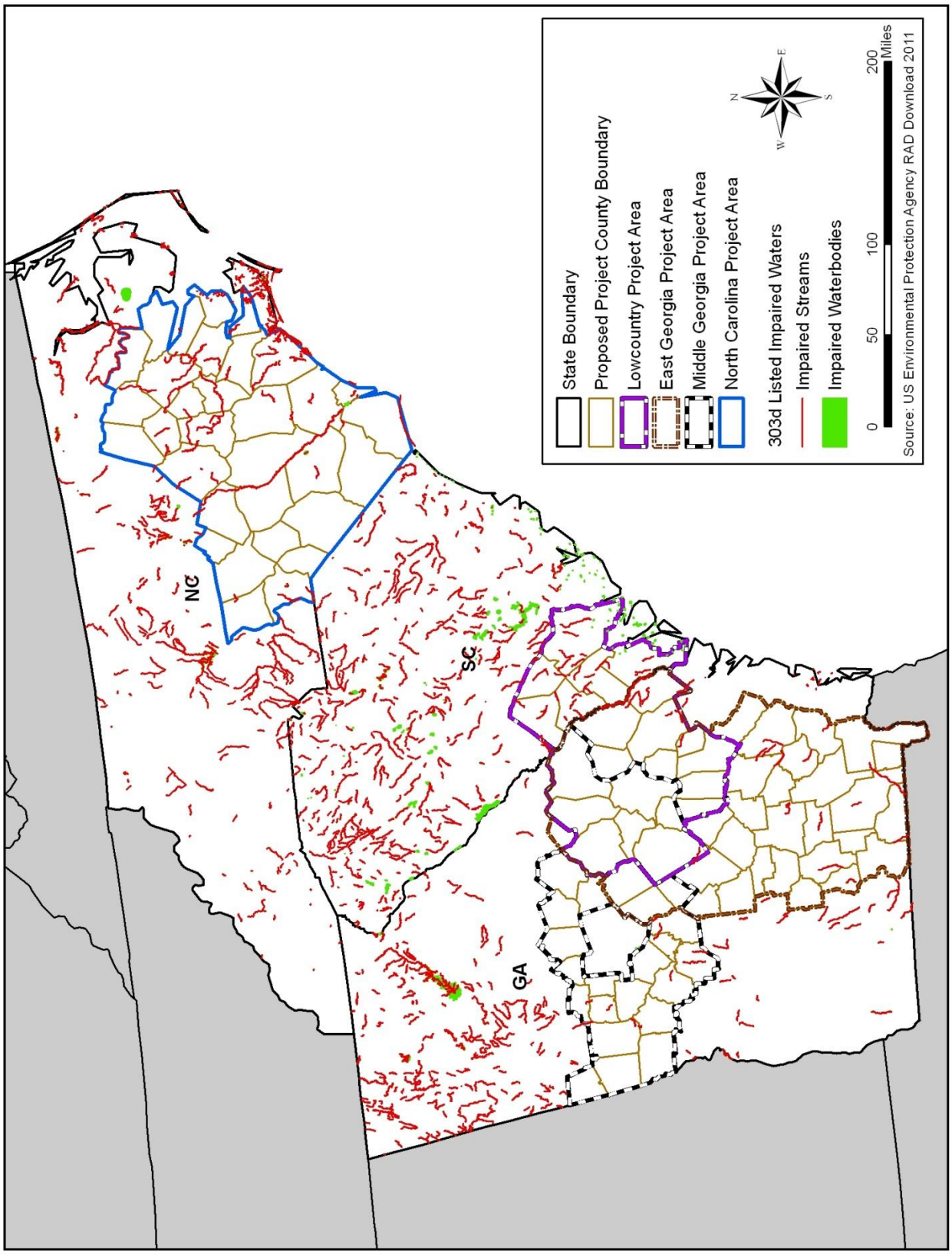


Figure 3-21. Waters Listed on the State 303(d) Lists for Impaired Waters

3.6.2 Water Quantity

3.6.2.1 Definition of the Resource

Water use/quantity is the specific amount of water used for a given task, such as the production of dedicated bioenergy crops. Three types are distinguished: *withdrawal*, where water is taken from a river, or surface or underground reservoir, and after use returned to a natural water body; *consumptive*, which starts with withdrawal but without any return (e.g. irrigation) and is no longer available directly for subsequent uses; *non-withdrawal*, the *in situ* use of a water body for, e.g. navigation, fishing, recreation, effluent disposal and power generation (Food and Agricultural Organization [FAO] 2005).

3.6.2.2 Existing Conditions

Currently, most counties within the proposed project areas are under a moderate to extreme drought condition. As of 06 December 2011, The Southeast, including the states of Alabama, Georgia, Florida, South Carolina, North Carolina, and Virginia, was experiencing some level of drought across 56.8 percent of the region. The majority of these effects were being seen in Georgia and parts of Alabama, Florida, and South Carolina. Overall in the Southeast, 13.5 percent of the area was abnormally dry (D0), 12.0 percent was in moderate drought (D1), 11.9 percent in severe drought (D2), and 19.4 percent in extreme drought (D3) (Miskus 2011). These severe drought conditions in many parts of the proposed project areas have limited streamflow and releases from surface water reservoirs. All three states have drought management plans in place to restrict water usage from public water systems at differing and more severe drought levels. As of the latest available information, 15.5 percent of the counties within North Carolina had mandatory watering restrictions, no counties in South Carolina had mandatory watering restrictions, and at least six cities or water districts had implemented strict water restrictions, including no outdoor watering in Georgia.

Overall agricultural water use from groundwater sources increases during abnormally dry periods; however, the most recent data concerning agricultural irrigation is from 2007. **Table 3-22** summarizes acres of the irrigated cropland by state and county. The table also contains a summary of the water withdrawals by source for each county within the proposed project area. The EPA defines a watershed as the area of land where all of the water that is under it or drains off of it goes into the same place (EPA 2009). Further, the U.S. Geological Survey (USGS) defines a watershed as the divide separating one drainage basin from another. The USGS has divided and sub-divided the United States using hydrologic units

(HUC). The hydrologic unit system has four levels of classification (USGS 2011). For this project the fourth level of classification, the 8-digit HUC codes, were used to classify the watersheds within the proposed project area.

Table 3-22. Acres of Irrigated Land and Water Withdrawals by County within Each Proposed Project Area

Location	Total Cropland	Irrigated Land	Percent Irrigated Acres	Withdrawals (in million gallons per day)		
				By source		
	Acres			Groundwater	Surface water	Total
Georgia	4,478,168	1,017,773	22.7%	1,160	4,280	5,380
North Carolina	4,895,204	232,075	4.7%	700	12,200	11,300
South Carolina	2,151,219	132,439	6.2%	378	7,470	7,850
Proposed Project Areas						
East Georgia	1,787,113	373,151	20.9%	158	112	269
Middle Georgia	730,236	115,706	15.8%	58	29	87
Lowcountry	1,049,647	140,275	13.4%	74	43	116
North Carolina	2,324,025	145,620	6.3%	47	107	153

Source: USDA NASS 2009, USGS 2010b

3.6.2.2.1 East Georgia Proposed Project Area

Within the East Georgia proposed project area, there was an average of 8,103.09 acres of irrigated land within the proposed project area. Overall, the amount of irrigated acres varied greatly within the proposed project area from 16 acres to 30,577 acres. There was a total of 276.27 million gallons of water withdrawn per day in the proposed project area, with an average of 49 percent from surface water and 51 percent from groundwater sources (USGS 2010b).

Twenty-one different watersheds are located within the counties in the East Georgia proposed project area. These 21 watersheds cover over 21 million acres with 60 percent within the proposed project area.

3.6.2.2.2 Middle Georgia Proposed Project Area

Within the Middle Georgia proposed project area, there was an average of 3,976.5 acres of irrigated land within the proposed project area. Overall, the amount of irrigated acres varied greatly within the proposed project area from 16 acres to 17,693 acres. There was a total of 87.03 million gallons of water withdrawn per day in the proposed project area, with an

average of 50 percent from surface water and 50 percent from groundwater sources (USGS 2010b).

Sixteen different watersheds are located within the counties in the Middle Georgia proposed project area. These 16 watersheds cover over 20 million with 37 percent within the proposed project area.

3.6.2.2.3 Lowcountry Proposed Project Area

Within the Lowcountry proposed project area, there was an average of 6,650 acres of irrigated land within the proposed project area. There was a total of 155.99 million gallons of water withdrawn per day in the proposed project area, with an average of 37 percent from surface water and 63 percent from groundwater sources (USGS 2010b).

Seventeen different watersheds are located within the counties in the Lowcountry proposed project area. These 17 watersheds cover over 15 million acres with 49 percent within the proposed project area.

3.6.2.2.4 North Carolina Proposed Project Area

Within the North Carolina proposed project area, there was an average of 4,854 acres of irrigated land within the proposed project area. There was a total of 153.41 million gallons of water withdrawn per day in the proposed project area, with an average of 61 percent from surface water and 39 percent from groundwater sources (USGS 2010b).

Twenty-four different watersheds are located within the counties in the North Carolina proposed project area. These 24 watersheds cover over 21 million acres with 54 percent within the proposed project area.

3.7 AIR QUALITY

3.7.1 Definition of the Resource

The Clean Air Act (CAA) (42 USC 7401-7671q), as amended, gives the EPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR §50) that set acceptable concentration levels for seven criteria pollutants: fine particles matter (PM_{10}), very fine particle ($PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_x), ozone (O_3), and lead (Pb). Short-term standards (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term standards (annual averages) have been established for pollutants contributing to

chronic health effects. Each state has the authority to adopt standards stricter than those established under the federal program. Federal regulations designate Air-Quality Control Regions (AQCRs) in violation of the NAAQS as "nonattainment" areas. Federal regulations designate AQCRs with levels below the NAAQS as "attainment" areas.

The CAA contains the general conformity rule, prohibiting federal agencies from conducting, supporting, or approving any actions that do not conform to an EPA approved State Implementation Plan (SIP); thereby, not interfering with a state's timely attainment of the NAAQS. Federal agencies must determine if increased emission associated with their actions would exceed *de minimis* levels or be "regionally significant". *De minimis* emissions are emissions associated with an action at rates less than specified applicability thresholds of a criteria pollutant in a nonattainment area. "Regionally significant" emissions are emissions associated with an action that are greater than 10 percent of a nonattainment area's total emissions for a criteria pollutant.

3.7.2 Existing Conditions

A quick analysis of the attainment status based on the NAAQS was conducted for each county within the proposed project areas through the use of the EPA's Green Book of Nonattainment Areas.

3.7.2.1 Georgia

Georgia has designations for the following criteria pollutants: $PM_{2.5}$, and 8-hour O_3. Heard and Putnam Counties are designated as in non-attainment for $PM_{2.5}$, while Spalding County is designated as in non-attainment for both $PM_{2.5}$ and moderate for 8-hour O_3 (**Figure 3-22**).

1 **Heard, Putnam and Spalding Counties are part of the Metropolitan Atlanta, Georgia**

AQCR 56. $PM_{2.5}$ pollutants are considered fine particles being less than 2.5

micrometers in diameter. Sources of fine particles include all types of combustion,

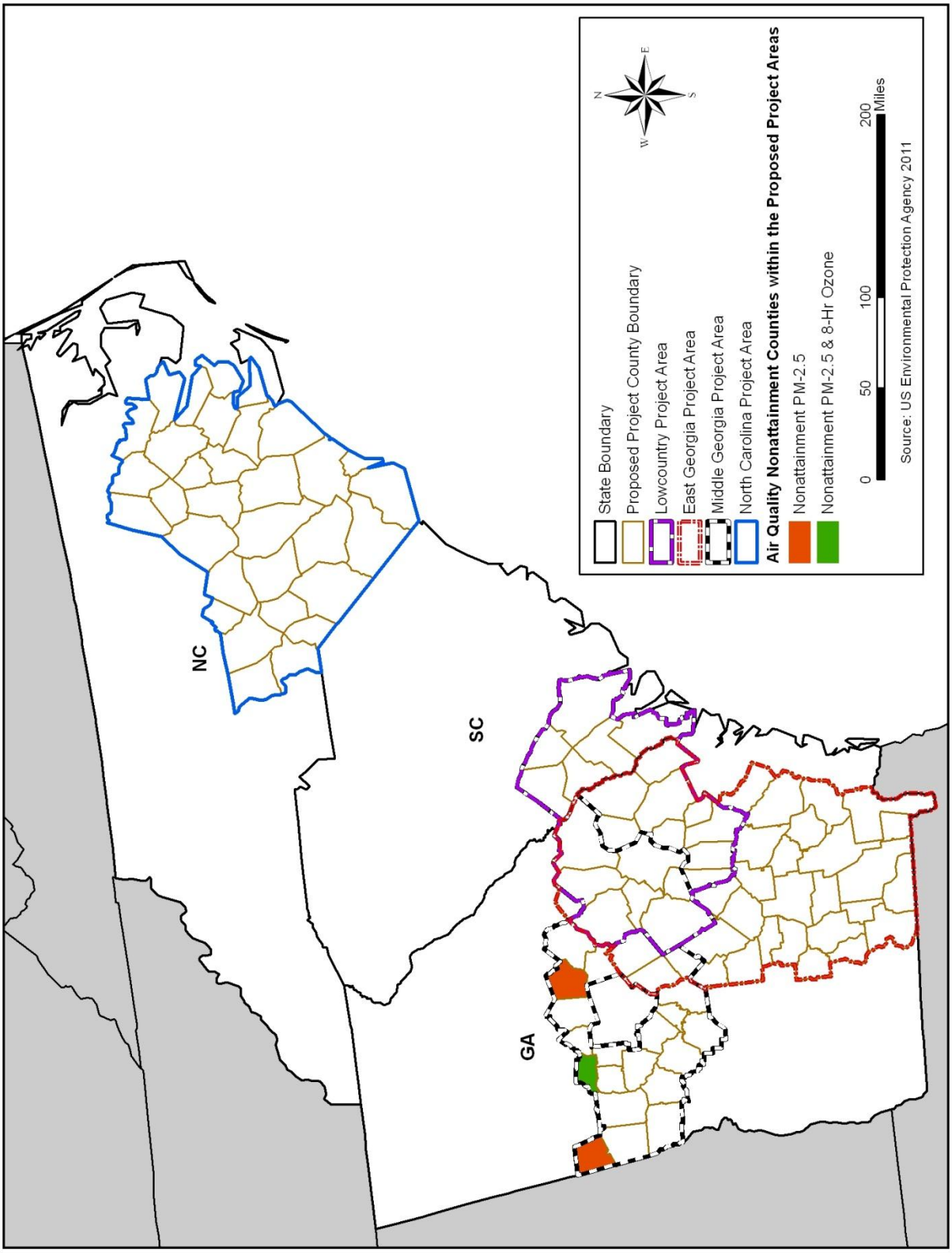
including motor vehicles, power plants, residential wood burning, forest fires,

agricultural burning, and some industrial processes (EPA 2011). The 2008 National

Emissions Inventory Data (EPA 2011) indicates that Putman County had 1,016 tons

per year (tpy) of $PM_{2.5}$ emissions (filterable and condensable) with electric generating

units accounting for 44 percent of the pollutant load, dust emissions (e.g., dust from



construction, paved roads and unpaved road) accounted for approximately 16.9 percent of pollutant load. In Spalding County, 970 tpy were monitored in

Figure 3-22. Non-Attainment Areas within the Proposed Project Areas.

2008, with 52.6 percent generated from dust emissions and 21.5 percent generated from industrial boilers. Heard County had 2,242 tpy of $PM_{2.5}$ emissions with electric generating units accounting for 87.2 percent of the pollutant load and dust emissions accounted for approximately 6.6 percent of pollutant load.

The 2009 Ambient Air Surveillance Report summarized the air quality data collected by the state of Georgia during the 2009 calendar year. According to the report, there are no monitoring stations in Heard, Spalding, or Putman counties but there were stations within the proposed project area. The annual arithmetic mean for Wilkinson County was 12.51 microgram per cubic meter ($\mu g/m^3$) and the annual arithmetic mean for Washington County was 11.27 $\mu g/m^3$.

3.7.2.2 North Carolina

North Carolina has designation for the following criteria pollutants: 8-hour O_3 and $PM_{2.5}$. All counties in the proposed project areas are designated as in attainment for all criteria pollutants.

3.7.2.3 South Carolina

South Carolina has designations for the following criteria pollutants: 8-hour O_3. All counties in the proposed project area are designated as in attainment for all criteria pollutants.

3.8 OUTDOOR RECREATION

3.8.1 Definition of the Resource

Recreational resources are those activities or settings either natural or manmade that are designated or available for recreational use by the public. In this analysis, recreational resources include lands and waters utilized by the public for hunting and viewing wildlife, fishing, hiking, birding, boating, and other water-related activities.

3.8.2 Existing Conditions

3.8.2.1 Georgia

According to the National Survey of Fishing, Hunting and Wildlife- Associated Recreation, approximately 2.8 million people 16 years old and older fished, hunted or wildlife watched in Georgia (USFWS and USCB 2008a). Of those people approximately 481,000 people spent 8.2 million days hunting. The largest percentage of hunting in Georgia was for big game (86 percent), then small game (47 percent), then migratory birds (26 percent). The total amount spent on these activities, including trip-related activities, equipment, and miscellaneous

expenditures was over $678 million. The average total expenditures in 2006 were $1,392 per hunter with an average trip expenditure of $493. Of the types of land, 7 percent of hunters used public land only, 71 percent used private land only, and 16 percent used both public and private land. Within the proposed project areas, there is approximately 0.3 million acres of public hunting access lands in East Georgian, 0.2 million acres in Middle Georgia, and 0.1 million acres in the Lowcountry proposed project area (**Figure 3-23**).

There were also 2.0 million people who observed or photographed wildlife in Georgia. Of those wildlife watchers, 90 percent (1.8 million) participated in those activities close to home and are designated "around the home" participants. Among the around the home participates, approximately 1.5 million fed wildlife, 1.1 million observed wildlife, and 0.4 million photographed wildlife. The remaining participants maintained natural areas (0.3 million), maintained plantings (0.2 million), or visited public areas (0.3 million). Wildlife-watching expenditures in Georgia totaled $1.6 billion.

3.8.2.2 North Carolina

In North Carolina, approximately 3.4 million people 16 years old and older fished, hunted or wildlife watched (USFWS and USCB 2008b). Of those people approximating 304,000 people 16 years old and older spent 4.9 million days hunting. The largest percentage of hunting in North Carolina was for big game, then small game, then migratory birds. The total amount spent on these activities, including trip-related activities, equipment, and miscellaneous expenditures was over $431 million. The average total expenditures in 2006 were $1,232 per hunter with an average trip expenditure of $296. Of the types of land, 26 percent of hunters used public land, 87 percent used private land, and 18 percent used both public and private land. There is approximately 0.5 million acres of public hunting access lands in the North Carolina proposed project area.

There were also 2.6 million people who observed or photographed wildlife in North Carolina. Of those wildlife watchers, 85 percent (2.2 million) participated in those activities close to home and are designated "around the home" participants. Among the around the home participates, approximately 2.1 million fed wildlife, 1.2 million observed wildlife, and 0.5 million photographed wildlife. The remaining participants maintained natural areas (0.4 million), maintained plantings (0.3 million), or visited public areas (0.3 million). Wildlife-watching expenditures in North Carolina totaled $917 million.

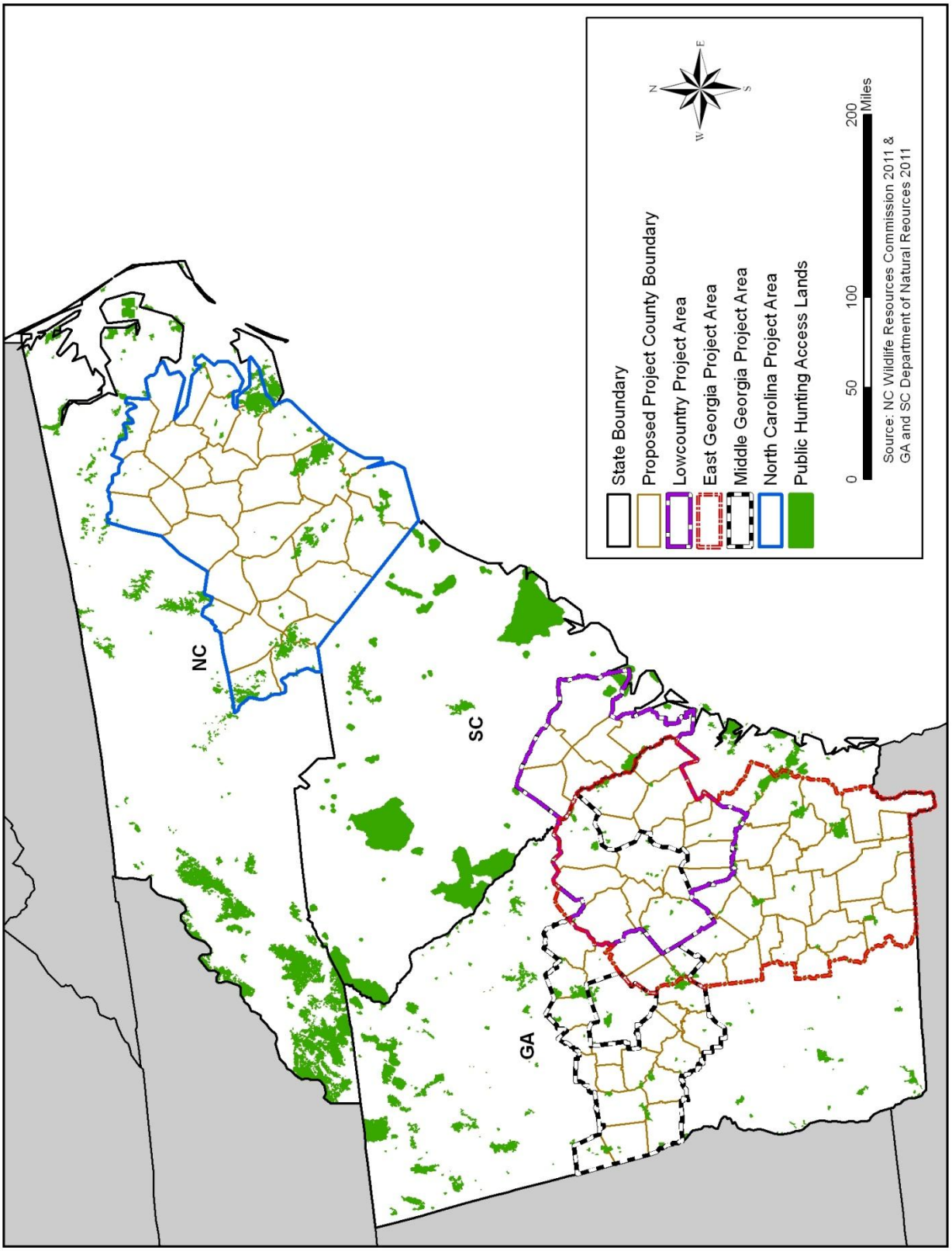


Figure 3-23. Public Game and Hunting Lands within the Proposed Project Areas

3.8.2.3 South Carolina

In South Carolina, approximately 1.7 million people 16 years old and older fished, hunted or wildlife watched (USFWS and USCB 2008c). Of those people approximating 208,000 people spent 4.3 million days hunting. The largest percentage of hunting in South Carolina was for big game (87 percent), then small game (28 percent), then migratory birds (22 percent). The total amount spent on these activities, including trip-related activities, equipment, and miscellaneous expenditures was over $279 million. The average total expenditures in 2006 were $1,336 per hunter with an average trip expenditure of $586. Of the types of land, 21 percent of hunters used public land, 85 percent used private land, and 14 percent used both public and private land.

There were also 1.1 million people who observed or photographed wildlife in South Carolina. Of those wildlife watchers, 83 percent (0.9 million) participated in those activities close to home and are designated “around the home” participants. Among the around the home participates, approximately 0.9 million fed wildlife, 0.6 million observed wildlife, and 0.2 million photographed wildlife. The remaining participants maintained natural areas (0.1 million), maintained plantings (0.1 million), or visited public areas (0.1 million). Wildlife-watching expenditures in South Carolina totaled $551 million.

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4 ENVIRONMENTAL CONSEQUENCES

4.1 DATA GAPS

Giant miscanthus is a new agronomic crop species in the United States, and also still relatively new in Europe, where the oldest cultivation areas are approximately 30 years old or less. The *Miscanthus* genus was introduced to the United States over 100 years ago in ornamental plantings and was first described by Beal in 1896 in the *Grasses of North America*. Several universities (i.e., University of Illinois, MSU, University of Wisconsin, Michigan State University [MSU2], and UGA) in the United States are currently cultivating giant miscanthus on a trial basis or conducting research on giant miscanthus or the *Miscanthus* genus. Additionally, large-scale acreages of giant miscanthus have not been cultivated in the United States; although commercial production of giant miscanthus for bioenergy production in co-fired systems have been established within the last few years in the United Kingdom. Given, that giant miscanthus has only been grown in large-scale trials in Europe, the data on giant miscanthus planting in the United States is limited. As mentioned previously, FSA approved four BCAP project areas for the production of giant miscanthus totaling 19,182 acres in the Midwestern United States in FY 2011.

In light of the lack of data applicable to the proposed project areas, an adaptive Mitigation and Monitoring Plan, which is a mandatory requirement on all contract producers within the proposed project areas, has been developed, which includes BMPs for the establishment and production of giant miscanthus. These BMPs are designed to ensure avoidance and/or minimization of potential effects to the immediate environment and the larger landscape. The Mitigation and Monitoring Plan is a living document that is highly dependent on routine monitoring of the fields to determine the success of giant miscanthus plantings, its overall effects to the immediate environment, and any potential effects to the larger landscape based on observation and measurement. This document contains information on appropriate and effective eradication methods that would be updated over time as new data become available. Likewise, other metrics or observable measurements will be adapted over time based on past observations, new research findings, and new regulations.

The following information related to the growth and production of giant miscanthus in the United States has been found to be lacking complete detail.

- Potential effects to socioeconomics are focused on the information provided in the pro forma analyses of the Project Sponsor. Data from Europe indicates a high cost

of establishment due to the vegetative propagation of the species; however, the BCAP combined with the production methods undertaken by the Project Sponsor and technical assistance to be provided to producers addresses most of these concerns.

- Landscape scale analyses of giant miscanthus are generally lacking since there have not been any commercial-scale field trials in the United States.
- Literature documenting the potential for invasiveness of the fertile species of the *Miscanthus* genus has been discussed along with documentation supporting that giant miscanthus should not be considered invasive due to its sterility and slow rhizome spread within the United States. The growth and management of giant miscanthus has been studied extensively by the University of Illinois and MSU and commercial-scale production has been implemented and monitored in the United Kingdom, but commercial-scale production of the plant has not yet been implemented in the United States. Although the preponderance of evidence indicates that the plant is sterile and slow spreading, documentation of sterility and spread is needed for commercial-scale operations in United States' environments.
- Literature discussing potential plant pests has been recently published relating to the western corn root worm, several species, of aphids, and rust. Those studies along with recommendations have been included.
- There is little peer-reviewed literature concerning the effects of giant miscanthus plantings on biological diversity in the United States; however, some specific studies have been published in Europe. These studies are primarily focused on bird species with some small mammal observations. These studies also looked at young-aged giant miscanthus stands, so there was little information available on biodiversity found in mature stands.
- Information concerning the nutrient uptake, nutrient addition trials, and root structure has been included to discuss the potential for soil erosion, soil organic matter, and soil carbon sequestration based on the available literature.
- Literature concerning nutrient uptake, water use efficiency, and irrigation during establishment has been discussed based on the available literature and field trial information obtained within the foundation acreage.

4.2 SOCIOECONOMICS

4.2.1 Significance Threshold

The significance thresholds for socioeconomics include a substantial change in farm income, which could lead to wider community effects such as employment loss and population declines.

4.2.2 Proposed Action

Implementing the Proposed Action would not result in significant adverse effects to the socioeconomic conditions of any of the proposed project areas, but would create benefits to producers through a diversified crop portfolio that spreads economic risk associated with agricultural production. The Proposed Action would provide a positive cash-flow stream to producers and an economically viable product through the BCF to local, regional, and potentially out of region sales according to the BCAP project area application documents. Giant miscanthus would require some level of inputs during the establishment phases; thereby, maintaining the existing agricultural products stream, with the potential for creating new markets for more species-specific agricultural chemicals. Agricultural services would be maintained in the short-term, with the potential creation of new services streams for heavier-duty equipment manufacture and contract farming for harvesting, baling, and transportation of baled products to the BCF. Overall, the maintenance of existing higher value cropland acres with the inclusion of smaller dedicated energy crop production should maintain or enhance farm household and agricultural services-related household incomes.

BCAP was developed to provide assistance to participating producer to offset a portion of the costs associated with establishing and producing dedicated energy crops. **Table 4-1** lists the estimated establishment and production costs for giant miscanthus with a comparison of the BCAP payments to participating producers. The value of BCAP to participating producers was analyzed by developing a crop budget based on actual and predicted costs associated with Freedom giant miscanthus in the proposed project areas.

MSU2 also developed crop budgets for miscanthus budgets using ‘cheap’ and market rate rhizomes (James et al. 2009). Under MSU2’s analysis with “market rhizomes” after 10 years the producer is still cash flow negative over $6,000 on each acre planted. If the rhizome costs were reduced to only 25 percent of MSU2’s estimate, the producer would still need 10

Table 4-1. Cost Comparison for Participating Versus Non-Participating Producers for the Establishment and Production of Giant Miscanthus

Item	Giant Miscanthus Establishment without BCAP	Giant Miscanthus Establishment with BCAP
	Per Acre (all values rounded to the next whole $)	
Crop Establishment		
Rhizomes ($0.26 ea)	$1,350	$1,350
Land Prep	$425	$425
Soil Amendments	$190	$190
Pest Control	$110	$110
Planting Cost	$250	$250
Total Establishment Cost	$2,325	$2,325
BCAP Establishment Payment	$0	$1,744
BCAP Annual Payment	$0	$51
Revised Establishment Cost	*$2,325*	*$530*
Year 2 Production		
Annual Costs – Year 2	$350	$350
Estimated Revenue – Year 2 (6 tons @ $50/ton)	$300	$300
BCAP Annual Payment	$0	$39
BCAP Matching Payment – Year 1	$0	$270
Profit/Loss Continual	*($2,375)*	*($271)*
Year 3 Production		
Annual Costs – Year 3	$343	$343
Estimated Revenue – Year 3	$500	$500
BCAP Annual Payment	$0	$450
BCAP Matching Payment – Year 2	$0	$39
Profit/Loss Continual	*($2,218)*	*$374*
Year 4 Production		
Annual Costs – Year 4	$343	$343
Estimated Revenue – Year 4	$700	$700
BCAP Annual Payment	$0	$39
Profit/Loss Continual	*($1,860)*	*$770*
Year 5 Production		
Annual Costs – Year 5	$343	$343
Estimated Revenue – Year 5	$900	$900
BCAP Annual Payment	$0	$39
Profit/Loss Continual	*($1,303)*	*$1,365*

Notes:

- All cost estimates derived from actual past expenditures and predicted on-going expenses from the Project Sponsor.
- The average rental rate for CRP as of February 2011 in each state containing proposed project areas are: Georgia = $47.02/acre; North Carolina = $68.72/acre; South Carolina = $38.38/acre. The average rental rate for these three states = $51.37/acre (USDA FSA 2011a)
- A reduction in the annual BCAP payment was estimated at 25 percent for biomass sold for heat, power, or biobased products (USDA FSA 2011d).

years to break even. Under MSU2's analysis, producers would have little incentive to establish energy crops.

The Project Sponsor has set as its company's goal the commercialization of giant miscanthus as a dedicated energy crop to provide feedstock to the developing biofuel and bioenergy markets. This commercialization is centered on making all aspects of energy crop production enjoy economies of scale that do not currently exist. This includes providing more affordable rhizomes, reducing establishment and growing costs, and providing for efficient harvest, storage, and transportation of giant miscanthus. BCAP helps reduce the financial risk of the company and its producers in the initial development stages; thereby, making it an important catalyst in the commercialization of a large-scale energy crop.

As **Table 4-1** shows, BCAP in combination with the Project Sponsor's costs for Freedom giant miscanthus establishment in the proposed project areas provides enough incentive that a producer would begin realizing a profit in year three, rather than in year eight without BCAP.

Under the Proposed Action, the Project Sponsor proposes to establish and produce Freedom giant miscanthus in the proposed project areas with a maximum acreage of 58,000 acres by 2013. The Project Sponsor has a goal of minimizing the amount of arable cropland to be included in the contract acreage, thereby maximizing producer incomes through diversification of a small amount of economically marginal croplands or idle lands, pasturelands, and abandoned/previously harvested timberlands.

The BCAP Final PEIS (Table 3.1-5) lists the national average farm size for different farm types; overall the majority of farms within the United States are considered small family farms with average farm size between 137 acres (Limited Resource) to 1,040 acres (Farming Occupation/Higher Sales). Small farms comprise 89.1 percent of the total farms in the East Georgia proposed project area, 92.6 percent in the Middle Georgia proposed project area, 90.5 percent in the Lowcountry proposed project area, and 73.1 percent in the North Carolina proposed project area.

The Project Sponsor estimates that within the East Georgia proposed project area, more than 85 full time or full time equivalent (FTE) jobs would be created directly or indirectly through this project with an estimate annualized effect of over $17 million once the establishment is mature. In the Middle Georgia proposed project area, the project sponsor is estimating more than 115 full time or FTE jobs would be created directly or indirectly

through this project with an estimate annualized effect of over $22 million once the establishment is mature. The Lowcountry proposed project area is estimated to provide more than 30 full time or FTE jobs would be created directly or indirectly through this project with an estimate annualized effect of over $5.5 million once the establishment is mature. For the North Carolina proposed project, the project sponsor estimates more than 85 full time or FTE jobs would be created directly or indirectly through this project with an estimate annualized effect of over $19 million once the establishment is mature. Overall, the increased number of jobs from the proposed action would increase employment numbers by less than 0.05 percent per proposed project area.

Potential costs to producers from this alternative would be the establishment costs, which the BCAP, would offset up to 75 percent, the harvesting costs, transportation costs to the BCF, and the cost of eradication of the fields and inadvertent spread outside of intended plantings. The establishment, harvesting, and production costs are outlined in Table 4-1. The cost for eradication for each producer would be anticipated to be similar to the cost of eradication for other forage hay species, such as Bermudagrass (*Cynodon dactylon*), which is susceptible to glyphosate control. Freedom giant miscanthus, similar to all other varieties of giant miscanthus, is highly susceptible to glyphosate treatment or a combination of glyphosate treatment and mechanical tillage.

4.2.3 No Action Alternative

The selection of the No Action Alternative would not result in significant adverse effects to the socioeconomic conditions of the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. The agricultural conditions would remain as described in Section 3.1 and would follow projected demand and production aspects. This alternative would not create a small acreage diversification into dedicated energy crops, nor would a new services market be developed for heavy-duty machinery associated with high-yielding biomass crops, such as giant miscanthus.

4.3 LAND USE

4.3.1 Significance Threshold

For land use the significance thresholds include a substantial change in land use type that could trigger the development of agricultural lands into other non-agricultural land use types within the region or adjacent to the region.

4.3.2 Proposed Action

Implementing the Proposed Action would not result in significant changes in land use types that could trigger development of agricultural lands into other non-agricultural land use types nor would it create a substantial loss of arable cropland within the proposed project areas. Also of concern, due to the proposed project area locations, is the amount of harvestable timberland and non-industrial private forestland with the potential for conversion into a dedicated energy crop. Under the Proposed Action, the Project Sponsor proposes to establish and produce Freedom giant miscanthus in the proposed project areas with a maximum total acreage of 58,000 acres by 2013. The Project Sponsor has a priority of using economically marginal or idle croplands and abandoned/previously harvested forestland in place of higher-value harvestable croplands, pasturelands, and timberlands.

Conrad et al. (2011) found through a survey of forestland owners in the Southern United States that 90 percent of respondents would regenerate their stands after harvest. This indicates that approximately 10 percent of private timberland would not be revegetated with timber after harvest, which would leave those acres available for alternative usages. To determine an approximate annual amount of available abandoned/previously harvested forestland for conversion into giant miscanthus within the proposed project areas, this 10 percent landowner value was extrapolated from Conrad et al. (2011), which was then used in combination with FS data to determine an approximately acreage value. The USDA FS (2009a, b) indicates that on average, in the Southeast, 2.7 percent of timberland acreage is harvested annually, with a replanting rate, as of 2003, of 0.7 percent of timberland acreage. This could indicate an extended fallow period due to a change in land ownership for this acreage or the loss of acreage to development into another land use.

Table 4-2 lists the estimated total acres that could be planted by each land use type, other cropland, pastureland (pastureland, all types), and abandoned forestland by proposed project area.

Table 4-2. Estimated Acres to be Planted by 2014 to Giant Miscanthus by Proposed Project Area and Percent of Land Use Type.

Proposed Project Area	Other Cropland	Pastureland All Types	Estimated Annual Abandoned Forestland After Harvest	Total Targeted Land Categories Available	Proposed Freedom Giant Miscanthus	Percent of Combined Targeted Land Categories
Eastern Georgia	212,404	623,189	170,928	1,006,521	15,000	1.5%
Middle Georgia	104,426	491,998	97,039	693,463	20,000	2.9%
Lowcountry	170,922	372,597	94,259	640,558	5,000	0.8%
North Carolina	124,076	312,939	116,706	553,721	18,000	3.3%

Source: Adapted from USDA NASS 2009, USDA FS 2011

Based on the targeted land use types there would be at least 0.5 million acres of lower-economic value acreage available for the establishment and production of Freedom giant miscanthus within each proposed project area. Due to the overlapping Georgia counties in three of the proposed project areas, an analysis was performed on the total targeted land use categories and proposed Freedom giant miscanthus acreage in Georgia and South Carolina. Overall, there would be 2.3 million acres of other cropland, pastureland, and estimated abandoned/previously cleared forestland within the three proposed project areas in Georgia and South Carolina; the establishment of 40,000 acres of Freedom giant miscanthus within these three proposed project areas would account for approximately 1.7 percent of the estimated available land uses.

Conversion of active agricultural lands could create short-term affects to livestock production and forestland. The conversion of pastureland could negatively affect livestock production within the proposed project areas, if sufficient grazing acreage was converted. The most productive (i.e., highest stocking rate forage availability) pastureland would not be converted into Freedom giant miscanthus, unless the individual producer determined that the net return would be higher from Freedom giant miscanthus per acre than from cattle. Likewise, the decision to replant forestland is based on the individual producers' willingness to produce Freedom giant miscanthus in the short-term at the opportunity cost of lost timber revenue in the future. Overall, the conversion of marginal and abandoned lands into a perennial herbaceous species that provides a positive rate of return for producers under highly monitored conditions with BMPs to reduce environmental effects to natural resources provides ecological benefits over the conversion of those lands into developed or urbanized uses.

4.3.3 No Action Alternative

The selection of the No Action Alternative would not result in significant adverse effects to the land use within the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. The agricultural conditions would remain as described in Section 3.3 and would follow projected demand and production aspects. This alternative would not create a small acreage diversification into dedicated energy crops and would allow for conversion of lands into other higher value categories for the producers such as developed or urbanized uses.

4.4 MANAGED COASTAL ZONES

4.4.1 Significance Threshold

A significant effect to managed coastal zones areas would be an activity that would substantially alter the ecological characteristics of sensitive environments of coastal areas (e.g., tidal areas) or non-tidal areas and uplands within the general watershed that contribute to the ecological balance of tidal areas. The vast majority of these effects would be avoided through the state-level permitting processes associated with ground disturbing activities within designated coastal zone management areas.

4.4.2 Proposed Action

Implementing the Proposed Action, in association with the Mitigation and Monitoring Plan (**Section 6**) would be anticipated to have no adverse impacts to managed coastal zones in any of the states within the proposed project areas. The Project Sponsor would exclude all acreage within any designated environmentally sensitive coastal area, such as AECs or lands with the potential to affect coastal waters in North Carolina, critical areas in South Carolina, or tidal wetlands and jurisdictional areas in Georgia, and upland buffer areas to these sensitive coastal land types. Also, per the BCAP regulations, BMPs, and CPS to be undertaken in the producer's mandatory site-specific Conservation Plan, no wetlands would be converted into production lands for Freedom giant miscanthus. On the whole, agricultural activities that do not cause new ground disturbing activities when compared to existing land uses (e.g., existing agricultural lands) and the exclusion from the conversion of wetlands would not result in changes to the ecological functioning of uplands adjacent to coastal areas.

4.4.3 No Action Alternative

The selection of the No Action Alternative would not result in significant adverse effects to managed coastal zones within the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. The agricultural conditions would remain as described in Section 3.1 and would follow projected demand and production aspects.

4.5 BIOLOGICAL RESOURCES

4.5.1 Vegetation

4.5.1.1 Significance Threshold

For vegetation, a significant effect would be a finding of invasiveness for the species, that it had a high likelihood of being a vector for a plant pathogen or insect harmful to native species, or that it was extremely difficult to eradicate once established.

4.5.1.2 Proposed Action

Implementing the Proposed Action, in association with the Mitigation and Monitoring Plan and mandatory site-specific Conservation Plan or Forest Stewardship Plan, (**Section 6**) would be anticipated to result in minor effects to local and regional vegetation due to the change in vegetation from the existing cover to Freedom giant miscanthus. These effects would be highly dependent upon the site-specific conditions and could be either positive or negative. Land areas dominated by annual species or invasive species would benefit from the conversion into a perennial herbaceous species under highly monitored conditions with BMPs to reduce environmental effects to natural resources. The Mitigation and Monitoring Plan addresses measures to avoid and minimize effects to vegetation. Some of these measures include exclusions from planting within sensitive segments of 100-year floodplains and floodways, which would be determined at the site-specific level based on localized conditions and regulations, to minimize the potential for vegetative spread through rhizome or active stalks transported via stormwater flows or wind, and active management to provide eradication in adjacent areas, if necessary. Additionally, for ephemeral systems, with a potential for high velocity flows during normal precipitation events, buffering restrictions could be developed as part of the producer's mandatory site-specific Conservation Plan or Forest Stewardship Plan and associated Mitigation and Monitoring Plan.

As mentioned previously, the Project Sponsor anticipates that most of the acreage for Freedom giant miscanthus would be marginal and idle lands, including abandoned timberland. Pasturelands throughout the proposed project areas could be in fallow agricultural fields with annual vegetation or a mix of annual and perennial vegetation, in permanent improved pasture, or rangeland. Abandoned/previously cleared forestlands could be fallow acreage with naturally occurring annual vegetation, a short-term erosion control cover, or the regeneration of naturally occurring woody species that have prevalence after a ground disturbance. It is anticipated that economically marginal croplands which

could be either currently fallow or in traditional row crops. Vegetation species diversity is highly site specific and part of the larger local landscape.

The Project Sponsor would recommend that wildlife corridors be installed between and around fields of Freedom giant miscanthus, as appropriate for the site specific conditions. These patches of corridors and field edges should assist in the minimization of the loss of landscape level vegetation biodiversity and richness along with anticipated buffers to riparian areas through the Mitigation and Monitoring Plan.

Jørgensen (2011) indicates a potential fire risk associated with senesced stands of giant miscanthus. To reduce potential fire risk, the Mitigation and Monitoring Plan includes a minimum buffer width and a more site-specific buffer width to be included in the individual contract producer's mandatory site-specific Conservation Plan, which would take into account landscape features (e.g., habitable structures, farmsteads, communities within close proximity), normal fire frequency within the areas, normal conditions during the fall/winter standing dead plant material), and adjacent land uses, which could contribute to increased fire risk.

There is currently no evidence of large giant miscanthus fires or large switchgrass fires that can be located in the literature. Because of the desired low moisture content of the harvest, the plant is harvested at its driest (and at its most flammable) state. Only a small amount of senesced material is left unharvested (approximately four to six inches), unlike corn which has considerable senesced material left in the field after the gain harvest. During its growing season, the plant is green and poses no significant fire risk. The Project Sponsors could remove standing senesced materials from the field prior to 15 percent moisture content, if the conditions warrant early removal. The removal of the standing senesced material at a higher moisture content would limit the fire potential of this species. Once senesced material is cut, giant miscanthus bales would be stored similar to other hay bales either in the field or transported to a covered barn or holding facility prior to delivery to the BCF. Stored giant miscanthus bales would not contain enough moisture to create an anaerobic environment, which would produce heat, and could lead to spontaneous combustion, unlike other forage hays routinely harvested at a higher moisture content and stored.

Two components of concern associated with giant miscanthus include its potential for invasiveness and as a vector for disease or plant pests. The following sections detail each of these areas.

4.5.1.2.1 Invasiveness

Overall, the existing literature indicates that giant miscanthus is not likely to become invasive due to seed sterility and slow rhizome spread; however, this has not been tested through field–sized trials in the United States. The very components that make a species ideal for a biomass feedstock are often the same characteristics that are described of weedy invasive species (**Table 4-3**).

Table 4-3. Characteristics of Ideal Biomass Crop/Weeds

Type of Characteristic	Ideal Biomass Crop	Ideal Weedy Characteristics
Life History	Perennial	Perennial
	High Aboveground Biomass Production	High Aboveground Biomass Production
	Flowers Late Or Little Allocation to Seed Production	
Physiology	Drought Tolerant	Drought Tolerant
	Tolerates Low Fertility Soils	Tolerates Low Fertility Soils
	Tolerates Saline Soils	Tolerates Saline Soils
	C4 Photosynthetic Pathway	C4 Photosynthetic Pathway
	High Water/Nutrient Efficiency	High Water/Nutrient Efficiency
Other	Highly Competitive – Reduces Herbicide Use	Highly Competitive – Reduces Herbicide Use
	Few Resident Pests – Reduces Pesticide Use	Few Resident Pests – Reduces Pesticide Use
	Allelopathic	Allelopathic
	Re-allocates Nutrients to Roots in Fall	

Source: Raghu et al. 2006

Giant miscanthus is a naturally occurring hybrid species that is vegetatively propagated and does not produce viable seeds. One of its parent species is *M. sinensis*, which is considered an invasive species in the United States, and the other parent species (*M. sacchariflorus*) is not included on any Federal or State lists of noxious or invasive species.

Raghu et al. (2006) indicated that aspects of the genetics (i.e., the parent species) associated with giant miscanthus could indicate the potential for this species to be invasive it has the ability to resprout from belowground, rapid growth, and efficient photosynthetic pathways. Jørgensen (2011) indicates that rhizome spread of giant miscanthus occurs only at about 10 centimeters (cm) per year from observation of intentionally planted areas, which is relatively slow. There have been no documented unintentionally spreading of giant miscanthus in Europe, where the species has been studied for over 30 years. Additionally, there have been no incidences of unintentionally spread of Freedom giant miscanthus from the Project Sponsor's foundation acreage over the past three years or any of the test plots of Freedom giant miscanthus established by MSU or its research partners.

In the event that giant miscanthus rhizomes in intentionally planted areas spread beyond the planted fields, Jørgensen (2011) indicates that rhizomes transported accidentally by man, soil erosion, or flooding could be easily eradicated using commercially available herbicides (e.g. glyphosate). In contrast, Jørgensen (2011) indicates that *M. sacchariflorus* (i.e., a parent species of giant miscanthus) has creeping rhizomes that spread several meters (m) in a few years with high adaptability to riparian areas, which has a higher potential for translocation via erosion and water transport.

Gordon et al (2011) assessed the potential invasiveness of several potential dedicated energy crop species using the Australian Weed Risk Assessment (WRA). The WRA is a tool that has been used in Australia and New Zealand for over a decade to determine if plant species should be considered for use in those countries. The WRA has been shown to be 90 percent accurate in indentifying invasive species, 70 percent accurate in non-invaders, with approximately 10 percent of non-invaders incorrectly predicted to be invasive (Gordon et al. 2011). Gordon et al (2011) performed the WRA on 12 potential dedicated energy crops, not native to Florida, for Florida and the United States. Based on the WRA results they found that only four species (giant miscanthus, plume grass, sugarcane, and sweet sorghum) should be accepted as potential dedicated energy crops, one species (cabbage gum) should be further evaluated, and the remainder rejected (giant reed, Red River gum, rose gum, jatropha, leadtree, elephantgrass, and castor bean). Gordon et al. (2011) did indicate that since both giant miscanthus and sweet sorghum had parent genetics from documented invasive species, production should be carefully monitored for changes in fertility or other traits. Barney and DiTomaso (2008) also performed a WRA on giant miscanthus and found it to be acceptable for a dedicated energy crop. The Project Sponsor has agreed to stringent Mitigation and Monitoring Plan (Section 6 of this document), which would be a mandatory inclusion with all producer contracts within the proposed project areas. Careful monitoring would be conducted by each producer, as part of their mandatory site-specific Conservation Plan or Forest Stewardship Plan, and any unwanted individual plants located outside of the intended plantings would be eradicated using commercially available herbicide known to be highly effective for this species (e.g. glyphosate).

Davis et al. (2010) suggests that using the WRA may not be sufficient as a stand-alone tool provided that the chance of an inadvertent approval of an invasive species could be 1:10 or 1:20. Davis et al. (2010) suggest a nested approach where an initial screen, such as WRA, is used to determine if a pre-entry evaluation of a species is warranted. The Davis et al

(2010) evaluation would analyze data from the species home range for its potential for invasiveness; if approved after this step, and then a post-entry evaluation would be conducted. The post-entry evaluation would include quarantined field trials to determine if release of a species is appropriate. Field trials of Freedom giant miscanthus have been in production for over 10 years at MSU and have been established on the Project Sponsor's foundation acreage since 2008 with no incidences of unwanted spread of this species.

4.5.1.2.2 Disease Vector, Host for Plant Pathogens, Host for Plant Pests

Another potential for vegetative effects is the movement of diseases and plant pests from one species to another, such as from giant miscanthus to corn. The Project Sponsor has had no indication of plant pests or diseases within the foundation acreage in Georgia through continual monitoring of the fields since the inception of the field establishment of Freedom giant miscanthus. Recently published literature in the United States does indicate that giant miscanthus could provide a refuge or reservoir for plant pests, especially for corn and sorghum, depending upon location. Jørgensen (2011) indicates that the western corn rootworm has been found in giant miscanthus, while Stewart and Cromey (2011) indicated that reports of diseases such as barley yellow dwarf virus, rust (*Puccinia emaculata*) and smut (*Tilletia maclaganii*) in miscanthus and switchgrass. Additionally, Spenser and Raghu (2009) found that in greenhouse and field studies, in the Midwestern United States, there was significant emergence of western corn rootworm from giant miscanthus placed near corn fields. Bradshaw et al. (2010) found two species of aphids (yellow sugarcane aphid and corn leaf aphid) in samples taken from giant miscanthus fields in four states with stands ranging from one year to 21-years old. The yellow sugarcane aphid was located in seven samples across the four states and the corn leaf aphid was located in four samples in four states. According to Bradshaw et al. (2010) the presence of aphids in giant miscanthus is of concern since aphids can transmit plant viruses. The research in this area is somewhat lacking as these are new reports and steps should be taken to monitor for any plant diseases or pests within established stands of giant miscanthus. The Mitigation and Monitoring Plan includes integrated pest management (IPM) programs associated with dedicated energy crops that will provide protection equal or greater than IPM programs for crops within the project areas. .

4.5.1.3 No Action Alternative

Selecting the No Action Alternative would not result in significant effects to the local or regional vegetation within the proposed project areas, as the Project Sponsor would not

establish and produce giant miscanthus in those areas. Current agricultural activities would remain similar or along the current projected trends for those regions. Land coverage would remain similar to existing, which could include areas currently dominated by annual or invasive species, which could result in future negative impacts to surrounding native vegetation areas.

4.5.2 Wildlife

4.5.2.1 Significance Threshold

For wildlife, a significant effect would be a finding of substantial decline in biodiversity or species richness for the local area or the region.

4.5.2.2 Proposed Action

Implementing the Proposed Action, in association with the mandatory site-specific producer Conservation Plan or Forest Stewardship Plan and Mitigation and Monitoring Plan (**Section 6**), would be anticipated to result in minor negative effects to wildlife diversity; however, given the lack of data associated with wildlife use of mature stands of giant miscanthus wildlife effects could also be minor and beneficial for certain types of wildlife.

Wildlife diversity effects would be contingent upon the type of previous land use the acreage was in prior to conversion into giant miscanthus stands. There could be adverse effects to larger wildlife as giant miscanthus stands mature when compared to pasturelands; however, data related to larger species is lacking; therefore, the implementation of appropriate BMPs, as developed in the Mitigation and Monitoring Plan, would be essential to gauge short and longer-term effects on local larger wildlife.

Additionally, wildlife that root or highly disturb (e.g. feral hogs or armadillos in the Southeast) the soils could be anticipated to uproot and distribute rhizomes from the fields. However, there has been no indication of these species distributing rhizomes from the foundation acres, though evidence of these species is clearly observed in these fields. Also, the probability of rhizomes left on the soil surface rooting and spreading giant miscanthus appears to be low given the loss of viability the longer the rhizome remains on the soil surface without appropriate depth of planting.

Fernando et al. (2010) indicates that monocultures are not generally as diverse as polycultures, but that biodiversity levels depend on the crop and the environmental setting (i.e., the overall landscape diversity and the lands being converted). They also indicate that

perennial rhizomatous grasses require less tillage, lower agrochemicals and high above- and below-ground biomass, which are beneficial for soil microfauna and provide cover to invertebrates and birds. Fernando et al. (2010) indicate that according to their weighted-model, no significant differences related to a suite of environmental impacts was observed for the perennial species supported for dedicated energy crops. They suggested that compared to cultivated fields (e.g., potato and wheat), all perennial dedicated energy crops had fewer environmental impacts; however, they had greater impacts than fallow fields when considered on the whole.

4.5.2.2.1 Wildlife Buffers, Corridors, and Cropping Systems

Field margins and wildlife buffers would provide continued access in areas where larger wildlife species are known to occur. The Project Sponsor would recommend that wildlife corridors be developed along field margins or through larger fields to allow continued wildlife movement. Additionally, due to early harvest periods in the Southeast, there would be less standing senesced material in the winter months, which would allow wildlife movement and use of the fields. This earlier harvest could allow for overcropping with a cool-season crop type for groundcover during the winter and early spring prior to the emergence of giant miscanthus. The Project Sponsor is currently conducting field trials on this overcropping method. The longer growing season in the Southeast could also provide the opportunity for a dual harvest cycle, which would open the landscape for wildlife use during the regrowth periods.

4.5.2.2.2 Birds

The Project Sponsor has allowed preliminary avian diversity studies to be undertaken on the foundation acreage to assess the number and species of birds that utilize the existing giant miscanthus stands and continue to gauge avian usage as the stands mature. Wildlife biologists with the GDNR Wildlife Resources Division, Game Management Section surveyed two fields to quickly indentify wildlife use of the giant miscanthus fields and associated buffer areas. The quick evaluation noted the presence of the following species (**Table 4-4**) through visual identification of the animal or evidence that the animal had been present (e.g., tracks or scat).

Table 4-4. Species Identified In and Around Foundation Acreage, 16 August 2011

Common Name	*Scientific Name*
BIRDS	
Brown Headed Cow Bird	*Molothrus ater*
Crow	*Corvus branchyrhynches*
Eastern Wild Turkey	Meleagris gallopavo
Mourning Dove	*Zenaida macroura*
Red Shouldered Hawk	*Bueto lineatus*
Rufous Sided Towhee	*Pipilo erythophalmus*
White Eyed Vireo	*Vireo griseus*
MAMMALS	
Bobcat	*Lynx rufus*
Coyote	*Canus latrans*
Eastern Cottontail Rabbit	*Sylvilagus floridanus*
Raccoon	*Procyon lotor*
Whitetail Deer	*Odocoileus virginianus*

Source: Waters 2011

Studies from Europe indicate a temporary neutral to positive effect for young-aged stands of giant miscanthus on bird species richness, depending upon the previous vegetation cover. Bellamy et al (2009) provide some preliminary information on the abundance and diversity of birds in giant miscanthus and winter wheat in the United Kingdom. They found a greater abundance and diversity of birds in fields (study field size of three hectare = 7.41 acres) with giant miscanthus aged between one to three years than in the control wheat fields. Bellamy et al. (2009) hypothesized that the reasons for greater diversity in giant miscanthus could have been the contribution to shelter provided by giant miscanthus during the winter and the abundance of non-crop plants (e.g., weeds) in these early stage giant miscanthus fields. Bellamy et al. (2009) surmised that on-going management for wildlife would be necessary to ensure continued biodiversity as the giant miscanthus plants matured and the crop structure developed.

Similarly, Semere and Slater (2007a) found that young giant miscanthus fields in Herefordshire, England have a greater variety and abundance of open-ground bird than reed canary grass fields; however, the abundance and diversity of birds and small mammals was higher at the edges of both type of perennial biomass fields than in the fields themselves. Semere and Slater (2007a) indicate that perennial biomass grasses could provide improved wildlife habitat due to the lower input of agricultural chemicals relative to traditionally managed row crops. Sage et al. (2010) found that the number of birds in young-aged miscanthus grown in southwestern England was approximately equivalent to the number of birds found in grasslands. They found bird use to be variable and dependent on many factors such as region, weediness, crop structure, and patchiness.

Fargione (2010) in a review of literature indicated that researchers found potential for a loss of bird biodiversity in high-input low diversity (HILD) bioenergy crops, such as corn and soybeans, while in low-input high diversity (LIHD) bioenergy crops, such as native prairie, bird species richness increased. They also found that the magnitude of changes was more than double for species of concern than for generalist species. Fargione (2010) indicates a lack of specific data availability for crops such as giant miscanthus, which has a different structure than native prairie grass species in the United States, indicating a need for more research on these species. Jørgensen (2011) indicates that very few species directly feed on miscanthus so diversity indicators are due in part to the lack of continual tilling, reduced pesticide levels, and provision of cover. At maturity, these stands could have a decline in biodiversity if the fields become so successful that weeds are fully suppressed or large field are planted which would reduce the quantity of field margin habitat (*Ibid*.).

4.5.2.2.3 Insects

In a study of invertebrates, Semere and Slater (2007b) found that more invertebrates utilized miscanthus fields than areas dominated by reed canary-grass but less than field margins, in large part due to the increased presence of weeds within the establishing fields. They surmise that the more mature fields of reed canary-grass observed in these studies could be an approximation in terms of the generalized potential for biodiversity effects from mature stands of giant miscanthus in the United Kingdom since data for biodiversity is lacking for the mature age class of giant miscanthus (*Ibid*.). As such, appropriately sized field buffers would provide necessary wildlife habitat and edge to ameliorate the loss of biodiversity from maturing stands of giant miscanthus. Landis and Werling (2010) provided a review of relevant literature related to arthropods and biofuel production, indicating a general lack of data associated with mature giant miscanthus stands and arthropod interactions. Gardiner et al. (2010) analyzed arthropods in three different types of potential biofuel crops, corn (planted for grain), switchgrass (planted for CRP), and mixed prairie (planted for CRP). They found that insects responded more positively to greater landscape diversity, provided by switchgrass and mixed prairie; however, if switchgrass was planted and managed for biomass feedstock, the overall insect diversity could increase with a decline in plant diversity. Felten and Emmerling (2011) observed earthworm diversity and density between differing field management regimes – fallow, grassland, giant miscanthus, rapeseed, cereals, and maize. They found that giant miscanthus had enhanced biodiversity when compared to the more intensively cultivated crops and less than the less intensively

managed areas. They observed that earthworms were attracted to the rhizomatous areas of the soil profile and less observed in the intersticel spaces.

4.5.2.3 No Action Alternative

Selecting the No Action Alternative would not result in significant effects to the local or regional wildlife within the proposed project areas, as the Project Sponsor would not establish and produce giant miscanthus in those areas. Current wildlife communities would remain similar for those regions.

4.5.3 Protected Species

4.5.3.1 Significance Threshold

For protected species, both for vegetation and wildlife, a significant effect would be a direct taking of a protected species or the finding of decline in the number or range of species for the local area or the region indirectly attributable to the Proposed Action.

4.5.3.2 Proposed Action

Implementing the Proposed Action would not result in significant effects to any protected species, state, Federal, or Tribally-listed as threatened and/or endangered, primarily due to the lack of those species within the site-specific acreage proposed project areas. Some transitory and migratory species may occur while commuting or migrating along waterways that serve as corridors between roost areas and other habitats, but existing crop and idle lands do not provide suitable habitat within the proposed project areas. Other concerns would be for fish, clams, and invertebrates located in streams near giant miscanthus plantings. The Mitigation and Monitoring Plan specifies buffers between plantings and streams and riparian areas. These buffers will ensure that effects to any aquatic and riparian species will be minimized or avoided.

4.5.3.3 No Action Alternative

Selecting the No Action Alternative would not result in significant effects to the local or regional protected species within the proposed project areas, as the Project Sponsor would not establish and produce giant miscanthus in those areas. Current agricultural activities would remain similar or along the current projected trends for those regions.

4.6 SOIL RESOURCES

4.6.1 Significance Threshold

Impacts to soil resources would be considered significant if implementation of an action resulted in permanently increasing erosion, altered soil characteristics that threaten the viability of the cover, or affected unique soil conditions.

4.6.2 Proposed Action

Implementing the Proposed Action would result in a positive reduction in the soil erosion through abundant below ground biomass with soil retaining abilities. Giant miscanthus produces abundant above and below ground biomass. The top soil layer (0 to 30 centimeters [cm]) contains around 28 percent of the root biomass, while nearly half of the total roots were present in the deeper soils layers (below 90 cm) (Neukirchen et al 1999). The extensive deep root system can improve soil qualities by improving water storage, microbial process, and soil organic carbon storage (Blanco-Canqui 2010). In a 10-year study of giant miscanthus in Illinois, Davis et al. (2010) found that giant miscanthus produced greater above ground carbon (C) (1,606 to 2,426 grams [g] C/ square meter [m^2]) when compared to switchgrass, native prairie, (344 to 705 g C/m^2) and corn (405 to 717 g C/m^2). Davis et al. (2010) also indicated that giant miscanthus could produce soil C at a faster rate due in part to greater litter fall and below ground plant production (root system). Hansen et al. (2004) indicated that between 26 to 29 percent of accumulated C input was retained in the soil in soil samples taken from 9-year old and 16-year old giant miscanthus plants in Denmark.

Initial preparation of land for giant miscanthus establishment could result in the soil disturbance similar to traditional tillage of commodity crops. The preparation process could cause erosion following rainfall events until the giant miscanthus becomes established (Donnelly et al 2010). Soil tillage for giant miscanthus establishment can redistribute the organic matter and nutrients that accumulate at the surface of soils and create beneficial effects for the soil quality by mixing the soils and organic matter (Donnelly et al 2010). The eradication of the crop would result in additional tillage, similar to the establishment phase and traditional row crop tillage, which would redistribute soil organic matter, but would leave the soil bare until a new cover crop was established. The crop is expected to have a 20+ year lifetime. Once the plant is established, the dense root and rhizome system is expected to minimize the potential for soil erosion. In the long term, the potential for soil erosion will

be significantly reduced relative to other regional crops and will likely be reduced relative to pasture land, which is disturbed by grazing stock.

Pimental and Kounang (1998) reviewed the literature to determine average soil erosion rates for different land types. They found that the average soil erosion rate on U.S. croplands was 13 tons per hectare per year or approximately 5.3 tons per acre per year (*Ibid*.). Pastureland was found to have a soil erosion rate approximately half that of cropland (six tons per hectare per year or 2.4 tons per acre per year) (*Ibid*.). They also cited that the natural soil formation rate is approximately 0.5 to 1.0 tons per hectare per year (0.2 to 0.4 tons per acre per year) (*Ibid*.). Triplett and Dick (2008) found that traditional tillage, when compared to a no tillage system for corn production in Ohio over 42 years, resulted in a difference of over 13.4 tons of soil lost per acre per year from traditional tillage acres. Overall, soil loss due to erosion greatly exceeds natural soil formation in most areas.

Once established, giant miscanthus fields would generate soil conservation benefits associated with a large perennial root system and no tillage production. The combined root system and high litter accumulation on the soil surface would reduce the wind and water soil erosion. During the establishment period, traditional tillage practices would be undertaken for a maximum of one year within the proposed project areas

Overall, there could be a positive result of soil quality and reduction of soil erosion for the Proposed Action. Giant miscanthus can produce an ample amount of above and below ground biomass allowing for reduction in soil loss, which would reduce the potential for sediment to move from fields carrying pesticides and nutrients to the surface water bodies. This also is expected to reduce the sediment runoff, which could be deposited off-site, or runoff directly into water bodies.

4.6.3 No Action Alternative

Selecting the No Action Alternative would be unlikely to change current practices. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. The proposed project areas would not receive the potential soil benefits that could be provided by giant miscanthus and could potentially receive negative effects to soil quality through continued traditional crop management.

4.7 WATER QUALITY AND QUANTITY

4.7.1 Water Quality

4.7.1.1 Significance Threshold

An accounting of increases or reductions in input use such as fertilizer, herbicides, and pesticides is performed to evaluate potential changes in water quality.

4.7.1.2 Proposed Action

Implementing the Proposed Action would not result in a significant decline in surface water quality or groundwater quality within the proposed project areas. Over the productive life of the Freedom giant miscanthus acres, inputs of fertilizer, herbicides, and pesticides would be anticipated to be lower when compared to inputs for traditional row crops and higher for unimproved pasture, but would be site-specific based on soil type and past land use activities.

Since giant miscanthus is expected to be an excellent nutrient scavenger and recycles nutrients back to the root system, and provides excellent soil surface cover to prevent erosion losses, off-site movement of nitrogen and phosphorus would be expected to be low. As indicated earlier, fertilization of giant miscanthus would not occur until after soil testing recommendations have been analyzed at the site-specific level. Cadoux et al. (2011) indicate that biomass harvest of miscanthus removes approximately 4.9 grams per kilogram (g/kg) of dry matter, 0.45 g/kg, and 7.0 g/kg of nitrogen, phosphorus, and potassium, respectively, which should indicate a maximum replenishment rate for fertilizer applications. Based on unpublished giant miscanthus trials at MSU, average rates were found to be 50 pounds of nitrogen and 60 pounds of potassium fertilizer per acre with average biomass dry tonnage in the range of 15 to 23 tons. **Table 4-5** lists the average fertilizer applications in pounds per acre by state within the proposed project areas. In general, the field trials of Freedom giant miscanthus indicated that it required less fertilization than the average application in Georgia for corn or cotton and in North Carolina for corn.

Table 4-5. Comparison of Average Fertilizer Applications, pounds per acre

	Corn	Corn	Cotton	Soybeans	Freedom Giant Miscanthus
Nutrient	Georgia (2010)	North Carolina (2010)	Georgia (2010)	North Carolina (2007)	Mississippi
Nitrogen	177	128	95	21	50
Phosphorus	68	40	59	84	0
Potassium	78	81	105	44	60

USDA ERS 2011, unpublished field trial data MSU

Research also suggests that, once established, giant miscanthus can lead to low levels of nitrate leaching and as a result improve groundwater quality relative to other crops (Christian and Riche 1998). Further, Love and Nejadhashemi (2011), through modeling with the Soil and Water Assessment Tool (SWAT) for scenarios of crop conversions in Michigan, found that perennial grasses (e.g., miscanthus, native grasses, and switchgrass) would improve water quality over traditional crops for sediment and phosphorus loading, but could slightly increase nitrogen. On lands with existing high nitrogen levels within the study area, that are currently cultivated with other crops (e.g., sugarbeets, potatoes, dry beans, and fruit crops) or lands considered marginal for crop production, the authors determined these areas would not be suitable for bioenergy production, as all herbaceous species modeled increased nitrogen loading. The authors did find that on these land types with less nitrogen concerns, miscanthus and native grasses would be suitable crops for bioenergy production (*Ibid.*). Ng et al. (2010) found using SWAT that a 10 percent land use change to miscanthus from a corn and soybean rotation in Illinois reduced nitrate export by 6.4 percent; while at a 50 percent conversion, up to a 30 percent decrease in nitrate export could be obtained.

The conversion of formerly cropped acres to giant miscanthus production would reduce runoff, sediment loss, and nutrient loss due to the high ground cover provided by the plant after it has established and the reduced need for nutrient application. This reduction in sediment and nutrient loss in runoff could enhance water bodies and water quality, especially in sensitive watersheds. In marginal areas, sediment runoff could be affected during the establishment of giant miscanthus; however, that would be contingent upon the quality of vegetation cover on the marginal lands. For lower quality vegetation, such as a previously disturbed site dominated by annual or early successional species, these areas would be anticipated to receive water quality benefits as giant miscanthus establishes perennial groundcover on the previous short-term or spare vegetative cover. For areas with improved perennial pasture, there could be short-term increases in off-site runoff, until giant miscanthus becomes established. Site-specific BMPs would be incorporated into the producer mandatory site-specific Conservation Plan to minimize these effects.

4.7.1.3 No Action Alternative

Selecting the No Action Alternative, would not produce a significant change in water quality, unless there was a substantial increase in land use toward traditional commodity crops. Based on agricultural crop production projections, planted corn acreage is anticipated to increase by approximately 5.4 percent between 2008 and 2017; however, all other primary

field crop planted acreage is anticipated to decline. Overall, the change in land use through the selection of the No Action Alternative would not indicate increased acreage with a need for increased agricultural chemicals.

4.7.2 Water Quantity

4.7.2.1 Significance Threshold

Water quantity changes could result in positive or negative effects on total water use in the short-term and over the life of the crop compared to other cropping systems depending on the regional climate. Land use and water use changes would affect hydrology relative to runoff and stream flow.

4.7.2.2 Proposed Action

Miscanthus has a higher efficiency of water use per biomass yield than corn or sorghum crops. Typically, giant miscanthus requires between 100 to 300 liters of water (approximately 26 to 79 gallons) to produce one kilogram (kg) (approximately 2.2 pounds) of biomass depending upon location of production with average anticipated to be approximately 200 liters per kg (approximately 500 millimeters [mm] equivalent precipitation per year) (Heaton et al. 2010).

Although miscanthus uses less water per unit of biomass produced than traditional crops in the project area, the net water use per acre may be higher. This is due to the higher biomass per acre, than corn, soybeans, and switchgrass, and a longer growing season than corn and soybeans. However, giant miscanthus could use slightly less water than other perennial herbaceous species commonly used for forage or hay, such as coastal Bermudagrass (600 mm per year) (Marsalis et al 2007).

Annual water use and water losses associated with evapotranspiration (ET) for giant miscanthus differs from those documented for annual row crops and pasturelands. Hall (2003) estimated that perennial energy grasses would use between 500 to 600 mm (20 to 24 inches) of water annually. Hall determined that giant miscanthus had approximately a 20 percent interception loss, indicating that a giant miscanthus crop, to be productive would need approximately 28 inches per year in precipitation. Grass hay, alfalfa, or pasture which typically require between 30 and 39 inches of water annually and corn typically requires 21 to 29 inches of water annually (Schneekloth and Andales 2009). **Table 4-6** summarizes literature associated with seasonal water use by crop type.

Table 4-6. Summary of Reported Water Use Values (mm) for Miscanthus and Other Crops

Crop	Estimated Water Use (mm)	Location	Source(s)
Miscanthus	200	England	Heaton et al. (2010)
	500	United Kingdom	Long and Beale (2001) as cited in Teoh et al. (2011)
	954.6	Illinois	Hickman et al. (2010)
	347.9 to 391.7	Italy	Consentino et al. (2006)
Alfalfa	763.0 to 999.2	Colorado	Schneekloth and Andales 2009
Barley	288 to 297 – monoculture and rotation	Spain	Álvaro-Fuentes et al. (2009)
Coastal Bermudagrass	680	Texas	Marsalis et al. (2007)
Corn	146 to 316	Colorado	Nielsen et al. (2006)
	551 to 584	Kansas	Hattendorf et al. (1988)
	255 to 422 – dry matter 293 to 448 - grain	South Dakota	Olson (1971)
	520.4 to 681.0	Colorado	Schneekloth and Andales 2009
	444 to 480	Kansas	Norwood (2001)
	611.9	Illinois	Hickman et al. (2010)
Giant Amaranth	261 to 282	North Dakota	Johnson and Henderson (2002)
Grain Sorghum	339 to 374	Nebraska	Maman et al. (2003)
	451 to 523	Kansas	Hattendorf et al. (1988)
	453 to 477	Kansas	Stone et al. (2001)
	202 to 424 – dry matter 296 to 443 - grain	South Dakota	Olson (1971)
	406.1 to 640.1	Colorado	Schneekloth and Andales 2009
Grass hay/pasture	661.4 to 880.4	Colorado	Schneekloth and Andales 2009
Pearl Millet	336 to 370	Nebraska	Maman et al. (2003)
	70 to 266	Colorado	Nielsen et al. (2006)
	441 to 529	Kansas	Hattendorf et al. (1988)
Soybean	441 to 596	Kansas	Hattendorf et al. (1988)
Sunflower	476 to 584	Kansas	Hattendorf et al. (1988)
	565 to 580	Kansas	Stone et al. (2001)
Sweet Sorghum	152 to 268	Arizona	Miller and Ottman (2010)
	272 to 390	South Dakota	Olson (1971)
Switchgrass	764.3	Illinois	Hickman et al. (2010)
Triticale	86 to 330	Colorado	Nielsen et al. (2006)
Wheat	317 to 342	Australia	Angus and Herwaarden (2001)
	318.3 to 499.1	Colorado	Schneekloth and Andales 2009
	300 to 345 – monoculture and rotation	Spain	Álvaro-Fuentes et al. (2009)

Beale et al. (1999) indicated that water use efficiency for giant miscanthus, when normalized by the daily maximum vapor pressure deficit, were within the range of C_4 crops over several environments (7.3 grams per kiloPascal per kilogram [g kPA/kg] – 9.4 g kPA/kg) and based on literature would be similar to corn (8.2 to 12.0 g kPA/kg) and pearl millet (8.4 to 10.6 g kPA/kg). Since some pastureland species use more water annually than miscanthus; depending upon land use cover of pastureland, total water use could be reduced somewhat through implementation of the project areas.

The majority of the data on ET comes from England where the plant has been grown in production for over a decade. Estimated ET for miscanthus is highly variable between studies (**Table 4-7**). In general, ET in miscanthus fields is two to three times lower than the values measured in corn, two times lower than various varieties Bermudagrass, similar to switchgrass, and somewhat higher than winter wheat and cool-season grasslands.

VanLoocke et al. (2010) indicated that through their modeling giant miscanthus at 100 percent cover that ET increased by over 200 mm per year and drainage declined between 50 to 250 mm per year. The model included the entire Midwest (11 states) with over 324 million acres of agricultural land and average precipitation ranging from 15 to 40 inches per year (west to east). At 10 percent cover (estimated more than 32 million acres) changes to ET and drainage were minimal compared to existing cover (*Ibid.*). The project is expected to enroll considerably less than 10 percent of the total agricultural lands in each of the production areas, so no significant regional change in ET is expected. VanLoocke et al. (2010) also indicate that past studies have shown that conversion from native grasslands to annual crop dominated cover could have reduced ET in Corn Belt of the United States by approximately 75 mm per year, indicating that giant miscanthus could have ET rates more in line with past vegetative cover in prime farming areas than current crop cover.

Giant miscanthus, as a result of the deep root system and large leaf area, likely has higher infiltration rates during rain events allowing for a reduced run-off and the reduced peak flows, which could reduce the effects of flooding in certain areas (Smeets 2008).

The project is targeting use of pastureland, marginal and idle croplands, and abandoned/previously cleared forestlands. Therefore, the number of acres converted from irrigated crops to giant miscanthus in these project areas will likely be negligible.

Table 4-7. Summary of Reported ET Values (mm/day) for Miscanthus and Other Crops

Crop	Estimated ET (mm/day)	Location	Source(s)
Miscanthus	2.3	England	Beale et al. (1999)
	1.2 to 1.6	England	Cranfield University (2001) as cited in Finch et al. (2009)
	1.9 to 3.1	Italy	Cosentino et al. (2007)
	3.2	England	Finch and Riche (2008) as cited in Finch et al. (2009)
	3.7 to 3.9	Illinois	McIsaac et al. (2010)[1]
Bermudagrass	5.8 to 6.4	Texas	Casnoff, Green, and Beard (1989)
	3.0 to 3.1	Georgia	Carrow (1995)
	4.2 to 5.2	Texas	Beard, Green, and Sifers (1992)
	4.1 to 5.9	Texas	Kim and Beard (1988)
	3.6 to 3.8	North Carolina	Van Bavel and Harris (1962)
Bahiagrass	8.2	Texas	Casnoff, Green, and Beard (1989)
Buffalograss	5.7	Texas	Casnoff, Green, and Beard (1989)
	4.4 to 5.3	Texas	Kim and Beard (1988)
Corn	6.8 to 7.4 (43 year average)	Kansas	Lamm et al. (2007)
	5.4	North Carolina	Van Bavel and Harris (1962)
	6 to 10	Texas	Howell et al. (1996)
	1.8-3.0 – no till 1.7-3.1 – chisel plow	Wisconsin	Brye et al. (2000)
Corn – Soybean	1.4 to 2.3	Illinois	McIsaac et al. (2010)[1]
Soybeans	4.1 to 5.1 – irrigated 3.4 to 4.6 – non-irrigated	Siberia	Maksimovic et al. (2005)
	3.4 – irrigated 3.2 - rainfed	Nebraska	Suyker and Verma (2009)
Switchgrass	2.5 to 2.6	Illinois	McIsaac et al. (2010)[1]
Winter Wheat	1.3 – drought crop 2.0 – rain fed crop	England	Weir and Barraclough (1986) as cited in Finch et al. (2009)
	1.5 to 1.7	England	Scott et al. (1994) as cited in Finch et al. (2009)
Alfalfa	7.9 to 8.1	Texas	Tolk et al. (2006)
Grasslands	1.4	England	Calder et al. (2003) as cited in Finch et al. (2009)[3]
	1.1	England, riparian areas	Finch and Harding (1988) as cited in Finch et al. (2009)
Native Prairie	2.6-2.7	North Dakota	Frank (2003)
	2.4-2.5	Wisconsin	Brye et al.(2000)
	3.2-3.4	Kansas	Bremer et al. (2001)
Western Wheatgrass	2.8	North Dakota	Frank (2003)
Loblolly Pine	3.0 to 4.1 summer	North Carolina	Cao et al. (2006)
Slash Pine	1.2 winter 2.4 autumn 5.7 spring	Florida	Riekerk (1982)

[1] Publication reported total annual ET; values converted to daily ET

[2] Publication indicated corn/soybeans were 104 mm less per growing season which is equivalent to 0.9 mm/day less. Number in table is value for miscanthus reported by the author minus 0.9 mm/day

[3] Grasslands in England have a longer growing season than Miscanthus

4.7.2.3 No Action Alternative

The selection of the No Action Alternative would not result in significant adverse effects to the water quantity within the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. The change in land use through the selection of the No Action Alternative would not indicate increased acreage with a need for increased agricultural irrigation.

4.8 AIR QUALITY

4.8.1 Significance Thresholds

A significant effect to air quality would be sufficient emissions generation to contribute a substantial amount to estimated calculated emissions to an AQCR. The percentage contribution would vary by area and the amount of existing pollutant emissions. In areas in nonattainment for criteria pollutants a significant effect could be an amount of emissions that would require obtaining a new source permit or would create negative effects to a state's emissions goals as developed in their SIP.

4.8.2 Proposed Action

Overall, it would be anticipated that agricultural equipment necessary for the establishment, harvesting, and transportation of giant miscanthus would provide a minimum amount of the $PM_{2.5}$ particulate load within the three counties located within the Metropolitan Atlanta AQCR based on the comparison of estimated emissions from new agricultural production to the emissions from electric generating units in Heard County and the proximity to the Atlanta, Georgia metropolitan area.

A calculation of $PM_{2.5}$ emissions for traditional agricultural tillage was developed following the EPA's Development of Agricultural Dust Emission Inventories for the Central State Regional Air Planning Association; it indicated a range of 0.0565 pounds per acre to 0.1790 pounds per acre (Penfold et al nd., EPA 1998). Agricultural tillage would occur for one year on each contract parcel within the proposed project areas. Based on the acres for the Middle Georgia proposed project area in **Table 2-3**, tpy of fine dust particulates generated from agricultural tillage within the entire proposed project area would range from 1.10 tpy to 3.49 tpy after planting. Even at the highest amount and assuming that all particulates would occur within the Metropolitan Atlanta AQCR, the contribution of agricultural tillage from this proposed project area would account for approximately 0.16 percent of the 2008 emissions

in Heard County or 0.36 percent of the 2008 emissions in Spalding County or 0.34 percent of the 2008 emissions in Putman County. The Proposed SIP Revision for the Atlanta $PM_{2.5}$ Nonattainment Area indicated that the 2012 estimated on-road mobile source emissions for Georgia are 3,127 tpy. When compared to the emissions from the proposed project, it would contribute 0.1 percent to this total. In the long term, $PM_{2.5}$ emissions should be reduced by the program since lands currently tilled annual will no longer be tilled once the rhizomes are planted.

4.8.3 No Action Alternative

The selection of the No Action Alternative would not result in significant adverse effects to the air quantity within the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas.

4.9 OUTDOOR RECREATION

4.9.1 Significance Thresholds

Overall trends in outdoor recreation participation in the United States have been positive in both the number of participants and the number of participant days. Based on these on-going trends as well as parallel data that can be derived from other USDA program-related outdoor recreation effects, impacts to recreational resources would be considered significant if there were long-term reductions in recreational participation or expenditures after implementation of an action and establishment of a new equilibrium.

4.9.2 Proposed Action

Under the proposed action, a maximum of 58,000 acres within three states would be converted to Freedom giant miscanthus. Wildlife-related outdoor recreation is highly dependent upon wildlife diversity and abundance in a given area; therefore, recreational opportunities are correlated with effects to wildlife habitat from this project. If wildlife buffers and corridors are part of the mandatory site-specific Conservation Plans wildlife movement would still occur, similar to other types of row crop usage. Land conversion into giant miscanthus would be relatively small on the regional scale and would be highly dependent on producer's determination of economic values associated with their properties. All three states have private hunting opportunities where properties are leased to day-hunters or longer-term season leases. If a producer determines that their income from their leasehold exceed the potential income from giant miscanthus production, then that producer would

choose not to convert the land into giant miscanthus production. High quality hunting lands with high economic value to the property owner are unlikely to be converted, which would provide continued opportunities for the direct consumptive use of wildlife for non-landowners. No public lands would be converted into giant miscanthus providing continued opportunities for the population to have non-consumptive wildlife uses (e.g., wildlife watching). Though further study is needed to determine the long-term use of giant miscanthus fields by wildlife, indications through anecdotal surveys are that wildlife in the short-term continue to use fields similar to use prior to conversion into giant miscanthus.

4.9.3 No Action Alternative

The selection of the No Action Alternative would not result in significant adverse effects to the outdoor recreation within the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. As such, land use conversion would follow existing patterns and available lands for outdoor recreation would remain similar to those described or would be developed according to the prevailing economic conditions of the time.

4.10 ENVIRONMENTAL JUSTICE ANALYSIS

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority and Low Income Populations," requires a federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high human health or environmental effects of its programs, policies, and activities on minority populations and low income populations." A message from the President concerning EO 12898 stated that federal agencies should collect and analyze information concerning a project's effects on minorities or low-income groups, when required by NEPA. If such investigations find that minority or low-income groups experience a disproportionate adverse effect, then avoidance or mitigation measures are to be taken. Under NEPA, if disproportionate impacts on minority or low-income populations are identified, a proposed action is not precluded from going forward, nor does it compel a conclusion that the action is environmentally unsatisfactory. Rather, identification of such an effect should heighten agency attention to alternatives, mitigation measures, monitoring needs, and preferences expressed by the affected communities or populations (Council on Environmental Quality [CEQ] 1997).

More specifically, EO 12898 requires all Federal agencies to:

- Conduct their programs, policies, and activities that substantially affect health and the environment so as not to exclude, deny benefits to, or discriminate against persons because of race, color, or national origin.
- Ensure that public documents, notices, and hearings relating to human health or the environment are concise, understandable, and readily accessible to the public.
- Whenever practicable and appropriate, collect, maintain, and analyze information assessing and comparing environmental and human health risks borne by populations identified by race, national origin, or income. To the same extent, Federal agencies shall use this information to determine whether their programs, policies, and activities have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Similarly, Federal agencies are to collect and analyze information on race, national origin, income level, and other readily accessible and appropriate information for areas surrounding facilities or sites expected to have a substantial environmental, human health, or economic effect on the surrounding populations, when such facilities or sites become the subject of a substantial Federal environmental administrative or judicial action.
- Collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence.

On 10 December 1997, the CEQ published *Environmental Justice Guidance Under the National Environmental Policy Act* as a guidance document for Federal agencies to follow for developing and implementing procedures to comply with EO 12898 during the NEPA process. CEQ guidance made several points with regard to agency NEPA analyses addressing environmental justice, these included:

- The importance of research, data collection, and analysis, particularly with respect to multiple and cumulative exposures to environmental hazards for low-income populations, minority populations, and Indian tribes. Thus, data on these exposure issues should be incorporated into NEPA analyses as appropriate.
- The importance of ensuring effective public participation and access to information.
- In regards to NEPA analyses, each Federal agency should analyze the environmental effects, including human health, economic, and social effects of

Federal actions, including effects on minority populations, low-income populations, and Indian tribes.

- Mitigation measures identified as part of a NEPA analysis should, whenever feasible, address significant and adverse environmental effects of proposed federal actions on minority populations, low-income populations, and Indian tribes.
- Each Federal agency must provide opportunities for effective community participation in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving the accessibility of public meetings, crucial documents, and notices.

The primary agency involved in ensuring meaningful access of minority and low-income communities is the U.S. Environmental Protection Agency (USEPA) which monitors the enforcement of EO 12898 nationwide to ensure that it is being enforced equally in all states to protect the environment and public health. In July 2010, the USEPA published the *EPA's Action Development Process* (2010a), which describes its internal guidance for addressing environmental justice concerns across agency rulemaking and providing a blueprint for other agencies to follow. The USEPA has further refined EO 12898 to further the concepts of fair treatment and meaningful involvement.

Fair treatment – no group of people should bear a disproportionate burden of environmental harms and risks, including those resulting from negative environmental consequences of industrial, governmental, and commercial operations or programs and policies.

Meaningful involvement – (1) potentially affected community members have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the decision-makers seek out and facilitate the involvement of those potentially affected.

4.10.1 Significance Thresholds

According to the CEQ (1997), a minority population can be described as being composed of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, not of Hispanic origin, or Hispanic, and exceeding 50 percent of the population in an area or the minority population percentage of the affected area is

meaningfully greater than the minority population percentage in the general population. Race and ethnicity are two separate categories of minority populations. A minority population can be defined by race, by ethnicity, or by a combination of the two distinct classifications.

Race as defined by the U.S. Census Bureau (2001) includes:

- White – A person having origins in any of the original peoples of Europe, the Middle East, or North Africa;
- Black or African American – A person having origins in any of the Black racial groups of Africa;
- American Indian or Alaska Native – A person having origins in any of the original peoples of North and South America (including Central America) and who maintain tribal affiliation or community attachment;
- Asian – A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, or the Philippine Islands; and
- Native Hawaiian and Other Pacific Islanders – A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

The U.S. Census Bureau (USCB) defines ethnicity as either being of Hispanic origin or not being of Hispanic origin. Hispanic origin is defined as "a person of Cuban, Mexican, Puerto Rican, South or Central America, or other Spanish culture or origin regardless of race" (USCB 2001).

Each year the USCB defines the national poverty thresholds, which are measured in terms of household income dependent upon the number of persons within the household. Individuals falling below the poverty threshold ($17,603 for a household of four in 2000; $22,314 for a household of four in 2010) are considered low-income individuals. USCB census tracts where at least 20 percent of the residents are considered poor are known as *poverty areas* (USCB 1995). When the percentage of residents considered poor is greater than 40 percent, the census tract becomes an *extreme poverty area*.

4.10.2 Proposed Action

Implementing the proposed action would not result in disproportionate adverse impacts to minority or low-income populations within the proposed project areas. The Project Sponsor

has diligently worked to find a species of dedicated biomass energy feedstock that could be competitively grown in the Southeastern United States that did not diminish acreage for food or fiber production and would have minimal adverse environmental effects from the species itself and/or the establishment and production methods. The Project Sponsor has developed processes that diminish the overall cost of establishing Freedom giant miscanthus within the proposed project areas, which should provide adequate opportunities for eligible producers of all races, ethnicities, and sex with land appropriate for giant miscanthus production to enroll in the program. Overall, this project could provide a needed diversified crop mix for minority and beginning producers within the proposed project areas. A short review of the sensitive populations is included below, as well as, information on the job tax credits available to draw new businesses into the proposed project areas.

4.10.2.1 Review of Minority and Low-Income Characteristics

The proposed project areas contain substantial minority and low-income populations throughout. As mentioned previously, 24.1 percent of the counties in the East Georgia proposed project area, 6.7 percent of the counties in the Middle Georgia proposed project area, 33.4 percent of the counties in the Lowcountry proposed project area, and 23.4 percent of the counties in the North Carolina proposed project area have a total minority population in excess of 50 percent of the total population.

As indicated in Section 3.1.3.3, minority operators in these three states account for as many as 8.6 percent of producer to as few as 4.8 percent of producers. In the proposed project areas, minority operators account for 9.1 percent of total operators in the Lowcountry proposed project area, 8.2 percent of operators in the North Carolina proposed project area, 7.7 percent in the Middle Georgia proposed project area, and 7.2 percent in the East Georgia proposed project areas. In all of the proposed project areas, minority operators account for a higher percentage of operators than at the state level, indicating greater opportunities for minority operators to participate in this project.

The proposed project areas have large percentages of the population that fall below the poverty threshold. Within the East Georgia proposed project area 93.3 percent of the counties have a poverty rate at or greater than 20 percent of the population, the Middle Georgia proposed project area has 75 percent of the counties at or greater than 20 percent of the population below the poverty threshold, the Lowcountry proposed project area has 95.5 percent of the counties, and the North Carolina proposed project area has 53.4 percent

of the counties. Additionally, the 2010 annual average unemployment rate within each of the proposed project areas was greater than 18 percent.

4.10.2.2 State-Level Tax Credit Programs

Each of the states within the proposed project areas have developed tax incentive programs to bring new businesses and job creation into these economically depressed counties. The Project Sponsor would provide feedstock for BCFs, which would bring in new jobs to many of these proposed project areas. The project sponsor estimates that within the East Georgia proposed project area, more than 85 full time or full time equivalent (FTE) jobs would be created directly or indirectly through this project with an estimate annualized effect of over $17 million once the establishment is mature. In the Middle Georgia proposed project area, the project sponsor is estimating more than 115 full time or FTE jobs would be created directly or indirectly through this project with an estimate annualized effect of over $22 million once the establishment is mature. The Lowcountry proposed project area is estimated to provide more than 30 full time or FTE jobs would be created directly or indirectly through this project with an estimate annualized effect of over $5.5 million once the establishment is mature. For the North Carolina proposed project, the project sponsor estimates more than 85 full time or FTE jobs would be created directly or indirectly through this project with an estimate annualized effect of over $19 Million once the establishment is mature.

4.10.2.2.1 Georgia

The Georgia Job Tax Credit Program is a statewide job tax for any business or headquarters of any such business engaged in manufacturing, warehousing and disruption, processing, telecommunication, broadcasting, tourism, or research and development industries that create and maintain sufficient number of new full-time jobs. Counties and certain census tracts in the state are ranked and placed in economic tiers using the following factors: (1) highest unemployment rate; (2) lowest per capita income; and (3) highest percentage of residents whose incomes are below the poverty level. The tier ranking of a county determines the amount of Job Tax Credit which as businesses located in the count will be entitled to receive, the minimum number of jobs they much created to be eligible the other program requirements and benefits. In Tier I counties, job tax credits are available to business of any nature. In Tier I counties recognized and designated as the 40 least developed counties, and certain specially designated areas, a business must create and maintain at least five net new jobs to eligible for a credit of $3,500 per job. There are 25

counties within the proposed project areas that are ranked in the 40 least developed counties for 2011 (DCA 2011) (**Figure 4-1**).

4.10.2.2.2 North Carolina

In North Carolina, Article 3J Tax Credits offer initiatives for creating jobs, investing in business property, and investment in real property. The primary activity at the business establishment must be an eligible type of business, which includes:

- aircraft maintenance and repair;
- air courier services hub;
- company headquarters that creates at least 75 new headquarters jobs;
- customer service call centers;
- electronic shopping and mail order houses;
- information technology and services;
- manufacturing;
- motorsports facilities and motorsports racing teams;
- research and development; and
- warehousing and wholesale trade.

4.10.2.2.3 South Carolina

The South Carolina Traditional Annual Job Tax Credit provides a tax credit against South Carolina income tax, bank tax, or insurance premium tax for a qualifying business creating new jobs in this state. To qualify for the job tax credit, a business must: (1) be a certain type of business, and (2) create and maintain a required minimum number of "new, full time jobs" at the time a new facility or expansion is initially staffed. The traditional annual job tax credit is available for five years and is first claimed on the taxpayer's tax return for the year following the creation of the new jobs, provided the jobs are maintained. The amount of credit that a business may receive for each job created is determined by the county where the business's facility is located. For 2011, the "basic" job tax credit amounts under the traditional annual job tax credit are listed below: $8,000 per year for each new, full time job created in a Tier IV county; $4,250 per year for each new, full time job created in a Tier III

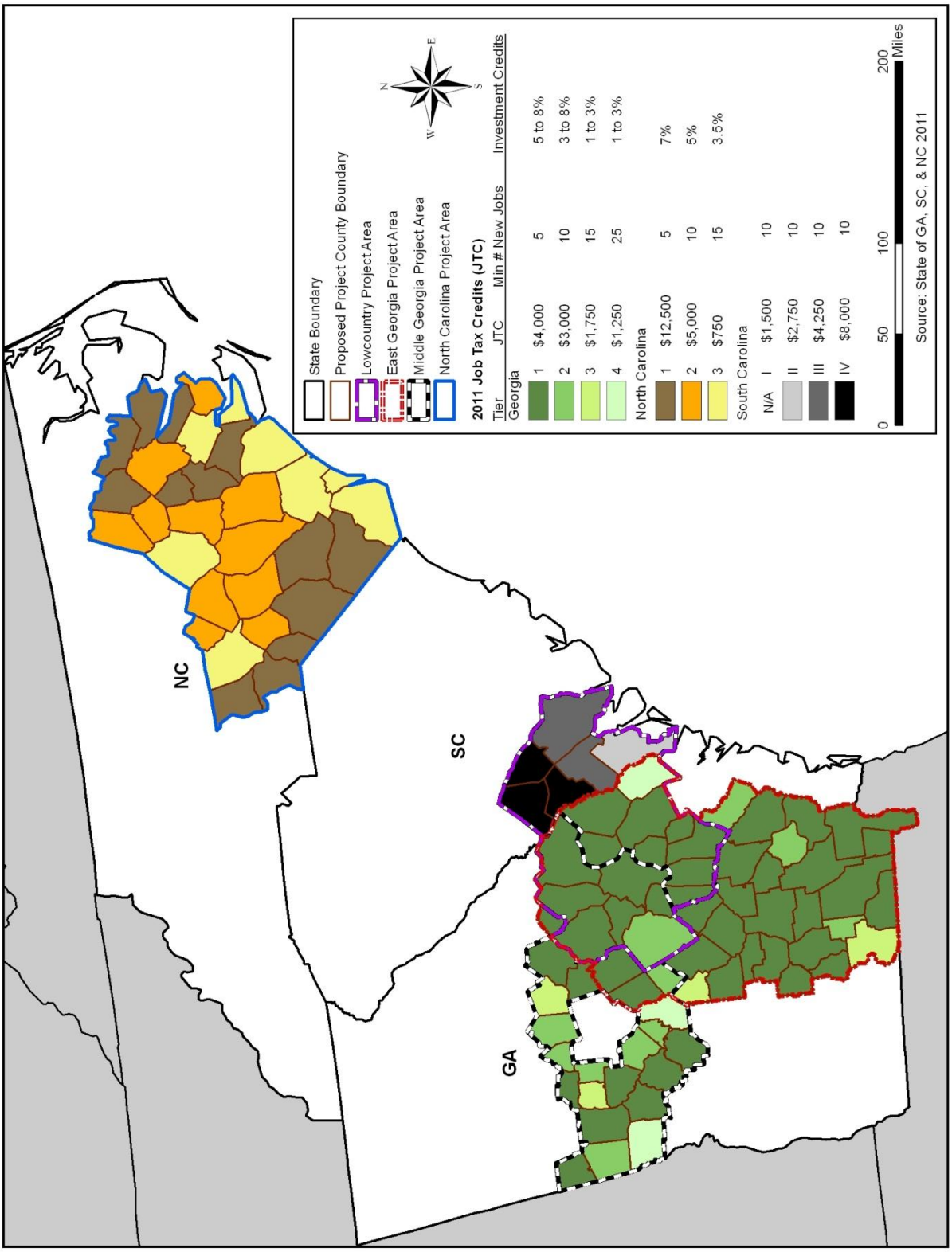

Figure 4-1. State-level Job Tax Credits Available within the Proposed Project Area Counties.

county: $2,750 per year for each new, full time job created in a Tier II county; $1,500 peryear for each new, full time job created in a Tier I county. Five of the six South Carolina counties within the Lowcountry proposed project area, fall within one of these tiers.

4.10.3 No Action Alternative

The selection of the No Action Alternative would not result in environmental justice effects within the proposed project areas. Under this alternative, the Project Sponsor would not undertake the establishment and production of giant miscanthus in the proposed project areas. As such, agricultural conditions would remain the same as current conditions.

4.11 ALTERNATIVES COMPARISON

This section of the EA provides a brief comparison for the potential effects associated with both the Proposed Action and the No Action Alternative. **Table 4-8** lists the qualitative comparison of the alternatives.

Table 4-8. Comparison of the Alternatives

Resource Area	Proposed Action	No Action Alternative	Cumulative Effects
Socioeconomics	Minor +/0	0	Minor +/0
Land Use	0/Minor -	0	0/Minor -
Coastal Zone Management Consistency	0	0	0
Biological Resources			
Vegetation	0/Minor -	0	0/Minor -
Wildlife	0/Minor-	0	0/Minor-
Protected Species	0	0	0
Soil Resources	+/Minor -	0/Minor -	+/Minor-
Water Quality/Quantity			
Water Quality	Minor +/0	0/Minor -	Minor +/Minor-
Water Quantity	Minor +/0	0/Minor -	Minor +/Minor-
Air Quality	0/Minor -	0	0/Minor-
Outdoor Recreation	Minor +/Minor -	0	Minor +/Minor-
Environmental Justice	Minor +/0	0/Minor -	Minor +/Minor-

Note: (+)=positive (-)=negative (0)=neutral

4.11.1 Proposed Action

Implementing the Proposed Action would result in minor positive and negative effects to the local and regional area; however, many of these effects would be minimized through the use of the Mitigation and Monitoring Plan. The Proposed Action could result in additional diversified income for the contract producer, as well as technical assistance from the Project Sponsor in the production and harvesting of giant miscanthus. The Project Sponsor have a proposed BCF in each of the proposed project areas ensuring that producers will have a

demand for their products. In addition, ancillary agricultural services should expect an increase due to the Project Sponsor goal of primarily contracting idle acres and not active cropland. The Proposed Action would result in a changed local landscape with the addition of the giant miscanthus fields. The Mitigation and Monitoring Plan will be used to ensure that adverse effects from this new crop are minimized or avoided.

Minor negative effects would be anticipated for biological diversity as pastureland is converted in giant miscanthus croplands. The Mitigation and Monitoring Plan will be essential to provide mechanisms such as buffers and field edges to support continued wildlife and vegetative diversity in these areas and control of rhizome and vegetative spread.

Recent research has indicated that giant miscanthus can function as a source of plant pests to conventional crops; the Mitigation and Monitoring Plan monitoring and buffer will be essential to ensure that any pests/diseases are identified and treated early to avoid transmission to local croplands, such as corn.

Giant miscanthus, which has an extensive perennial root system, would be anticipated to have positive effects on soil retention, soil organic matter, and conversion to soil carbon, as well as increased water quality due to reduced nutrient leaching and transported sediments. Giant miscanthus would be anticipated to require more water than annual crops, such as corn; however, giant miscanthus has much higher water use efficiency, generating high amounts of biomass per volume of water consumed.

4.11.2 No Action

The No Action Alternative would result in no adverse effects to the local and regional area since there would be no giant miscanthus planted in any of the proposed project areas as described in this BCAP Project Proposal. However, the No Action Alternative would not assist in meeting the overall goal of BCAP, which is to develop dedicated energy crops for use into the conversion of bioenergy.

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5 CUMULATIVE IMPACTS ASSESSMENT

5.1 DEFINITION

The CEQ regulations stipulate that cumulative effects analysis consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present and reasonably foreseeable actions regardless of what agency or person undertakes such other actions." Cumulative effects most likely arise when a relationship exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in proximity to the proposed action would be expected to have more potential for a relationship than those more geographically separated. Similarly, actions that coincide, even partially, in time tend to have potential for cumulative effects.

The Proposed Action is to establish BCAP project areas supporting the establishment and production of giant miscanthus as a dedicated energy crops for bioenergy production. The scale of this action is regional and includes counties within Georgia, North Carolina, and South Carolina. Given the action is to produce an alternative crop on existing agricultural lands, identifying past, present, and reasonably foreseeable future actions is based on existing cropland production, projected future cropland production, existing CRP acres within each county, future expirations of CRP acres within each county, and the potential for additional BCAP project acres within these proposed project areas.

5.2 CUMULATIVE IMPACTS ANALYSIS BY RESOURCE AREA

5.2.1 Socioeconomics

In the United States, average farm operator household income from 2007 to 2009 has been consistently higher than the average United States household income; however, the percentage difference has been declining from a high of 31.1 percent higher to 13.5 percent higher (USDA ERS 2011b). Farming activities have contributed approximately 11.3 percent to household income, with the projected average being 12.5 percent in 2010 (*Ibid.*). After two declining years of total household income of farm operators, the forecast for 2010 and 2011 indicate an increase, which will be record levels (*Ibid.*). Traditional commodity crops continue to be high-value for associated land production capabilities providing a substantial proportion of farm operator household income for many areas. Combined with the foreseeable high commodity prices associated with recent natural occurrences that have impacted food crops globally and the driver for alternative fuels and energy sources from

renewable resources, traditional crops such as corn and soybean would be anticipated to continue as the dominant agricultural land uses within these proposed project areas.

Under the Proposed Action, contract producers would be creating a diversified crop profile with the inclusion of giant miscanthus on their marginal or idle lands. More than likely woody biomass would be the primary bioenergy feedstock developed in the Southeastern United States given the large amount of land use currently in timberland and forest cover and the relative value of timber in relation to livestock production. Given the infancy of industry for biomass feedstock production, large acreages are not anticipated to be converted into dedicated biomass crops with the short-time frame associated with BCAP. The Project Sponsor is anticipating a total combined acreage across all proposed project areas to be up to 58,000 acres by 2013. The addition of smaller acreages of Freedom giant miscanthus could diversify the producer portfolio and provide an annual revenue stream to supplement the production of other traditional row crops or the longer term production of timber. The potential for dedicated energy crops exists through many regions of the United States; however, one of the primary limiting factors is accessibility to a BCF that (1) provides a market to producers for their biomass feedstock and (2) has a market for sale of the bioenergy product produced at that facility. Overall, the cumulative effects to socioeconomics associated with the Proposed Action and No Action Alternative would be minor, given the high commodity prices associated with traditional crops and the lack of adequate BCF with enough demand in the region to convert more than a modest amount of agricultural lands to dedicated energy crop production away from traditional crops.

5.2.2 Land Use

The combined proposed project areas include approximately 5.5 million acres of cropland and pastureland with varying degrees of activity. Overall, soybeans are the most cultivated crop within the proposed project areas accounting for just under 1.0 million acres. Corn followed with 0.6 million planted acres in the combined proposed project areas. Projections from the *USDA Agricultural Projections to 2020* indicate that increased United States planted acres of soybeans and corn would, on average, remain relatively flat, with some short-term increase in corn (USDA 2011).

Of the land in farms, approximately 227,361 acres are in CRP as of July 2011 (5.0 percent of total cropland) within the proposed project areas, with approximately 120,313 acres (52.9 percent) expiring from CRP between 30 September 2011 and 30 September 2015. Currently, there are approximately 26.1 million acres enrolled in CRP practices in the United

States as of July 2011, with 4.4 million expiring at the end of Fiscal Year 2011 (16.9 percent). Overall, the cumulative effects to land use associated with the Proposed Action and No Action Alternative would be minor, given the high commodity prices associated with traditional crops and the lack of adequate BCF with enough demand in the region to convert more than a modest amount of agricultural lands to dedicated energy crop production away from traditional crops.

5.2.3 Managed Coastal Zones

This project would not be anticipated to create cumulative effects to managed coastal zones, primarily through acreage exclusion of designated environmentally sensitive areas and upland buffers to those designated areas. States have been granted the authority to manage their coastal zone resources to protect their integrity and their high-value associated with additional key resources that depend on those areas for existence. The state-level permitting processes within each state require the review of ground disturbing activities within the designated environmental sensitive areas. The Project Sponsor would limit giant miscanthus production to existing agricultural lands in upland areas outside the designated sensitive areas and upland buffers. All contract producers would be required to implement all appropriate CPS and BMPs associated with their activities and their proximity to coastal areas. The potential amount of available acreage within the coastal zone counties would be small and adverse effects would be fully avoided.

5.2.4 Biological Resources

Cumulative effects from the Proposed Action would be minimized through the use of the producer mandatory site-specific Conservation Plan or Forest Stewardship Plan in association with the Mitigation and Monitoring Plan to ensure that effects to overall biodiversity would be minimized and the potential for plant pests would be minimized. The potential cumulative effects of establishment of a biomass crop would impact wildlife as habitats are fragmented, degraded, or destroyed from dedicated energy crop establishment; however, the amount of acreage within any of the proposed project areas would be minor and would be mitigated through the producer mandatory site-specific Conservation Plan or Forest Stewardship Plan in association with the Mitigation and Monitoring Plan. The establishment of new dedicated energy crops in areas previously fallow, cropped for a different style of agriculture, or previously cleared timberland could create a loss of previous habitat and may itself cause some direct mortality and range shifting at the local scale of wildlife. Direct effects are likely to occur during the establishment phase, but would be

similar to traditional agricultural cropping of fallowed or idle lands. During the short term, mobile species using pastureland, fallowed areas, or previously cleared timberland could relocate to other marginal lands in the vicinity or adjacent wildlife corridors. Less mobile or non-mobile species currently inhabiting pastured or fallowed land could be adversely affected; however, it would be similar to a loss associated with the re-introduction of a traditional crop on fallowed acreage. Overall, the cumulative effects to biological resources associated with the Proposed Action and No Action Alternative would be minor, given the high commodity prices associated with traditional crops and the lack of adequate BCF with enough demand in the region to convert more than a modest amount of agricultural lands to dedicated energy crop production away from traditional crops. The use of the Mitigation and Monitoring Plan for the Proposed Action would also minimize effects to biological resources and provide mechanisms for adaptive management should the need arise based on crop monitoring.

5.2.5 Soil Resources

The Proposed Action would be anticipated to have positive effects on soils at multiple levels, including a reduction of soil erosion, and increase in soil organic matter, and soil carbon deposition, relative to traditional crops, fallowed land under annual species, or previously cleared forestland that has not been revegetated. Overall, the cumulative effects to soils resources associated with the Proposed Action and No Action Alternative would be minor, given the high commodity prices associated with traditional crops and the lack of adequate BCF with enough demand in the region to convert more than a modest amount of agricultural lands to dedicated energy crop production away from traditional crops.

5.2.6 Water Quality and Quantity

The conversion to a perennial dedicated energy crop provides greater water use efficiency than traditional row crops such as corn, thereby indicating a more productive choice for biomass production. Giant miscanthus would be anticipated to use more water than fallowed or idle lands with permanent pasture, rangeland, or annual species. Taken in combination with traditional crops in the proposed project areas, there could be greater use of groundwater supplies or effects on groundwater recharge. However, these effects would be mitigated through monitoring and BMPs associated with the Mitigation and Monitoring Plan. The conversion from traditional crops to dedicated energy crops would be anticipated to limit runoff from agricultural fields and potential need for irrigation. Potential plant pests newly associated with giant miscanthus could require pesticide use in larger quantities than

described in peer-reviewed literature or greater IPM than potentially anticipated based on existing literature from Europe, but should be less than traditional row crops. Overall, the cumulative effects to water quality and quantity associated with the Proposed Action and No Action Alternative would be minor, given the high commodity prices associated with traditional crops and the lack of adequate BCF with enough demand in the region to convert more than a modest amount of agricultural lands to dedicated energy crop production away from traditional crops.

5.2.7 Air Quality

Cumulative effects to air quality from the Proposed Action would be avoided due the limited use of agricultural machinery for the establishment and production of giant miscanthus. As indicated previously, even at the maximum amount of acreage tilled at one point in time, the amount of $PM_{2.5}$ would be less than 0.1 percent of the projected total emissions in 2012. Tillage would only occur during the establishment year, with the addition of harvesting equipment included in the on-farm mobile sources each year thereafter. Overall, emissions from agricultural equipment and tractor trailers for transportation of products would be limited and only create minor, temporary increases in emissions over a period of a few weeks per year across all proposed project areas.

5.2.8 Outdoor Recreation

Cumulative effects from the Proposed Action would be minimized through the use of the Mitigation and Monitoring Plan to ensure that overall biodiversity would be maintained thus providing on-going outdoor recreational opportunities for both consumptive and non-consumptive users. The potential cumulative effects of establishment of a biomass crop would impact wildlife as habitats are fragmented, degraded, or destroyed from dedicated energy crop establishment; however, the amount of acreage within any of the proposed project areas would be minor and would be mitigated through the Mitigation and Monitoring Plan. Overall, the cumulative effects to outdoor recreation associated with the Proposed Action and No Action Alternative would be minor, given the high commodity prices associated with traditional crops and the lack of adequate BCF with enough demand in the region to convert more than a modest amount of agricultural lands to dedicated energy crop production away from traditional crops. The use of the Mitigation and Monitoring Plan for the Proposed Action would also minimize effects to biological resources and provide mechanisms for adaptive management should the need arise based on crop monitoring.

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6 MITIGATION AND MONITORING

6.1 INTRODUCTION

The CEQ issued revised guidance for mitigation and monitoring to be included in NEPA decision documents that include three general types of scenarios including: (1) mitigation incorporated into project design; (2) mitigation alternatives for NEPA decision documents (i.e., EA and EIS); and (3) mitigation commitments analyzed in EAs to support a Mitigated FONSI (CEQ 2011). The purpose of mitigation in this EA is the first type, which is incorporation into project design following the original intent of the definition of mitigation provided by CEQ that includes:

- Avoiding an impact by not taking a certain action or parts of an action;
- Minimizing the impact by limiting the degree or magnitude of the action and its implementation;
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time, through preservation and maintenance operations during the life of the action; and
- Compensating for an impact by replacing or providing substitute resources or environments.

The recently revised CEQ guidance also explicitly specifies that adaptive management, or the potential for the lead agency under NEPA to take corrective actions if the originally committed mitigation measures fail to address the target potential impacts, is allowable and desirable to both protect the environment and help a Federal agency meet their stated goals.

6.2 ROLES AND RESPONSIBILITIES

The revised CEQ guidance on mitigation and monitoring explicitly requires each federal lead agency under NEPA, or FSA in this case, to identify mitigation tracking mechanisms, commitments for any mitigation proposed; responsibility for implementation particularly if shared, reasonably foreseeable circumstances regarding anticipated or projected funding availability to implement mitigation commitments; and the identification of any outside entities that may be responsible for assisting the lead agency through financial or other

means to implement the committed mitigations. In BCAP, the lead agency under NEPA is FSA with technical support provided by the USDA Rural Development, APHIS, the Forest Service (FS), and the NRCS, as described in the Final PEIS (USDA FSA 2010). FSA will have primary responsibility for implementation and tracking of the mitigation and monitoring program. FSA has signed a Memorandum of Understanding (MOU) with NRCS to provide BCAP technical assistance for producers on an individual contract basis. FSA will ensure each producer complies with existing requirements of BCAP including completion of the Environmental Screening worksheet, completion of a mandatory site-specific Conservation Plan with appropriate BMPs and/or NRCS CPS, as adopted by FSA for the BCAP. Based on comments received on the Draft EA and to ensure the best possible results for this mitigation and monitoring plan, FSA will sign a MOU with the Project Sponsor defining roles and responsibilities in implementing this Mitigation and Monitoring Plan. The Project Sponsor will provide the appropriate financial assistance associated with implementation of the monitoring program to assess the effectiveness of mitigation and provide financial assistance for any eradication efforts outside of the intentionally planted areas. The Project Sponsor will continue the Mitigation and Monitoring Plan through the life of the contract between the producer and the Project Sponsor, which can be renewed in perpetuity.

Based on the comments submitted on the Draft EA, in consultation with NRCS and ARS, FSA has developed a mitigation and monitoring plan that will be applied to this BCAP project. Additionally, FSA is aware of on-going research for giant miscanthus; however, publication of some of those results has not yet been provided. FSA will continually review and monitor newly developed and available data for inclusion into the mitigation and monitoring plan within this BCAP project area annually. **Table 6-1** summarizes the responsible party for different mitigation and monitoring activities per this plan.

Table 6-1. Roles and Responsibilities for the Mitigation and Monitoring Plan

Activity	Responsible Party	Comment
Biannual Producer meetings to discuss new developments in production, management, pest/disease treatment, and eradication.	Project Sponsor	Project Sponsor will coordinate with FSA, NRCS, ARS, and local extension as presenters as those parties are available.
New Producer orientation to discuss production methods, management activities, potential for spread of giant miscanthus, treatment methods, and responsibilities, pest/disease identification, treatment methods, and responsibilities, eradication methods, if necessary, and reporting requirements.	Project Sponsor	Project Sponsor will coordinate with FSA, NRCS, ARS, and local extension as presenters as those parties are available.
Producer Conservation Plans to include site specific best management practices (BMPs), which could included, but not be limited to, Natural Resources Conservation Services (NRCS) Conservation Practice Standards (CPS) and mitigation measures identified on the Environmental Evaluation CPA-52 for soil erosion, pesticide use and application, fertilizer use and application, and other areas for each specific site.	NRCS	
Monitoring program developed to identify spread of giant miscanthus outside of planted fields with notification provided to the FSA County Office, local Weed Control Board, and Project Sponsor as soon as possible after identification of the issue. Producer will eradicate the portion of the miscanthus that has moved outside of the edge of the field.	Producer	Project Sponsor will provide confirmation to FSA, ARS, and NRCS of eradication.
Once notified of spread of miscanthus referenced above, Project Sponsor will confirm with Producer that elimination has been completed. If Producer refuses or cannot treat the miscanthus growth, Project Sponsor will eliminate the portion that has spread beyond the field boundary. FSA and/or NRCS will make a site visit to ensure compliance.	Project Sponsor	Project Sponsor will provide confirmation to FSA, ARS, and NRCS of eradication.
Monitoring program developed to identify diseases and pests with notification provided to the Project Sponsor as soon as possible after identification of the issue. Producer will treat the disease or pest in the BCAP contract acres.	Producer	Project Sponsor will consult with FSA, NRCS, and ARS to ensure monitoring program is capturing the appropriate structured data that will facilitate accurate annual reporting.
Once notified of disease or pests referenced above, if Producer refuses or cannot treat for the disease or pest, Project Sponsor will treat the producer's BCAP contracted acres in the field and notify FSA and/or NRCS who shall make a site visit to ensure compliance.	Project Sponsor	
Monitoring program developed to monitor wildlife use or changes in use. Environmental Evaluation CPA-52 may need to be revised to capture changes and any new mitigation to be implemented.	Project Sponsor	This will require coordination. Project Sponsor will handle report and consult with FSA, NRCS, and ARS to ensure appropriate structured data is being collected that will facilitate accurate annual reporting.
Project Sponsor will verify that Producers will only establish giant miscanthus that (1) is Freedom variety and (2) has been incorporated into Georgia Crop Improvement Association Quality Assurance Program for Miscanthus.	Project Sponsor	
Data gathering to include (1) land use tracking (2) average and total size of enrolled fields (3) prior land use (4) rationale for land use change (4) spread of giant miscanthus outside of planted fields (5) any pests/diseases identification (6) the use of pesticides/herbicides to control unwanted spread of giant miscanthus or pests/diseases (6) BMP and CPS incorporated into field management, such as erosion control structures or materials, vegetative barriers, (7) fertilizer usage and application methods, and (8) cost data.	Project Sponsor	This will require coordination. Project Sponsor will handle report, and work with NRCS, ARS, FSA and local extension to improve data collection.

Activity	Responsible Party	Comment
Annual Report. Draft report summarizing information gathered immediately above and submit to the FSA and other agencies that would like the information such as the NRCS and ARS.	Project Sponsor	
Initiation of a seed sampling program to determine the on-going sterility of seeds produced from the BCAP acres within the project areas. The seed sampling program includes recommended actions, including halting harvesting of material from the field, additional testing to verify findings, additional testing to fields in the region, and an eradication plan for that field.	Project Sponsor	Project Sponsor intends to coordinate these activities with an independent third party and/or ARS
Exclusion of planting giant miscanthus on certain acreage within 400 m (approximately 1,300 feet) from any know *M. sinensis* or *M. sacchariflorus* to limit the potential for cross-pollination resulting in viable seed.	Project Sponsor	Will coordinate with NRCS Conservation Plan efforts.
Exclusion of planting giant miscanthus on certain acreage within the project areas, depending upon certain site-specific conditions. This is beyond the Conservation Plan and will also consider economics and other considerations.	Project Sponsor	Will coordinate with NRCS Conservation Plan efforts

6.3 MITIGATION AND MONITORING RECOMMENDATIONS

General mitigation and monitoring recommendations for BCAP, as a national program with numerous feedstock options, were detailed in the Final PEIS including common BMPs to address potential adverse impacts of energy crop establishment. Examples of the common BMPs include conservation buffers strips, avoiding the primary nesting season to protect grassland bird populations, and work window avoidance for energy crop establishment to avoid establishment during high precipitation or rainfall events.

6.3.1 Purpose and Overview

The purpose of this mitigation and monitoring plan is to provide project-specific mitigation measures that FSA is proposing to implement as part of the approval of the proposed BCAP project area. An inherent part of that process includes a site-specific environmental review by FSA through the use of an Environmental Screening worksheet to determine whether environmentally sensitive resources such as Federally threatened or endangered species or wetlands are present and could be potentially affected. Where possible, implementation of appropriate BMPs and/or CPS identified during the conservation planning process would mitigate or reduce any potential environmental impacts on key resources addressed within the scope of this EA. In the event sensitive resources have the potential to be present, FSA will be the lead agency in conducting any and all appropriate consultations with the resource regulatory agencies such as the USFWS, U.S. Army Corps of Engineers (USACE), and State Historic Preservation Offices (SHPO).

In general, potential environmental impacts associated with establishment and cultivation of giant miscanthus as proposed by the Project Sponsor are likely to be temporary in nature and variable in scale from local to regional depending on existing characteristics of the individual producer's total land acreage being enrolled, their current land use, the surrounding mix of agricultural uses in each of the four proposed project areas, and the year in the growth. Potential localized impacts are more likely to be in areas where the average farm size or the portion of total land holdings an individual producer is enrolling in the project area is small. In areas with large farm sizes and/or large portions of total land holdings are enrolled, impacts could be more regional in nature; potential impacts are also likely to vary by current land use. Impacts will be less where cropped lands are currently in traditional row crops and potentially greater where lands are currently idle or in pastureland then converted into giant miscanthus. Potential impacts are also likely to vary depending on the surrounding character of farmland; areas dominated by a single agricultural use (e.g., corn or soybeans) that have a large proportion of land converted to BCAP may have greater impacts than regions dominated by a variety of agricultural uses where land conversions to BCAP cover a smaller area. Finally, impacts are likely to vary by phases of the growth cycle. Establishment may have greater impacts than maintenance related to soil erosion and loss, water quality and quantity impacts, and herbicide application for weed control.

All proposed site-specific mitigation measures will rely on adaptive management and monitoring to ensure that proposed mitigation commitments are met, and, in the event they do not prevent the intended potential impacts, that additional corrective measures are implemented to rectify the situation as required by the recent CEQ guidance (CEQ 2011). Adaptive management and monitoring is also useful for assessing the effectiveness of particular mitigation actions and addressing any uncertainty regarding whether a proposed method of mitigation is likely to address the intended potential environmental impact. All mitigation and monitoring will also follow the USDA NRCS Technical Note No. 4 *Planting and Managing Giant Miscanthus as a Biomass Energy Crop.*

6.3.2 Meetings with Contract Producers

The Project Sponsor shall hold regional meetings with the BCAP contract producers within the proposed project areas at least twice per year. These meetings will be used to disseminate information of interest to the producers and will also be used to provide information and resources regarding the latest recommendations and developments in the use of appropriate approved fertilizer, the control of pests and disease, erosion control,

control options in the event of a potential spread of giant miscanthus, and other related topics. Additionally, new enrollees will be required to attend an orientation meeting, which will include training similar to the information presented at the biannual meetings with greater focus on the overall basics of establishment, maintenance, and production. The implementation of the actions contained in this section would be required of the producers.

6.3.3 Socioeconomics

The proposed project has the potential to impact socioeconomics by converting land currently enrolled in food crops to energy crops. Potential impacts are expected to be mitigated by minimizing the land conversion of food crops to energy crops and when that conversion does occur, focusing on the marginally productive lands currently in food crop production. The Project Sponsor has worked with FSA, the USDA Agricultural Research Service (ARS), and NRCS to develop appropriate metrics for tracking conversion of lands currently enrolled in food production and tracking documentation of their productive status.

- **Contract Producer Application Forms** - The Project Sponsor will develop an application form that documents the prior use of enrolled land (e.g., cropland, idle cropland, pasture, hayland, or previously harvested forestland or timberland) and the reason the applicant wishes to convert to giant miscanthus production. If the applicant identifies current land use as cropland for food production, additional questions will provide insight into the economic rationale for the desired conversion (e.g., marginally productive cropland).
- **Contract Producer Annual Report and Project Area Annual Reporting** – Annual reporting to FSA will include the number of producers that enrolled, average and total enrolled field size, their prior land use, rationale for applying, and a summary of economic rationales where appropriate. After review of the annual reporting effort, FSA will determine whether an unexpectedly high proportion of food crop acres may be converted, the rationale, and whether restrictions on land conversion may be necessary as part of adaptive management and monitoring to mitigate potential environmental impacts.

6.3.4 Land Use

Potential impacts on land use may include conversion of land use types such as the conversion from traditional row crops to giant miscanthus as discussed above or the conversion of idle land, pastureland, hayland, or previously harvested forestland or

timberland into giant miscanthus. The BCAP program does not allow conversion of native sod into BCAP; therefore, areas meeting this definition were excluded from this analysis because they will not be eligible for enrollment. Potential mitigation measures as discussed above for tracking the conversion of land types and their productive status are also expected to mitigate potential adverse impacts on land change. If adaptive monitoring indicates large-scale or regional land use conversions are both occurring, and are having a negative effect, then additional restrictions on land use conversion will be considered and implemented. Annual reporting to FSA following the methods described above in Section 6.3.1 will also be used to monitor any potentially unexpected changes in land use. In the event any unexpected changes in land use are detected, FSA will determine whether additional requirements are necessary to mitigate potential environmental impacts on land use.

6.3.5 Biological Resources

6.3.5.1 Vegetation

A potential impact of giant miscanthus establishment relates to the potential for fertile seed production and the potential to spread beyond the intended acres. All published research, including detailed genetic studies of giant miscanthus, indicate it is a sterile triploid (i.e., meaning three sets of genetic material) hybrid that reproduces vegetatively through rhizomes and does not produce sterile seed (Linde-Laursen 1993, Lewandowski et al. 2000). The New Zealand Environmental Risk Management Authority (NZERMA) approved giant miscanthus for use as a biomass feedstock in 2007 after an extensive process of literature review, risk assessment methodology, and contact with researchers (NZERMA 2007). The NZERMA concluded, through literature and contact with researchers, that giant miscanthus is a triploid hybrid that does not produce seed or viable pollen; however, it will produce inflorescences in warmer climates (NZERMA 2007).

- **Exclusion of Acreage Near Other *Miscanthus* Species** - As to seed dispersal, the Project Sponsor would take steps necessary to minimize the unintentional development of viable seed from giant miscanthus. The Project Sponsor would be willing to exclude acreage within 400 m (approximately 1,300 feet) from any known *M. sinensis* or *M. sacchariflorus* to limit the potential for cross-pollination resulting in viable seed. This distance is the maximum distance observed in Quinn et al. 2011. As noted in Section 3.4.1.2.1, *M. sinensis* distribution has been located in Echols County, Georgia and Beaufort, Craven, Harnett, Lee, Moore, Nash, and Scotland counties in North Carolina. The Project Sponsor is fully aware of potential for this

parent species to occur near potential contract acreage; however, the Project Sponsor would fully screen all contract acreage to ensure that the exclusion buffer exists and would be maintained prior to the acceptance of the acres by the Project Sponsor.

- **Seed Sampling Program** – Based recommendations of ARS, a seed sampling program will be undertaken by the Project Sponsor to determine if the Freedom giant miscanthus being used within the proposed project areas could produce viable seed. Seed samples at a rate of 50 to 100 inflorescences from four samples in each proposed project area would be provided to either a third party verification or ARS to determine the viability of the seeds. Samples would be taken to represent a range of environmental variability, such as land positions, slope, soil moisture, soil types, etc. If viable seed are found through the seed sampling program these additional steps could be undertaken, which include (1) halting any harvest of the identified field with no off-site movement of any material harvested from that field, (2) immediate removal of existing inflorescences in the field that was found to contain viable seeds, (3) resampling of those inflorescences at a greater rate to determine an approximate percent of inflorescences that produced viable seeds, (4) sampling of fields in the immediate region to determine if additional viable seed is occurring, (5) a commitment by the project sponsor to recommend eradication of that field, if it is determined that the percentage of viability is outside a safe range.

- **Quality Assurance Program overseen by Georgia Crop Improvement Association -** Participation in the Georgia Crop Improvement Association's (GCIA) Quality Assurance Program is voluntary and illustrates a company's efforts to use effective quality control in rhizome production and marketing. The services and records generated under this system provide quality assurance for every customer. This program provides an unbiased quality control system of the items described below and rhizomes carrying the purple registered tag or blue certified tag have met the minimum standards set out by the GCIA for Miscanthus. This Quality Assurance Plan is based on dual certification of (1) the rhizome stock and (2) the producer acreage.

  At the plant material level, the Project Sponsor has developed foundation stock per the standards of the GCIA from breeder stock obtained from the original plant breeder, which is a patent-pending variety of giant miscanthus. The Project Sponsor

follows all appropriate protocols as set forth by the GCIA, which includes on-going field inspections at a rate of three to four times per year by the GCIA. From the foundation stock, the Project Sponsor has the ability to supply registered stock or certified stock to producers. Certified stock does not allow for the sale or movement of rhizomes from the designated acreage.

Registered and certified stock can only be produced in fields that have been field verified by the GCIA as having the ability to be registered or certified. Each producer must submit an application to the GCIA and receive appropriate designation of their fields prior to any rhizomes being planted by the Project Sponsor. Producers are subject to on-going field inspections and their field can be decertified, if field conditions do not meet the standards set forth by the GCIA. Producers must be under a continual maintenance plan with the GCIA to ensure that their fields remain in their appropriate designation.

Other specific quality control items include field inspections, botanical description and origin confirmation, field history, agreed distance from other miscanthus varieties, the proper cleaning and storage of equipment, head sample collection to test for viability, and proper record keeping of all of the above with an agreement to inspections without notice.

Another potential impact of giant miscanthus plantings is the potential for spread or invasion in areas that are not intentionally planted or propagated. Based on numerous published studies, the likelihood of rapid growth in intentionally planted areas or invasion to areas where giant miscanthus has not been deliberately planted appears low. For example, weed risk assessments conducted on giant miscanthus compared to other potential bioenergy crops such as giant reed, switchgrass, *Eucalyptus* species, and *Jatropha* (i.e., a deciduous succulent plant) have concluded the risk of invasiveness in the United States is low (Barney and DiTomaso 2008, Gordon et al. 2011).

Published research studies have shown a slow growth rate of intentionally planted giant miscanthus rhizomes of approximately five cm per year (approximately two inches) in Europe (Jørgensen 2011), but those studies focused on rhizome growth from deliberately planted giant miscanthus, which is an expected characteristic in deliberately planted areas and not consistent with an invasion. Unpublished data provided by ARS indicates giant miscanthus tillers and rhizomes have a potential maximum rate of growth in Illinois from established plants of 1.2 meters (m) per year (approximately four feet) (Davis, unpublished

data, 2011). In the event, giant miscanthus does escape, eradication studies indicate spring tillage followed by glyphosate application was successful in eliminating 95 percent of aboveground biomass after the first application (Anderson et al. 2011).

Another potential, but secondary impact, is the potential for giant miscanthus plantings to provide an additional host plant for crop pests such as the western corn rootworm. Results of a recent greenhouse and field study showed that planted giant miscanthus may support emergence of western corn rootworm eggs, although emergence on giant miscanthus was reduced compared to corn in field studies (Spencer and Raghu 2009).

The Project Sponsor will rely on a tiered approach coupled with adaptive management to monitor and manage any potential spread of giant miscanthus.

- **Contract Producer Trainings** - The Project Sponsor will coordinate biannual producer community trainings and resource sessions with local extension and TSPs to provide specific training on identification of western corn rootworm incidents.
- **Equipment Sanitizing** – As part of the agreement with the GCIA for quality assurance the Project Sponsor and contract producer would agree that all equipment will be power-washed in the field to ensure that no unintentional release of rhizomes would occur during or after transport of live rhizomes. All rhizomes would be contained within closed shipping containers for any shipments that leave a property destined for any other location.
- **Monitoring of Buffer Areas by Contract Producers-** The first tier will rely on individual producers to monitor and report any detections of giant miscanthus spread beyond a specified monitoring buffer outside the planted areas. The Project Sponsor have indicated that typical fields have an existing buffer of woody vegetation or other areas that are not actively planted up to the fence or property line, so a monitoring buffer of a minimum width beyond the planted areas with maximum buffer width determined by site-specific conditions as determined within the mandatory site-specific Conservation Plan, these buffers will be monitored every other year, at a minimum.
- **Minimum Setback/Buffer Distance** - Although published data on the maximum rate of giant miscanthus rhizome spread indicates five cm per year (two inches) may be expected, the FSA, in consultation with both NRCS and ARS, have elected to implement the following setbacks for giant miscanthus with the purpose of the

setback/buffer being to manage the giant miscanthus stand to prevent unintentional spread. The contract producer would follow all local, State, and/or Federal regulations for containment of biomass plantings in existence at the time of the development of the producer's mandatory site-specific Conservation Plan or through an amendment of the mandatory site-specific Conservation Plan initiated by the producer and approved by FSA and NRCS, if determined appropriate for the site-specific conditions. If no such guidance exists, minimum procedures to prevent unintentional spread of giant miscanthus shall include:

  - Establish or maintain a minimum 25 feet of setback/buffer around a giant miscanthus stand, unless the field is adjacent to existing cropland or actively managed pasture with the same producer.
  - Setback/buffer areas may be planted to an annual row crop such as corn or soybeans; may be planted to a site-adapted, perennial cool-season or warm season forage or turf grass; may be kept in existing vegetation, or kept clear by disking, rotovating, or treating with a non-selective burn down herbicide at least once a year. The method used may be dependent on slope and the potential for erosion.

- **Action if Unintentional Spread is Identified** - In the event that giant miscanthus is detected within the field monitoring buffer, each enrolled producer will be contractually obligated to report this to the Project Sponsor, along with their plans for control and eradication. In the event the producer is unable or unwilling to implement control efforts, a second tier will be followed, whereby the Project Sponsor assume responsibility for applying chemical control on the producer's acres enrolled under BCAP and will subsequently deduct the associated cost from the producer's yield payment as described in the producer's enrollment contract. All chemical treatment applications would be applied during proper environmental conditions under the supervision of a licensed or trained pesticide applicator consistent with Federal and State guidelines.

- **Contract Producer Annual Report and Project Area Annual Reporting** – Beginning in year two after the first monitoring cycle is complete, annual monitoring reports will include the number of producers where potential giant miscanthus spreads were documented, the distance detected from areas planted, years since planting, and any additional structured data determined appropriate by ARS as

continual monitoring occurs. FSA, NRCS, ARS, and the Project Sponsor will evaluate data on the potential spread of giant miscanthus and determine whether additional adaptive monitoring and management is required to mitigate potential environmental impacts.

- **Long-Term Eradication Strategy** - At the end of the project contract or at the termination of the contract between the producer and the Project Sponsor, the producer contracts would allow for either party, the producer or Project Sponsor, to eradicate giant miscanthus within the contracted acres at the termination of the contract.

To address potential crop pest and disease outbreaks such as the western corn rootworm, an IPM Plan will be developed as part of each producer's mandatory site-specific Conservation Plan. The biannual producer community meetings will include updates on any new or emerging pests or diseases to assist in early detection and reporting for effective treatment. The IPM Plan will also follow a tiered approach, similar to that described above for detection of potential vegetative spread.

- **Monitoring of Buffer Areas by Contract Producers** - In the first tier, producers will be required to annually survey their fields for potential pest and disease outbreaks.
- **Contract Producer Treatment of Pest and Diseases** - In the event that pests or diseases are detected, the producer will be contractually obligated to notify the Project Sponsor and to treat or control the pest or disease on the producer's acres enrolled under BCAP.
- **Project Sponsor Treatment of Pest and Diseases** - In the event that the producer is unable or unwilling to control and treat the pest or disease, the second tier approach will be for the Project Sponsor to assume responsibility to treat the affected producer's acres enrolled under the BCAP program and to deduct any costs from the producer's yield payment that will be described in the producer's contract. Courtesy notification of immediately adjacent land owners would also be required. All chemical treatment applications would be applied during proper environmental conditions under the supervision of a licensed or trained pesticide applicator consistent with Federal and State guidelines.

6.3.5.2 Wildlife

Potential impacts on wildlife and biodiversity would include habitat loss associated with conversion of lands currently idle, in pasture, in hay, or from previously harvested forestland or timberland to giant miscanthus; reduced winter cover and food supplies on lands currently enrolled in row crops; impacts on nesting grassland bird populations; and additional habitat fragmentation in areas where field sizes are larger and more contiguous. Potential impacts due to habitat loss are expected to be mitigated using similar measures as described above to assess land use change to track and document the current status of any land converted to giant miscanthus under BCAP. The relatively low residual height left after harvesting giant miscanthus may reduce winter cover and affect nesting conditions for grassland birds such as northern bobwhites (*Colinus virginianus*), eastern meadowlarks (*Sturnella magna*), and grasshopper sparrows (*Ammodramus savannarum*). Finally, conversion of larger areas dominated by a single land use type (i.e., idle land, pastureland, or hayland) may have proportionally larger impacts on habitat fragmentation in project areas.

- **Monitoring of Buffer Areas and Fields by Contract Producers** - Mitigation measures will primarily focus on monitoring the conversion of winter cover and food sources for wildlife as a result of reduced residual or crop stubble height after harvest.

- **Contract Producer Annual Report and Project Area Annual Reporting** – As part of the enrollment process, individual producers will be asked to report any incidental data (e.g., casual observation, hunting data, or supplemental feeding data) or existing systematic data (i.e., agency counts or surveys) on wildlife winter cover and food use. Annual reporting will include the incidental or existing systematic data on wildlife use of winter cover or food use from any of the same data sources along with reported residual and stubble height on each field after harvest. In the event that unexpected significant changes in wildlife winter cover or winter food sources are detected, FSA will work with NRCS and the Project Sponsor and appropriate State fish and wildlife agencies to determine additional agreed upon mitigation measures to offset potentially significant impacts and how to monitor those agreed upon measures.

6.3.5.3 Protected Species

Potential impacts on protected species, such as Federally threatened or endangered species are possible in those areas where Critical Habitat has been designated, suitable habitat exists within the documented range of the species, or known records have been documented. Additionally, state-listed, protected, or tribal-listed species will be analyzed for potential impacts, as well. Compliance with existing regulations, including the Endangered Species Act, will be accomplished with the assistance of NRCS through the Environmental Screening worksheet and subsequent resource agency consultation, if deemed necessary, with FSA being the lead agency.

- **Contract Producer Conservation Plans** - Mitigation measures will follow a tiered structure whereby individual producers who enroll land in close proximity to sensitive habitat such as streams, wetlands, or riparian zones are required to implement additional BMPs and/or NRCS CPS as part of their mandatory site-specific Conservation Plan and potentially work with FSA to complete appropriate resource agency consultations, if necessary. Such a tiered approach is expected to be used throughout the monitoring program to ensure additional measures are taken when sensitive resources are present or in close proximity. Potential examples of BMPs for these areas would include buffers to maintain specific planting distances, conservation buffer strips or plantings, silt fencing or other erosion control measures, potential application of no-till establishment methods to address sedimentation impacts, and use of appropriately labeled herbicides and/or pesticides to protect aquatic or other sensitive species.

6.3.6 Soil Resources

Potential impacts on soil resources may include soil erosion and loss as a result of field preparation and planting in giant miscanthus. Compared to land currently in traditional row crops, potential soil erosion and loss is expected to be temporary and short-term, primarily associated with the establishment phase compared to more intensive annually tilled crops. Compared to land currently idle or in pasture or hay, potential soil erosion and loss may be slightly higher but still temporary and short-term associated with establishment. Regardless of current land use, long-term benefits of soil retention with established rhizomes and carbon soil sequestration towards the middle of the 15-year maintenance period on enrolled fields are expected to off-set temporary and short-term increases in soil erosion and loss that may also be associated with reduced carbon sequestration.

Mitigation will include a tiered structure that uses BMPs associated with no-till planting methods for proposed project areas in close proximity to sensitive habitats such as streams, wetlands, or other water bodies.

- **Contract Producer Conservation Plans** - Specific mitigation requirements will be developed for each producer and included in the producer's mandatory site-specific Conservation Plan in conjunction with BMPs and/or existing NRCS CPS, applicable to the individual site. It is expected that mitigation will be consistent with the BMPS and/or NRCS CPS on management of soil erosion, including the guidelines on management within high concentration flow areas and HEL.
- **Contract Producer Annual Report and Project Area Annual Reporting** – The Project Sponsor will collect information regarding the BMPs and/or NRCS CPS that are being applied by each producer and will include that information in annual reports.

Adaptive monitoring and management is expected to be used to track the effectiveness of carbon sequestration over the life of a given giant miscanthus planting (i.e., up to 15 years). In addition to the analyses performed, the Project Sponsor anticipates selling carbon credits, or similar type credits, from the sequestration benefits. However, carbon credit sales would not occur until such a time that the market for carbon credits becomes more wide-spread and the effectiveness of carbon sequestration from Freedom giant miscanthus has been documented in the proposed project areas or through other field trials.

6.3.7 Water Quality and Quantity

6.3.7.1 Water Quality

Potential impacts on water quality include short-term and temporary increases in nutrient and fertilizer runoff during establishment and monitoring. Compared to land currently in traditional row crops, conversion to giant miscanthus is expected to result in less nutrient and fertilizer runoff. Compared to land currently idle or in pasture or hay, conversion to giant miscanthus may result in slight but short-term and temporary increases in nutrient and fertilizer runoff. In general, fertilizer application is only recommended at a site-specific level based on soil testing recommendations. However, long-term declines in nutrient loss (i.e., phosphorus and nitrogen) during the maintenance period (years three to 15) are likely to off-set temporary and short-term increases in nutrient leaching or runoff. The anticipated

fertilizer application rate is also expected to be substantially lower compared to traditional row crops, but may be higher than idle or pasture or hay land.

- **Contract Producer Conservation Plans** - Potential impacts to water quality will be mitigated through the development of the mandatory site-specific Conservation Plans for each producer based on existing BMPs and/or NRCS CPS or newer variants that may be developed specifically for BCAP, as adopted by FSA. The less frequent application of fertilizer compared to traditional crops will further reduce potential impacts on water quality due to runoff.
- **Contract Producer Trainings** - The Project Sponsor will include training and resources on soil testing and fertilizer amendments to minimize unnecessary additions during their biannual producer community meetings.
- **Contract Producer Annual Report and Project Area Annual Reporting** – Annual reporting will include the rate, type, frequency, and cost of fertilizer application on a per acre basis for each field enrolled. In the event that FSA determines potential water quality impacts are not being appropriately mitigated, FSA and the Project Sponsor will work with the producer cooperatives to provide further training to implement BMPs to minimize unnecessary inputs.

6.3.7.2 Water Quantity

Potential impacts on water quantity may arise from surface or groundwater supply depletion if giant miscanthus increases the amount of water withdrawal relative to current land uses (traditional row crops or idle, pasture, hayland, or previously harvested forestland or timberland). Giant miscanthus is expected to be able to attain all the required water for the growing season from within the rooting zone of the plant and should not require irrigation. Giant miscanthus plantings should have either no change to the amount irrigated acres in the project areas or result in a net reduction in irrigated acres within the project areas; thereby, reducing irrigation water demand, since the acres would not be irrigated for giant miscanthus.

- **Contract Producer Conservation Plans** - Mitigation will include BMPs and/or existing NRCS CPS that minimize water use and will be incorporated into each producer's mandatory site-specific Conservation Plan.

- **Contract Producer Annual Report and Project Area Annual Reporting** – Annual reporting will include the total number of producers enrolled in each project area, the BMPs or existing NRCS CPS utilized, and their average and total yield per field enrolled.

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8 PREPARERS

Name	Organization	Experience	Project Role
Phillip Jennings, COO	REPREVE Renewables, LLC	31 years	Project Review and Methodology Oversight
Jay Brinson, Sales Manager	REPREVE Renewables, LLC	11 years	Project Review and Technical Oversight
Craig Patterson, Manager Commercial Operations	REPREVE Renewables, LLC	17 years	Project Review and Technical Oversight
Rae Lynn Schneider M.P.P, Public Policy, Harvard University, 2001 B.S., Rangeland Ecology & Management, Texas A&M University, 1997	Integrated Environmental Solutions, LLC	10 years	Project Management, Project Review
Katelyn Kowalczyk B.S., Environmental Science, Stephen F. Austin State University, 2008	Integrated Environmental Solutions, LLC	2.5 years	Affected Environment, Environmental Consequences
Ransley Eberhart M.S., Geoarchaeology and GIS, University of North Texas, 2008 B.A., Anthropology, University of North Texas, 2002	Integrated Environmental Solutions, LLC	6 years	GIS Analysis and Map Generation

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9 PERSONS AND AGENCIES CONTACTED

9.1 TRIBAL CONSULTATION

This section has been added to the Final EA after reviewing comments received on the Draft EA concerning Tribal Consultation. FSA is committed to government-to-government consultation. FSA conducts these consultations in a regular and meaningful way that takes into account the comments and concerns of American Indian Tribal governments.

As part of this FSA's commitment and as required by EO 13175 "Consultation and Coordination with Indian Tribal Governments," FSA conducted two formal consultations with Tribal governments on BCAP prior to the publication of the final rule. Both of the Tribal consultations were conducted through teleconferences. All Federally recognized Tribes were invited to the first consultation, which was held on July 21, 2010. The Forest County Potawatomi Community requested a separate government-to-government consultation on BCAP, which was held on July 22, 2010. All comments from the government-to-government Tribal consultations were addressed in the final rule.

This proposed BCAP project is an action that does not have a "substantial direct effect on one or more Indian tribe" (Sec.1 (a) EO 13175). As such, no separate government-to-government consultations were deemed necessary for this project. The proposed locations that were analyzed in this Final EA do not encompass any Tribal lands as defined under 36 CFR 800.16(x).

Tribal members may own private lands which would be within the project area of this BCAP project and thus may be eligible to apply. These applicants would have the same rights and eligibility requirements as any private lands applicant.

Tribal consultation is required for any proposed federal action that may significantly affect the human environment according to NEPA Implementing Regulations (40 CFR 1500). EO 13175, *Consultation and Coordination with Indian Tribal Governments,* further described the obligation of federal agencies to coordinate and consult with federally recognized tribes for any proposed federal action that may affect significant cultural or historic resources to that tribe. The USDA released a department-wide Action Plan for Tribal Coordination and Consultation on February 3, 2010 in response to a memorandum from President Obama on November 5, 2009 that required effective tribal consultation in carrying out federal actions (USDA 2010). Agency-specific guidance has also been developed by the NRCS within USDA that provides the FSA with technical assistance in relation to environmental

compliance at the field or contract level on a state basis including tribal consultation (NRCS 2009).

Tribal consultation was initiated by FSA as part of the Final BCAP PEIS using a variety of teleconferences or follow up individual teleconferences if requested by individual tribes. FSA also initiated tribal consultation with three tribes based on the Final BCAP PEIS process, which included the Sac and Fox Nation of Oklahoma, Osage Nation of Oklahoma, and the Seneca Nation of New York. Each of these three tribes was provided with a copy of this Draft EA and invited to comment during the public comment period that opened on April 8, 2011 with the publication of the Draft EA in the Federal Register.

The Project Sponsor completed additional desktop reviews to support the Draft EA including a review of publicly available information on Indian lands, the Bureau of Indian Affairs (BIA) list of federally recognized tribes and their affiliations, and State Historic Preservation Office (SHPO) web sites for the four states within the proposed project areas. Based on a review of National Atlas data, there are no Indian reservations or Indian lands in any of the proposed project areas (National Atlas 2011). Based on a review of the BIA list of federally recognized tribes by state that was last updated on October 1, 2010, there is one federally recognized tribe currently living North Carolina but there are no tribes currently living in the other two states and none within the proposed project areas (BIA 2010). A review of the SHPO web sites for additional tribal information provided no additional data for Georgia and North Carolina, but the South Carolina State Historic Preservation Office provided a list of 16 tribes federally recognized tribes and seven state recognized tribes that have historical affiliation to the state (SCSHPO 2011). Any specific tribal concerns raised during the public comment period on the Draft EA will be further incorporated into the development of conservation plans to avoid and minimize such impacts as part of the overall environmental compliance program that NRCS will assist FSA with implementing for BCAP enrollees.

9.2 AGENCIES AND PERSONS CONTACTED

Name	Organization/Agency
Responsible Agency Officials	
Juan M. Garcia	Acting Deputy Administrator for Farm Programs, U.S. Department of Agriculture, Farm Service Agency, Washington D.C.
Kelly Novak	Associate Director, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division, Washington D.C.
Matthew T. Ponish	National Environmental Compliance Manager , U.S. Department of Agriculture, Farm Service Agency, Washington D.C.
Amy Braun	Natural Resource Specialist, U.S. Department of Agriculture, Farm Service Agency, Washington D.C.
Todd Atkinson	Senior Policy Advisor, U.S. Department of Agriculture, Farm Service Agency, Washington D.C.
Federal Agencies Contacted	
USDA, Agricultural Research Service	• Adam Davis, Ecologist, Global Change and Photosynthesis Research Unit, IL • Seth Dabney • Richard Lowrance, Research Ecologist, GA • John Sadler, Research Leader,, Cropping Systems and Water Quality Research Unit, MO
USDA, Animal Plant Health Inspection Service	• Neil Hoffman, Special Assistant to the Deputy Administrator
USDA, Forest Service	• Joseph Carbone, Assistant Director, Ecosystem Management Coordination - NEPA
USDA, Natural Resources Conservation Service	• Diane E. Gelbund, PhD, Special Assistant to the Chief for Strategic Natural Resource Issues • Philip Barbour, PhD, Wildlife Biologist • Meg Bishop, Landscape Ecologist, Environmental Compliance • Steve Brady, PhD, Team Leader, National Wildlife Technology Development Team • John Englert, National Plants Materials Specialist • Matt Harrington, National Environmental Coordinator • C. Wayne Honeycutt, PhD, Deputy Chief for Science and Technology • Norm Widman, National Agronomist
USDA, Rural Development	• Linda Rogers, Deputy Director, Program Support Staff

Name	Organization/Agency
U.S. Environmental Protection Agency	
Region 1	Washington, D.C.
Region 2	Boston, MA
Region 3	New York, NY
Region 4	Philadelphia, PA
Region 5	Atlanta, GA
Region 6	Chicago, IL
Region 7	Dallas, TX
Region 8	Kansas City, KS
Region 9	Denver, CO
Region 10	San Francisco, CA Seattle, WA
U.S. Fish and Wildlife Service	
Region 1	Portland, OR
Region 2	Albuquerque, NM
Region 3	Fort Snelling, MN
Region 4	Atlanta, GA
Region 5	Hadley, MA
Region 6	Denver, CO
Region 7	Anchorage, AK
Region 9	Washington, D.C.
State Agencies Contacted	
State of Georgia	• Gary Black, Commissioner, Georgia Department of Agriculture • Mark Williams, Commissioner, Georgia Department of Agriculture • Jill Stuckey, Director, Center of Innovation for Energy • Terry Hollifield, Executive director, Georgia Crop Improvement Association
State of North Carolina	• Steve Troxler, Commissioner, North Carolina Department of Agriculture and Community Services • Sam Brake, Director of Farming, Biofuels Center for North Carolina • Dee Freeman, North Carolina Department of Environment and Natural Resources • Ron Gehl, Assistant Professor and Extension Specialist, North Carolina State University
State of South Carolina	• John E. Frampton, Director, South Carolina Department of Natural Resources • Hugh Weathers, Commissioner, South Carolina Department of Agriculture • Tom French, Chairman, South Carolina Biomass Council
Political Officials	
State of Georgia	• The Honorable Johnny Isakson, US Senator • The Honorable Saxby Chambliss, US Senator • The Honorable John Barrow, US Representative • The Honorable Jack Kingston, US Representative

Name	Organization/Agency
State of North Carolina	• The Honorable Richard Burr, US Senator • The Honorable Kay Hagan, US Senator
State of South Carolina	• The Honorable Jim DeMint, US Senator • The Honorable Lindsey Graham, US Senator
State of Mississippi	• The Honorable Thad Cochran, US Senator
State of Alabama	• The Honorable Jeff Sessions, US Senator

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APPENDICES

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APPENDIX A – State-listed Species that Could Potentially Occur within the Proposed Project Areas

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Table A-2. State-listed Threatened and Endangered Species that Could Potentially Occur in Georgia

Category	Scientific Name	Common Name	T/E	Counties
Amphibians	*Ambystoma cingulatum*	Frosted Flatwoods Salamander	T	Ben Hill, Berrien, Burke, Charlton, Effingham, Emanuel, Evans, Irwin, Jeff Davis, Lanier, Long, Lowndes, Screven, Ware
	Notophthalmus perstriatus	Striped Newt	T	Berrien, Charlton, Emanuel, Evans, Irwin, Jenkins, Lanier, Long, Lowndes, Screven, Taylor, Ware, Wilcox
Birds	*Haliaeetus leucocephalus*	Bald Eagle	T	Appling, Baldwin, Bulloch, Coffee, Cook, Hancock, Harris, Heard, Jefferson, Lanier, Long, Lowndes, Macon, Talbot, Troup, Twiggs, Wilkinson
	Picoides borealis	Red-cockaded Woodpecker	E	Appling, Ben Hill, Brantley, Charlton, Effingham, Emanuel, Evans, Irwin, Jefferson, Laurens, Long, Meriwether, Montgomery, Putnam, Talbot, Tattnall, Upson, Ware, Washington, Wheeler, Wilcox
	Mycteria americana	Wood Stork	E	Brantley, Charlton, Jenkins, Long, Lowndes, Screven, Ware, Wayne
Fish	*Alosa alabamae*	Alabama Shad	T	Cook, Lowndes
	Cyprinella xaenura	Altamaha Shiner	T	Butts, Crawford, Jasper, Lamar, Putnam, Spalding
	Enneacanthus chaetodon	Blackbanded Sunfish	E	Berrien, Charlton, Ware
	Elassoma okatie	Bluebarred Pygmy Sunfish	E	Jefferson
	Percina crypta	Halloween Darter	T	Crawford, Meriwether, Pike, Talbot, Tayoe, Upson
	Moxostoma robustum	Robust Redhorse	E	Baldwin, Burke, Emanuel. Houston, Johnson, Laurens, Pulaski, Twiggs, Washington, Wilkinson
	Acipenser brevirostrum	Shortnose Sturgeon	E	Appling, Burke, Effingham, Jeff Davis, Long, Montgomery, Screven, Tattnall, Toombs, Wayne, Wheeler
Insect	*Cordulegaster sayi*	Say's Spiketail	T	Candler, Coffee, Effingham, Emanuel, Evans, Irwin, Tallnall, Toombs, Wayne
Invertebrates	*Alasmidonta arcula*	Altamaha Arcmussel	T	Appling, Ben Hill, Coffee, Jeff Davis, Laurens, Long, Montgomery, Tattnall, Telfair, Toombs, Wayne, Wheeler
	Elliptio spinosa	Altamaha Spinymussel	E	Appling, Coffee, Jeff Davis, Long, Montgomery, Tattnall, Telfair, Toombs, Wayne, Wheeler
	Fusconaia masoni	Atlantic Pigtoe	E	Bulloch, Burke, Glascock, Hancock, Jefferson, Jenkins, Screven, Washington
	Elliptio arctata	Delicate Spike	E	Crawford, Harris, Meriwether, Pike, Spalding, Talbot, Taylor, Upson, Wayne
	Amblema neislerii	Fat Threeridge	E	Macon
	Medionidus penicillatus	Gulf Moccasinshell	E	Harris, Meriwether, Pike, Spalding, Taylor
	Elliptio purpurella	Inflated Spike	T	Spalding, Taylor
	Procambarus gibbus	Muckalee Crayfish	T	Crawford
	Cambarus truncatus	Oconee Burrowing Crayfish	T	Laurens, Washington, Wilkinson
	Pleurobema pyriforme	Oval Pigtoe	E	Macon, Meriwether, Pike, Spalding, Taylor
	Cambarus harti	Piedmont Blue Burrower	E	Meriwether
	Elliptoideus sloatianus	Purple Bankclimber	T	Crawford, Harris, Macon, Spalding, Talbot, Taylor, Upson
	Anodontoides radiatus	Rayed Creekshell	T	Macon, Meriwether, Pike, Spalding, Upson

Category	Scientific Name	Common Name	T/E	Counties
	Toxolasma pullus	Savannah Lilliput	T	Burke, Jeff Davis, Long, Screven, Tattnall, Telfair, Wayne
	Hamiota subangulata	Shinyrayed Pocketbook	E	Crawford, Macon, Meriwether, Pike, Spalding, Taylor
	Alasmidonta triangulata	Southern Elktoe	E	Crawford, Macon, Meriwether, Pike, Spalding, Taylor, Upson
Mammals	*Puma concolor coryi*	Florida Panther	E	Bulloch, Evans, Troup
	Trichechus manatus	Manatee	E	Effingham
	Neofiber alleni	Round-tailed Muskrat	T	Brantley, Charlton, Ware
	Geomys pinetis	Southeastern Pocket Gopher	T	Emanuel, Jefferson, Jenkins, Laurens, Screven, Tattnall, Taylor, Telfair
Reptiles	*Macrochelys temminckii*	Alligator Snapping Turtle	T	Cook, Crawford, Echols, Lanier, Lowndes, Pike, Taylor, Upson
	Graptemys barbouri	Barbour's Map Turtle	T	Crawford, Macon, Meriwether, Pike, Talbot, Taylor, Upson
	Drymarchon couperi	Eastern Indigo Snake	T	Appling, Atkinson, Bacon, Ben Hill, Berrien, Brantley, Bulloch, Candler, Charlton, Clinch, Coffee, Cook, Echols, Effingham, Emanuel, Evans, Irwin, Jeff Davis, Lanier, Long, Lowndes, Pierce, Tattnall, Telfair, Toombs, Ware, Wayne, Wheeler, Wilcox
	Gopherus polyphemus	Gopher Tortoise	T	Appling, Atkinson, Ben Hill, Berrien, Brantley, Bulloch, Candler, Charlton, Clinch, Coffee, Cook, Dodge, Effingham, Emanuel, Evans, Glascock, Irwin, Jefferson, Jeff Davis, Lanier, Long, Lowndes, Montgomery, Pierce, Talbot, Tattnall, Taylor, Telfair, Toombs, Ware, Wayne, Washington, Wheeler, Wilcox
	Heterodon simus	Southern Hognose Snake	T	Ben Hill, Bleckley, Bulloch, Burke, Coffee, Effingham, Glascock, Houston, Irwin, Jeff Davis, Jefferson, Jenkins, Johnson, Long, Macon, Peach, Pulaski, Screven, Talbot, Tattnall, Taylor, Wilcox
Plants	*Matelea alabamensis*	Alabama Milkvine	T	Wayne
	Berberis canadensis	American Barberry	E	Harris, Meriwether
	Schisandra glabra	Bay Star-vine	T	Heard, Troup, Washington
	Isoetes melanospora	Black-spored Quillwort	E	Butts, Heard
	Oxypolis canbyi	Canby Dropwort	E	Butts, Jenkins, Screven
	Kalmia carolina	Carolina Bog Laurel	T	Taylor
	Schwalbea americana	Chaffseed	E	Pike, Upson
	Pinguicula primuliflora	Clearwater Butterwort	T	Taylor
	Pteroglossaspis ecristata	Crestless Plume Orchid	T	Berrien, Brantley, Charlton, Irwin, Long, Tattnall, Tift
	Croomia pauciflora	Croomia	T	Crawford, Harris, Talbot, Taylor
	Eriocaulon koernickianum	Dwarf Hatpins	E	Hancock, Meriwether
	Fothergilla gardenii	Dwarf Witch-alder	T	Brantley, Candler, Emanuel, Long, Macon, Tattnall, Taylor, Ware, Wayne
	Salix floridana	Florida Willow	E	Dodge, Pulaski, Wilcox
	Silene polypetala	Fringed Campion	E	Crawford, Houston, Talbot, Taylor, Twiggs, Upson
	Symphyotrichum georgianum	Georgia Aster	T	Houston

Category	Scientific Name	Common Name	T/E	Counties
	Elliottia racemosa	Georgia Plume	T	Atkinson, Ben Hill, Bulloch, Burke, Candler, Coffee, Emanuel, Evans, Irwin, Jeff Davis, Jenkins, Long, Tattnall, Telfair, Wheeler
	Arabis georgiana	Georgia Rockcress	T	Harris
	Sarracenia oreophila	Green Pitcherplant	E	Crawford, Taylor, Upson
	Baptisia arachnifera	Hairy Rattleweed	E	Brantley, Wayne
	Ptilimnium nodosum	Harperella	E	Putnam
	Cuscuta harperi	Harper's Dodder	E	Heard, Washington
	Hartwrightia floridana	Hartwrightia	T	Brantley, Charlton, Ware
	Macranthera flammea	Hummingbird Flower	T	Ben Hill, Emanuel, Evans, Johnson, Tattnall, Treutlen, Wilcox
	Cypripedium kentuckiense	Kentucky Ladyslipper	E	Laurens, Wilkinson
	Rudbeckia heliopsidis	Little River Black-eyed Susan	T	Harris
	Asplenium heteroresiliens	Marl Spleenwort	T	Bleckley
	Isoetes tegetiformans	Mat-forming Quillwort	E	Hancock, Putnam
	Sedum nevii	Nevius Stonecrop	T	Harris
	Scutellaria ocmulgee	Ocmulgee Skullcap	T	Ben Hill, Bleckley, Burke, Houston, Laurens, Telfair, Treutlen, Twiggs, Wheeler, Wilcox
	Morella inodora	Odorless Bayberry	T	Brantley
	Quercus oglethorpensis	Oglethorpe Oak	T	Jasper, Putnam
	Calamintha ashei	Ohoopee Wild Basil	T	Candler, Tattnall
	Sarracenia psittacina	Parrot Pitcherplant	T	Bacon, Ben Hill, Berrien, Bulloch, Candler, Charlton, Clinch, Coffee, Cook, Emanuel, Irwin, Jeff Davis, Lanier, Telfair, Tift, Toombs, Ware, Wilcox
	Stylisma pickeringii var. pickeringii	Pickering's Morning-glory	T	Jenkins, Talbot, Tattnall, Taylor, Toombs
	Rhododendron prunifolium	Plumleaf Azalea	T	Harris
	Lindera melissifolia	Pond Spicebush	E	Effingham, Screven, Taylor, Wheeler
	Amphianthus pusillus	Pool Sprite	T	Butts, Hancock, Harris, Heard, Meriwether, Pike, Putnam
	Sarracenia purpurea	Purple Pitcherplant	E	Evans, Tattnall, Tift, Toombs
	Trillium reliquum	Relict Trillium	E	Bleckley, Harris, Houston, Jasper, Laurens, Macon, Talbot, Taylor, Twiggs, Upson, Wilkinson
	Astragalus michauxii	Sandhill Milk-vetch	T	Bleckley, Bulloch, Burke, Candler, Dodge, Emanuel, Jenkins, Laurens, Screven, Tattnall, Washington
	Ceratiola ericoides	Sandhill Rosemary	T	Burke, Candler, Emanuel, Tattnall, Toombs, Wheeler
	Hymenocallis coronaria	Shoals Spiderlily	T	Harris, Talbot, Upson

Category	Scientific Name	Common Name	T/E	Counties
	Rhynchospora solitaria	Solitary Beakrush	E	Irwin, Tift
	Sarracenia rubra	Sweet Pitcherplant	T	Bulloch, Burke, Candler, Crawford, Emanuel, Jefferson, Macon, Peach, Talbot, Tattnall, Taylor, Toombs, Twiggs, Wheeler
	Crataegus triflora	Three-flowered Hawthorn	T	Houston

Table A-3. State-listed Threatened and Endangered Species that Could Potentially Occur in North Carolina

Category	Scientific Name	Common Name	T/E	Counties
Amphibian	*Rana capito*	Carolina Gopher Frog	ST	Belfort, Bladen, Brunswick, Hoke, Jones, New Hanover, Onslow, Pender, Robeson, Sampson, Scotland
	Ambystoma tigrinum	Eastern Tiger Salamander	ST	Cumberland, Hoke, Richmond, Robeson, Scotland
Bird	*Haliaeetus leucocephalus*	Bald Eagle	ST	Belfort, Bladen, Brunswick, Columbus, Craven, Edgecombe, Harnett, Johnston, Jones, Lee, Lenoir, Martin, Montgomery, Nash, New Hanover, Onslow, Pamlico, Pender, Pitt, Richmond, Wayne
	Gelochelidon nilotica	Gull-billed Tern	ST	Brunswick, New Hanover, Onslow
	Falco peregrinus	Peregrine Falcon	SE	Brunswick
	Charadrius melodus	Piping Plover	ST	Brunswick, New Hanover, Onslow, Pender
	Picoides borealis	Red-cockaded Woodpecker	SE	Beaufort, Bladen, Brunswick, Columbus, Craven, Duplin, Edgecombe, Green, Harnett, Hoke, Johnston, Jones, Lee, Lenoir, Montgomery, Moore, Nash ,New Hanover, Onslow, Pamlico, Pender, Pitt, Richmond, Robeson, Sampson, Scotland, Wayne, Wilson
	Mycteria americana	Wood Stork	SE	Brunswick, Columbus, Sampson
Fish	*Notropis bifrenatus*	Bridle Shiner	SE	Craven, Jones
	Notropis mekistocholas	Cape Fear Shiner	SE	Harnett, Lee, Moore
	Noturus furiosus	Carolina Madtom	ST	Craven, Edgecombe, Greene, Johnston, Jones Lenoir, Nash, Pitt, Wayne, Wilson
	Elassoma boehlkei	Carolina Pygmy Sunfish	ST	Brunswick, Columbus
	Moxostoma sp. 3	Carolina Redhorse	ST	Harnett, Lee, Montgomery, Moore, Richmond
	Lampetra aepyptera	Least Brook Lamprey	ST	Edgecombe, Johnston, Jones, Lenoir, Pitt
	Moxostoma robustum	Robust Redhorse	SE	Richmond
	Etheostoma perlongum	Waccamaw Darter	ST	Columbus
	Menidia extensa	Waccamaw Silverside	ST	Columbus
	Acipenser brevirostrum	Shortnose Sturgeon	SE	Beaufort, Bladen, Brunswick, Columbus, Craven, New Hanover, Onslow, Pamlico, Pender, Pitt, Richmond
Invertebrate	*Anodonta implicata*	Alewife Floater	ST	Montgomery, Richmond
	Fusconaia masoni	Atlantic Pigtoe	SE	Beaufort, Bladen, Cumberland, Edgecombe, Harnett, Johnston, Montgomery, Moore, Nash, Pender, Pitt
	Triodopsis soelneri	Cape Fear Threetooth	ST	Brunswick, Columbus, New Hanover, Onslow
	Lasmigona decorata	Carolina Heelsplitter	SE	Richmond
	Aristida simpliciflora	Chapman's Three-awn	SE	Brunswick, Columbus, Onslow, Pender
	Strophitus undulatus	Creeper	ST	Edgecombe, Johnston, Jones, Lee, Montgomery, Moore, Nash, Pitt, Richmond, Wilson

Category	Scientific Name	Common Name	T/E	Counties
	Lampsilis radiata	Eastern Lampmussel	ST	Bladen, Columbus, Craven, Edgecombe, Johnston, Jones, Lee, Montgomery, Nash, Pender, Pitt, Richmond, Sampson, Wayne, Wilson
	Ligumia nasuta	Eastern Pondmussel	ST	Brunswick, Martin, Nash, Pitt, Richmond
	Elliptio roanokensis	Roanoke Slabshell	ST	Bladen, Craven, Cumberland, Edgecombe, Harnett, Johnston, Jones, Lee, Montgomery, Moore, Nash, Onslow, Pitt, Richmond, Wayne
	Leptodea ochracea	Tidewater Mucket	ST	Columbus, Edgecombe, Martin, Pitt
	Alasmidonta undulata	Triangle Floater	ST	Edgecombe, Harnett, Johnston, Jones, Lee, Montgomery, Moore, Nash, Pitt, Wayne, Wilson
	Catinella waccamawensis	Waccamaw Ambersnail	ST	Columbus
	Lampsilis fullerkati	Waccamaw Fatmucket	ST	Columbus
	Anodonta couperiana	Barrel Floater	SE	Bladen, New Hanover
	Alasmidonta varicosa	Brook Floater	SE	Moore
	Villosa vaughaniana	Carolina Creekshell	SE	Montgomery, Moore, Richmond,,,
	Alasmidonta heterodon	Dwarf Wedgemussel	SE	Johnston, Nash, Wilson
	Lasmigona subviridis	Green Floater	SE	Edgecombe, Johnston, Montgomery, Nash, Pitt,
	Helisoma eucosmium	Greenfield Rams-horn	SE	Brunswick, New Hanover
	Planorbella magnifica	Magnificent Rams-horn	SE	Brunswick, New Hanover
	Elliptio steinstansana	Tar River Spinymussel	SE	Edgecombe, Johnston, Nash ,Pitt
	Lampsilis cariosa	Yellow Lampmussel	SE	Columbus, Cumberland, Edgecombe, Harnett, Johnston, Lee, Montgomery, Moore, Nash, Pender, Pitt, Richmond, Sampson
	Elliptio lanceolata	Yellow Lance	SE	Duplin, Edgecombe, Johnston, Nash, Wayne,
Mammal	*Neotoma floridana floridana*	Eastern Woodrat - Coastal Plain population	ST	Brunswick, New Hanover, Onslow, Pender
	Trichechus manatus	West Indian Manatee	SE	Beaufort, Brunswick, Craven, Jones, Lenoir, New Hanover, Onslow, Pamlico, Pender, Pitt,
Plant	*Pityopsis graminifolia var. graminifolia*	A Silkgrass	SE	Brunswick, Columbus
	Chasmanthium nitidum	A Spanglegrass	ST	Pender
	Xyris serotina	Acid-swamp Yellow-eyed-grass	ST	Columbus
	Rhynchospora crinipes	Alabama Beaksedge	ST	Hoke, Brunswick
	Buchnera americana	American Bluehearts	SE	Cumberland, Harnett, Sampson
	Veronica	American	ST	Craven

Category	Scientific Name	Common Name	T/E	Counties
	americana	Speedwell		
	Scleria baldwinii	Baldwin's Nutrush	ST	Brunswick, Columbus, Pender
	Eupatorium paludicola	Bay Boneset	ST	Onslow, Scotland
	Ipomoea imperati	Beach Morning-glory	ST	Brunswick
	Aristida condensata	Big Three-awn Grass	ST	Bladen, Hoke, New Hanover, Pender, Richmond, Scotland
	Bacopa caroliniana	Blue Water-hyssop	ST	Bladen, Brunswick, Columbus, New Hanover, Pender
	Dichanthelium caerulescens	Blue Witch Grass	SE	Brunswick, Pender
	Andropogon mohrii	Bog Bluestem	ST	Brunswick, Columbus, Craven, Onslow, Pender, Robeson
	Agalinis virgata	Branched Gerardia	ST	Brunswick, Craven, Duplin, New Hanover, Onslow, Pender, Scotland
	Lachnocaulon minus	Brown Bogbutton	ST	Brunswick, New Hanover, Onslow, Pender
	Trifolium reflexum	Buffalo Clover	ST	Harnett, Montgomery, Moore
	Sabal palmetto	Cabbage Palm	ST	Brunswick
	Oxypolis canbyi	Canby's Dropwort	SE	Scotland
	Parnassia caroliniana	Carolina Grass-of-parnassus	ST	Bladen, Brunswick, Columbus, Cumberland, Harnett, Hoke, Lee, Onslow, Pender, Scotland
	Crocanthemum carolinianum	Carolina Sunrose	SE	Brunswick, Craven, Brunswick, Onslow, Pender, Cumberland
	Cirsium carolinianum	Carolina Thistle	SE	Montgomery
	Tridens chapmanii	Chapman's Redtop	ST	Bladen, Craven, Hoke, Jones, Martin, Montgomery, Moore, Pender, Richmond, Scotland
	Carex cherokeensis	Cherokee Sedge	SE	Pender
	Rhynchospora pleiantha	Coastal Beaksedge	ST	Brunswick, New Hanover, Onslow
	Solidago villosicarpa	Coastal Goldenrod	SE	Brunswick, Craven, New Hanover, Onslow, Pender,
	Carex exilis	Coastal Sedge	SE	Cumberland, Harnett, Hoke, Moore,
	Hibiscus aculeatus	Comfortroot	ST	New Hanover, Robeson
	Gaylussacia nana	Confederate Huckleberry	SE	Pender
	Vaccinium macrocarpon	Cranberry	ST	Bladen, Brunswick, Cumberland
	Cardamine douglassii	Douglass's Bittercress	ST	Cumberland, Harnett
	Scirpus lineatus	Drooping Bulrush	ST	Brunswick, Craven, Jones, New Hanover, Onslow, Pender
	Utricularia olivacea	Dwarf Bladderwort	ST	Brunswick, Craven, Cumberland, Hoke, New Hanover, Onslow, Pender
	Echinodorus tenellus	Dwarf Burhead	SE	Brunswick, Robeson

Category	Scientific Name	Common Name	T/E	Counties
	Ludwigia linifolia	Flaxleaf Seedbox	ST	Brunswick, Columbus, New Hanover, Onslow
	Amphicarpum muhlenbergianum	Florida Goober Grass	SE	Hoke, Robeson, Scotland
	Crocanthemum nashii	Florida Scrub Frostweed	SE	Brunswick, New Hanover
	Eleocharis elongata	Florida Spikerush	SE	Brunswick, Onslow
	Helianthus floridanus	Florida Sunflower	ST	Bladen, Brunswick, Columbus, Robeson
	Xyris floridana	Florida Yellow-eyed-grass	ST	Brunswick, Columbus, Onslow, Pender, Robeson
	Symphyotrichum georgianum	Georgia Aster	ST	Montgomery
	Clinopodium georgianum	Georgia Calamint	SE	Brunswick, Pender, Richmond, Robeson
	Amorpha georgiana	Georgia Indigo-bush	SE	Cumberland, Harnett, Hoke, Lee, Lenoir, Moore, Pender, Richmond, Robeson, Scotland
	Crocanthemum georgianum	Georgia Sunrose	SE	Brunswick, New Hanover
	Spiranthes longilabris	Giant Spiral Orchid	SE	Bladen, Brunswick, Onslow, Pender
	Ludwigia sphaerocarpa	Globe-fruit Seedbox	SE	Bladen, Columbus, Craven, Hoke, Johnston, Moore, New Hanover, Richmond, Wayne
	Minuartia godfreyi	Godfrey's Sandwort	SE	Craven, Jones
	Carex lutea	Golden Sedge	SE	Onslow, Pender
	Epidendrum magnoliae	Green Fly Orchid	ST	Bladen, Brunswick, Columbus, New Hanover, Pender
	Eleocharis cellulosa	Gulfcoast Spikerush	SE	Beaufort, Onslow
	Persicaria hirsuta	Hairy Smartweed	SE	Brunswick, Onslow, Richmond, Scotland
	Fimbristylis perpusilla	Harper's Fimbry	ST	Brunswick, Columbus
	Euphorbia cordifolia	Heartleaf Sandmat	ST	Bladen Richmond, Wayne
	Dichanthelium hirstii	Hirsts' Panic Grass	SE	Onslow
	Sarracenia minor	Hooded Pitcher Plant	SE	Brunswick, Columbus, New Hanover
	Utricularia cornuta	Horned Bladderwort	ST	Brunswick, Columbus, New Hanover
	Gillenia stipulata	Indian Physic	ST	Lee, Montgomery, Moore
	Carex reniformis	Kidney Sedge	ST	Bladen, Johnston, Pender, Sampson
	Ludwigia lanceolata	Lanceleaf Seedbox	SE	Brunswick ,New Hanover
	Parnassia grandifolia	Large-leaved Grass-of-parnassus	ST	Brunswick, Columbus, Pender
	Solidago leavenworthii	Leavenworth's Goldenrod	ST	Columbus, Robeson, Sampson, Scotland

Category	Scientific Name	Common Name	T/E	Counties
	Cyperus lecontei	Leconte's Flatsedge	ST	Brunswick, New Hanover, Onslow
	Eupatorium leptophyllum	Limesink Dog-fennel	SE	Brunswick, New Hanover, Robeson, Scotland
	Ruellia strepens	Limestone Wild-petunia	SE	Pender, Richmond
	Helenium brevifolium	Littleleaf Sneezeweed	SE	Brunswick, Lenoir, Montgomery
	Leptochloa fascicularis var. maritima	Long-awned Spangletop	SE	Brunswick
	Schisandra glabra	Magnolia Vine	ST	Martin
	Rhus michauxii	Michaux's Sumac	SE	Cumberland, Hoke, Johnston, Moore, Nash, Richmond
	Paronychia herniarioides	Michaux's Whitlow-wort	SE	Scotland
	Paspalum dissectum	Mudbank Crown Grass	SE	Brunswick, Columbus, Craven, Moore, Pender, Scotland
	Scleria reticularis	Netted Nutrush	ST	Brunswick, Cumberland, Hoke, New Hanover, Onslow, Sampson, Scotland
	Utricularia resupinata	Northeastern Bladderwort	SE	Columbus
	Carya myristiciformis	Nutmeg Hickory	SE	Brunswick, Pender
	Hypericum fasciculatum	Peelbark St. John's-wort	SE	Cumberland, Hoke, Moore, New Hanover, Robeson
	Crocanthemum corymbosum	Pinebarren Sunrose	ST	Brunswick
	Plantago sparsiflora	Pineland Plantain	ST	Bladen, Brunswick, Columbus, Onslow, Pender
	Xyris stricta	Pineland Yellow-eyed-grass	SE	Brunswick, Pender
	Fleischmannia incarnata	Pink Thoroughwort	ST	Martin, Richmond
	Sabatia kennedyana	Plymouth Gentian	ST	Brunswick, Columbus
	Lindera melissifolia	Pondberry	SE	Bladen, Cumberland, Onslow, Sampson
	Baptisia australis var. aberrans	Prairie Blue Wild Indigo	SE	Montgomery
	Balduina atropurpurea	Purple-disk Honeycomb-head	SE	Bladen, Brunswick
	Sagittaria isoetiformis	Quillwort Arrowhead	ST	Bladen, Brunswick, Columbus, Cumberland, Hoke, New Hanover, Samson, Scotland
	Zephyranthes simpsonii	Rain Lily	SE	Brunswick
	Ludwigia ravenii	Raven's Seedbox	ST	Brunswick, Columbus, Craven, Duplin, New Hanover, Pamlico, Sampson
	Ptilimnium costatum	Ribbed Bishop-weed	ST	Brunswick, New Hanover
	Crocanthemum rosmarinifolium	Rosemary Sunrose	ST	Hoke, Richmond, Scotland

Category	Scientific Name	Common Name	T/E	Counties
	Cornus asperifolia	Roughleaf Dogwood	SE	Onslow, Pender
	Sporobolus virginicus	Saltmarsh Dropseed	ST	Brunswick
	Gaillardia aestivalis var. aestivalis	Sandhills Blanket-flower	SE	Cumberland, Hoke, Moore, Richmond, Scotland,
	Lilium pyrophilum	Sandhills Lily	SE	Cumberland, Harnett, Hoke, Lee, Moore, Nash
	Ruellia ciliosa	Sandhills Wild-petunia	ST	Cumberland, Hoke, Richmond, Scotland
	Amorpha confusa	Savanna Indigo-bush	ST	Bladen, Brunswick, Columbus, New Hanover
	Toxolasma pullus	Savannah Lilliput	SE	Columbus, Lee, Montgomery
	Helianthus schweinitzii	Schweinitz's Sunflower	SE	Montgomery, Richmond
	Amaranthus pumilus	Seabeach Amaranth	ST	Brunswick, New Hanover, Onslow, Pender
	Polygonum glaucum	Seabeach Knotweed	SE	Beaufort, Brunswick, New Hanover
	Aeschynomene virginica	Sensitive Jointvetch	ST	Beaufort, Craven, Lenoir
	Ponthieva racemosa	Shadow-witch	ST	Beaufort, Brunswick, Craven, Jones, Onslow, Pender
	Primula meadia	Shooting-star	ST	Montgomery
	Ludwigia suffruticosa	Shrubby Seedbox	ST	Bladen, Brunswick, New Hanover, Onslow, Robeson, Scotland
	Pinguicula pumila	Small Butterwort	SE	Onslow, Pender
	Sageretia minutiflora	Small-flowered Buckthorn	ST	Onslow, Pender
	Iva microcephala	Small-headed Marsh Elder	ST	Robeson, Scotland
	Echinacea laevigata	Smooth Coneflower	SE	Montgomery
	Platanthera nivea	Snowy Orchid	ST	Beaufort, Bladen, Brunswick, Columbus, Craven Hoke, New Hanover, Pender, Robeson
	Galactia mollis	Soft Milk-pea	ST	Brunswick, Cumberland, Hoke, Richmond, Scotland, Wayne
	Scutellaria australis	Southern Skullcap	SE	Johnston, Lee, Richmond
	Rhynchospora macra	Southern White Beaksedge	ST	Cumberland, Harnett, Hoke, Moore, Richmond, Scotland
	Helenium vernale	Spring Sneezeweed	SE	Brunswick, Columbus
	Sagittaria macrocarpa	Streamhead Sagittaria	ST	Hoke, Moore
	Rudbeckia heliopsidis	Sun-facing Coneflower	SE	Harnett, Moore
	Rhynchospora decurrens	Swamp Forest Beaksedge	ST	Brunswick, Columbus, Onslow
	Cystopteris tennesseensis	Tennessee Bladder-fern	SE	Craven, Jones, Onslow

Category	Scientific Name	Common Name	T/E	Counties
	Baptisia alba	Thick-pod White Wild Indigo	ST	Johnston, Montgomery
	Isoetes microvela	Thin-wall Quillwort	ST	Brunswick, Jones, Onslow, Pender, Sampson
	Lechea torreyi	Torrey's Pinweed	SE	Brunswick, Moore, Pender
	Sideroxylon tenax	Tough Bumelia	ST	Brunswick, New Hanover
	Rhynchospora tracyi	Tracy's Beaksedge	ST	Brunswick, New Hanover, Onslow, Scotland
	Solidago tortifolia	Twisted-leaf Goldenrod	SE	Bladen, Brunswick, Hoke, Jones, New Hanover, Robeson, Scotland
	Adiantum capillus-veneris	Venus Hair Fern	ST	Columbus
	Tradescantia virginiana	Virginia Spiderwort	ST	Harnett, Montgomery, Moore
	Hymenocallis pygmaea	Waccamaw River Spiderlily	ST	Brunswick, Columbus
	Elliptio waccamawensis	Waccamaw Spike	SE	Brunswick, Columbus
	Stylisma aquatica	Water Dawnflower	SE	Brunswick, Moore, Robeson, Scotland
	Solidago radula	Western Rough Goldenrod	SE	Montgomery
	Carex tenax	Wire Sedge	SE	Moore, Wayne
	Sporobolus teretifolius	Wireleaf Dropseed	ST	Brunswick, Columbus, Craven
	Chrysoma pauciflosculosa	Woody Goldenrod	SE	Columbus, Cumberland, Robeson
	Solidago plumosa	Yadkin River Goldenrod	ST	Montgomery
	Linum floridanum var. chrysocarpum	Yellow-fruited Flax	ST	Brunswick, Columbus, Onslow, Pender
	Oldenlandia boscii	Bosc's Bluet	SE	Brunswick, Columbus, Cumberland, Hoke, Scotland,
	Lobelia boykinii	Boykin's Lobelia	SE	Bladen, Cumberland, Hoke, Onslow, Robeson, Scotland
	Macbridea caroliniana	Carolina Bogmint	SE	Bladen,Brunswick,Columbus,Harnett,Johnston,Jones,Pender,Robeson,Sampson,,
	Trillium pusillum var. pusillum	Carolina Least Trillium	SE	Onslow, Pender
	Warea cuneifolia	Carolina Pineland-cress	SE	Harnett, Hoke,,,,
	Asplenium heteroresiliens	Carolina Spleenwort	SE	Bladen, Craven, Jones, Onslow
	Schwalbea americana	Chaffseed	SE	Bladen, Cumberland, Hoke, Moore, Pender, Scotland
	Sagittaria chapmanii	Chapman's Arrowhead	SE	
	Thalictrum cooleyi	Cooley's Meadowrue	SE	Brunswick, Columbus, New Hanover, Onslow, Pender,
	Erythrina herbacea	Coralbean	SE	Brunswick, New Hanover

Category	Scientific Name	Common Name	T/E	Counties
	Spiranthes eatonii	Eaton's Ladies'-tresses	SE	Beaufort,Bladen,Brunswick,Craven,Cumberland,Moore,Onslow,Pamlico,Pender,,
	Lophiola aurea	Golden-crest	SE	Brunswick, Columbus, New Hanover, Onslow,,
	Sagittaria weatherbiana	Grassleaf Arrowhead	SE	Beaufort, Bladen, Brunswick, Columbus, Craven, Duplin, New Hanover, Onslow, Pender, Pitt, Sampson
	Ptilimnium nodosum	Harperella	SE	Lee
	Myriophyllum tenellum	Leafless Water-milfoil	SE	Bladen
	Myriophyllum laxum	Loose Water-milfoil	SE	Brunswick, Craven, Cumberland, Hoke, Onslow
	Calopogon multiflorus	Many-flower Grass-pink	SE	Brunswick, Onslow, Pender
	Tridens ambiguus	Pineland Triodia	SE	Scotland
	Lysimachia asperulifolia	Rough-leaf Loosestrife	SE	Beaufort,Bladen,Brunswick,Columbus,Craven,Cumberland,Harnett,Hoke,Montgomery,Moore,New Hanover
	Arnoglossum ovatum	Savanna Indian-plantain	SE	Bladen, Brunswick, Columbus, Jones, Onslow, Pender
	Scutellaria leonardii	Shale-barren Skullcap	SE	Moore
	Anemone berlandieri	Southern Anemone	SE	Montgomery
	Pteroglossaspis ecristata	Spiked Medusa	SE	Bladen, Cumberland, Hoke, New Hanover, Robeson,
	Eriocaulon texense	Texas Hatpins	SE	Cumberland, Richmond
	Trillium pusillum var. virginianum	Virginia Least Trillium	SE	Johnston, Nash
	Eleocharis vivipara	Viviparous Spikerush	SE	New Hanover, Onslow, Pender
Reptile	*Alligator mississippiensis*	American Alligator	ST	Beaufort, Bladen, Brunswick, Columbus, Craven, Cumberland, Duplin, Hoke, Jones, Lenoir, New Hanover, Pender, Robeson, Onslow, Pamlico, Pitt, Sampson, Scotland
	Micrurus fulvius	Eastern Coral Snake	SE	Bladen, Brunswick, Cumberland, Harnett, Hoke, Moore, New Hanover, Onslow, Pender, Robeson, Scotland
	Crotalus adamanteus	Eastern Diamondback Rattlesnake	SE	Brunswick, Columbus, Craven, Cumberland, Duplin, Jones, New Hanover, Onslow, Pender, Robeson, Sampson
	Chelonia mydas	Green Seaturtle	ST	Brunswick, New Hanover, Onslow, Pender
	Lepidochelys kempii	Kemp's Ridley Seaturtle	SE	Beaufort, Brunswick, Pamlico
	Dermochelys coriacea	Leatherback Seaturtle	SE	Brunswick, Craven, New Hanover, Onslow
	Caretta caretta	Loggerhead Seaturtle	ST	Brunswick, New Hanover, Onslow, Pender

Table A-4. State-listed Threatened and Endangered Species that Could Potentially Occur in South Carolina

Category	Scientific Name	Common Name	T/E	Counties
Amphibian	*Pseudobranchus striatus*	Dwarf siren	ST	Hampton, Jasper
	Ambystoma cingulatum	Frosted flatwoods salamander	SE	Jasper
	Rana capito	Gopher frog	SE	Barnwell, Hampton
Bird	*Haliaeetus leucocephalus*	Bald eagle	SE	Allendale, Barnwell, Colleton, Hampton, Jasper
	Sterna antillarum	Least tern	ST	Colleton, Jasper
	Picoides borealis	Red-cockaded woodpecker	SE	Allendale, Barnwell, Colleton, Hampton, Jasper
	Charadrius wilsonia	Wilson's plover	ST	Colleton
	Mycteria americana	Wood stork	SE	Bamberg, Colleton, Hampton, Jasper
Fish	*Acipenser brevirostrum*	Shortnose sturgeon	SE	Colleton, Hampton, Jasper
Mammal	*Corynorhinus rafinesquii*	Rafinesque's Big-eared bat	SE	Allendale, Bamberg, Barnwell, Colleton, Hampton, Jasper
Reptile	*Gopherus polyphemus*	Gopher tortoise	SE	Allendale, Colleton, Hampton, Jasper
	Caretta caretta	Loggerhead sea turtle	ST	Colleton, Jasper
	Clemmys guttata	Spotted turtle	ST	Allendale, Bamberg, Barnwell, Colleton, Hampton, Jasper

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APPENDIX B – Comments on the Draft Environmental Assessment

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