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Biennial Monitoring Evaluation Report for the Uwharrie and Croatan National Forests

Forest Service National Forests in North Carolina September 2020

For More Information Contact:

Michelle Aldridge, Planning Staff Officer
National Forests in North Carolina
160 Zillicoa Ave.
Asheville, NC
828-257-4200

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About Our Plan Monitoring Program

Purpose

Each National Forest has a Land Management Plan, commonly referred to as a forest plan. The forest plan provides strategic direction for the forest and guidance for project and activity-level decision making. The plan describes desired ecological, social, and economic conditions of the forest and provides constraints that focus management activities toward maintaining or achieving those conditions over time. Each forest plan also includes a plan monitoring program to evaluate whether the plan is being implemented properly, whether it is effective at guiding management toward long-term outcomes, or whether changes need to be made. The plan monitoring program includes the specific monitoring questions and associated indicators that are to be used for forest plan evaluations, feedback for adaptive responses, and reporting. Monitoring and evaluation are continuous learning tools that form the backbone of adaptive management.

This biennial monitoring evaluation report reviews the questions included in the forest plan monitoring program and aids the Forest Supervisor in determining whether a change is needed in forest plan direction. The biennial monitoring evaluation report is not a decision document—it evaluates monitoring questions and indicators presented in the plan monitoring program chapter of the forest plan, in relation to management actions carried out across the forest and conditions in the broader landscape.

This monitoring report addresses the plan monitoring programs of two separate Land Management Plans – one for the Croatan National Forest, and one for the Uwharrie National Forest. While they are separate national forests and are guided by separate forest plans, they are both administered by the National Forests in North Carolina, have multiple forest resources and conditions in common, and share some monitoring questions. The biennial monitoring evaluation report represents one part of the Forest Service's overall monitoring program for the Croatan and Uwharrie National Forests.

Our monitoring plan covers these eight topics required under FSH 1909.12 in addition to social, economic, and cultural sustainability. You'll find each of these topics addressed in this report.

1. The status of select watershed conditions.
2. The status of select ecological conditions, including key characteristics of terrestrial and aquatic ecosystems.
3. The status of focal species to assess the ecological conditions required under § 219.9.
4. The status of a select set of the ecological conditions required under § 219.9 to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.
5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
6. Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.
7. Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.
8. The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(C)). (36 CFR 219.12(a))

How the Croatan and Uwharrie Plan Monitoring Programs Work

Monitoring and evaluation requirements have been established through the National Forest Management Act (NFMA) at 36 CFR 219. Additional direction is provided by the Forest Service in Chapter 30 – Monitoring – of the Land Management Handbook (FSH 1909.12).

The Croatan and Uwharrie monitoring programs were updated in 2016 for consistency with the 2012 planning regulations [36 CFR 219.12 (c)(1)]. Each Plan was administratively changed to include the updated monitoring program (Uwharrie, Chapter 4 and Croatan, Chapter 5). For a copy of the current monitoring program, go to https://www.fs.usda.gov/land/nfsnc/landmanagement. Monitoring questions and indicators were selected to inform the management of resources on the plan area, and not every plan component was determined necessary to track [36 CFR 219.12(a)(2)]. See the Plan Monitoring Program at https://www.fs.usda.gov/land/nfsnc/landmanagement for discussion on how the monitoring questions were selected to be consistent with the 2012 planning regulations [36 CFR 219.12].

The monitoring evaluation implementation guide (monitoring guide) is part of the overall plan monitoring program and provides more specific direction for implementing selected indicators of the strategic plan monitoring program and details monitoring methods, protocols, and roles and responsibilities. The monitoring guide is not part of the plan decision and is subject to change as new science and methods emerge. The Croatan and Uwharrie monitoring guide documentation is in progress (See Appendix B for Longleaf Condition Class protocols).

Providing timely, accurate monitoring information to the responsible official and the public is a key requirement of the plan monitoring program. This biennial monitoring evaluation report is the vehicle for disseminating this information.

Monitoring Objectives

The objectives of our plan monitoring plan include:

- Assess the current condition and trend of selected forest resources.
- Document implementation of the plan monitoring program.
- Evaluate relevant assumptions, changed conditions, management effectiveness, and progress towards achieving the selected desired conditions, objectives, and goals described in the forest plan.
- Assess the status of previous recommended options for change based on previous monitoring & evaluation reports.
- Document scheduled monitoring actions that have not been completed and the reasons and rationale why.
- Present any new information not outlined in the current plan monitoring program that is relevant to the evaluation of the selected monitoring questions.
- Incorporate broader scale monitoring information from the Regional Broader Scale Monitoring Strategy that is relevant to the understanding of the selected monitoring question.
- Present recommended change opportunities to the responsible official.

Monitoring Results Summary

The results of monitoring and evaluation of two national forest plans are presented in this report.

The Uwharrie NF Forest Plan was approved in 2012. This plan is relatively current with existing agency policies and guidance for managing desired conditions throughout the plan area. The review of information from 2018 and 2019 resulted in six recommended changes to the monitoring program or monitoring activity and one change for management actions. Additionally, these findings demonstrate an opportunity to assess potential for climate change mitigations as part of a plan assessment in the future. The plan assessment would inform the plan need-for-change prior to amendment or revision.

The Croatan NF Forest Plan was approved in 2002. Agency policies and conditions throughout the plan area have changed over the past 18 years, and the FS adopted a new Planning Rule in 2012. Due to these circumstances, four topics could be evaluated as part of a plan assessment prior to plan revision or amendment. In addition, there are four changes to the monitoring program and four changes in management activities that are recommended.

Tables S-1a&b and S-2a&b below summarize findings and adaptation recommendations for line officer consideration.

Table S-1a. Findings for Uwharrie NF Monitoring and Evaluations that Support Recommendations (2020 Report)

Findings
1. The status of select watershed conditions, including aquatic ecosystems and aquatic species habitats
Stream restoration did not occur on the Uwharrie NF during the 2018-19 period, thus watershed conditions remained unchanged.
Trends for the NC Index of Biotic Integrity (including EPT ratings) are stable for selected stream segments on the Uwharrie NF and consistently rated higher than streams on adjacent ownerships thus indicating relatively healthy fish communities and trending toward desired conditions.
Hydrologic stability, habitat quality, and diversity continue to improve in the Uwharrie River Watershed.
2. The status of select ecological conditions including key characteristics of terrestrial systems
A protocol to estimate and track longleaf condition classes was developed during this monitoring cycle and documented in the monitoring guide (see Appendix B).
3. The status of focal species to assess the ecological conditions (some overlap with Category 4 regarding endangered species)
Declines in pileated woodpecker presence are not clear and need further investigation.

Findings
Trends in relative abundance of Northern bobwhite are declining, although the quality of early successional habitats has been improving, such as the return of bunch grasses due to the significant increase of prescribed fire. Further study is recommended. The same trend is noted in the NCWRC's Avid Quail Hunter Survey summary of harvest and flush rates. This study encompasses hunting and harvest from both public and private lands.
4. The status of a select set of ecological conditions to contribute to the recovery of federally listed threatened or endangered species, conserve proposed and candidate species, and maintain a viable population of species of conservation concern
The condition classes of Natural Areas on the Uwharrie remain unchanged during the 2018-2019 monitoring cycle. A consistent classification system for identifying the conditions of natural areas needs to be documented and filed in the monitoring guide.
5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives
There is an increase in the mileage of trails being maintained or improved to reach the regional trail standards. In FY 2019 a total of 46.35 miles of trails were maintained or improved among trail grants, volunteers, and Forest Service staff, and moving in a positive direction.
Two miles of trail reroute/improvement were completed on the Uwharrie National Recreation Trail to move it toward the new land acquisitions for this trail corridor.
For the Uwharrie National Recreation Trail: Change in the amount of trail maintenance backlog is decreasing as funding through trail grants has increased.
6. Measurable changes on the plan area related to climate change and other stressors
Temperatures are expected to rise with more days above 90 degrees, and precipitation is expected to have a modest increase. Stressors from a changing climate are likely to affect water resources, forest health, recreation, and plant and animal communities.
Forests in the Southern region are maintaining a modest carbon sink with carbon stocks increasing about 30 percent from 1990 to 2013.
7. (a) Social, economic, and cultural sustainability. This category focuses on cultural resources and the prescribed fire programs.
Eight significant heritage assets were protected successfully by decreasing disturbances from off-highway vehicle use and creating reroutes around sensitive locations.
Three cemeteries were given permanent site boundaries.

Findings
Three structures were stabilized on the Thornburg farm.
An overall reduction in the maintenance backlog is occurring which meets the intention of the plan and objective (Cultural-1).
The district is currently burning right at the target amounts described in the forest plan and is able to accomplish those acres consistently.
7. (b) Social, economic, and cultural sustainability, specific to broader scale economic trends
Population change (10%) is less than the regional average. Other variables: unemployment (4.9%), below poverty level (17%), payments to counties (1.47$/ac) are similar to regional trends.
To understand land use change on the Forest and surrounding lands over time, the Forest GIS Coordinator and Croatan and Uwharrie GIS Editor developed a method to provide annual estimates of the acreage gain or loss of vegetation, landcover, and land use types and generated a raster dataset from 1983 to serve as a baseline for future comparisons.
8. Effects of management systems on the soil productivity of the land
The two timber sale units surveyed post-harvest were ground-based harvested and had some degree of soil disturbance; however, detrimental soil disturbance in each of the units was below the guideline level (15% detrimental disturbance as specified in the standard).

Table S-1b. Summary of Recommended Changes for Uwharrie NF by Monitoring Category (2020 Report)

1. The status of select watershed conditions, including aquatic ecosystems and aquatic species habitats	
Type of Change	**Recommended Change**
Monitoring program or monitoring activity	Reframe biotic integrity and EPT ratings to be part of the assessment of overall conditions and scores for the watersheds. This is a follow-up from 2018.
Management Activity	Follow up on the management action plan for Crow Creek.
2. The status of select ecological conditions including key characteristics of terrestrial systems	
Type of Change	**Recommended Change**
Monitoring program or monitoring activity	Following up from the 2018 recommendation, a protocol for determining condition classes for longleaf pine has been developed and documented in the monitoring guide. Follow up on the protocol and report the condition class findings in the 2022

Type of Change	Recommended Change
	Report. This information is important for tracking the R8 Longleaf Restoration Challenge.
Monitoring program or monitoring activity	Re-assess the need to develop protocols for oak-hickory and shortleaf pine, and, if needed, prioritize which ecological type should be developed for the reporting in 2022.

3. The status of focal species to assess the ecological conditions (some overlap with Category 4 regarding endangered species)

Type of Change	Recommended Change
Monitoring program or monitoring activity	To facilitate understanding declines in pileated woodpecker and Northern bobwhite relative abundance on the Uwharrie National Forest, develop monitoring questions and protocols for: 1) The amount and quality of snags for species such as pileated woodpecker, and 2) The amount and quality of early seral habitat for species such as bobwhite quail. Assess potential use of NCWRC quail monitoring information to understand trends on Uwharrie National Forest in the midst of fragmented ownerships.
Monitoring program or monitoring activity	Assess potential use of NCWRC quail monitoring information to understand trends on Uwharrie National Forest in the midst of fragmented ownerships.

4. The status of a select set of ecological conditions to contribute to the recovery of federally listed threatened or endangered species, conserve proposed and candidate species, and maintain a viable population of species of conservation concern

Type of Change	Recommended Change
Monitoring program or monitoring activity	A consistent classification system for identifying the conditions of natural areas needs to be documented and filed in the monitoring guide.

5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives

Type of Change	Recommended Change
	No changes are recommended in the recreation program at this time.

6. Measurable changes on the plan area related to climate change and other stressors

Type of Change	Recommended Change
Forest Plan; Need to Change Assessment	Assess the need to plan for conditions to mitigate the expected stressors of climate change as shown in the Broad Scale Climate Change Monitoring Report for the Southern region.

7. (a) Social, economic, and cultural sustainability. This category focuses on cultural resources and the prescribed fire programs.

Type of Change	Recommended Change
	No changes are recommended for fire or cultural resources programs at this time.

7. (b) Social, economic, and cultural sustainability, focusing on broader economic trends

Type of Change	Recommended Change
	No changes are recommended at this time.

8. Effects of management systems on the soil productivity of the land

Type of Change	Recommended Change
	No changes are recommended for timber sale activities that may affect soil productivity at this time.

Table S-2a. Findings for the Croatan NF Monitoring and Evaluation that Support the Recommendations (2020 Report)

Findings
1. The status of select watershed conditions, including aquatic ecosystems and aquatic species habitats
There are currently seven 6th-level watersheds of the 22 watersheds on the forest considered as properly functioning (32%). The remaining 15 watersheds are functioning at risk (68%). Condition classes have not changed during the 2018-2019 monitoring cycle.
The Watershed Restoration Action Plan for the Holston Creek Watershed will address aquatic organism passage needs, sediment sources, and unstable stream conditions during 2021 through 2025.
Priority watersheds were not identified in the 2002 Forest Plan.
2. The status of select ecological conditions including key characteristics of terrestrial systems
A protocol to estimate and track longleaf condition classes was developed during this monitoring cycle and documented in the monitoring guide (see Appendix B).

Findings
The Holston Hunter Project was signed in 2018 to improve and restore 2,923 acres of longleaf pine habitat.
The ecological classification was updated in 2018 and would likely show more opportunities for restoration than the current plan.
3. The status of focal species to assess the ecological conditions (some overlap with Category 4 regarding endangered species)
In 2018, storms associated with Hurricane Florence affected at least 40 active RCW clusters on the Croatan. This damage was immediately mitigated including placement of approximately 35 inserts within the damaged clusters.
Results of restoration and maintenance efforts are reflected in overall RCW cluster nesting success which has averaged 96% since 2012.
Black bear populations are increasing within the coastal bear management unit, including the Croatan National Forest.
Overall, wild turkey productivity (mean number of poults per hen overall) in the coastal region is trending slightly downward (i.e., decreases in nesting success are slightly higher than gains in brood survival).
4. The status of a select set of ecological conditions to contribute to the recovery of federally listed threatened or endangered species, conserve proposed and candidate species, and maintain a viable population of species of conservation concern
On the Croatan, there are 17 Natural Areas on the Croatan with six in excellent condition, nine in good condition, one in fair condition, and one unranked. A consistent classification system for identifying the conditions of natural areas needs to be documented and filed in the monitoring guide.
Conditions of natural areas are being maintained overall with an exception to Flanners Beach that was damaged by Hurricane Florence in 2018.
Spring flowering goldenrod (Solidago verna) was impacted by the construction of the Havelock Bypass and road widening of NC17 and NC70, and mitigation is being planned with Dept. of Transportation.
LeConte's thistle (Cirsium lecontei) will have at least one and possibly two populations of this plant impacted by the construction of the Havelock Bypass. The USFS will work closely with DOT to help ensure the success of mitigation efforts for this plant. The largest population on the Croatan occurs in a powerline, and discussions are underway to mitigate past damage caused by herbicide applications in the utility corridor.
5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives

Findings
Recreation Opportunity Settings were significantly impacted by Hurricane Florence in 2018. Major repairs will be made at Flanners Beach (campground, day use, and beach), Fisher's Landing, Pinecliff Recreation Area, and Siddie Fields. All other recreation areas and opportunities are present and intact.
6. Measurable changes on the plan area related to climate change and other stressors
Sea level rise is causing damage to some special interest sites on the Croatan. Saltwater intrusion of fresh water supplies is occurring.
Temperatures are expected to rise with more days above 90 degrees, and precipitation is expected to have a modest increase. Stressors from a changing climate are likely to affect water resources, forest health, recreation, and plant and animal communities. Hurricanes are expected to be more severe and have increased impacts on the Croatan.
Forests in the Southern Region are maintaining a modest carbon sink with carbon stocks increasing about 30% from 1990 to 2013.
7. (a) Social, economic, and cultural sustainability. This category focuses on cultural resources and the prescribed fire programs.
Cultural and historic special interest areas were found to be unstable (damaged) during this monitoring cycle, mostly due to impact from Hurricane Florence in FY19.
Zone archeologist and contractors monitored 27 sites. Fourteen are stable, while 13 sites are experiencing degradation from recreation users, rising sea levels, and hurricane damage.
In 2018, more than 26,000 acres were treated with prescribed fire-the most of any year on record.
In 2019, no prescribed fire occurred due to effects of Hurricane Florence.
In 2020, more than 23,000 acres have been treated with prescribed fire (as of early September 2020).
7. (b) Social, economic, and cultural sustainability, focusing on broader economic trends
Population change (13%) is less than the regional average. Other variables: unemployment (5.2%) and below poverty level (15%) are similar to regional trends. However, payments to counties were much lower (0.92$/ac) than regional averages.
To understand land use change on the Forest and surrounding lands over time, the Forest GIS Coordinator and Croatan and Uwharrie GIS Editor developed a method to provide annual estimates of the acreage gain or loss of vegetation, landcover, and land use types and generated a raster dataset from 1983 to serve as a baseline for future comparisons.

Findings
8. Effects of management systems on the soil productivity of the land
Two timber sale units surveyed post-harvest were ground-based harvested and had some degree of soil disturbance, however all disturbance was below the significant level (15% detrimental disturbance as specified in the plan). The past practice of bedding the soil to improve growing conditions for desired species occurred in these units and can be found in many places on the Croatan.

Table S-2b. Summary of Recommended Changes for Croatan NF by Monitoring Category (2020 Report)

1. The status of select watershed conditions, including aquatic ecosystems and aquatic species habitats

Type of Change	Recommended Change
Forest Plan; Need to Change Assessment	Assess the need to add plan components for priority watersheds, including watershed restoration objectives. Although watershed restoration activities do occur, strategic guidance is needed to develop priorities and objectives.
Forest Plan, Need to Change Assessment	Assess the need for objectives 2.1.8.3 to 2.1.8.4 about mapping acidic and non- acidic streams.
Management Activity	Finalize the Watershed Action Plan for Holston Creek Watershed

2. The status of select ecological conditions including key characteristics of terrestrial systems

Type of Change	Recommended Change
Forest Plan; Need to Change Assessment	The ecological classification was updated and mapped in 2018 and should be used to determine if ecological restoration objectives should be changed from the 2002 Forest Plan. This would affect plan components in other categories as well.
Monitoring program or monitoring activity	Following up from the 2018 recommendation, a protocol for determining condition classes for longleaf pine has been developed and documented in the monitoring guide. Follow up on the protocol and report the condition class findings in the 2022 Report. This information is important for tracking the R8 Longleaf Restoration Challenge.
Monitoring program or monitoring activity	Reassess the need to develop protocols for hardwood cypress wetlands and upland hardwood, and, if needed, prioritize which ecological type should be developed for the reporting in 2022.

3. The status of focal species to assess the ecological conditions (some overlap with Category 4 regarding endangered species)

Type of Change	Recommended Change
Forest Plan; Need to Change Assessment	Coordinate with regional office and USFWS staff to assess appropriateness of RCW cluster objectives for the Croatan National Forest. Specifically, Objectives 2.1.1.1 (meet a long-term population objective of 137-169 RCW clusters), 2.1.1.3 (establish 20 to 26 new RCW clusters over the next 10 years (2002-2012)), and 2.1.1.4 (establish 50 to 63 new clusters during the next 30 years (2002-2032)).
Management Activity	Choose red-cockaded woodpecker cavity sites after project analysis. To accelerate RCW population restoration, cavity inserts and cavity drilling should be used in suitable areas that are closer to the size class and habitat conditions that successfully promote viable RCW clusters. It will remain important to choose these areas carefully and to analyze habitat structure, size of stand, and connectivity to ensure breeding success and population growth.

Type of Change	Recommended Change
Management Activity	For black bear, buffer bottomland hardwoods and riparian corridors from pine-centric treatments to retain the characteristics that constitute those types of habitats.
Management Activity	For wild turkey, ensure upland hardwoods are protected during longleaf pine restoration. Identify upland hardwoods that are being outcompeted by faster growing, shade tolerant species in fire suppressed areas.

4. The status of a select set of ecological conditions to contribute to the recovery of federally listed threatened or endangered species, conserve proposed and candidate species, and maintain a viable population of species of conservation concern

Type of Change	Recommended Change
Monitoring program or monitoring activity	A consistent classification system for identifying the conditions of natural areas needs to be documented and filed in the monitoring guide.
Monitoring program or monitoring activity	Determine whether longleaf old growth needs to be tracked considering the development of condition class protocols (see Category 2 above), and, if not, delete Q11 from the monitoring program.

5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives

Type of Change	Recommended Change
	No changes are recommended for recreation program at this time.

6. Measurable changes on the plan area related to climate change and other stressors

Type of Change	Recommended Change
Forest Plan; Need to Change Assessment	Assess the need to add plan components or management approaches to mitigate the effects of sea level rise (and other stressors) that is occurring in the plan area.

7. (a) Social, economic, and cultural sustainability. This category focuses on cultural resources and the prescribed fire programs.

Type of Change	Recommended Change
	No changes are recommended for fire or cultural resources programs at this time.

7. (b) Social, economic, and cultural sustainability, focusing on broader economic trends

Type of Change	Recommended Change
	No changes are recommended at this time.

8. Effects of management systems on the soil productivity of the land

Type of Change	Recommended Change
	No changes are recommended for timber sale activities that may affect soil productivity at this time.

Forest Supervisor's Certification

I have evaluated the findings of this report, documenting the results of monitoring activities that occurred through Fiscal Year 2019 on the Uwharrie and the Croatan National Forests and associated management recommendations.

Monitoring on some topics is long-term and evaluation of those data will occur later in time.

I have directed that the administrative changes to the monitoring program above be implemented. Changes to the monitoring and management activities should respond to these recommendations, unless new information or changed resource conditions warrant otherwise.

I have examined the recommended changes to the 2012 Uwharrie Land Management Plan and 2002 Croatan Land Management Plan, as amended. I consider both plans sufficient to continue to guide land and resource management for the near future. A few topics have been identified for deeper evaluation as to whether there is a need to change the plan in the future. Deeper evaluation for these topics is not immediately needed but should be considered when the forest undergoes a future plan assessment to inform a potential amendment or revision with input of resource specialists and the public.

/s/ Deborah A. Caffin (for)

CAVAN FITZSIMMONS

ACTING FOREST SUPERVISOR

Date 10/19/2020

1. Watershed conditions, including conditions of aquatic ecosystems and aquatic species

Summary

The intent of this monitoring category is to estimate water quality and condition of habitat for aquatic organisms by tracking overall watershed conditions using the Watershed Condition Framework, which includes aquatic indicators such as the Index of Biotic Integrity.

Monitoring Questions and Indicators

Uwharrie

Q1. What are the trends in conditions for hydrologic stability?

Q2. What are the trends for instream and streamside habitat conditions for selected stream segments?

Indicator: %stream segment using: NC Index of Biotic Integrity; NCEPT rating

Croatan

Q1. Are aquatic habitat and biota conditions of tidal and non-tidal streams progressing toward desired conditions?

Indicator: %stream in the following classes: 1) functioning properly, 2) functioning at risk; 3) functionally impaired

Key Results

See Appendix A, Tables 1A and 1B for Watershed Condition Class Scores.

Uwharrie

Summary: Stream restoration did not occur on the Uwharrie NF during the 2018-19 period, thus watershed condition remained unchanged.

Since the development of the Uwharrie Plan in 2012, stream rehabilitation activities have occurred in the Crow Creek – Uwharrie River 6th-level Watershed (HUC: 030401030502). This watershed became a forest priority watershed with a comprehensive Watershed Restoration Action Plan in 2018, and more watershed improvement work is planned in the Crow Creek – Uwharrie River Watershed. Additional stream restoration is planned in the Moccasin Creek drainage within the Outlet Uwharrie River Watershed (Hydrologic Unit Code 030401030505) in the Badin Lake Recreation Area.

The additional work planned in the Crow Creek – Uwharrie River Watershed (Big Creek through the Russell Mine area and within the downstream reach of Crow Creek) would complete the Watershed Restoration Action Plan for the watershed. Continued monitoring of previous years' work shows that hydrologic stability, habitat quality, and diversity continue to be an improving trend in these stream reaches. During 2018-19, the Densons Creek

road/stream crossing was improved with funding and coordination with USFWS to provide aquatic organism passage (AOP); thereby reconnecting several miles of stream channel to year-round aquatic movement in the Densons Creek Watershed (HUC:030401040303).

Since the watershed condition assessment was completed, the biotic integrity and EPT ratings were folded into the criteria for the watershed condition classes and need not be a separate monitoring indicator.

Croatan

The Watershed Restoration Action Plan for the Holston Creek Watershed will address AOP needs, sediment sources, and unstable stream conditions during 2021 through 2025. Other watersheds are in the initial planning stages of action plan development on the Croatan. Until now, watershed-wide projects have not been implemented to move functioning at risk watersheds toward *properly functioning*. There are currently seven 6th-level watersheds, of the twenty-two watersheds on the forest, considered as properly functioning (32%). The remaining 15 watersheds are functioning at risk (68%).

Watershed restoration and improvements to water and soil quality have occurred on the Croatan NF over the last decade through implementation of changes in general management, such as eliminating soil bedding and addressing erosion and AOP at road/stream crossings. Specific improvements to the forest have been focused on timber stands, transportation systems, and wildlife habitat.

Although the condition assessment from 2011 is helpful, the Forest Plan was approved almost 10 years before that assessment was accomplished. There are no plan components to guide the overall strategy or management approaches and the Plan should be re-assessed for the need to change.

No mapping of acidic or non-acidic streams has occurred, and it is uncertain what information this would provide to help guide management of the Croatan NF. The objectives should be investigated further.

Recommended Changes

Forest Plan; Need to Change Assessment

- Assess the need to add plan components for priority watersheds, including watershed restoration objectives. Although watershed restoration activities do occur, strategic guidance is needed to develop priorities and objectives. (Croatan)
- Assess the need for objectives 2.1.8.3 to 2.1.8.4 about mapping acidic and non- acidic streams. (Croatan)

Monitoring program or monitoring activity

- Reframe biotic integrity and EPT ratings to be part of the assessment of overall conditions and scores for the watersheds. This is a follow-up from 2018. (Uwharrie)

Management activity

- Follow up on the management action plan for Crow Creek. (Uwharrie)
- Finalize the Watershed Action Plan for Holston Creek Watershed. (Croatan)

2. Terrestrial ecosystem conditions, including key characteristics, stressors, and threats

Summary

This monitoring category is a synthesis of questions that relate to terrestrial ecosystem conditions, including key characteristics, stressors, and threats. Restoring and maintaining the Longleaf Pine Ecosystems has been the primary focus for these national forests during this monitoring cycle. One driver has been the R8 Million Acre Longleaf Restoration Challenge that highlights the benefits of longleaf ecosystems, including the recovery on the endangered red cockaded woodpecker. The following results reflect updates from data collected from 2018-2019. New information collected or compiled from the last evaluation report from 2018 has been incorporated.

Monitoring Questions and Indicators

Uwharrie

Indicator for the following questions: Estimate condition classes of Maintain, Improve, Restore.

Q3. What are the conditions of longleaf pine ecosystems and the trends for restoring these systems?
Q4. What are the conditions of oak-hickory forests and the trends of restoring those forests?
Q5. What are the conditions of shortleaf pine woodlands and the trends for restoring these systems?

Croatan

Q2. Are pine savannas, pine flatwoods, and woodlands improving toward desired conditions?
Q3. Are hardwood cypress wetlands maintained and functioning as planned?
Q4. Are upland hardwood conditions maintained or improving?

Key Results

Uwharrie NF: The selected ecosystems for the Uwharrie NF are longleaf pine, shortleaf pine, and oak-hickory forests. Treatment activities have focused on longleaf pine and shortleaf pine during this management cycle (Appendix A, Table 2A) along with consistent prescribed fire (see Category 7), and significant achievements are being made toward desired conditions.

Croatan NF: The selected ecosystems for the Croatan NF are longleaf pine, hardwood cypress wetlands, and upland hardwoods. Treatment activities have focused on longleaf pine (Appendix A, Table 2B) during this monitoring cycle along with more than 20,000 acres of prescribed fire (See Category 7), and conditions are trending toward the goals in the forest plan. However, there were no treatments for prescribed fire in 2019 due to Hurricane Florence. The prescribed fire program has rebounded in 2020.

The ecological classification was updated and mapped in 2018. This updated information should be used to reassess the potential for terrestrial ecological restoration objectives in the CNF Plan approved 18 years ago.

The monitoring team developed a protocol for estimating and tracking longleaf condition classes (See Appendix B). The protocol will be used over the next monitoring cycle and reporting findings in 2022. Adjustments to the protocol will be recommended in the next reporting period.

There are questions related to terrestrial ecological types other than longleaf that need to be addressed. The monitoring team needs to assess the need for these questions or how to proceed with addressing the questions.

Recommended Changes

Forest Plan; Need to Change Assessment:

- **Croatan**: The ecological classification was updated and mapped in 2018 and should be used to determine if ecological restoration objectives should be changed from the 2002 Forest Plan. This would affect plan components in other categories as well.

Monitoring program or monitoring activity

- **Uwharrie**: Reassess the need to develop protocols for oak-hickory and shortleaf pine, and, if needed, prioritize which ecological type should be developed for the reporting in 2022.
- **Croatan**: Reassess the need to develop protocols for hardwood cypress wetlands and upland hardwood, and, if needed, prioritize which ecological type should be developed for the reporting in 2022.

3. Focal Species

Summary

The intent of Category 3 is to track the presence of species that would provide insight into the functioning of key characteristics of selected ecological conditions and habitats. The key ecological systems or fine filter habitat elements are noted in the questions below.

Monitoring Questions and Indicators

Uwharrie

The indicator is relative abundance for the following questions:

Q6. What is the status of brown headed nuthatch as a focal species for the function of longleaf pine ecosystems?
Q7. What is the status of scarlet tanager as a focal species for the function of dry oak and oak hickory forests?
Q8. What is the status of Acadian flycatcher as a focal species for the function of streamside zones?
Q9. What is the status of pileated woodpecker as a focal species for the function of large canopy trees and presence of snags?
Q10. What is the status of northern bobwhite quail as a focal species for the conditions of early successional habitat?

Croatan

Q5. What is the status of red-cockaded woodpecker to assess the ecosystem functioning of pine savannas, flatwoods, and woodlands? Indicator: Active clusters, nesting success
Q6. What is the status of black bear to assess ecosystem function and connectivity of hardwood cypress wetlands? (harvest trends)
Q7. What is the status of eastern wild turkey to assess the function of upland hardwoods? ((summer brood counts) and harvest trends)

Key Results

Brown-headed nuthatch, *Sitta pusilla*, has always occurred in low relative abundance on the Uwharrie National Forest. In the Forest Plan, this species is associated with the small, fragmented longleaf pine stands and serves as an indicator of longleaf forest restoration. It is also found in loblolly pine and other mixed pine-hardwood forest types across the Forest. Population trends of brown-headed nuthatch appear to be increasing across all habitat types on the Uwharrie and was documented occurred in longleaf habitats for the first time in 2016. Increased efforts to target restoration of longleaf pine ecosystems on the Uwharrie began in 2002, which may correlate with the increase in nuthatch observations during migratory bird monitoring (Appendix A, Figure 3A). Brown-headed nuthatch relative abundance is expected to increase across the Forest.

Scarlet tanager, *Piranga olivacea*, appears to be declining at a moderate rate across the Forest (Appendix A, Figure 3B). During this time period, trends in brown-headed cowbirds, *Molothrus ater*, increased across the Uwharrie (Appendix A, Figure 3C). This increase in relative abundance of brown-headed cowbirds is likely correlated to the decline of scarlet tanagers on the Uwharrie. The Uwharrie National Forest proclamation boundary is heavily fragmented by private inholdings, many of which are agricultural homesteads and private timberlands. Agricultural lands created the edge habitat preferred by the cowbirds, allowing them to become established around intact woodlands and move further into forest habitats.

Acadian flycatcher, *Empidonax alnorum*, appears to be decreasing across the Forest; however, adjusted three-year averages appear more stable (although still slightly decreasing) (Appendix A, Figure 3D). Relative abundance of Acadian flycatcher remains at levels that are easily detected by Forest Service monitoring and have high variability. These results indicate that streamside forested habitat quality and quantity remain adequate and abundant across the Forest.

Pileated woodpecker, *Dryocopus pileatus* , Migratory bird monitoring data from 1997-2019 indicates decreasing relative abundance of pileated woodpecker on the Uwharrie National Forest (Appendix A, Figure 3E). Reasons for the decline are not clear, and the situation is likely a result of multiple factors culminating in the declining numbers of this snag-dependent species, such as fragmented ownership, past timber practices that reduced the number of trees that would eventually become snags suitable for nesting, fire suppression history and techniques, and/or increase in nest predators (e.g. squirrels, raccoons) due to decrease or lack of larger predators (e.g. bobcats, fox).

Northern bobwhite, *Colinus virginianus*, on the Uwharrie has declined steadily since 1997 (Appendix A, Figure 3F). Numbers of bobwhite observed appear to remain relatively stable; however, the frequency of observations has declined. This may be due to natural population variability resulting from habitat that is burned (i.e., maintained as suitable for quail) at different intervals (i.e., quail move in and out of suitable areas) or a sign of a decline in overall population numbers. The increase in prescribed fire has provided more quality early successional habitat as long as native plants and bunchgrasses are returning to these burned sites. Nonnative plants may be a factor in the bobwhite decline, as the quality of the seed protein may not be providing the nutrients required for population growth. Loss of native bunch grasses that provide ideal nest sites, such as big bluestem, will reduce nest success. A revised wildlife opening management protocol for the National Forests in North Carolina emphasizes the use of native plant material whenever possible. This may be an example of where a shift in opening maintenance is needed.

Red-cockaded woodpecker (RCW), *Dryobates borealis,* is a Federally-listed endangered species that is dependent on mature pine savanna, flatwoods, and woodlands. The population on the Croatan grew from 44 clusters to 64 clusters from 1992 to 1997 as a result of active forest management to encourage characteristics required by RCW. Populations declined after the 1996-97 hurricane season and recovered to pre-hurricane levels in 2001. In 2018, storms associated with Hurricane Florence affected at least 40 active RCW clusters on the Croatan. This damage was immediately mitigated through the placement of approximately 35 inserts within the damaged clusters. RCW monitoring did not occur in 2020 due to Covid-19 travel restrictions. Future monitoring will identify residual effects of Hurricane Florence on the Croatan's RCW population.

Most longleaf pine forest providing habitat conditions suitable for red-cockaded woodpeckers on the Croatan is occupied by the species. This is likely why the number of active and breeding clusters has remained stable, excluding the effects of hurricanes and other large-scale natural disturbances (Appendix A, Figure 3G). While some of the more isolated breeding clusters that existed previously (10+ years) have become inactive, the

clusters in continuous habitat and/or habitat with good connectivity have continued to persist for many decades. The clusters in continuous, connected habitat have been the source of budded and new clusters in recent years (<10 years).

Results of longleaf restoration and maintenance efforts on the Croatan is reflected in overall RCW cluster nesting success which has averaged 96% since 2012, excluding 2019 monitoring following Hurricane Florence (Appendix A, Figure 3H).

Longleaf pine habitat restoration projects have been implemented across the Forest, removing loblolly pine plantations and replanting longleaf pine in the resulting openings. However, there is a long process (time-lag) between forest management and habitat suitability for red-cockaded woodpeckers-- as long as 40 years. And even then, restored habitat will likely serve as foraging habitat and will not be developing breeding habitat characteristics for another 20 years. In the interim, with continued prescribed burning and active longleaf pine forest restoration, RCW populations on the Croatan are expected to remain stable.

Black bear, *Ursus americana,* require large tracts of land with linkages between patches of suitable habitat, hard mast foods, escape cover for bears hunted with dogs, and freedom from motorized disturbances.

The following is a summary of data and trends presented in Olfenbuttel (2019), North Carolina Black Bear Annual Report: Bear population estimates and population growth rates are estimated annually by the NCWRC from biological data collected voluntarily from harvested bears through the Bear Cooperator Program. This method of population analysis reconstructs the age structure of the bear population three years prior to when the biological data is collected. Therefore, impacts of harvest on the bear population are not known until three years after any regulatory change has occurred. In addition, population reconstruction is sensitive to changes in harvest levels, so population trends may follow harvest trends. Anecdotal evidence indicates the sampled harvest is biased towards older bears, because hunters are less interested in receiving age results from younger bears (e.g. yearlings, sub-adults.) Population reconstruction is mainly meant as a tool to monitor bear population trends (i.e., growth rates) over time rather than to produce precise population estimates.

From this analysis, black bear populations are increasing within the coastal bear management unit, including the Croatan National Forest (Appendix A, Figure 3I).

Reported bear harvest and estimated population levels continue to increase on the coastal bear management unit. Despite annual variation in the number of bears harvested (reported) from the Croatan National Harvest, the long-term trend is stable (Appendix A, Figure 3J), likely reflecting varying degrees in hunter success as opposed to being a reflection of estimated bear populations.

The majority of the landscape outside of the Forest is developed and heavily roaded, which suggests that the bear population in the surrounding area is likely tied to the Croatan. The surrounding agricultural areas provide for higher foraging values that increase fitness; however, reproductive success is heavily influenced by having refuge from disturbance and year-round forage provided by the Forest.

On the Croatan, prescribed fire is a vital tool used to maintain or enhance woodland and savannah habitats that are important for summer foraging (i.e., huckleberry and blackberry). The natural mosaic pattern of these burns allows for enough retaining cover to provide for escape. Approximately 20,000 acres are burned annually on the Forest. Additionally, the Holston Hunter project will be treating 2,923 acres of longleaf habitat but will not be altering hardwood corridors or bottomland forests that provide the majority of the black bears habitat needs.

Wild turkey, *Meleagris gallopavo,* rely heavily on acorns and other hard mast as forage. Oak-dominated forest types have been in gradual decline across the Southeast due to residential and commercial development, conversion to pine plantations and farmland, and oak decline. Because Wild Turkey is so dependent on hard mast, it was identified as a focal species for upland hardwood forest types on the Croatan National Forest.

The following is a summary of data presented in NCWRC annual Wild Turkey Summer Observation Survey Summaries for the coastal ecoregion (e.g. Kreh (2019)). Each summer, the North Carolina Wildlife Resources Commission (NCWRC) coordinates an observation survey to gain insight into wild turkey productivity, nesting, success, and survival. Participants report wild turkeys observed during the course of routine daily activities from July 1 through August 31. It is recognized that this sampling method represents only a portion of the turkey population in a given area but reduces turkey hunter bias and efficiency (i.e., reliance on harvest rate as the sole indicator of wild turkey population trends).

Nesting success of wild turkey populations (percent of turkey hens observed with poults) in the coastal ecoregion (including the Croatan National Forest) is trending downward. However, survival (mean number of poults per hen with poults) is increasing (Figure 3K). Generally speaking, fewer hens are nesting successfully, but when nesting is successful, brood size is larger.

Overall, wild turkey productivity (mean number of poults per hen overall) in the coastal region is trending slightly downward (i.e., decreases in nesting success are slightly higher than gains in brood survival) (Appendix A, Figure 3L). It is important to remember that this data encompasses coastal turkey populations as a whole (all ownerships and land uses) rather than just the Croatan National Forest. Spring turkey harvest from the Croatan National Forest remains stable (Appendix A, Figure 3M).

On the Croatan, prescribed fire is a vital tool used to maintain or enhance woodland and savannah habitats as well as mast production. The natural mosaic pattern of these burns allows for enough retaining cover to provide for escape. Approximately 20,000 acres are burned annually on the Forest. Additionally, the Holston Hunter project will be treating 2,923 acres of longleaf pine habitat but will not be altering hardwood corridors or bottomland forests that provide the majority of wild turkey habitat on the Forest.

Recommended Changes

Forest Plan; Need to Change Assessment

- **Croatan**: Coordinate with regional office and USFWS staff to assess appropriateness of RCW cluster objectives. Specifically, Objectives 2.1.1.1 (meet a long-term population objective of 137-169 RCW clusters), 2.1.1.3 (establish 20 to 26 new RCW clusters over the next 10 years (2002-2012)), and 2.1.1.4 (establish 50 to 63 new clusters during the next 30 years (2002-2032)).

Monitoring program or monitoring activity:

- **Uwharrie**: To facilitate understanding declines in pileated woodpecker and Northern bobwhite relative abundance on the Uwharrie National Forest, develop monitoring questions for: 1) The amount and quality of snags for species such as pileated woodpecker, and 2) The amount and quality of early seral habitat for species such as bobwhite quail.
- **Uwharrie**: Assess potential use of NCWRC quail monitoring information to understand trends on Uwharrie National Forest in the midst of fragmented ownerships.

- **Croatan**: Choose red-cockaded woodpecker cavity sites after project analysis. To accelerate RCW population restoration, cavity inserts and cavity drilling should be used in suitable areas that are closer to the size class and habitat conditions that successfully promote viable RCW clusters. It will remain important to choose these areas carefully, to analyze habitat structure, size of stand, and connectivity to ensure breeding success and population growth.
- **Croatan**: For black bear, buffer bottomland hardwoods and riparian corridors from pine-centric treatments to retain the characteristics that constitute those types of habitats.
- **Croatan:** For wild turkey, ensure upland hardwoods are protected during longleaf pine restoration. Identify upland hardwoods that are being outcompeted by faster growing, shade tolerant species in fire suppressed areas.

4. Ecological Conditions Required to Contribute to Species Recovery

Summary

The purpose of this category is to monitor conditions that are required for rare species and to demonstrate conformance with both the Endangered Species Act and the planning regulations at 36 CFR 219.9. Both plans for the national forests focus on conditions of botanical special interest areas where most of the rare plant species are present or where suitable habitat can be provided. Note: Red cockaded woodpecker findings are located in Category 3 above).

Monitoring Questions and Indicators

Uwharrie

Q11. What are the trends in Schweinitz's sunflower across the UNF?

Q12. What are the trends in element occurrences across the forest?

Q13. Are botanical special interest areas fully functioning?

Q14. What are the trends of NNIS?

Croatan

Q9. What are the conditions of special interest natural areas on the CNF?

Q10. What are the occurrences of specific at-risk species?

Q11. What are the amounts and conditions of old growth in each ecological type?

Q12. What is the status of rare land types in the plan area?

Key Results

Uwharrie

Schweinitz's Sunflower: As shown in Appendix A, Table 4A; about 13 populations of this species are stable and approximately three are declining or may be extirpated. The stable populations should be attributed to consistent prescribed fire to maintain open conditions. Providing open canopy conditions using thinning also has improved habitat for Schweinitz's sunflower.

Element Occurrences: New occurrences for seven rare species and five rare communities have been documented since 2016 (Appendix A, Table 4B). One new species (tentatively called *Isoetes uwharrie*) has been found by researchers from Old Dominion University and the Smithsonian. These species and communities with new occurrences require open canopy conditions which are created and maintained using prescribed fire.

Croatan

Special Interest Natural Areas: To summarize (Appendix A, Table 4C), there are 17 natural areas with six in excellent condition, nine in good condition, one in fair condition, and one unranked. Conditions were identified as Excellent Condition if entire natural area is in a "maintain" condition class; good condition if more than half of the natural area is in a "maintain" condition class; and fair condition if high quality vegetative patches are scattered throughout the natural area.

At risk plant species: Element occurrences (EOs) for at risk plant species were obtained from the NC Natural Heritage Program (Appendix A, Table 4D) and briefly described as follows.

Rough leaved loosestrife (*Lysimachia asperulifolia).* There are 62 EOs for rough leaved loosestrife on the Croatan NF in the NC NHP database. Populations of this species are especially numerous in the southern section of the forest, where it is found in suitable habitat south of Millis and Roberts Road from Hibbs Road west to Pettiford Creek.

Spring flowering goldenrod (*Solidago verna).* There are 41 records for spring flowering goldenrod on the Croatan in the NC NHP database. At present the Croatan is a stronghold for this rare species with several documented populations numbering hundreds of plants. However, one large population of this species has recently been directly impacted by the widening of NC17, and more large populations will be impacted by the construction of the Havelock Bypass and the widening of NC70 beginning in 2019. The USFS will coordinate with DOT on mitigation efforts for the impacted populations, and the USFS will resurvey and assess the status of all populations of this plant on the Croatan NF in 2021.

Spring flowering goldenrod has responded well to increased sunlight after timber treatments on the Croatan. The plant is found on slightly loamy soils which can quickly become overgrown with hardwoods if not regularly burned.

LeConte's thistle (Cirsium lecontei). There are 10 records for LeConte's thistle on the Croatan area in the NC NHP database, but several of these have not been found recently and are considered historic. Several of the other records are for populations with only a few individuals. This is one of the rarest plants on the forest. The Havelock Bypass project will impact at least one and possibly two populations of this plant. The largest population on the Croatan occurs in a powerline, and discussions are underway to mitigate past damage caused by herbicide applications in the utility corridor. The largest population on the Croatan occurs in a powerline ROW where Duke Energy sprayed herbicide in 2017 and 2020. The USFS will work closely with DOT to help ensure the success of mitigation efforts for this plant and meet with Duke Energy to prevent further unauthorized application of herbicides on the Croatan. Croatan staff will annually monitor and carefully manage all populations of this plant on the Croatan NF.

Recommended Changes

Monitoring program or monitoring activity:

- **Croatan & Uwharrie**: A consistent classification system for identifying the conditions of natural areas needs to be documented and filed in the monitoring guide.
- **Croatan**: Determine whether longleaf old growth needs to be tracked considering the development of condition class protocols (see Category 2 above), and, if not, delete Q11 from the monitoring program.

5. Visitor Use, Satisfaction, and Progress on Recreation Objectives

Summary

This monitoring category is comprised of questions that relate to environmental and social conditions that affect visitors and recreation users of the forest's lands and waters. Nature-based recreation experiences, trail maintenance, and changes to recreation settings are considered in this category. The following results reflect updates from data collected from 2018-2019. New information collected or compiled from the last evaluation report from 2018 has been incorporated.

Monitoring Questions and Indicators

Uwharrie

Q15. What amount and kind of visitor use activities are occurring on the forests, and how satisfied are people with their experience? (NVUM survey)

Q16. What are the trends in trail conditions? (Miles of trail maintained to regional standards)

Q17. What is the percent of completion of the Uwharrie National Recreation Trail? (Additions)

Croatan

Q13. What amount and kind of visitor use activities are occurring on the forests, and how satisfied are people with their experience? (NVUM survey)

Q14. What are the changes in conditions of ROS settings? (Change in Settings)

Key Results

Uwharrie

NVUM Surveys: The FY 2018 National Visitor Use Monitoring data was collected on the UNF in 2018. The analysis and report have not been completed or sent out to the National Forests yet.

Trail Maintenance: Trail maintenance is needed to maintain the condition of forest trails. In general, the trend is increasing the mileage of trails being maintained or improved to reach the regional trail standards. In FY2011, the year before the Forest Plan was signed, 20.6 miles of trail were maintained, 4.88 miles of trail were improved, and 25.4 miles were meeting standards. Following the signing of the Forest Plan Revision, the trail system that was maintained to regional standards has shown a trend for increased mileage for both motorized and non-motorized trails. There was a temporary dip in FY17 and FY18 with fewer maintenance dollars, however, FY19 and the amount accomplished to date in FY20 show an increase in maintenance (see Appendix A). These accomplishments in motorized and non-motorized trail maintenance were possible through partnerships and

volunteer efforts with local trail clubs and the NC Department of Natural and Cultural Resources through their Recreational Trails Program (RTP) grants. Through the continued success in receiving RTP grants, active involvement from volunteer organizations, and public engagement in developing trail assessments during the Uwharrie NF Trail Strategy, the Forest is positioned to improve trail sustainability and reduce the maintenance backlog in the next monitoring period.

Uwharrie National Recreation Trail: Change in the amount of trail maintenance backlog is decreasing as funding through trail grants has increased. Many of these projects are getting into contracting this fall. Generally, the forest can maintain approximately 35 to 45% of the trail mileage across the Uwharrie National Forest. So as the forest rotates through the different areas on the trail system, we can maintain or improve the trails to regional trail standards. There will always be slight ups and downs in the actual mileage completed each year based on funding and staffing and the amount of volunteer involvement.

Tract additions for the Uwharrie National Recreation Trail realignment and re-creation have included the King Mountain Tract, the Little Long Mountain Tract, and the Klaussner Tract for a total of 546.84 acres as of August 2018. This has added approximately 6.5 miles to the length of the Uwharrie National Recreation Trail (UNRT). There are two other acquisitions that occurred in FY 2020 for the UNRT corridor, which will connect the UNRT all the way up to High Pines Church Road (SR 1143) and then have it continue north. These additions are the Mill Creek Tract and the Walkers Creek Tract for a total of 54.98 acres. These latest additions have added approximately 2.5 miles to the Uwharrie National Recreation Trail. The trail is now approximately 29 miles. From there, the Forest will then need to make the final connection to the Birkhead Mountains Wilderness Area and then do a few reroutes to get the trail back to be 50 miles in length.

Croatan

Recreation Opportunity Settings were significantly impacted by Hurricane Florence in 2018 (Appendix A, Table 5D). Major repairs will be made at Flanners Beach (campground, day use, and beach), Fisher's Landing, Pinecliff Recreation Area, and Siddie Fields. All other recreation areas and opportunities are present and intact.

Recommended Changes

No changes recommended at this time.

6. Climate Change and Other Stressors

Summary

This monitoring category is comprised of questions related to the 2012 Planning Rule about how climate variability has changed, the influence of climate change on the plan area, and effects of national forests on climate change. This monitoring is conducted and reported by the Southern Region as part of the broad scale monitoring requirements in the 2012 Planning Rule. The following results reflect updates from data collected from 2018-2019. New information collected or compiled from the last report in 2018 has been evaluated. The "Broad-Scale Climate Change Monitoring Evaluation Report for the Southern Region" is posted at: https://www.fs.usda.gov/main/r8/landmanagement/planning#Monitoring

Monitoring Questions and Indicators

Uwharrie

Q18. How has climate variability changed, and how is it projected to change across the region?

Q19. How is climate variability and change influencing the ecological, social, and economic conditions and contributions provided by the plan areas in the region?

Q20. What effects do national forests in the region have on a changing climate?

Croatan

Q15. How has climate variability changed, and how is it projected to change across the region?

Q16. How is climate variability and change influencing the ecological, social, and economic conditions and contributions provided by the plan areas in the region?

Q17. What effects do national forests in the region have on a changing climate?

Q18. Are land cover changes occurring due to sea level rise, especially lands adjacent to tidal streams?

Key Results

Sea Level Rise

Croatan. The relative sea level trend is 3.22 millimeters per year with a 95% confidence interval of plus or minus 0.35 millimeter per year based on monthly mean sea level data from 1953 to 2019 which is equivalent to a change of 1.06 feet in 100 years. Forecasted 2036 coastal high tide flooding is expected to increase to seven (7) days per year under the representative concentration pathway 4.5 (low greenhouse gas emissions scenario) and 17 days per year under the representative concentration pathway 8.5 (high greenhouse gas emissions scenario) and increase in 2065 to 34 days (low) and 265 days (high).

Temperature

Projections suggest that future warming is expected, resulting in 25 to 70 more days above 90 degrees Fahrenheit and 11 to 32 fewer freezing days per year.

Precipitation

Precipitation was historically variable and will likely continue to be variable from one year to the next. There does appear to be a trend toward a modest increase in total precipitation with little change in the number of dry days per year. Changes in total precipitation and in days per year with over two (2) inches of precipitation include a considerable amount of uncertainty when accounting for both representative concentration pathways 4.5 and 8.5 scenarios.

Forest Health – Southeast forests will be affected by many factors including extreme weather, shifts in plant hardiness zones, sea level rise and saltwater intrusion, and increased pressure from invasive plants and pests, drought, and wildfire frequency. Increasing temperatures will worsen disturbance due to invasive plants and insects.

Animal Communities – Some bird species along the coast have been negatively affected by development of ghost forests and consequent habitat loss. Certain amphibian and insect species such as the red legged salamander or the Diana Fritillary that are highly dependent on elevation are becoming more and more isolated due to habitat fragmentation and loss.

Plant Communities – Suitability conditions are projected to change for different tree species with certain species having more adaptive capacity (southern pines, oaks, and hickories) than others (balsam fir, red spruce, eastern hemlock, and sugar maple) due to pests and climate competition. Changes in growing season and flowering dates are also possible with increasing minimum temperatures. Projected increase in temperatures can allow invasive pests and plants to increase their spread.

Water Resources – With climate change projected to cause warmer temperatures and variable precipitation in the future, water resources will likely be even more affected by drought and extreme weather events. Severe drought impacts could lower streamflow in forested watersheds. Increased water temperature due to a warming climate can potentially lead to an increase in toxic algal blooms in lakes.

Recreation – Changes in precipitation due to drought could negatively impact water-based outdoor recreation like canoeing, kayaking, and motorized activities. Increase in temperature can impact visitors' comfort. Climate change can also have impacts on culturally significant natural resources.

Extreme Weather – Extreme precipitation events are becoming more likely; however, there are longer dry periods between storms. Increasing drought frequency and a projected increase in dry season, as much as 156 days in some areas, will increase the risk of wildfires. Not only are extreme precipitation events becoming more likely, hurricanes are becoming more severe and are able to sustain damaging conditions for longer periods of time.

Recommended Changes

See Appendix A, Table 6A for potential mitigation recommendations to be considered during Forest Plan Assessment, Need to Change.

7a. Progress Toward Meeting Desired Conditions and Objectives, Specific to Cultural Resources and Fire Management

Summary

This monitoring sub-category is comprised of questions about conditions of cultural resources and the program for prescribed fire that is essential for reaching the desired ecological conditions as well as providing community protection of adjacent lands. The following results reflect updates from data collected from 2018 to 2019. New information collected or compiled from the last evaluation report from 2018 has been evaluated.

Monitoring Questions and Indicators

Uwharrie

Q23. What are the trends in protection and/or stabilization and preservation of cultural or historic sites? (# High Priority Sites Maintained)

Q24. What are the risks of wildfire that may affect local communities, and what strategies may provide for community protection from wildfire? (Amount, timing, and location of prescribed fire)

Croatan

Q24. What are the conditions of cultural and historic Special Interest Areas? (Changes in cultural/historic site conditions)

Q25. What are the risks of wildfire that may affect local communities, and what strategies may provide for community protection from wildfire? (Projects through community wildfire protection plans)

Key Results

Uwharrie – Cultural Resources

Summary: An action plan to protect heritage assets was initiated during this monitoring cycle. Eight significant heritage assets were protected successfully by decreasing disturbances from off-highway vehicle (OHV) use and creating reroutes around sensitive locations. Three cemeteries were given permanent site boundaries. Three structures on the Thornburg farm were stabilized. While some sites continue to degrade, an overall reduction in the maintenance backlog is occurring which meets the intention of the plan and objective (Cultural-1). There is an increase in damage from dispersed campsites, horse trails, and gold panning, while damage from OHV trails is decreasing.

A total of two sites were monitored on the Uwharrie National Forest between October 1, 2017 and September 30, 2019. Both sites were stable. The lack of Uwharrie NF site monitoring was due to staff turnover and employee retirement for FY18 and FY19. The Uwharrie Zone Archeologist detailed into the retiree's position and was unable to monitor sites regularly. In general, sites continue to experience disturbance through recreational use (OHV trail, horseback riding, and gold panning), and monitoring needs to continue. The remaining site is the National Register Eligible Buck Mountain Fire Tower in need of a structural assessment.

The Uwharrie National Forest has implemented a management plan for protecting cultural resource sites along the OHV trail system. This plan includes the use of barricades placed along the trail in order to deter users from driving over known significant cultural resources and/or disperse camping on these resources. In FY17, sites monitored showed a significant decrease in large vehicle traffic and dispersed camping within the site boundaries. Four of the sites showed increased user created trails. The trails were created by horseback riders and/or smaller vehicles such as four wheelers and motorcycles which can get through barricade gaps. Natural erosion is still occurring on all sites monitored, particularly within the trail prism and site boundary intersection. Efforts to monitor, barricade, and reroute OHV trails from these areas are ongoing.

Shoreline wave action erosion continues along Badin Lake. Plans to monitor cultural sites experiencing erosion will be implemented in FY20.

A Forest Service partnership with Central Michigan University known as "Alternative Break" has continued the preservation of the National Register Listed Thornburg Farm. Three National Register contributing structures were stabilized and interpreted in FY 18 and FY19. University students travel to the site during winter break and work with master carpenters to restore historic structures.

Gold panning continues to disturb cultural resources located within adjacent river/stream terraces. Of particular concern is stream bank excavation and rock movement within water courses. Monitoring of one site noted gold panning participants moving larger rocks/boulders in order to divert the water into undisturbed banks.

Croatan – Cultural Resources

Summary: Cultural and historic special interest areas were found to be unstable (damaged) during this monitoring cycle, mostly due to impact from Hurricane Florence in FY19. The Zone Archeologist and contractors monitored 27 sites. Fourteen are stable, while 13 sites are experiencing degradation from recreation users, rising sea levels, and hurricane damage.

A total of 27 sites were monitored on the Croatan National Forest between October 1, 2017 and September 30, 2019. Fourteen sites were stable. One site experienced disturbance through recreational use (campers collecting eroding artifacts from bank, and another through unauthorized ground disturbance. Shore erosion by the White Oak and Neuse River has increased on ten sites. Recent excavations to mitigate damages from Hurricane Florence have established the water table base level at NRHP Eligible Holland Point site. The remaining site is a National Register Eligible Newport-Simmons Fire Tower in need of a structural assessment.

The Croatan cultural and historic Special Interest Areas are mostly stable, however several shoreline SIAs have been impacted from Hurricane Florence. A replicated CCC-era shelter at Pinecliff Recreation area has been damaged and needs repairs. Rising water tables threaten to impact sites at Holland Point and Brice's Creek. Base water table levels need to be established at sites along Brice's creek.

The National Register Eligible prehistoric sites within the Holland Point, Flanner's Beach, Fisher's Landing, Siddie Fields, and Pinecliff continue to erode or experience hurricane damage. Mitigation measures are ongoing at these sites and need engineering stabilization recommendations.

The Island Creek SIA has experienced an increase in user created trails which have impacted known historic and prehistoric sites.

The large historic cemetery in the White Oak River SIA has been researched and stabilized. The African American ancestors of the displaced Long Point community along with the non-profit Croatan Coalition group have partnered with the Forest Service to research, protect, maintain, and preserve the cemetery and postbellum agricultural complex. Metal detecting continues to disturb known sites within the White Oak SIA. Continued efforts to engage with the local African American community are ongoing to encourage interest in stewardship at this location.

The Camp Patterson SIA was disturbed by DOT road construction activity. National Register Eligible CCC Camp Patterson mitigation measures were conducted by Forest Service and DOT archeologists. Preservation and protection activities were carried out on existing historic CCC camp foundations. Interpretive signage and trail design are being formulated as part of the mitigation. A research contract was conducted for gathering information on mitigating the camp, and VSFS college student virtual interns are being selected to utilize this research to design interpretive signage at this site. Research was conducted at CCC Camp Gillett to contribute to its determination of eligibility and association with Camp Patterson.

Uwharrie - Prescribed Fire

The district is currently burning right at the target amounts described in the forest plan and able to accomplish those acres consistently. More than 6,300 acres were treated in 2019 (Appendix A, Table 7A) which is the most prescribed fire activity in the recent past. Fortunately, the areas that have the highest concentration of WUI areas are also the same areas that contain longleaf pine. So, multiple important objectives are achieved on the same piece of ground with one single treatment, including wildfire protections. The Uwharrie needed to suppress only three acres of wildfire in 2019 (Appendix A, Table 7B). The longleaf areas are burned more frequently, and those communities that are adjacent or nearby receive protective treatments more often because of the longleaf presence.

Croatan - Prescribed Fire

The Croatan has made significant improvements in longleaf pine conditions by averaging more than 20,000 acres per year on a three-year burning cycle contributing to restoring longleaf pine. However, no prescribed fire occurred in 2019 due to the damage caused by Hurricane Florence (Appendix A, Table 7C). Wildfire suppression averaged about 50 acres this monitoring cycle (Appendix A, Table 7D). Community Wildfire Protection Plans are developed and implemented for every community fire department within the Croatan National Forest plan area. (Table 7E).

Recommended Changes

No changes are recommended for this monitoring cycle.

7b. Progress Toward Meeting Desired Conditions and Objectives, Specific to Broader Scale Economic Trends

Summary

This monitoring sub-category is comprised of a question related to the 2012 Planning Rule about the contribution of national forests toward social, economic, and cultural sustainability. This monitoring is conducted and reported by the Southern Region as part of the broad scale monitoring requirements in the 2012 Planning Rule. The following results reflect updates from information analyzed during 2018 to 2019. The "Broad-Scale Socioeconomic Monitoring Evaluation Report for the Southern Region" is posted at: https://www.fs.usda.gov/main/r8/landmanagement/planning#Monitoring.

Monitoring Questions and Indicators

Uwharrie

Q25. What changes are occurring in the social, cultural, and economic conditions in the areas influenced by national forests in the region?

Croatan

Q26. What changes are occurring in the social, cultural, and economic conditions in the areas influenced by national forests in the region?

How has land use on and around the National Forests changed over time? (This new question was added because the 2016-2017 report called for the development of a question to track land use change at the broadscale).

Key Results

Refer to Appendix A, Table 7B-1.

Population Change: Increase in population growth places more demands on resources. Populations increased about 10% in the Uwharrie plan area and about 13% in the Croatan plan area. These are modest increases but below the R8 average of 17%.

Unemployment Rate: Corresponds between residents' skills and employment opportunities. Unemployment rates were 4.9% (Uwharrie) and 5.2% (Croatan), which is near the level at the regional scale of 5.1%.

Population below poverty level: Changes or restrictions to forest uses may affect individuals depending on local resources. Populations below poverty levels are 17% (Uwharrie) and 15% (Croatan), which is similar to the regional scale of 18%.

Payments to Counties: Payments contribute to employment and labor to counties where forests are located. The average payment per acre is $1.47 (Uwharrie) and $0.92 (Croatan) which is below the regional average of $2.08.

Expenditures: Expenditures by the national forests and their employees contribute to economic activity surrounding the forests. The statistics are only available for all of NFsNC, where $17MM are spent on salaried employees and $13MM are spent on non-salaried work.

Land use change: To understand the baseline for land use change over time, the Forest GIS Coordinator and Croatan and Uwharrie GIS Editor developed a method to provide annual estimates of the acreage gain or loss of vegetation, landcover, and land use types. During this monitoring period, 1983 raster products were generated to serve as a baseline for showing changes. For future reports, acreage change estimates will be derived from the agency's Landscape Change Monitoring System application developed by USDA Forest Service Geospatial Technologies and Applications Center (GTAC). In addition, investigate other remote sensing applications currently in development for change detection analysis.

Recommended Changes

No changes are recommended for this monitoring cycle.

8. Effects of Management Systems on Productivity of the Land

Summary

This monitoring category is comprised of a question related to potential impairment of soil productivity. The following results reflect updates from data collected from 2018-2019. New information collected or compiled from the last evaluation report from 2018 has been evaluated.

Monitoring Questions and Indicators

Uwharrie

Q26. Are there significant changes in soil productivity? (Percent detrimental soil disturbance at selected sites)

Croatan

Q27. Are there any impairments to soil productivity? And, if so, what are the restoration strategies (Best Management practices monitoring)

Key Results

Summary: While all timber sale units have some degree of increased soil disturbance, none of the surveyed units exceeded the significant level thus maintaining appropriate land productivity.

Uwharrie

A summary of the SDM data is presented in Appendix A, Table 8A. The two timber sale units surveyed post-harvest were ground-based harvested and had some degree of soil disturbance, however detrimental soil disturbance in each of the units was below the guideline level (15% detrimental disturbance as specified in the standard). Although an increase in disturbed area occurred from pre-harvest conditions, the units surveyed maintained appropriate land productivity.

Croatan

A summary of the SDM data is presented in Appendix A, Table 8A. The two timber sale units surveyed post-harvest were ground-based harvested and had some degree of soil disturbance, however all disturbance was below the significant level (15% detrimental disturbance as specified in the plan). The past practice of bedding the soil to improve growing conditions for desired species occurred in these units and can be found in many places on the Croatan. This past disturbance was not counted in the current monitoring as detrimental. The extent of ground disturbance was moderate to high because of harvesting techniques used on the units, and several areas within the units had evidence of wet soil conditions during logging. Although an increase in disturbed area occurred in the units surveyed, the amount of detrimental disturbance was not extensive, and the units maintained appropriate land productivity.

Recommended Changes

No changes are recommended during this monitoring cycle.

Appendix A: Data or Other Information for Each Category

Category 1: The status of select watershed conditions, including aquatic ecosystems and aquatic species habitats

Table 1A. Watershed Condition Framework Evaluation for Uwharrie (6th level HUCs; 2011)

Watershed	Total Acres	FS AC	% FS	Condition Score
Betty McGees Creek-Uwharrie River	20038	2387	12	1
Hannahs Creek-Uwharrie River	21058	3159	15	2
Barnes Creek	15415	4324	28	2
Crow Creek-Uwharrie River	28957	3817	13	2
Outlet Uwharrie River	20266	11534	57	2
Beaverdam Creek-Yadkin River	42391	7317	17	2
Wood Run-Lake Tillery	11359	4285	38	2
Clarks Creek	21241	1211	6	2
Densons Creek	22264	1340	6	2
Rocky Creek	18793	3625	19	2
Eury Dam-Little River	31952	3406	11	2
Cheek Creek	20720	2306	11	2
Big Town Creek-Little River	27581	1454	5	2

Table 1B. Watershed Condition Framework Evaluation for Croatan (6th Level HUCs; 2011)

Watershed	Total Acres	FS Ac	% FS	Condition Score
Mill Creek	23050	12697	55	2
Headwaters Brice Creek	28773	17798	62	1
Outlet Brice Creek	13661	6278	46	2
Cherry Point Marine Corps Air Station-Slocum Creek	37613	9571	25	2
Cherry Point-Hancock Creek	18155	7369	41	1
Clubfoot Creek	23612	5772	24	2
Black Swamp Creek	22402	17517	78	2
Holston Creek	9751	8603	88	2
Black Swamp Creek-White Oak River	11511	2370	21	1
Hunters Creek	21767	19095	88	1
Mulberry Creek-White Oak River	8515	1653	19	2
Hadnet Creek	11427	8627	75	2
Pettiford Creek	12084	7837	65	2
White Oak River	21381	1155	5	2
Bogue Banks-Bogue Sound	12878	1295	10	2

Watershed	Total Acres	FS Ac	% FS	Condition Score
Upper Newport River	21382	13526	63	1
Middle Newport River	24602	8903	36	2
Black Creek	8540	4058	48	1
Harlowe Creek	7959	859	11	2
Newport Marshes-Lower Newport River	24597	1329	5	2
Town of Salter Path-Jumping Run	18878	3392	18	2

Category 2: The status of select ecological conditions, including key characteristics of terrestrial systems

Uwharrie NF

Table 2A. Activity in Selected Ecological Systems for Uwharrie NF

Selected Activity	Acres 2016-2017	Acres 2018-2019	Purpose
Plant Shortleaf	236	51	Restoration of shortleaf pine
Plant Longleaf	31	0	Restoration of longleaf pine
Longleaf Release	148	0	Removal of competing vegetation
Pine Thinnings	141	20	Loblolly and Shortleaf
Treat Nonnative Invasive Species	62	8.8	Control invasive species

Croatan NF

Table 2B. Activity in Selected Ecological Systems for Croatan NF 2018-2019

Selected Activity	Acres 2016-2017	Acres 2018-2019	Purpose
Planted Longleaf	136	119	Restoration from loblolly to longleaf
Longleaf Release	188	73	Removal of competing vegetation
Pine Thinnings	505	174	Foraging habitat and insect prevention
Midstory Control	2,372	168	Conditions for herbaceous understory

Category 3: The status of focal species to assess the ecological conditions (some overlap with Category 4 regarding endangered species)

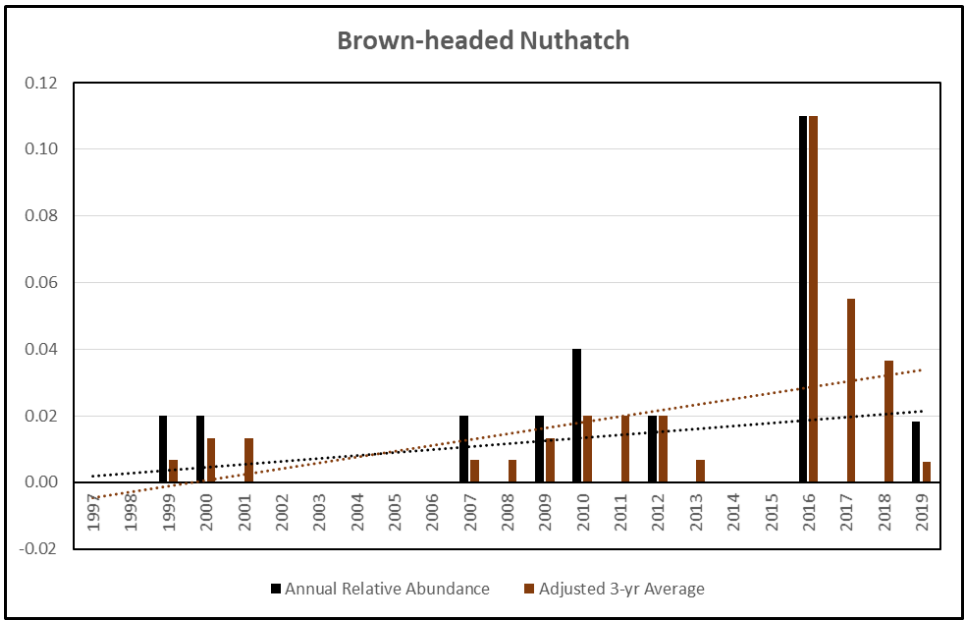

Figure 3A. Trend in relative abundance of brown-headed nuthatch across the Uwharrie National Forest, 1997-2019 (data source: R8Bird 2019).

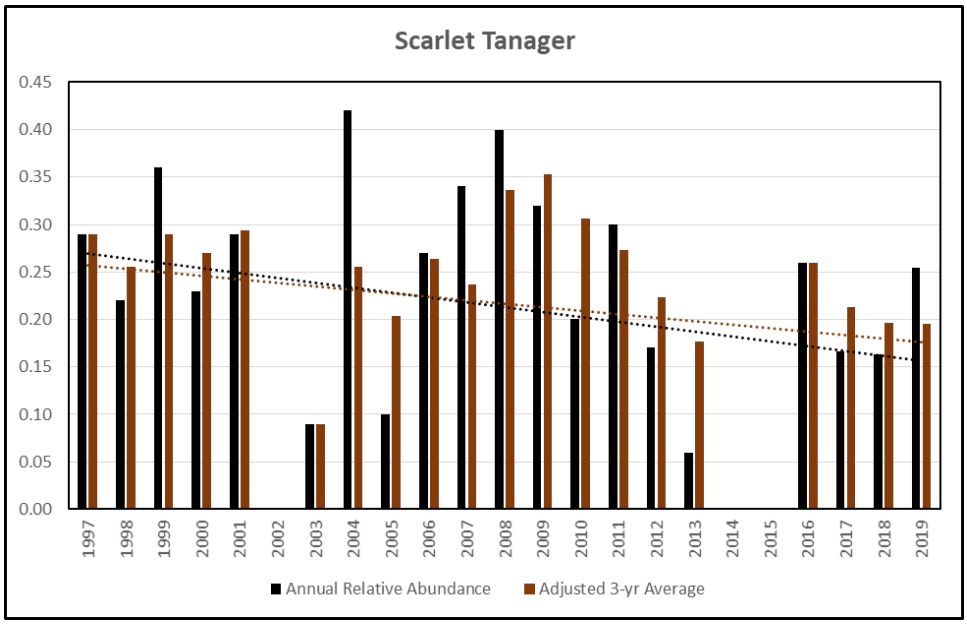

Figure 3B. Trend in relative abundance of scarlet tanager across the Uwharrie National Forest, 1997-2019 (data source: R8Bird 2019).

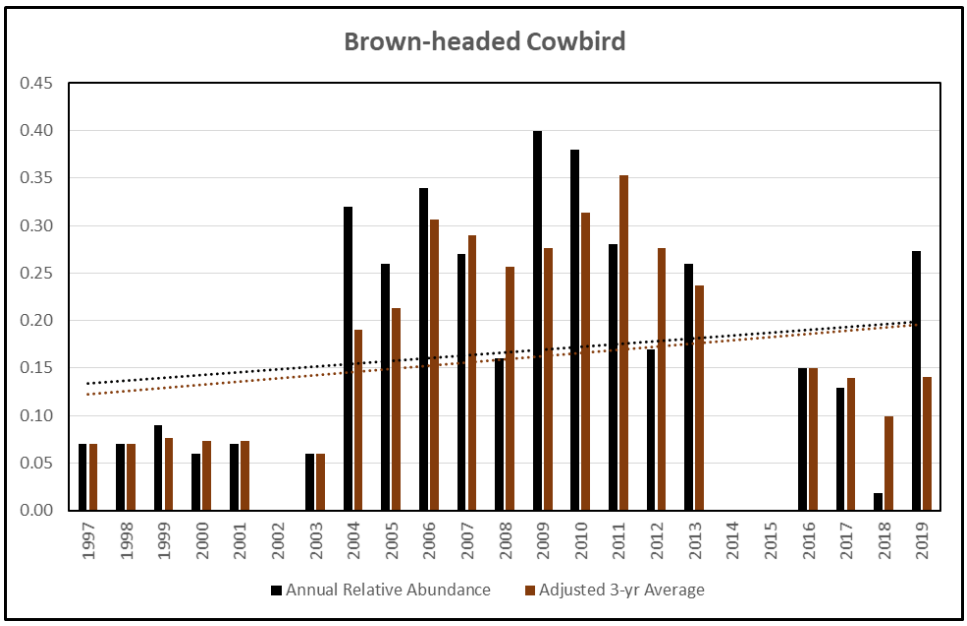

Figure 3C. Trend in relative abundance of brown-headed cowbird across the Uwharrie National Forest, 1997-2019 (data source: R8Bird 2019).

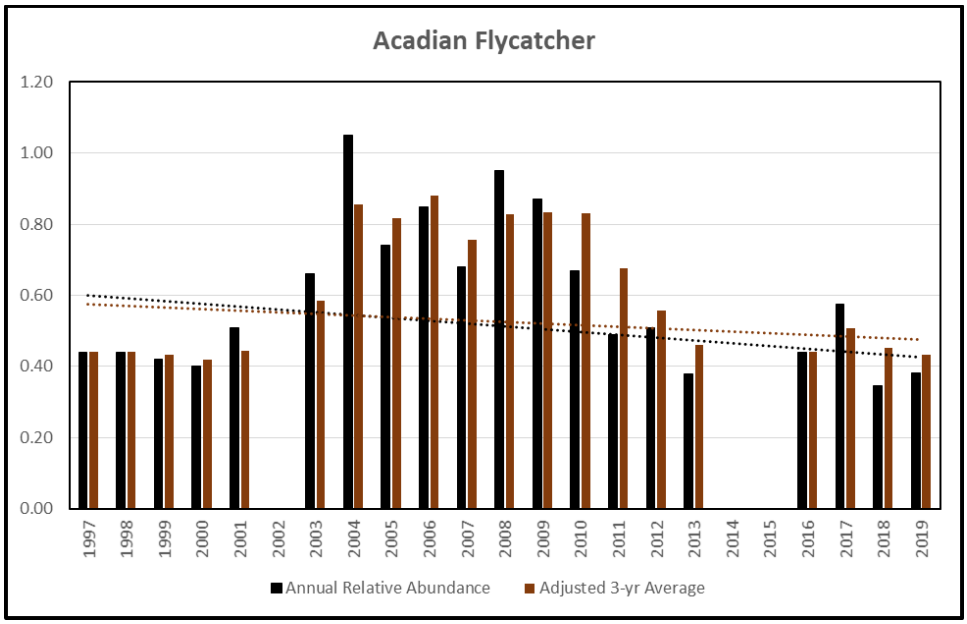

Figure 3D. Trend in relative abundance of Acadian flycatcher across the Uwharrie National Forest, 1997-2019 (data source: R8Bird 2019).

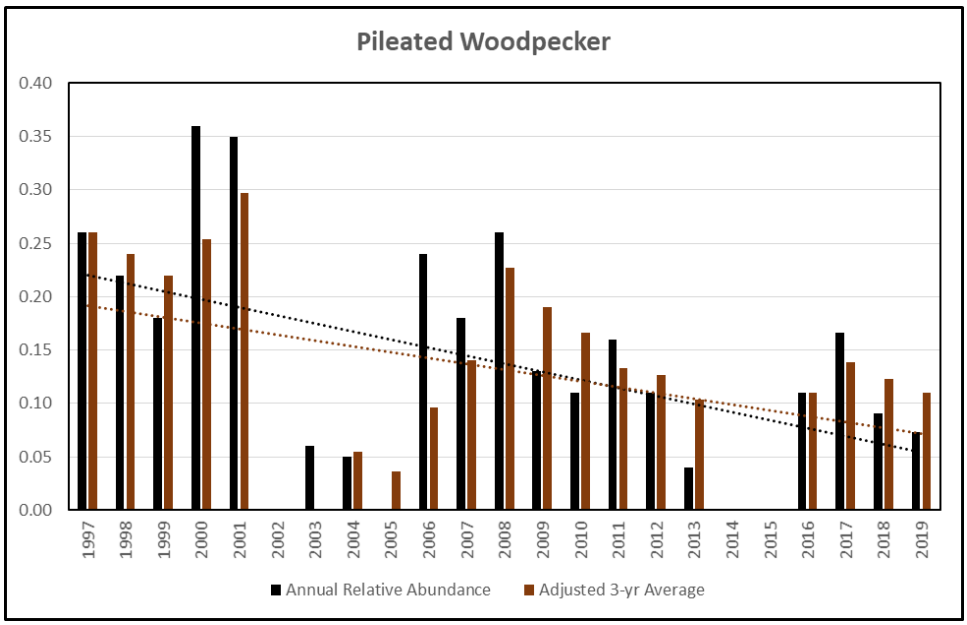

Figure 3E. Trend in relative abundance of pileated woodpecker across the Uwharrie National Forest, 1997-2019 (data source: R8Bird 2019).

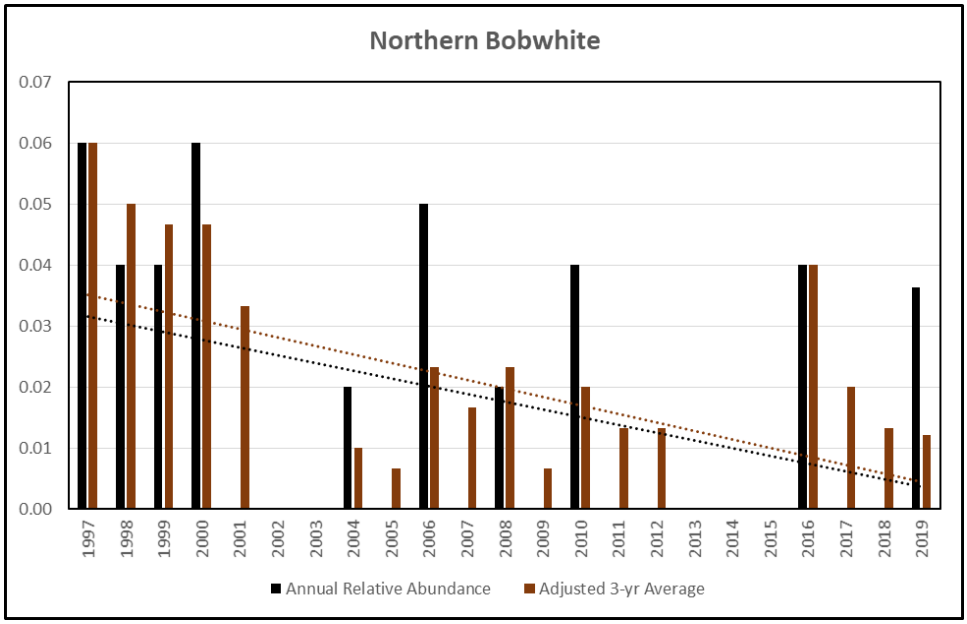

Figure 3F. Trend in relative abundance of Northern bobwhite quail across the Uwharrie National Forest, 1997-2019 (data source: R8Bird 2019).

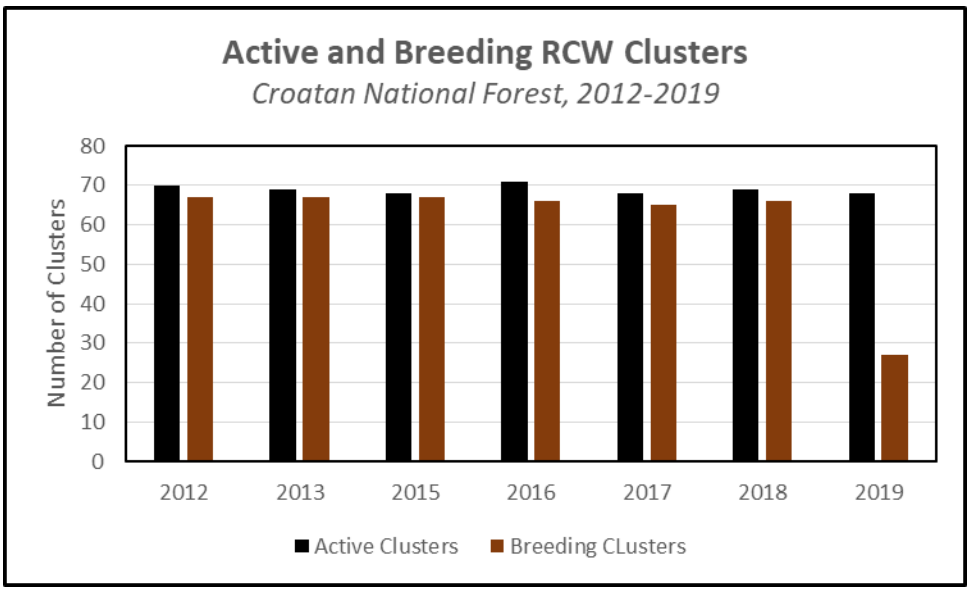

Figure 3G. Trend in active and breeding red-cockaded woodpecker clusters across the Croatan National Forest, 2012-2019.

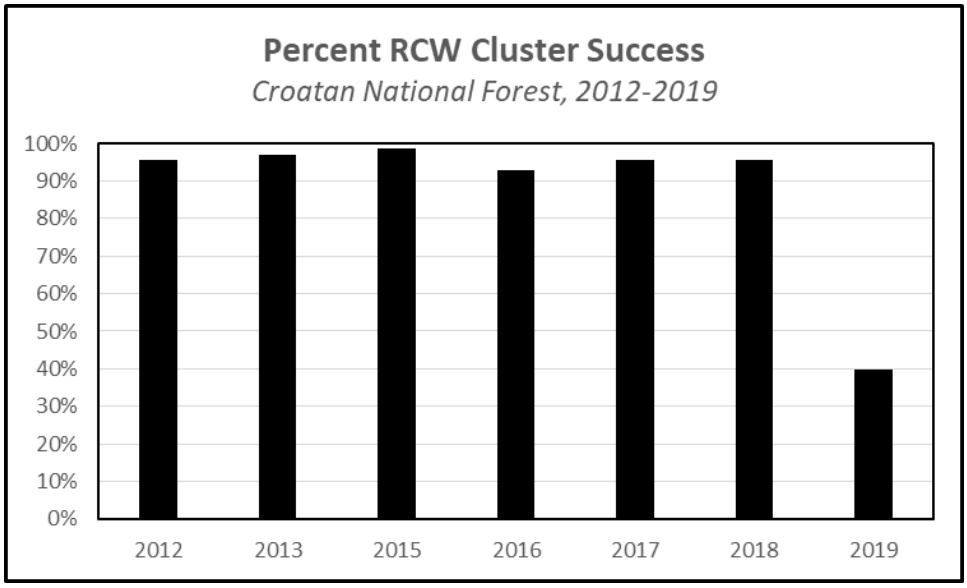

Figure 3H. Percent RCW cluster nesting success across the Croatan National Forest, 2012-2019.

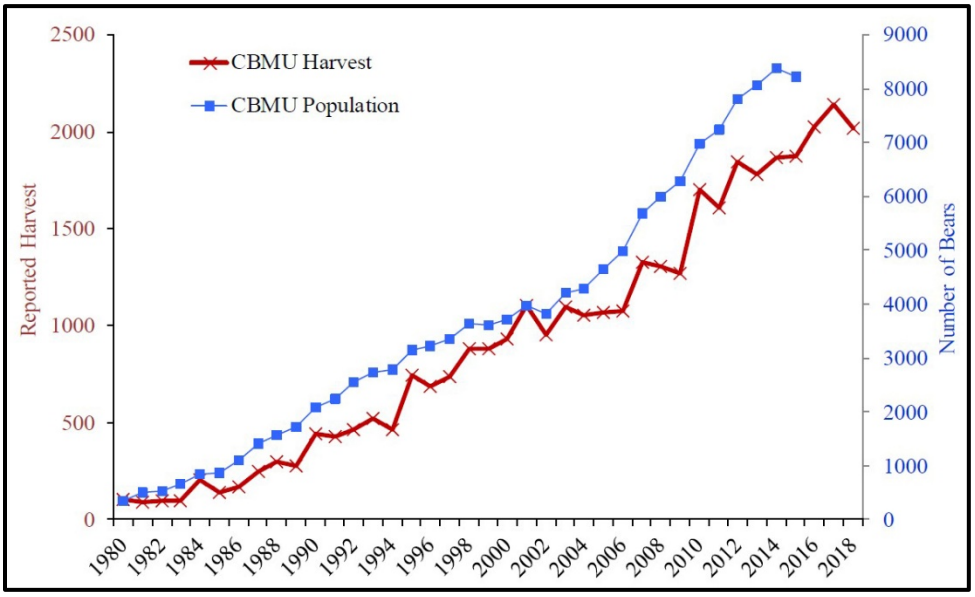

Figure 3I. Coastal bear management unit harvest and population estimates, 1980-2018, as presented in Olfenbuttel (2019).

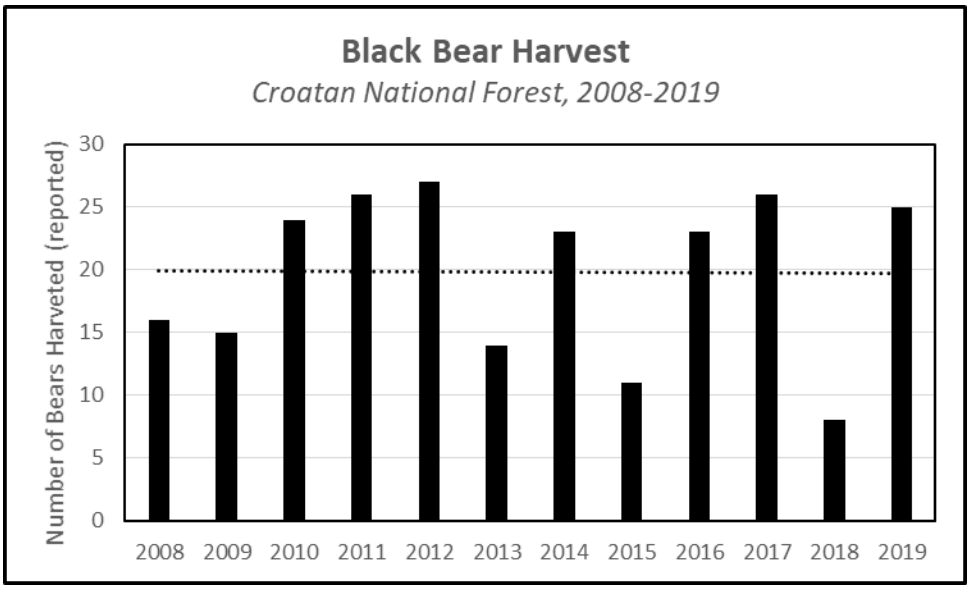

Figure 3J. Black bear harvest (reported) from the Croatan National Forest, 2008-2019, as summarized by the NCWRC.

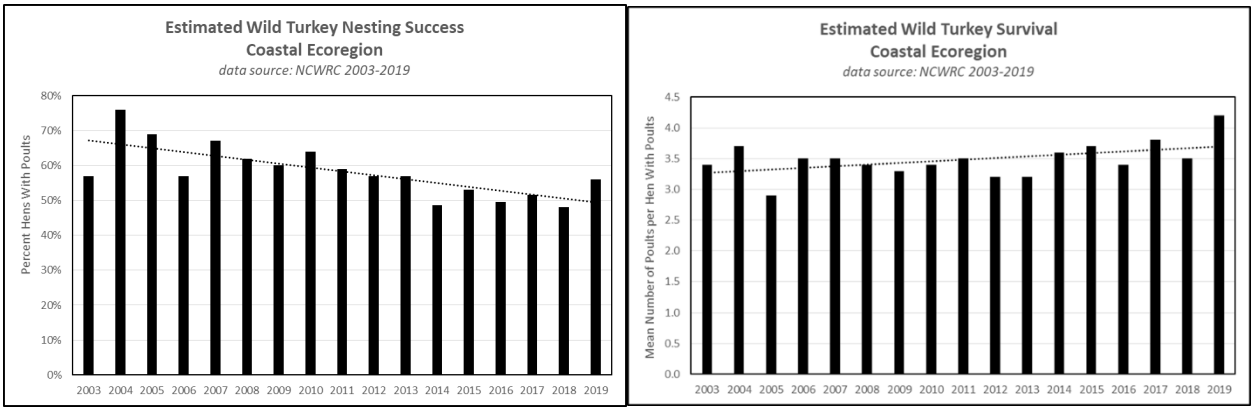

Figure 3K. Estimated wild turkey nesting success and survival from the coastal ecoregion, 2003-2019.

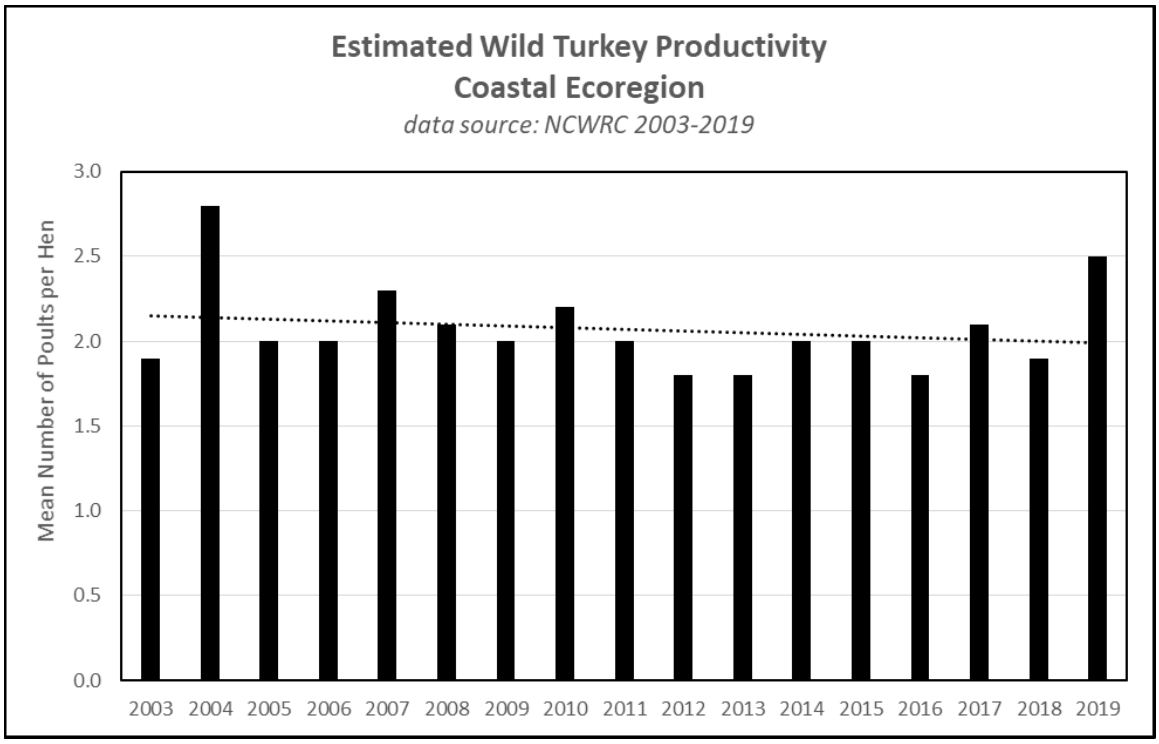

Figure 3L. Estimated wild turkey productivity within the coastal ecoregion, 2003-2019.

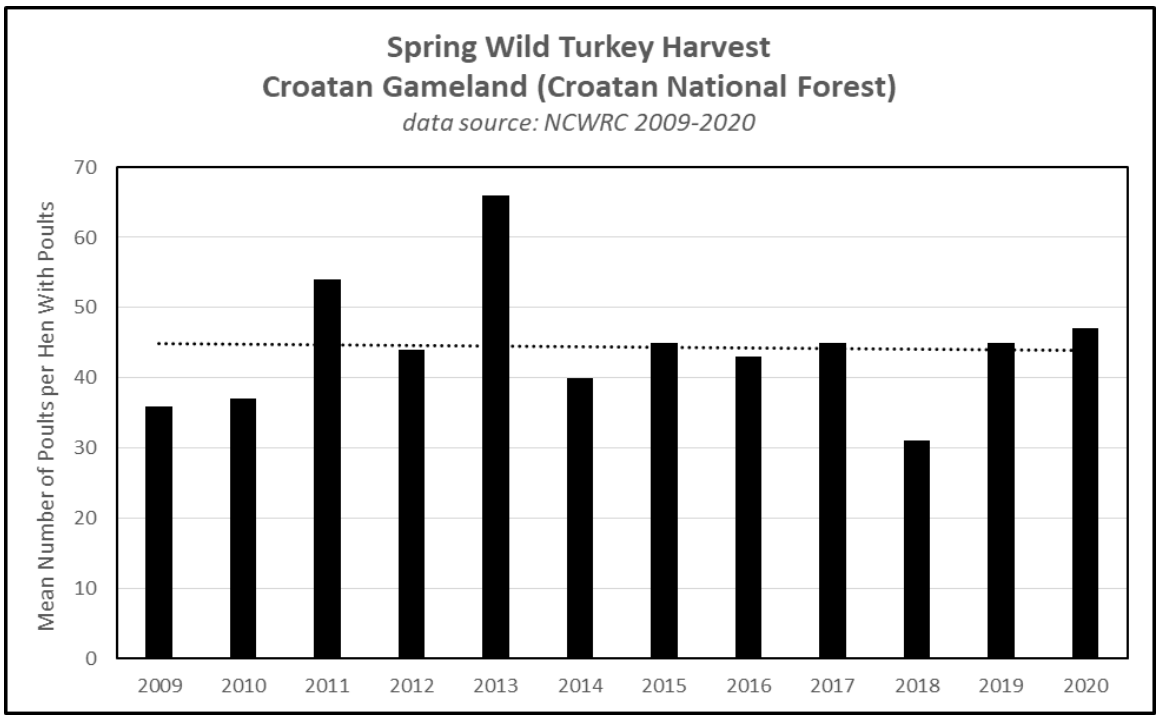

Figure 3M. Spring wild turkey harvest from the Croatan National Forest, 2009-2020.

Category 4: The status of a select set of ecological conditions to contribute to the recovery of federally listed threatened or endangered species, conserve proposed and candidate species, and maintain a viable population of species of conservation concern.

Table 4A. Schweinitz's Sunflower Occurrences (Uwharrie NF)

Element Occurrence Number	Location	Stem Count
Parent EO 44	NC 109	1760 (stable)
Parent EO 110	Badin Area	488 (4 of 6 populations-stable)
Parent EO 111	Roberdo Area Clark's Grove (sub EO 61)	7 populations (stable); 1 population (declining) 2100 (stable & increasing)
Parent EO's 145, 146,148	Northern UNF	50 each

Table 4B. New Element Occurrences Found on the Uwharrie NF since January 2017
(From 2018 report, no change for 2020 report)

Plant Species

Common Name	Scientific Name
Bog Spicebush	*Lindera subcoriacea*
Mountain camelia	*Stewartia ovata*
Carolina thistle	*Cirsium carolinianum*
Crested coralroot	*Hexalectris spicata*
Bog oatgrass	*Danthonia epilis*
Slender Blue Iris	*Iris prismantica*
Mountain witch alder	*Fothergilla major*
Hillside Seepage Bogs	N/A
Piedmont Boggy Streamheads	N/A
Xeric Hardpan Forests	N/A

Common Name	Scientific Name
Dry Piedmont Longleaf Pine Forest	N/A
Quillwort Species (new)	Name to be determined

Table 4C. List of Special Interest Natural Areas with Estimates of Conditions (Croatan NF) (Updates for the 2020 Report)

Special Interest Natural Area	Condition Estimate
Croatan Pocosins	Good
Cedar Point/White oak river marshes	Excellent
Flanner Beach Natural Area	Fair – Hurricane Florence damage
Gum Swamp Bottomland Hardwood Forest	Not checked
Hadnot Creek Ponds and Longleaf Pine Woods	Good (2020 Burn)
Hibbs Road Ridges	Good (2018 Burn)
Holsten Creek/Heywood Landing	Good (2018 Burn) (2020 Burn)
Hunters Creek Upland Forest	Excellent (some NNIS) (2020 Burn)
Island Creek Natural Area	Good (some NNIS and unauthorized bike trails)
Little Road Longleaf Pine Savannas	Excellent (2020 burn)
Millis Road Savannas and Pocosins	Excellent (2017 burn) (2020 burn)
Millis Swamp Road Pinewoods	Good
Nine Foot Road/Broad Creek Pinewoods	Good (2018 Burn)
Nine Foot Road/Roberts Rd Limesink Ponds	Excellent (2018 Burn)
Patsy Pond Limesink Complex	Good (2018 Growing Season burn)
Pettiford Creek Open Flatwoods	Good (2017 Burn) (2020 burn)
Pringle Road Bay Rims	Excellent (2017 Burn) (2020 burn)

Excellent Condition: The entire natural area is in a "maintain" condition class

Good Condition: More than half of the natural area is in a "maintain" condition class

Fair Condition: High quality vegetative patches are scattered throughout the natural area

Table 4D. At Risk Plant Species on the Croatan NF
(From 2018 report, no change for 2020 report- see Key Findings section for updates)

Common Name	Scientific Name	Number of EO's
Rough Leaved Loosestrife	Lysimachia asperulifolia	62
Spring Flowing Goldenrod	Solidago verna	41
Leconte's thistle	Cirsium lecontei	10

Category 5: The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives

Table 5A. Trail Maintenance Data for Uwharrie NF

Year	Maintained (miles)	Improved (miles)	Maintained to Standard (miles)
2011	20.6	4.88	25.4
2013	44.0	0.64	37.0
2015	20.6	0	59.8
2016	39.3	0.8	41.7
2017	2.35	0	2.35
2018	14.05	0.8	14.85
2019	44.35	2.0	46.35
2020 (to date)	21.35	0	21.35

Table 5B. Trail Maintenance Backlog on Uwharrie NF

Report Year	Non-motorized trail miles	Motorized trail miles
2018	70	17
2020	57.70	24.50

Table 5C. Additions to the Uwharrie National Recreation Trail (Uwharrie NF)

Years	Additional Tracts (Ac)	Additional Trail Miles	Total Trail Miles
2016-2018	3 tracts (547 ac)	5 miles	25 miles
2018-2019	2 tracts (54.98 ac)	4 miles	29 miles

Table 5D. Recreation Site Improvements Needed on the Croatan from Hurricane Florence

Location	Type of Improvement
Pinecliff Recreation Area	Bank stabilization, tree removal, parking area improvements, expansion of rec area behind bathroom/shelter, reestablish trailhead, replace amenities (tables, grill, trash cans, etc.), split rail fencing, move non-motorized boat launch closer to parking area.
Flanners Beach	Bank stabilization, beach access reestablished, reclaim portion of beach, remove trees, and brush along river edge.
Siddie Fields	Bank stabilization, install walking path from parking area to beach, pave a couple handicap parking spots, add bathroom (from Dixon field), new trash cans, improve aggregate parking area.
Fisher's Landing	Bank stabilization, new amenities (tables, trash cans, grills), build a shelter (like Pinecliff), brushing, repair/upgrade bathroom, interpretative signage.

Category 6: Measurable changes on the plan area related to climate change and other stressors

The following information is excerpted from the Broad-Scale Climate Change Monitoring Evaluation Report (Appendix C) for the Southern Region for consideration on the Croatan and Uwharrie NFs. **(**https://www.fs.usda.gov/main/r8/landmanagement/planning#Monitoring)

Table 6A. Climate Change Potential Threats and Mitigations

Potential Threats from a Changing Climate	Potential Mitigations to Consider During Future Planning Efforts
Threat to biological diversity: Non-native invasive species. (Uwharrie) Invasive and aggressive plant and insect species may increasingly outcompete or negatively affect native species in the future. Winter freezes currently limit many forest pests, but higher temperatures will likely allow these species to increase.	Manage tree densities through practices such as thinning and prescribed fire to maximize carbon sequestration and reduce the vulnerability of forest stands to water stress, insect and disease outbreaks, and fire. Monitor for new invasive species moving into areas where they were not traditionally found, especially following events such as hurricanes.
Threat to forest heath and water resources (Croatan –priority) (Uwharrie) Southeast forests will be affected by many factors including extreme weather, shifts in plant hardiness zones, sea level rise and saltwater intrusion, and increased pressure from invasive plants and pests, drought, and wildfire frequency. Increasing temperatures will worsen disturbance due to invasive plants and insects. Warmer temperatures due to climate change are converting saltwater marsh to mangroves and shifting where the marsh to mangrove ecotone exists. Sea level rise will increase soil salinity levels in coastal communities. Coastal forest retreat due to saltwater intrusion and the formation of “ghost forests” has been documented along the Southeast U.S. coastline. In addition, coastal wetlands have seen plant community shifts due to higher levels of salinity.	Develop a coordinated system of monitored and controlled entrance points that control the majority of water flow inland from the shoreline and high-value water and land restoration areas in order to reduce salt-intrusion as well as to preserve marshes and swamps. Efforts to restore ecological integrity to impacted ecosystems (ex. by managing for longleaf and shortleaf pine) can have positive effects on disease and pest resistance.

Potential Threats from a Changing Climate	Potential Mitigations to Consider During Future Planning Efforts
Threat to Wildlife (Uwharrie) (Croatan) Some bird species along the coast have been negatively affected by the development of ghost forests and consequent habitat loss. Certain amphibian and insect species such as the red legged salamander or the Diana Fritillary that are highly dependent on elevation are becoming more and more isolated due to habitat fragmentation and loss.	Conserve buffer areas along riparian habitats to provide habitat for amphibian species. High elevation areas are crucial refugia for many species. Preventing the addition of new roads and heavy equipment in these areas can maintain habitat connectivity. Create habitat corridors, assist in species movement, increase national forest management unit sizes, and identify high- value conservation lands adjacent to national forests.
Threat to Wildlife (Uwharrie) Wildlife species will be affected in different ways. Amphibians may be most at risk, due to dependencies on moisture and cool temperatures that could be altered. Bird species, such as red cockaded woodpeckers, may see a decrease in population as vegetation types change and heat stress makes their food sources more difficult to come by. Alternatively, mammals such as deer and bears may increase	Maintain piles of natural woody debris in areas of high amphibian diversity to supplement habitats that retain cool, moist conditions. Create habitat corridors, assist in species movement, increase national forest management unit sizes, and identify high- value conservation lands adjacent to national forests.
Threats to Plant Communities (Uwharrie) (Croatan) Suitability conditions are projected to change for different tree species with certain species having more adaptive capacity (southern pines, oaks, and hickories) than others (balsam fir, red spruce, eastern hemlock, and sugar maple) due to pests and climate competition. Changes in growing season and flowering dates are also possible with increasing minimum temperatures. Projected increase in temperatures can allow invasive pests and plants to increase their spread.	Manage for tree species with high adaptive capacity. Early detection and rapid response are the most effective way to respond to invasive species and should be implemented where possible.
Threats to Water Resources (Uwharrie) (Croatan) With climate change projected to cause warmer temperatures and variable precipitation in the future, water resources will likely be even more	Reduce impact on aquatic ecosystems affected by drought by favoring tree species that are fire tolerant and have relatively low water use (e.g., longleaf pine).

Potential Threats from a Changing Climate	Potential Mitigations to Consider During Future Planning Efforts
affected by drought and extreme weather events. Severe drought impacts could lower streamflow in forested watersheds. Increased water temperature due to warming climate can potentially lead to an increase in toxic algal blooms in lakes.	Remove invasive species that use more water to reduce stress on the aquatic ecosystems.
Threats from Extreme Weather (Uwharrie) (Croatan) The potential for severe storm events is expected to increase in the future, including more intense hurricanes making landfall in the southern US. Extended periods of extreme high temperature and drought may lead to drier forest fuels which will burn more easily and contribute to larger and more frequent wildfires. More cloud-to-ground lightning due to warming may also increase wildfire ignitions.	Identify areas that provide particularly valuable ecosystem services, like timber harvest or carbon sequestration, and are also vulnerable to extreme weather, like hurricanes or fires. Then plan conservation strategies (e.g. thinning, selective species planting) accordingly to mitigate for extreme weather impacts. Reduce increased wildfire potential by conducting prescribed burns
Threat to Water Resources (Uwharrie) (Croatan) Shifts in rainfall patterns will lead to periods of flooding and drought that can significantly impact water resources. Increases in heavy downpours and more intense hurricanes can lead to greater erosion and more sedimentation in waterways. Increased periods of drought may lead to poor water quality. Geographically isolated wetlands are critical wildlife habitat and can be impacted by changes in surrounding land cover.	Focus attention on and near smaller, isolated water systems that are more vulnerable and may not be able to absorb and benefit from wildfires and heavy rains that cause large floods or debris flow. Relieve groundwater and large reservoir use when there is ample surface water during wet periods or times of high-water flow to recharge aquifers, provide temporary irrigation, decrease stored sediment loss, and construct small reservoirs
Threats to Recreation Experiences (Uwharrie) (Croatan) Changes in precipitation due to drought could negatively impact water-based outdoor recreation like canoeing, kayaking, and motorized activities. Increase in temperature can impact visitors' comfort. Climate change can also have impacts on culturally significant natural resources.	Enact monitoring to determine when it is safe for recreational activities to take place in water recreation areas and communicate effectively to visitors the potential risks of higher temperature or high-water levels. Work with local indigenous populations and cultural groups to provide resources for them to adapt to the climate.

Category 7a: Social, economic, and cultural sustainability. This category focuses on cultural resources and the prescribed fire programs.

Table 7A. Area of Prescribed Fire on Uwharrie NF

Year	# Prescribed Fires	Acres of Prescribed Fire
2015	22	4,923
2016	14	4,876
2017	20	4,534
2018	20	4,918
2019	20	6336

Table 7B. Wildfire Incidents on the Uwharrie NF

Year	# Fires	Acres of Fire
2015	4	26
2016	16	192
2017	13	1718
2018	4	10
2019	6	3

Table 7C. Area of Prescribed Fire on the Croatan NF

Year	**# Prescribed Fire**	**Acres of Prescribed Fire**
2015	11	8,926
2016	25	16,389
2017	33	21,420
2018	51	26,707
2019	0* (*Hurricane Florence)	0* (*Hurricane Florence)
2020	28	23,288

Table 7D. Wildfire Incidents on the Croatan NF

Year	**# Fires**	**Acres of Fire**
2015	4	10
2016	13	1,717
2017	16	192
2018	4	10
2019	13	85
2020	11	571

Table 7E. List of Community Wildfire Protection Plans by County and Fire District on the Croatan

County	Fire District
Craven	New Bern
	Township 7 VFD
	Township 6 VFD
	Havelock FD
	Cherry Point FD
	Harlowe FD
Carteret	Newport FD
	Mill Creek VFD
	Wildwood FD
	Broad and Gales Creek VFD
	Western Carteret VFD
	Stella VFD
Jones	Maysville VFD
	Pollacksville VFD

Category 7b-1: Social, economic, and cultural sustainability, specific to broader scale economic trends

Table Broad Scale A: Socioeconomic Indicators and Comparison of Uwharrie and Croatan Area with Region 8 Area.

Indicator	Region 8 Area	Uwharrie	Croatan	Finding
Population change	Increase 17%	Increase 10%	Increase 13%	Increased population growth places more demands on resources.
Unemployment rate	5.1%	4.9%	5.2%	Corresponds between residents' skills and employment opportunities.
Population below poverty level	18%	17%	15%	Changes or restrictions to forest users may affect individuals depending on local resources.
Payments to counties	$2.08 average payment per acre	$1.47 average payment per acre	$0.92 average payment per acre	Payments contribute to employment and labor to counties where forests are located.
Expenditures (includes Nantahala/Pisgah NFs)	Salaried: $186MM Non-Salaried: $125MM	Salaried: $17MM Non-Salaried: $13MM	Uwharrie column includes all NFsNC	Expenditures contribute to economic activity surrounding the forests

Category 8: Effects of management systems on the soil productivity of the land

Table 8A. NFsNC 2018-2019 Uwharrie N.F. and Croatan NF Soil Quality Monitoring Results with Detrimental Soil Disturbance.

Uwharrie National Forest

Survey Year	Timber Sale	Unit #	Pre-harvest (Pre) or Post-harvest (Post)	Unit Area (acres)	Percent Detrimental Soil Disturbance
2019	Pine Bark T.S.	4	Post	15	9.7
2019	Moccasin T.S.	4	Post	58	0

Croatan National Forest

Survey Year	Timber Sale	Unit #	Pre-harvest (Pre) or Post-harvest (Post)	Unit Area (acres)	Percent Detrimental Soil Disturbance
2019	Holston	6	Post	25	3.0
2019	Holston	12	Post	10	0

Appendix B: Monitoring Guide Croatan & Uwharrie NFs

Category 2: Longleaf Condition Classes

2020 Biennial Monitoring Process
September 2020

This section of the monitoring guide for the Croatan and Uwharrie National Forests responds to the need for a protocol to determine the conditions of longleaf pine on the forests as identified in the previous Biennial Monitoring Report of 2018. The longleaf conditions need to be identified as the following: maintain (at or near desired conditions); improve (in restoration process); restore (need to begin longleaf restoration). The following procedure is recommended for the next two-year monitoring cycle.

Procedure:

Task A: Develop an Initial Longleaf Condition Class Model (ICCM) to estimate and map existing longleaf condition classes.
Timeframe: October 2020 – August 2021

ICCM Team: Forest Monitoring Coordinator, Forest Silviculturist, Forest Botanist Ecologist, Forest GIS Coordinator, District Silviculturist, District Botanist, District GIS Editor, Croatan Fire Specialist, Uwharrie Fire Specialist

1. Team members review the NFsNC Longleaf Restoration Strategy (Nicholas, Hutchinson, Spisak, Rodrigue, July 2018), and the Monitoring Coordinator files this version in the CU Monitoring Project Record. The strategy calls for about 4,320 acres (Uwharrie) and 14,148 acres (Croatan) by year 2025 in order to meet the Region 8 Million Acre Challenge.
2. Forest and District Silviculturists complete updates of FSVeg Data and other housekeeping items identified in the restoration strategy (p. 6).
3. Forest Ecologist and District Botanist provide shapefiles of the most updated version of Potential Natural Vegetation (PNV) and file this in the project record. (This is Step A of the LL Strategy, p. 7)
4. Sync the PNV Types with NatureServe Types for metric evaluation as follows:

Croatan National Forest

Longleaf Types (PNV)	NatureServe Type
Xeric Longleaf Woodland	Xeric longleaf Pine barrens
Dry-mesic Longleaf Woodland	Dry and Mesic Longleaf Pine Woodlands
Mesic Longleaf Woodland	Mesic Longleaf Pine Flatwoods
Wet Flatwoods	Wet Longleaf & Slash Pine Flatwoods & Savannas
Wet Savanna	Wet Longleaf & Slash Pine Flatwoods & Savannas

Uwharrie National Forest

Longleaf Types (PNV)	NatureServe Type
Wet Piedmont Woodland	Dry and Mesic Highlands Pine Woodlands
Dry Longleaf-Shortleaf Woodland	Dry and Mesic Highlands Pine Woodlands

For measures of LL condition classes refer to: Field Manual for Rapid Assessment Metrics for Wildlife and Biodiversity in Southern Open Pine Ecosystems; Appendix C; White and Nordman, 2016). Attachment 1 of this monitoring guide.

5. Silviculturists intersect the PNV types (as in Step 4) with FSVeg to estimate the amount of existing longleaf and opportunities to restore longleaf. (This is Step E of the LL strategy). Identify stands with existing LL and those without LL for potential opportunities for restoration. A potential scoring strategy follows:

EV Code	EV Description	Score
21	Longleaf Pine	4
30	Longleaf/Shortleaf	4
29	Longleaf/Loblolly	3
31	Loblolly	2
36	Pond Pine	2
All others		1
32*	Shortleaf	4
32+	Shortleaf	2

* on Uwharrie where shortleaf and longleaf mixed on dry rocky steep slopes, assessed on case by case basis with on-the-ground knowledge

+ on Uwharrie dominated by shortleaf, portions of which were planted, forest type may also be on small portions of Croatan

6. Forest GIS Coordinator and GIS Editor develops remote sensing tools for estimating canopy condition (closure/openness) for stands with existing LL working with silviculturists and botanists to use local knowledge of existing stand conditions to calibrate canopy conditions. Investigate using the following scoring technique:

% Canopy Closure	Score
< 60 percent	4
60-100 percent	Linear decline from 60-100

7. Forest GIS Coordinator and GIS Editor provide annual estimates of the acreage gain or loss of vegetation, landcover, and land use types. Acreage estimates will be derived from the agency's Landscape Change Monitoring System application. In addition, investigate other remote sensing applications currently in development for change detection analysis.
8. While developing tools in Step 6, the GIS coordinators investigate the potential to estimate mid-story condition using remote sensing methods. This step should be coordinated with fire specialists, silviculturists, and botanist as described in Step 9.
9. Forest botanists estimate existing longleaf mid-story and ground herbacous layer conditions using prescribed fire (and wildfire occurrences) frequency working with fire specialists and silviculturists. Information to also consider in addition to the potential scoring technique below is recent thinnings or on-the-ground knowledge of the midstory and herb layer, in particular if the layer is appropriate for that type:

Longleaf Type	#Burns/10yr	#Growing Season Burns/10yr	Score
Dry or Wet	3	1 or more	4
Dry	2	1 or more	4
Wet	2	0	3
Dry	1	0	2
Wet	1	0	1

10. Botanists include the presence/absence of non-native invasive species. The potential scoring is 4 for Absent NNIS; 3 for less than <5% presence of targeted non-native (list to be developed by botanists), 2 for 5-10% presence, and 0 for > 10% presence of NNIS.
11. The Forest GIS Coordinator and GIS Editor assign the scoring using an average score (could use a weighted average) for each stand and produce a map.

Task B: Check LL Condition Classes with ground inventory and revise the Initial LL Condition Class Model. Timeframe: August 2021 – August 2022

1. The district rangers each assign a two-person team from their staff to train in the NatureServe Metrics, including how to process and record the data. The Forest Ecologist develops the agreement with NatureServe to provide the training. The training and data collection take approximately one week on each district.
2. The team and NatureServe select stands to measure condition classes from each category of conditions. Each team measures and records the information and files the data in the monitoring project record.
3. The entire monitoring team evaluates the monitoring data and revises the Initial LL Condition Class Model and statistics.
4. The Forest GIS Coordinator is responsible for reporting the information in the 2022 Biennial Monitoring Report.
5. Assessments in the future (2024 reporting and beyond) will be with trained USFS personnel and may include a more rapid assessment of the existing condition within the three layers, canopy, midstory, and ground.