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Biennial Monitoring Evaluation Report for the Uwharrie and Croatan National Forests

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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 Croatan NF Forest Plan was approved in 2002.

During this monitoring cycle, there are no recommendations to change forest plans. Current forest plans are guiding projects appropriately, such as longleaf pine restoration, use of prescribed fire, protection and maintenance of heritage asset sites, recreation settings, trial maintenance, and habitat for aquatic and terrestrial wildlife and plants, which includes threatened and endangered species.

Persistent and increased monitoring is recommended for heritage asset sites, especially in the Birkhead Wilderness. Longleaf pine condition class estimates should be updated for the 2024 report. The 2023 NVUM recreation survey should consider suggestions from the local district staff to increase the accuracy of the data.

Watershed and aquatic biota remain relatively unchanged. Restoration of the Crow Creek watershed on the Uwharrie NF is scheduled to begin during the 2024 monitoring cycle. The Holston creek watershed restoration is scheduled for 2023-2025.

The first approximation of a longleaf pine condition evaluation was completed during this monitoring cycle. About 10,600 acres (Croatan) and 3500 acres (Uwharrie) were evaluated for the condition status. About one-third (Croatan) and one-quarter (Uwharrie) are estimated to be in maintenance condition. Each national forest is on a path with frequent prescribed fire, and as this continues, higher proportions of longleaf should reach maintenance conditions. No changes to forest plans or monitoring activities are planned at this time, except to re-assess longleaf condition classes for a second approximation to assess changes.

Pileated woodpecker and Northern bobwhite had been declining as cited in the 2020 Monitoring Report. A check on these species indicate populations are still declining. Otherwise, there have been no changes to other bird focal species and no changes in forest plans or monitoring activity is recommended.

Red Cockaded woodpecker was affected by Hurricane Florence prior to 2020, but the effects were mitigated with the placement of cavity inserts. Monitoring activity has been affected by the Covid-19 pandemic. For this monitoring report, the status of RCW is estimated to be stable.

The four special interest areas on the Uwharrie NF continue to improve, except for minor impacts to one for powerline maintenance. Of the 17 special interest areas on the Croatan, eight were monitored. Seven are improving and one was impacted by timber harvest.

As cited in the 2020 report, impacts to spring flowering goldenrod and Le'Conte's thistle occur due to road widening (Highway 17) and the Havelock bypass. Spring flowering goldenrod is improving with openings from timber activities on loamy soils.

The 2018 NVUM survey (recreation visits and experiences) was evaluated this monitoring cycle and shows a dramatic decrease in recreational visits from the 2013 NVUM survey; the next survey is scheduled in 2023. The cause of the decline in visitors can be attributed to the timing of year when contractors were surveying visitors. For example, there would be less recorded visitors in the winter months due to the cold weather.

The deferred maintenance backlog for trails on the Uwharrie NF had declined during this monitoring cycle as more maintenance and trail re-construction is occurring. The recreational setting at Flanners landing and surrounding area is improving from the effects of Hurricane Florence. Future maintenance of trails and recreation sites by contractors is less certain as there are fewer contractors due to the Covid-19 pandemic and much higher costs due to the rate of inflation.

Forty-one heritage sites on the Uwharrie were monitored. Thirty-eight are in stable condition while 3 had damage from recreational uses or from gold panning. Protection and maintenance of heritage assets (e.g. Thornburg Farm) is reducing deferred maintenance backlog but continuing damage needs persistent monitoring. There is site damage in the Birkhead Wilderness and monitoring activity should increase on those sites.

Using a hurricane recovery team, 56 heritage sites were monitored on the Croatan NF, with 12 sites experiencing degradation. The team is making recommendations for recovery of those sites. Regardless of progress made in protections of sites on the Croatan NF, damage from Hurricane Florence as well as use of the forest continues to cause degradation.

Prescribed fire on the Croatan is on target but challenged due to the forested stand damage from Hurricane Florence in 2019 and the Covid-19 pandemic. The Uwharrie NF has been burning “on target” with the forest plan, and able to repeat burns with favorable understory plant responses.

Effects of climate change is likely to be more apparent on the Croatan NF. Sea level rise is monitored by multiple agencies and will be reported in the 2025 Southern Region Broad Scale Monitoring Report. Potential mitigating efforts to offset the effects of climate change are located in the Project Record for the 2020 report. One example is to manage tree densities using thinning a prescribed fire to reduce forest stands from water stress, outbreaks of insect and disease, and wildland fire. An activity could be to get longleaf pine in “maintenance condition” as soon as possible.

Broad scale economic trends (Project Record, 2020 Southern Region Broad Scale Monitoring Report) show that the surrounding counties of the Croatan and Uwharrie NFs have indicator(s) values similar to regional averages. Indicators such as payments to counties, expenditures, unemployment rates, and populations below poverty level were similar to regional averages. Population change is somewhat lower than regional averages. Land use change adjacent to the forests could be examined for the 2024 monitoring cycle.

Forest Supervisor's Certification

I have evaluated the findings of this report, documenting the results of monitoring activities that occurred through Fiscal Year 2022 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 at a later date.

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

I consider both the 2012 Uwharrie Land Management Plan and 2002 Croatan Land Management Plan, as amended 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.

JAMES MELONAS Digitally signed by JAMES MELONAS
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/s/

JAMES MELONAS

FOREST SUPERVISOR

Date

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?

Croatan

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

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 2020-21 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 in Fiscal Year (FY) 2022 – 2023. 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 during the summer of 2022.

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.

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 2023 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

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

The emphasis in this monitoring cycle has been estimating the condition of longleaf pine ecosystems. A monitoring guide was developed in 2020 and provided guidance for calculating estimates. A monitoring guide was recommended for determining the condition class of longleaf. That guide was used for this monitoring cycle but revised for practical considerations. See Appendix A for the revised monitoring guide. 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.

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

Ecologists created the following classification system, which varies slightly between the Croatan and the Uwharrie. The determinations were made using s field visit observations.

Longleaf Condition Class Definitions for the Croatan NF

Maintenance	1	Density of Longleaf pine provides a woodland canopy with an open shrub and small tree midstory and a diverse forb layer. Periodic, typically 1-3 year frequency, low intensity burns will maintain the current longleaf pine community structure.
Partial Restoration	2	Plant Community typically has dominant longleaf pine overstory or young longleaf saplings but either appropriate herbaceous layer is lacking and/or midstory shrub density is considerable. Restoration will typically involve at least 1 of the following: 1) opening up the midstory with either a more intensive prescribe burn or

		mastication, 2) planting an appropriate understory grass/forb species mix
Heavy Restoration	3	Plant Community may have partial, or young longleaf but appropriate herbaceous layer is lacking and midstory shrub density is considerable. Restoration will involve at least 2 of the following: 1) planting an appropriate understory grass/forb species mix, 2) opening up the midstory with either a more intensive prescribe burn or mastication, 3) reducing associated loblolly pine in the overstory
Loblolly Pine	4	Stand is mis-typed in FSVeg, should be Loblolly Pine
Unknown	5	No Recent Review, uncertain on current condition (2022)
Unnatural Longleaf	6	Stands were established with longleaf but will be hard to persist since other more appropriate species such as pond pine invading
Unsuitable Longleaf	7	Old Fields or agricultural areas that should not be typed as longleaf pine
Wilderness Longleaf	8	In Wilderness, will be difficult to maintain due to management limitations

Longleaf Condition Class Definitions for the Uwharrie NF

Maintenance	1	Density of Longleaf pine provides a woodland canopy with an open shrub and small tree midstory and a diverse forb layer. Periodic, typically 1–3-year frequency, low intensity burns will maintain the current longleaf pine community structure.
Partial Restoration	2	Plant Community typically has dominant longleaf pine overstory or young longleaf saplings but either appropriate herbaceous layer is lacking and/or midstory shrub density is considerable. Restoration will typically involve at least 1 of the following: 1) opening up the midstory with either a more intensive prescribe burn or mastication, 2) planting an appropriate understory grass/forb species mix
Heavy Restoration	3	Plant Community may have partial, or young longleaf but appropriate herbaceous layer is lacking and midstory shrub density is considerable. Restoration will involve at least 2 of the following: 1) planting an appropriate understory grass/forb species mix, 2) opening up the midstory with either a more intensive prescribe burn or mastication, 3) reducing associated loblolly pine in the overstory
Loblolly Pine	4	Stand is mis-typed in FSVeg, should be Loblolly Pine
Walker Finds Maintenance	51	Recent (2018-2020) loblolly plant communities located by Andy Walker, at maintenance level (see code 1)
Walker Finds Partial Restoration	52	Recent (2018-2020) loblolly plant communities located by Andy Walker, at partial restoration level (see code 2)

Longleaf Condition Class Summary for the Croatan & Uwharrie NFs

Condition Class	Croatan (Ac/%)	Uwharrie
Maintenance	3177 ac/ 30%	721 ac/ 21%
Partial Restoration	2625 ac/ 25%	1139 ac /32%
Heavy Restoration	3605 ac/ 34%	1415 ac/ 40%
Loblolly	298 ac/ 3%	111 ac/ 3%

Other	871 ac/ 9%	132 ac/ 4 %
Total	10580 /100%	3517 ac/ 100%

Key Results:

Croatan NF

- Nearly one-third of the managed longleaf acreage is in the maintenance condition and about ¼ of managed acreage is in partial restoration.
- The potential natural vegetation (PNV) mapping for longleaf is estimated to be about 32,000 acres and the managed estimated longleaf for 2022 is approximately 10,580 acres or about 1/3 of the PNV. The other two-thirds of the PNV are coded as either loblolly or pond pine in the FSVeg inventory.
- Most (>85%) of the longleaf sites on the Croatan are Mesic Loamy ecozones or Wet Flatwoods, which are more challenging to prescribe burn for effective results. About 7 percent of the managed longleaf are on upland sites that can be burned effectively at prescribed fire intervals.

Uwharrie NF

- About 53% of the managed longleaf sites on the Uwharrie are maintained or partially restored.
- The potential natural vegetation (PNV)mapping for longleaf is estimated about 7,7600 acres and the managed estimated longleaf for 2022 is approximately 3,517 acres or about 1/2 of the PNV.
- Most of the managed longleaf are on the upland longleaf sites, with less than 1 percent on sites with co-occurrence with shortleaf pine. These later sites are the steepest longleaf sites across the Uwharrie.

Recommended Changes

- **Monitoring Activity:** Update condition classes for longleaf pine for the 2024 monitoring cycle.

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 to occur 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. 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 Uwharrie National Forest. During this time period, trends in brown-headed cowbirds, *Molothrus ater*, increased across the Uwharrie. This increase in occurrences 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 stable or slightly decreasing across the Forest; however, occurrence data suggests the species may be more stable (although still slightly decreasing). 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 1997-2021 indicates decreasing occurrences of pileated woodpecker on the Uwharrie National Forest. 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. 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 to 1997 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 the Hurricane.

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.

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 Forest, the long-term trend is stable 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, 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 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). 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

Monitoring program or monitoring activity:

- **Uwharrie**: To facilitate understanding declines in pileated woodpecker and Northern bobwhite relative 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.
- **Uwharrie**: The NFsNC wildlife program manager recommends that future reports use the eBird Status and Trends Tools from science.ebird.org to monitor key focal species metrics, such as relative abundance.

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. The emphasis for this monitoring cycle has been to track the condition of special interest areas.

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: Populations are stable except for one that was impacted from powerline maintenance.

Special Interest Areas

Three SIAs are continuing to improve: Abner's Bog, Clark's Grove Longleaf Pine Forest, and Little Island Creek-Lick Mountain Xeric Slopes. One SIA, Pleasant Grove Bog and Pine Savannah had recent impacts from harvest operations.

Croatan

Special Interest Natural Areas: Of the 17 natural areas, 8 were checked for changed conditions. Seven were found to be improving in good to excellent conditions: Hadnot Creek Ponds and Longleaf Pine Woods, Holsten Creek/Heywood Landing, Hunters Creek Upland Forest, Little Road Longleaf Pine Savannas, Millis Road Savannas and Pocosins, Patsy Pond Limesink Complex, and Pettiford Creek Open Flatwoods. One SIA, Pringle Road Bay Rims, has been impacted by road maintenance that has increased the presence of invasive species.

At risk plant species:

Rough leaved loosestrife (*Lysimachia asperulifolia*). *No Change.* 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*). *Impacts as noted previously in the last 2 monitoring reports.* 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.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). ***Impacts as noted previously in the last 2 monitoring reports.*** 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.

Recommended Changes

None

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: NVUM surveys were completed in FY 2018 and the next survey will be done in FY 2023. A summary of visitor use on the Uwharrie NF & Croatan NF indicates there was a decrease in visitor use from 2018 to 2013. The total annual estimated site visits went from 2,380,000 with +/-41 % confidence down to 893,000 with +/- 18.3% confidence. The decrease in visitor use is likely a result of changes to when sampling occurred (from summer to winter).

Trail Maintenance: There are approximately 120 miles of system trail on the Uwharrie NF. In FY 2020 about 24.35 miles of trail were maintained to meet standards. In FY 2021 about 24.19 miles of system trails were maintained and 0.74 mile of trail was improved through a reroute / new construction. These two years of maintenance totals 49.12 miles of system trails. The deferred maintenance backlog is decreasing as a result of rotating maintenance and construction projects.

There was a reduction in the deferred maintenance backlog for non-motorized trails (from 20.15 miles in FY 2020 to 11.9 miles in FY 2021). There was also a reduction in the deferred maintenance backlog for motorized trails (from 4.2 miles in FY 2020 to 8.9 miles in FY 2021). Completing trail maintenance in FY 2020 and 2021 was challenging as a result of the COVID-19 pandemic; as a result, several projects were delayed until FY 2022. The forest now has the motorized trail system on a rotation where every other year 8.9 to 10 miles of trails are maintained with a contractor.

Uwharrie National Recreation Trail (UNRT): There have been 3 parcels purchased since the last monitoring report, adding 125.64 acres to the Uwharrie NF. Some of these acquisitions were done to consolidate NFS ownership in the Uwharrie NF corridor without extending the length of the UNRT. With the addition of Mills Creek Tract the UNRT is now approximately 30 miles. The trail is about 95% completed. With these acquisitions the forest also added another trailhead for the UNRT.

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

None

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 findings from the 2020 Southern Region Broad Scale Monitoring Report that was used in the previous Croatan & Uwharrie NF update and repeated here. The next update of the Southern Region Broad Scale Monitoring Report is scheduled for 2025.The current report is posted at the following link :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 Project Record (2020) for potential mitigation recommendations to be considered during Forest Plan Assessment, Need to Change.

Social, Economic and Cultural Sustainability

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.

This monitoring category also applies a question related to the 2012 Planning Rule about the contribution of national forests toward economic 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 are from the 2020 report that was cited in the previous Croatan and Uwharrie report of 2020 and repeated here. The "Broad-Scale Socioeconomic Monitoring Evaluation Report for the Southern Region" is posted at the following link: https://www.fs.usda.gov/main/r8/landmanagement/planning#Monitoring.

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)

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

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)

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

Key Results

Uwharrie – Cultural Resources

Summary: An action plan to protect heritage assets initiated in FY18-19 is in progress 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. Planning for site protection and barricading is ongoing. Two structures on the Thornburg farm were stabilized and vandalism to multiple buildings were repaired. 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, quartz rockhounding and gold panning, while damage from OHV trails is decreasing.
A total of 41 sites were monitored on the Uwharrie National Forest between October 1, 2019 and September 30, 2021. Thirty-eight sites were stable, three were recorded with adverse effects from storm damage and impacts from recreational users. In general, sites continue to experience disturbance through recreational use (OHV trail, horseback riding, and gold panning), resulting in a need for continual site monitoring. The National Register Eligible Buck Mountain Fire Tower is in need of a structural assessment/management plan, with implementation planned for FY23. There is an increase in site damage in the Birkhead Wilderness due to storms, unauthorized rock hounding, and social media accounts depicting site locations. It is recommended to determine a base line for site conditions in the Wilderness, and increased monitoring.

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 FY20-21, 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 FY23.

A Forest Service partnership with Central Michigan University known as “Alternative Break” has continued the preservation of the National Register Listed Thornburg Farm. Two National Register contributing structures were stabilized and interpreted in FY20, but not FY21 due to the Covid-19 Pandemic. University students travel to the site during winter break and work with master carpenters to restore historic structures.

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 Hurricane Recovery Archeologist, the Zone Archeologist and archeological contractors and interns monitored 68 sites, 13 of which were PHA’s. Fifty-six sites are stable, while 12 sites are experiencing degradation from recreation users, rising sea levels, and hurricane damage. A Hurricane Florence Shoreline Site Damage Assessment was completed, determining which of the NRHP eligible or unevaluated shoreline sites were impacted. Following this damage assessment, a shoreline site mitigation and recommendation contract was carried out. Recommendations and mitigation are ongoing at this time. A hurricane recovery archeologist on the hurricane recovery team was employed this monitoring cycle to make recommendations and mitigate Hurricane Florence related impacts.

A total of 55 sites were monitored on the Croatan National Forest between October 1, 2019 and September 30, 2021. Forty-three sites were stable. Twelve sites experienced disturbance. One was from recreational use (dirt bike tracks over site), another from unauthorized ground disturbance, and the rest were from fallen trees and storm damage. 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 National Register Eligible Newport-Simmons Fire Tower remains 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. The site was monitored for storm damage in 2021 and no further damage was recorded. Plans for site interpretation on are ongoing. VSFS Students in FY20 created a flow chart for ARC-GIS to utilize LiDAR to predict the location of tar kiln cultural remains present on the Croatan, and VSFS students in FY21 researched methods to better record non-perennial waterways to better inform site type distributions and typology patterns on the Forest.

Uwharrie - Prescribed Fire

For RX fire, the district has been able to accomplish somewhere in the 5 to 6k acres per year range with the exception of 2020. Burn season was interrupted by Covid and there was a 2 to 3 month lull during burn season, and about 3900 acres were burned that year. In burn season 2022, which we just concluded, we were able to exceed a bit and got right at 6900 acres done for the year. Averages are still however, in the LMP target range of 6 thousand or so per year. An item of note – Longleaf pine is a significant focus of our plan, and it should be noted that the district has in recent burn seasons made a concerted effort to burn longleaf more frequently, such as, rather than burning every third year, we have been shooting for every other year with a target of growing season fire occurring at least every other burn. Plant response in the understory has dramatically improved. Species richness and diversity are both increasing and many plants that are considered rare in the piedmont are now being found inside the burn units.

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 Wildfire suppression averaged about 50 acres this monitoring cycle (Community Wildfire Protection Plans are developed and implemented for every community fire department within the Croatan National Forest plan area.

Broad Scale Economic Trends

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

None

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.

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.

Recommended Changes

None

Appendix A:
Monitoring Guide Croatan and Uwharrie NFs (Revised)

Category 2: Longleaf Condition Classes

2022 Biennial Monitoring Process

The monitoring guide (2020) for the Croatan and Uwharrie National Forests responded to the need for a protocol to determine the conditions of longleaf pine on the forests. The monitoring guide is updated for practical applications.

Procedure:

Task A: Develop an Initial Longleaf Condition Class Model (ICCM) to estimate and map existing longleaf condition classes.

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. Ecologists 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. (Use this procedure for 2024 monitoring cycle). 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. (Use this procedure for 2024 monitoring cycle). 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. (Use this procedure for 2024 monitoring cycle) 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. (see "Replacement" below) Forest botanists estimate existing longleaf mid-story and ground herbaceous 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. (see "Replacement" below) 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. (see "Replacement" below) 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: (See "Replacement) Check LL Condition Classes with ground inventory and revise the Initial LL Condition Class Model.

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.

Replacement of cited procedures

Ecologists develop longleaf condition classes as follows.

Longleaf Condition Class Definitions for the Croatan NF

Maintenance	1	Density of Longleaf pine provides a woodland canopy with an open shrub and small tree midstory and a diverse forb layer. Periodic, typically 1–3-year frequency, low intensity burns will maintain the current longleaf pine community structure.
Partial Restoration	2	Plant Community typically has dominant longleaf pine overstory or young longleaf saplings but either appropriate herbaceous layer is lacking and/or midstory shrub density is considerable. Restoration will typically involve at least 1 of the following: 1) opening up the midstory with either a more intensive prescribe burn or mastication, 2) planting an appropriate understory grass/forb species mix
Heavy Restoration	3	Plant Community may have partial, or young longleaf but appropriate herbaceous layer is lacking and midstory shrub density is considerable. Restoration will involve at least 2 of the following: 1) planting an appropriate understory grass/forb species mix, 2) opening up the midstory with either a more intensive prescribe burn or mastication, 3) reducing associated loblolly pine in the overstory
Loblolly Pine	4	Stand is mis-typed in FSVeg, should be Loblolly Pine
Unknown	5	No Recent Review, uncertain on current condition (2022)
Unnatural Longleaf	6	Stands were established with longleaf but will be hard to persist since other more appropriate species such as pond pine invading
Unsuitable Longleaf	7	Old Fields or agricultural areas that should not be typed as longleaf pine
Wilderness Longleaf	8	In Wilderness, will be difficult to maintain due to management limitations

Longleaf Condition Class Definitions for the Uwharrie NF

Maintenance	1	Density of Longleaf pine provides a woodland canopy with an open shrub and small tree midstory and a diverse forb layer. Periodic, typically 1–3-year frequency, low intensity burns will maintain the current longleaf pine community structure.
Partial Restoration	2	Plant Community typically has dominant longleaf pine overstory or young longleaf saplings but either appropriate herbaceous layer is lacking and/or midstory shrub density is considerable. Restoration will typically involve at least 1 of the following: 1) opening up the midstory with either a more intensive prescribe burn or mastication, 2) planting an appropriate understory grass/forb species mix
Heavy Restoration	3	Plant Community may have partial, or young longleaf but appropriate herbaceous layer is lacking and midstory shrub density is considerable. Restoration will involve at least 2 of the following: 1) planting an appropriate understory grass/forb species mix, 2) opening up the midstory with either a more intensive prescribe burn or mastication, 3) reducing associated loblolly pine in the overstory
Loblolly Pine	4	Stand is mis-typed in FSVeg, should be Loblolly Pine
Walker Finds Maintenance	51	Recent (2018-2020) loblolly plant communities located by Andy Walker, at maintenance level (see code 1)
Walker Finds Partial Restoration	52	Recent (2018-2020) loblolly plant communities located by Andy Walker, at partial restoration level (see code 2)

Ecologists and botanist use local knowledge to classify the conditions of stands managed as longleaf according to the updated FSVeg inventory. ArcGis shapefiles document the condition classes and data are downloaded in Excel workbooks and filed in the project record.