A1.3 Uwharrie National Forest

A1.3.1 Setting and Context of the Uwharrie National Forest

The Uwharrie National Forest (originally called the Uwharrie Reservation) was first purchased by the federal government in 1931 during the Great Depression. In 1961, President John F. Kennedy proclaimed the federal lands in Montgomery, Randolph, and Davidson Counties (Fig. A1.6). The UNF is within a two-hour drive of North Carolina's largest population centers, including Winston-Salem, Greensboro, Charlotte, Raleigh, and Durham. The forest is fragmented into 61 separate parcels, which pose unique forest management challenges (Fig. A1.6). Therefore, much of UNF has been modified from a natural to a managed ecological condition. UNF has a rolling topography, with elevation ranging from 122 to 305 m above sea level. Although small by most national forest standards (20,383 ha), the UNF provides a variety of natural resources, including clean rivers and streams, diverse vegetation for scenery, wildlife habitat, and wood products. There is also a wide variety of recreational activities, and UNF is a natural setting for tourism and economic development.

Figure A1.6. Map of the Uwharrie National Forest in North Carolina.[7]

The UNF is rich in history. It is named for the Uwharrie Mountains, some of the oldest in North America. According to geologists, the Uwharries were created from an ancient chain of volcanoes. The 1,000-foot hills of today were once 20,000-foot peaks.

The UNF is located at the crossroads of both prehistoric and historic settlements. Their legacy is one of the greatest concentrations of archeological sites in the Southeast. Left undisturbed, these sites and artifacts give a record of our heritage. The first large gold discovery in the United States occurred around 1799 at the nearby Reed Gold Mine. In the early 1800s, gold was found in the Uwharries, with a later boom during the depression of the 1930s. Old mining sites still remain, and part-time prospectors still pan in the streams and find traces of gold dust.

Today, the UNF is dynamic and responsive to public needs. It continues to provide timber, wildlife, water, recreation opportunities, and a natural setting for tourism and economic development. Recreational use is growing, especially in the Badin Lake area and along the 20-mile Uwharrie National Recreation Trail. Badin Lake is one of the largest bodies of water included in the series of reservoirs within the Yadkin-PeeDee River drainage system. The entire watershed is known as the Uwharrie Lakes Region. Badin Lake is a popular setting for many different recreation activities, including camping, hiking, fishing, boating, and hunting. The area is rich game land for deer and wild turkey, and a home for bald eagles.

[7] **USDA Forest Service**, 2007: Uwharrie National Forest Uwharrie Ranger District. University of North Carolina at Asheville National Forest Service Website, http://www.cs.unca.edu/nfsnc/uwharrie_plan/maps/uwharrie_map.pdf, accessed on 7-30-2007.

A1.3.2 Current Uwharrie NF Planning Context, Forest Plan Revision and Climate Change

The National Forest Management Act of 1976 requires that all NFs periodically revise their forest management plan.[8] Existing environmental and economic situations within the forest are examined. Then plans are revised to move the forest closer to a desired future condition. The current UNF forest management plan was originally developed in 1986, and UNF is now undergoing a Forest Plan Revision (FPR).

The revised forest plan focuses on three themes. Two of the themes—restoring the forest to a more natural ecological condition, and providing outstanding and environmentally friendly outdoor recreation opportunities—will likely be affected by a changing climate. The third theme of the FPR (*i.e.*, better managing heritage (historical and archeological) resources) will likely not be significantly affected by climate change. Thus, this case study examines potential impacts on the first two UNF FPR themes.

The revised forest plan will suggest management strategies that help reduce risks to the health and sustainability of UNF associated with projected impacts of a changing climate. Therefore, the UNF case study focuses on specific recommended modifications to the forest plan. This level of specificity was not possible with either the Tahoe or Olympic National Forest case studies because neither has recently undergone a forest plan revision that incorporates climate change impacts into forest management decision making.

A1.3.2.1 Revised Forest Plan Theme 1: Restoring the Forest to a More Natural Ecological Condition

Prior to the 1940s, fires were a regular occurrence in southern U.S. ecosystems (Whitney, 1994). The reoccurrence interval varied among vegetation types, with more frequent fires being less intense than less frequent fires (Wear and Greis, 2002). Upland oak (*Quercus* sp.) and hickory (*Carya* sp.) forests would burn at an interval of 7–20 years with flame heights of less than one m (3.3 ft.). These fires would kill thin-barked tree species such as red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and tulip poplar (*Liriodendron tulipifera*), while leaving the more fire-resistant oaks and hickories alive. Pine ecosystems had a shorter fire return interval of 3–5 years, with flame heights reaching 1–2 m (3.3–6.6 ft.), thus favoring fire- and drought-resistant longleaf (*Pinus palustris*) and shortleaf (*Pinus echinata*) pines more than loblolly pines. The fires also removed much of the mid-canopy vegetation and promoted light-demanding grasses and herbs.[9] Deciduous and coniferous tree species are equally represented in UNF. However, a higher percent of the conifers are in loblolly pine (*Pinus taeda*) plantations than would have historically occurred, because of the planting emphasis of this species over the past 40 years.[9]

[8] 16 U.S.C. §1600-1614

[9] **Uwharrie National Forest**, 2007: *Proposed Uwharrie National Forest Land Management Plan*. Available from http://www.cs.unca.edu/nfsnc/uwharrie_plan/wo_review_draft_plan.pdf. USDA Forest Service, Asheville, NC.

Climate change is projected to increase the number and severity of wildfires across the southern United States in the coming years (Bachelet *et al.*, 2001). As part of its FPR, UNF plans to restore approximately 120 ha (296 acres) of loblolly pine plantation to more fire-resistant ecosystem types (*e.g.*, longleaf pine) each year.[9] This management shift will restore UNF to a more historically natural condition and reduce catastrophic wildfire risk associated with an increase in fuel loading (Stanturf *et al.*, 2002; Busenberg, 2004) and hotter climate (Bachelet *et al.*, 2001).

A1.3.2.2 Revised Forest Plan Theme 2: Provide Outstanding and Environmentally Friendly Outdoor Recreation Opportunities

Recreation opportunities provided by UNF are an important ecosystem service to the local and regional communities. The proximity to large population centers and diverse interest in outdoor activities make UNF a destination for many groups that use the trails and water bodies located within the forest. The continued quality of these trails, streams, and lakes are of very high importance to UNF's mission.

During the 20th century the frequency of extreme precipitation events has increased, and climate models suggest that rainfall intensity will continue to increase during the 21st century (Nearing, 2001). Soil erosion occurs when the surface soil is exposed to rainfall and surface runoff. Soil erosion is affected by many factors, including rainfall intensity, land cover, soil texture and structure (soil erodibility), and land topography (slope) (Toy, Foster, and Renard, 2002). Because soil erosion increases linearly with rainfall-runoff erosivity, it would be expected to increase over the next 50 years in the UNF region if no management measures are taken to control the current soil erosion problems. Soil erosion is limited to exposed (*i.e.*, without vegetative cover) soil surfaces (Pimentel and Kounang, 1998). Hiking, off-highway vehicles, and logging trails and forest harvest areas represent the major types of exposed soil surface in UNF.[9] Increased soil erosion would degrade both trail and water quality.

In response to current and projected increases in soil erosion potential, the UNF FPR proposes to repair authorized roads and trails, close unauthorized roads and trails, minimize new road construction, and reroute needed roads that increase soil erosion. In total, these measures should effectively reduce the potential impact of increased precipitation intensity on soil erosion in the UNF.

A1.3.3 Long-Term Natural Resource Services

In addition to the objectives outlined in the Uwharrie forest plan revision, forests in the United States provide valuable natural resources of clean water and wood products. While the demand for U.S. pulp and paper products has decreased in recent years, it is important to assess the long-term ability of the forests to supply wood resources if a future need should arise. The demand for clean, dependable water is increasing within the southern United States as population pressure on water resources increase. Therefore, climate change impacts on UNF water yield and timber supply were also assessed in the UNF Watershed Analysis Document of the FPR.

A1.3.3.1 Water Yield

Clean water is one of the most valuable commodities that our NFs provide. National forest lands are the largest single source of water in the United States and one of the original reasons that the NFS was established in 1891 (USDA Forest Service, 2000b). There is concern that climate change could reduce water yield from the Uwharrie. Currently, about 1,590 mm of precipitation falls in UNF every year, with close to 70% (or 1,100 mm) of it evapotranspiring back to the atmosphere. The other 30% (or 490 mm) leaves the forest as stream runoff and percolates downward becoming a part of the groundwater.[9] Climate change models suggest that precipitation may increase to 1,780 mm per year. Air temperature is also expected to increase, which will, in turn, increase forest evapotranspiration. In total, stream water flow is projected to decrease by approximately 10% by the middle of the 21st century if there is no change in forest management (Sun *et al.*, 2005).[10]

Forest water use increases with increased tree stocking density and leaf area (Hatton *et al.*, 1998; Cook *et al.*, 2002). The use of controlled fire and other forest management activities that will increase tree spacing and shift the forest toward more fire- and drought-tolerant tree species will also help to reduce forest water use (Heyward, 1939). Based on this line of research, most of the climate change-caused reductions in water yield can be compensated through this proposed change in forest management.

A1.3.3.2 Timber and Pulpwood Productivity

The southern United States has long been a major supplier of pulpwood and timber. But because an increasing amount of timber and pulpwood is being supplied to the United States by Canada, Europe, and countries in the Southern Hemisphere (USDA Forest Service, 2003), national forest managers have moved away from an emphasis on timber supply toward recreational opportunities and sustainable water (Apple, 1996).

Climate change will have variable impacts globally. Timber production in some countries, such as Canada, may benefit from warmer climate, while countries closer to the Equator may experience significant reductions in productivity (Melillo *et al.*, 1993). Although NFs are not currently major sources of wood products, this situation could change as timber production from other parts of the world shifts. Therefore, it is important to assess the impact of climate change on forest productivity in UNF. Forest productivity models suggest that although pine productivity may decrease, hardwood productivity is projected to increase and the net loss of total forest productivity would be small for the UNF over the next 40 years (National Assessment Synthesis Team, 2000). However, the analysis did not account for the potential for increased fire occurrence, which could significantly reduce overall forest volume and growth (Bachelet *et al.*, 2001). The proposed shift in forest tree types to more drought-tolerant and fire-resistant species should also help to assure that UNF remains a timber resource for future generations (Smith, Ragland, and Pitts, 1996).

[10] See also **Sun**, G., S.G. McNulty, E. Cohen, J.M. Myers, and D. Wear, 2005: Modeling the impacts of climate change, landuse change, and human population dynamics on water availability and demands in the Southeastern US. Paper number 052219. Proceedings of the 2005 ASAE Annual Meeting, St. Joseph, MI.