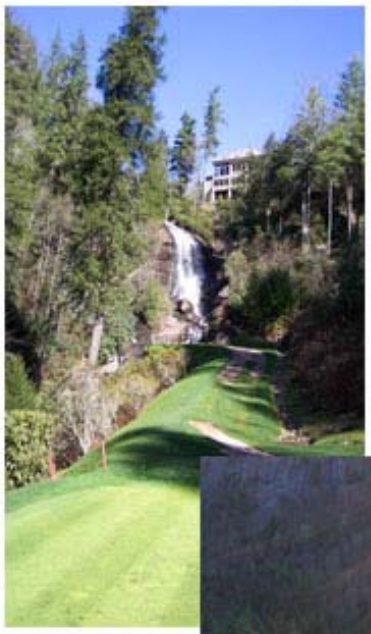


Land Use Change and Implications for Biodiversity on the Highlands Plateau

A report by
the Carolina Environmental Program

Part B

Bryan West
Luke Worsham
Emily Walgate
Katrina Chmielecki
Carla Frisch
Andrew Roe

December 10, 2004
Highlands Biological Station
P.O. Box 580
Highlands, NC 28741

Contents

Introduction

Throughout the course of the semester, six interns at the Highlands Biological Station have had the opportunity to have hands-on experience researching how biodiversity is affected by wilderness areas, trail systems, zoning policy, population dynamics, and land conservation. Each intern was mentored by a community member affiliated with that student's particular area of study. After typically working two days a week, each project culminated in a capstone report that includes the student's results, recommendations, and assessment of affects of land use change on biodiversity in the Highlands area.

The first three students focus on specific areas, using hands-on techniques to rework plans affecting biodiversity. Bryan West concentrates on the different USDA Forest Service management areas in the vast area of wilderness along the North Carolina-Georgia border. Wilderness areas preserve habitat for animal and plant species, and the preservation of these areas ensures minimal human interaction with the biodiversity of the area. Luke Worsham researches and implements a new trail plan for the Panthertown Valley region east of Cashiers. While flagging new trails for construction, he took care to minimally affect biodiversity in the area. Emily Walgate assesses reasons for lack of public involvement with the Highlands Greenway Trail and works to improve the publicity about the trail. Greenways help connect wildlife habitats and provide an opportunity for local residents to learn about nature.

The next three students emphasize policy and recommendations surrounding more broad locations. Katrina Chmielecki considers zoning laws and development on steep slopes. Soil erosion from unregulated construction can cause sedimentation, a serious problem for stream ecosystems. Carla Frisch focuses on reevaluating and establishing population projections for the vacationer, seasonal, and permanent populations in the Highlands area. Population growth can increase the affects of interaction between humans and the environment. Andrew Roe made myriad masterful maps measuring miscellaneous mechanisms and outlining conservation priorities based on a variety of factors. He combines GIS technology and scientific research, a necessary step in prioritizing land parcels for preservation of biodiversity.

Often, there is a gap between completing scientific research and enacting public policy. This lack of contact can be a problem for biodiversity preservation, because policy makers may

be uninformed as to what decisions are best for local ecosystems. Members of the social science team sought to bridge this gap. The reports are grouped according to their type of study, beginning with specific focus areas and moving toward topics encompassing broader principles. Hopefully the work presented here will become an integral part of public policy and will be valuable to the preservation of biodiversity on the Highlands Plateau.

A Reevaluation of Forest Management in the Three Forks – Blue Valley Areas of the Chattahoochee and Nantahala National Forests

Bryan C. West

The purpose of this study is to provide an unbiased reevaluation of USDA Forest Service management of a large tract of national forest between Highlands, North Carolina and Pine Mountain, Georgia. Portions of this area have been evaluated previously for Wilderness designation (a legal designation that only the U.S. Congress can grant) but rejected. These rejections followed decades of disputes between Wilderness advocates and opponents and are framed by the current reluctance of the Forest Service to recommend new Wilderness areas in the southern Appalachians. Referring to the issue of Wilderness, Highlands District Forester Jeff Owenby stated that "it's a lightning rod" that triggers divergent views and is a hotly debated topic in the community. Here I report my own findings, following many hikes into this remote study area and extensive interviews with forest users, advocates, and managers. I also present possible options for future management, including whether or not the study area could meet specific Wilderness requirements.

The research involved personal interviews with officials from different conservation groups and the USDA Forest Service, with each generally being questioned in accordance with an interview guide (see Appendix C). The author also observed the area on the ground to ascertain whether criteria for Wilderness, such as solitude, were being fulfilled. Additionally, numerous documents and scientific papers were examined and analyzed to assess the uniqueness of the biodiversity of the area and to inform the final list of management options.

What is Wilderness?

By definition, Wilderness is an area designated by Congress that "is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain…retaining its primeval character and influence (Handbook, Wilderness Act of 1964)." The law imposes the following requirements:

- (5000) The area generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.
- (5001) There are exceptional opportunities for solitude or a primitive and unconfirmed type of recreation.
- (5002) It has to be at least 5,000 acres or have a sufficient size so that preservation is practicable and use in an unimpaired condition is feasible. (There are about 100 Wilderness areas that are smaller than 5,000 acres.)
- (5003) The area may exhibit features of scientific, educational, historic, or scenic value.

Three Forks – Blue Valley Study Area

The Three Forks – Blue Valley study area in southwestern North Carolina and northeastern Georgia spans more than 12,000 acres (see Appendix A). The area cuts across two national forests: the Nantahala National Forest in North Carolina and the Chattahoochee National Forest in Georgia. It ranges from approximately 2,000 feet in elevation at Three Forks to approximately 4,000 feet at Chinquapin Mountain. This land harbors rich biodiversity and pristine streams such as the West Fork, East Fork, and main stem of Overflow Creek, Holcomb Creek, part of Big Creek, the west fork of the Chattooga River, and numerous other waterways.

Forest Service roads crisscross Blue Valley and both private property and public property surround it. The general boundaries of the study area consist of NC 106 to the north and GA 28 to the east. Billingsley Creek and Hale Ridge Roads and adjacent private property essentially form the western boundary of Blue Valley; the West Fork of the Chattooga River forms the southern boundary (see Appendix A).

Forest ecosystems in the study area consist of upland oaks and other upland hardwoods. There are also cove hardwood and white pine stands. Most of these timber stands are 60- to 80-years-old (USFS: N.C. Plan 1994), and came in following historical logging.

Both the Overflow part of the forest and the Blue Valley Experimental Forest were extensively logged in the last century, and tramways were used to remove the timber (Sluder 1964). The Experimental Forest is still being logged today (Loftis: interview). The Three Forks

watershed in both Georgia and North Carolina was logged using splash dams to carry the timber downstream.

Although the forest was logged years ago, much of the area looks more like a mature forest today. Included in the study area are stands of old-growth forest. In an old-growth forest assessment, Carlson (1994) reported "a significant cluster of mapped old-growth lies at mid-elevation (2,200' – 2,900') at the junction of Overflow and Clear Creeks (Carlson 1995)."

The Three Forks – Blue Valley study area includes historical and recreational areas. The overall study area also contains the remains of old amethyst mines, a splash dam, and old residences. Despite historical development, the area appears to be returning to nature in many spots and many of the old structures are difficult to distinguish. Numerous hiking trails and trail networks, including the Hurrah Ridge Trail, part of the Bartram Trail, and the hiking trail network to Three Forks can be found here; many of the old logging roads have been converted into trails. Marked hiking trails also make their way to Holcomb Creek Falls and Ammons Falls. These trails, as well as roads going through the forest, provide opportunities for recreation.

The author visited the area approximately a dozen times between August and November 2004 and has experienced its beauty and scenic value firsthand. The area does not appear to be heavily used, and visitors are mainly there on weekends, if at all. On a clear day, motorists get vast scenic views from the northern rim of the study area. When approached from the ground level, the sites themselves are very impressive. Pickleseimer Rock House and Three Forks are truly remarkable. From the point of view of biodiversity, there are many unique and varied environments, such as the East Fork of Overflow Creek, where beavers have created a wetland.

History of Wilderness Debate in Blue Valley

There have been previous attempts to designate portions of this area as Wilderness. In 1998, Georgia Senator Max Cleland requested that the Forest Service expand the acreage of Wilderness in the Chattahoochee National Forest and have areas, including Three Forks, designated as potential wilderness areas. The Forest Service, however, declined to do so, arguing that the area was either too small or located too close to roads (Harmon 1998).

The Overflow Area of Blue Valley in North Carolina was designated a Wilderness Study Area in 1984. The USDA Forest Service later recommended that the Overflow Wilderness Study Area not be designated Wilderness, but Congress has not changed the study area designation. The Forest Service did not think the study area was appropriate for Wilderness for a number of reasons. Because the Overflow study area was only designated as 3,200 acres, Forest Service planners did not feel that there was a good opportunity for solitude. Additionally, a portion of Forest Road No. 79 exists inside the boundary of the Forest Service's designation of the Overflow Study area, and this road would be difficult to decommission. Currently, the Overflow Wilderness Study Area management plan consists of "semi-primitive non-motorized recreation management direction (Backcountry, Management Area 5)" with no timber harvesting allowed. The Forest Service recommended that the area be managed as Management Area 5, but it must be managed as a Wilderness Study Area, in accordance with the current Nantahala Forest Management Plan (USFS: N.C. Plan). "All Wilderness Study Areas will continue to be managed to protect wilderness attributes, under the direction for Management Area 6, until Congress determines whether or not to include them in the National Wilderness Preservation System" (USFS: N.C. Plan).

The Forest Service currently has subdivided the Three Forks-Blue Valley study area into 11 different management areas that regulate how the forests are used, six in North Carolina and five in Georgia. These management prescriptions vary from emphasizing motorized recreational use and permitting timber production to emphasizing high quality black bear habitat and closing most roads to motorized vehicles. The following is a list of the management areas:

North Carolina (USFS: N.C. Plan)

2A: Visually pleasing scenery; allows timber production
4A: Visually pleasing scenery, wildlife habitat; allows timber production
4C: Visually pleasing scenery, wildlife habitat; no timber production
4D: High quality habitat for wildlife (black bear); allows timber production
5: Backcountry; no timber production
8: Experimental forests; researches timber production

Georgia (USFS: GA Plan)

2B1: Recommended wild river segments; no timber production
2B2: Recommended scenic river segments; no timber production
4I: Natural areas – few open roads; limits timber production
7E2: Dispersed recreation areas with vegetation management; allows timber production
9H: Management, maintenance, and restoration of plant associations to their ecological potential; allows timber production

(See Appendix B)

This checkerboard-like management could be vastly simplified if the Forest Service disregarded the artificial boundaries of the North Carolina and Georgia state boundaries and those of the two different national forests. The Forest Service is allowed to do this, and research shows that "the nation's biological resources do not respect conventional political boundary lines" (Keiter 1998). This would make for a much larger and contiguous management area, with greater potential for Wilderness designation. In fact, this is what happened to two nearby Wilderness areas, the Ellicott Rock and the Southern Nantahala Wilderness Areas. The Ellicott Rock Wilderness is 8,274 acres across three states: North Carolina with 3,394 acres; South Carolina with 2,859 acres; and Georgia with 2,021 acres. The Southern Nantahala Wilderness consists of 23,473 acres, with more than 11,700 acres in Georgia and North Carolina each.

Considering the larger area would make it much easier for the Three Forks-Blue Valley study area to meet the specific requirements for Wilderness spelled out in federal law by the Wilderness Act of 1964. It should also make it easier to meet the many, varied criteria that the USDA Forest Service imposes before it feels comfortable recommending Wilderness designation. If the whole study area was considered, and not just Overflow, it would come to a radius of about two miles across, totaling more than four miles north to south and more than four miles east to west. The Three Forks – Blue Valley Study Area measures 12,576 acres when both the 6,308 acres in North Carolina and the 6,268 acres in Georgia are considered together (Appendix A).

Forest Service Wilderness Criteria

The USDA Forest Service interprets the Wilderness Act and has developed a set of criteria to determine whether land is eligible to be designated Wilderness. These criteria are very

detailed and strict, such as requiring specific attributes of solitude and challenging recreation and a roadless area's ability to provide scientific education and study. The stringency of the criteria is evidenced in that only four of the 95 Wilderness designations made before the Eastern Wilderness Areas Act in 1975 are east of the 100th meridian. This act was passed because Congress was upset over the lack of Wilderness areas in the East (Handbook 2004). The Eastern Wilderness Areas Act states that areas of wilderness in the eastern half of the United States are vulnerable to the increasing human population, creating an "urgent need to identify, study, designate, and preserve areas for addition to the National Wilderness Preservation System."

Besides Congress, other organizations have found fault with the Forest Service's interpretation of Wilderness. A recent report charged that the Forest Service has "flagrantly abused its discretion by misinterpreting the Eastern Wilderness Act and incorrectly applying ad hoc guidelines to the evaluation process" (Furnish 2004).

Furnish, a consulting forester and former Deputy Chief of the Forest Service said that the incorrect application of Wilderness is "an inconsistent approach, suggesting an inherent anti-wilderness bias." The Heritage Forests Campaign report states that the Forest Service guidelines "misapplied the concepts of 'improved road' and 'core of solitude' to roadless evaluations" (Furnish 2004).

In Support of Wilderness

Conservation groups generally support Wilderness, and some, such as the Wilderness Society, make it their business to advocate it. There are many positive aspects of Wilderness designation, and advocates emphasize these whenever the issue arises.

Wilderness areas provide benefits to science, recreation, the economy, and national and cultural heritage. According to officials from the Chattooga Conservancy, The Wilderness Society, and Georgia Forestwatch, the positive aspects of Wilderness can be seen through its scientific, recreational, economic, solitude, and historic value.

Biodiversity

Areas such as the Three Forks – Blue Valley study area provide scientific value that is increasingly more difficult to obtain. Biodiversity in the Southern Appalachians is best preserved in an unfragmented forest (McClure 1993). In an interview with Brent Martin, former executive director of Georgia Forestwatch, he also emphasized that biodiversity is the only feasible way to argue for wilderness, even though he supports the intrinsic value of the forest as well. "The wilderness areas serve as valuable controls against which to measure the health of the planet" (Mittermeier 2004). Martin further stated that Wilderness is also a good place to have a "benchmark" and leave an area alone as a control to see what happens. Additionally, there are numerous species that are rare and can be found only in certain habitats. Below is a list of the Proposed, Endangered, Threatened, or Sensitive species of plants and animals (PETS) found in Blue Valley (Rankin: email).

Scientific Name	**Common Name**	**# of Locations**
Micrasema burksi	caddisfly	2
Micrasema sprulesi	caddisfly	2
Hydrothyria venosa	aquatic lichen	2
Carex biltmoreana	outcrop sedge	3
Solidago uliginosa	outcrop goldenrod	1
Liatris turgida	blazing star	1
Robinia hartwegii	shrubby locust	1
Aneides aeneus	green salamander	1
Plagiochila caduciloba	spray cliff liverwort	1
Sorex palustris punctulatus	southern water shrew	1

The Three Forks – Blue Valley study area hosts other communities that provide habitats for unusual plants. The bog community that was created by the beavers supports many rare species. Moreover, the Glen Falls area is a Spray Cliff Community (unpublished Mountain Treasures). There are also many steep slope areas that "may support uncommon or rare plant species" (unpublished Mountain Treasures). Old-growth forests, which are valuable to a diverse ecosystem, have been identified near Clear Creek (Carlson 1995). In addition to this, a number of areas near Three Forks have old-growth characteristics (GA Mountain Treasures).

Recreation

Many more arguments can be made for the preservation of wild areas. One is for recreation. Wildlands provide opportunities for backcountry recreation, including hiking, hunting, birding, photography, and camping, to the increasing population of the Southeast. For the most part, individuals must depend on public land for outdoor activities because private land is usually either closed off or developed (McClure 1993).

Property Values

Wilderness also provides fiscal benefits. Property values are enhanced when they are located near public Wilderness areas. Additionally, since there are minimal management and public service costs in Wilderness areas, tax rates should decrease. Wilderness land also offers recreational opportunities and scenery that could provide tourism-based revenue (Wilderness Society: Economics 2004).

History and Culture

History is very important to a people's culture. The culture and heritage of the United States has been shaped by the fact that this country has traditionally had wildlands and a frontier to explore (McClure 1993). Wilderness embodies the culture and heritage of the past and, as former acting regional director of The Wilderness Society Butch Clay put it, "Wilderness is a window into the past of our people, our race, and it's a window into what the earth was like before any of us got here." He further emphasized that primitive values should be protected, and this is truly important with the ever-increasing human population. Leopold (1966), a renowned conservationist eloquently stated, "wilderness is the raw material out of which man has hammered the artifact called civilization."

In Opposition to Wilderness

Those who oppose wilderness, for whatever reason, appear to have an ally in the Forest Service. Brent Martin states that "The Forest Service is a management driven agency and they have to be doing something," and a Wilderness designation would "tie their hands." While not

opposed to Wilderness designation per se, the opponents and the Forest Service point out a multitude of criteria or problem areas that would work against Wilderness designation. Such problems include roads, wildlife openings, fire management, certain types of recreation, and the fact that the Chief of the Forest Service has already designated about 1,200 acres of the study area as an Experimental Forest.

However beneficial Wilderness designation is, one cannot arbitrarily select different areas of land to be Wilderness. "You can't put the genie back in the box," notes Jeff Owenby of the Highlands Ranger District of the USDA Forest Service. There are various structures, such as the lantern posts and the heavy concrete bridge on Forest Service Road 79, throughout the area and most of these would have to be removed in order for Blue Valley to be designated a Wilderness.

Roads

One major obstacle to Wilderness regards roads. Roadless areas are crucial to Wilderness designation, and Erin Bronk, Highlands District Ranger of the Forest Service has noted that no part of the study area is an inventoried roadless area. Jeff Owenby, the planner for the Highlands Ranger District, also explains that roads going to private lands must be left open. This is significant because the last part of Forest Service Road 77 is gated but kept open to private use to allow access to Wilson Camp, a private inholding next to the Georgia border. Bronk also states that there is not much public support for shutting down the current roads, especially because the Blue Valley Road (FS 79) is probably one of most popular roads that local people drive on. According to Bronk, decommissioning a road is a very complicated, lengthy and controversial process. Another option is to "cherry stem" roads so that the land the road is currently on is not part of the designation but the surrounding land is. This is generally disfavored, however, because it disconnects the forest and typically defeats the purpose of having Wilderness.

Furthermore, certain forms of recreation could be inhibited if Congress designated Three Forks – Blue Valley as Wilderness. Kayakers like to use Billingsley Creek Road (FS Road 86B) to access Overflow Creek at times of high water. This road probably would have to be

decommissioned if the area were designated Wilderness. Additionally, individuals and families use dispersed camping areas along Overflow Creek Road and Forest Service Road 79. For the most part, these camping areas are used on the weekends for people to park their campers and recreational vehicles. These would also have to be removed if the area were designated Wilderness.

Logging

The interview with Erin Bronk also delved into the issue of logging. At least half of the forest in the study area consists of white pine. Furthermore, the majority of these white pines are getting to the stage in their lives when "harvesting" them would be ideal, she said. If left unmanaged, these trees will eventually die; if all these trees are the same age, then they will die at approximately the same time. If these trees died then the potential timber would be unusable; there would be "a lot of dead timber in there that is wasted, that we don't get to use" (Bronk: interview).

In Georgia, a new wildlife opening has been proposed along the closed segment of Billingsley Creek Road. Most of this area is located in management prescription 4.1, Natural Areas, which limits logging and wildlife openings in order to provide an area where "users can obtain a degree of solitude and the environment can be maintained in a near-natural state" (USFS: GA Plan). In spite of this, the Forest Service is promoting cutting this area to promote "early successional habitat" (USFS: Environmental Assessment).

Experimental Forest

The 1,200-acre Blue Valley Experimental Forest is located within the Three Forks – Blue Valley study area. This forest was established in 1964, the same year that the Wilderness Act became federal law, to provide opportunities for white pine management research (Sluder 1964). In past years, the Forest Service's budget did not permit research to be conducted; but, the budget improved and research again proceeded. Currently, there are two studies being conducted in the Experimental Forest. One is studying the regeneration of white pine stands in response to shelterwood cutting and burning, and the other involves the regeneration that follows

single-tree selection (Loftis: email). Experimental Forests are designated by the Secretary of Agriculture, through the Chief of the Forest Service; these designations cannot be changed by a forest plan. Thus, it would be difficult to change the designation of the research area.

Fire Management

Fire management is another important issue to consider. Erin Bronk and the Highlands Ranger District are concerned about houses in the area surrounding Blue Valley. Numerous dead pine trees killed by the recent Southern Pine Beetle outbreak provide plentiful fuel for fires, and if Blue Valley were designated Wilderness, then pines could not be harvested before they died. Additionally, machinery is not allowed to operate in Wilderness areas. This means that fire suppression tools such as chainsaws and bulldozers would be forbidden. Although machinery can be used if the Regional Forester deems it necessary, Bronk feels that the permission "may not be obtainable quickly enough to help" (Bronk: interview). Bronk further cited her concerns from a fire several years ago: "Several years ago, a relatively small fire came out of Clear Creek in Blue Valley, went up the slope of Brushy Face on the National Forest and threatened 14 houses, several of which were singed. The fire easily crossed over the top of the houses that lined the rim of Brushy Face, crossed the road behind them and was making its way down slope when it was finally contained (Bronk: email)."

Wildlife Openings

Wildlife openings are human-cleared areas of the forest that are distributed throughout a managed forest to provide browse for animals. There are several wildlife openings in Blue Valley that are being maintained by the North Carolina Wildlife Resources Commission. These areas are maintained by bush-hogging and fertilization. According to Jerry Anderson of the N.C. Wildlife Commission, the openings here are mainly for wild turkey. If Blue Valley is designated Wilderness, these wildlife openings would have to be abandoned and natural re-growth allowed. The Resources Commission hopes, however, that the wildlife openings will stay open indefinitely. These openings also provide areas for hunters to hunt more easily and the hunters,

in my view, would most likely be displeased if the openings were allowed to regenerate and close up.

Special Interest Areas

Glen Falls is located on the East Fork of Overflow Creek off NC 106. This section is designated as a Regional Forester Special Interest Area in the current management plan. The area includes trails, hand railings, and a parking lot. Many hikers and visitors frequent this area because of its scenic value. The Glen Falls Scenic Area protrudes like a tongue into the Three Forks – Blue Valley study area (see Appendix B) and creates a problem for Wilderness designation because of the access road, FS 79C located below the falls. To access this road, another road, Forest Service Road 79, must be used. The Glen Falls access road is maintained to allow emergency personnel to reach people quickly who need to be rescued from the base of the falls. In addition to the road, there is also a power transmission line adjacent to the Special Interest Area. The Wilderness section of the Forest Service Management Planning Handbook states that electrical installations are allowed if their impact is minimal, but this power line does not seem to show minimal impact, as the understory plant growth is periodically mowed. Therefore, it would likely be very difficult to change the current designation for the Glen Falls Scenic Area so that it would fit Wilderness designation criteria.

Political Climate

Political reality also influences the designation of forests and has apparently created a division of opinion in the conservation community. Cynthia Strain, the chairwoman of the Jackson-Macon Conservation Alliance, argued that Blue Valley's current designation would be difficult to change because it is already being partially protected (Strain: email). Additionally, North Carolina representative Charles Taylor, who handily won reelection last month and also scored a zero on the League of Conservation Voters scorecard (League 2004), is unlikely to give Blue Valley a status that prohibits logging. "U.S. Rep. Charles Taylor, R-NC, opposes designation of both Overflow and Snowbird as wilderness, favoring releasing the areas to the Forest Service for general use, including logging (Horan 1997)." Accordingly, as Strain says, "if

we don't have his support, there is not a chance in the world of changing it. The old saying is true in this case: don't fight a battle that you cannot win. It takes too much effort and makes you a loser in the long run."

Future Management Options

There are multiple opposing views on Wilderness designation and various options for future management of the area. This will be particularly pertinent in North Carolina as the Nantahala National Forest revises its forest management plan in the near future. Several options are discussed below.

1. Maintain current management

The simplest recommendation that can be made is to keep the management in the area the same. This way, the forest continues to be managed as it has been for decades. The current management pleases some individuals and displeases others and is not perfect. Even if kept the same for now, management area designations can change in the future if the Forest Service deems it necessary or appropriate. However complicated and difficult to follow the different management areas are, the forest is not linear, and thus neither can be its management.

2. Move towards Wilderness designation, despite criteria problems

Another option is to move toward designating the study area as Wilderness. In order for Wilderness to be designated, a series of steps must be taken. First, federal land management agencies, in this case the Forest Service, must recommend the land to Congress. Then Congress decides whether or not to designate the area as Wilderness (The Wilderness Society: How). The Forest Service, however, has additional steps that it feels are necessary before a recommendation can be made to Congress. Merely designating an area Wilderness is not enough to maintain the land. Management is required to control visitor impact and "an understanding of wilderness values is needed to guide all activities in wilderness, including grazing, access to private lands, mining, fish and wildlife, cultural sites, fire and insects and disease" (wilderness.net). Roads disrupt potential study areas, and this affects biodiversity. Since Wilderness requires roadless

areas, the absence or decommissioning of existing roads would help to protect the biodiversity of the study area. Wilderness designation would certainly please some conservation groups.

3. Continue and expand logging

One option that could be considered is a management prescription that opens the Three Forks – Blue Valley study area to more logging. Forest Service personnel such as Erin Bronk see this as a potential benefit for a number of reasons. For one, more timber management options would allow the Forest Service to administer fire safety regulations concerning trees. If trees such as white pine were periodically harvested, then the threat of a widespread wildfire running out of control could be reduced. Of the eleven current management areas in the study area, four do not allow timber harvesting. If these areas had their management changed to permit logging, then there would be many fewer processes and formalities to go through in order to cut down trees. This option would also potentially benefit homeowners in the area who are worried about fires scorching their houses.

4. Scenic Area designation

Scenic Area designation is another way to manage an area, which provides more protection of the values that the Three Forks – Blue Valley study area provides, but is also more accessible by allowing vehicular access. "Scenic areas designated by the Regional Forester are managed to protect and enhance the outstanding natural beauty, special ecological features, watershed integrity, mature forest habitat, scenic recreation opportunities, and other distinctive values for which they were designated. Forest health is maintained to protect the values for which the area was established, including scenery and recreation" (USFS: GA Plan). Either the Regional Forester or Congress can designate Scenic Areas. Mountain biking, hiking, and horseback riding are allowed in this prescription area. Furthermore, wildlife openings and roads can be maintained. Lands in Scenic Areas are for the most part unsuitable for timber production, "however, salvage sales, sales necessary to protect other multiple-use values, or activities that meet other Plan goals and objectives are permitted" (USFS: GA Plan). This management designation would not change many measures in the current management. Designating this area

as a Scenic Area, however, would dispose of the checkerboard-like management and turn the management compartments into a more concise, better-organized area (USFS: GA Plan).

Conclusion

The recommendations given in the previous section suggest very different management prescriptions. In the course of this study, I have developed a deep appreciation for Wilderness and have concluded that, all else being equal, the Three Forks – Blue Valley study area should be designated Wilderness. Given the multitude of obstacles present, however, this Wilderness designation may not be feasible. In assessing both the support of and opposition to Wilderness, it may be advisable to simplify management into one or two areas that protect the values of the forest. Restrictions on logging and road building (or even possible decommissioning of existing roads) would greatly benefit the biodiversity of the forest and provide opportunities for scientific studies in the future. To designate an area as possible Wilderness, the U.S. Forest Service requires a "public involvement process, which includes public input to environmental analysis (USFS: Wilderness)." This participation of local individuals and organizations is important in formulating any policy. Moreover, I think that public support is imperative and should be a prerequisite to any significant changes in the Three Forks – Blue Valley study area. Blue Valley is a land of exceptional beauty with scientific potential and should not be allowed to be developed or urbanized.

References Cited

Anderson, Jerry. 21 Oct. 2004. North Carolina Wildlife Commission. Phone Interview.

Bronk, Erin. 29 Oct. 2004. Highlands District Ranger, USDA – Forest Service. "Blue Valley." E-mail to the author.

Bronk, Erin. 22 Oct. 2004. Highlands District Ranger, USDA – Forest Service. Personal Interview.

Carlson, Paul J. 1995. An Assessment of the Old-Growth Forest Resource on National Forest System Lands in the Chattooga River Watershed. USDA Forest Service.

Clay, Butch. 24 Sep. 2004. Former Acting Regional Director of The Wilderness Society. Personal Interview.

Furnish, Jim. 2004. "Eastern Roadless Areas Under Threat: How the U.S. Forest Service Minimizes Roadless Areas with Biased Procedures." *The Heritage Forests Campaign*. Washington D.C.

Harmon, John. 27 Nov. 1998. "Forest Service agrees to study roadless area." *The Atlanta Journal Constitution*: E10.

Horan, Jack. 1997. Where Nature Reigns: The Wilderness Areas of the Southern Appalachians. North Carolina: Down Home Press.

Irwin, Hugh. 10 Sep. 2004. Conservation Planner for the Southern Appalachian Forest Coalition. Personal Interview.

Keiter, Robert B. May 1998. Ecosystems and the Law: Toward an Integrated Approach. Ecological Applications, Vol. 8, No. 2, 332-341

League of Conservation Voters. Feb. 2004. *2003 National Environmental Scorecard.* League of Conservation Voters.

Leopold, Aldo. 1966. *A Sand County Almanac*. New York: Oxford University Press.

Loftis, David. 18 Nov. 2004. Project Leader – Bent Creek Experimental Forest, USDA – Forest Service. "Blue Valley paper." E-mail to mentor.

Loftis, David. 18 Oct. 2004. Project Leader – Bent Creek Experimental Forest, USDA – Forest Service. "Experimental Forest." E-mail to the author.

Loftis, David. 10 Sep. 2004. Project Leader – Bent Creek Experimental Forest, USDA – Forest Service. Personal Interview.

Martin, Brent. 4 Oct. 2004. Former Executive Director of Georgia Forestwatch. Personal Interview.

McClure, Thomas. May 1993. *North Carolina's Mountain Treasures: The Unprotected Wildlands of the Nantahala and Pisgah National Forests*. Washington, DC: The Wilderness Society.

Mittermeier, R. A., et al. 20 Oct. 2004. "Wilderness and Biodiversity Conservation." The National Academy of Sciences 100.18 (2003). http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=12930898.

Owenby, Jeff. 3 Sep. 2004. Forester/Planner, USDA – Forest Service. Personal Interview.

Rankin, Duke. 12 Oct. 2004. Botanist, USDA – Forest Service. "Re: Heritage Question." E-mail to mentor.

Seyden, Terry. 10 Sep. 2004. Public Affairs Officer, USDA – Forest Service. Personal Interview.

Sluder, Earl R. 6 Feb. 1964. *Establishment Report for the Blue Valley Experimental Forest*. Nantahala National Forest. USDA Forest Service.

Southern Appalachian Forest Coalition. Unpublished update of North Carolina Mountain Treasures.

Strain, Cynthia. 23 Oct. 2004. "Blue Valley / Three Forks Wilderness." E-mail to mentor.

Sullivan, James. Nov. 2004. GIS map of the Three Forks - Blue Valley Study Area.

USDA – Forest Service. 1994. *Land and Resource Management Plan: Nantahala and Pisgah National Forests, Amendment 5*. National Forests in North Carolina. Asheville, North Carolina.

USDA – Forest Service. 2004. *Land and Resource Management Plan Revision for the Chattahoochee-Oconee National Forests*. USDA – Forest Service, Chattahoochee National Forests. Gainesville, Georgia.

USDA Forest Service. 30 Sept. 2004. "Environmental Assessment." Early Successional Habitat Project: Chattahoochee National Forest. Tallulah Ranger District. Clayton, Georgia.

USDA Forest Service. "Wilderness Evaluation." *Land and Resource Management Planning Handbook.*

The Wilderness Society. Mar. 2004. "The Economic Benefits of Wilderness: Focus on Property Value Enhancement." No. 2. The Wilderness Society: Ecology and Economics Research Department.

The Wilderness Society. 2004. *Why Wilderness? What the Last Remaining Wild Lands of the Southern Appalachians Mean to the People of the Southeast.* The Wilderness Society.

The Wilderness Society. Feb. 2000. *Georgia's Mountain Treasures: The Unprotected Wildlands of the Chattahoochee National Forest*. The Wilderness Society.

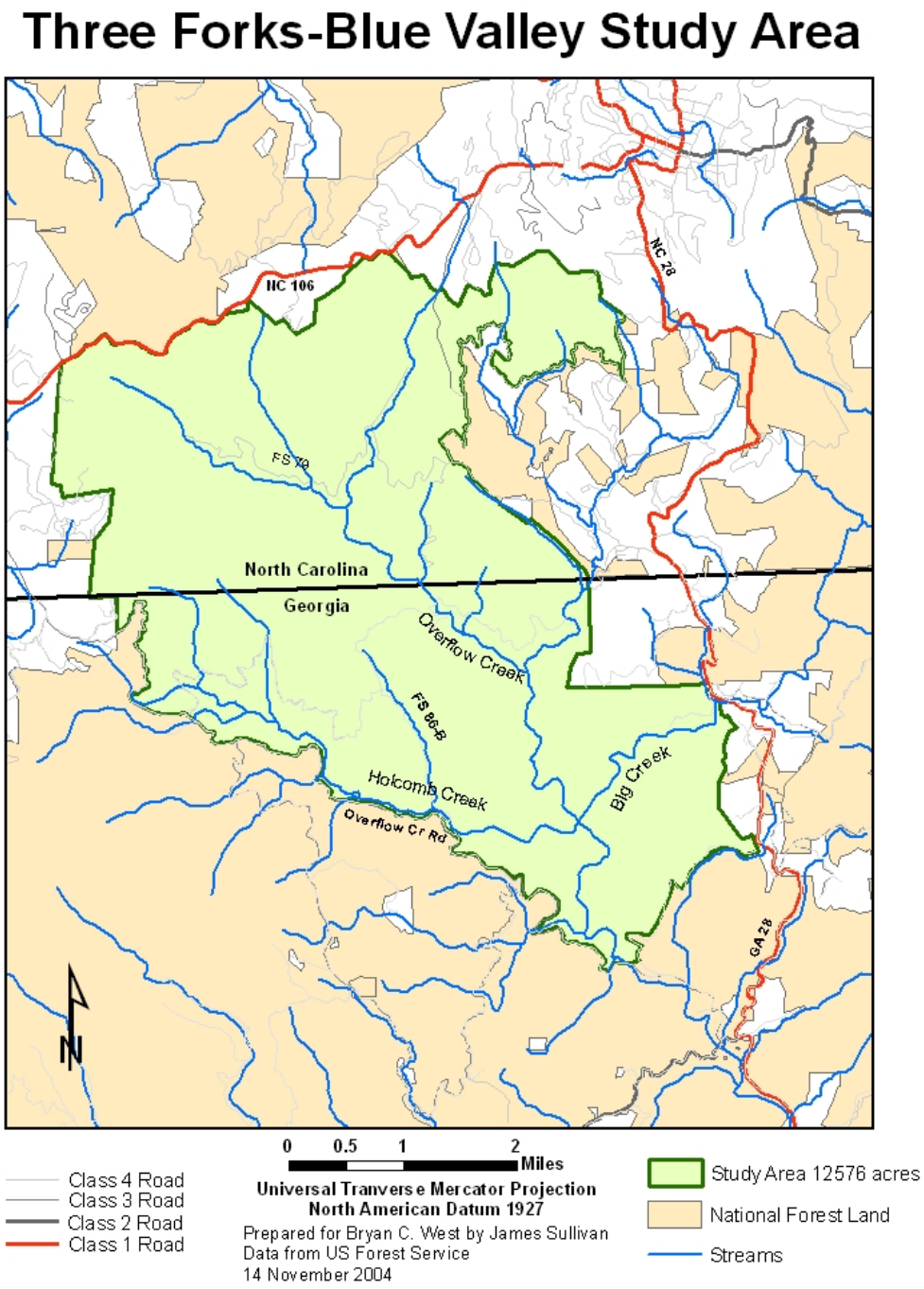
The Wilderness Society. 08 Nov. 2004. "How Wilderness Areas Are Designated." *The Wilderness Society*. http://www.wilderness.org/OurIssues/Wilderness/designate.cfm.

The Wilderness Society. Apr. 2004. *The Wilderness Act Handbook*. Fifth Edition (revised).

Wilderness.net. 08 Nov. 2004. "What is 'Wilderness Management'?" *Wilderness.net*. http://www.wilderness.net/index/cfm?fuse=NWPS&sec=manageIssues.

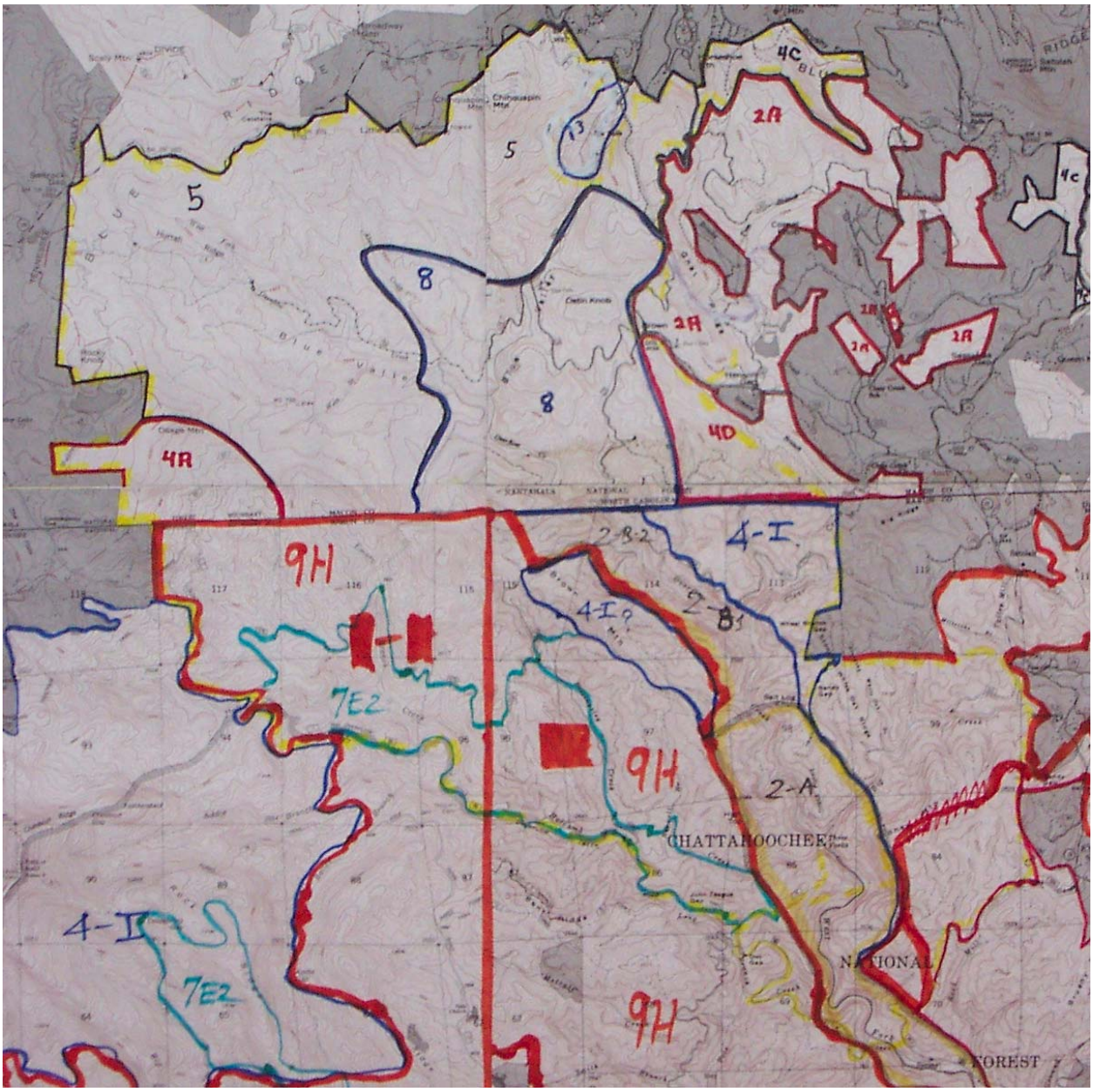
Williams, Buzz. 30 Aug. 2004. Executive Director of the Chattooga Conservancy. Personal Interview.

Appendix A


Three Forks-Blue Valley Study Area
NC 106
NC 28
FS 49
North Carolina
Georgia
Overflow Creek
FS 86B
Holcomb Creek
Overflow Cr Rd
Big Creek
GA 28
N
0 0.5 1 2
Miles
Universal Tranverse Mercator Projection
North American Datum 1927
Prepared for Bryan C. West by James Sullivan
Data from US Forest Service
14 November 2004
Class 4 Road
Class 3 Road
Class 2 Road
Class 1 Road
Study Area 12576 acres
National Forest Land
Streams

Appendix B

Current Forest Service Management



U.S. Forest Service Management Prescriptions in the Three Forks – Blue Valley Study Area.

Sources: Nantahala National Forest, Chattahoochee National Forest; as drawn by Ruth Barker (NC) and Joe Gatins (GA).

Appendix C

Three Forks – Blue Valley Management Re-Evaluation
Interview Guide

1. What is Wilderness?

2. Is Wilderness desirable or undesirable in your estimation? Why?

3. Should society promote Wilderness? What would be the best way to do this?

4. Is Wilderness desirable or not desirable in the Three Forks-Blue Valley study area? Why or why not?

5. What characteristics or facts argue on behalf of Wilderness in this specific area?

6. What are the obstacles to Wilderness designation in the specific area?

7. Could these obstacles be overcome? If yes, how? If no, why not?

8. What other designations could be used for Blue Valley? What would be the result of these designations?

9. Do you have anything else to add?

Southern Perimeter Trail Plan for Panthertown Valley

Luke Worsham

Introduction

Panthertown Valley is a region located east of Cashiers that encompasses some 6300 acres of primitive and nearly undisturbed forest land. Waterfalls, mountains, cliffs, and valleys are just a few of the many sights that continue to attract hikers, horseback riders, mountain bikers, and other outdoor enthusiasts to the region year around. Panthertown is host to a wide variety of flora and fauna, though increased recreational use of the area has the potential to negatively affect this biodiversity. Additional traffic contributes to the creation of unauthorized user trails, which in turn contributes to the introduction of exotic species and trampling of existing native species. The objective for this project was to locate the best route for a southern connector trail that will turn the existing main trail system into a loop along the perimeter of Panthertown. In turn, this new route will mitigate the negative effects on biodiversity and trail conditions that are associated with an increase in visitation.

Recently, Lake Toxaway and Bald Rock subdivisions (Figures 2 & 3) have begun construction on areas immediately bordering Panthertown. In certain places along the borders with these subdivisions, unofficial user-created trails stem from these two neighborhoods directly into Panthertown. In addition, Trillium Links and Lake Club is in the process of purchasing approximately 2,000 acres of land adjacent to Panthertown for the construction of 200 home sites and a golf course. The land was purchased from the Carlton family, who owns much of the land bordering Breedlove Road, and the property will be an extension of the existing Trillium development near Lake Glenville (Connor 2004).

Undoubtedly, as these subdivisions grow, traffic into Panthertown will increase, placing further stress on the system of trails and the management strategy implemented by the Forest Service (FS). Jeff Owenby of the Highlands Ranger District suggests that Panthertown will continue to increase in popularity over time as more visitors to the region learn of its existence. Most of the hikers enjoy Panthertown for its solitude, and therefore want the area to remain largely unknown (Dendy 2004). However, the increase in private residences immediately

bordering Panthertown, as well as the construction of private trails leading into Panthertown will undoubtedly increase the traffic within the system of trails.

In keeping with the multiple use goal of the FS, Panthertown is managed chiefly with recreation in mind. To mitigate the effects of increased visitation to Panthertown, a plan has been initiated to create a southern connector loop. This new trail would connect the Salt Rock and Cold Mountain trailheads, which are the two main trailheads that provide access into Panthertown (Figure 4). In addition, the trail would connect the main access trail constructed by the Bald Rock subdivision (Figure 2) in the southwest corner of Panthertown, as well as the main access trail on Fox Run Ridge Road, which provides access for Lake Toxaway residents on the southeast corner of Panthertown (Figure 3). The objective of this trail is to allow more users to enjoy the trail system while having a convenient route to access the sites most commonly visited in Panthertown, such as Schoolhouse Falls and Big and Little Green Mountains (Figure 1). The proposed trail will also help to discourage the creation of additional unauthorized user trails, which can be disruptive to local ecosystems.

In December of 2003, a public forum was held to discuss the future of Panthertown, where numerous comments were collected from attendees. Most of the comments regard user designation, and the majority of opinions were of the nature that hikers should receive priority in trail designation, although areas for mountain biking and horseback riding should also be allowed. Commenters acknowledged that, while increased use of the Panthertown trail system is inevitable and unfortunate, Panthertown should be managed to accommodate the increase in traffic. Many also noted that despite the designation of some trails as hiker-only, many trails received heavy horse traffic, thus contributing to the destruction of the trail as well as danger to the user and other hikers. Horse trails require extra width, gentler grades, and smoother surfaces than hiker-only trails, which is why many of the trails in Panthertown that do not meet these specifications are designated as hiker-only.

With the addition of a southern loop, new trails and access points will be available to horseback riders, some of which are located in the “equestrian” Bald Rock subdivision. The expected result is decreased infringement by horseback riders on secondary trails and footpaths,

thus reducing damage to trails and contributing to a more enjoyable experience for all types of user traffic in the region.

Current Trail Development Plans

There are two main portions of the southern connector trail for which construction plans exist (Figure 4). Beginning in the Goldspring Ridge region just west of Drybone Gap, the Bald Rock subdivision has constructed a nature trail (Figure 2) that connects to the main Panthertown hiker path near Buck Knob (Figure 1). This nature trail follows the FS boundary along the perimeter of the Bald Rock subdivision and across Goldspring Ridge above Chestnut Mountain. New trail has been flagged at the head of the nature trail running southeast through Drybone and Burnt Cabin Gaps. This new western trail will run along the north slope of Little Hogback Mountain and connect with existing trails leading east towards Toxaway Mountain and north towards Mac's Gap. The trail leading east towards Toxaway Mountain is not listed as a public trail and currently leads to the eastern border of Panthertown where it becomes Spencer Lane of the Lake Toxaway subdivision (Figure 3). The second area of construction will be along the west fork of Greenland Creek. This new eastern trail will connect the Toxaway trail and the main trail leading to Cold Mountain Gap.

The nature trail constructed by the Bald Rock subdivision runs mostly along private property, but sporadically crosses onto public property. At certain points along the trail, the FS land markers actually lie in the middle of the trail, bisecting the land ownership on which the trail lies. Although the Bald Rock subdivision received no permission from the FS before constructing portions of the nature trail on public land, the FS must obtain a right-of-way from the private land owners in order to incorporate the nature trail into the existing Panthertown trail system. The Bald Rock subdivision website advertises "Panthertown Valley Preserve Private Access," although no such agreement has been made with the FS. Nevertheless, because the nature trail system was constructed recently, it is in excellent condition. Therefore, it would be more logical for the FS to obtain access to the existing nature trail than to extend the construction of the connector trail parallel along the nature trail, which would be a misuse of time and resources.

In addition, the existing footpath along the east fork of Greenland Creek will be closed at the junction with the main trail in order to protect endangered moss and lichen species inhabiting the spray cliffs of Greenland Creek Falls and Carlton Falls (Rankin 2004). These two waterfalls are popular destinations for hikers and, since their access will be prohibited by the east fork closure, possibilities exist for development of two extensions along the main trail. These two small spur trails will lead to a viewing platform or area below each of the falls, preventing users from treading on any sensitive areas while viewing the waterfalls.

With the addition of these two areas of construction, a complete loop of main trail will be established so that users will not have to backtrack, and the existing access to Panthertown from the Bald Rock subdivision and Fox Run Ridge Road will be expanded.

National Environmental Policy Act (NEPA)

After the trail has been flagged for construction, the next phase of development involves an environmental assessment performed in accordance with the regulations of the National Environmental Policy Act (USDA 1986). Passed in 1969, this Act was established in order to "declare a national policy which will encourage productive and enjoyable harmony between man and his environment" and "to promote efforts which will prevent or eliminate damage to the environment and biosphere" (USDA 1986). Basically, the act establishes categories and procedures for activities with the potential to disturb local environment and ecosystems, and therefore must undergo a NEPA-regulated environmental impact statement (EIS) before any action may be taken (Owenby 2004). The product of the evaluation is an environmental document that takes into account various consequences that the intended action may have on natural resources, urban quality, as well as historic and cultural resources (USDA FS 1986). If the consequences are identified as preclusive to the intended action, then the assessor must "rigorously explore and objectively evaluate all reasonable alternatives" (USDA FS 1986). At all points during the process, NEPA agencies are required to maintain a level of public involvement, soliciting and considering the opinions of all interested parties. According to NEPA, these agencies are obligated to do the following:

(1) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures

(2) Provide public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected.

(3) In all cases the agency shall mail notice to those who have requested it on an individual action.

After comments have been received, a final draft of the statement is submitted, and depending on the results, the action under question may or may not be performed.

In the case of Panthertown, the assessment will include botanical, archaeological, wildlife, and aquatic evaluations. Evaluating how trail construction might affect local plant and animal species and their habitats will ultimately determine alternatives for trail development. If sensitive flora are found in the trail area by FS botanists, the trail might have to be relocated or rerouted. Another likely outcome of the assessment is the presence of important archaeological sites, especially since other such sites have already been identified in Panthertown (Southard 2004). During the initial trail planning phase, a site containing the remains of an old stone chimney was identified in the southwestern corner of Panthertown. Although no definitive conclusion was reached, the chimney is likely of German-American origin, and the estimated age of the trees surrounding the site roughly suggests its origin during the mid-nineteenth century (Dyson 2004). Since early assessments of the site concluded that no detrimental impacts would be expected (Dyson 2004), the plans for the western connector trail were routed to include the chimney site as a feature of the trail. This suggests that other significant sites may be identified along the planned trail corridor, thus potentially affecting the location of the trail.

History of Panthertown

Common belief is that the Cherokee were the first inhabitants of the land that is now called Panthertown. Panthertown Valley would have provided a rich environment with diverse flora and fauna for early inhabitants to utilize in their everyday life. This relationship of the Native Americans and the land would have persisted for hundreds or even thousands of years

before European settlers entered the valley. No record of permanent settlement in Panthertown exists, but early pioneers referred to the valley as a "town of painters"—"painters" being an old Appalachian term for panthers. Although panther sightings have not been proven, the name Panthertown is reminiscent of the wild and untamed valley observed by these pioneers (Kornegay 1995).

Around the turn of the century, the Panthertown area entered into a succession of private ownership led by Pennsylvania native R.G. Jennings (Ellison 2001). Jennings enjoyed the region for its ample fishing opportunities, but only possessed the land for 20 years before selling it to a logging company managed by magnate Carl Moltz in the 1920s. At this point Panthertown entered a period of heavy logging, placing a heavy burden on the land with impacts from new skid roads and resulting erosion. Frequent fires burned much of the valley, and railroads stretched throughout the valley connecting three lumber camps in Panthertown to the main southern connector railway (Busch 2004). The heavy toll taken on the land is still apparent today, as many of the old logging roadbeds persist as main trails, and portions of the main trails follow the original railway. Old barbed-wire fencing lines the trail in several areas where cattle herding once took place, and many slopes and rock outcrops are still eroded as a result of activity during this time (McNeill 2004).

By 1940 logging had ceased in the area, and the valley recovered for the next two decades until purchased by a North Carolina investment company, Liberty Properties, in the 1960s. As the land bordering Panthertown was privatized, Liberty drafted a vast development plan for the region that included a dam near the Warden's Falls area. The dam was intended to aid in the creation of a large artificial lake that would deluge the entire valley. Plans also included house sites around the lake, complete with a golf course for the residents (Kornegay 1995). Although a few lots did sell around Laurel Knob on the west side of Panthertown, fortunately for the valley none of these plans ever materialized, and the largest alteration was a field of white pines planted as a Christmas tree farm on the floor of the valley. Previously an open meadow, a dense stand of white pines still exists in the valley floor as a result of the farm. The white pines stand out from the surrounding deciduous forests in many of the views from the

high points and mountain sides in Panthertown, and the boggy creek trail past Mac's Gap and through the valley provide excellent hikes through the secluded pine forest.

In 1987 Duke Power purchased Panthertown in order to transect a portion of the valley with the EB Shuler transmission line—a 27-mile long conduit connecting Nantahala Power and Light Company with Duke Power (Duke Power 2004). Although the line was protested by local environmental groups, construction proceeded anyway, and the land surrounding the power line was subsequently sold to the Nature Conservancy in 1989 at a cost of $7,875,000 (Nature Conservancy 2004). Not long after, the FS purchased the land from the Conservancy at a comparable price, thus returning the 6,295 acres of Panthertown to public hands after almost a century of private ownership. Duke Power still owns approximately 800 acres of land for the transmission line right-of-way, and the lines are a visible mark on the landscape from various areas throughout Panthertown. The Highlands Ranger District currently manages Panthertown as part of the Nantahala National Forest, which stretches throughout western North Carolina.

In keeping with the multiple-use objective of the FS, Panthertown attracts many different types of recreational users. Besides the array of hiking trails, the area includes waterfalls and numerous rock faces suitable for rock-climbing. Many of the streams throughout Panthertown provide numerous recreational opportunities for the catch-and-release fisherman, though the streams are a sink for sedimentation during storms. To divert the run-off water, mounds of dirt called water bars are commonly constructed diagonally across the trail so that running water does not continue along the trail, but rather is diverted to the side. Although water bars have been constructed by trail crews on some of the main trails in Panthertown, many of the smaller trails lack in erosion control and have small streams that flow along the trail or retain puddles in low-lying areas after heavy rain. In some of the worst spots, recent storms have carved trenches 3 to 5 feet deep along the trail, making passage difficult for mountain bikers and hikers.

Many of the major trails in Panthertown are remnants of old road beds and railroad lines, although "unofficial" user-created trails exist and continue to be made throughout the region. These smaller, lesser-known trails exist mainly as shortcuts that connect the main trails at various points, or they lead out as "spur" trails from a main trail to waterfall-viewing areas. Maps of Panthertown available to the public include the main trails, but they leave out many of

these smaller, unofficial trails. Most of these trails were not included because the authors of the map were not aware of their existence. There is an upside to the omission of these trails: if users cannot locate these trails on the map, then there is less chance they will use them. This in turn, protects these smaller trails from the same issues that the main trails face such as erosion, trampling of habitat, loss of biodiversity, etc. Because the FS did not construct these trails, many of them exist on dangerous or steep terrain where the FS is unable to maintain their condition. The westernmost waterfall near Frolictown Creek may only be accessed by one of these unofficial trails and is an example of the dangers that unplanned trails can present. The slope is steep and follows a slippery rock surface down to the view of the waterfall, presenting several opportunities for injury to the unwary hiker. Fortunately, with assistance from the Highlands Ranger District, a new trail has been flagged to provide an alternative, safer route to the view of the falls.

Biodiversity of Panthertown

One of the greatest attractions of Panthertown today is the rich flora and fauna that exist in the region. Commonly referred to as the "Yosemite of the East," Panthertown is one of the most diverse areas in the southern Appalachians (Kornegay 1995). Although most of the valley was clear-cut earlier in the century, time has allowed secondary forests of oak, hickory, and magnolia to grow back (Ellison 2001). In fact, the only remaining areas of old-growth forest are around rivers and streams, where the geography proved impassable to logging equipment (Kornegay 1995). Old-growth stands of rare Carolina hemlock (*Tsuga caroliniana*) still live around the lower falls of the Greenland Creek Trail, and many endangered lichens and mosses inhabit the spray cliffs around the waterfalls in Panthertown.

During the summer of 2004, experts from the Highlands Ranger District erected small signs marking and describing many of the native species along the main trail (Rankin 2004). Some of the common plants and trees throughout the valley include buckberry (*Gaylussacia ursina*), Buffalo nut (*Pyrularia pubera*), doghobble (*Lecothoe axillaris*), Solomon's seal (*Polygonatum biflorum*), as well as species of birch (*Betula*), rhododendron (*Rhododendron*), poplar (*Liriodendron*), maple (*Acer*), oak (*Quercus*), blueberry (*Vaccinium*), pine (*pinus*), and

beech (*Fagus*). The valley also boasts many other species of wildflowers and an abundance of ferns in its moist, shady areas. Endangered and rare species include northern beech fern (*Thelypteris phegopteris*), deerhair bulrush (*Isoetes engelmanii*), Cuthbert's turtlehead (*Chelone cuthbertii*), and swamp pink (*Helonias bullata*). The varieties of habitats present throughout Panthertown, from moist and dark bog understory to dry and exposed rock face, explain the high diversity of plants found throughout the area (Kornegay 1995).

Several animal species also live in Panthertown. Although scattered reports of panther sightings still exist (McNeill 2004), the presence of panthers in the region has not been confirmed for many years. However, all of Panthertown is classified as sanctuary for black bear (*Ursus americanus*), though sightings of this species are rare as well. More common wildlife includes wild turkeys (*Meleagris gallopavo*), foxes (*Vulpes*), raccoons (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), grouse (*Dendragapus*), and several snake species including the venomous timber rattlesnake (*Crotalus horridus*) and copperhead (*Agkistrodon contortrix*). Brook trout (*Salvelinus fontinalis*) inhabit the streams throughout Panthertown, providing fishermen with numerous outlets for catch-and-release fishing. Undoubtedly, the plant and animal species of Panthertown are some of the most diverse in the region.

Trail Implications

According to the FS Trails Management Handbook, there are a number of factors that must be considered when constructing a new trail. During the scouting process for the new trail, care was taken to select the route that would best mitigate erosion and other potential forms of damage to the trail and surrounding areas. Sloped areas serve as natural drainages to the trail, and well-drained soil is essential to the integrity of trails along slopes (Section 6, p.85). In steep areas, erosion problems are one of the factors that lead users to make new trails, further compounding the problem of erosion and trampling. In areas such as Panthertown where soils stay wet much of the year, the soil is compacted more easily and may contribute to puddling in low points along the trail. Moreover, "long straight stretches (tangents) and sharp angular turns should be avoided as much as possible" (USDA Forest Service 1985). A level-off grade should be provided at the end of a section of steep grade, and the maximum grade should never exceed

12% for hikers (Owenby 2004). Since the trail will also be used for horseback riding, the maximum grade should ideally not exceed 10% (Williams 2004).

As mentioned, biodiversity is another necessary consideration when constructing new trails, as new trails have the potential to alter local species composition along trail margins. According to Kirk (2003), trampling or erosion can contribute to a loss of species richness and hikers can be vectors for introduction of exotic species. Kirk also mentions that "trails can act as artificial channels for rainwater, increasing erosion and sediment runoff." He further advises that "human disturbance associated with construction, maintenance and use of trails has a negative impact on species richness of the vascular flora". Trail construction also creates gaps of increased light intensity where exotic species tend to grow (Kirk 2003). The bigger the gaps, the more exotic species flourished: "In all of the 0.1-m transect counts along USFS authorized old roads, there was at least one or more exotic plant species recorded… the single-track construction had no exotic species present in any of the 39 transects" (Kirk 2003). In addition, seeds are also transported by hikers' shoes, further contributing to the spread of exotic species along trails. Kirk (2003) found that there was an indirect correlation between trail width and species richness along trail margins. To mitigate these effects and promote trail sustainability, Kirk (2003) recommends increased outreach and public education in the form of signs, educational programs, and educational hikes.

The addition of new trails will increase the amount of maintenance required by the Highlands Ranger District. Although no trail crew is currently employed, a user volunteer base exists and is strongly committed to maintaining the trails in Panthertown. The actual construction of the new trail is only the beginning of the effort needed to ensure that the trail remains usable. Since the portion of trail being constructed will be of considerable length (~2.5 mi), the addition of culverts, bridges, and water bars will probably be necessary. Periodic maintenance may also be necessary to sustain the integrity of the trails as the need arises. Overall, the new trail construction represents a large increase in responsibility for the FS to maintain and preserve the area for the enjoyment of hikers and other users.

Current Management Plan

One of the main policies of the FS is to maintain land for multiple uses. For this reason, they have devised various management classifications in order to regulate what and how certain activities such as logging, hunting, and hiking are allowed within that region (USDA FS 1994). This management plan is a main influence in the decision of the Highlands Ranger District to pursue a connector trail in Panthertown.

To help preserve local biodiversity, Panthertown Valley is classified by the FS as a Management Area 5, a designation reserved for backcountry recreation in a primitive setting. The general direction for this management plan dictates that the area must "emphasize visual quality in all activities" and gives instructions on appropriate methods to establish and maintain trails and recreation areas. Usually occurring on large tracts of land to ensure seclusion, these areas also serve as wildlife sanctuaries with large areas of undisturbed forest and wildlife habitat (USDA FS 1994).

The current plan indicates that "ovenbird, black bear, and cerulean warbler are likely to be present." This plan also prohibits unauthorized motorized vehicles, as well as timber harvesting in the region. This particular management plan also dictates that "grass and forb openings of a few acres widely dispersed about the management area will be developed or maintained to provide suitable areas for wildlife requiring this habitat" (USDA FS 1994). Such openings are present in Panthertown (e.g., around the Salt Rock shelter) and also provide different scenery because of the different grasses and shrubs that grow in those areas.

Methods

To plan for the new trail system, the first step was to evaluate the condition of existing trails and decide which ones would make ideal connectors to the new trail. Specifically, time was first spent assessing the condition of the western trail near Big Green Mountain that would connect to the planned trail. Pictures were taken to note the condition and width of the trail, and the trail was tracked on a Garmin III Plus GPS hand-held unit. After performing the same assessment on the remainder of the main trail near the eastern Cold Mountain access point, the next step was to decide where exactly the southern connector would be built.

The main difficulty facing construction of the new trail was the proximity of houses and developments to the southern border where the new trail was to be constructed. Ideally, houses and roads should be out of view of the trail in order not to diminish the natural setting, though a few houses are visible from the nature trail adjoining the subdivision. The new western trail was scouted to provide the most attractive setting possible, maximizing viewpoints while maintaining a relatively consistent and gentle grade. Using Big Ridge and Toxaway topographic quadrangle maps, the contour lines were used as a guide for placement of the new trails with deviations being made in the field as necessary. This method generally minimizes slope and maintains a shallow grade.

Most days in the field were spent following the public land boundary on the south border of Panthertown in order to see the proximity of houses and developments to potential trail locations along this corridor. After the best route was determined, the GPS unit was used to track the tentative trail in order to view it on a map layer. Pictures were also taken of features along the trail, including damaged sites and scenic overlooks. With the data collected from the GPS, a GIS layer showing existing trails and planned trails was created (Figure 4). After the trail plan is made, the trail is flagged for the NEPA assessment—which will occur after the termination of the project. The flagging outlines the general route for the trail, but it is open to modification or relocation if the need arises.

Results

An initial assessment of the existing western connector trail and the eastern trail near Cold Mountain Gap revealed that no serious obstacles were present on either trail; both trails were therefore deemed acceptable to become links to the new trail. Most common forms of damage on the trails were usually standing water or runoff crossing the trail. Both of these problems contribute to erosion of the trail and increase the frequency with which repairs must be made. Since Panthertown experienced the remnants of three hurricanes during the course of this project, downed trees were also a common occurrence along many of the trails. Although damage was present on many of the trails in Panthertown, the FS is currently in the process of finishing environmental assessments of the area and identifying funding for reconstruction and

clearing of the damaged portions later this year (Owenby 2004). The main trails involved in the connector loop are listed as highest priority for reconstruction.

As a result of the scouting done for the new western trail, it was determined that many houses are visible from the boundary, necessitating that the trail be constructed farther inside the southern boundary area. After exploring the wooded region along the boundary, it was decided that the trail would work best along the north side of the ridge that forms the majority of Little Hogback Mountain. This way, the development area would be out of sight of the trail, and vistas of the Panthertown Valley between Big Green Mountain and Goldspring Ridge would remain open to trail users.

The new western trail will stretch from the Bald Rock nature trailhead to the secondary hiking trail south of the "four corners" intersection on the southeast slope of Big Green Mountain (Figure 4). Since the slope is gentle and no switchbacks have been necessary on the construction of this new eastern trail, the trail winds easily through the woods and across Drybone and Burnt Cabin Gaps, constantly revealing new terrain at a steady pace. The trail crosses two tributaries to Greenland Creek, and then mostly hugs the contour lines along the northern slope of Little Hogback Mountain before finishing the climb back to the connection with the existing hiking trail.

The new eastern link to the main trail on the east end has also already been flagged to connect the lateral Toxaway trail to the main trail just below Cold Mountain Gap. In addition, a new trail has been flagged south of the Salt Rock trailhead to provide easier access to the Wilderness Falls on Frolictown Creek. The existing trail to the waterfall is steep and slippery and traverses sensitive ledge habitat. The new trail takes a more gradual slope through less sensitive and safer areas.

Plans also exist for a viewing platform for the falls, just like Greenland Creek and Carlton Falls along Greenland Creek. The current plan is for the trail proposal to be submitted to NEPA for scoping and analysis early next spring 2005, with an implementation decision hopefully following that summer. In a best-case scenario, trail construction may begin during fall 2005, with the trail opening early in 2006 (Owenby 2004).

Discussion

Plans for a southern connector have remained fairly consistent throughout the course of the semester. This new trail should help to ease the inevitable increase in traffic in Panthertown. It was clear from the comments in the public forum that users appreciate the valley but want it to remain primarily a backcountry, undisturbed area. With the existing levels of visitation in Panthertown as well as the inevitable increase in visitation due to housing developments and increased popularity, the new trail plan should help to thin the traffic throughout Panthertown and contribute to a more enjoyable experience for all users.

The only compromise necessary to fully realize the trail plan is the use of the nature trail in the Bald Rock subdivision (Figure 2). The nature trail exists on both public and private land, but only stretches for approximately 0.75 mi. A right-of-way will have to be obtained to use this portion of the land as part of the connector trail, but the FS is optimistic that this improved access into Panthertown will be in the best interest of the Bald Rock residents, who will most likely agree to allow assimilation of their nature trail into the main Panthertown trail system.

After seeing most of the trails in Panthertown, it is obvious that user-created trails represent a considerable proportion of the trails that exist in Panthertown. Most of these trails are not on the map. Besides the effects on biodiversity, these unofficial trails also create confusion for visitors looking for specific trails on the map. I would recommend that some of these trails be closed and/or obliterated and that any number of measures be adopted to ensure new trails are not created. Increased signage at the trailheads, signs within Panthertown, signs blocking unofficial trails, outreach and educational programs, and interpretive guides are all possibilities to help maintain the official trail system within Panthertown. I also recommend that plans be carried out to close the existing trail along Greenland Creek to preserve rare species near the falls. In lieu of this trail, I recommend that viewing trails/platforms be constructed from the proposed new eastern trail to assure that the incredible views of these two waterfalls are not lost entirely to the public.

Conclusion

The new trail plan will provide sustainable trail access to members of the Bald Rock subdivision to the west, as well as members of the Lake Toxaway subdivision to the east of Panthertown. If plans move forward to develop the newly acquired Trillium property, the trail plan would also afford accessibility to those residents. Moreover, the inevitable increase in traffic in Panthertown over time will also be mitigated and hopefully the creation of unauthorized trails and the trampling problems that are a direct result of increased usage will be reduced. This complies with the multiple-use goal of the FS, which dictates that this area be managed for the benefit of users. Since these users come in many different forms, the triple-use trail (hiker-biker-rider) will accommodate any form of traffic in Panthertown.

The implementation of this trail plan will have numerous effects on the biodiversity of the area as well. Construction of the trail might lead to different growth patterns due to gaps in the canopy. Exotic species might be brought to the trail via users' boots, and possible trampling of plants near the trail might lead to decreased species diversity in the area. These issues were considered during the initial flagging of the trail, however, and will be assessed again through the NEPA impact statement. These measures will ensure that there is minimal impact on the biodiversity of Panthertown from the construction of the new trails. The result of these additional corridors should be a pleasing and functional trail system that facilitates appreciation and admiration of the natural beauty of the area.

References Cited

Bald Rock, a Civilized Wilderness. 2004. http://www.baldrock.com/BaldRock/location.html.

Busch, W. 2004 "North Carolina – Panthertown Valley." *Rock climbing in the Southeastern USA.* http://www.southeastclimbing.com/climbing_areas/north_carolina/panthertown.htm.

Connor, J. 2004. "More Growth? - Trillium May Expand Amenities to Breedlove Road." *Crossroads Chronicle*.

Dendy, H. 2004. "Panthertown Considerations." E-mail to the author.

Duke Power. 2004 “This Day in History for the Month of October.” http://www.dukepower.com/aboutus/company/history/thisday/october.asp. Duke Power Company.

Dyson, D. 2004. Personal communication. USDA Highlands Ranger District.

Ellison, G. 23 May 2001. “Panthertown Valley – A place to take it easy.” *Smoky Mountain News*.

Executive Office of the President of the United States. 1986. Council on Environmental Quality. *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*. Washington: US Government Printing Office.

Kirk, M. Dec. 2003. *Impacts of recreational trails on vascular plants of the Highlands Plateau*. Land Use Change and Implications for Biodiversity on the Highlands Plateau.

Kornegay, B. 1995. *A Guide’s Guide to Panthertown*. Cashiers: Slickrock Expeditions Inc.

McNeill, C. 2004. Personal communication. Panthertown Trail Guide.

The Nature Conservancy. 2004. “Panthertown Valley.” http://nature.org/wherewework/northamerica/states/northcarolina/preserves/art5621.html.

The Original Lake Toxaway Company. 2004. http://www.laketoxaway.com/.

Owenby, J. September-November 2004. Personal communication. USDA Highlands Ranger District.

Rankin, D. October, November 2004. Personal communication. USDA Highlands Ranger District.

Southard, M. 1 November 2004. Personal communication. USDA Highlands Ranger District.

USDA Forest Service. 1994. *Land and Resource Management Plan – Amendment 5*. Asheville, NC: Forest Service Southern Region,

USDA Forest Service. 1985. *Trail Management Improvement Program Handbook*. Washington: Forest Service Southern Region,

USDA Forest Service. March 1993. *Forest Plan Implementation*. NEPA Course 1900-01.

Williams, B. 10 November 2004. Personal communication. Chattooga River Conservancy.

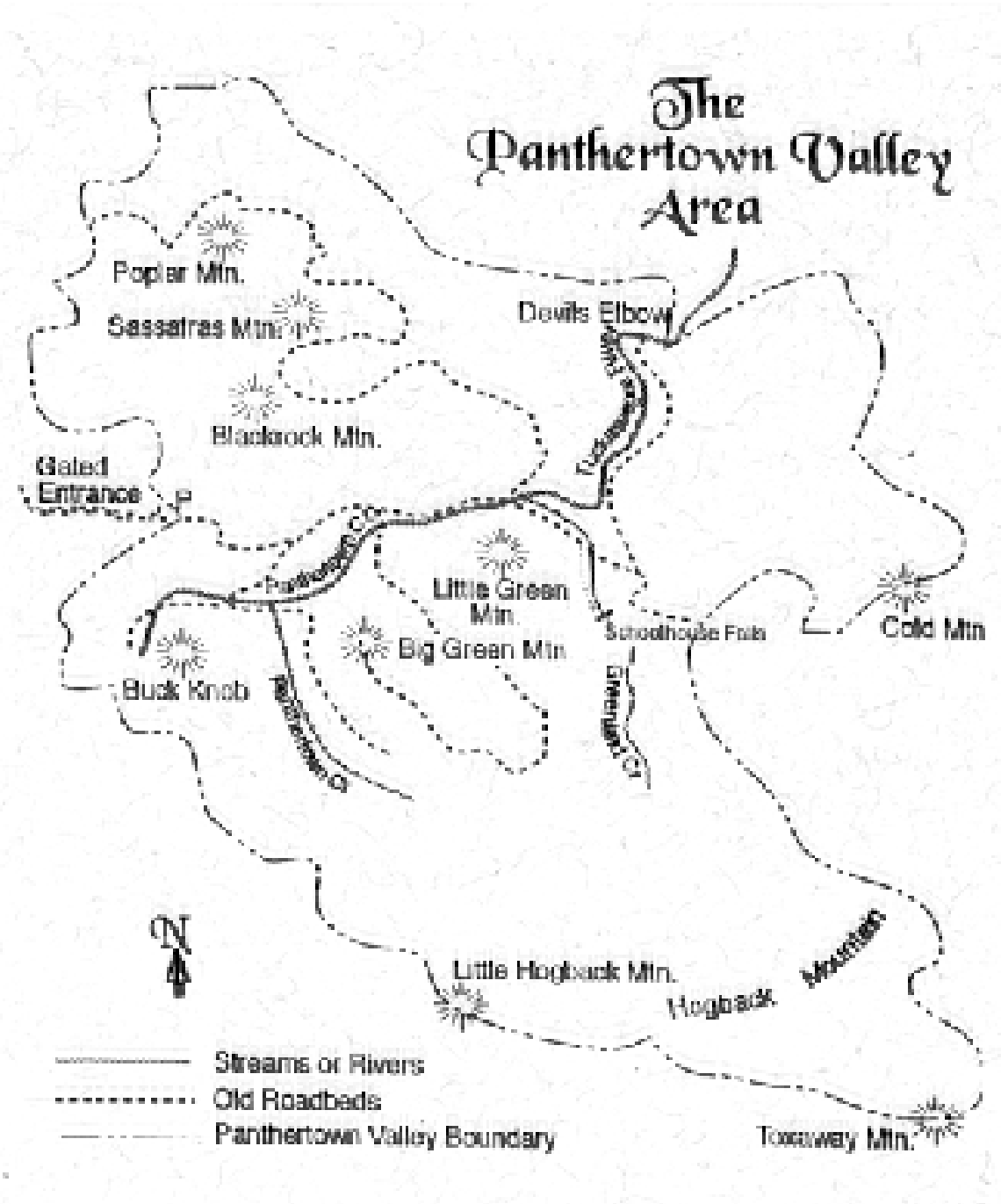


Figure 1. Panthertown Valley General Trail Map and Landmark Location

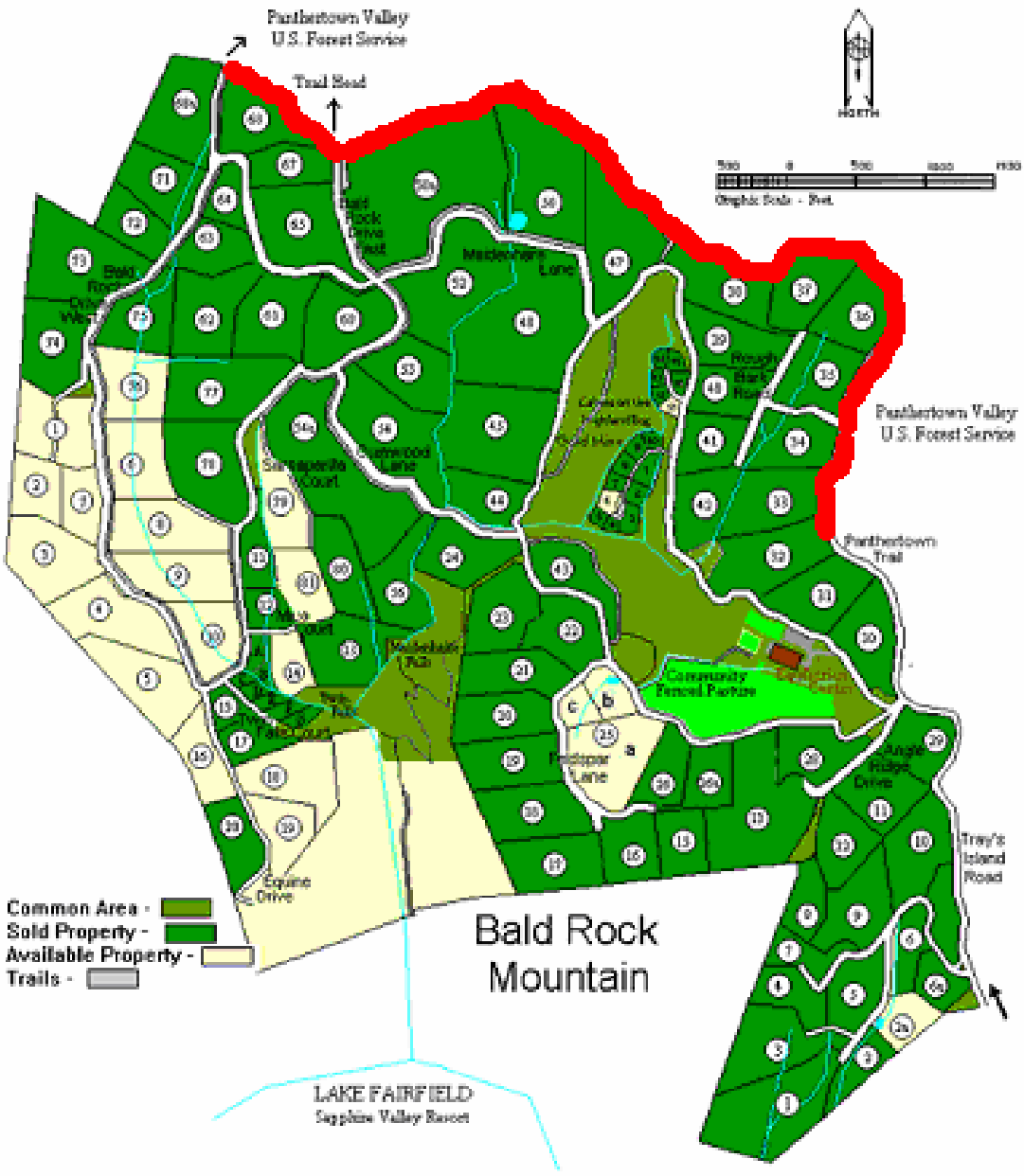


Figure 2. Bald Rock Subdivision Plan Showing Nature Trail Border

Figure 3. Lake Toxaway Subdivision Plan Showing Spencer Lane

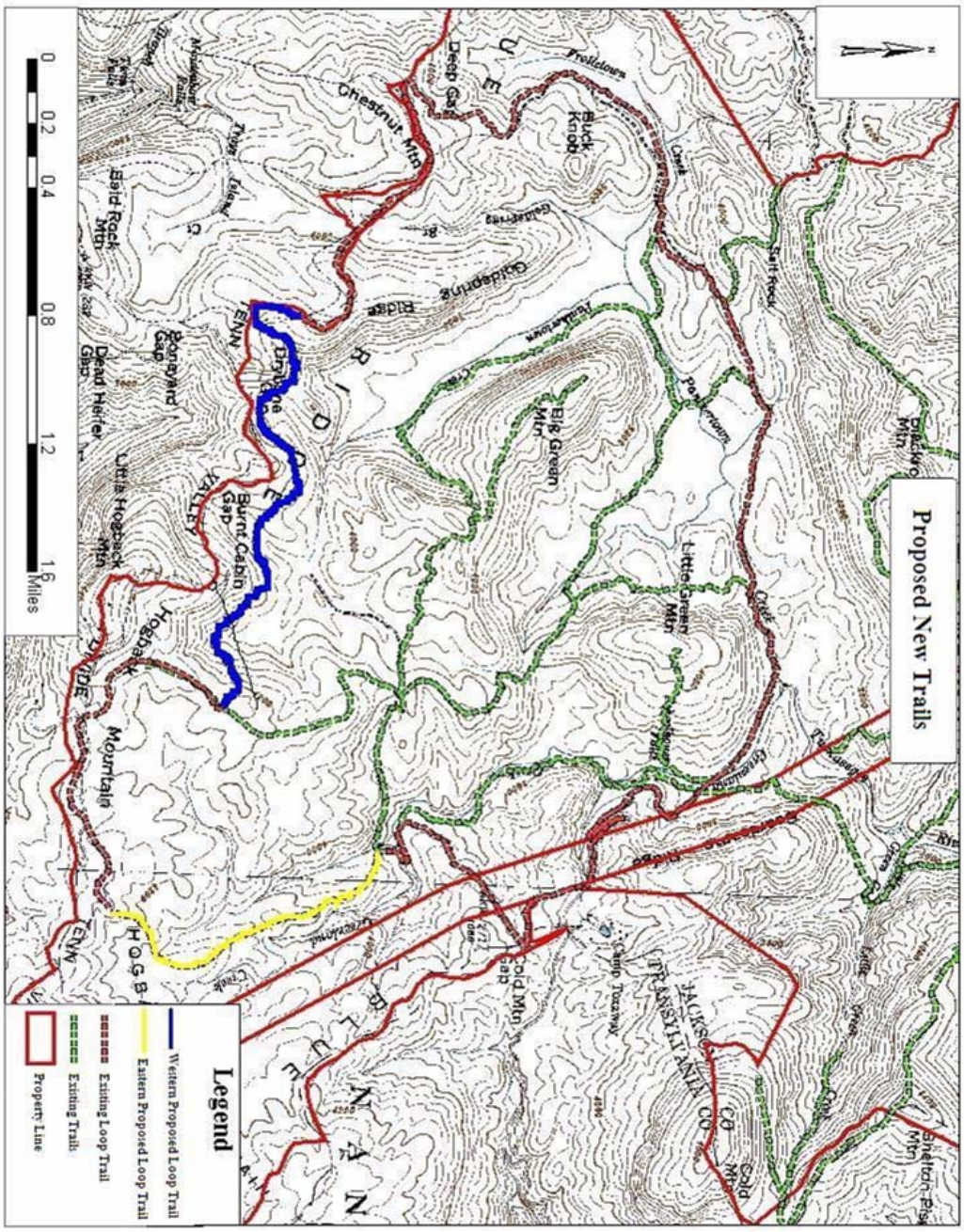


Figure 4. Proposed Trails with Existing System

The Highlands Greenway: An Examination and Reintroduction into the Community with Recommendations for the Future

Emily Walgate

Introduction

The Greenway Trail that traverses the Town of Highlands preserves a bounty of biodiversity that is found in no other place. Continuing development and population growth, however, threaten this unique natural heritage. Getting the community involved through public awareness and education will allow them to enjoy more fully the natural diversity of Highlands and its Greenway Trail. Before beginning to educate the public, an assessment of what they already know is needed. There is some concern that the Greenway is underused and unknown; thus, the goal of this project is to survey the people of Highlands, to understand what the public would like to see improved. Based on this information, recommendations and predictions for the future can be devised. The town of Highlands will then be able to improve the trail based on the wishes of the community. Recommendations have also been developed by competitive study of other successful Greenway programs in North Carolina. By comparing the present Greenway Trail of Highlands with other Greenways and the true definition of a Greenway, the community can make changes to enhance future use.

As previous interns have completed similar, but broader research projects on environmental awareness in the community, the specific focus for this project is awareness of the Greenway Trail. In particular, Mathews (2002) suggests that future interns should complete more extensive surveys on outreach programs to find out how people feel about each program and what they think could be added. She further believes that conducting interviews would add more depth to her original survey results (Mathews 2002). With this in mind, an outreach program for the Greenway Trail was undertaken this semester.

Background Information on Greenways

Greenways are open-space corridors that can be managed for conservation, recreation, and/or transportation (Department of Conservation and Recreation, DCR 2004). There are many different types of greenways, each with a different priority and purpose. There are greenways for landscape linkages, conservation corridors, greenbelts, recreational corridors, scenic

corridors, and utilitarian corridors. They tend to follow natural land or water features, such as ridges or rivers, or landscape features such as railroads or canals. In many cases greenways seek to connect recreational, natural, cultural, and historical areas. They are generally intended for enjoyment of wildlife, biodiversity, and scenic beauty. A greenway can be as wide as a watershed or as narrow as a trail. It can be paved or unpaved. A greenway system is composed of large hubs, links, and smaller sites, all of which come in different sizes from large protected reserves to smaller regional parks and preserves. Greenways can be a local system within a single community or county, but a regional greenway system may link conservation areas and trails with one or more watersheds. Statewide greenways may link community and regional greenway systems (Jaroszjo 2004).

The benefits of greenways to a community are immense. They connect the people of the community with nature to promote environmental awareness and facilitate appreciation of important cultural and historical sites. They provide refuges and safe migration routes for wildlife. Used as alternative transportation routes, they provide access to other sectors of the population. Trails attract visitors from outside the local area, thus expanding economic development and tourism. Often they increase real estate values, as they provide buffers to developed areas. In turn, homeowners develop a sense of living in a preserved area.

On the whole, greenways are created on a local or regional scale to reflect a community's needs. They are usually formed by cooperative public and private partnerships, government agencies, and private businesses. Dedicated work from diverse citizens and landowners is required to plan a successful greenway project. Expertise in planning, safety, security, environmental, and liability issues need to be thoroughly integrated when constructing a greenway. There have been many guides and publications such as *Greenways: A Guide to Planning, Design and Development* (Flink and Sterns 1993), which offers valuable information on the planning and involvement process. Implementation and maintenance are just as important. A strong support group or committee is needed to manage a successful greenway system.

Success of Other Greenways in North Carolina

North Carolina has 11 operating greenways or greenway systems with an additional 28 communities either in the process of developing greenways or considering them (Furuseth and Altman 1990). Studying what makes these greenways successful helps to provide information for organizers and managers of future greenways. By comparing the advantages and disadvantages of strategies taken, recommendations can be made and subsequently implemented by the Town of Highlands.

I investigated two of North Carolina's oldest and largest Greenways: the Capital Area Greenway System in Raleigh and the McAlpine Greenway in Charlotte. Furuseth and Altman (1990) strongly suggested that, if the planning and development of a greenway reflects the needs of potential users and types of users, then facility usage will be enhanced and strong community support for the greenway will be encouraged. By means of an intercept survey, demographic data were collected on greenway users, their activity patterns, and thoughts or concerns about each of their trails. For each Greenway case study, more than 250 surveys were answered; therefore, the results present solid and beneficial information for further understanding the usage of Greenways. This understanding will help future planners to make decisions based on the success of other greenways.

In both case studies, the average greenway user was a young to middle-aged, white upper middle class person; but the most active users were persons over 55 years of age. The majority of greenway visitors lived within a five-mile radius and used the trail primarily for walking, jogging, or running. The study showed that the trail was heavily used for pedestrian and bicycle recreation. The lowest use category was transportation, perhaps because neither trail was designed for intra-city travel. Data strongly suggested that the public has great enthusiasm for local greenways and greenway expansion when their recreational needs are met. The only concerns were crime and carrying capacity, and these were mentioned by only a few respondents.

As a result, Furuseth and Altman (1990) concluded that, "the lesson for planners and managers may be to either accept the current perceptions and design and operate their greenways accordingly, or, alternatively, to market the greenway as a broader public resource." The latter

would require more effort to develop new programs and activities to attract other user populations (Furuseth 1990). The success of these two greenways provides an excellent example for implementation of the Greenway concept. Unfortunately, the dynamics and locations of these greenways and the Greenway of Highlands are entirely different. Nevertheless, future planners and managers of the Highlands Greenway can benefit from such results which emphasize the importance of developing and managing a greenway in ways that recognize different types of user needs.

In addition to responding to the needs of users, other research offers further insight into the importance of Greenways and ways to fund and maintain them. Grove (1990) noted that today's urbanization has reduced open land and often made it too expensive to set aside open land for parks. Thus rivers, streams, and abandoned rail beds make excellent alternatives as corridors for greenways. For example, Florida has the second largest national wildlife refuge east of the Mississippi River, and the Cuyahoga Valley National Recreation Area in Ohio protects 3,000 wooded acres along 22 miles. Grove (1990) further noted that, "On a town sidewalk strangers may make eye contact, but that's all. On a path like this they smile, say hello, and pet one another's dogs. I think every community in America should have a greenway." This underscores the important connection between a greenway and a community. The search for funding is not always a difficult stumbling block. For example, city council members in High Point, North Carolina, sold "deeds" to foot-long sections of the path. In Pueblo, Colorado, trail markers were inscribed with donor's names (Grove 1990). States are also directing money from special taxes and user fees to fund greenways. With grants from the Land and Water Conservation Fund, the federal government has been the single largest funder of recreation corridors (Grove 1990).

Another student of America's greenways, Little (1990) has thoroughly described dozens of greenway projects across the country. His evaluations promote the environmental movement first hand as these paths and trails for recreation have improved environmental quality and preserved outdoor spaces for much of America. According to Little (1990), there are three basic organizational approaches to having a successful Greenway. The first is for a government agency to do all the planning and operational work. One example is the very successful regional

system mentioned above in Raleigh, North Carolina. Such work must be assigned to a greenway commission that has sole responsibility for maintaining the greenway. A second approach is to have a private, nonprofit organization in charge. There are fewer of these in the country, but they can be just as successful. The final possibility is a combination of the two, with a government/private group partnership in the form of a single-purpose, publicly authorized greenway foundation. A public/private partnership maintains Casper's Platte River Parkway in Denver, Colorado (Little 1990). This approach avoids the disadvantage of the lack of authority sometimes associated with private funding and allows use of governmental powers to ensure the best use of public funds. This provides authority for construction and maintenance of the trail.

This last method was implemented in Franklin, North Carolina, to establish a thriving greenway in that community, which is only about 18 miles from Highlands. The apparent success of the Franklin Greenway and its nearness to Highlands provides a unique opportunity for comparison. Information regarding the organization and management of the Franklin Greenway could be used to improve the Highlands Greenway. Friends of the Greenway ("FROGs") has a 12-member Board of Directors and more than 50 members dedicated to the management and development of the Franklin Greenway. It was established in May 2001. Their main goals include "integrating public recreational, historical, and cultural facilities with compatible commercial interests adjoining the Greenway and developing an informational center and educational materials to enhance awareness of environmental and historical value of the Greenway."(Guffey 2002). Local citizens can easily contribute to the greenway program by joining FROGs for an annual membership of $25.00. The organization also holds fundraising events such as a recent dinner auction which raised more than $10,000 for construction of the Wesley Powell Playground Project. Currently the trail is a 13 foot wide hiking and bicycling trail that is 4 miles long but will be extended two more miles in the future. It has canoe put-ins, fishing piers, bridges for pedestrian crossings, recreation areas with benches and picnic tables, and two information booths at Tassee and Big Bear Parks. The organization has bold aspirations for the future, including the Greenway Vision. More information can be found on their website at www.littletennessee.org.

After visiting the Little Tennessee River Greenway in Franklin, I found a number of similarities to the Highlands Greenway, but also many differences. The two towns have similar vegetation and natural beauty; therefore, their purposes for recreation, environmental protection, community building, and historical awareness are shared. The well-developed organization of the Franklin Greenway presents an ideal example for the possibilities of the Highlands Greenway. Franklin has a very detailed map of the trail with the mile markers and history behind the names of each segment of the trail. These maps are available in map boxes at several locations on the trail. There is ample space for parking, with five parking lots along different sections of the trail. There is a large covered picnic area with well-kept restrooms and a playground for children at mile marker one. The restroom walls are built with bricks engraved with organization names, such as churches, that have made donations to the organization and maintenance of the trail. Their up-to-date and easily navigated website provides information on the location, history, and future of the trail.

History of the Greenway Trail

The Highlands Greenway Trail was founded in 1989, when The Land Use Plan of the Town of Highlands, (specifically under Residential Areas, Strategy 3: Initiate a community natural areas and greenways program). With its strong interest in preserving natural areas apparent throughout, this Plan further proposed:

> "The last element involves establishing a partnership with a private non-profit land trust for the purpose of acquiring and protecting unique natural areas, and for developing a system of greenways throughout the community. This could be accomplished by municipal government independently of a private corporation. However, based on the experiences of land trusts across the country, a partnership has been proven to be more effective (The Land Use Plan of the Town of Highlands)."

After the Zoning Ordinance was enacted, L.L. Gaddy, a consulting biologist from Wahalla, South Carolina, was hired to identify all the areas to be protected and preserved in the Highlands region. He was the initial organizer of the Greenway and connected Sunset Rock with the Civic Center and Thorne Park, tied together by a walking trail. Subsequently, Ruth Fox, chairman of the Planning Board of Highlands, in 1991 fulfilled the mission of the Highlands Land Use Survey "to preserve, protect and enhance those gifts of nature which make up the

unique quality of our town and its environs" by creating a Greenways Plan for Highlands. The Highlands Greenway Committee, with seven members, established the Greenway Trail in 1991. Several meetings were held throughout the year, as evidenced by the records of the minutes from the committee meetings (1991). It seems that the committee had the majority of their problems with funding. Money is not only needed for the construction of the trail, but also for trail maintenance, for improvements such as placing benches along the trail, and for acquiring additional land. Grant proposals to seek funds from the Land and Water Conservation Fund were briefly mentioned in the minutes but were apparently never prepared. The committee contacted private property owners for possible donations to the Land Trust. They successfully acquired the piece of access road where the greenway passes over the Mill Creek Trail section, as seen in Figure 1, section 7. The last recorded greenway meeting was held on February 12, 1992, which stated that signs were designed and ordered that would be placed on distinct spots on the trail. A map was to be prepared and made available at the Chamber of Commerce's Visitor Center. There were also plans for a walking bridge to be built over Mill Creek, both of which were pursued.

The Greenway Trail at Present

Today there are several hiker logo signposts spread along the trail's length. These signs were posted thanks to the efforts of Ronnie Waller, owner of a local construction company and leader of the local Boy Scout troop. His scout troop placed these signs along the trail. A map (Figure 1) is available at the Chamber of Commerce. It includes a detailed list of several trees along the Greenway Trail. Bill Wykle, a local botanist, and Richard Betz, the town manager, identified many of the important flora and fauna along the trail. Betz constructed nametags and placed them on the trees. A small grant from the national foundation 'America the Beautiful' helped with the completion of this project. There is also a wooden bridge across Mill Creek.

It seems that several sections of the Greenway are used and enjoyed much more than other parts. For example, numerous people hike or picnic at the top of Sunset Rock, which is owned by the Highlands Land Trust, on hot summer days or during festive October weekends.

On the other hand, the section toward Mirror Lake may not even be recognized as part of the Highlands Greenway Trail.

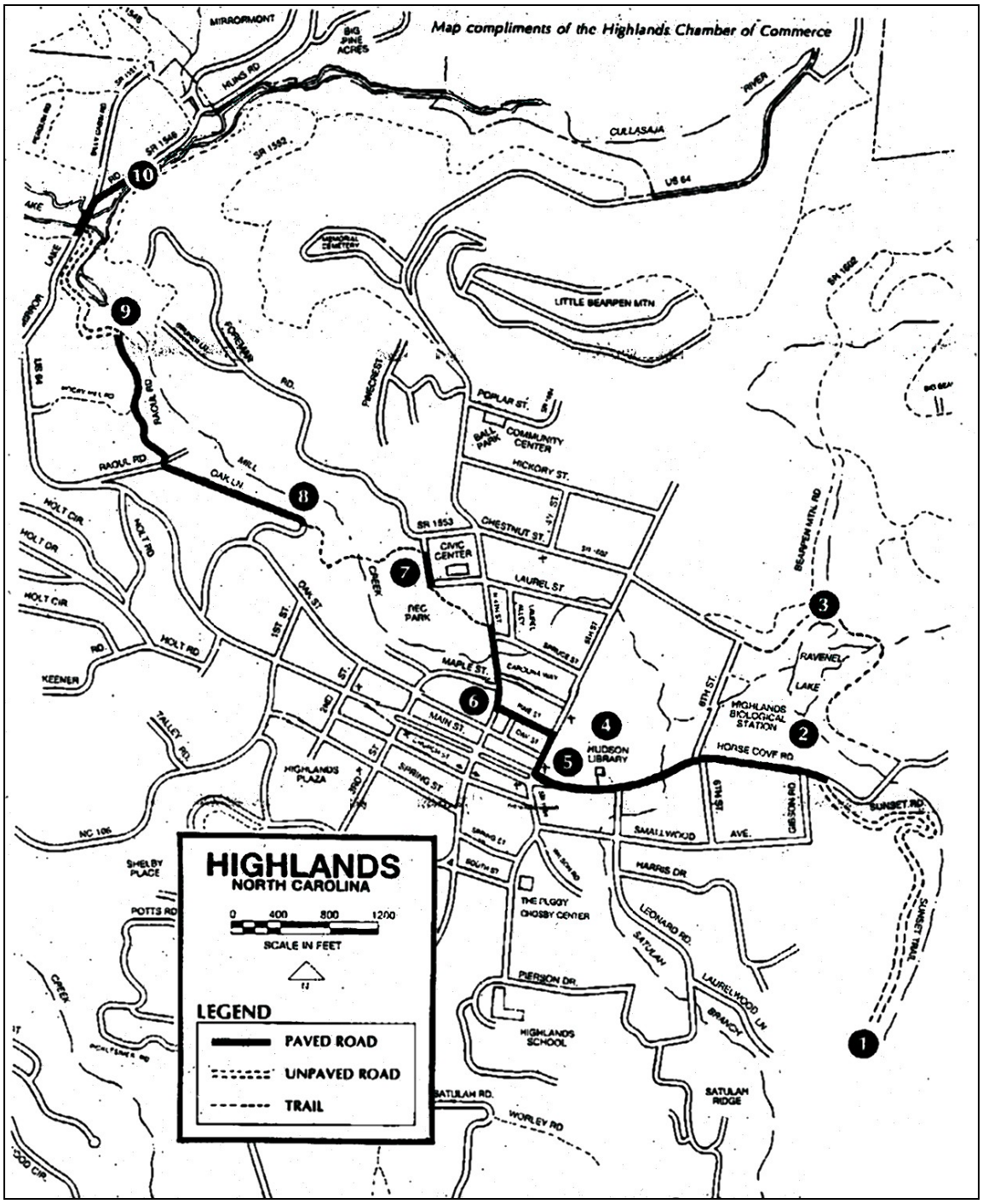


Figure 1. Map of Highlands Greenway Trail. The Trail begins at number 1, Sunset Rock and terminates at number 10, Mirror Lake Thorne Park.

Though the Highlands Greenway Trail may not fit all of the definitions of a greenway, it does serve as a corridor for conservation, recreation, and possibly transportation into the downtown part of Highlands. Its chief purpose is to preserve the natural diversity of Highlands, but it should also incorporate more of Highlands's rich culture and the local history of the Southern Appalachians. It is diverse in its terrain, even though it does not follow a river or railroad. It is as wide as a gravel road to the top of Sunset Rock and as narrow as a small footpath through dense hemlock forest behind the Civic Center enroute to Mirror Lake.

Evaluation of Community Awareness in Highlands

To increase awareness and publicize the Greenway Trail, a number of approaches were considered: newspaper articles, a celebration of some kind, a written survey, and an interview. First, *The Highlander* newspaper conducted interviews on each of the 12 students studying at the Highlands Biological Station in the fall of 2004; the article on this project was the first to be published. The article not only described the project, but also included a strong advertisement for the celebration event on Saturday, October 23. Listed in the events calendar for several weeks, the planned route for the walk was to follow a section of the greenway trail starting at the Civic Center and ending at the Nature Center at the Biological Station. At the Nature Center, refreshments and music by several of the students were planned. Food donations were received from Mountain Fresh Fine Foods, and a number of Greenway Trail Celebration flyers (Appendix 1) for the event were placed around town. After gaining permission, the flyers were posted in both of the grocery stores, newspaper office widows, the library, the Highlands School, and several stores and boutiques downtown. I also wrote an article about the project, which included color pictures of the trail and an advertisement for the celebration event (Appendix 2). My article was published in *Highlands' Newspaper* in the largest October issue of the year. A short survey was developed and handed out at the event to get a better understanding of what the public would like to see and change about the Greenway Trail (Appendix 3). Several discussions with local residents added to my understanding of the desires of the public. An interview with Richard Betz, Highlands Town Administrator and one of the original organizers of the Greenway Trail, also provided important insights.

Results

Gaining permission to place flyers in store windows was not at all difficult as many people knew about the event from the advertisement in the newspapers, showing that the local residents are informed about the month's events. The celebration event took place on October 23 on a rainy Saturday morning. More than 30 people attended. Although it was a soggy walk through the wetlands area behind the Civic Center, the public appeared to be very enthusiastic about the trail. One resident, when he first arrived, said "As soon as I saw this in the newspaper, I had to come see where the trail went. I have lived here for three years and did not even know there was a Greenway Trail in Highlands." Many were asking about the flora and fauna of the area throughout the walk: "What kind of tree is this one?" and "Are these all native to Highlands?" A couple from Florida, who are summer residents in Highlands said they "keep getting the trees and plants of Florida and Highlands mixed up. Once we have learned the plants down there, we forget them during our summer in Highlands." These people said that they would like to see a concise guide to Highland's plants. The husband chuckled as he shared their learning technique with the group: "At home in Florida we collect the leaves of many plants, write their names on the back of the leaves and keep them on our coffee table until we have learned them all."

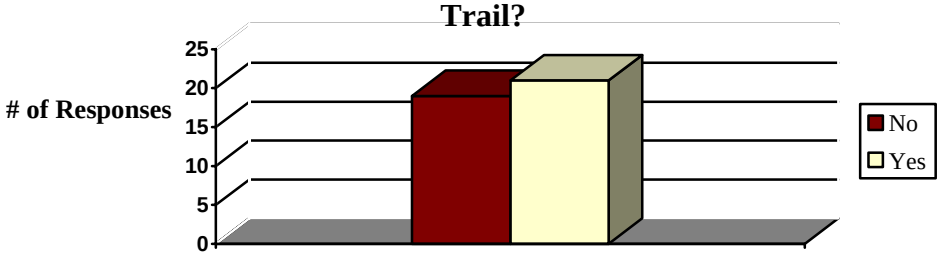
Results of the Survey

Several methods were used to reach as much of the population as possible with the survey (Appendix 3). At the celebration event, 13 surveys were completed. To get a better representation of the public, 9 more surveys were completed at the Annual Art Walk 5K Fun Run held on October 30. The community was out to enjoy a beautiful morning in the streets of Highlands and was happy to help with a survey. Eighteen more surveys were completed at the Civic Center on Election Day to make a total of 40 surveys. The sample population was nearly equal in male and female respondents, and the majority were either 25-44 or 45-64 years of age. It can be assumed that the bulk of the people surveyed were athletic, nature-oriented residents of Highlands by their attendance at the greenway event or at a running event.

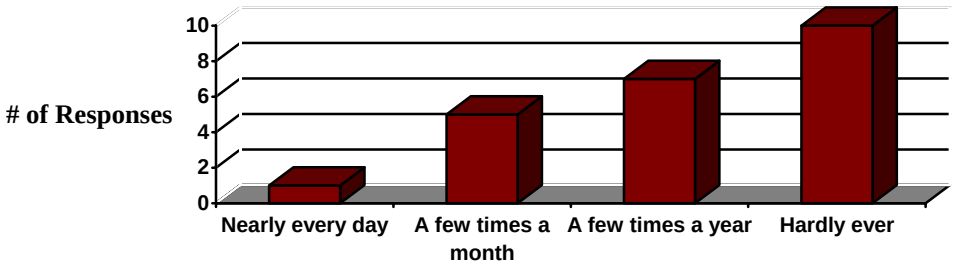
The results of the survey illustrate several patterns (Figures 2a-2e). To begin with, just over half of the public surveyed knew that Highlands had its own Greenway Trail (Fig. 2a). Of

those that knew, only 5 of the 21 used it a few times a month, and only one person said they used it nearly every day (Fig. 2b). However, 10 of the 19 people that said they did not know about the Greenway indicated that they would use the trail now that they do know about it (Fig. 2c). Many people use or have been on certain parts of the Trail, but were unaware that it was part of the official Highlands Greenway Trail. One significant factor to consider in assessing how often the public uses the Greenway might be the distance the residents live from it. Twelve people surveyed actually live outside Highlands, and all indicated that they use the trail infrequently. However, 11 people live less than a mile away and use it more often (Fig. 2d). One man said he lives practically on the trail and did not know it was considered the Greenway Trail. Walking and running were the most popular activities (Fig. 2e). Almost everyone selected at least one of these, if not both, and 6 people said they would like to use it as a transportation route into town. Walking into town on the Trail for shopping or to get to work is a way to avoid parking hassles and traffic lights. When asked what would encourage them to use the Greenway Trail more often, essentially all of the options were checked. The public would like to see the trail more clearly marked and have more maps available on the trail and in town. They support having more community events, like the October 23 celebration walk, to enjoy the trail. Some support having more benches along the trail to sit and enjoy the scenery and have a picnic, but the idea of having more trashcans along the trail, perhaps for picnicking or discarding dog droppings, was not highly regarded and one person even commented that trashcans would take away from the scenery. More than half of the sample population are college graduates and the rest have had at least some college. They were all aware of the importance of preserving natural areas in a town that is rapidly growing and developing. Similarly, they were all interested in learning more about the flora and fauna of Highlands and wished there was more literature on this subject.

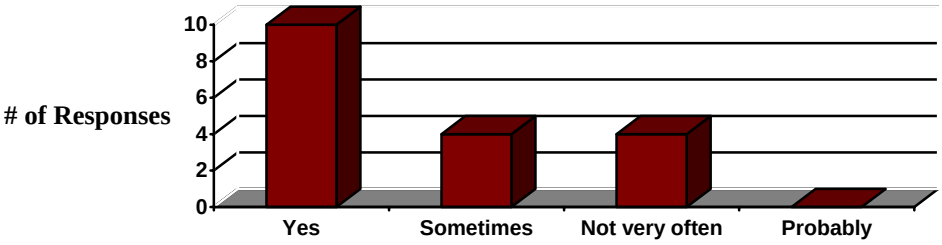
A. Did you know Highlands had its own Greenway Trail?



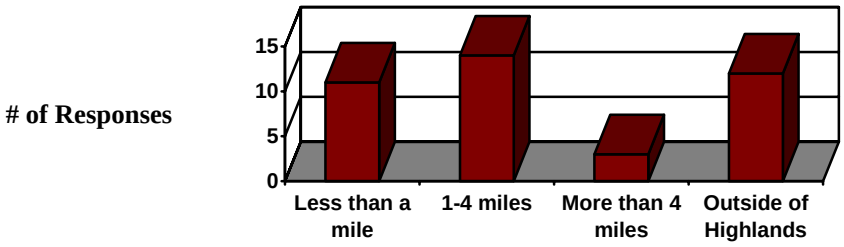
B. If yes, about how often do you use the Greenway Trail?



C. If no, would you use it now that you know?



D. How far do you live from the Greenway Trail?



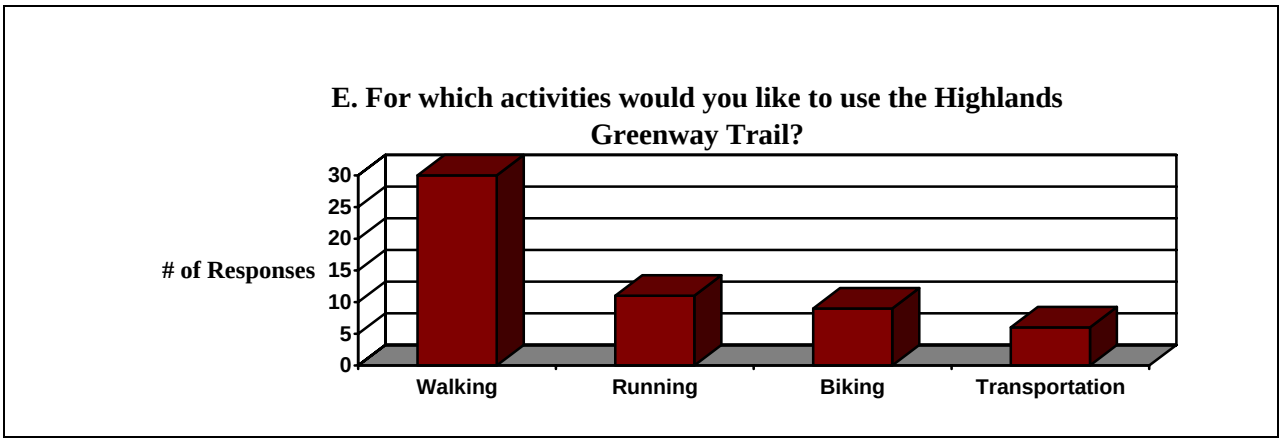


Figure 2. Results of Survey Responses.

Results of Interview

An interview was conducted with Richard Betz, a member of the original Greenway Committee and current Town Manager. He is very knowledgeable about the Greenway Trail and its history. A considerable amount of work was put into the organization and construction of the Greenway Trail that was never completely recognized by the public. He believes that there was never substantial publicity and promotion of the trail to get people involved, and that this research project was needed long ago to promote public awareness and to inform the community about this beautiful trail that several committee members spent a couple of years developing. Another problem that Betz identified is that the committee members were involved in many other aspects of Highlands, such as Town Council or the Planning Board, and simply did not have enough time for the Greenway Trail. It was "put on the back burner." Moreover, because Highlands is a summer home for many residents, a few members did not have the continuous time throughout the year to invest in the Greenway Trail.

Conclusion and Recommendations

The results from the responses of the community and from the participants at the Greenway event show that the community is active and conscious of the natural beauty of Highlands. At the same time, however, the results of the survey make it clear that the people of Highlands are not completely aware that Highlands has a Greenway Trail to preserve, protect, and connect natural areas in the town. Although these results do not represent the entire population of Highlands, they do represent a group of active, nature-minded members of the

community. There was some difficulty in finding appropriate survey respondents. Several residents said they did not know about the Trail and therefore were reluctant to fill out a survey. Also, when trying to get the attention of people throughout town, they were simply not from Highlands, but rather were tourists. Many of the summer residents in Highlands have returned home by this time of year, making it difficult to get a sample population of residents who may use the Trail in the warmer summer months.

Though the community was not fully aware of the location and status of the Trail today, they had excellent suggestions to increase future participation and enjoyment of the greenway. The key response to the question "What are your other ideas about the Highlands Greenway Trail?" was that it needs more trees and plant identifications along the trail to educate the community and encourage them to come and take pleasure in it. The other strong recommendation was for more publicity: suggestions such as advertising, not only in the newspapers, but also on the radio station and by word of mouth through the garden club meetings or Land Stewards meetings. Other comments were written such as "I think it is a great thing" or "Glad to have it." The proposition of needing more sidewalks along US 64 and within the town limits also came up on several surveys.

Richard Betz similarly recommends there be more public awareness and activities involving the community and the unique natural history of Highlands. He suggests reorganizing the Greenway Committee or organizing another group with the sole purpose of maintaining the Greenway Trail to encourage continuous attention and use.

Involvement of governmental powers in Highlands is necessary for the organization and implementation of the trail as advocated by Little (1990). Formation of a "greenway foundation" that could receive donations and grants and derive continuing income from membership dues could be very useful as it seems that there are many residents who would be willing to support such a project to preserve the natural beauty of their hometown and allow them and their visitors a place to enjoy the outdoors. Little (1990) supports a Geographic Information System approach, GIS, but he recommends it later in the process because GIS projects tend to be a substitute for action and suppress a sense of creative possibility by overloading the project with data manipulations. Public attitude surveys and in-depth economic studies should come first for a

stronger understanding of future possibilities. He believes that "the most successful greenway projects make a serious effort early on to communicate their greenway concept to a broad audience." Hiss (1990), a writer on regional-planning, calls such publications "vision documents" and states that "although other communications efforts should take place, of course--magazine and newspaper articles, slide shows and special publicity-generating events such as promotional walks—the basic consensus-seeking source of information about the greenway idea should be the words and pictures and drawings of the vision document." With this information, perhaps a vision document could be composed and presented to Highlands to give the public a better idea of what is possible for the town. With greater appreciation of the possibilities, an enthusiastic public is more likely to volunteer and take action to preserve the Greenway Trail and its biodiversity.

The enormous success of the Little Tennessee River Greenway all began with passionate volunteers from Franklin helping the 12 dedicated board members. Similar to Franklin, Highlands needs to establish an organization to take charge of all aspects of the Trail. As emphasized by the results of Furuseth and Altman (1990), this team should conduct more surveys to get a solid idea of what changes the public would most like to see. With a clear purpose in mind, fundraising and public awareness events can be held to meet these goals. The auction in Franklin, North Carolina, is an example. The maps available for the Highlands Greenway Trail should be more easily accessible, perhaps making them available in covered boxes along the trail, as well as at the Visitor Center and perhaps the Nature Center. More information about the trees and plants could accompany the maps along with better signage along the trail. Signs should be strategically placed at each intersection or turn of the trail. Parking needs to be more accessible for greenway patrons. For example, Sunset Rock needs more space and clearly marked parking spaces. If better parking were provided for the Greenway Trail, curiosity would increase and people would explore where the trail leads.

Websites are the number one source of information today. If a Highlands Greenway Trail website was established, the public could easily be informed of the location and direction of the trail. Possibilities are endless with the production of a website. Visitors can not only see where it is, but also how they can contribute and become more involved. They can also read

about its history and, of course, learn the flora and fauna of their hometown. According to Jennifer Mathews, "People are interested the most in learning about native flora and fauna, local history, and environmental issues. Having knowledgeable community members take people on walks around the town's natural and historical areas may be a way to address these interests (Mathews 2002)." All of the information collected thus far suggests that the public will be responsive to this type of information. Also, if the Nature Center were to work in partnership with the Greenway Committee, it could provide this information and educational materials at the present shelter.

Future Projects

I recommend that future interns conducting research projects on community awareness and environmental education should conduct surveys at the very beginning of the semester when a greater percentage of the population is available. Parallel recommendations were found in previous projects, as the sample population was not representative of seasonal residents who leave for the winter months. A larger target population was also needed for this study as only active, outdoor enthusiasts were surveyed. On the other hand, these people are the ones most likely to be interested in using the Greenway Trail. Targeting a wider population, perhaps a younger population, would allow these people to decide if they would like to enjoy the trails of Highlands. Although flyers for the event were put up at the Highlands School, only a couple of children attended the celebration event. In addition, targeting the elder population would have been beneficial, as these residents constitute the majority of the population and are probably less likely to travel outside the town to hike the more challenging trails of the region.

As a continued effort in community awareness, the research this semester has uncovered strong recommendations for future improvement of the Greenway Trail. Although further studies may be conducted, the Town of Highlands can take action with this guidance to bring the Greenway Trail to a level of greater recognition and higher value to its citizens and visitors.

References Cited

Department of Conservation and Recreation. “Recreational Planning, Greenways.” 2004. Virginia. Available at <www.dcr.state.va.us/prr/greenway.htm>.

Flink, C. A. and R. M. Sterns. 1993. Greenways; A Guide to Planning, Design, and Development. Island Press. Washington, D.C.

Furuseth, O. J., and R. E. Altman. 1990. Greenway Use and User: An Examination of Raleigh and Charlotte Greenways. *Carolina Plannin.* 16:37-43.

Greenways Incorporated. “Greenways Incorporated FAQs.” 2001. Durham, NorthCarolina. Available at <www.greenways.com/pages/faqs.html>.

Grove, N. 1990. Greenways, Paths to the Future. *National Geographic.* 6:77-94.

Guffey, S. Friends of the Greenway, Inc. 2002. Franklin, North Carolina. Available at <www.littletennessee.org>.

Jaroszjo E. “About Greenways.” 2004. New York. Available at <wwwmsn.edu/~jaroszjo/greenway/green/what.htm>.

Little, C. E. 1990. Greenways for America. The John Hopkins University Press. London.

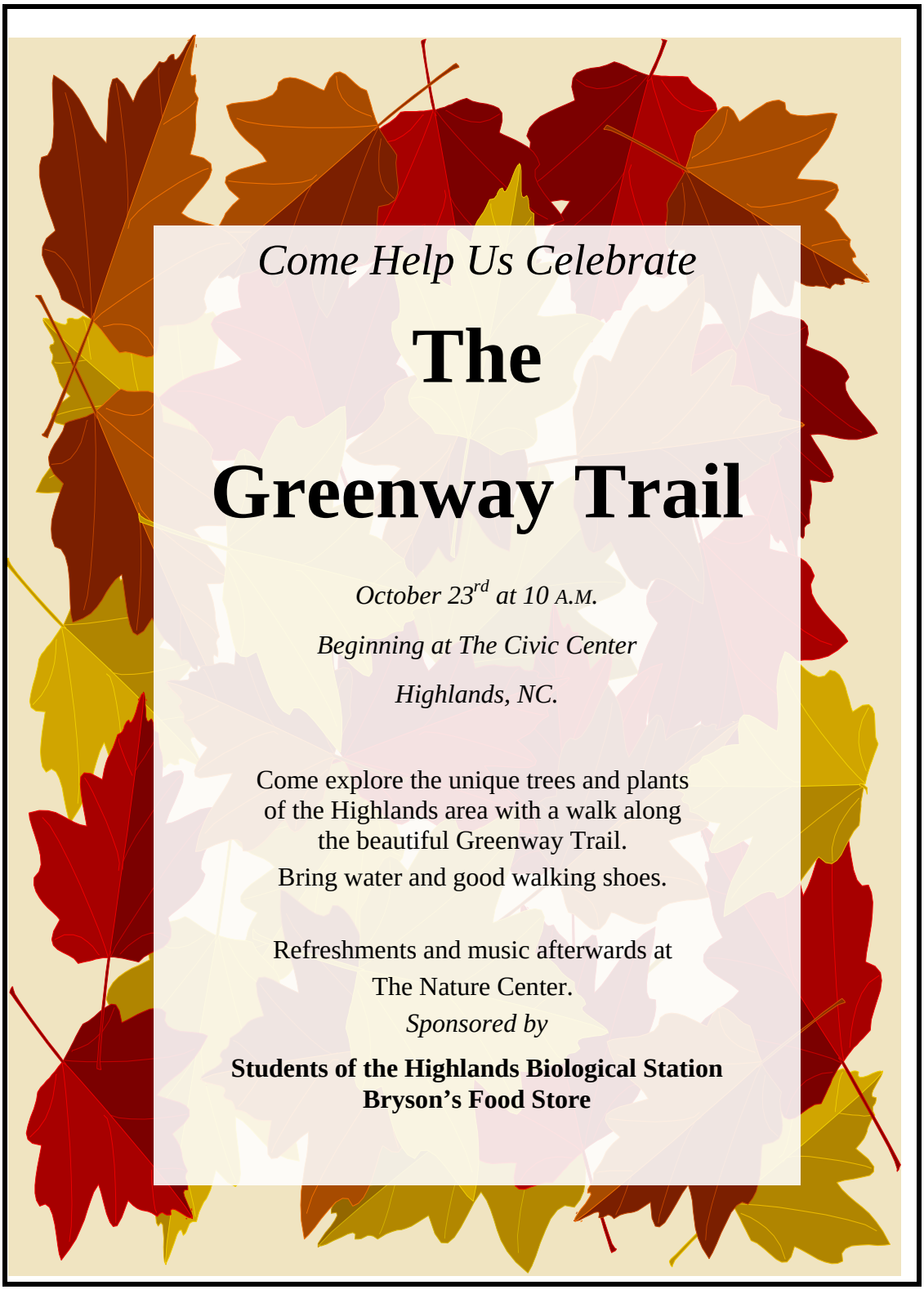
Little, C. E. 1987. Linking Countryside and City: The Uses of Greenways. *Journal of Soil and Water Conservation.* 42:167-169.

Mathews, J. 2002. Community Awareness. The Effects of Land-Use Change on the Biodiversity of the Highland Plateau.

The Land Use Plan of the Town of Highlands, State of North Carolina, Board of Commissioners, September 20, 1989.

Appendix 1

Advertisement for celebration event



Appendix 2

Newspaper article in Highlands' Newspaper on Oct. 15, 2004

College students make Highlands their laboratory

By Emily Walgate
CEP student

Who would have imagined that studying in the remote mountain town of Highlands, North Carolina, which receives the most rainfall east of the Mississippi River, to be such an amazing experience.

Having been here for just over one month and sadly only two months left, the 11 other students and I are having the time of our lives. We are learning about the diversity, history and beauty of the highlands plateau, and enjoying every minute outside.

As the majority of us are either Environmental Science or Environmental Studies majors, practically every weekend we take advantage of the wonderful activities the area has to offer, especially hiking, camping and biking.

Our typical week consists of three classes: Mountain Biodiversity of the South Appalachians, The Ecological and Cultural History of the Southern Applicants and Wednesday we go on an educational excursion.

This past week we went hiking in the Smoky Mountains to study the flora of the region. Earlier we took a delightful visit to the Cherokee Museum. In addition to these classes, each student has an individual capstone project. The project is an internship with a mentor to study an aspect of the area, whether it is scientific research, such as studying the Woolly Adelgid's affects on the Carolina Hemlock or more socially based for example the effects of the population growth on the plateau.

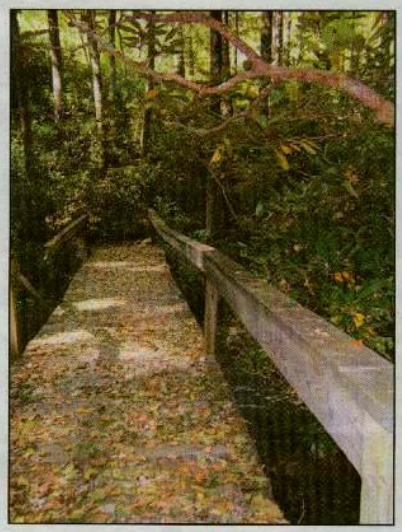
My project is more community and socially orientated as I am assigned to take an indepth look at the Highlands Greenway Trail. The Trail was established back in 1992 by many of the well known environmentalists, such as Jeff and Bob Zahner, Richard Betz and Ruth Fox. For some reason the trail's popularity has not continued to this day -- either the key organizers moved from Highlands or the community was never involved enough to put it to use.

This is the base of my study -- Why the Highlands Greenway never took off and became a successful place to enjoy the environment like so many other greenways in various cities of North Carolina.

After studying and comparing the 11 operating greenways in various cities of North Carolina, I plan to identify and make suggestions on how to improve the existing trail. Ultimately, I want to familiarize the community with the trail to encourage more use and bring it to a level of high recognition and true value to its citizens and visitors.

To begin this process, I am holding a Greenway Trail Celebration Event on October 23 at 10 a.m. We will park at the Civic Center to walk the trail behind the center and then take the route up to the Nature Center, where we will enjoy refreshments and music outside at the amphitheatre.

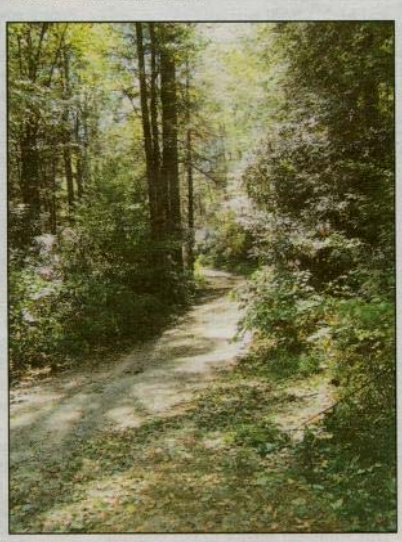
During the walk, we will recognize and enjoy the diversity of native trees and plants on the plateau. Additionally, I plan to offer a short survey on what the Highland's community would like to see and improve about the trail. It is surprising that many Highlanders are not very familiar with the Greenway Trail. It seeks to connect Sunset Rock's many beautiful mountain views, the Nature Center and trails, with the Biological Gardens, Hudson Library and Bascom-Louise Art Gallery, Chamber of Commerce, Woodruff Civic and Recreation Center and trail to the Wetlands and Parks of Mirror Lake.



The part of the Greenway Trail that meanders behind the Civic Center crosses a stream via a wooden bridge.

My favorite part by far is the trek through the dense wetlands behind the Civic Center, which goes over a graceful stream flowing over a smooth rock crossed by a wooden bridge. The neighborhoods around Mirror Lake offer such unique houses to ponder at as you walk throughout the back roads of Highlands. It's easy to forget there is a small bustling town beside you.

With more advertising and publicity, I hope to incorporate the Greenway Trail and its natural beauty into the everyday lives of the community and the lives of the tourists that love this special mountain town so much.



The trek traverses the Mirror Lake community. It's hard to believe this peaceful spot is in the middle of a bustling town.

Greenway Trail Celebration Event on October 23 at 10 a.m. Park at the Civic Center to walk the trail behind the center. The trek will end at the Nature Center for refreshments and entertainments

Newspaper article written by Glenda Bell in The Highlander on Nov. 5, 2004

Trail offers pedestrians an in-town path

It was a damp and foggy day, but more than 30 people showed up for the hike on Oct. 23. We all met in the parking lot of the civic center and were treated to an overview of what to expect by Emily Walgate, our energetic and enthusiastic UNC intern. Isn't it amazing what youth and vigor can influence people to do! Many of the Chapel Hill interns were in the group, as well as Emily's family members, Audubon Society members and good friends. Hank Ross' dalmatian, Syd, came along and was impressed by all the new sights and smells.

The trail is lovely. It starts behind the picnic tables behind the back parking lot. The forest behind the civic center is a beautiful part of the trail. The large trees tower above the trail and give the hiker a sense of peace and serenity. One would never know that civilization is a few meters away. The bridge over Mill Creek was especially pretty and has been repaired since the storm. Although we walked up to the old jail from the bridge, a hiker can take the trail that leads to Mirror Lake. That part of the trail goes to Raoul Road, then to Cullasaja Drive. All of it is nice. The route of the trail offers Highlanders an alternative to driving to town. Wouldn't it be a good idea if folks who lived near the trail walked to town to do their errands. All you need is a backpack and some comfortable shoes.

The Greenway Trail we took led us across Fourth Street and to Spruce. From there we could look back and see the Highlands Historical Society's Prince House and library building. It looks attractive with the roses planted on the bank. We hiked along this little-traveled road past Mountain Findings. We then took a right on Fifth Street, then up to the corner of Main Street. There we passed the Episcopal Church of the Incarnation. We turned left and followed Main Street as it changed its name to Horse Cove Road. The sidewalk follows a beautiful hedge of Rhododendrons and crosses a small footbridge over a creek. Further along there is a gravel path that passes under more Rhododendron on the other side of the street. At the end of that segment there is the parking lot for hikers who want to climb to Sunset Rock. At this spot, we crossed back over Horse Cove to the nature center. If one wanted to take the entire Greenway Trail, they could continue up to the top of Sunset Rock, about another 20-minute walk. The Sunset segment of the trail can also be driven, but walking allows one to do more sightseeing. At the top there is a grand view of downtown Highlands.

We chose, instead of going up the trail, to go to the amphitheater behind the nature center, to be treated to bottled water and apples donated by Mountain Fresh (thank you!), hot tea and cocoa and muffins baked by Emily. Katie Burke played the guitar and sang, and Luke and Andrew played their brass instruments for our pleasure. It was such fun. We filled out the Greenway Trail surveys suggesting ways to make the trail more utilized, chatted with everyone, listened to the music and relaxed. It turned out to be a very different and enjoyable morning.

At the end of this social time, several of the hikers took the botanical garden trail, which winds through the woods and ends on Lower Lake Road. This path is marked with signage identifying trees and native plants along the way. There were various ways to return to the civic center. A few souls went to the Edwards' property along the Kelsey Trail; others walked along Chestnut Street and crossed onto Foreman Road and up to the parking lot. Still others retraced the way we had come.

If you enjoy walking and want to see some of the best of Highlands, try walking these trails. They are not difficult and offer some pretty scenery. People living near town may spend one entire day never having to drive their cars.

If anyone needs a map of the trail, Bonnie Earman at the Chamber of Commerce Visitors Center kindly printed some. She will happily give you one. Thank you, Emily, for opening our eyes to this beautiful place right here in Highlands.

Appendix 3

Survey questions

Please take a moment to help improve the Greenway Trail of Highlands by understanding what the people would like and will enjoy in their community. Mark the box that best answers each question.

The Trail

Did you know Highlands had its own Greenway Trail?

- ☐ No
- ☐ Yes

If yes, about how often do you use the Greenway Trail?

- ☐ Nearly every day
- ☐ A few times a month
- ☐ A few times a year
- ☐ Hardly ever

If no, would you use it now that you know?

- ☐ Yes
- ☐ Sometimes
- ☐ Not very often
- ☐ Probably Not

How far do you live from the Greenway Trail?

- ☐ Less than a mile
- ☐ 1-4 miles
- ☐ More than 4 miles
- ☐ Outside of Highlands

For which activities would you like to use the Highlands Greenway Trail?

- ☐ Walking
- ☐ Running
- ☐ Biking
- ☐ Transportation to town

What would encourage you to use the Highlands Greenway Trail more often? (Check all that apply)

- ☐ Having the trail more clearly marked
- ☐ Having more maps of the trail around town
- ☐ Having more community events to enjoy the trail
- ☐ Having more benches along the trail
- ☐ Having more trash cans along the trail

Greenway Users (optional)

Gender?

- ☐ Male
- ☐ Female

Age?

- ☐ <24 yrs
- ☐ 25-44 yrs
- ☐ 45-64 yrs
- ☐ >65 yrs

Education?

- ☐ High School Diploma
- ☐ Some College
- ☐ College Graduate
- ☐ Graduate Studies

Future and Additional Comments

What are your other ideas about the Highlands Greenway Trail?

Land Use Planning for a Cleaner Watershed

Katrina Chmielecki

Introduction

The Highlands Plateau, situated in the western North Carolina at over 4,000 feet altitude, is the wettest place in eastern North America, receiving an average of 86.7 inches of precipitation per year (Highlands Biological Station 2002). This high level of precipitation supports a wide array of biodiversity and waterfalls and makes Highlands the closest approach to a temperate rainforest in eastern North America. Many rare plant and animal species are found throughout the plateau and in Town. The area is well known for its waterfalls and plant diversity. This natural beauty attracts many people to the Highlands area. The year-round population of the Highlands area is only about 3,000, but in the summer it increases to more than 20,000 people (Chamber of Commerce 2004).

Highlands, established in 1875, has experienced accelerated growth over the years with development for summer homes, shopping districts, golf courses, and access roads. This development is driven by people with a desire to have a second home during the summer months, to take advantage of the countryside's natural characteristics, and the small-Town charm. Residential developers see the mountainous slopes as a challenge with a monetary bonus, while scientists see the environmental hazards of steep ridge development. Ironically, increased development threatens the natural characteristics that attracted people to the Town in the first place.

The Town of Highlands faces a challenge: to preserve its natural beauty and fragile mountain ecosystems in the face of rapid growth and development. The plentiful rainfall results in runoff that feeds into a network of streams which make up the watershed. The watershed and its streams are threatened by the silt and sedimentation runoff from development on steep slopes. Of major concern therefore, for Town planners in particular, is finding ways to control and reduce the amount of development per acre on steep slopes. This is an important process for planners because it limits the amount of development on each parcel, thereby decreasing the amount of off site runoff and reducing residual pollutants and preventing erosion, all of which pollute the Upper Cullasaja River Watershed for Highlands.

Watershed

The network of streams that sustain the Cullasaja watershed lakes begin when runoff from the ridges and upper slopes in the watershed contribute to first-order streams. First-order streams, the "fingertip tributaries," are the smallest water sources in the system. They have no other contributors, but when merged, create a second-order stream. Second-order streams merge to form third-order streams, and these join to create fourth-order streams. The bottom of the drainage basin or floodplain is created by the fourth-order stream, which is formed by erosion, deposition of non-dissolved sediment, and subsurface geology.

The major source of contamination in the Highlands's watershed is silt deposition. Sedimentation fills lakes, ponds, and streams, thus decreasing their ability to store floodwaters and increasing power and utility operating costs for water treatment plants. Sediment in the form of suspended solids in waterways creates special problems for water quality. Increased turbidity reduces the amount of sunlight a stream receives, thus inhibiting the growth of aquatic plants and productivity. Sediment also settles to the bottom of the stream to form oxygen-demanding sludge (USDA 1980)." As aquatic plants and productivity diminishes, an increase in drinking water treatment costs is ultimately passed on to the consumer.

In many cases, 20- 30 % of rainfall is lost as runoff, while in developed areas with impervious surfaces, the percent of runoff may increase to 90-95 %, which exacerbates the runoff problem (Unterman 1973). Moreover, land not yet acquired for development is becoming hard to find on the Plateau, and land that is available is usually on steep slopes, which are not recommended for development. Of course, the slope of the land directly affects rates of erosion. As slope increases so does the velocity of surface runoff, further increasing erosion. Few sites are entirely level and many are broken and steep, sometimes too steep for proper development.

Development on steep slopes in mountainous areas is a complex undertaking, but regulating development on these sites is vital to the preservation of mountain watersheds. Laws that require effective erosion control measures on construction sites in the mountains are difficult to implement, and numerous factors must be considered. Inaccurate data, limited economic resources, and marginal intraregional cooperation are just some of the considerations that hamper counties and townships in their effort to develop programs and policies that match local

environmental and development conditions. Fortunately, Highlands has long recognized the importance of regulating residential and commercial growth. The Town adopted a Land Use Plan in 1988 that established a plan of action intended to enhance the quality of life for its citizens while preserving the natural beauty of the plateau. In furtherance of that goal, in 1993 the Town adopted one of the most stringent watershed ordinances in the state.

During the decade since the watershed ordinance was adopted, Highlands has grown at an accelerated rate, and much of the remaining undeveloped land is situated on slopes exceeding 30° (Town Watershed Administrator). Unfortunately, building on slopes greater than 30° is becoming a trend, not only because these lots are available, but also because they provide beautiful views. Despite Highlands's strict watershed ordinances, the ordinances do not require extraordinary storm water controls on slop development above 30°. The goal of this project is to explain how science is used to affect regulations by using the watershed as the example. Here I review the history of the Highlands's Land Use Plan and ordinances; examine why we need watershed ordinances; examine issues and methods related to reducing erosion on steep slopes; and make proposals for new watershed ordinances.

Land Use Plan and Ordinances

This Land Use Plan is a document of action that is intended to enhance the quality of life in the Town of Highlands. The General Mission of the current plan is "to preserve, protect, and enhance those gifts of nature which make up the unique quality of our Town and its environs" (Highlands's Land Use Plan 1988). The Land Use Plan's specific mission for the natural environment is to maintain or improve the present quality of it's: (1) soils and soil structure; (2) water quality and hydrology; and (3) wildlife and ecology.

In accordance with this mission and careful planning, a developed environment can coexist with the natural environment (HLUP 1988). Highlands has worked hard to keep the rustic mountain character that makes the Town so popular to tourists and weekend homeowners by applying this plan.

What is an ordinance?

In 1972 the Town contacted the University Of North Carolina School Of Law's, Institute of Government and began to develop land use ordinances to be enacted by the Town board. Before developing land use ordinance, the town must decide on a set of characteristics for the Town and develop a clear vision of what to preserve in the area. The town vision statement came to read, "Highlands is a mountain community, rooted in history, dedicated to preserving its natural environment and ensuring a high quality of life for its residents and visitors." Zoning seeks to maintain a healthy, safe, and orderly environment, by trying to achieve a balance between the right of the property owner to use land and the rights of the general public.

The most common means of regulating local land use in the United States is through zoning. Zoning gained popularity in the 1920s when many states passed planning and zoning laws that enabled cities, towns, and counties to enact land use plans and zoning regulations (Daniels 1988). Here are three zoning purposes planners should consider while developing ordinances: (1) to separate conflicting land uses; (2) to ensure that new development is located according to the general community plan; and (3) to promote quality development that does not compromise the health, safety, and welfare of the public (HLUP 1988).

Conventional zoning is a device to guide development at the local level. It is usually employed to control the use of land and type of structures thereon, as well as to establish more detailed regulations concerning the area of the parcel that may be developed (setbacks and separation of structures), the density of the development (minimum lot sizes, etc.), and size of buildings and other structures. The general purpose of zoning is to avoid undesirable side effects of development by segregating incompatible uses and by maintaining adequate standards for individual uses (Brower 1984).

Why do we need watershed ordinances?

Water quality

Water quality is directly related to land use and stream sedimentation is the greatest water pollution problem on the Highlands Plateau. Each watershed is unique. In the development of a watershed protection plan, many factors must be considered, such as watershed size and

topography, existing land use, population growth, and susceptibility of the watershed to pollution.

YEAR	SPECIAL USE PERMITS	Zoning Permits	NEW RESIDENCES	ADDITIONS	TOTAL COST (MIL)
1989	7	78	14	17	4.678
1990	7	53	7	8	3.326
1991	9	65	10	7	5.234
1992	5	78	11	9	4.668
1993	8	76	15	12	7.031
1994	14	90	12	10	5.354
1995	18	92	16	11	6.227
1996	15	104	18	20	8.083
1997	17	106	22	21	11.301
1998	15	130	30	30	18.303
1999	10	114	29	17	18.611
2000	16	108	30	30	18.303
2001	13	102	21	22	17.712
2002	12	133	31	35	25.254
2003	16	134	37	31	28.645
Oct-2004	9	106	25	17	18.829

Table 1: Special Use Permits, Zoning Permits, and Annual Construction Costs 1989- October 2004.

Development contributes to water pollution from both “point sources,” such as sewage treatment plants, and “nonpoint sources,” such as storm water runoff. We will examine nonpoint pollution, such as runoff, which derive from diverse sources. The quality of storm water runoff is closely related to the land use from which it originates. The level of nonpoint pollution will increase with an increase in development.

The most significant consequence of development on steep slopes is an increase in impervious surfaces, such as roads and buildings. Rainwater that falls on impervious surfaces becomes storm water runoff unless properly controlled because impervious surfaces prevent the natural infiltration of water into the soil.

Surface and subsurface drainage systems are affected by the structural characteristics of a given soil, moisture content, and location of the water table. Subsurface drainage includes percolation, which is the natural ability of the plants and soil to absorb water into the ground. Surface drainage is the process of transporting water across the ground and is the primary cause

of erosion. The surface soil is formed by an external force such as wind or rain. After the bond that binds the soil particles together is broken by runoff, the detached particles are carried to lower elevations with assistance from wind or water to settle later when the energy source dissipates (Brooks 1988). Thus, the erosion process involves soil detachment, transportation, and sedimentation.

There are many types of erosion. The first is geological erosion or natural erosion. This is a process of soil formation change through natural processes. Most of our present topographic features in the rural landscape are formed under this long-term, continuing the erosion process. The second is accelerated erosion. This is deterioration and loss of surface soil as a result of natural or human activities (Brooks 1988). Accelerated erosion is often due to inadequate slope stabilization, which is why stricter ordinances are being considered by the Town of Highlands.

There are three types of erosion that threaten slope integrity on the Highlands Plateau: sheet erosion, rill erosion, and wind erosion. Sheet erosion is just as it sounds; it is a thorough, somewhat even washing of water, down a slope, similar to a sheet of water (Principals of Hydrology handbook). Rill erosion is the result of subsurface failure, in which great areas of slope may suddenly sag or give way. This usually occurs during extremely long or heavy rainfalls in which the soil becomes permeated with water, weakening subsurface bonding or compaction (e.g., Hurricane Ivan at Peek's Creek). Wind erosion most often occurs along ridges, where wind forces are greatest. Wind erosion can cause the loss of valuable nutrient-providing rich topsoil and mulch, exposing the roots of seedlings until seedlings are blown away, or simply causing poor growth and aid water erosion (Brooks 1988).

Erosion control at its first stage should concentrate on the problems resulting from soil detachment. Erosion control studies have concluded that surface water causes most of the erosion damage. Surface vegetation can absorb the energy of falling precipitation, reduce the soil detachment effect, and hold soil particles together (Brooks 1988). Vegetation absorbs a fraction of the water reducing the velocity of the water as it falls down slope. On the other hand, impervious surfaces contribute to the volume of runoff and reduce any potential for groundwater or aquifer recharge. When precipitation can be absorbed, the rate of infiltration slows down as

the soil soaks up the water. When the rate of the rainfall exceeds the ability of the soil to absorb the water, the excess becomes runoff.

As water runs downhill, the runoff erodes soil as it moves. Excessive runoff will cause flooding and then carry sediment that clogs flow channels thereby escalating the flood potential. The volume of runoff depends directly on the amount and rate of precipitation, the ability of the site's soils to absorb the water, and the topography and amount of ground cover.

Soil

Land disturbing activities such as road building, construction, and vegetation removal accelerate soil erosion which promotes the number one type of pollution in the watershed, sedimentation. Development of steep slopes may result in rapid or large scale movement of soil and rock, excessive storm water runoff, loss of aesthetic beauty, and septic failures, all of which are potential dangers to public health, safety, and welfare (HLUP 1988). Steep slopes, some of the heaviest rainfall in the country, and highly erosive soils exacerbate the problem.

The sediment in streams can adversely affect fish, wildlife, and aquatic insects living in the affected waterway and results in long-term ecological damage. Large amounts of suspended sediment and turbidity increase the costs for drinking water treatment. Finally, erosion washes away the most valuable portion of land, the topsoil (Little Tennessee Watershed Association, 2004).

Soil is an important consideration because it can be used to identify highly eroded areas on a site, where extra precautions against erosion may be needed. Soil analyses also reveal the distribution of particle sizes in the soil, a critical factor in sizing sediment basins and traps. Approximately 80% of the land area in Highlands has a soil type with a severe rating for septic field absorption (HLUP 1988). Of the total land area, <2% is ideally suited for all types of development and nearly 46% of the soils have an exceptionally high rate of erodability when disturbed or not properly maintained. These same soil types severely constrain road construction and development due to their susceptibility to erosion.

Soil scientists have determined that under normal conditions, nature creates about one inch of topsoil every 500 years in a deciduous forest environment. Soil conditions in the

Highlands area are more extreme than average, and the rate of creation is probably much slower. More importantly, the sensitivity to soil loss is significantly greater and requires a correspondingly greater amount of care as development occurs (HLUP 1988).

On hillside sites, many jurisdictions routinely require a soils report (HLUP 1988). A soil survey report consists of a map that shows the distribution of soils in the area, descriptions of the soils, some suggestions as to their use and management, and general information about the area. Significant properties that can be known from soil maps include physical properties, such as the amount of moisture that the soil will hold for plants, the rate at which air and water move through the soil, and the kinds and amounts of clays, all of which are important in drainage, irrigation, erosion control, maintenance of good till, and the choice of crops. While the topography determines the path and flow of water, the soils attest to a site's ability to absorb precipitation. The shape of the site topography is the basis for drainage analysis because soils differ from point to point. Soils and slopes collectively identify those areas that are unstable and susceptible to erosion or, conversely, suitable for building.

Erosion and Sediment Control

Storm water runoff, increased sedimentation from development, poorly-functioning septic tanks, and activities common to land management, such as the use of lawn chemicals, can affect the drinking water supply and water quality in general (HLUP 1988).

Rainfall is dispersed by vegetation through transpiration and interception. Transpiration loss is a much greater loss than that due to interception. The leaves of plants intercept water in its free fall to the soil, permitting evaporation from the vegetation. Healthy plants also withdraw water from the soil and transpire moisture through their leaves during photosynthesis. Precipitation falling in a watershed or drainage basin is either absorbed into the soil or it moves across the surface of the land, always seeking a lower elevation. This second process is referred to as runoff and occurs when the amount of water applied to a surface occurs at a rate or volume beyond the ground's ability to absorb it. A problem occurs if the surface is completely impervious and will not accept any water. Manmade impervious surfaces include buildings, asphalted areas such as sidewalks and parking lots, and graveled areas.

Methods for reducing erosion on steep slopes

Plants play a major role in reducing erosion. Shrubs and grasses that have dense, spreading root systems bind the soil and prevent unstable slopes from eroding. The keys to the selection of plants for erosion control are soil type, climate, soil pH, amount of water available, and plant adaptability (Brooks 1988).

Natural plant materials, both trees and shrubs, are an integral part of the slope. They serve not only as aesthetic elements but as buffer strips, screens, and dividers. Building on steep slopes threatens the integrity of the watershed by replacing these plants with impervious surfaces. When these plants are rooted from the ground, the soil which would naturally be held in place will very easily erode until stabilized.

There are two direct kinds of erosion and sediment control measures: mechanical and vegetative. Mechanical is used to reshape the land to intercept, divert, convey, retard, or otherwise control runoff. An example of mechanical sediment control is land grading. While developing a parcel of land, instead of clear cutting the entire site, land grading allows cutting only in areas where immediate construction is planned. This process helps immensely in controlling erosion. On large tracts, to avoid having large areas bare and unprotected, units of workable size can be graded one at a time. As construction is completed on one area, grading proceeds to another. As a general rule, grading should be kept to the minimum that makes the site suitable for its intended purpose without appreciably increasing runoff. Wherever possible, only undesirable trees should be removed.

Vegetation can provide temporary cover to help control erosion during construction and permanent cover to stabilize the site after construction has been completed. These measures include the use of mulches around vegetation to hold soil intact, as well as temporary and permanent cover crops such as specific grasses. Sites that are difficult to stabilize because of exposed subsoil, steep slopes, a droughty exposure such as bare or thin soil, and other conditions, require special treatment. Such sites are called critical areas because they erode severely and are the source of much sediment if they are not well stabilized. There are several products on the market such as jute mats and plastic webbing, which are designed to be used on slopes that are to be planted.

Implementing Ordinances: Recommendations

Many communities such as Highlands have adopted policies that require developers to submit erosion and sedimentation control plans prior to receiving building permits. The following are typical examples of erosion abatement methods (Brooks 1988):

- Build sediment basins or traps to keep soil on the site. Stabilize cut and fill slopes with temporary diversions, beams, bench terraces, or dikes to intercept and divert storm runoff.
- Leave vegetation on the site as long as possible. Plant temporary turf or ground cover promptly after grading.
- Use jute matting or a similar stabilizer on slopes to protect seeds or plants.
- Preserve trees and shrubs on one side of the stream to provide shade and maintain wildlife habitat.
- Reduce runoff velocity with grade stabilization structures, grassed waterways, or energy dissipaters.

Best Management Practices, BMPs, are economically feasible conservation practices that avoid or minimize adverse impacts to the degradation of watershed characteristics. An example of a BMP for steep slope development is land contour. Land contouring is simply a practice in which steep slopes are broken up by making flat divots that slow the rate at which gravity can pull the soil down slope. Holding ponds are another BMP which is becoming common on the Plateau. This practice requires the creation of a pond at the bottom of the lot to catch the storm water runoff while development occurs. Afterwards, the pond is cleaned out and converted to part of the landscaping as an impoundment or rain garden. Rain gardens utilize specific native plants that are suited for wet conditions and require little maintenance. This might be an enticing management strategy on the Highlands Plateau where gardening is already a popular activity and residents recognize the importance of landscaping with native plants. A rain garden is both an opportunity to enjoy landscaping with native plants, and continually reduce stormwater pollution from a developed site by taking advantage of the natural drainage pattern.

A holding pond is another BMP example which is becoming common on the Plateau. A holding pond is formed at the bottom of the lot to catch the storm water runoff while development occurs. The pond is cleaned out and converted to part of the landscaping as an impoundment or rain garden. Gardening and landscaping proves to be a popular practice on the Highlands Plateau, especially with native plants. Native plants, flourish in wet conditions, do not

require additional pesticides/herbicides or fertilizers, offer low maintenance, and cost. A rain garden is a practical opportunity for these native plants. Rain gardens can be placed on an area where water tends to runoff the most, thus allowing the native vegetation to collect and infiltrate the water naturally. A rain garden will not only take advantage of native species but will prevent and avoid runoff from entering the watershed.

Fitting development to the natural constraints of the site and protecting sensitive areas such as steep slopes, poor soils, and floodplains will decrease the amount of impervious surface on steep slopes. The location of a building on a site or its relationship to other buildings is extremely important. If properly situated, the building achieves harmony with the topography, livability is enhanced, drainage problems are minimized, and the building's functional efficiency is increased. If the building is not properly situated, many problems that cannot easily be corrected can and will ensue (De Chiara 1978). A building should be placed to conform to the site's topography, minimizing necessary grading, reducing initial construction costs, and eliminating continuous drainage problems.

The most important factor affecting sedimentation and erosion is the amount of runoff available to erode the soil. Designs that limit the amount of impervious surface and disturbed area on a site will generate less runoff and thus less erosion and sedimentation. A good practice to minimize runoff is to minimize impervious surfaces such as parking lots, houses, and roads. Instead of creating expensive storm sewers and concrete channels, use the natural drainage system. Collect roof drainage to water the lawn or direct it to the garden where plants can absorb it. In doing so, natural flora will intercept the impervious surface and the steep slope.

Vegetative buffer strips and greenways along urban streams are effective pollution filters, as well as providing recreational and open space benefits. Maintaining vegetative buffer strips along all streams and drainage ways promotes percolation into the soil and acts as a filter. Runoff from disturbed areas can be routed to undisturbed areas, such as the forest floor, which have high infiltration rates. Greater care and maintenance of streams will benefit larger rivers and lakes in the area, thus improving watershed quality (Watershed Management Guide 1982).

Design considerations for controlling sedimentation and erosion include: (1) Plan the development to fit the physical characteristics of the site with a minimum of clearing and

grading; (2) Avoid site facilities that require massive land disturbances on areas of steep slopes or highly erodable soils; (3) Carefully site those development features, such as road corridors, which require considerable alterations of natural curve contours; (4) Minimize disturbance of existing soils and retain as much existing vegetation as possible. The development should be phased so that only areas which are being actively developed are exposed; (5) Apply proper erosion control practices to prevent excessive sedimentation. Communities should adopt and enforce local Sedimentation and Erosion Control Ordinances. Local control programs enable more careful review of site plans and more frequent field inspection of construction sites than State program. Sediment and erosion control should be incorporated into the regular development permitting process (Waste Management).

Highlands Watershed Ordinance

The Highlands Watershed Ordinance divides the Town into two watershed districts: the "critical area" of the watershed and the "balance of the watershed". The boundary between the two districts acts similar to a continental divide. Land to the west of this line is deemed the critical area because rainfall flows directly into Lake Sequoya and Mirror Lake. The critical area requires lower density- less people per unit. The Highlands Land Use Plan uses a "built-upon limit" which is a restriction placed on parcel development in accordance with property size. This limit is a calculated percentage of the property on which development is allowed. For example, there is a 12% built-upon limit for property south of the watershed, so for 1 acre a resident can build impervious surfaces up to 12%. To the east of the distinct line is the balance of the watershed- the less critical area. The minimum lot size for this less critical area is ½ acre with a 24% built-upon limit. Also, the Town adopted an ordinance requiring a 30 foot buffer along streams and a 50 foot buffer around the lakes.

The Town planning administrator has devised an ordinance that will address development for any parcel that does not meet the required lot size and for any slope development. Currently, if a resident meets the minimum lot requirement of 1 acre in the critical area, there is a 12 % built-upon limit. However, if the resident owns property exceeding the 1 acre minimum then there are no built-upon limitations. Additionally, there are no current ordinances limiting slope

development >30°. The goal for a steep slope development ordinance will direct storm water runoff away from surface waters and into areas that can properly infiltrate. Not only will these extraordinary storm water precautions control or even prevent pollution, but will minimize the amount of erosion and sedimentation that pollutes upstream and downstream locations, nonpoint pollution sources.

The two watershed ordinance recommendations will be proposed by the Town Administrator to the Town Planning Board this winter: (1) The Built-Upon Limit proposes that single family residential uses on lots that do not meet the minimum lost size of ½ acre shall not exceed a maximum of 24% built-upon area, as defined by this ordinance. Single family residential uses on lots that meet or exceed the minimum lot size of ½ acre may develop up to 33% built-upon area provided that storm water is directed away from surface waters and Best Management Practices are employed to control storm water runoff and minimize water quality impacts; and (2) The Slope Development says that an new Construction on slopes that exceed 30° must direct storm water runoff away from surface waters and maximize utilization of Best Management Practices to control storm water runoff and minimize water quality impacts. Both of these proposals will set limitations on development, especially as the population of Highlands's increases and development on steep slopes accelerates.

Major problems that the Town faces in protecting the watershed are neighboring perimeters, areas outside the Town lines. As the population increases in the Highlands area so does a desire for residential development surrounding the Town. Development that occurs in these outer areas impact the watershed because residents do not follow the strict land ordinances set by the Town. Approximately 65% of land feeding the watershed is outside the Town's control and in these perimeters. In order for the Town to achieve total access to these areas, annexing must occur. Annexation is a process that will allow the Town to extend it's boundary in order to attain control of outlying areas. Unfortunately, Annexation creates civil disputes between the Town and residents of these outer areas because annexation will require them to pay Town taxes. In return, the Town can extend sewer, water, police, ambulance, and fire services which will replace well water, septic tanks, and high fire insurance. Buildings established before annexation will be grandfathered into the land use plan and new development must meet Town

zoning ordinances. Eventually, when the Town boundary includes the entire watershed district and with improvements to the zoning ordinances, a cleaner watershed with stricter regulations can exist (see Town Zoning Map in Appendix).

Other area ordinances

The Town of Highlands is located in Macon County. Macon County does not have county-wide land use planning. However, there is a county-wide watershed ordinance and a floodplain ordinance. The Town board urges the county to adopt a stringent erosion and sedimentation ordinance. They argued that their effort to preserve the Town's water supply were in vain without county-wide compliance because stream pollution does not stop at city limits, the pollution continues downstream. The board of commissioners has been studying an erosion and sedimentation ordinance and looks at Highlands as an example because of the years of experience with land-use planning.

The Macon County Planning Department mission is to serve the people of Macon County by: (1) Applying land use regulations in a way that promotes the health and public safety of our citizens, and (2) Facilitating various Boards involved in the long term planning and development of Macon County (Macon County Planning Department 2004). An ordinance was established in September to protect the Little Tennessee River, which flows through the northern part of Macon County. The ordinance specifies that a 1000-foot section on either side of the river be protected in three ways: (1) no point source discharges, (2) density limited to 2 houses per acre, and (3) limiting impervious surfaces on non-residential development to 18% per parcel.

By comparison, Highlands's watershed ordinance is much stricter than Buncombe County, another North Carolina mountainous area. According to Jim Coman, senior planner for Buncombe County, they have added a hillside development provision to their subdivision ordinance, which requires larger lots as the land gets steeper. The county is in the process of adding another section that will tie in soil types. Currently there is a county-administered erosion control ordinance, with standards matched to the steepness and size of the disturbed acreage.

Areas in North Carolina that focus on increased population pressures include Orange and Wake County. Orange County has county-wide subdivision regulations and a sedimentation and erosion control ordinance. A Water Resources Task Force was established by the County Commissioners to develop recommendations for the protection of water resources in the County. These recommendations include: (1) Required stream buffers along perennial streams in water supply watershed and recommends that these buffers remain as natural vegetation, (2) Adopt storm water management measures that would apply to protected watersheds, (3) Continue to administer a strong local sedimentation and erosion control program, and (4) Develop a plan of action for dealing with spills of hazardous materials in water supply watersheds. Orange County has exhibited strong support for water quality protection and is well on the way to developing a strong and comprehensive water quality program.

Another area with rising population pressures is Wake County. Wake County has county-wide zoning and subdivision regulations as well as a sedimentation and erosion control ordinances. In addition, the County is preparing a Development Plan. The plan calls for the establishment of a Watershed District for the portion of the county within the Falls Lake watershed. In the Wake County Parks and Recreation Master Plan the creation of Greenway Corridors along major streams is recommended. Greenways protect floodplains from urban development, aids in preserving water quality, and forms a natural link between areas which can be used for recreation.

Conclusion

It is much less expensive to control erosion than to clean up sediment (LTWA Brochure). Because development on steep slopes creates runoff, erosion, and silt deposition into the watershed, we should develop ordinances that will stop or slow down the process. The Town Planning Administrator will propose new ordinance recommendations to the Town Planning Board Committee. If the proposals are approved by the Planning Board, they will be presented to the Town Board, and if accepted by the Town Board, the proposals will be included in the Land Use Plan. New recommendations and proposals are devised every year by the Zoning Administrator as watershed science evolves. In addition to the Town Board, there are two

organizations, the Mirror Lake Improvement Association and Lake Sequoya Improvement Association, who are working on lake improvements. These agencies are currently work together to form, a "Watershed Remediation and Preservation Project," developed to keep the Highlands's watershed intact. With interest from these groups, the Planning Board, and local citizens future watershed improvement will continue.

References Cited

Brooks, G.R. 1988. Site Planning: Environment, Process, and Development. Prentice Hall, Englewood Cliffs, NJ, pgs 38, 42, 64, 78, 193-194, 196.

Brower, D.J. 1984. Managing Development in Small Towns. Planners Press, Chicago, pgs 90, 133.

Chamber of Commerce. 2004. Macon County, North Carolina.

Daniels, T. 1988. Small Town Planning Handbook. Planners Press, Chicago, pg 158.

De Chiara, J. and Koppelman, L.E. 1978. Site Planning Standards. Halliday Lithograph Corporation and the Book Press, New York, pgs 13, 107.

Falls of the Neuse and B.E. Jordan Watersheds. 1982. Watershed Management Guide. Research Triangle Park, NC, pg 14.

Highlands Biological Station. 2002. United States Weather Bureau Station.

Highlands's Land Use Plan. 1988. Highlands, NC.

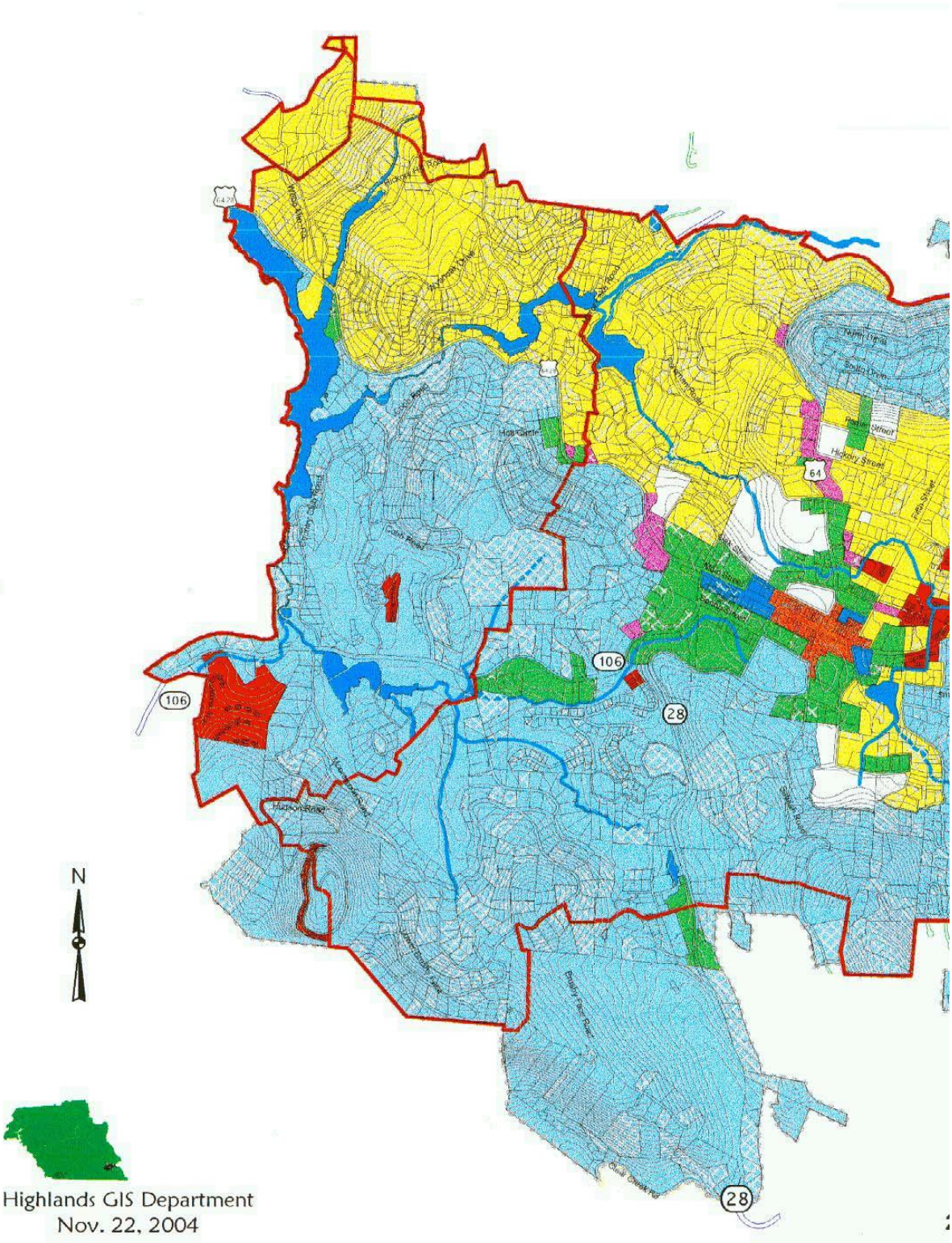
Little Tennessee Watershed Association. 2004. Sediment in our Watershed Brochure.

U.S. Dept. of Agriculture. 1980. Soil Conservation Service, America's Soil and Water: Conditions and Trends. SCS, Washington, D.C., pgs 18, 30.

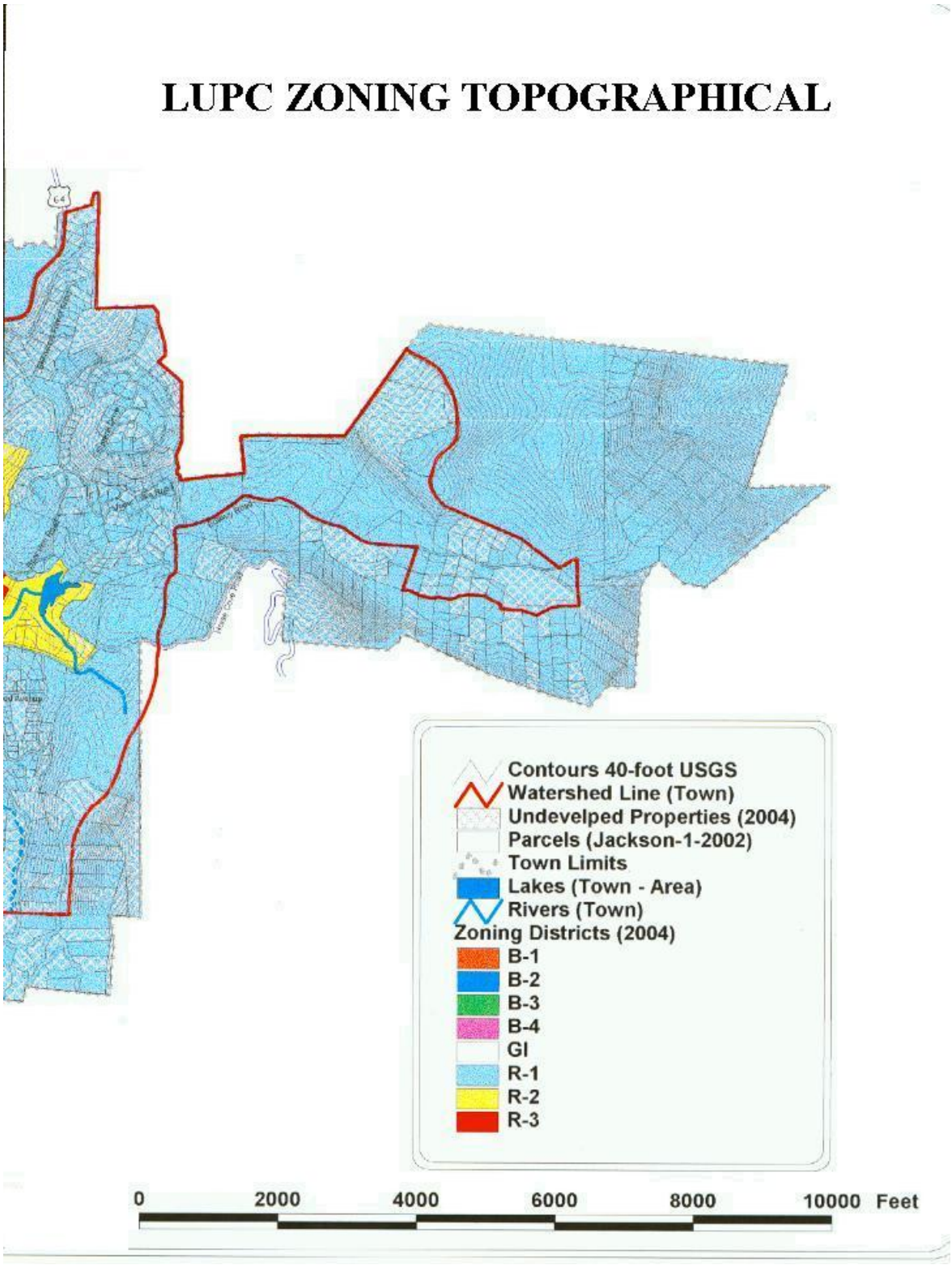
Untermann, R.K. 1973. Grade Easy. Library of Congress, Washington, D.C., pgs 45, 53.

Appendix

Town Zoning Map, left half



Town Zoning Map, right half



Population Trends on the Highlands Plateau: Assigning Confidence Limits to Growth Trajectories

Carla M. Frisch

Introduction

In Highlands, North Carolina, citizens have begun to take note of increased rates of construction and loss of green space. Headlines in local newspapers read "Will population study be useful to Highlands?" and "Discrepancy over figures but growth to remain steady" (Highlander 2004). For years, there has been talk of analyzing population growth of the area. In fact, both formal and informal studies have already been completed in an attempt to project future growth.

Why is knowledge of the exact population so important? The human population of Highlands will shape the future of the area. As people move into any region, land use is significantly altered. More people mean more demand for homes and services, creating more demand on the environment and greater impact on the land. In Highlands, the unusually rich flora and fauna will continue to be affected by people. Many species are endemic to habitats in the Southern Appalachians, and these habitats are increasingly threatened throughout the region. As for people, key infrastructure issues related to population growth include zoning, land use, housing needs, water, sewer, power, transportation, recreation, waste disposal, and environmental controls on such threats as storm water, erosion, air pollution, water pollution. Albarre (1977), a scholar of rural second homes in Europe, notes problems with increased building that come with population growth: "the change in the landscape and the general aspect of the habitat, the rise in price of plots of land and of houses; the increase in communal expenditure on the road system, extension of the water supply, modernization of the electricity supply and the like, and stimulation of local trade." Considering the vast impacts that human populations can have on the land, planning for the future is essential and must be done in a thorough manner.

This report aims to review, reconcile, and formulate historical, present, and future population statistics for the permanent resident, seasonal resident, and vacationer populations of both the Town of Highlands and Highlands Township. After comprehensively assessing the

population of the area, zoning and housing are considered in a separate document as integral parts of the Town infrastructure. In each section, Macon County is included to broaden the perspective on growth in the area. To complete these goals, previous studies and existing data about the population of Highlands will be assessed.

Methods

Relevant information was gathered from many Highlands residents, including members of the Town Board and Land Use Planning Committee. Land Use Planning Committee meetings were particularly helpful and informative because the committee itself is in the process of assessing the future growth of the Town. Specific population data were obtained from the U.S. Census and the North Carolina State Data Center. Microsoft Excel was used to organize all information.

Clarification of Terms

A significant aspect of the town history is the transient population. People frequently visit Highlands because its high elevation provides cool weather and beautiful scenery (Shaffner 2001). Its proximity to many major cities in the South has also made the town attractive to visitors. The historical and recent presence of many vacationers and seasonal residents makes the exact population and population growth extremely hard to assess. Therefore, it is necessary to split the people who frequent the town into three categories. First, to stay consistent with a population study done by Marketek in February 2004, the "permanent resident population" refers to those who live in Highlands for more than six months out of the year. This group lives in what the U.S. Census refers to as "occupied houses." Second, the "seasonal resident population" refers to those who stay in Highlands for fewer than six months out of the year, including those living in homes referred to as "seasonal" or "vacant" by the U.S. Census. Third, the "vacationer population" refers to any other people who visit Highlands and do not fit into the two prior categories.

Likewise, clarification of the boundaries of the land area of Highlands is necessary. People often refer to "the Highlands Plateau," but the area is rarely defined precisely. For the

purpose of this report, the Town of Highlands and the Township of Highlands refer to the areas defined as such by the U.S. Census and the Town government itself (Figure 1). The Township is also the same as the area defined by the state government as Voting District One. On a larger scale, the Zip Code Tabulation Area refers to the area defined by the U.S. Census, and Macon County's boundaries are defined by the government.

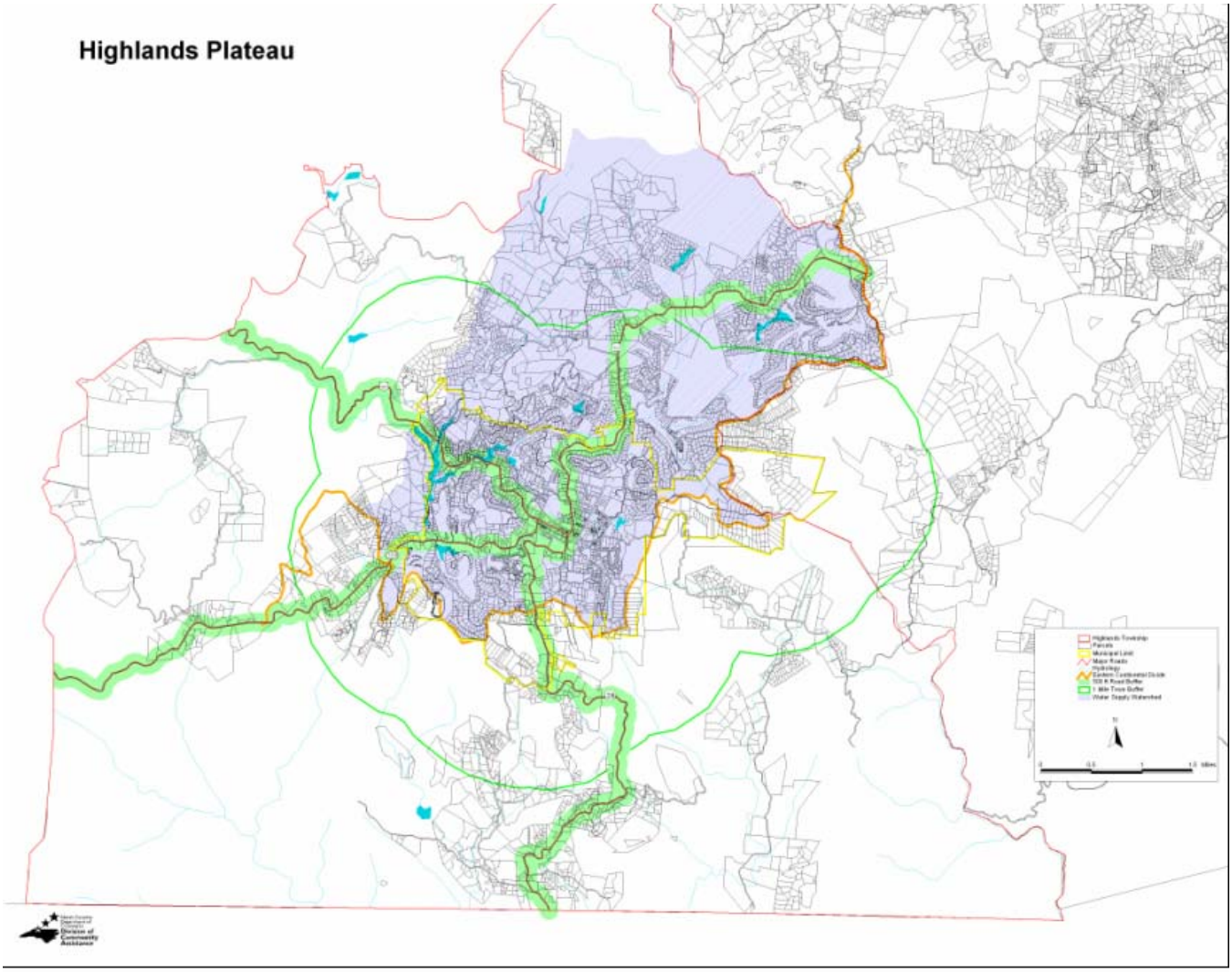


Figure 1. Map of Town and Township boundaries in Highlands: Yellow: Town boundary, Red: Township boundary, Green Circle: One-mile radius around Town, Green Line: Roads, Orange: Continental Divide.

Historic Population Growth of Permanent Residents

Historically, the growth of Highlands has not always correlated with growth or events in other parts of the country. Many people who traditionally lived in and visited Highlands were wealthy, and their expenditures and building decisions could have been independent from trends in other locations. Money spent on developments in Highlands did not all come from the area; people made money elsewhere and came to Highlands to spend it. Nevertheless, population growth has been steady.

Eric Morris, an intern at the Highlands Biological Station in 2002, described historical population growth and noted that, recently, population growth in Highlands has accelerated rapidly. His data came from Shaffner (2001), who compiled numerous population statistics from many different sources such as the Highlander, the U.S. Census, Franklin Press, and the NC Department of Conservation and Development. Because they came from different sources, the methods used to record or tabulate these figures may not be consistent. Such discrepancies could skew evidence of population growth.

Comparing statistics from a consistent source should be more accurate. In this case, U.S. Census data are satisfactory to portray permanent resident population growth. Data are not readily available for the seasonal population, but the U.S. Census has recorded population growth for permanent residents more methodically and accurately than any other historical method (Pankowski 2004). The U.S. Census first started recording the population of the Township in 1870 (157 people) and of the Town in 1880 (82 people). The Township population includes residents of the Town. To determine historical growth rates per decade accurately, the formula $(N_2-N_1)/N_2*100$ was developed by the author and is used in Microsoft Excel. The results show that the growth rates per decade, excluding the first ten years of growth, average 14.4% for the Town and 12.4% for the Township (Figure 2).

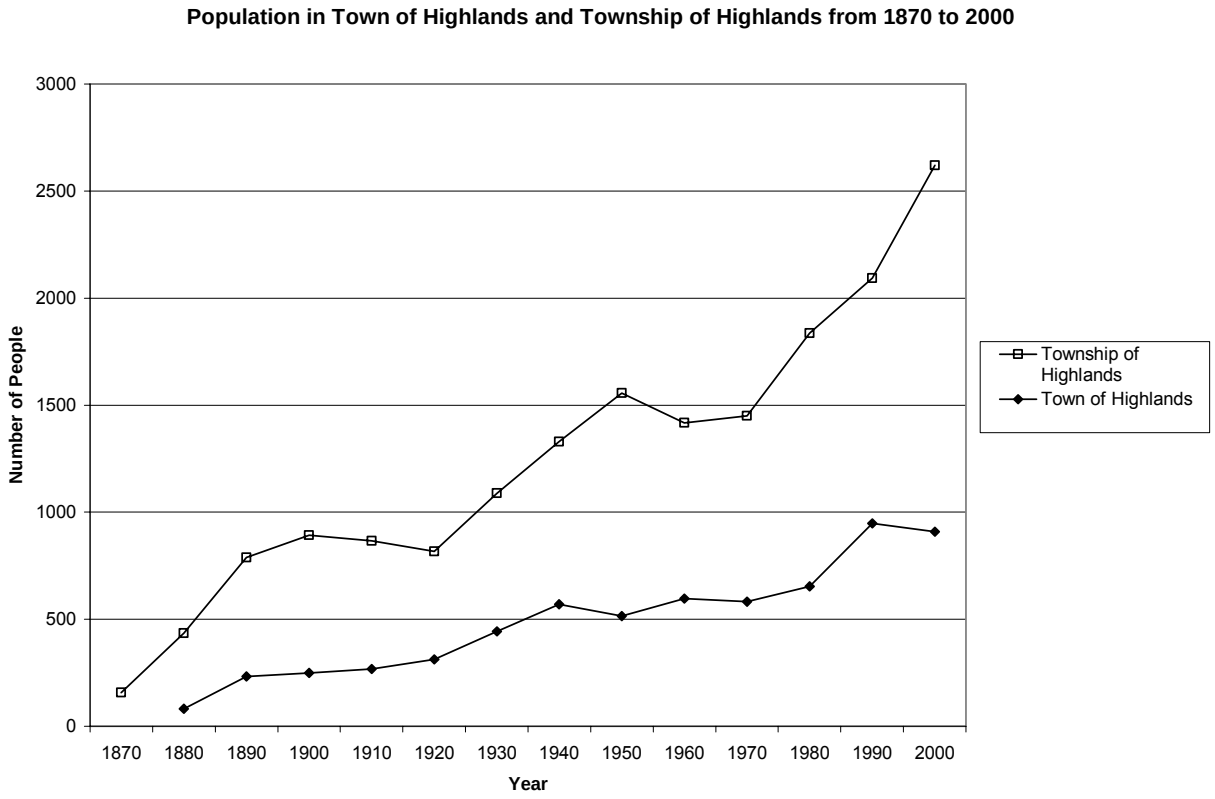


Figure 2. Permanent resident population growth in the Town and Township of Highlands from 1870 to 2000 based on U.S. Census data.

The permanent resident population has increased slowly and steadily since the founding of the Town of Highlands in 1875. For a more detailed plot of the yearly population change from 1980 onward, see Appendix I. The more rapid population increase between 1980 and 1990 can be attributed to the annexation of 2.22 square miles. This annexation added 291 people and almost doubled the area of the Town which was previously 2.61 square miles (Tillman 2004/Census 2000). The size of the Town population certainly would not have increased as much without this annexation. In fact, the population in the Town of Highlands decreased in the most recent decade from 1990 to 2000. In this time period, only 0.12 acre was annexed. Compared to the decade from 1980 to 1990, the decrease in population may seem unusual, but the earlier annexation accounts for the disparity. Seasonal residents could have purchased permanent residents' homes. There was also a rapid increase in the population of the Township from 1990 to 2000, an area including both the area of the Town and the area that was annexed

into the Town. The plot of Township growth may be more representative of actual population growth in the area. Any further discrepancy can be explained by the seasonal and vacationer populations.

It is also useful to compare growth of the Highlands area with that of the entire county. According to the U.S. Census, population in Macon County has steadily increased since its founding. For a plot of historical growth in Macon County from 1830 to 2000, see Appendix II. The Town of Highlands and Township of Highlands are also included for comparison.

Existing Studies of Present and Future Population Growth

The 2000 U.S. Census states that the median age in the Town of Highlands is 50.9 years and that 29 percent of residents are more than 62 years old. Almost the entire population is white, many of Dutch, German, and Scots-Irish ancestry. Out of 909 people, 481 are employed. The household income recorded in the U.S. Census is lower than the actual income of many families in the area however, because many people work elsewhere and bring money to Highlands. In addition to the U.S. Census, which counts only permanent residents, several other sources present conflicting data about present and future population trends for Highlands.

All of the figures from these various sources are valid in some way, but problems lie in how the data have been manipulated and interpreted. An assortment of population statements and projections have been done by Marketek (February 2004), WK Dickson for the Sewage Treatment Plant (January 2002), the Highlands-Cashiers Hospital's Marketing Department (Spring 2003), McClure of Macon County (2003), and the State Data Center's Log into North Carolina or LINC (2003). Numbers are presented from each of the studies for the permanent resident population of the Town, the Township, the Zip Code Tabulation Area, and the county (Table 1).

Initially, this report was designed to compare two other studies, referred to as the Marketek study and the Macon County study. The media and talk among residents of the area had concluded that these two studies have significantly differing population figures and projections. Upon further investigation, however, it was discovered that no formal Macon County study has been completed.

	YEAR							
	1990	2000	2001…	2003	2004	2005…	2009…	2025
Town								
Census		909						
State Demographer		915		929				
Dickson			1152	1194	1215	1237	1328	1763
Marketek				958				1388
LINC	948	915	917					
Township								
Census		2620						
Census (Fact Finder)		2652						
Marketek				2826				4395
Census Tract 9705		2918						
Zip Code								
The Right Site		3332			3521		3776	
ZCTA (sample est)		3424						
ZCTA (100% count)		3444						
House and Home		3359						
Macon County		5484						
County								
LINC	23499	29808	30440	3172	31968	32567	35121	
Census	23499	29811						

Table 1. Population estimates from different sources for the Town of Highlands, Highlands Township, the Zip Code, and Macon County.

Macon County employees have taken an informal look at the population of Highlands. Byron McClure (2003) notes that there are 3,226 electric meters operating under Duke Power, Haywood EMC, and the Town of Highlands. Multiplied by 1.7 people per house living in a "retirement community," he concludes that there are 5,484 residents in Highlands. Unfortunately, the area of Highlands is not well defined in the analysis as the Town or the Township because electricity use does not stop at political boundaries. This lack of definition makes it hard to compare this estimate with other figures, and it may explain some of the confusion over the Macon County study.

The Marketek study (2004), mentioned in the media, has caused much discussion among Town residents and members of the Land Use Planning Committee. Because it was completed

by a firm involved in demographics, it is particularly well researched and presented. Much of the information in this study is useful for further research. Most of the data and projections about population are based on the U.S. Census or ESRI BIS. Some people have faulted the study because they find that it focuses on the permanent population instead of assessing the full effects of seasonal residents. The Marketek projections are lower than those in most of the other studies (Table 2).

	Town			Township		
Year	Year Round	Seasonal	Total	Year Round	Seasonal	Total
2003	958	3867	4825	474	1289	1763
2008	1055	4323	5378	530	1441	1971
2015	1188	5010	6198	614	1670	2284
2020	1288	5465	6753	670	1822	2492
2025	1388	5899	7287	723	1966	2689

Table 2. Marketek Town and Township population projections from 2003 to 2025.

In contrast to the Marketek study, the W.K. Dickson study (2002) has been criticized as having high population projections. The study was done to plan for wastewater treatment plant expansion, and the plant does have to be designed for peak usage, including water from all permanent residents, seasonal residents, and other vacationers. The Dickson study has to allow for potential expansion of the number of resident households using the plant, because many may soon convert from septic tank use. If the study included more conservative population estimates, the treatment plant might be ill-prepared to accommodate peak usage. According to the Dickson study, the permanent resident population increases at a rate of 1.9%, and the seasonal resident population increases at a rate of 3.93%. These percentages are calculated using historical rates from 1988 to 1999 and assume that growth in the most recent decade is the best predictor of growth in the next decade. The seasonal resident population is calculated using a multiplier of 2.16 people per residential water meter, a slightly different figure from the 1.7 people per electric meter used by Macon County (Appendix III).

Another study has been produced by the Highlands-Cashiers Hospital Marketing Department, partly to encourage physicians and other medical professionals to move to the area. The hospital has to plan for the future and assess population size for maximum occupancy and

maximum use. Data about Highlands used by the hospital are compiled using the U.S. Census Zip Code Tabulation Areas. The projected average annual growth rate of total housing units is 1.9%, and the projected average annual growth rate of the seasonal population is 2.6%. The data suggest that there are 2.13 people per house, again a different number from the Macon County and Dickson studies (Appendix IV). The numbers for the year 2015 listed in this study seem particularly high.

Broader sources of population information can also be useful, such as "Log into North Carolina" (http://data.obsm.state.nc.us/pls/linc/dyn_linc_main.show), an on-line database. LINC is run by the North Carolina Census and lists up-to-date population statistics for the Town, Township, and county. Data from this source can be viewed by year instead of by decade and are often more up-to-date than data from other sources. Unfortunately, it only provides population projections for the county. Like other studies, it takes a particular average annual growth rate and applies it every year, assuming that the population will increase at a constant rate. A graph of such growth shows a straight diagonal line representing a steadily increasing population.

The U.S. Census itself is usually considered a very reliable source of population data. It is the country's definitive record of population size and population growth. In the case of Highlands, however, U.S. Census data may not be the best representation of the actual population. It does not include seasonal or vacationer populations aside from listing the number of seasonal residences. There is also some question as to how the U.S. Census data were collected in 2000. The houses in Highlands are spread throughout the hills and can often be hard to locate. Town officials speculate that many houses were missed during the door-to-door data canvassing done by the U.S. Census. Due to the migrant nature of many residents, many people may also have been unavailable or unresponsive to U.S. Census questions.

Newly Calibrated Data on Present and Future Population Growth of Permanent Residents

Part of reconciling the studies listed thus far involves placing the figures on a similar scale; otherwise, population numbers for the Town, the Township, and the Zip Code Tabulation Area cannot be compared. The Township is the most reasonable scale to consider because

growth in the Township greatly affects the Town as well, but Town data are better documented and used more frequently. When available, information will be provided for both the Town and the Township. If only the Town is referenced, Township data are not available.

Unfortunately, traditional growth models cannot be used to project the population of Highlands. Including the number of people that are born and die or speculating on how each cohort will age are interesting methods for considering growth, but they are not relevant to Highlands. This community changes size by migration in and out of the area. People moving to Highlands are the ultimate cause of population growth, not people being born. Again, this transient population makes the exact number of residents hard to decipher. Bill Tillman (2004), state demographer, says that he would prefer not to project the population of Highlands because there are so many factors that limit the accuracy of such a projection.

Most population projections presented here are done using an average rate of growth for a year or decade. Using an average rate of growth over any time period, one can take the present population and project what it will be if it continues to grow at this constant rate. Many of the previously completed studies used this method. More complicated demographic models are available, but projections using average growth rate are used here because they are simple, straightforward, and can be easily manipulated for other purposes in the future.

The number of residences that receive electric, water, or garbage service from the Town of Highlands can be used to determine the current population, the first step in completing population projections (Table 3). The numbers for electric and water users differ due to the fact that both systems reach outside of the Town boundaries but not necessarily to the same locations. Also, many older buildings used for businesses share water sources but have separate electric meters. Multiplying each total by 2.17, the 2000 U.S. Census figure for "average household size of owner-occupied units," the current population for an area larger than the Town but smaller than the Township is projected to be between 4700 and 5800.

	Residential	Commercial	Total	Population
Electric Meters	2274	403	2677	5809
Water Meters	2217	248	2465	5349
Garbage Collection	1904	268	2172	4713

Table 3. 2004 population estimates based on electric, water, and garbage service.

As mentioned in the description of the Dickson study, building infrastructure is based mainly on the maximum occupancy of the area. The figure for the actual population is not functional for planners trying to decide on the scale of a project which serves the entire Town. In this case, an overestimate is more useful than an underestimate. When planning for improvements or changes to town systems such as water, sewer, or garbage collection, it may be best to use a figure between 4700 and 5800. Richard Betz (2004), the Town Administrator, notes that he generally refers to a population of 5200.

These figures are interesting to consider for the current population, but what about the future? Fitting trend-lines to historical growth trajectories from Figure 2 allows the population in 2030 to be projected (Figure 3). If growth continues at historical rates, the Town will have a population over 1000 and the Township will have a population over 3000 in 2030.

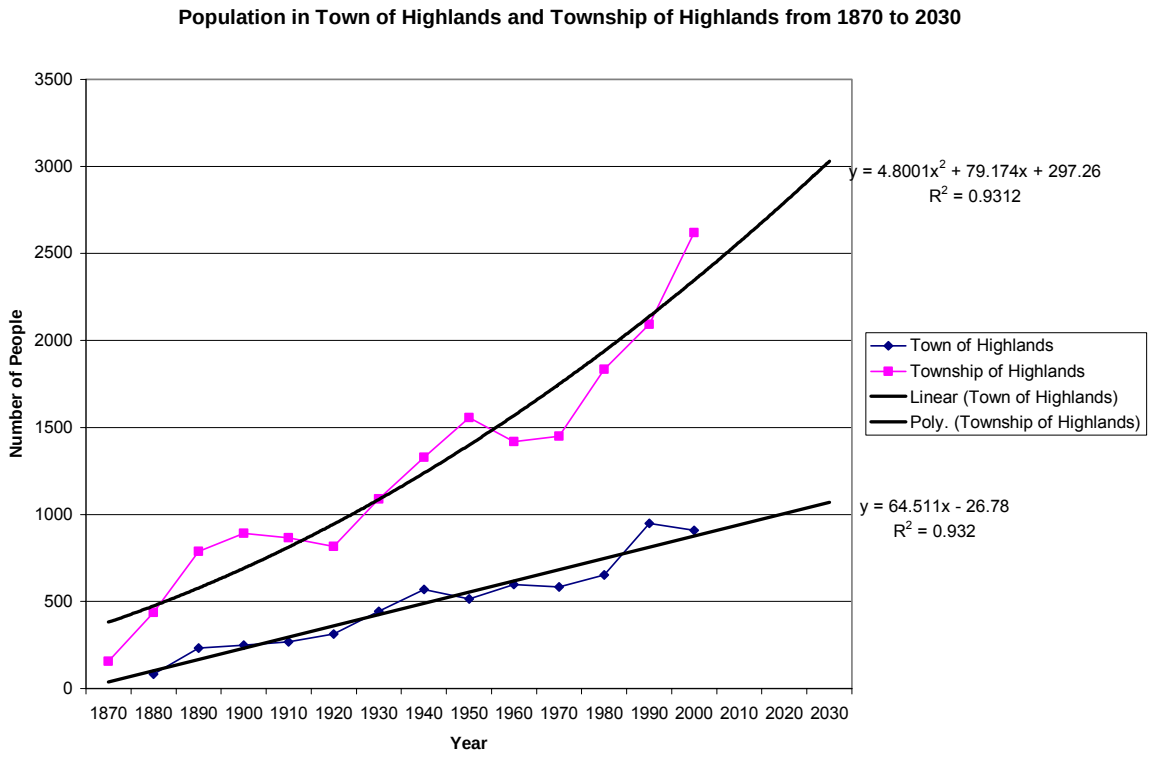


Figure 3. Town of Highlands permanent resident population growth from 1870 to 2030 based on U.S. Census data and trend-line projections.

To consider all options of how the Town and Township population might change, it is interesting to compare how each will grow at different growth rates. Charts V and VI in the appendix show the Town and Township 2003 population projections and consider that the population could grow at the lowest growth rate in its history, the highest growth rate in its history, the average growth rate for all of its history, or the growth rate of the most recent decade. Not surprisingly, such differing growth rates can vastly alter the population projections. Growth at a historical low or high rate is very unlikely; more realistically, the population will grow at an average growth rate or continue to grow at the most recent growth rate. A four rate projection chart for Macon County like the ones for the Town and the Township is also included in Appendix VII.

Getting rid of the historical high and low growth rates, the lines in Figure 4 are based on the average historical growth rate, excluding the first decade of growth, and the growth rate of the most recent decade. The lowest line is the Town, the middle line is the Township, and the highest line is the county. Similar to the trend-line projections, the Town will have more than 1,000 people in 2030. This Township projection is higher than the trend-lines; the population will be more than 4,000 in 2030. The county will have more than 46,000 people in 2030. For comparison to these county projections, LINC county projections are extremely similar (Appendix VIII).

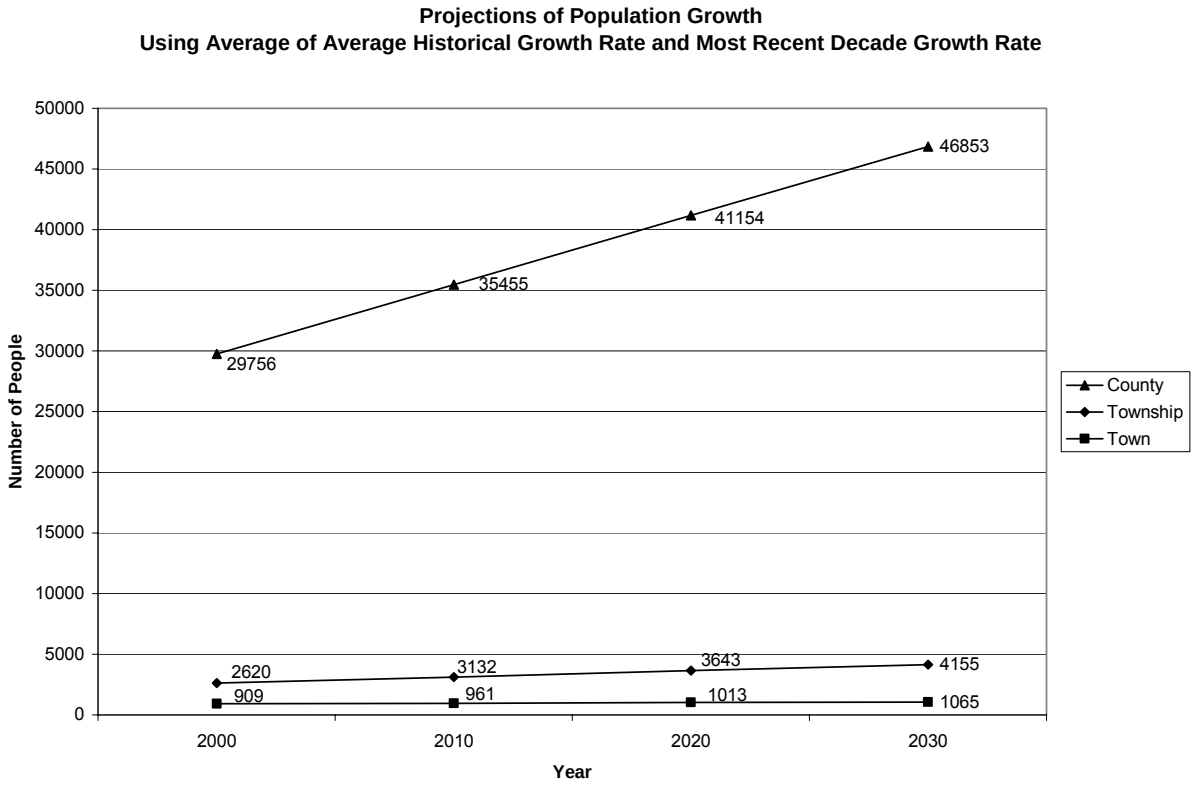


Figure 4. County, Township, and Town growth projections from 2000 to 2030 using average historical growth rate augmented by most recent decade growth rate.

The state demographer, Bill Tillman, suggests that to project future permanent resident population accurately, only data that do not include the increase in population size due to annexation should be used (pers. comm.). Using 2003 Municipal Population Estimates, change in population is 1.5% from a Town population of 915 in 2000 to 929 in 2003. Therefore, over three years, the average annual growth rate is 0.5%. This rate seems rather low compared to the rates used in other studies, but it may be more realistic because it excludes the annexation from 1980 to 1990 and the decrease in population from 1990 to 2000. If the population of the Town of Highlands continues to grow at such a rate, the population will be 1030 in 2025 and 1056 in 2030 (Figure 5).

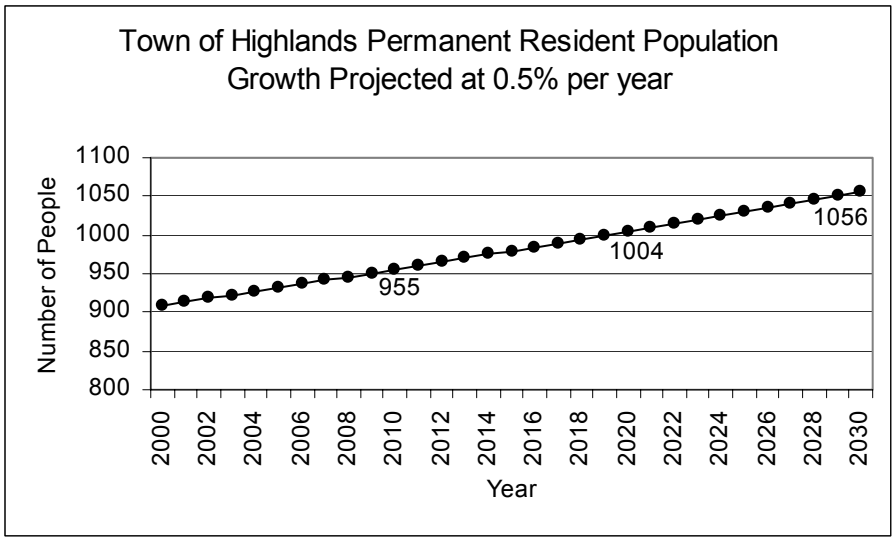


Figure 5. Town permanent resident population growth at 0.5% per year from 2000 to 2030.

The permanent population of the Town of Highlands will grow slowly, if at all. All three of the methods described above project the permanent resident population of the Town to be just over 1000 in 2030. These estimates are significantly lower than the Marketek study, which projects the Town population to be 1388 in 2025. This report's estimates project Town permanent resident growth to be slower than it has been in the past. If growth continues at the historical average rate of 15.6% per decade, the 2030 population will be 1334. If growth occurs at a rate equaling the average of the historical average, the historical low, the historical high, and the most recent decade, the population will be 1230 in 2030. If growth continues at a constant rate of 10% per decade, the 2030 population will be 1215. These two numbers can serve as an upper limit for the Town population projection.

The two Township estimates seen in Figures 3 and 4 are not as similar as the two Town estimates, but both are still lower than the Marketek estimate of 4,395 in 2025. The 2030 range from this study is from a little more than 3,000 to more than 4,000. If growth continues at the historical average rate per decade of 13.9% per decade, the 2030 population will be 3,711. If growth occurs at a rate equaling the average of the historical average, the historical low, the historical high, and the most recent decade, the population will be 3,867 in 2030. These two numbers are within the above 3,000 to above 4,000 range. More growth is likely to occur in the

Township than the Town, because limited Town area might force people to move into the Township.

Unpredictable events could affect the population in any number of ways, so the projections stated thus far may not necessarily be correct. The projections do not account for possible future annexations to the Town. Mayor Buck Trott has told the Land Use Planning Committee that he thinks annexations will definitely happen within the next ten years. The farther any of these projections go into the future, the less accurate they become. The projections as far ahead as 2030 cannot be considered reliable. Nevertheless, predictions that may prove incorrect can still help to assess and guide growth and development. From the planning perspective, inaccurate predictions can be better than no predictions at all.

Seasonal and Vacationer Population Growth

As mentioned previously, the seasonal and vacationer populations are the key issue in accounting for discrepancies in population statements and projections for Highlands. The present density of permanent residents is about 170 people per square mile. This density is comparable to rural areas and to the state average of 160 people per square mile. To be considered a city, the density has to be 252 people per square mile (Tillman 2004). With seasonal residents and vacationers added in, Highlands definitely qualifies as a city with over 252 people per square mile.

There are some concrete records such as the number of people registered to vote or how many houses have been built that might provide some information on the seasonal population, but it is almost impossible to calculate the number of people moving in and out of the town at any given time. People come to the area for daytrips, for weekends, for a few weeks, or a few months. They bring varying numbers of friends and family members. They visit with friends, stay in hotels, rent cottages, and buy houses. In a study on second homes, Coppock (1977) explains reasons for discrepancies very well:

> "Two aspects of the use of second homes are particularly relevant: the amount of time occupiers spend in their second homes and the way they use their time. From what has been said about problems of definition, it will be clear that the former will show a wide range of variation, from a few days on one occasion each year, through use for annual holidays and at weekends in summer and regular weekend use throughout the

> year, to permanent occupation, the cut-off point for the latter being a matter of debate; a great deal will depend on accessibility and the extent to which second homes are let to or used by others apart from the owner and his family."

To explain the differentiation between resident, seasonal, and vacationer population more fully, one must take a look at more recent trends of the type of population in the area. Historically, the town has been both a resort and retirement community and has fluctuated between the two. Anecdotal evidence from members of the Land Use Planning Committee cites the Town as being in a state of transition from a resort to a retirement community. People who used to vacation in Highlands during the summer may now be retiring to their second homes. Those buying resort homes now have shifted in age from retirees to professionals in their forties and fifties. Some may purchase homes as a stable financial investment. Bob Wright, President of the Upper Cullasaja Watershed Association, says seasonal residents from Florida used to stay in Highlands for six month periods, but now visitors from Atlanta are buying homes to use for weekend trips. Wright explains that, although both the population and number of houses have increased, water use has decreased. From 2000 to 2003, Highlands' country clubs have been pumping less water on an annual basis, probably because people in the area on weekends use less water than people who come and stay for more extended periods.

Another major change in the dynamics of the population is an extended season for seasonal residents and vacationers. The Chamber of Commerce notes that people who used to come to Highlands only during the summer are now staying in the area longer or returning more frequently in the fall. Second home owners are now likely to spend Thanksgiving and even Christmas in Highlands. The off-season used to be about half of the year, but now it only includes January, February, and March.

Considering all of the above impediments to calculating seasonal and vacationer populations, Bill Bassham of the Highlands Chamber of Commerce has come up with an effective way to assess the situation. He considers that, with 340 available hotel rooms and a maximum capacity of two people in each room, 680 vacationers will be added to the population. Using records of property taxes paid from addresses outside of Highlands, it is estimated that there are 720 second homes in the area. With an average of 2.5 people in each of those homes, this adds another 18,000 people. Bassham (2004) notes that it is impossible to calculate "day-

trippers." With 680 people staying in hotels, 18,000 second home owners, permanent residents, and day-trippers, Bassham concludes that there are 20,000 to 22,000 people in Highlands. The Highlands Chamber of Commerce website estimates the summer population to range from 20,000 to 30,000.

Using the number of second homes is a useful way to assess seasonal residents. The Town contains almost twice as many total housing units as permanent residents. From the 1990 U.S. Census to the 2000 U.S. Census, the population of the Town of Highlands decreased, but the total number of homes increased. More building and zoning permits were issued (Gantenbein 2004), and the annual cost of construction increased during this time period (Appendix XIV). The 2000 U.S. Census states that within the Town of Highlands, 70.6 % of homes are "for season, recreational, or occasional use." In 2000, the seasonal homes added a population of 2,626 extra people inside the Town limits. In 1990, seasonal homes added 2,378 people. Even with increased construction, the ratio of permanent residents to seasonal residents appears to stay basically the same over the decade (Figure 6).

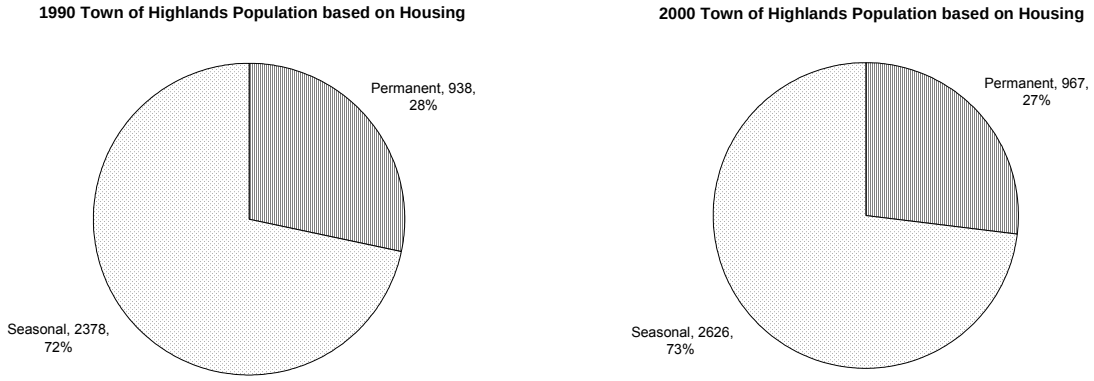


Figure 6. 1990 and 2000 Town seasonal versus permanent population ratios based on number of seasonal versus permanent housing units.

Focusing on the U.S. Census housing data, instead of the population data, may give a more accurate portrayal of the number of people who could be in Highlands at one time. Vacancy and occupancy for the Town of Highlands were first recorded in 1980, but the U.S. Census began keeping these records for other areas in the 1940s. Macon County was recorded from 1940 forward. For a chart of Macon County's occupied and vacant residences, see Appendix IX.

The transient vacationer population outside of seasonal residents is a vague concept; no one has any idea how many people come through Highlands. A total of 680 people could stay in hotels at one time, but it is unlikely that every room is filled with exactly two people all of the time. Moreover, other people could be in the area but not stay in hotels. Just two years ago, there were 450 hotel rooms (Dickson 2002), but recently a few hotels and bed and breakfasts have closed. In 2003, Evening Shade and 1827 Stewart House closed. Renovations at Old Edwards Inn kept rooms closed for two years. During 2004, Toad Hall and Mirror Lake Suites will close, and Kelsey-Hutchinson Lodge will undergo renovations. In fact, tourism in Highlands has not yet returned to its pre-September 11th records (Bassham 2004). Considering these facts, the number 600 is used below as a placeholder to represent people who are in Town but do not own homes. This number stays constant with time, because there is no way to tell how the tourism industry will change in the future.

To project the future of the seasonal population, one approach would be to assume that the ratio of permanent homes to seasonal homes will stay the same as the town continues to grow. The present ratio of permanent residents to seasonal residents is 2.89. With the permanent resident growth rate at 0.5% per year and with the number of seasonal residents growing proportionally to the permanent residents, the total population reaches 4,705 in 2030 (Table 4).

Year	Vacationer	Seasonal	Permanent	Total
2000	600	2626	909	4135
2003	600	2665	923	4188
2004	600	2679	927	4206
2005	600	2692	932	4224
2010	600	2760	955	4315
2015	600	2830	980	4409
2020	600	2901	1004	4505
2025	600	2974	1030	4604
2030	600	3049	1056	4705

Table 4. Town population growth including permanent growth rate of 0.5% annually and seasonal growth rate proportional to permanent growth rate.

Year	Vacationer	Seasonal	Permanent	Total
2000	600	2626	909	4135
2003	600	3088	923	4611
2004	600	3260	927	4787
2005	600	3441	932	4973
2010	600	4509	955	6065
2015	600	5909	980	7489
2020	600	7744	1004	9348
2025	600	10148	1030	11778
2030	600	12730	1056	14386

Table 5. Town population growth including permanent growth rate of 0.5% annually and seasonal growth rate of 5.6% annually.

Considering the amount of construction around town, it seems unlikely that the seasonal population will grow proportionally to the permanent population. A second method for projecting future seasonal population numbers assumes that growth will continue at a past rate. The average rate of vacant seasonal home growth from 1980 to 2000 was 15.6%. This rate is exceedingly high because it includes the annexation. To account for the discrepancy, the number of seasonal homes in 1980 is multiplied by two (because the annexation doubled the size of the Town). The calibrated average growth rate is therefore 5.6%. With the permanent residents growing at 0.5% per year and the seasonal population growing at 5.6% per year, the 2030 population is 14,386 (Table 5). Although this estimate is for the Town, it is close to Marketek's projection for the Township population in 2025.

Giving double weight to the 1990 to 2000 seasonal growth rate slows down the average rate of seasonal growth to 3.3% per year. Increasing the permanent growth rate to 1% per year makes the projections higher and closer to the upper limits developed in the permanent resident growth section. Using these two rates, total population in 2030 is projected to be 8,776 (Figure 7). Here, the permanent population is lower, but the seasonal population is higher than Marketek's projections.

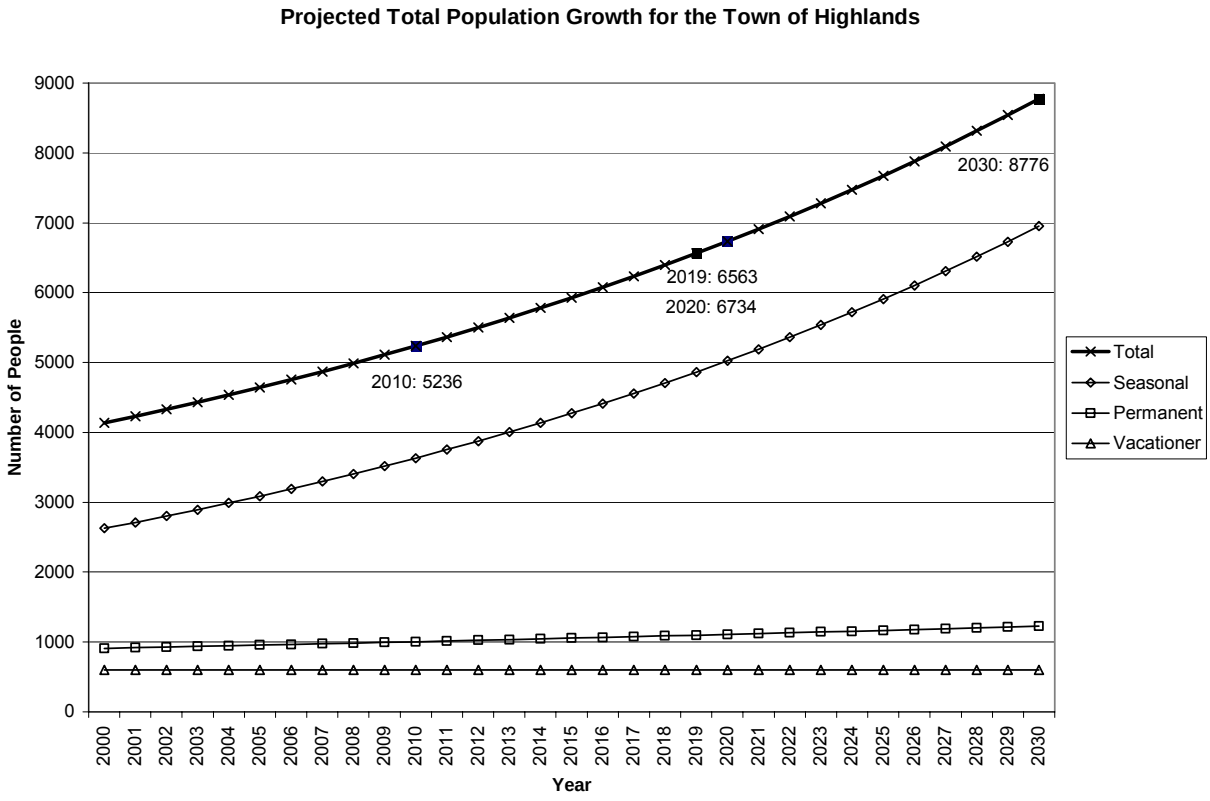


Figure 7. Town Population Growth from 2000 to 2030 including permanent growth rate of 1% annually and seasonal growth rate of 3.3% annually.

These projections may simplistic because growth may not continue at a steady rate. Growth can happen quickly while there is still space for building. As space becomes more scarce or perhaps ordinances become more strict, growth may slow. There is more space in the Township for growth than in the Town, so when growth slows in the Town, growth may accelerate in the Township.

There are no U.S. Census data on vacancy and seasonal housing available for the Township, so the seasonal Township population cannot be assessed in the same way that the seasonal Town population can be assessed. The following assumptions must be made for the Township projection: 70% of the Township residents are seasonal, the seasonal population grows at 3.3%, and 600 remains the estimate for vacationers. Based on these numbers, the Township total population will equal 16,691 in 2030 (Table 6).

Year	Vacationer	Seasonal	Permanent	Total
2000	600	4585	2620	7805
2010	600	6343	3005	9948
2020	600	8774	3446	12821
2030	600	12138	3952	16691

Table 6. Township projected population growth with 70% of residents categorized as seasonal and seasonal growth 3.3% annually.

Because there are so many assumptions that must be made in these predictions, looking for different ways to assess population growth can be useful. The accommodations tax is another tool that can help estimate the changing vacationer population. The accommodations tax is a 3% tax paid on all hotel, motel, bed and breakfast, and rental property bills. Vacationers who do not own houses pay this tax for staying in Highlands. From 1995 to 2004, more tax was paid in the peak tourist months of July, August, and October (Appendix X). The yearly average of accommodations tax increases steadily from 1995 onward, representing an increasing number of visitors. After September 11th, 2001, there was a drop in the taxes paid, but the total reached its highest peak in 2004. If the accommodations tax continues to increase at the rate that it has increased over the past decade, each year will be a new high. Although the rate of the accommodations tax has stayed constant since it became official in 1987, increases in prices of hotel rooms and rental properties will affect how much is paid. Inflation and greater demand account for some of the increased prices, so all increases may not represent increased tourism.

Yet another approach to calculating the population of an area is to consider the amount of traffic on the roads. The North Carolina Department of Transportation completes yearly Traffic Survey County Maps that can evaluate not only traffic patterns but also assess the population of an area. The DOT counts the number of axles that cross over a road for two 24-hour periods. Using a formula specific for both season of the year and number of trucks that go through the area, the DOT converts the number of axles into the number of vehicles that come through the area. From there, the DOT calculates a number that is an average of how many vehicles travel on a particular road during any random 24-hour period. In 2003, averages recorded for roads in Highlands ranged from 300 to 8,400 vehicles per day (Appendix XI). Other high counts for roads in the area are 5000, 6200, 7300, and 7700. The map itself cites the population of Highlands as 926, so it may seem unusual that 926 people are driving on one road 8,400 times in

one day. There are many visitors in the area, and some people commute to Highlands or through Highlands to other places. These averages of traffic patterns are certain evidence that a larger population than just permanent residents make use of Highlands.

Carrying Capacity

Can Highlands accommodate the projected growth? Space in Highlands is certainly limited. The terrain is mountainous, and parcels suitable for building are expensive and sometimes hard to acquire and develop. As more and more people arrive in the area, the only land left will be on steep slopes and in less convenient locations. Much of the Township is part of the Nantahala National Forest, and growth cannot continue past these boundaries (Appendix XIII). The amount of development that continues inside the Town will depend on the constraints that the Town government puts in place via ordinances. Outside the Town in Macon County, growth can presently continue uncontrolled. If historical population growth rates continue, a great amount of growth will take place, and those people will want places to live.

The Marketek study outlines the number of parcels of land available for development in the area. A map of all parcels in the Town and Township is available in Appendix XII. Marketek explains that parcels >1 acre can be subdivided, but does not assess the impacts of subdivision in their population projections. Since the study was made available in February of 2004, four parcels of land within the Town limits have been divided into 50 more parcels of land. Right now, there are plans to divide another two parcels into about 20 more parcels of land. Larry Gantenbein, Town Planner and Zoning Administrator, estimates that, not including the 50 lots already mentioned, the count of lots will increase by at least 50 to 100 within the next couple years.

Development can continue on subdivided parcels. Marketek parcel data are used below to calculate future population if each parcel were developed by building a home for 2.17 residents. The figures assume that parcels >10 acres will be subdivided into at least two parcels. A total of 2,088 more people can live in the Town, and 7,604 more people can live in the Township (Table 7). Data on subdivided parcels are not available for Macon County. It is not likely that all of these people in the Town and Township will live in Highlands as permanent

residents. In addition, some parcels could remain undeveloped or even more subdivision could take place. Marketek (2004) notes that properties are subdividable "regardless of factors that limit redevelopment potential such as slope, soil conditions, ownership, zoning, existing units, etc." This list of limiting factors includes some rather significant restrictions that will definitely impact growth.

	Total Parcels	Subdividable Parcels	Subdividable Parcels (+≥10acres/2)	Extra Population	Carrying Capacity
Town	3232	852	962	2088	6223
Township	6886	2870	3504	7604	13412

Table 7. Town and Township carrying capacities based on Marketek's data about subdividable land parcels.

There is a second way to assess carrying capacity based on parcels of land. Marketek states which parcels are vacant and available for re-development. Assuming no one lives on vacant or re-developable land, 2.17 people could move into a home on each of these parcels. A total of 2,394 more people could live in the Town; 6,007 more people could live in the Township; and 52,106 more people could live in Macon County (Table 8). One limitation of this analysis is that vacant land may not necessarily be vacant; it qualifies as vacant because it is listed that way on tax records.

	Total Parcels	Vacant Parcels	Redevelopable Parcels	Vacant and Redevelopable	Population	Carrying Capacity
Town	3263	974	129	1103	2394	6529
Township	6981	2427	341	2768	6007	15012
Macon Co	40656	17398	6614	24012	52106	

Table 8. Town and Township carrying capacities based on Marketek's data about vacant and redevelopable land parcels.

Although both of these methods have restrictions, they do provide a valuable basis for estimating a carrying capacity. Combining both methods can set some upper and lower boundaries. The Town can add between 2,100 and 2,400 people, while the Township can add between 6,000 and 7,600 people. The wider range for the Township is understandable because there is more room for growth within its larger total area.

If the seasonal population grows proportionally to the permanent population (Table 4), the Town will not reach its carrying capacity until long after 2030. If the seasonal population grows at its past rate (Table 5), the Town will reach carrying capacity between 2011 and 2012.

However, the Town will reach carrying capacity between 2019 and 2020 if permanent residents grow at 1% annually and seasonal residents grow at 3.3% annually (Figure 7). The Township will reach carrying capacity after 2021 (Table 6). These projections show that the Highlands area will definitely be near its carrying capacity within 20 years. After this time period, Highlands cannot accommodate the level of projected growth. In fact, depending on regulations and available land, the area may reach carrying capacity even before the 20-year estimate.

The Town might reach carrying capacity earlier than the projected date due to the maximum densities assigned to each of the Town's zoning districts. There are specific restrictions about the minimum lot size in each area and the amount of development that can take place on different size lots (Zoning Ordinance 2004). Laws could be changed to accommodate higher density development and more population growth. Presently, subdivision and redevelopment must follow the instated regulations and, therefore, may not continue in the ways estimated in Tables 7 and 8.

Annexations are a controversial topic, but a decision by the Town Board could add more parcels within the Town limits, ultimately making room for a greater population under the Town government. There is discussion about annexation of the area between the Town border and the Highlands-Cashiers Hospital. Legally, the Town can annex any amount of area nearby. Under annexation, land owners will have to pay property taxes to the Town but will benefit from Town infrastructure and will be able to vote in Town elections. The vicinity within a one mile radius of the town can be under Extra Territorial Jurisdiction, allowing the Town to immediately enact all of its regulations without providing services to this area. Returning to the map in Figure 1, the circular line around the Town border shows generally how far the one-mile Extra Territorial Jurisdiction or annexation can extend.

Conclusion

Data Results

For now, there is room in the Town of Highlands and Township of Highlands for more development of residences and of local infrastructure. Construction is expanding and increasing living spaces all over the area. Outside of the Town boundaries, growth is unparalleled and

unrestricted. At some point, however, space will be depleted, and the area will reach its carrying capacity. Ultimately, land will be the determining factor limiting population growth.

In planning for a future filled with growth and development, population figures are essential. The past inconsistency in these figures is mainly due to the transient population. This report does not claim to surpass estimates from previous studies, but instead tries to assess the situation more cautiously. Through projecting various types of average growth rates into the future, population estimates and ranges for projected growth have been determined by the author (Table 9).

Town	2030
Permanent	1060 – 1230
Seasonal	~ 7000

Township	2030
Permanent	3100 - 4100
Seasonal	~ 12000

County	2030
Permanent	46800 – 47200
Seasonal	insufficient data

Table 9. Population growth projections and ranges for 2030.

As for infrastructure planning, more general, high-end estimates or larger numbers can be used successfully to consider maximum capacity. Although planning too ambitiously can cause lost revenue and time, underestimating the needs of the Town and surrounding areas can prove more expensive in the long run. In addition, no matter what numbers are used for planning, the natural environment should have greater weight in future decisions about Town infrastructure.

Considering population projections to be completed in the future, there are other calculation methods not discussed here. James D. West of the Blowing Rock Planning Board suggests using records from the post office, the school district, voter registration, and telephone accounts (pers. comm.). Bill Tillman, the state demographer, Richard Betz, the Town Administrator, and Skip Taylor of the Highlands-Cashiers Hospital all conclude that the best way to get an accurate portrayal of the seasonal and vacationer population of Highlands is to complete a survey. Going out into the area during different times of the year and asking people about themselves as well as their neighbors could be an effective in resolving many major questions about the population. The exact vacationer population would still be hard to calculate, but a survey would definitely be the most complete way to compile information.

Discussion

The natural beauty of the area, the climate, the high elevation, the proximity to major cities, and the atmosphere of the Town itself are all cited as reasons for tourism and migration to Highlands. These factors and others will continue to draw vacationers, seasonal residents, and permanent residents to the area, and more people will learn about Highlands' assets. Already, the population of the area is greater than it ever has been, and the tourist season continues to be extended. Surveys compiled and analyzed by Geoffrey Willett (1989, 1997) state that people like the quaint atmosphere of Highlands, and many think the area is already growing too fast, both in real estate and commercial development.

The continued population increase and extension of human impact have begun to negatively affect the environment. Fragmentation of animal habitats, increased soil erosion, and increased water and air pollution are just a few examples of effects that come from a larger human population. Sedimentation is a major concern for many streams and lakes in the area and has turned a few bodies of water into wetlands (Wright 2004). Sewage can drain into waterways from problematic septic systems. Clear-cutting destroys functioning parts of the forest. More people cause more noise and light pollution, decreasing quality of life for other humans. Overall, the growing human population and land use changes that come with this growing population have serious implications for biodiversity in the Highlands area.

Fortunately, some people have expressed concern not only for quality of life, but also for the environment. In the 1989 Results of the Citizen Survey, there was "strong favor, almost unanimous" of residents saying they liked the natural environment of Highlands "a lot." Likewise, the Land Use Planning Committee has stated that environmental issues should be a key focus. From here, a detailed focus and plan need to be created to help the environment. More specific regulations could instate mandatory storm water control on private property or ban clear cutting. As for regulating continued development, Coppock (1977) explains that it "rests squarely with the planning authorities to ensure that new second-home development is of such a quality, location, lay-out, and design as to minimize adverse environmental impact and possibly make environmental gain."

Decisions made by the Town government, specifically the Town Board, the Land Use Planning Committee, and the Zoning Board, will help shape continued growth in the area. Zoning regulations in Highlands are already strict, but if the Town or Town government is not content with the amount of present growth, more regulations can be put into place to control growth. For a more complete assessment of zoning and housing that includes both impacts of population and recommendations for the future, contact the author. Unlike the Town of Highlands, there are no zoning laws in place in Macon County, and unrestricted development could cause many problems. Population growth means further development, and every conflicting projection in this report agrees on one thing: population growth will continue.

References Cited

Bassham, Bill. 8 Oct. 2004. Highlands Chamber of Commerce. Personal Communication.

Bassham, Bill. 17 Nov. 2004. Highlands Chamber of Commerce. Email to author.

Betz, Richard. 8 Nov. 2004. Town Administrator. Personal Communication.

Chamber of Commerce, Town of Highlands. 2004. http://www.highlandschamber.org

Coppock, J.T. 1977. *Second Homes: Curse or Blessing?* Pergamon Press, Oxford

Dickson, W.K. Jan. 2002. Preliminary Engineering Report for the Town of Highlands Wastewater Treatment Plant Expansion.

Daniels, T. L., J. W. Keller and M. B. Lapping. 1995. *The Small Town Planning Handbook*. American Planning Association, Chicago.

Gallent, H. and M. Tewdwr-Jones. 2000. *Rural Second Homes in Europe: Examining housing supply and planning control*. Ashgate, Aldershot, England.

Gantenbein, Larry. 2004. Town Planner/Zoning Administrator. Personal Communication.

GIS Traffic Survey Maps. 2003. http://www.ncdot.org/planning/tpb/gis/DataDist/GISTrafSurvMaps.html

Guffey, Stacy J. 5 Sept. 2004. Macon County Planning Director. Email to author.

HCH Marketing Department. 2003. Demographic Report: Maximum Seasonal Population Projections.

Highlander, The. 2004. http://www.highlandsnews.com

House and Home. 9 Sept. 2004. http://houseandhome.msn.com/pickaplace/nf_details.aspx?search=1&zip=28741

Kean, T. H. 1991. *"Not in My Back Yard" Removing Barriers to Affordable Housing*.

Log into North Carolina. 2004. http://data.obsm.state.nc.us/pls/linc/dyn_linc_main.show

Marketek. Feb. 2004. Residential Growth Analysis for the Town of Highlands and Highlands Township, North Carolina.

Morris, Eric. 2002. Land Use Planning: Suggestions for Conservation Land Use in Highlands, NC. *Land Use and Biodiversity on the Highlands Plateau*: 80-94.

Municipal Population Estimates. 2003. http://demog.state.nc.us/muntot03.html

Owens, D. W. 1995. *Introduction to Zoning*. Institute of Government, The University of North Carolina at Chapel Hill.

Pankowski, Chester. 1 Nov. 2004. Practice Leader for Planning, Demographics, and Impact Analysis. Personal Communication.

Shaffner, R. P. 2001. *Heart of the Blue Ridge: Highlands, North Carolina*. Faraway Publishing, Highlands.

Taylor, Skip. 15 Oct. 2004. Director of Marketing, Highlands-Cashiers Hospital. Email to author.

Tillman, Bill. 10 Nov. 2004. State Demographer. Personal Communication.

United States Census. 1870, 1880, 1890, 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1990, 2000.

U.S. Census Bureau. 2003. http://factfinder.census.gov/home/saff/main.html?_lang=en

West, James D. 3 Nov. 2004. Chairman, Blowing Rock Planning Board. Email to author.

Willett, Geoffrey. 1997. Merchants Survey Results. Town of Highlands Planning Board.

Willett, Geoffrey. 1997. Property Owners Survey Results. Town of Highlands Planning Board.

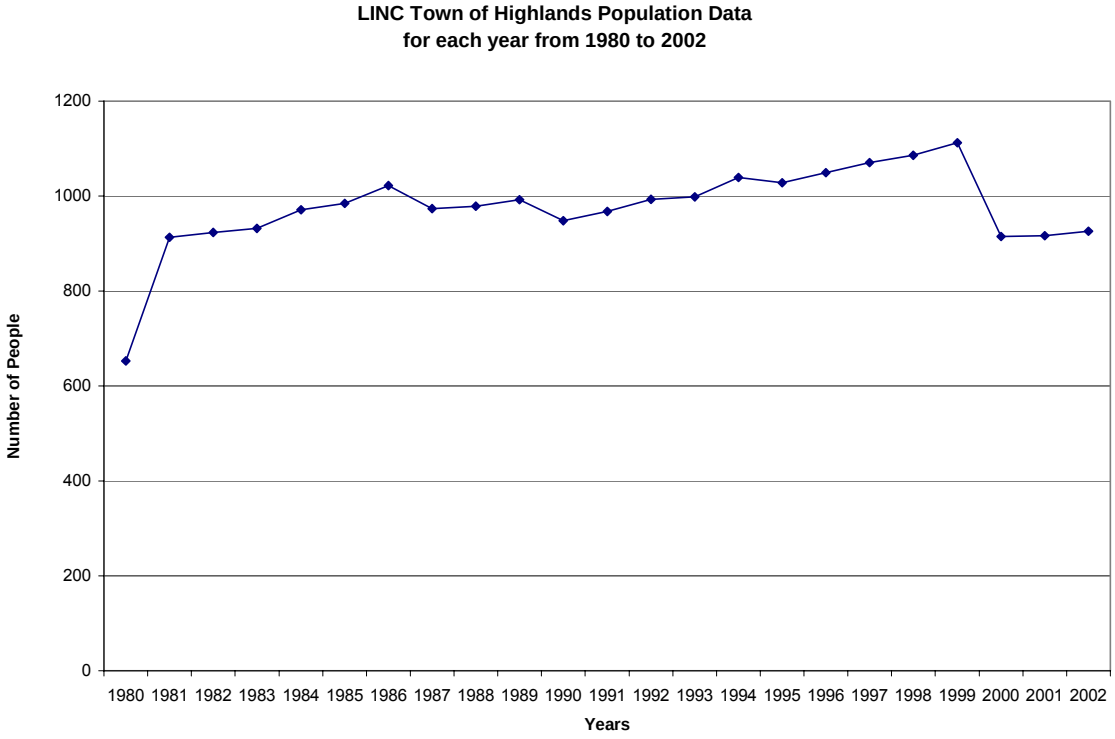
Willett, Geoffrey. 1989. Results of the Citizen Survey. *Appendix I of the 1989 Highlands Land Use Plan.*

Wright, Bob. 17 Nov. 2004. President, Upper Cullasaja Watershed Association. Speech.

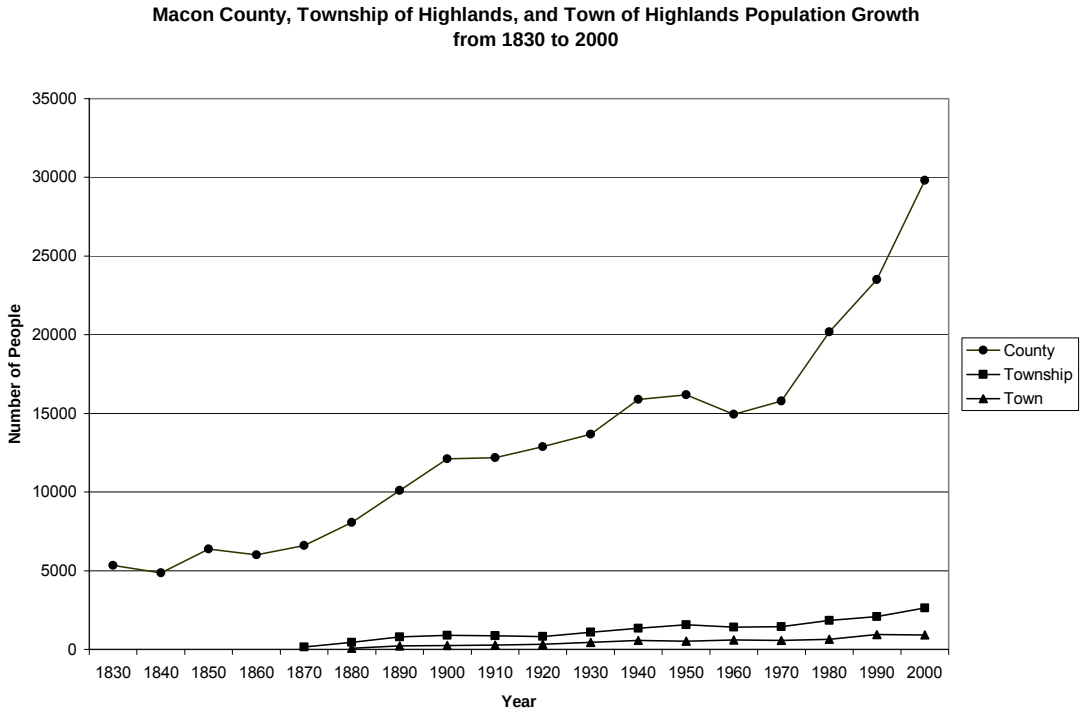
Zoning Ordinance of the Town of Highlands. 2004. http://www.main.nc.us/highlands/zonord.htm

Appendix

I. Yearly Population Growth in the Town of Highlands from 1980 to 2002



II. Historical Population Growth in Macon County from 1830 to 2000



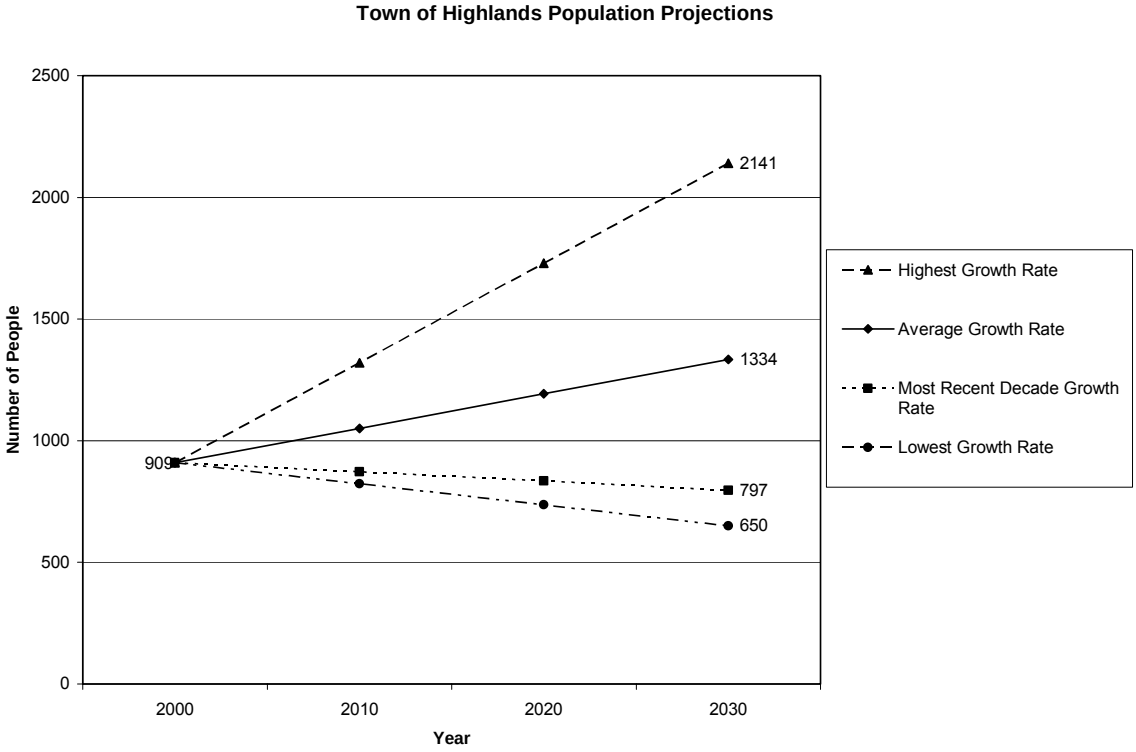
III. Dickson Population Projections

Year	Permanent Residents	Seasonal Residents	Transient	Total Population
2001	1152	4637	900	6689
2002	1173	4819	900	6892
2003	1194	5009	900	7102
2004	1215	5205	900	7320
2005	1237	5410	900	7547
2006	1259	5623	900	7782
2007	1281	5844	900	8025
2008	1304	6073	900	8278
2009	1328	6312	900	8540
2010	1351	6560	900	8811
2011	1376	6818	900	9093
2012	1400	7086	900	9386
2013	1425	7364	900	9690
2014	1451	7654	900	10004
2015	1477	7954	900	10331
2016	1503	8267	900	10670
2017	1530	8592	900	11022
2018	1558	8930	900	11387
2019	1585	9281	900	11766
2020	1614	9645	900	12159
2021	1643	10024	900	12567
2022	1672	10418	900	12990
2023	1702	10828	900	13430
2024	1732	11253	900	13886
2025	1763	11696	900	14359

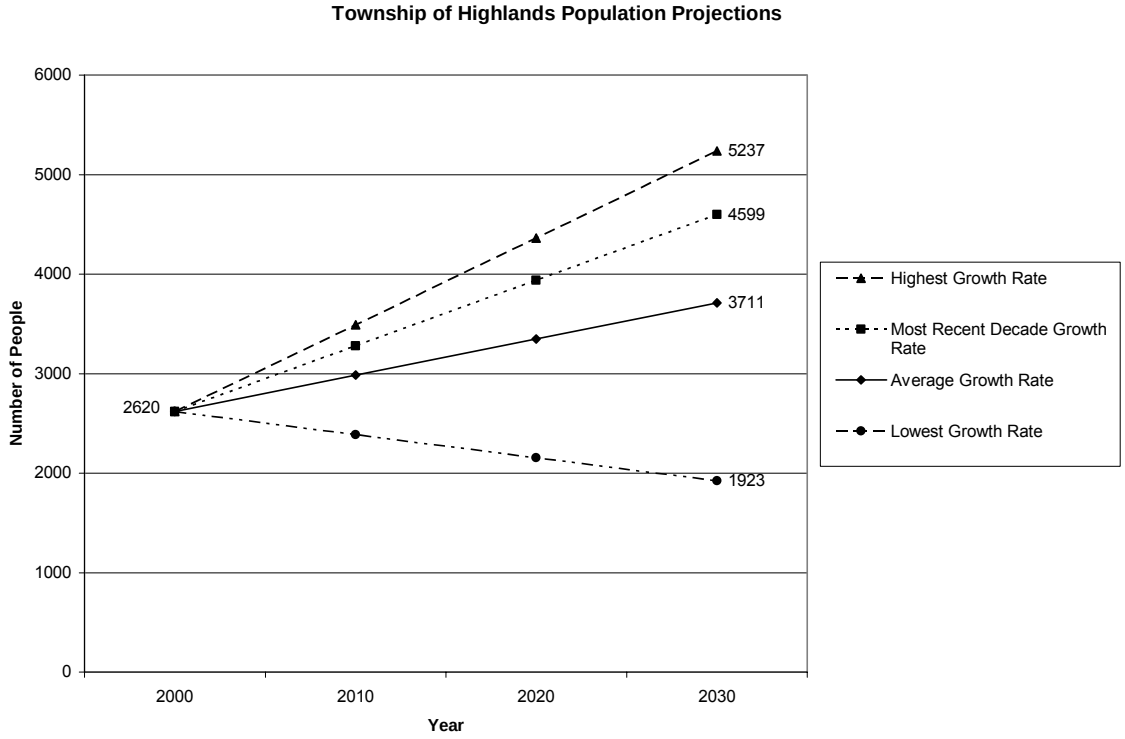
IV. HCH Study Maximum Seasonal Population Projections

Year	Total Housing Units	Total Population
2003	4000	8520
2004	4076	8682
2005	4153	8847
2006	4232	9015
2007	4313	9186
2008	4395	9361
2009	4478	9539
2010	4563	9720
2011	4650	9905
2012	4738	10093
2013	4828	10284
2014	4920	10480
2015	5014	10679

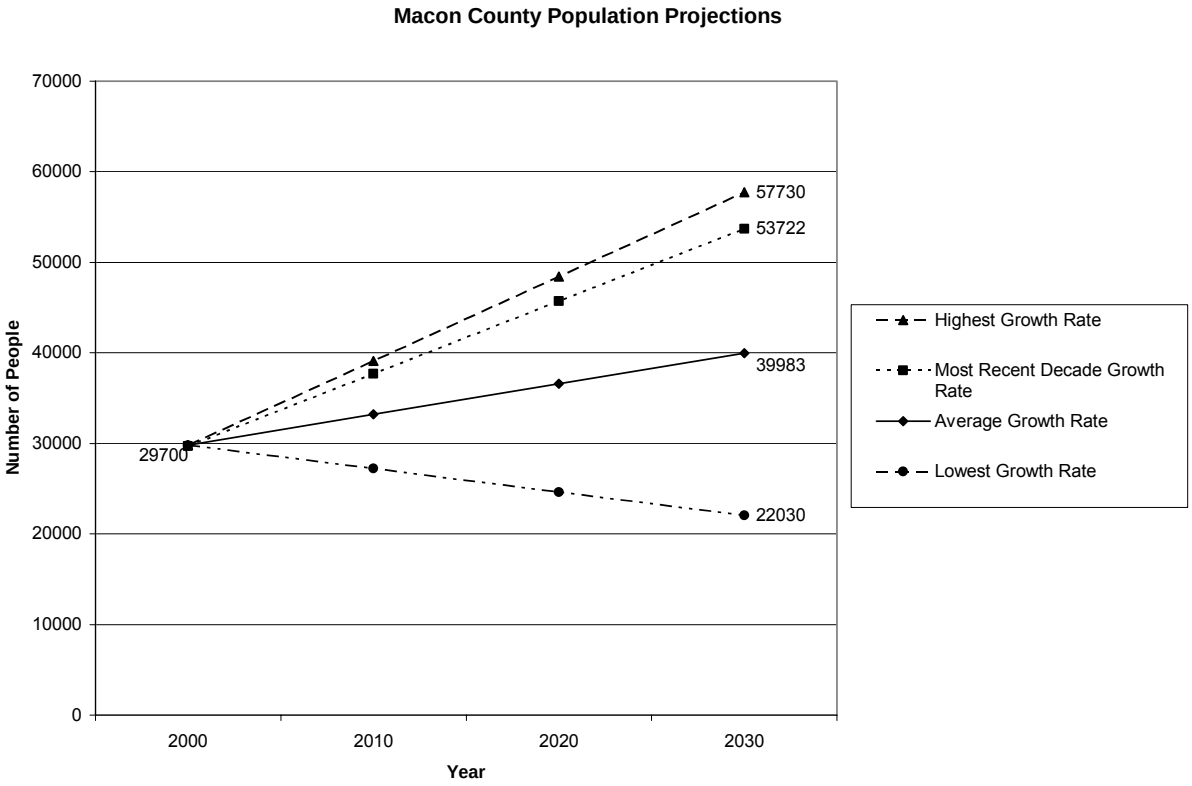
V. Town of Highlands Range of Projections



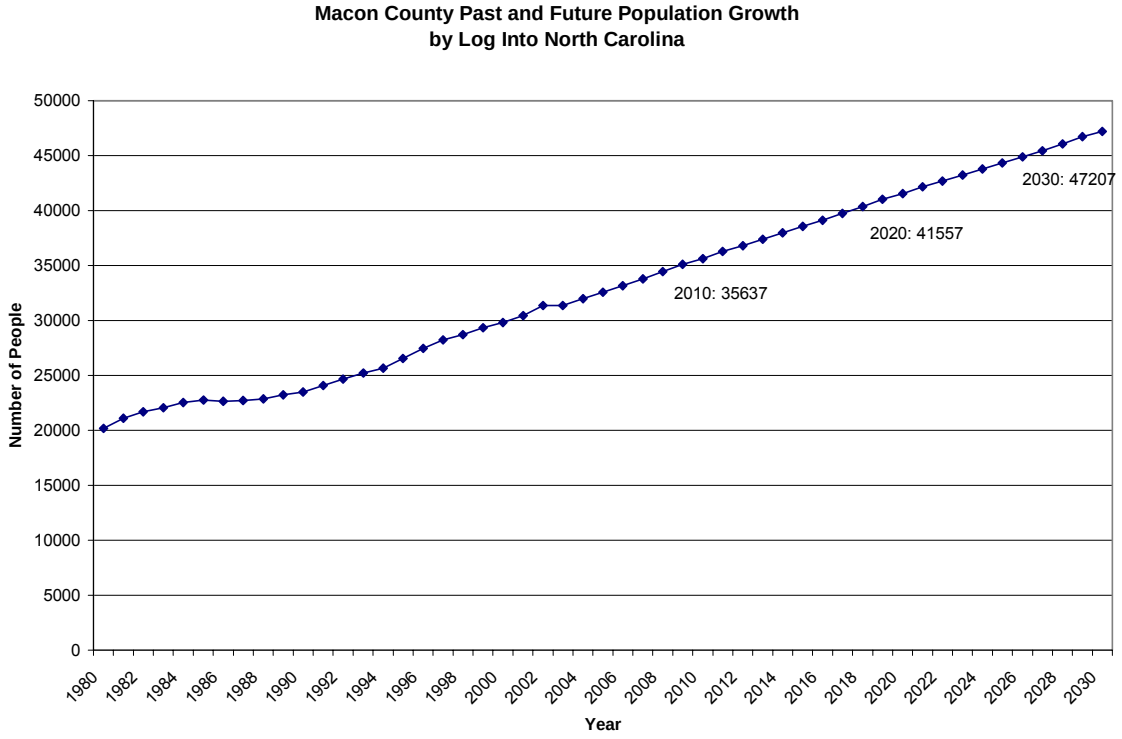
VI. Township of Highlands Range of Projections



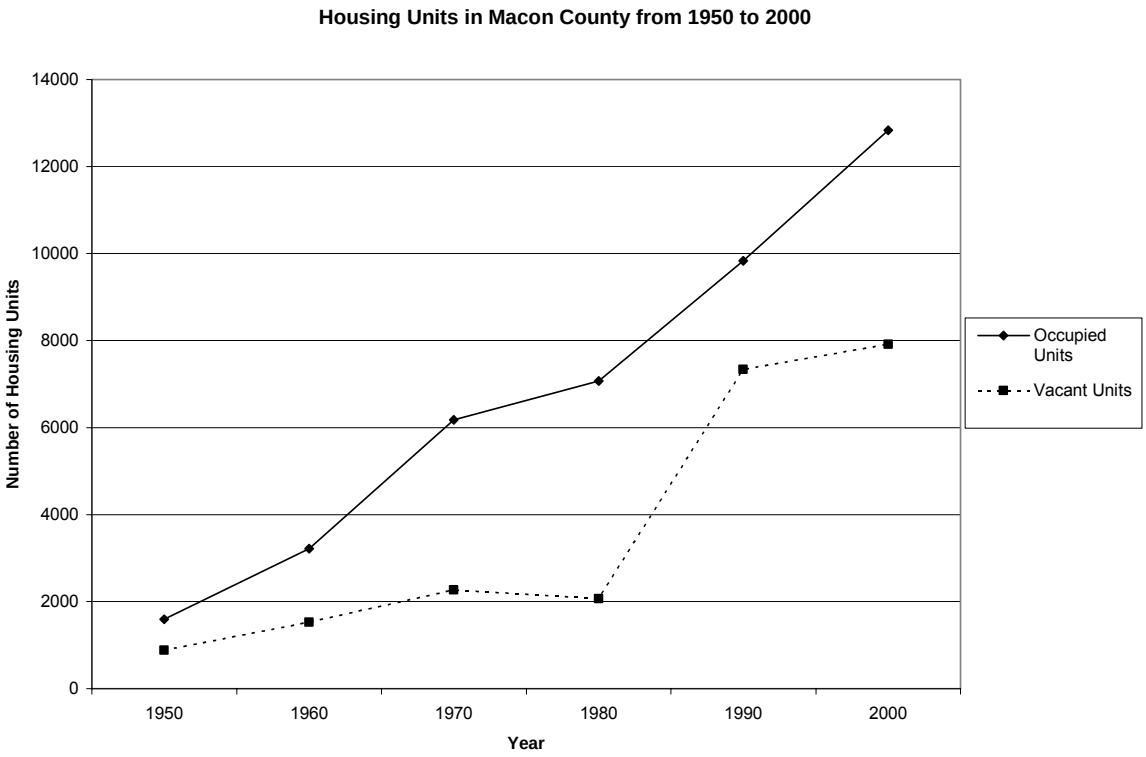
VII. Macon County Range of Projections



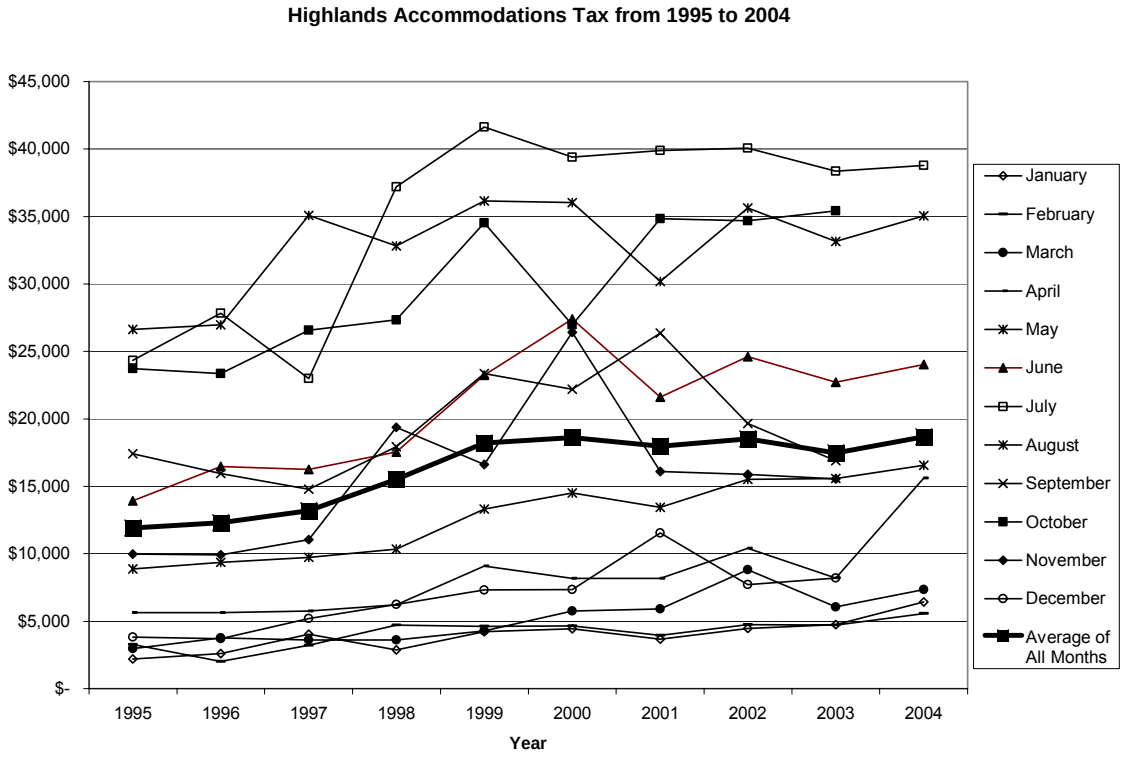
VIII. LINC Macon County Population Projections



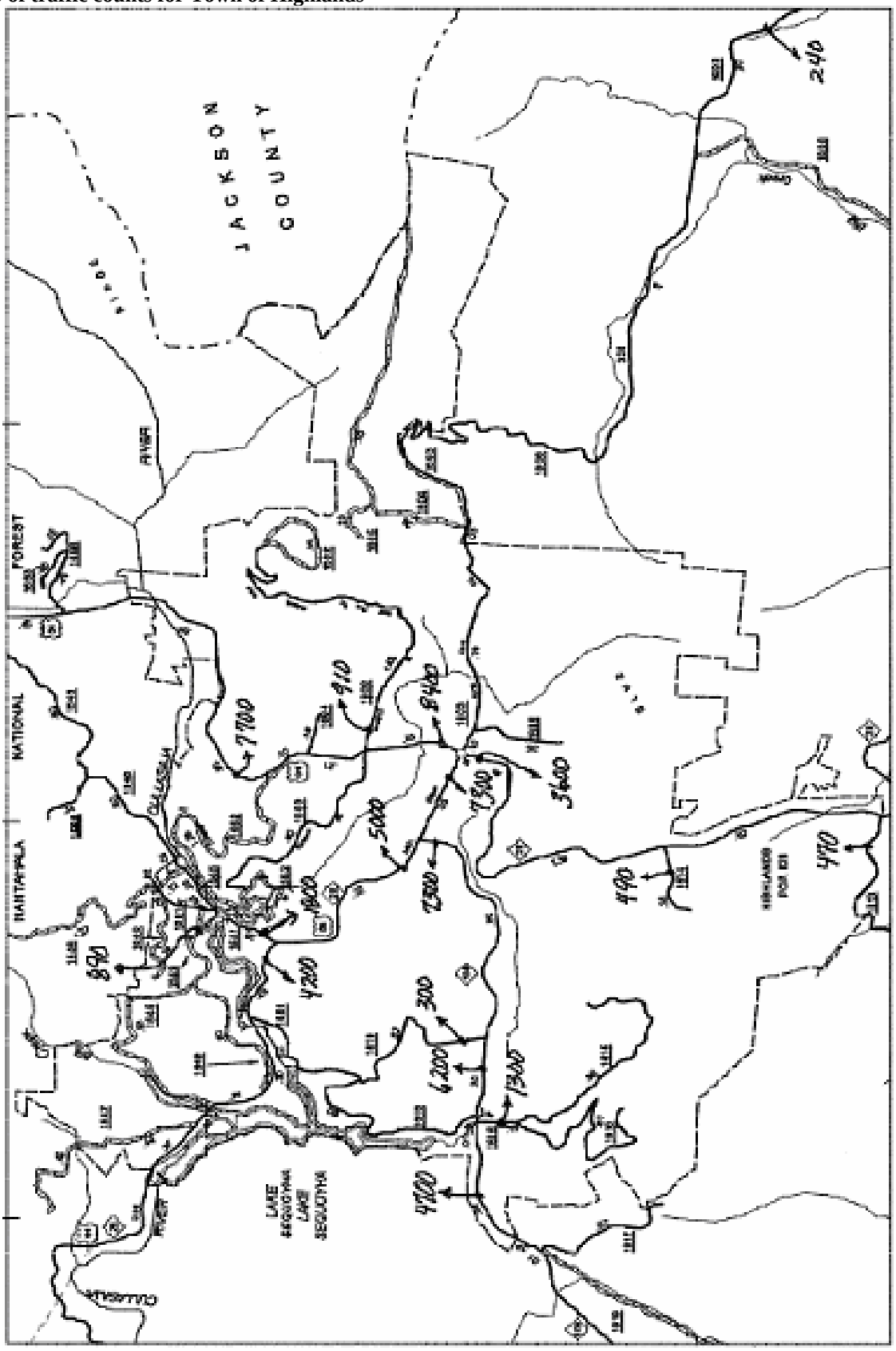
IX. Macon County Vacationer Data



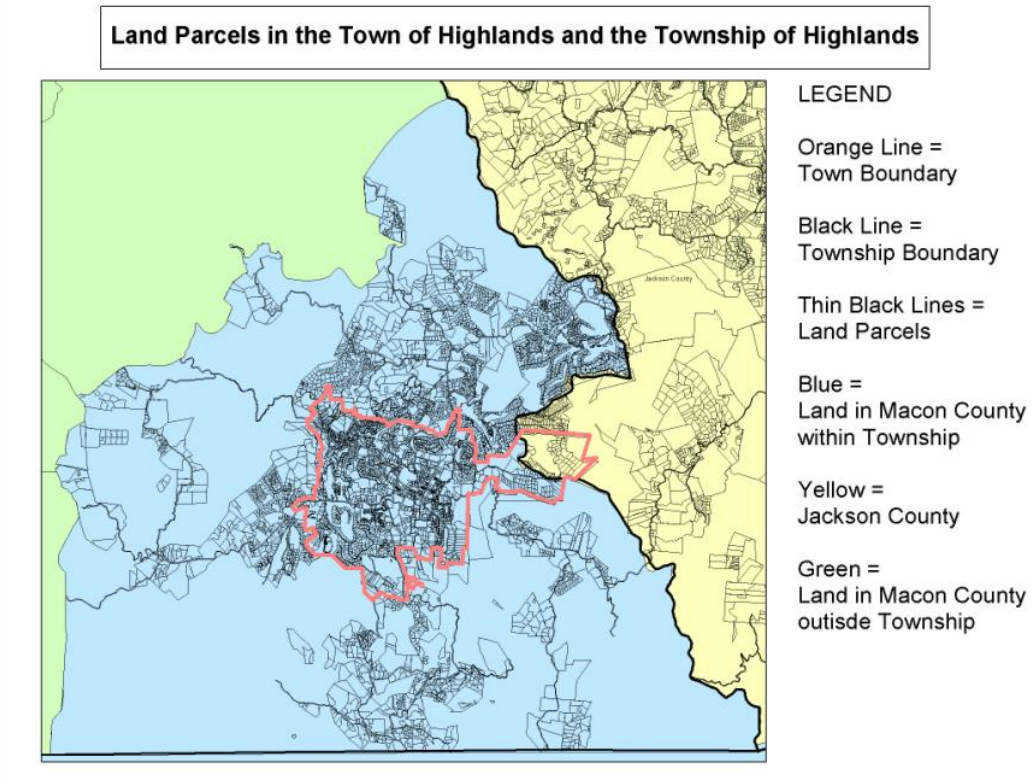
X. Town of Highlands Accommodation Tax Records



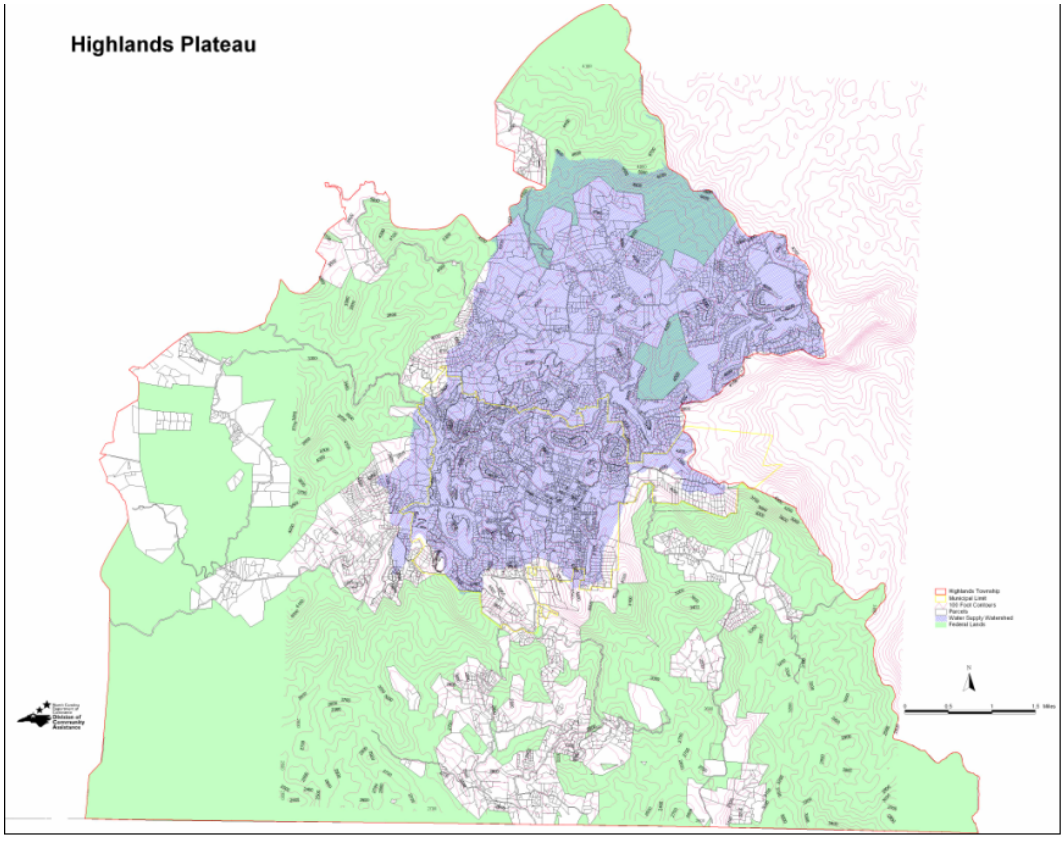
XI. Map of traffic counts for Town of Highlands



XII. Map of land parcels in Township



XIII. Map of National Forest locations within the Township (light green areas represent National Forest)



XIV. Total Annual Construction Costs in Millions of Dollars for the Town of Highland from 1989 to 2004

An Assessment of Conservation Priorities on the Highlands-Cashiers Plateau Using Geographical Information Systems

Andrew Roe

Introduction

Since the last decade of the nineteenth century, private, non-profit conservation organizations known as land trusts have been protecting land from development. A land trust is recognized as an independent charitable organization under federal tax laws and actively works to preserve land by undertaking or assisting direct land conservation transactions. According to the Land Trust Alliance (LTA), a national coordination organization, there are more than 1,300 of these nonprofit land trusts across the country. According to the Conservation Trust for North Carolina (CTNC), a statewide land trust and resource center, more than 130,000 acres of land in the state had been protected by land trusts by 2001. Land trusts in the United States have protected more than 4.7 million acres of land (Gustanski 2000).

Preservation of the Highlands-Cashiers Plateau, an ecologically and culturally rich area in Macon County and Jackson County, North Carolina, has been undertaken by the Highlands-Cashiers Land Trust, Inc (HCLT). The current executive director of the Land Trust is Mike Cavender and its main offices are located in the Peggy Crosby Center, on Fifth Street in Highlands, North Carolina. The stated mission of the Land Trust is, "To preserve the natural areas, scenic beauty, and green spaces of Highlands and Cashiers for the enjoyment and benefit of the public." In following this mission, the Land Trust has set forth several specific goals:

- to acquire and manage natural areas;
- to protect native species of plants and animals;
- to preserve the area's rural and cultural heritage;
- to sustain air and water quality and biological diversity;
- to provide opportunities for outdoor education and recreation; and
- to enhance and buffer communities.

The main tools for achieving these goals are direct acquisition of land or placement of conservation easements that limit the development of land. The Land Trust currently owns 16 pieces of property in Macon County and one property in Jackson County (Table 1). It also holds

conservation easements on several pieces of land on the Plateau (Figure 1). More than 400 acres of land have already been protected for the community and several pieces of land under negotiation will increase that number dramatically in the near future.

The Highlands-Cashiers Land Trust is a relatively small organization. This provides some distinct advantages. According to Michael Clarke, president of Natural Lands Trust in Media Pennsylvania, "A small land trust can easily be more effective than larger land trusts in promoting local leadership and developing working relationships with landowners. While a large land trust may have more impressive experience, it will not necessarily have good connections within a local community—and it may even be regarded with suspicion as an outsider. Opportunities often exist for the small and larger organizations to work together" (Clarke 1997). Furthermore, the small scale of the organization allows more detailed observation and flexibility for land identification.

The origins of the Highlands-Cashiers Land Trust go back to 1909, when local citizens united to raise $500 to save the top 60 acres of Satulah Mountain from development. The Highlands Land Trust was officially formed in the late 1980s and began to pursue property in the Highlands Plateau in the early 1990s. In 2003 the Land Trust decided to expand its conservation services to the area around the town of Cashiers in Jackson County, North Carolina. This has not only increased the possibilities for more land to be protected, but has raised some unique challenges for the organization to define itself and accomplish its goals efficiently.

To reach its preservation goals, the Land Trust has embarked on a strategic plan to identify and pursue land actively for preservation within its service area. The organization has entered into a relationship with the University of North Carolina at Chapel Hill's Carolina Environmental Program and its students at the Highlands Biological Station. The first student intern, Jeff Davis, did a preliminary project researching the possible applications of Geographic Information Systems (GIS) with the land trust. As the second student intern, I, Andrew Roe, will be using GIS to build on Jeff Davis' work and acting to meet the following goals set forth by the Land Trust:

- to define a clear service area;
- to identify key areas for protection or acquisition;

- to produce maps to inform landowners and gain public support; and
- to leave a system in place that can be easily modified and updated by future interns.

These objectives fit into the Land Trust's efforts to comply with Standard 8 of the Land Trust Alliance's Land Trust Standards and Practices guidelines (2004): Evaluating and Selecting Conservation Projects.

The Use of GIS in Conservation Planning

For centuries cartographers have used layered maps to relate geographic information. During the last half of the twentieth century, the technology known as Geographic Information Systems, or GIS, has been developed as a sophisticated, computer-based method to analyze and present this information. According to John Randolph, a professor of environmental planning at Virginia Polytechnic Institute, "Geographic Information Systems have emerged as one of the most useful tools in environmental land planning, indeed in all applications that have a spatial dimension" (Randolph 2004). This utility for preservation organizations was further enhanced by Edwards and Kelcey Inc. planning director Brian McMahon (1998): "A Geographic Information System (GIS) is a powerful and versatile tool that can be used by land trusts to help identify priorities for acquisition or protection. It can also help land trusts quickly understand the resources on a parcel of land, develop individual property management plans, and identify potential donors for specific deals."

A geographic information system (GIS) is a coordinated set of tools for the management, analysis, and display of geographic knowledge. GIS computer software allows users to process and manipulate forms of spatial data, referred to as "layers." This spatial information can then be represented through maps and electronically linked to information contained in databases.

For this analysis, the ArcMap ™ 8.2 computer program was used. This program is produced by Environmental Systems Research Institute, Inc. (ESRI), which produces a wide array of GIS software. The program was installed on a Gateway personal computer platform in the Highlands Biological Station computer lab.

As identified by Jeffrey Davis in his 2001 Capstone report, "Land Conservation," a crucial component of performing a mapping analysis is to assemble a sufficient database of

suitable layers. A wide range of spatial information and data forms is available on government internet sites (Randolph 2004), and data for this analysis were obtained from the resources of several individuals and institutions (Table 2). Dr. John DiBari, Assistant Professor of Landscape Ecology at Western Carolina University, kindly provided a large amount of information for the Macon and Jackson County areas. These included layers showing the locations of county lines, city boundaries, roads, streams, and land parcels of the two counties. The Natural Heritage Program, a part of the North Carolina Department of Environment and Natural Resources, provided layers showing the locations of species and significant natural heritage areas identified during their natural heritage inventory, as well as the locations of areas already protected and managed by government agencies and the Nature Conservancy. The Macon County GIS department, through its website (www.maconnc.org) provided a great deal of information, with parcel maps tied to a large database of information.

The Highlands-Cashiers Land Trust, like all small, non-profit organizations, is faced with the challenge of determining where to allocate and focus limited resources. The goal of this project is to combine scientifically established management strategies with the technological power of GIS to narrow the focus of the organization. As part of his research for the Highlands Land Trust, Jeffrey Davis identified six factors for identifying land for conservation. These factors include:

- cost, or market value of land upon availability;
- public access for low impact recreational use;
- presence of rare species of plants and/or animals;
- corridor areas that connect natural habitats;
- presence of fragile, rare or endangered habitat types; and
- proximity to water resources.

Each of these factors was researched and the results are discussed in this report. Using these six criteria, scientific guidelines, and available GIS data, parcels on the Highlands-Cashiers Plateau will then be identified and saved as separate GIS layers. Using these files, a series of maps will be produced that can be used by the Highlands Cashiers Land Trust to prioritize land parcels for acquisition and to use in public presentations. The analysis will borrow from the

Little Tennessee Watershed Prioritization Model prepared for the Land Trust for the Little Tennessee in 2002 by Will Allen and Dan Tinker (Allen and Tinker 2002).

The ultimate objective of the project is to produce a consolidated map presentation, combining maps of the identified criteria, to quantitatively identify a specific group of priority land parcels on the Highlands-Cashiers Plateau that best fit into the strategic conservation goals of the Land Trust.

Definition of Land Trust boundaries

The Highlands Land Trust expanded in 2003 to encompass the region around the town of Cashiers, North Carolina. Cashiers is located approximately ten miles east of Highlands, in southern Jackson County. This expanded the Land Trust territory to encompass the entire region known as the Highlands-Cashiers Plateau, a region that has never been absolutely defined. The first task of this GIS analysis was to define a clear and absolute boundary for the territory for land protection by the Highlands-Cashiers Land Trust.

Several existing landmarks were considered for defining the Land Trust's service boundary. These included political, ecological, elevation, and watershed features of the area. Each of these features is discussed in the following paragraphs in relation to how they were considered in determining a boundary that would be located subject to various constraints.

The roads and political features of the area presented several options for defining the Land Trust's territory (Figure 3). The most immediately obvious boundary for the Highlands-Cashiers Land Trust territory was the border between North and South Carolina. This political boundary is simple, well-defined, and universally recognized. The eastern boundary for the territory appeared to be best served by a political boundary as well. The border between Jackson and Transylvania County appeared to be the best and easiest compromise between the Highlands-Cashiers Land Trust territory and the territory of another land conservation group, the Carolina Mountain Land Conservancy.

The prospective Plateau territory for the Highlands-Cashiers Land Trust is bounded by three other local land trust organizations (Figure 4): The Land Trust for the Little Tennessee, the Carolina Mountain Land Conservancy, and the Chattooga Conservancy. There are other land

protection organizations active in the area as well. The USDA Forest Service owns a large amount of land in the area and the Nature Conservancy owns several pieces of land. Special consideration had to be made for the boundaries of these groups in order to preserve vital working relationships between the organizations.

The Land Trust for the Little Tennessee is a nonprofit organization dedicated to conserving the rural lands, forests, and waters of the upper Little Tennessee Valley (www.ltlt.org/about.html). It has headquarters in Franklin, North Carolina. Some streams that make up the headwaters of the Little Tennessee River originate on the Highlands-Cashiers Plateau, but most of their conservation activities have taken place closer to the town of Franklin, in central Macon County.

The Carolina Mountain Land Conservancy is a local nonprofit organization that is based in Hendersonville, North Carolina (www.carolinamountain.org). Their territory encompasses most of the two counties to the east of the Highlands-Cashiers Plateau. Their website shows their territory extending into Jackson County as far as Cashiers. Negotiations between the Highlands-Cashiers Land Trust and the Carolina Mountain Land Conservancy determined that they would be willing to accept the Jackson County line as a boundary between the two territories.

The Chattooga Conservancy is a nonprofit organization dedicated to protecting the Chattooga River Watershed in Georgia, South Carolina, and the mountains of western North Carolina (www.chattoogariver.org). Their office is located in Clayton, Georgia. They are working to protect areas along the watershed, which extends into the southern part of Macon County, just south of Highlands.

In order to allow the Land Trust for the Little Tennessee to maintain their territory along that watershed, the Highlands-Cashiers Land Trust sought to impose on itself a clear territorial restriction to higher areas and only the uppermost water sources. The clearest definition appeared to be a boundary along an elevation gradient of 3,200 feet above sea level to the north and west of Highlands and Cashiers (Figure 5). The elevation of the area does drop below this height on the southeast corner of the Plateau, but it was decided that the 3,200 foot boundary could be limited to the northern and western sides of the Plateau. The elevation gradient would

also serve to define the ecological factors under protection of the Land Trust. It will limit the territory to include montane ecosystems and the headwaters of several bodies of water.

As one of the largest landowners in the Southern Appalachians, the USDA Forest Service oversees more than 70,000 acres of land as National Forests in the Plateau area (Figure 6). The boundaries of these properties are well defined and are clearly displayed on many maps that are produced for public use. Furthermore, these areas are already under the management of the federal government and are not available for Land Trust protection. These National Forest boundaries were used to further define the territory boundary.

Using the previously mentioned factors, a rough map of the Land Trust's territory boundary was constructed (Figure 7). The boundary encompasses a total area of approximately 268 square miles, or 171,500 acres. A small amount of overlapping protection territories between neighboring land trusts was deemed to be acceptable in order to provide complete coverage of all land parcels and to prevent any areas from being overlooked by the organizations. The overlaps also provide opportunities for land trusts to work together for land protection as long as good communication and positive relationships are maintained. The construction of a boundary also allowed the GIS shapefiles to be limited to a clear geographic scope.

Conservation Priorities

Market Value and Development Status of Properties

In considering areas of land for preservation, the development status and costs of land parcels should be thoroughly examined. The cost of property is a significant factor in any negotiation of preservation. Land values of property in Macon County vary greatly (Figure 8), and these values have been increasing dramatically over the past decade with an increased demand for mountain property for residential homes. Fortunately, the Highlands-Cashiers Land Trust has been able to protect the majority of its acreage through fee simple donations and conservation easements. These preservation measures, commonly utilized by land trusts, do not involve actually purchasing land from the land owner. Therefore, the overall value of the property is not as critical as other factors in identifying key parcels of land on which to focus.

The amount of development on a piece of property is also a significant factor in targeting parcels for acquisition. There are still a large number of undeveloped parcels in Macon County. However, parcels of land with buildings already in place should not be ruled out for conservation. Conservation easements can still be placed on parcels of land that have buildings but also have a large amount of undeveloped acreage.

These ideas were incorporated into two GIS layers displaying two different factors. All parcels with no buildings were identified (Figure 9) and saved as a new layer. Additionally, land parcels were categorized by their acreage divided by the number of buildings on the property (Figure 10) and saved as a new layer. It was intended that these files be used to fulfill the "cost and market value" factor identified by Jeffrey Davis for the final prioritization combination. Unfortunately, this information was only readily available through the Macon County GIS database. To avoid skewing the results in favor of Macon County properties, these layers will be excluded from the final prioritization combination.

Public Access

The beauty and richness of the natural environment of the Highlands-Cashiers Plateau is an important resource for all of its residents, whether they are permanent, seasonal, or transient. Providing protection of natural areas with public access so that citizens can enjoy and learn about them is one of the primary goals of the Highlands-Cashiers Land Trust.

Preserving natural habitat, or green space, within urban communities provides several advantages to the community. It fulfills a variety of public health, recreation, planning, and economic functions (Pryde 1976). These areas also serve to protect portions of habitats for ecosystems which continue to interact with and enhance the urban setting. For example, open space within cities has been found to maintain high biodiversity in some groups of species, such as birds and butterflies. To retain such benefits, conservation organizations are advised to work towards ensuring the creation and maintenance of suitable habitats within developing areas (Mason 2000).

Two factors were used in determining the public access qualifications of each land parcel: 1) the parcel's proximity to a major road, and 2) distance to downtown. It was

determined that parcels bordering major roads would be visually important to the area, as well as relatively easy to access for recreation. Moreover, areas within city limits and those located just outside the city limits should be high priorities for publicly accessible land. For these reasons, all land parcels within a half mile of the major roads of Macon and Jackson County were included as a separate layer (Figure 11). Parcels within town boundaries and parcels within one mile of town boundaries used to create another layer (Figure 12). These layers will both be used to fulfill the "public access" factor identified by Jeffrey Davis for the final prioritization combination.

Habitat Connectivity and Wildlife Corridors

Increasing development, which encroaches on forested lands, continues to fragment the landscape of the Highlands Cashiers Plateau. Several negative effects of habitat fragmentation are exaggerated in human-dominated landscapes (Sharitz 1992). These include reduction in the amount of total forest habitat, smaller habitat patches, patch isolation, and edge effects. Although it may not be as important a factor as overall habitat loss, habitat fragmentation remains detrimental to populations. It can be especially harmful to species that require interior forest conditions or those that require several habitats in close proximity, especially large mammals (Sharitz 1992).

A strategy of implementing wildlife connectors or corridors is a valuable tool for reducing the effects of habitat fragmentation. These interconnections among patches in a landscape are significant to the maintenance of diversity (Noss 1983). Many species appear to benefit from wildlife corridors that link areas of suitable habitat. These include species that avoid dispersing through open areas, and species for which adequate habitat suitability is a primary factor influencing dispersal (Lindenmayer 2002). Corridors may also enhance dispersal success by reducing mortality during such movement, such as those caused by crossing multiple roads and open yards. The larger wildlife corridors are, the more benefits they appear to have, because they better approximate interior forest conditions and minimize edge effects, capture a greater array of habitat types, and have a higher probability of supporting populations of resident animals (Lindenmayer 2002). Corridors may need to be more than 100m wide for the migration

of some interior species (Ranney 1981). It may also be useful to promote the development of "stepping stones" of small forest tracts to encourage dispersal between forest islands on private lands (Diamond 1975).

Connectivity potential was incorporated into a GIS layer displaying all parcels bordering existing protected land (Figure 13). Preservation of these areas would increase contiguous habitat and might eventually lead to the development of permanently protected corridors between the areas. Another layer was created showing land parcels categorized by size (Figure 14) and saved as a new layer. Larger parcels will be given more weight in the final analysis because they present an opportunity to protect more contiguous habitat in one transaction. These files will both be used to fulfill the "corridor area" factor identified by Jeffrey Davis for the final prioritization combination.

Water Resources

Watersheds are one of the most basic and important ecological units in the Appalachian landscape. A watershed is an area of land from which all surface and underground water drain to a common waterway. Each of these drainage basins is unique, varying with rainfall and topography. The Highlands-Cashiers area encompasses the watersheds of the headwaters for two very important bodies of water: the Savannah and Little Tennessee Rivers (Figure 15).

The town of Highlands, and areas to the north and east, is located almost entirely within the Upper Cullasaja watershed. All water that falls into the watershed flows into Lake Sequoyah and over the dam into the Cullasaja River. The Cullasaja is a major tributary for the Little Tennessee River. Water that falls to the north and west of Cashiers flows into the Thorpe Reservoir, which also eventually feeds into the Little Tennessee River. Water that flows to the south of the two towns flows into the Chattooga River, which flows southwest into the upper Savannah River. Water that flows to the east and southeast of Cashiers flows into the Whitewater River, which feeds into Lake Jocassee in South Carolina and eventually into the upper Savannah River (Figure 16).

The rivers flowing off of the Highlands-Cashiers Plateau flow in opposite directions, eventually flowing into two distant portions of the ocean. The Little Tennessee River flows into

the Tennessee River after crossing the Tennessee border. Water in the Tennessee River flows into the Mississippi River and eventually reaches the Gulf of Mexico. The Savannah River flows in a southeasterly direction from the Blue Ridge province of North Carolina, South Carolina, and Georgia, toward Charleston, eventually emptying into the Atlantic Ocean.

The lands surrounding the headwaters of these streams have great biological significance. A large proportion of the biodiversity found in forested landscapes is associated with aquatic ecosystems (Lindenmayer 2002). The number of amphibian species, a group very important to the Highlands-Cashiers plateau, increases in streams with increased levels of uncut forest cover (Corn and Bury, 1989). Preservation is traditionally focused on major fish-bearing streams and rivers and on the main channel of these waterways. However, small streams may actually support most of the biodiversity, represent the bulk of aquatic habitat, generate most of the aquatic productivity, and act as the source areas for large woody debris, sediments, and water volume which are essential for the biodiversity of these larger channels (Lindenmayer 2002).

Riparian areas are not just important centers of biodiversity. They have a broad ecological impact (Table 3, from Sharitz 1992). They are very efficient at removing harmful nutrients from runoff and stream flow. Forested wetlands and riparian zones have been reported to remove 20% to 90% of nitrogen and 20% to 80% of phosphorous (Kuenzler 1989). They also affect other abiotic factors, such as maximum stream temperature, which decreases as the percentage of forest cover upstream increases (Barton, 1985). Furthermore, one of the best ways to provide wildlife corridors is to maintain forest cover along waterways (Recher et al. 1987).

Appropriate buffer widths for streams depend on several factors, including stream size, forest type, topography, soil conditions, the type of species and ecological processes targeted for protection, and any silvicultural systems or harvesting machinery employed in the surrounding forest (Lindenmayer 2002). Proposed and adopted widths for streamside corridors vary widely from near-stream buffers of 10m to buffers that cover 100m or the entire floodplain (Pearson, 2001). Research suggests that riparian vegetation in buffer strips as narrow as 10-30m significantly ameliorate the transport of nutrients and sediments into streams (Karr 1978). In addition, buffer minimums for particular species can be measured: 30m (Lemckert and Brassil 2000) and 45m (Pearson and Manuwal 2001). Federal policies in the northwestern United States

exemplify an approach that is ecologically conservative. All channels, including intermittent ones, have buffer widths equal to surrounding tree heights or a minimum streamside corridor width of 100m (Lindenmayer 2002)

This information was incorporated into a GIS layer displaying only those parcels located within the conservative distance of 100m from all bodies of water. At the recommendation of the Land Trust strategic planning committee, land parcels within 500m of streams were also identified and incorporated into a separate layer (Figure 17). These layers will both be used to fulfill the "proximity to water resources" factor identified by Jeffrey Davis for the final prioritization combination.

Sensitive and Important Ecological Factors

The southern Appalachians region contains a variety of unique ecosystems and rich biodiversity. The Highlands vicinity has long been considered one of the "richest" for outstanding natural areas in the entire Southern Appalachians region. In the early 1990s, the Town of Highlands contracted the North Carolina Natural Heritage Foundation to administer an inventory of significant natural areas of the Highlands area (Gaddy 1992).

The Natural Heritage Program is a part of the Office of Conservation and Community Affairs, which is a part of the North Carolina Department of Environment and Natural Resources. The Program has collected an extensive amount of information about rare species and the best examples of natural communities in the state through its Natural Heritage Inventory. This database is available online (http://www.ils.unc.edu/parkproject/nhp/).

The program identified several ecologically significant occurrences on the Highlands-Cashiers Plateau. A great number of species identified by the state and federal government as endangered, threatened, or of special concern were located and recorded (Table 4). Several communities identified as significant natural heritage areas were also located in the area (Table 5).

The layers for this analysis were kindly provided by Scott Pohlman, protection specialist, and Michael P. Schafale, community ecologist, of the Natural Heritage Program in Raleigh. The files provided several pieces of information on natural occurrences across the state. These

included the exact locations of state and federal listed species and significant natural communities (Figure 18). Land parcels that contained these elements and land parcels that contained portions of these significant areas were selected and saved as separate shapefiles (Figure 19). Areas that bordered these parcels were also identified as important for habitat contiguity (Figure 20). These files will be used to fulfill both the "rare species" and "important habitats" factors identified by Jeffrey Davis for the final prioritization combination.

Natural Areas Prioritization Model and Ranking System

To begin the process of identifying key areas for conservation, a prioritization model was developed. This model is based on the Land Trust for the Little Tennessee Watershed Prioritization Model prepared by Will Allen in 2002. The work is based on parcel maps for Macon and Jackson County. Each parcel of land receives a score between 0 and 10 for each category, as described below. The scores are then combined to produce a total priority value.

Market Value and Development Status

This information is currently only readily available for Macon County, which would increase the values for all Macon County parcels relative to Jackson County Parcels. Therefore, this information will not be used in the final prioritization.

Habitat Contiguity:

5 = Total parcel size > 500 acres

4 = 100 to 500 acres

3 = 50 to 100 acres

2 = 25 to 50 acres

0 = < 25 acres

5 = Parcel is adjacent to existing protected lands

0 = Parcel is not adjacent to existing protected lands

Riparian Proximity:

10 = Parcel is within 100m of water

3 = Parcel is 100 to 500m from water

0 = Parcel is more than 500m from water

Significant Biological Features:

5 = Parcel contains Natural Heritage Identified Element

3 = Parcels border area with Natural Heritage Identified Element

0 = Parcel does not contain or border Natural Heritage Identified Element

5 = Parcel overlays Natural Heritage Significant Area

3 = Parcels border area with Natural Heritage Significant Area

0 = Parcel does not overlay or border Natural Heritage Significant Area

Public Accessibility:

5 = Parcel is within 0.5 mile of major road

0 = Parcel is more than 0.5 mile from major road

5 = Parcel is downtown or within 1 mile of town limits

0 = Parcel is more than 1 mile from town limits

Combination Procedure

The production and combination of ArcMap files to accomplish the prioritization model is a multi-step process (Table 6). To begin, a large amount of data must first be obtained. Parcels fitting the criteria previously outlined are then identified and saved as new layers. These layers are converted to RASTER format, which changes the shapefiles to a series of small squares, or cells. A formula is then developed to correctly weight and add the values of the identified land parcels for each category. Parcels of land that are already protected are then subtracted from these totals. This process produces a map for each county with a score value for

each parcel of land. The county parcel map is overlaid as a clear layer on top of this map so that parcels can be identified.

Analysis

The combination of all weighted parcel identification yields a distinct priority map for each county section of the Highlands-Cashiers Plateau (Figures 21 and 22).

In Jackson County, the map identifies one land parcel with a 40 point score and ten other parcels with scores above 30 points (Table 7). These properties can be identified using the parcel numbers and the Jackson County website (http://www.jacksonnc.org). The owners of some of these properties, however, cannot be identified using the parcel numbers, perhaps signifying that parcel information has changed since the release of the Jackson County parcel shapefile. Most of the highest ranked parcels are large parcels located close to Cashiers, in the central part of the Plateau. This appears to be a result of the public access factor as well as large amounts of protected land in close proximity to the town. Properties around the Thorpe Reservoir tend to have some of the lowest values, as a result of less protected land and few Natural Heritage identifications in that area. Values increase at the northern end of the territory, however, with more parcels of greater size and more Natural Heritage identifications.

In Macon County, the map identifies only six parcels of land with scores above 30 points (Table 8). Three of these properties are owned by local country clubs. Additional information about each piece of property can be obtained with the Map/Block/Pin of the parcel and the Macon County tax administration website (http://63.167.19.252/devpaas/). The values of properties in Macon County appear to be lower, overall, than those in Jackson County because of smaller parcel size. Like Jackson County, however, most of the highest ranked parcels are located in the central part of the Plateau, close to the town of Highlands. Parcels in the northern end of the territory receive lower scores, as a result of less protected land and few natural heritage identifications in this area.

Overall, the information presented by these maps is very useful. The maps quantitatively rank a small group of important parcels of land that fit into the Highlands-Cashiers Land Trust's preservation goals. Some of these significant parcels have been purchased and developed by

local country clubs, underscoring the fact that the Land Trust must continue to focus on threatened areas. As has been the case with recent negotiations with the High Hampton Inn near Cashiers, however, some of this land may still be undeveloped and available for protection under conservation easements. More importantly, several other highly scored parcels are completely undeveloped and appear to provide extraordinary opportunities for conservation.

Land Protection

The method of identifying parcels can be used effectively in the process of working to achieve the conservation goals of the Highlands-Cashiers Land Trust. The primary methods of the organization for preserving natural areas come through donations of land to be owned and protected by the land trust, bargain sales of property to the land trust at a reduced price, and conservation easements.

Donations and bargain sales of property are relatively simple concepts. Conservation easements, however, like other easements, are non-possessory licenses that run with the land and are transferred with its title. While widely used, they are a topic of much legislation and occasional litigation. They are basically an agreement between three separate parties. The federal government encourages conservation easements through the federal income tax code and the state defines, protects, and enforces the real property interests that are created. Land owners protect a particular land surface, giving up some of their rights in exchange for monetary compensation offered by the government. Land trusts often arrange the transaction and provide the third party oversight required by federal and state law (Gustanski 2000).

Funding is also available from several government sources to help purchase land or pay for costs associated with the easement process. These include the Farmland Preservation Trust Fund, the Natural Heritage Trust Fund, the Parks and Recreation Trust Fund, and the Clean Water Management Trust Fund (NC Conservation Trust Funds and Incentives). By successfully acquiring grants from these trust funds, additional land may be purchased or incentives offered to landowners considering donating their property.

In the past, the Highlands-Cashiers Land Trust has often been reactive, rather than proactive, in its land acquisition process. The Land Trust does sponsor community events and

publications to inform landowners about the benefits of land preservation. Nevertheless, the Trust still relies on landowners coming in and offering their property for donation or easement. Using the priority identifications, the most critical landowners can be directly targeted. It is suggested that they are personally contacted with a goal of forming individual relationships. This, if done effectively, should serve to enhance the preservation efforts of the Land Trust.

Furthermore, the maps produced in this project can be used to promote overall public awareness. Each map is available in a digital format (jpeg) which can be easily transferred to paper or to other forms of digital presentation such as Microsoft's Powerpoint® software. These visual aids will enhance communications with prospective land owners or community members wishing to become involved.

Future Work

The assimilation and combination of computer files is merely a basic system for identification. Any areas identified as priorities should be physically located, observed, and analyzed before they are pursued for protection. Furthermore, the information used in this analysis is constantly changing and will need to be updated. For instance, the parcel information for Macon and Jackson Counties will need to be updated each year. It is also recognized that the Natural Heritage inventory does not recognize the full breadth of the vast ecological resources of the Highlands-Cashiers Plateau. GPS points for important cultural or ecological locations can be overlaid onto a parcel map or incorporated into the important ecosystems category for prioritization. Certain other features, however, such as roads, political boundaries, and streams are unlikely to change dramatically and thus can be used for a longer period of time.

There is also a lot of work that can be done in using the information provided by this assessment. Maps can be produced and enhanced graphically for display to local governments, civic organizations, and the general public. Most importantly, owners of identified land should be approached and invited into the conservation discussion. They must be made aware of the Highlands Cashiers Land Trust and educated about the importance of their land and details of conservation easements. Caution must be exercised in this approach, however, so that land owners do not try to use the importance of their land to demand additional compensation or

advantages in return for preserving it. Nevertheless, by successfully integrating GIS mapping into its strategic planning, the Land Trust can more effectively protect land and work to preserve biodiversity on the Highlands-Cashiers Plateau.

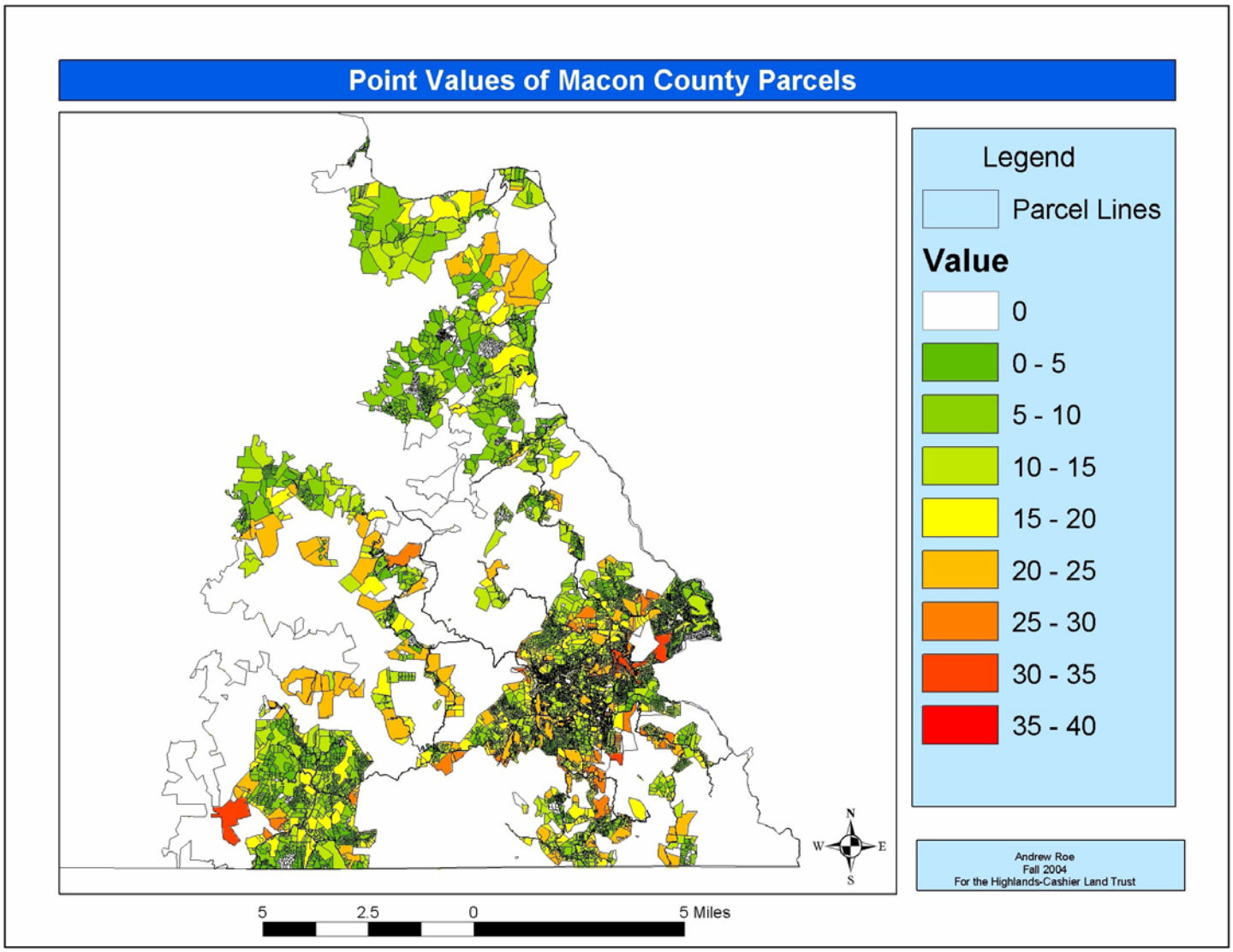


Figure 21. Priority Map for Macon County Land Parcels

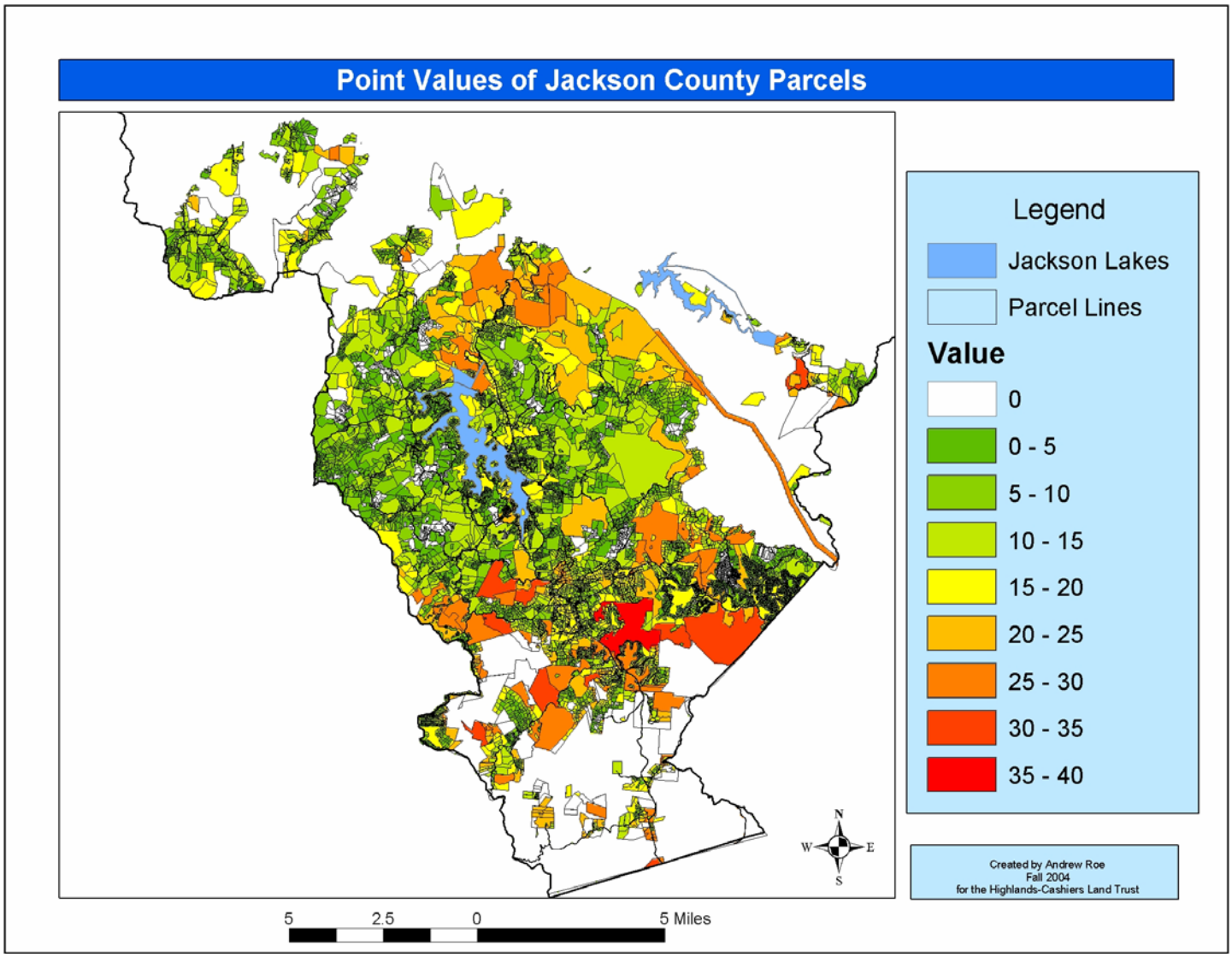


Figure 22. Priority Map for Jackson County Land Parcels

References Cited

Allen, W. and D. Tinker. Little Tennessee Watershed Prioritization Model. 2002.

Barton, D. R., Taylor, W. D. and Bietta, R. M. 1985. Dimensions of riparian buffer strips required to maintain trout habitat in southern Ontario streams. *North American Journal of Fisheries Management*, 5: 364-78.

Carolina Mountain Land Conservancy. "About CMLC." 22 Sept. 2004. http://www.carolinamountain.org/index.php?option=content&task=view&id=5&Itemid=25.

Chattooga Conservancy. "Conservation Plan." 22 Sept. 2004. http://www.chattoogariver.org/ccp.ccp.htm.

Clarke, M. 1997. "A Successful Communities Checklist" in *Exchange* [Vol. 16, No. 1] 25 Oct. 2004. http://www.ltanet.org.

Clean Water Management Trust Fund. "North Carolina Conservation Trust Funds and Incentives." cwmtf.net. 09 Nov. 2004. http://www.cwmtf.net/fundsum.htm.

Corn, P.S. and Bury, R.B. 1989. Logging in western Oregon: Responses of headwater habitats and stream amphibians. *Forest Ecology Management*, 29: 39-57.

Diamond, J.M. 1975. The island dilemma: Lessons of modern biogeographic studies for the design of natural preserves. *Biological Conservation*, 7: 129-146

Gaddy, L.L. 1992. Natural Areas of the Highlands Region: Inventory of Primary Natural Areas of the Highlands Township Region, in Macon and Jackson Counties, North Carolina.

Gustanski, J. A. "Protecting the Land: Conservation Easements, Voluntary Actions, and Private Lands" in Protecting the Land: Conservation Easements Past, Present, and Future. Edited by Julie Ann Gustanski. Island Press, Washington DC: 2000.

Karr, J.R. and Schlosser, I.J. 1978. Water resources and the land water interface. *Science*, 201: 229-34.

Kuenzler, E.J. 1989. Value of forested wetlands as filters for sediments and nutrients. In, Proceedings: The forested wetlands of the southern United States. USDA Forest Service General Technical Report SE-50, Asheville, NC. pp. 81-84.

Land Trust Alliance. 2004. "Land Trust Standards and Practices." 10 Oct. 2004. http://www.ltanet.org.

Land Trust for the Little Tennessee. “Who We Are.” 22 Sept. 2004. http://www.ltlt.org/about.html.

Lemckert and Brassil. 2000. Movements and habitat use of the endangered giant barred river frog, *Mixophyes iteratus*, and the implications for its conservation in timber production forests.” *Biological Conservation*, 96: 177-184.

Lindenmayer, D. B. Conserving Forest Biodiversity: A Comprehensive Multiscaled Approach. Island Press, Washington DC: 2002. pp. 99, 101, 104-107, 112-114.

Mason, C. F. 2000. Thrushes now largely restricted to the built environment in eastern England. *Diversity and Distributions*, 6: 189-194.

McMahon, B. 1998. “GIS for conservation planning.” *Exchange* [Volume 17, No. 4] 25 Oct. 2004. http://www.ltanet.org.

Noss, R.F. 1983. A regional landscape approach to maintain diversity. *BioScience*, 33: 700-706

Pearson, S. F. and D. A. Manuwal. 2001. Breeding bird response to riparian buffer width in managed Pacific Northwest Douglas-fir forests. *Ecological Applications*. 11: 840-853.

Pryde, P. R. 1976. The Residential-Landscape Conservation Zone as an Example of Applied Geography. *Geographical Review*, 66: 200-208.

Randolph, J. Environmental Land Use Planning and Management. Island Press, Washington DC: 2004. pp. 298

Ranney, J. W., M. C. Bruner, and J. B. Levenson. 1981. The importance of edge in the structure and dynamics of forest islands. In: R.L. Burgess and D.M. Sharpe, editors. Forest island dynamics in man-dominated landscapes. Springer-Verlag, New York. pp. 67-96.

Recher, H. F., J. Shield, R. Kavanagh and G. Webb. 1987. Retaining remnant mature forest for nature conservation at Eden, New South Wales: a review of theory and practice. In: D.A. Saunders et al. Nature Conservation: The role of remnants of native vegetation. Surrey Beatty and Sons: 1987.

Sharitz, R. R., L. R. Boring, D. H. Van Lear and J.E. Pinder, III. 1992. Integrating ecological concepts with natural resource management of southern forests. *Ecological Applications*, 2: 226-237.

Acknowledgements

We would like to thank the following individuals and organizations that helped us successfully complete the 2004 Capstone Report. Our semester would not have been nearly as enjoyable without their help.

First we would like to thank our mentors for all of the tireless support, friendship, and wisdom they shared with us this semester: Glenda Bell; Patrick Brannon (Highlands Nature Center); Mike Cavender (Highlands-Cashiers Land Trust); Barry Clinton (Coweeta Hydrological Laboratory); Larry Gantenbein (Town Planner/Zoning Administrator); Joe Gatins (Georgia Forestwatch); Tom Goforth (Crow-Dog Nursery); Dr. Brian Kloeppel (Coweeta Hydrological Laboratory); Jeff Owenby (USDA Forest Service); Dr. Duke Rankin (USDA Forest Service); Hank Ross (Town Commissioner); and Robert Tucker (Inside Out Designs).

We would also like to thank our teachers and CEP advisors who helped guide us through the semester: Dr. Robert Wyatt; Dr. Greg Gangi; Lisa Mazzarelli; Andrea Jones; and Megan Hazelman.

Our individual projects would not have been possible without the help of the following individuals and organizations:

Erin Bronk, John Froystad, David Loftis, Max Riddle, Terry Seyden; Dave Stamey, and Marty Southard (USDA Forest Service); Bill Bassham, Richard Betz, and Ginger Slaughter (The Town of Highlands); Paul Carlson and Dennis Desmond (Land Trust for the Little Tennessee); Butch Clay (The Wilderness Society); Stacy Cuffey (Macon County Planning Director); Carol Denhof (Atlanta Botanical Garden); Dennis DeWolfe; Dr. John DiBari (Landscape Ecology at Western Carolina University); Andy Gerschutz (Department of Biology); Hugh Irwin (Southern Appalachian Forest Coalition); The Land Stewards; Amy Lorang (GIS whiz); Brent Martin (Georgia Forestwatch); Chester Pankowski (NC State Data Center); Scott Pohlman and Michael P. Schafale (Natural Heritage Program in Raleigh); Beth Rowe (UNC Electronic Documents Librarian); Bill Stiefel (Highlands-Cashiers Land Trust); Cynthia Strain (Jackson-Macon Conservation Alliance); James Sullivan; Skip Taylor (Highlands-Cashiers Hospital); Bill Tillman (State Demographer); Rebecca Welch and Bill Wykle (Highlands Biological Station); Geoffrey Willett (NC Department of Commerce); Buzz Williams (Chattooga Conservancy); and Bob Wright (Upper Cullasaja Watershed Association).