SUSTAINABLE PLANNING FOR UPPER ETOWAH TIMBERLAND

by

AMANDA JEANNE TOPPING

(Under the Direction of R. Alfred Vick)

ABSTRACT

The Etowah watershed of North Georgia is one of the most biodiverse in the United States and the world. It is also, however, one of the more threatened, as its county population growth rates are among the nation's highest, and development pressures are quickly increasing. Large landholders are facing not only these pressures, but also economic strain imposed by Georgia's *ad valorem* tax structure. As one of these landholders, Temple-Inland, Inc. is planning the sale of its approximately 63,000 acres of timberland in the watershed. This paper identifies a single Temple-Inland property for study and seeks to assemble a plan for its long-term protection and sustainability – economic, ecological, and social. Elements considered include stacking non-timber resource use with continued forestry practices, alternative land uses, introduction of conservation easements, and introduction of an education center to increase community awareness and stakeholder involvement.

INDEX WORDS: Etowah watershed, timberland, forestry, land-use, population growth, sustainable development, non-timber resource, land planning, environmental education

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DEDICATION

for those who have shared their wonder of nature…

…thank you for making the world shine.

and for the kindness, generosity, and laughter

of dear friends, my second family.

ACKNOWLEDGEMENTS

In thankful recognition of several people's assistance and contributions: This paper originates from a research project conducted with Rebecca Haynes and Oliver Drose; their efforts and findings are incorporated here and merit acknowledgment and thanks. The project stems from an Etowah watershed course under the direction of Laurie Fowler. Sam Breyfogle generously shared time and information to facilitate a site visit and better understanding of forestry practices and non-timber resources. Bill Bumback and Liz Kramer's patient help with GIS and spatial information furthered my site analysis and helped preserve my sanity. Marguerite Madden facilitated loan of a GPS unit and helped prepare collected data for GIS processing. Thanks to members of my committee, who have shared their time and expertise to help edit and improve this document. And enormous gratitude to Alfie Vick, who has taken countless minutes and hours to proofread, coach, and listen as my paper has mutated and evolved.

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CHAPTER 1

INTRODUCTION

The warm scent of decomposing leaves reaches with each breath, welcome in the slightly chill air that brushes damp and pearly gray with the mist of morning and expected rain. Walk… stand… turn… trying to grasp the landscape – what it comprises, why it might be special, why it matters. Rather than cracked with autumn dryness or hard from years' erosion-caused run-off and impermeability, the soil – when visible from under its protective patchwork of leaf litter, moss, and groundcover – is soft, almost spongy and, approaching the river, even slippery with mud and dislodged roots. Not that this land is untouched or pristine; fescue, fences, and paths indicate a history of human interaction. Pause in contemplation to hear the outfitter warn against trying to paddle down a several foot fall, the cause of his recently dislocated shoulder. Our class prepares to travel the river as a group of tourists, supporting a local economy and visiting a watershed that faces ecological death from impending development.

The water of the Etowah, though slurried with sediment and chemicals, still flows in one of the cleanest rivers in Georgia. It supports some of the nation's greatest aquatic biodiversity, as well as some of its most imperiled. Should fate favor us, perhaps some of our group will see a rare darter swim through one of the shallower, rockier passages. But my interest is held by the greater landscape. Floating down in rented kayaks, we observe sheerly translucent areas in the tree line where leaves, having stopped generating food, have dropped for winter. Other stretches have gaps, like missing teeth, where trees have been thinned or removed to accommodate construction. And still others remain steadfastly green, where stands of *Pinus taeda*, or loblolly

pine, whisper of the region's historic dependence on forestry. These timberlands hold particular significance; some of them are as imperiled as the river they shelter. They belong to Temple-Inland Inc., a forestry company planning to sell most of its properties in the region because of compounded economic pressures.

Land within the Etowah watershed has been valued differently with society's evolving needs and understandings. In addition to ecological functions and interactions, the landscape has served purposes of Native American habitation and ceremony, western exploration, agriculture, gold mining, forestry, recreation, aesthetic and spiritual grounds, biological research, and modern residential and industrial development. Land values are now increasing dramatically with regional population. These same lands, however, are also crucial to helping maintain current watershed health, water quality, and biodiversity. With multiple demands on the land, is it possible to meet them all? Will the experience of floating down this aesthetically, ecologically, economically, and culturally significant river still be available after 20, or even 10 years of intense development?

Environmental degradation is not isolated within the Etowah; quickly growing regions of nations around the globe have experienced similar pressures. Though describing landscape and emotional changes in developing Ireland, James Joyce cogently identifies a multifold conflict now engendered in North Georgia: "Her head was leaned against the window curtains and in her nostrils was the odour of dusty cretonne. … she heard his footsteps clacking along the concrete pavement and afterwards crunching on the cinder path before the new red houses. One time there used to be a field there in which they used to play every evening with other people's children. … they seemed to have been rather happy then."[1] Development offers shelter and employment to a burgeoning population; regional economy prospers, and residents' standard of

living increases to afford new luxuries. In the longer-term, however, the area suffers ecological and social impoverishment.

This thesis investigates the possibility of a sustainable management plan for a single Temple-Inland landholding in the Etowah watershed. Project goals are threefold: to help preserve the ecology of a fragile watershed, including species protected under the federal Endangered Species Act, by reusing forestlands that would otherwise be sold for higher-impact development; to support Temple-Inland's economic needs by stacking multiple land uses for maximum profit; and to empower the public by helping to conserve resources and gradually shifting common perceptions of and interactions with nature by making visible and directly experiential the link between human and ecological existence in a way relevant to the local landscape. These represent the hope of reaching ecologically, economically, and socially sustainable solutions to this land-use challenge.

Notes

[1] James Joyce, “Eveline,” Dubliners (New York: Penguin, 1976) 36.

CHAPTER 2

SUSTAINABILITY: ECOLOGY, ECONOMY, SOCIETY

Before following a process of site selection, inventory, and planning, this chapter seeks to establish a background for such further investigation. A cursory view of sustainable development explains assumptions carried through further chapters. An overview of ecological, economic, and social factors driving the work of this thesis also helps influences and needs within Temple-Inland, Ind, the Etowah watershed, and its residents.

Sustainable Development

"Biological diversity is the key to the maintenance of the world as we know it."[1] Such richness and variety of life has developed over the earth that virtually every niche is inhabited by communities of well-adapted plants, animals, and microorganisms. These species have evolved to not only interact with each other, but also to endure, even thrive, with passing disturbances characteristic of their ecosystems. The rhythm and balance they maintain within their dynamic, stochastic habitats and systems helps make the world resilient and nurturing for human existence. In this way, we rely on nature's bounty not simply for natural resources, but also for the woven interactions that sustain ecosystem health and environmental stability.

The human story is part and subset of the earth's evolutionary history. As a biological species interacting with and within its ecosystem/s, *Homo sapiens* affects and is affected by other species and the surrounding landscape. It should follow, then, that people could prolong species survival and sustain a healthier, more empowered existence by developing greater understanding of the dynamics of human-ecosystem interaction. Many cultures, however, have developed

traditions of extending environmental use beyond ecosystems' carrying capacities. Despite increasing scientific understanding, many people lack first-hand experience with and knowledge of the natural world; the very tools that might assist in conservation of resources and greater understanding of human-ecosystem dynamics often instead supply both reason for and means of excessive environmental use. Effects are heightened with the increasing needs of global population growth. "But biodiversity, the property that makes resilience possible, is vulnerable to blows that are greater than natural perturbations. It can be eroded away fragment by fragment, and irreversibly so if the abnormal stress is unrelieved."[2] The cumulative result is a web of impoverished ecosystems, which ultimately will no longer be capable of supporting our continued demands. As habitats deteriorate and biodiversity declines, so does our own probability of health and longevity.

Awareness of the impending global biodiversity crisis has induced at least partial reevaluation of resource use patterns. One product of such thought is the recognition that material growth has environmental implications. Sustainable development seeks to reconcile the apparently conflicting goals of ecology and short-term economy and the needs of the present and future. It was first formally defined in the World Commission on Environment and Development's 1987 *Brundtland Report* as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[3] Despite continued concern over definition, fairness to developing nations, and ramifications of imposing ecological control, sustainability establishes a constructive framework: work with the land instead of against it, and develop with long-term, low-impact goals that do not exceed an ecosystem's carrying capacity.

Underlying concepts of sustainability are embedded in the Governor's Advisory Council for the Georgia Land Conservation Partnership's goals for Georgia's future: "a statewide network of natural, historic, and recreational areas and land and water corridors; a priceless legacy which enhances the health of ecosystems, encourages working landscapes, fosters natural resource stewardship, sustains a healthy economy, and promotes a sustainable high quality of life for current and future generations of Georgians."[4] The interaction of such benefit and outcome components is simplified in a diagram (Figure 1). Of note is the consideration of cultural identity. The way a people identify themselves is a defining factor of environmental interaction and must be addressed as an integral part of a sustainable management program.

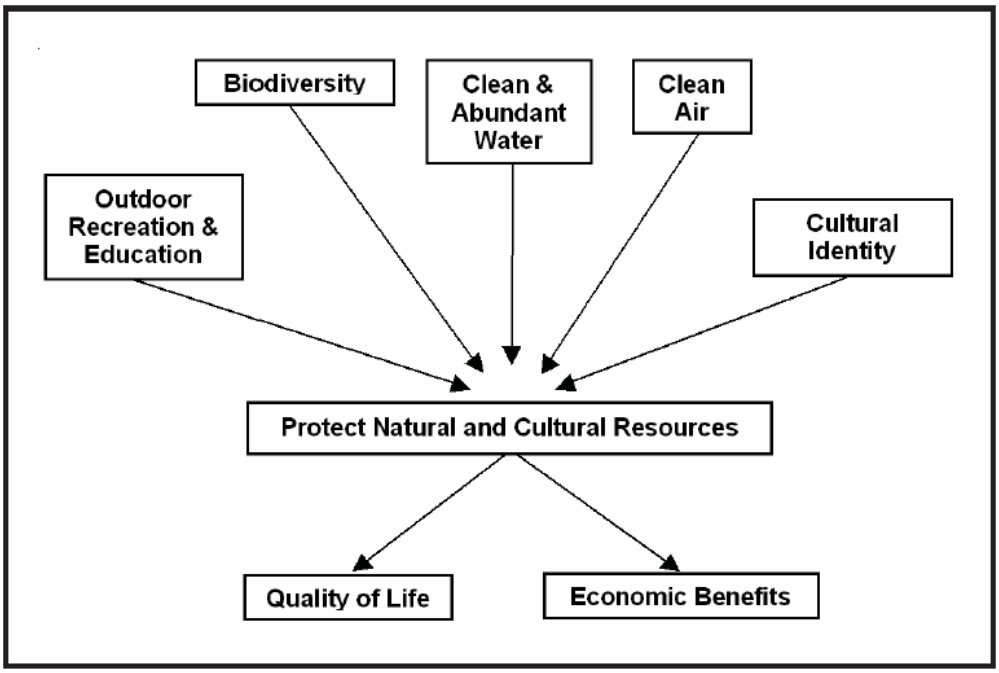

Figure 1: Interrelationships of sustainability [5]

Cultural identity within the U.S. and even southeast is evasive, particularly when seeking a unifying environmental ideology or myth. Cronon describes an American wilderness myth of

nostalgia for lost frontier life and the illusion of escape from responsibility, with the affiliated idea that "wilderness" is pristine.[6] Alternately, Quinn's Ishmael teaches our culture's primary embedded myth is man's righteous, eminent domination of the planet, solar system, universe, and all "lesser" life.[7] Or perhaps traditional environmental lore has been shunted in the face of increasingly complex knowledge of other things, and myth is unnecessary as gaps in knowledge of the world are more tangibly-filled with scientific facts. These new understandings are meaningless, however, without efficient transmission and exchange of information; as Twain narrates, "The face of the water, in time, became a wonderful book – a book that was a dead language to the uneducated passenger, but which told its mind to me without reserve, delivering its most cherished secrets as clearly as if it uttered them with a voice. And it was not a book to be read once and thrown aside, for it had a new story to tell every day."[8] Regardless of current cultural and ecological identification, education will prove vital to the functional embrace of sustainability.

Considering the breadth of conceptualization and realization sustainable development requires, as many people as possible should be involved. Particular roles, however, remain potentially unidentified. The American Society of Landscape Architects establishes landscape architects' accountability in its 1993 *Declaration on Environment and Development*. In accordance with this document, landscape architects must accept responsibility for actions affecting the health of natural systems and cultural communities; generate strategies and policies based on cultural and ecosystem context, including actions to conserve biodiversity and to heal and nurture degraded systems; develop, use, and specify materials, technologies, and techniques that exemplify principles of sustainable development and landscape regeneration; seek constant improvement of knowledge; and actively shape decisions, attitudes, and values that support

health, the environment, and sustainable development.[9] Landscape architects, as members of a dynamic community, must actively engage in revaluing our relationship with nature and implementing more sustainable interactions.

Having briefly summarized and examined some of the multiple realities and concepts of environmentalism and sustainability, this thesis proceeds within the context of a series of assumptions: There is an intrinsic link between environmental health and human well-being. Some degree of sustainability is both attainable and necessary, and ecosystems should be conserved and restored when possible. Society's interactions with and perceptions of nature can and should be recultured with the goal of reuniting people and landscape, because lack of understanding or experience can both misinform the present and keep future generations from exploring, embracing, and protecting the natural world and their place within it. Such topics and responsibilities fall within the realm of landscape architecture, both in discipline and in practice.

Ecological Drivers

Georgia's Etowah River flows approximately 150 miles from its headwaters in Lumpkin County's Appalachian foothills to its confluence with the Oostanaula, forming the Coosa River near Rome. Its watershed drains about 1,189,120 acres in eleven Georgia counties: Bartow, Cherokee, Cobb, Dawson, Floyd, Forsyth, Fulton, Lumpkin, Paulding, Pickens, and Polk.[10] Coursing through three physiographic provinces – the Blue Ridge, Ridge and Valley, and Piedmont – the Etowah supports 76 native fish species (91 historically) and is one of the most biologically rich river systems in the nation and the world (Figure 2).[11] The area is particularly significant because the Coosa River is "impounded by reservoirs along most of its length, [so that] many species that were originally more widespread are now found only in headwater

tributaries, such as the Etowah."[12] A number of mussel species (though likely extirpated), several fish species, and an insect, the Etowah caddisfly, occur only in the watershed.[13]

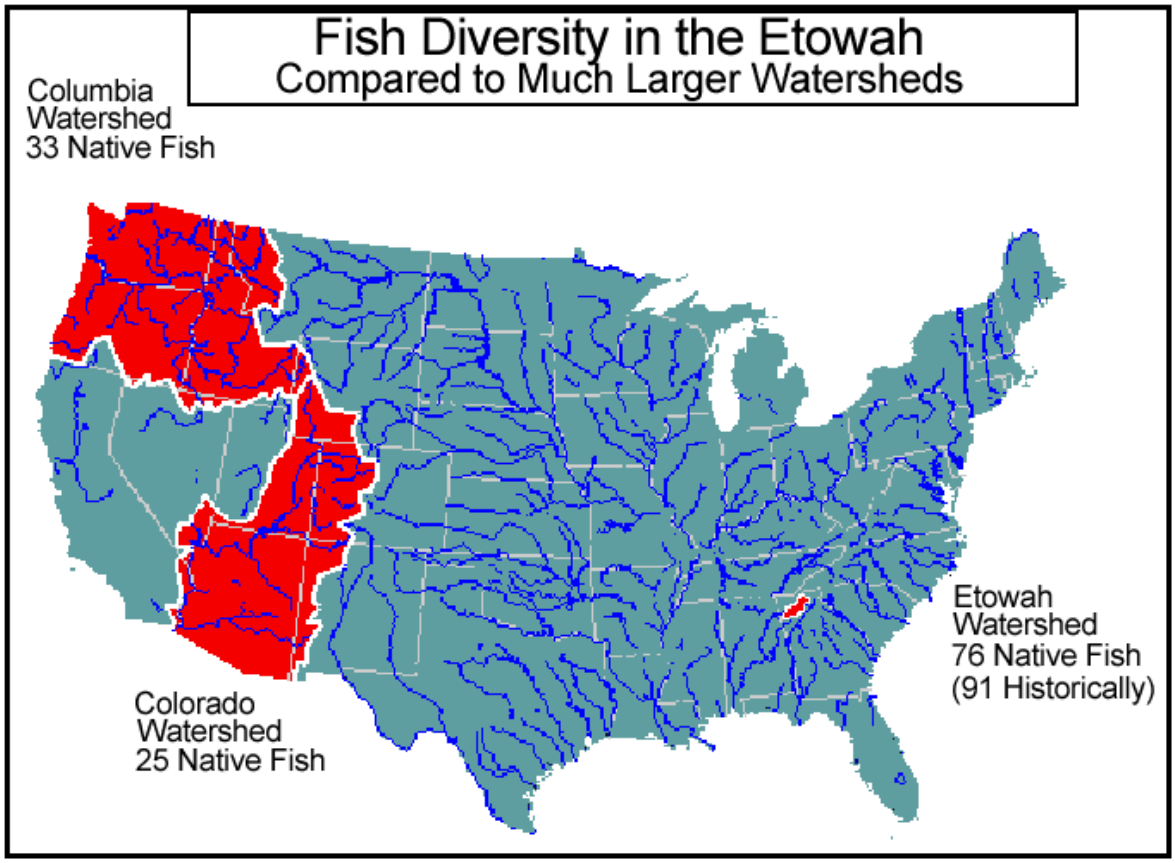

Figure 2: Comparison of Etowah fish diversity to other watersheds [14]

Dammed for hydroelectric power generation in 1947, the river is now divided by the Allatoona Dam and reservoir into what are known as the Upper and Lower Etowah.[15] Many species are believed extirpated from the lower river due to impacts from the dam. The upper watershed, covering about 390,400 acres above Lake Allatoona, sustains the rare aquatic species described above and is recognized by the Nature Conservancy as a biological "hot spot."[16]

The longevity of this diversity, however, is tenuous. American Rivers, Inc listed the Etowah in 1996 as the nation's third-most endangered river because of sewage and development;

this was broadened to include the entire Alabama-Coosa-Tallapoosa Basin in 1999 because of sprawl, water withdrawals, pollution, and damming.[17] The watershed has endured hundreds of years of disturbance from early pre-historic Native Americans to the mound-building Etowah Indians of the Mississippian period to western settlement with its associated agriculture and mining to more modern developments. Each interaction and land-use shapes present and future watershed health. Traditional forestry practices likely also impact the Etowah landscape: periodic harvesting and use of heavy machinery cause erosion and sedimentation; application of herbicide treatments and use of fossil fuel-dependent equipment increase water pollution; installation of infrastructural stream crossings can impair hydrologic flow and species habitat; roads (construction, maintenance, and use) cause localized soil exposure and compaction; and cultivation of monoculture stands can shift ecosystem processes.[18]

In managing silvicultural resources, though, the forestry industry also preserves landforms, protects stream integrity from the increased degradation of residential and commercial use and associated impervious surfaces, cultivates trees that improve air quality and sequester carbon, produces natural renewable resources, maintains wildlife habitat, conserves areas of aesthetic value, generates regional employment, and supports local economies. Such protection increases with regular adherence to best management practices (BMPs) in forestry, incentives for mitigation and installation of conservation easements, and growing markets for environmentally-sensitive products, such as certified sustainable timber. Adverse effects of forestry and many other past land uses, excluding the extreme slurrying and sedimentation that resulted from gold mining and the devastating erosion of less-informed agricultural practices, are relatively transient and negligible compared to the prospect of higher-impact development.[19]

Rapid development radiating north from Atlanta particularly threatens watershed biodiversity. While watersheds consisting of 10% - 12% impervious cover display marked decline, there is a speculated drop in most Etowah imperiled fish species at much lower percentages, and those further developed face severe aquatic degradation.[20] [21] As natural areas critical to watershed health are converted to urban and suburban uses, ecosystems are subjected to increased stress, from which they may never fully recover. Georgia "ranks third in the nation among states converting farms and forest into suburban sprawl."[22] Etowah development demonstrates this trend; from 1974 to 1998, watershed counties lost significant agricultural and forest lands to higher-impact use (Figures 3 & 4). Despite an increase in mixed deciduous-evergreen forest, total forest cover decreased from approximately 70% to about 65% of the watershed's total land cover. Agricultural lands similarly decreased by about 5% of the total cover. These areas are being converted primarily for urban use; those being clear-cut will likely support near-future development. This growth primarily follows a pattern radiating outward from Atlanta and along interstate corridors; development seems particularly focused in Cobb and southern Cherokee counties, with more localized patches in Bartow County and along the southern banks of Lake Allatoona.[23] Conversion of natural, forest, and agricultural lands is expected to continue at an increasing rate over coming years.

Development impacts are manifold. Long-term persistence of sensitive fish species requires water to sustain appropriate temperature, sufficient oxygen, low turbidity, and minimal pollution; habitat to include refuge, forage grounds, and spawning areas; food resources to be readily available; maintenance of natural density of competitors and predators; and unimpeded corridors among neighboring populations.[24] Development impacts, however, include

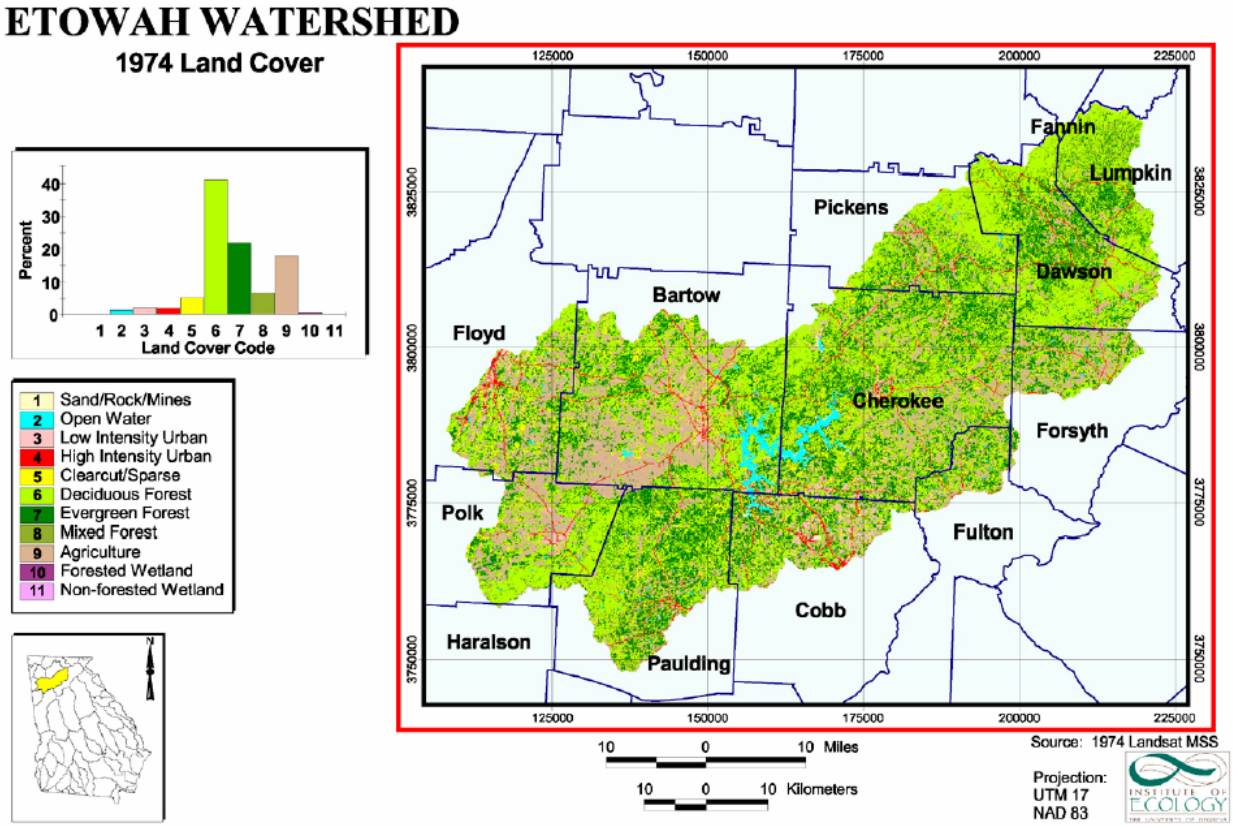

Figure 3: 1974 land cover [25]

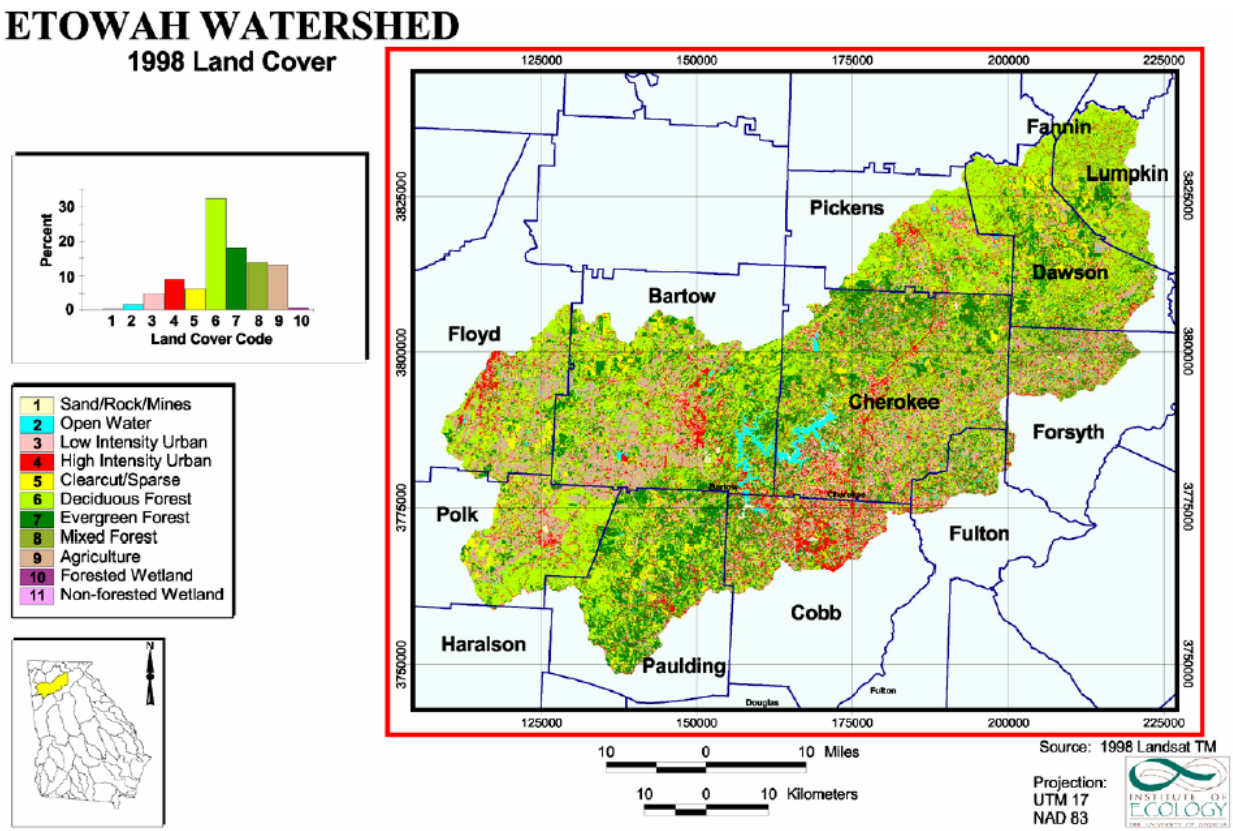

Figure 4: 1998 land cover [26]

sedimentation, pollution, fragmentation, habitat change, and hydrologic alteration. Of the biological wealth initially surveyed in the late 1800s, nearly all mussels and 15 fish species are already extirpated from the Etowah system. Eight federally endangered or threatened fish and mussel species, four of which live only in the Etowah, have been identified in the watershed, and others are likely candidates for federal listing. Furthermore, five additional species are classified as endangered, threatened, or rare by the state of Georgia.[27] (Table 1) Continued unplanned, unmitigated regional development will further impact and endanger these species.

Table 1: Imperiled aquatic species of the Etowah basin [28]

SCIENTIFIC NAME	COMMON NAME	STATUS
Etheostoma etowahae	Etowah darter	Fed. Endangered
Etheostoma scotti	Cherokee darter	Fed. Threatened
Etheostoma sp cf *brevirostrum* A	holiday darter	GA Threatened
Etheostoma sp cf *brevirostrum* B	holiday darter	GA Threatened
Macrhybopsis sp cf *aestivalis*	speckled chub	---
Noturus sp cf *munitus*	frecklebelly madtom	GA Threatened
Percina antesella	amber darter	Fed. Endangered
Percina lenticula	freckled darter	GA Endangered
Percina sp cf *macrocephala*	bridled darter	GA Rare
Epioblasma metastriata	upland combshell	Fed. Endangered
Medionidus acutissimus	Alabama moccasinshell	Fed. Endangered
Pleurobema decisum	southern clubshell	Fed. Endangered
Pleurobema perovatum	ovate clubshell	Fed. Endangered
Ptychobranchus greeni	triangular kidneyshell	Fed. Endangered
Brachycentrus etowahensis	Etowah caddisfly	---

Economic Drivers

Large landholders within the Etowah, such as timber companies, are finding it increasingly difficult to profitably maintain their properties. Temple-Inland, Inc is a diverse corporation with three core operations: financial services, corrugated packaging, and forest products. The forest products division manages the company's approximately 2.1 million acres, which make Temple-Inland the largest private landowner in Texas and the 5th-largest corporate

forestland owner in the southern US.[29] The company holds approximately 415,000 acres across Alabama and Georgia, about 63,000 of which are within the Etowah watershed.[30]

The company has a strong land ethic, as demonstrated through their *Forestry Principles*, which establishes an ideology of ecologically responsible philosophy and method, and their attention to BMPs in forestry, such as maintenance of streamside management zones (SMZs).[31] This sense of environmental stewardship can be compromised, however, by corporate goals. Two of the company's four key operating initiatives, for example, are to be market-driven and to maximize forestland value through development of significant real estate opportunities on high-value land.[32] Further, the company maintains a responsibility to its shareholders, who expect some degree of financial success.

Several factors have induced Temple-Inland to consider many of their Georgia properties, particularly those within the Etowah, among such "significant real estate opportunities." The U.S. timber market is in a period of decline. The international timber industry, often government-subsidized, is increasing pressure on the U.S. market.[33] The U.S. currently faces import and tariff issues, especially with Canada.[34] Though forestry in the southeastern U.S. still returns a fairly reliable 4-6% profit, it no longer generates enough to remain competitive with other potential land uses.[35] Georgia's *ad valorem* tax burden exacerbates this weak market position, as explained below. Consequently, the timber and forest products industry in the U.S. is being driven to mergers, buy-outs, and sell-offs.[36]

The state's *ad valorem* (Latin, "according to value") property tax structure taxes land at its highest development potential as determined by its fair market value. Thus, taxes assessed increase to reflect a tract's potential, be it a residential community, golf course, or shopping mall. In counties with lower populations and resulting lower fair market land values, the tax burden

remains relatively small. Inversely, though, taxes quickly increase in growing counties, such as those of the Etowah.[37] The combined effect of rising property taxes and potential financial gain through land sale reaches a threshold once land values reach approximately $800 per acre, at which point large landholders can be expected to divest of their properties.[38] While Georgia's tax structure can benefit community residents by generating funds for local government services and schools, it also creates a strong disincentive for conservation or even low-density development and can effectively force sale of ecologically significant lands. In comparison, all of Georgia's neighboring states tax property at its value of current use.[39] A company, such as Temple-Inland, planning to sell otherwise equal tracts among landholdings in several states would be economically driven to sell Georgia properties first.

Encroaching Atlanta development and booming regional population have also raised land values in counties of the Etowah watershed. As regional urban sprawl and population increase, the pressure to develop lands currently managed as open space, both agricultural and silvicultural, also increases. Higher demand raises market values. This becomes a problem with a cyclic nature: increasing land values provide economic incentive for landholders planning to divest of their properties to developers and, as tracts are sold, fair market land values further increase, which forces more owners to sell their tracts as well.[40] Temple-Inland's landholdings in the watershed consequently face severe development pressures, which are expected to continue increasing.

Temple-Inland's Etowah landholdings have, therefore, been deemed of particularly high value. These lands are considered "crown jewels" of a 170,000 acre portfolio of highest and best-use (HBU) lands that are being groomed for eventual sale for any type of development over the coming twenty years.[41] Immediate sale of these watershed acres could generate an estimated

$315 million, while traditional forestry over the same area would earn only $2 million a year.[42] Temple-Inland 2002 property taxes per acre per county can be compared to 2002 fair market value per acre per county: the year's total tax for Etowah properties was in excess of $1 million, while sale could have generated nearly $115 million (Table 2).

Table 2: Temple-Inland's Average 2002 Etowah Land Values [43]
Values as determined by county tax assessor offices; may not reflect true development worth. Timber values not reflected. Only tracts used for timber harvest considered. Temple-Inland properties currently advertised at higher prices – 261 acres in Lumpkin County are listed as sold for $5000-$11,000 per acre.

COUNTY	ACRES	FMV	FMV/ACRE	TAX PAID	TAX/ACRE
Bartow	15,439	$9,598,840	$621.73	$104,051.48	$6.74
Cherokee	14,349	$24,312,400	$1,694.36	$265,297.05	$18.49
Dawson	8,163	$13,110,428	$1,606.08	$122,891.94	$15.05
Lumpkin	7,264	$22,869,250	$3,148.30	$190,345.34	$26.20
Paulding	7,909	$17,143,240	$2,167.56	$171,223.52	$21.65
Pickens	10,069	$27,900,568	$2,770.94	$231,924.74	$23.03
Total	**63,193**	**$114,934,725**	**$1,818.79**	**$1,085,734.07**	**$17.18**

Social Drivers

"In a valley, near a river, there's a place called perfect…" quotes a popular drugstore commercial.[44] In search of such utopian living, people have flocked to the mountains and rivers of North Georgia for years, no more so than now. "People want to live, work and play in a quality environment."[45] North Georgia counties are, resultantly, facing unprecedented change. Georgia was the sixth-fastest growing state from 1990 to 2000, and population growth rates (ranging from 44.21% to 123.23%) for counties of the upper Etowah (Cherokee, Dawson, Forsyth, Lumpkin, and Pickens) are also among the highest in the nation.[46] The "population in six of the once rural counties along the Etowah has doubled since 1990 to nearly 500,000 … expecting 2 million people to move to the region by 2030."[47] Pickens County, for example,

experienced 59.3% growth from 1990 to 2000 (Figure 5).[48] As regional populations continue to increase, local land-use and development pressures will also soar.

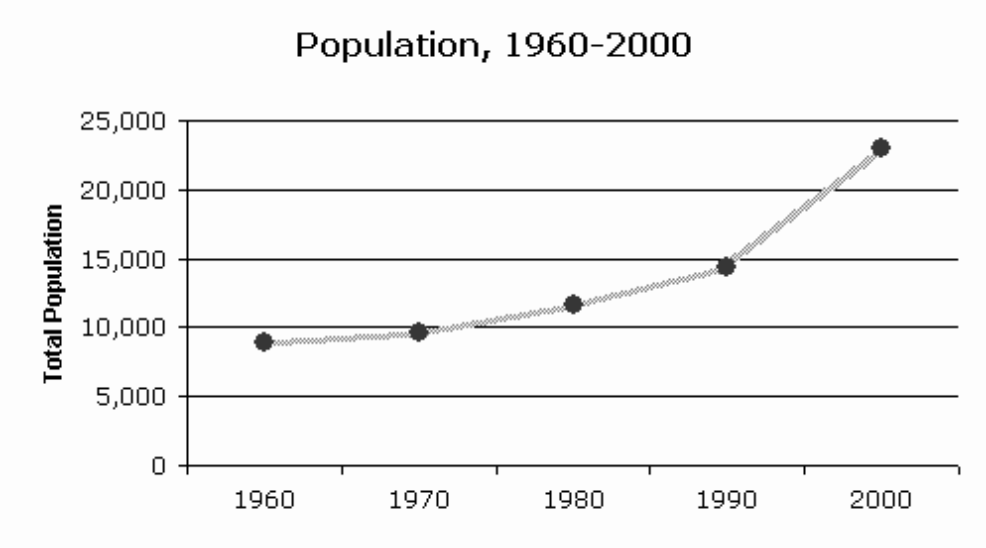

Figure 5: Pickens County population growth [49]

With such rapid changes, is "a place called perfect" attainable for residents who seek country living, the solace or stoicism of wilderness, or basics such as lower crime rates and clean water? Counties can react to population trends by either sustainably planning for resident welfare or allowing short-term economic gain. The latter, however, could compromise the future such that "Georgia will find it difficult to sustain a high quality of life and a competitive economy," not to mention face the effects of a devastated natural system.[50] It is therefore imperative that county governments and stakeholders develop awareness and make conscious decisions. Inaction will have the same effect as choosing unplanned development, sprawl, short-term boon, and long-term loss.

Much of the region's enticement and charm lies in the very resources being most compromised – the scenic beauty and natural resources of the Etowah River and its tributaries –

forming a paradoxical "tragedy of the commons," where "ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons."[51] Thus each member of society seeking the "valley, down by a river" actually uses part of a potentially non-renewable resource pool. When few people sustainably use these resources, the effect remains minimal. Large populations, however, pose a much greater threat to not only the environment, but also their own future economy, standard of living, and social structure.

Not only residents of north metro Atlanta, but also those of six counties, for instance, rely on the Etowah and the Allatoona reservoir for their water supply.[52] The watershed area's regional economy is also partially supported by tourism (Figure 6), which generates more than $75 million annually.[53] This tourism revenue is largely a product of recreational use of area rivers and Lake Allatoona. Should development continue unchecked, however, habitat and water quality will decline, thereby endangering the health of residents, further impacting regional biodiversity, increasing water treatment costs, and impairing the local tourist trade.

Figure 6: Etowah Practicum fall 2004 trip [54]

Population growth, however, is a reality, and people move to areas for their beauty or their economic and societal opportunities. North Georgia will continue to face conflicts between rapid growth and planned conservation, again demonstrating need for careful planning and full awareness. Such planning should include mechanisms for retention of industries that help support local economy, such as forestry, and management of lands to help prevent further loss of biodiversity. Sale and development of Temple-Inland properties does not support either goal, but rather further opens the watershed to negative impacts, thereby impairing the region's longevity and sustainability.

Several Etowah counties have recognized the value in preserving land and are re-zoning areas to help ensure continued quality of life and aesthetic appeal within their jurisdictions. Such county zoning and greenspace plans should guide designations of land uses and development of conservation scenarios. Some counties have guidelines for conservation subdivisions, means of demarcating greenspace, and/or priorities for addition of greenspace. Furthermore, local governments participating in the Etowah Regional Aquatic Habitat Conservation Plan (HCP), which aims to alleviate negative effects on biodiversity by controlling development's impact on the watershed, must adopt policies to ensure minimal impact and possibly designate additional permanent greenspace; these governments may, consequently, set aside funds or compete for federal grants for land acquisition.[55] Longevity of the watershed and its dependant benefits can be assured only when system stressors, such as development impacts, stop increasing.

Summary

Ecological, economic, and social values within the Etowah watershed are becoming increasingly endangered. The watershed's fragile ecosystem, which sustains one of the nation's most biodiverse aquatic assemblages, is more dangerously exposed with each new parking lot

and fertilized lawn. The timber industry's process of harvesting, regenerating, and managing regional forests is also challenged by increasing land values, an unfavorable state property tax system, and associated cycles and implications. Finally, watershed residents and stakeholders face the threats of an over-used, over-developed water supply: increased cost, decreased accessibility, diminished aesthetic value, and greater public health risk. Is it possible to sustainably meet such diverse needs? Can a plan be assembled that preserves regional ecology, sustains forestry's economic needs, and empowers the public so that future generations can experience the river and watershed's beauty? Following chapters will select a site with intirnsic conservation value, assess its history and current 2005 status, and assemble a plan for its long-term use and protection for environmental and public benefit.

Notes

[1] Edward O. Wilson, The Diversity of Life (New York: Norton, 1999) 12.

[2] Wilson 14.

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CHAPTER 3

SITE SELECTION

Having examined the necessity for forestland conservation in the Etowah watershed and considered some factors of sustainability, this thesis now prepares to examine practical applications of principles and tools towards the preservation of endangered timberlands in the watershed. The initial preparatory step, as outlined in this chapter, follows a process of identifying desirable site traits, prioritizing potential sites, and selecting a single property: Traits that may help perpetuate site sustainability and ecologic, economic, and/or social health are identified as later detailed; these features are also mapped to facilitate the development of a composite overlay with Temple-Inland properties. Traits are then ranked according to their relative importance, and Temple-Inland landholdings are examined in terms of how many desirable features they offer. Higher-priority properties are further narrowed by comparing the rankings of their features. In addition to these traits, the final site selection also considers public interest and any potential government or non-government funding and/or involvement. The identified site will be the focus of the remainder of the paper.

Watershed Location

The Etowah watershed is a sub-basin of the Alabama-Coosa-Tallapoosa Basin that drains into Mobile Bay along the Alabama Gulf Coast. It is located in north-central/north-west Georgia and drains parts of eleven counties (Figure 7). Of interest are its proximity to Atlanta and the Etowah River's headwater region in Lumpkin County, drainage into Lake Allatoona, and confluence with the Oostanaula to form the Coosa River in Floyd County.

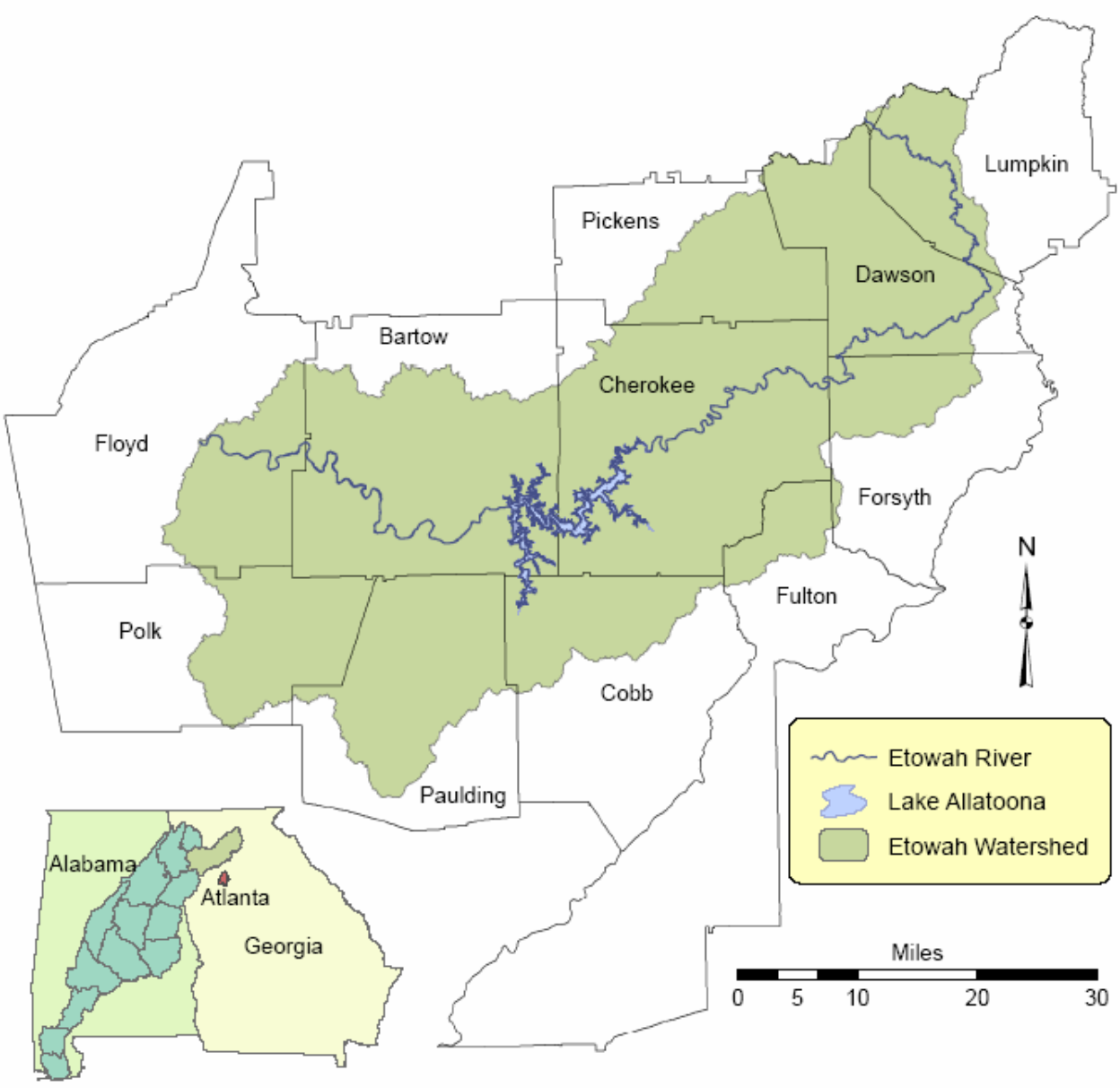

Figure 7: Etowah watershed; inset (not to scale): Alabama-Coosa-Tallapoosa basin [1] [2] [3] [4] [5]

Temple-Inland Landholdings

Temple-Inland holds (under fee-simple ownership and long-term lease) approximately 63,000 acres in nine counties of the watershed (Figure 8).[6] These are distributed over sites of varying size and characteristic; sites may or may not feature streams, wetlands, or other

resources. When these landholdings are superimposed on variables for classification, broad priority zones are evident, as will be later described.

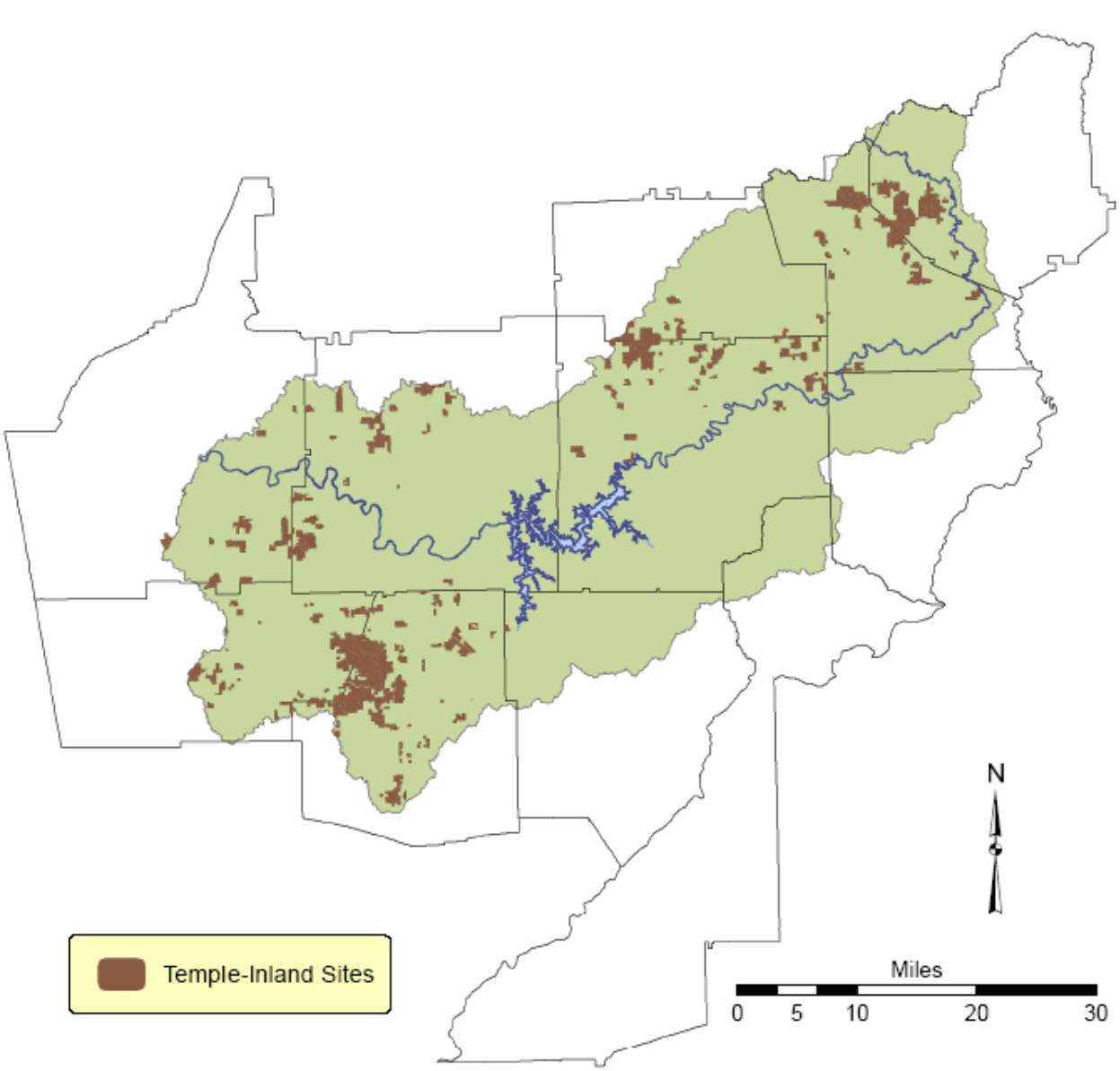

Figure 8: Temple-Inland properties [7] [8] [9]

Prioritization

Because of its ecological significance, the Etowah watershed warrants protection from high-impact development and unsustainable practices. It lies within a region of quickly

increasing population and high development pressure, however, which requires planning for not only ecological health, but also economic and social well-being. Because the watershed neither can nor will be preserved in its entirety, planners must prioritize areas regarding need and degree of protection. The Georgia Land Conservation Partnership Plan (GLCP), which seeks to "identify lands that provide the environmental benefits needed to sustain a high quality of life and a sound economy in Georgia," starts the classification process by stating that the "most important benefits that conservation lands can provide include: clean and abundant water, clean air, biodiversity, cultural identity, and outdoor recreation and education."[10]

Temple-Inland properties share many similar characteristics and environmental benefits, such as timber stands that protect air and water quality. For purposes of this study, landholdings are further classified based on inventory of several variables:

Only lands within the nine participating HCP counties (Figure 9) are considered. These counties have expressed interest in preserving and/or maintaining watershed health according to guidelines proscribed by the HCP and are more likely to help fund or cooperate with any conservation efforts. Of these counties, those within the upper watershed are given preference; waters of Lake Allatoona and the lower watershed are already impacted enough to harbor fewer species, making management and conservation of upper watershed lands vital to continued survival of imperiled aquatics.

Etowah watershed ecological priority areas (Figure 10), as established by the University of Georgia Institute of Ecology, guide classification. These priorities are expressed in terms of percent additional impervious surface an area can sustain without further impacting watershed health and biodiversity.[11] Priority area one, for example can sustain 2% - 4% further impervious

development before damaging ecological status quo. Higher priority areas are in greater need of conservation than lower or non-prioritized areas.

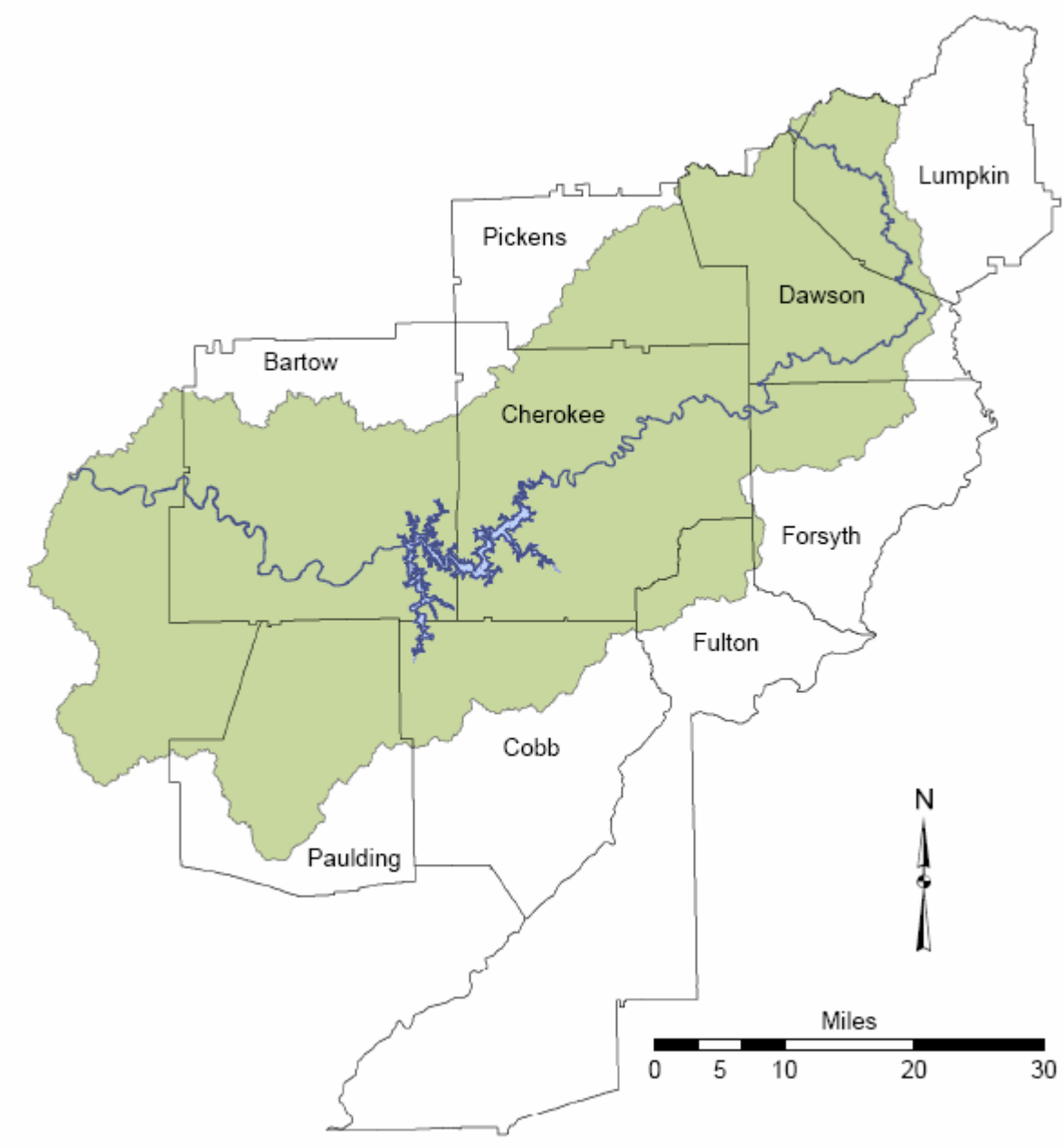

Figure 9: Counties participating in the Habitat Conservation Plan [12] [13]

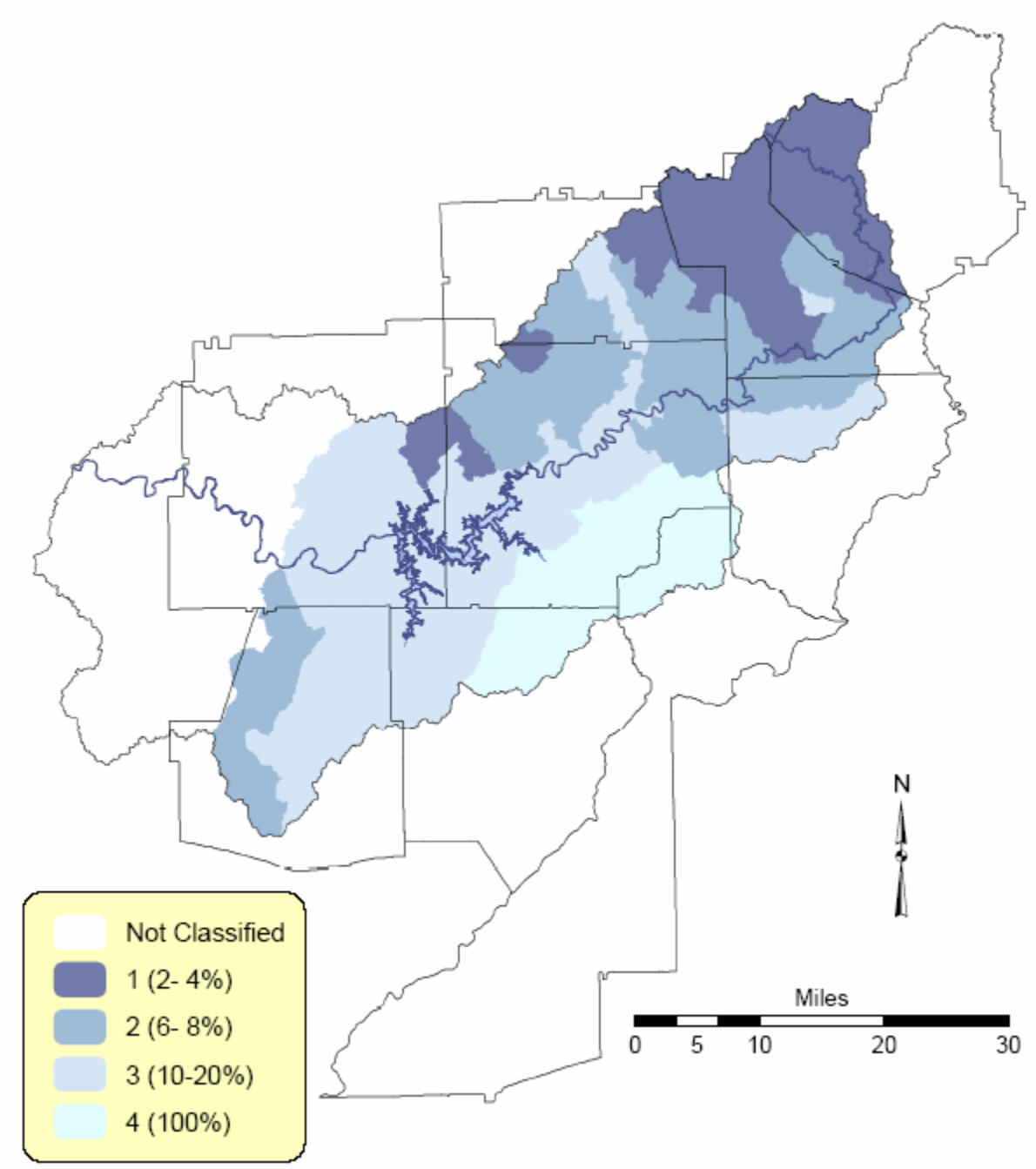

Figure 10: Watershed ecological prioritization (in terms of percent impervious surface limits) [14] [15] [16]

Properties containing or converging with waters that provide habitat for imperiled fishes (Figure 11) are considered higher priority. These areas of fish habitation are accounted for in the ecological prioritizations of Figure 9, however, and are presented here for purposes of

background and visualization only. Of interest is a possible relationship between existing areas of conservation and forest lands and areas of imperiled fish species. This does not mean that aquatics only thrive in waters of conserved lands or that a stream flowing through preserved land will harbor imperiled species. Runoff from an impervious surface will affect a watercourse from its point of infiltration through areas further downstream, regardless of land quality. Conservation areas and stream buffers instead provide areas of minimal impact. If we aim to protect watershed biodiversity, we must aim also to conserve land, particularly forested areas such as timberlands.

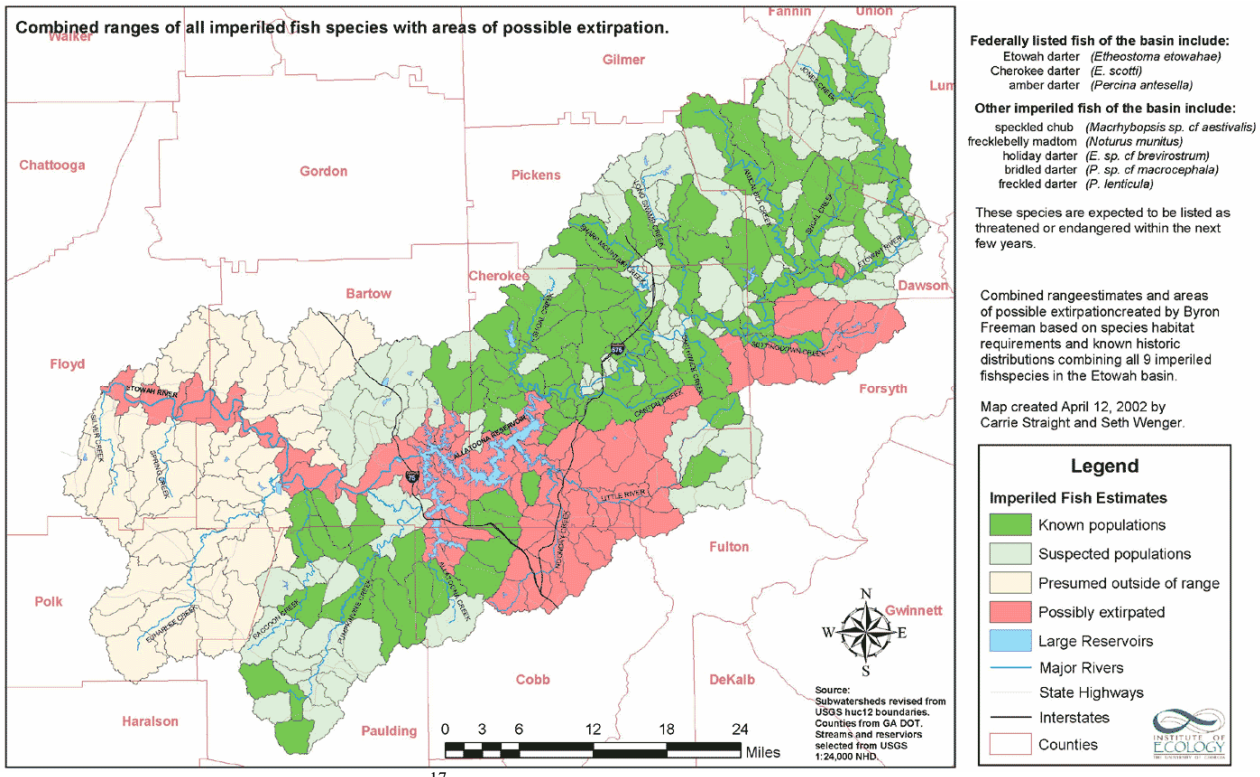

Figure 11: Ranges of imperiled fishes [17]

Landholdings adjacent to existing conservation areas (Figure 12) are considered higher priority, as they offer the potential of maintaining or developing larger corridors of protected

and/or forested land that will buffer streams and protect aquatic species. Contiguous forested and conserved tracts will also provide wildlife corridors with greater overall tract size and minimal habitat fragmentation. Resulting smaller edge to internal space ratios should also increase survival of resident wildlife.

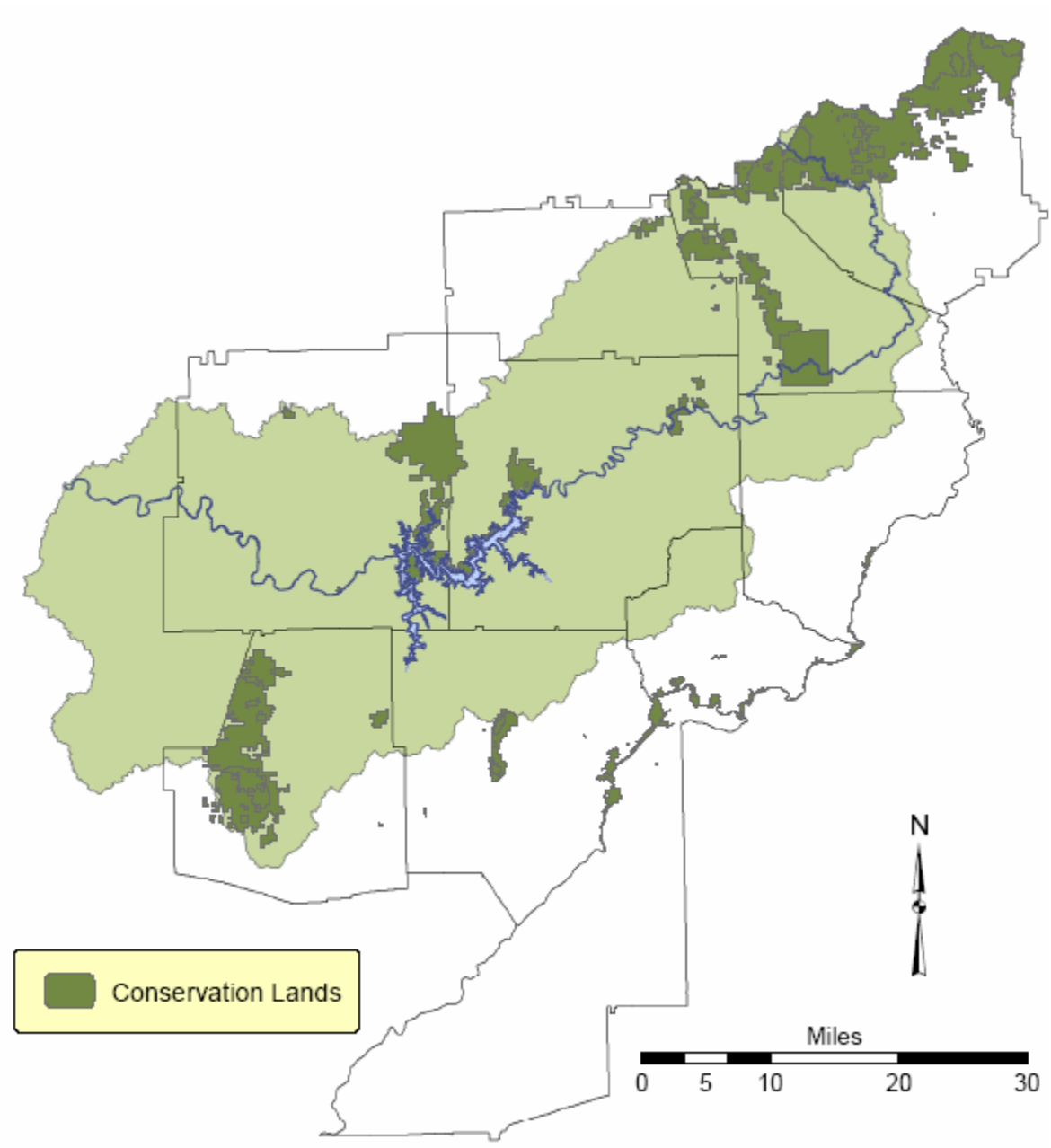

Figure 12: Conservation lands [18] [19] [20]

Landholdings in close proximity to cities (Figure 13) or rapidly urbanizing areas are given less preference. For purposes of this study, these are defined as tracts within a one-mile urban buffer, as shown later in the chapter. These areas, because of their zoning and development pressures, typically have higher land values and, therefore, may cost more to conserve. Similarly, lands surrounding highway corridors are of lower priority because of their high development potential.

Properties to the periphery of such urban areas, however, are actually given slight preference for their accessibility to a greater percentage of the community and resident stakeholders. While such access increases traffic throughout protected areas and, therefore, poses some ecological threat, it can also increase public awareness of human-ecosystem interaction and the need for conservation effort, thereby supporting watershed conservation goals overall.

Landscape characteristics also help define conservation possibilities and site suitability for various land-uses. Wetlands are identified on some Temple-Inland properties (Figure 14), which offers potential for higher ecological conservation benefit and for mitigation and associated conservation funding; these sites are given preference. Because steep grades pose a greater erosion hazard, they are used as a basis for conservation in some county greenspace plans; though Temple-Inland properties feature a mixture of grades, sites with steep slopes (Figure 15) are given slight preference. Land cover and species composition, which define an area's level of succession and describe its aesthetic, are not used for prioritization, because they change with forestry practices, such as clear-cutting; Temple-Inland properties share a similar history and show various stages of succession consistent with current or recent forestry, including pine stands, mixed pine-hardwood stands, evidence of clear-cut, and streamside

management zones. Highway access and internal roads are also discounted, as they are common to most Temple-Inland sites.

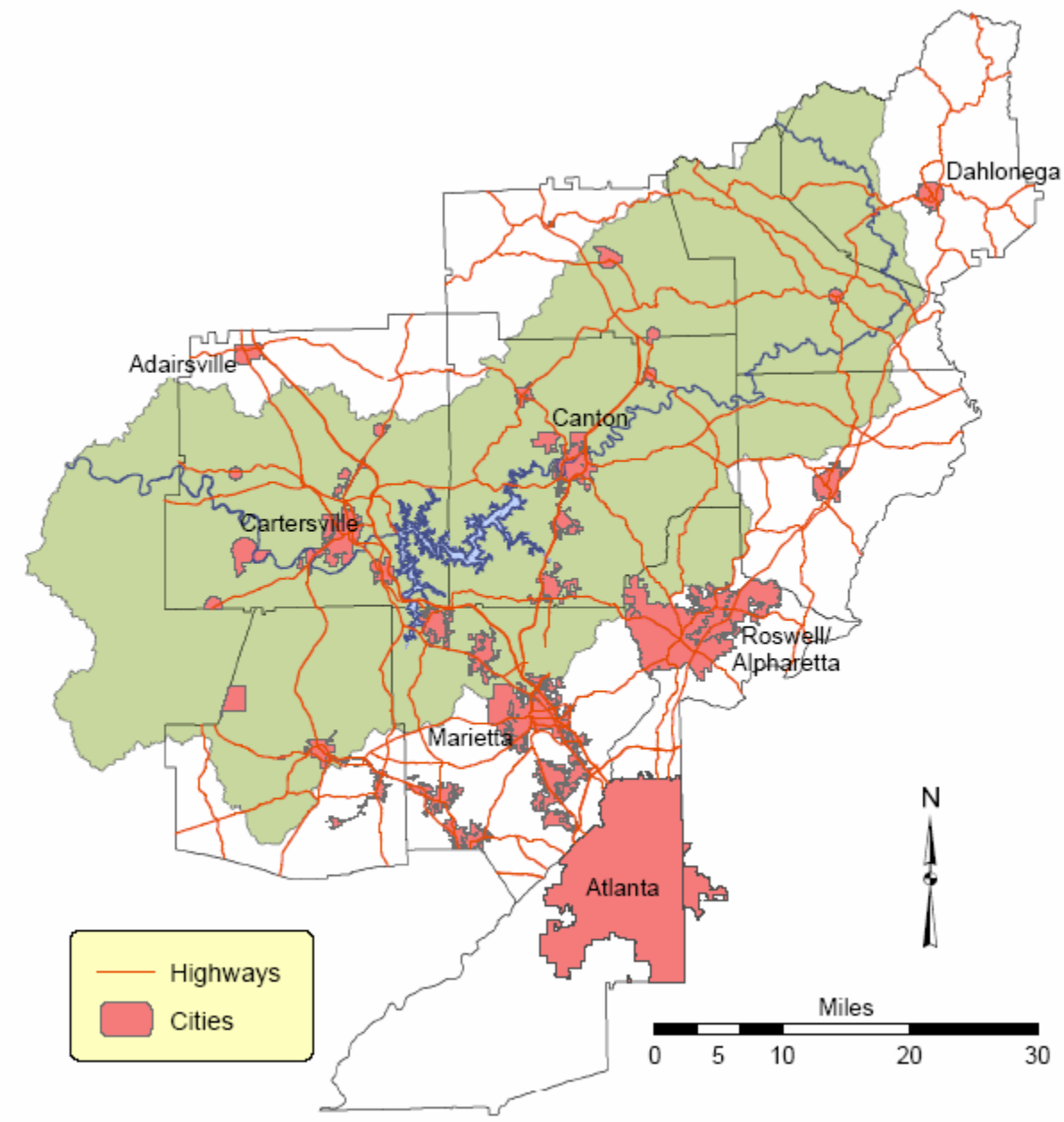

Figure 13: Cities and highways [21] [22] [23] [24]

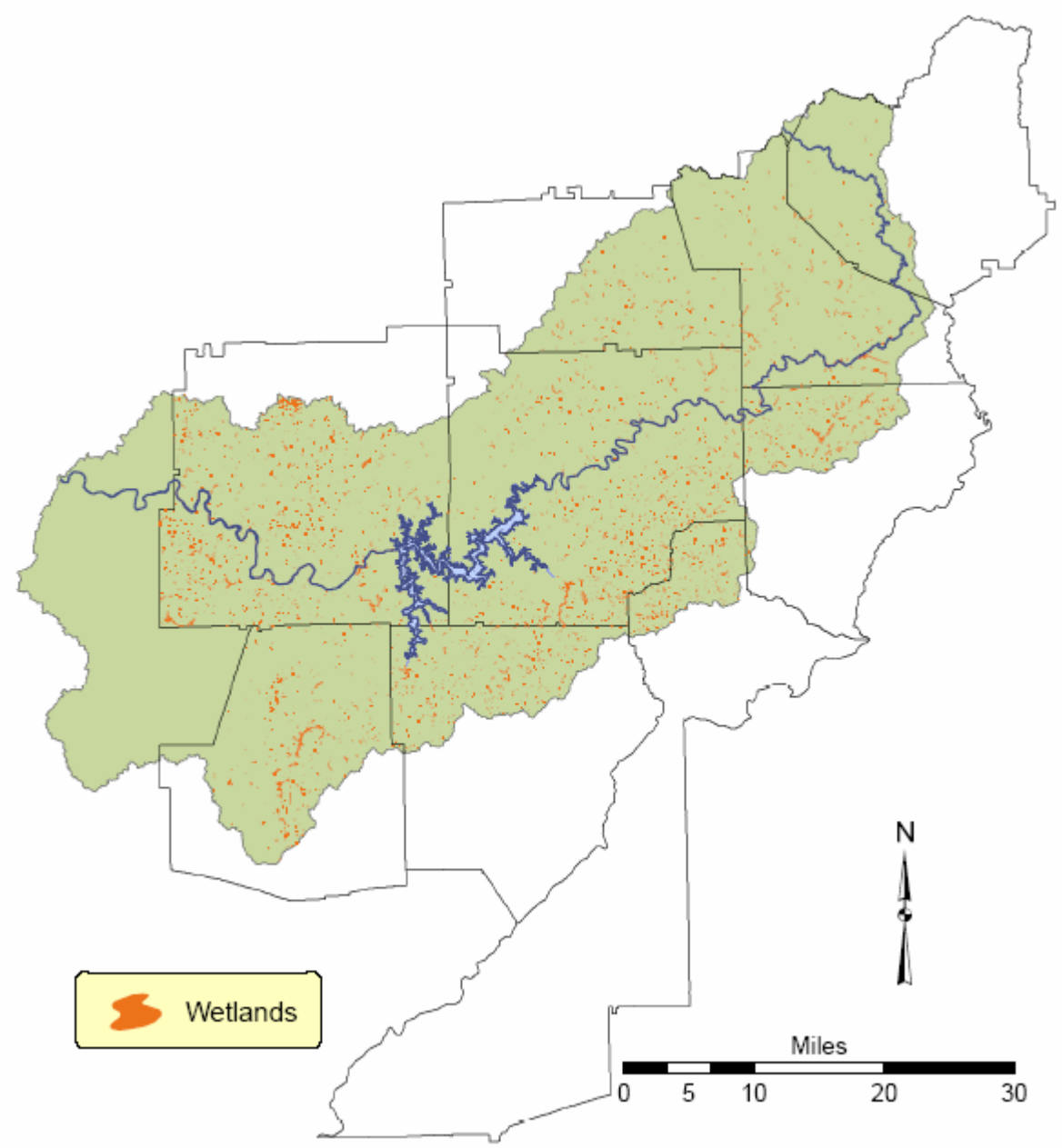

Figure 14: Wetland areas [25] [26] [27]

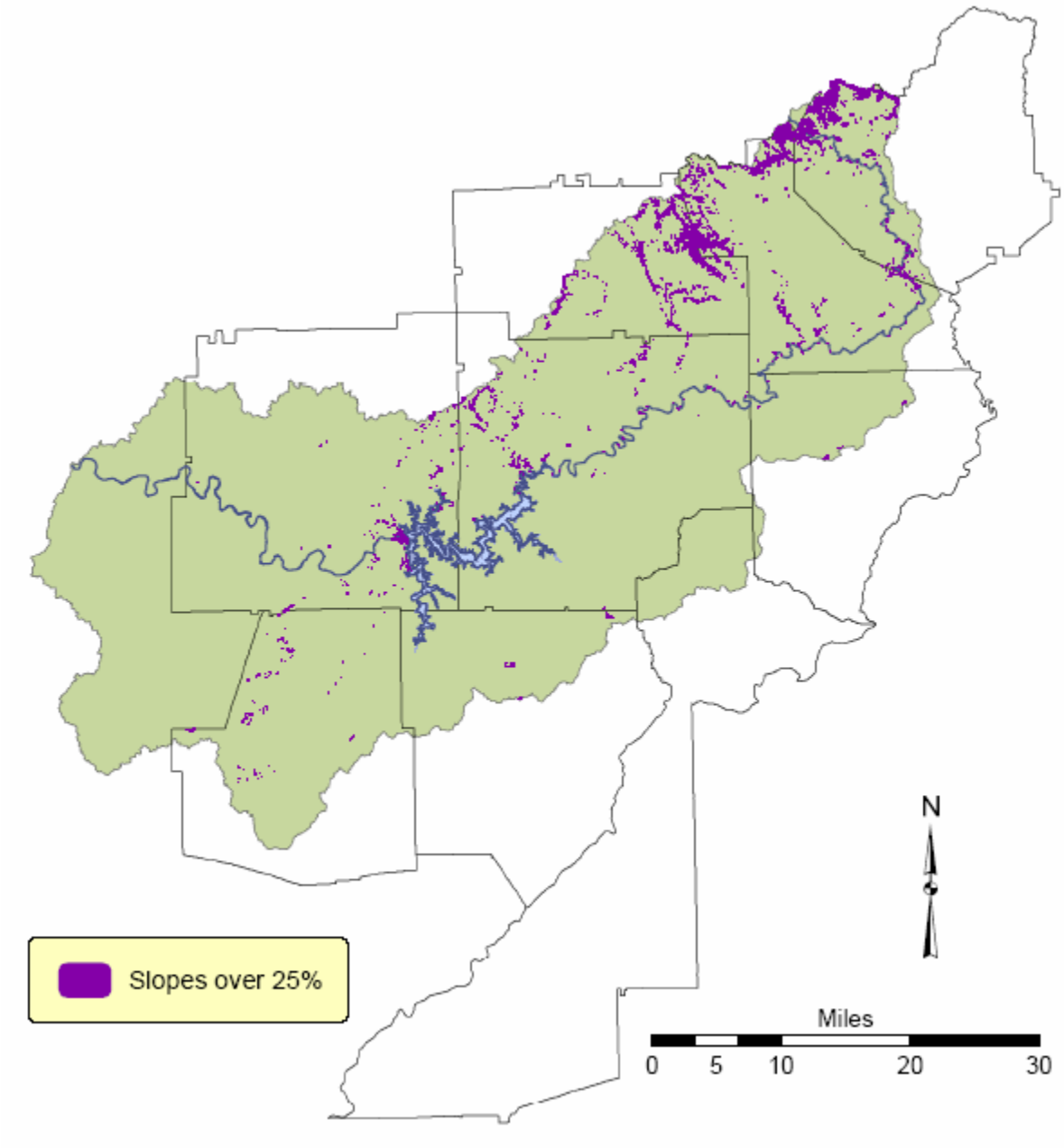

Figure 15: Slopes over 25% [28] [29] [30]

Counties with higher population growth rates (Table 3) are also given preference. These counties include Paulding, Dawson, Pickens, and Cherokee. Though larger populations and greater rates of increase typically also indicate higher land values and more difficulty in

protecting sites, these counties experience a more immediate need of conservation and planning. Without such intervention, their resources face depletion or exhaustion.

Table 3: Census statistics for HCP counties with Temple-Inland property [31]

COUNTY	AREA: MI²	2000 PEOPLE/MI²	2003 POPULATION	1990-2000 Δ POP	2000-2003 Δ POP
Bartow	459	165.5	84,730	36.0%	11.5%
Cherokee	424	334.9	166,639	57.3%	17.4%
Cobb	340	1786.7	651,027	35.7%	7.1%
Dawson	211	75.8	18,575	69.7%	16.1%
Lumpkin	284	73.9	23,185	44.2%	10.5%
Paulding	313	260.6	100,071	96.3%	22.7%
Pickens	232	99.0	26,905	59.3%	17.1%

Reconciling Conflicting Priorities

Most factors described for prioritization support each other. Limiting the site to participating HCP counties of the upper watershed, for example, reinforces selection of higher ecological priority areas. Some priorities, however, conflict with each other. Conflicts can be partially resolved by ranking the relative importance of each factor (Table 4).

Table 4: Site properties to choose among and rankings

FACTOR	IMPORTANCE
within HCP county	mandatory
high ecological prioritization	high
adjacent to conservation area	medium-high
wetlands present	medium-high
within quickly growing county	medium
proximity to urban area	
too close - within 1 mile	medium-low
easy access - within 10 miles	low
steep slopes present	low

Superimposing mapped priorities with Temple-Inland landholdings makes higher priority land stand out (Figure 16). These areas become more apparent by eliminating all sites outside HCP counties, outside the highest two ecological priority zones, within a one-mile city buffer, within counties with lower population growth rates (Bartow and Cobb), and held under long-term lease instead of fee simple ownership (Figure 17). No single site meets all designated preferences, though several meet more than one. These are selected based primarily on ecological priority, proximity to conservation lands, and presence of wetlands (Figure 18).

Two sites offer particular benefits that, stacked with other priorities, make them special (Figure 19). A wetland site in Dawson County near Dawsonville offers the potential of both harboring wetland species and generating funds through mitigation credits. It also features community accessibility and imperiled fish habitat. It doesn't lie in the highest watershed priority zone, though, and it is separate from existing conservation lands and bisected by a major road. The second site is also in Dawson County and provides the benefit of linking two large tracts of existing conservation land to form a continuous corridor. Also in its favor are that it is in the highest watershed priority zone and provides habitat for imperiled fish. Because it is farther from Dawsonville and Athens, it is not as easily accessible to as large a portion of the public, though, and it has no wetlands.

Both sites feature advantages and drawbacks (Table 5). The final decision was made by considering the expressed interest of conservation agencies and the possibility of Temple-Inland developing good public relations with the north Georgia community and among environmental groups. Either site could serve these purposes, but the second holds an apparently greater potential: Its conservation has been specifically sought by agencies, including The Nature Conservancy and the State of Georgia, that have approached Temple-Inland staff.[32] The rest of

this paper, therefore, focuses on alternatives to residential/commercial development of this particular tract. Tools and land-uses may apply to a variety of parcels and situations, but applications will be directed towards this site.

Table 5: Ranked features applied to two sites

FACTOR	IMPORTANCE	SITE 1 (wetland)	SITE 2 (corridor)
within HCP county	mandatory	yes - Dawson	yes - Dawson
high ecological prioritization	high	yes - priority 1	yes - priority 2
adjacent to conservation area	medium-high	yes	no
wetlands present	medium-high	no	yes
within quickly growing county	medium	yes	yes
proximity to urban area too close - within 1 mile easy access - within 10 miles	 medium-low low	 no yes	 partially yes
steep slopes present	low	yes	no

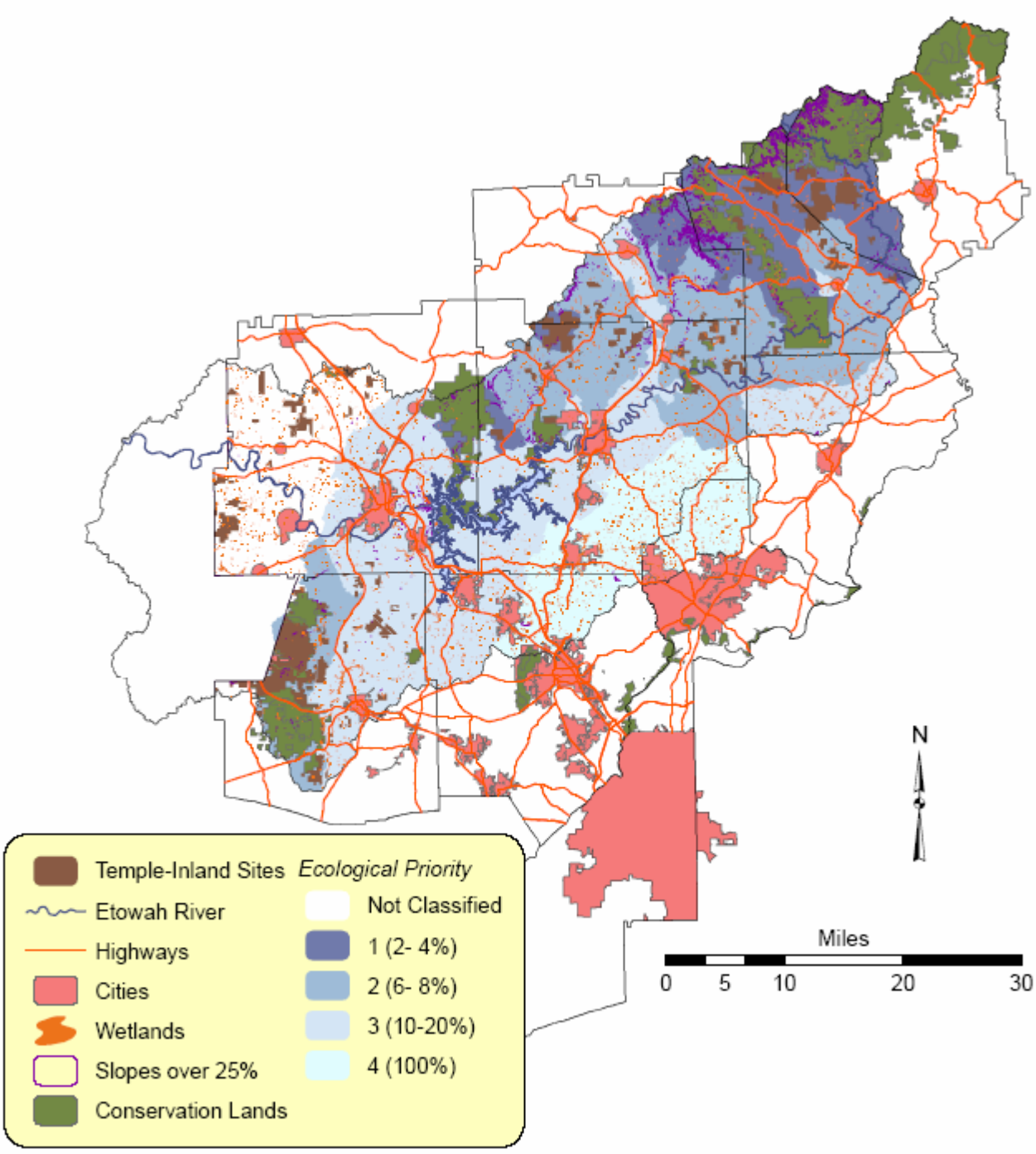

Figure 16: Temple-Inland landholdings with classification features [33] [34] [35] [36] [37] [38] [39] [40] [41]

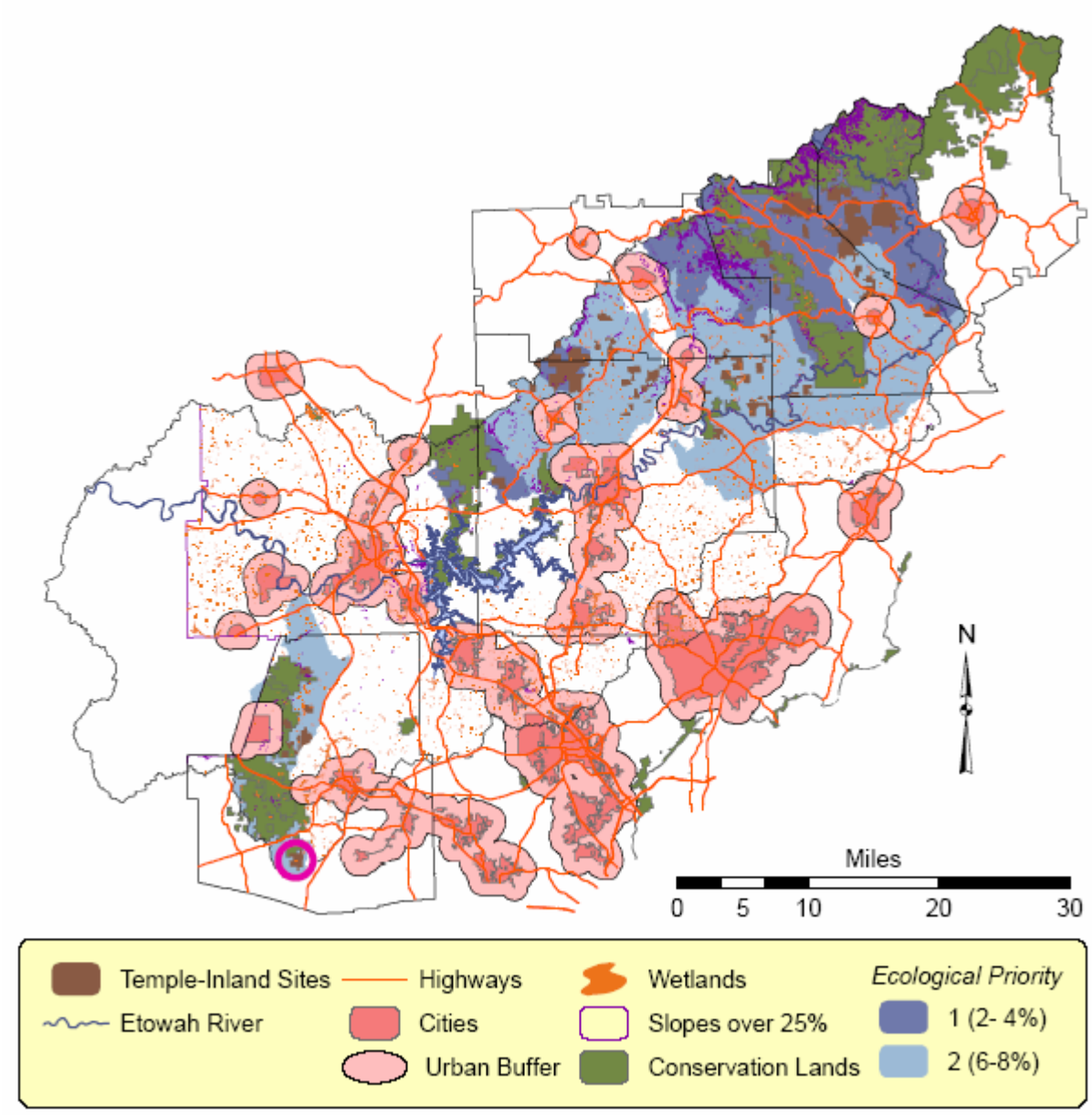

Figure 17: Narrowed selection of Temple-Inland properties with classification features [42] [43] [44] [45] [46] [47] [48] [49] [50]

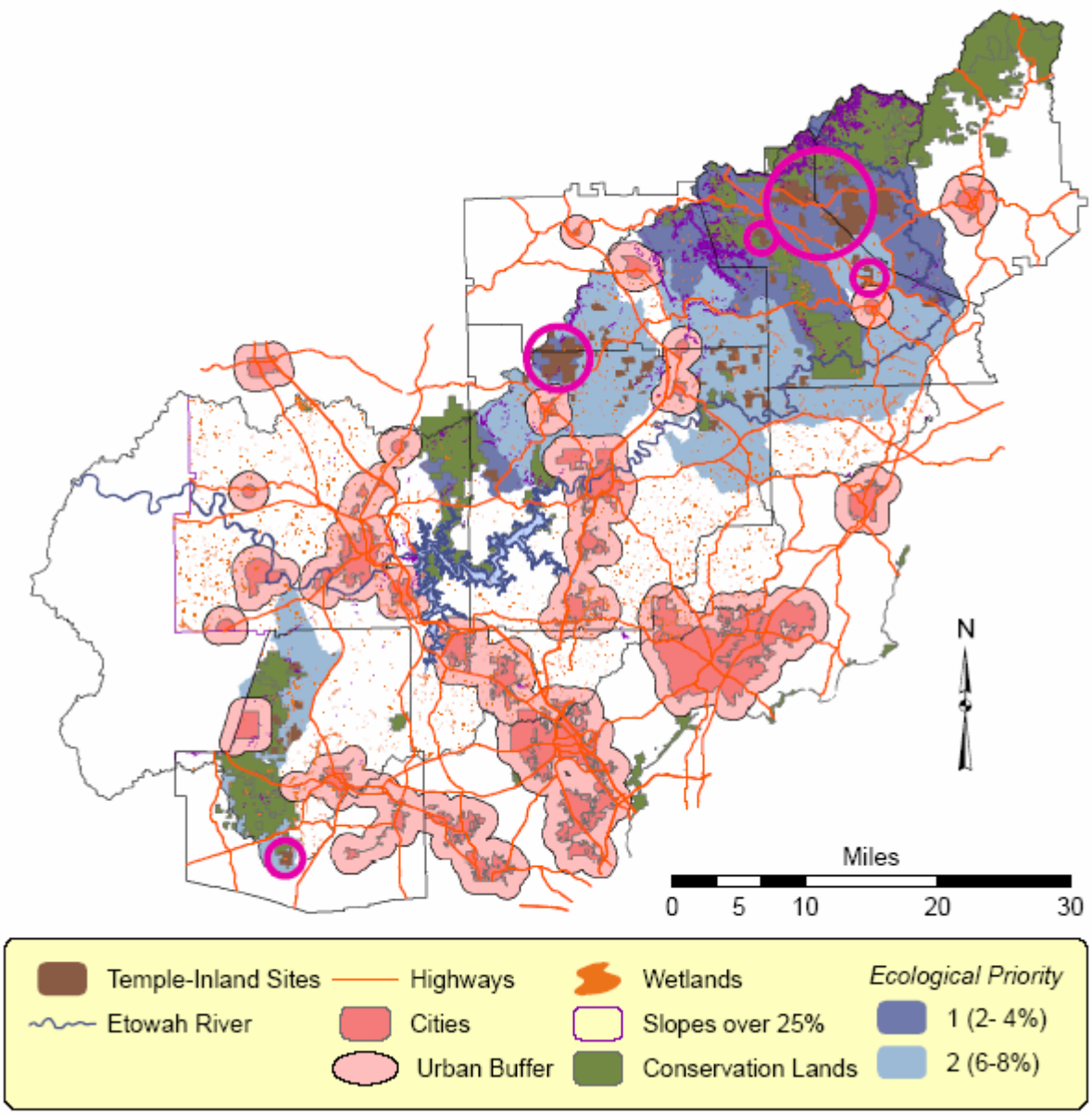

Figure 18: High priority Temple-Inland properties (circled in magenta) [51] [52] [53] [54] [55] [56] [57] [58] [59]

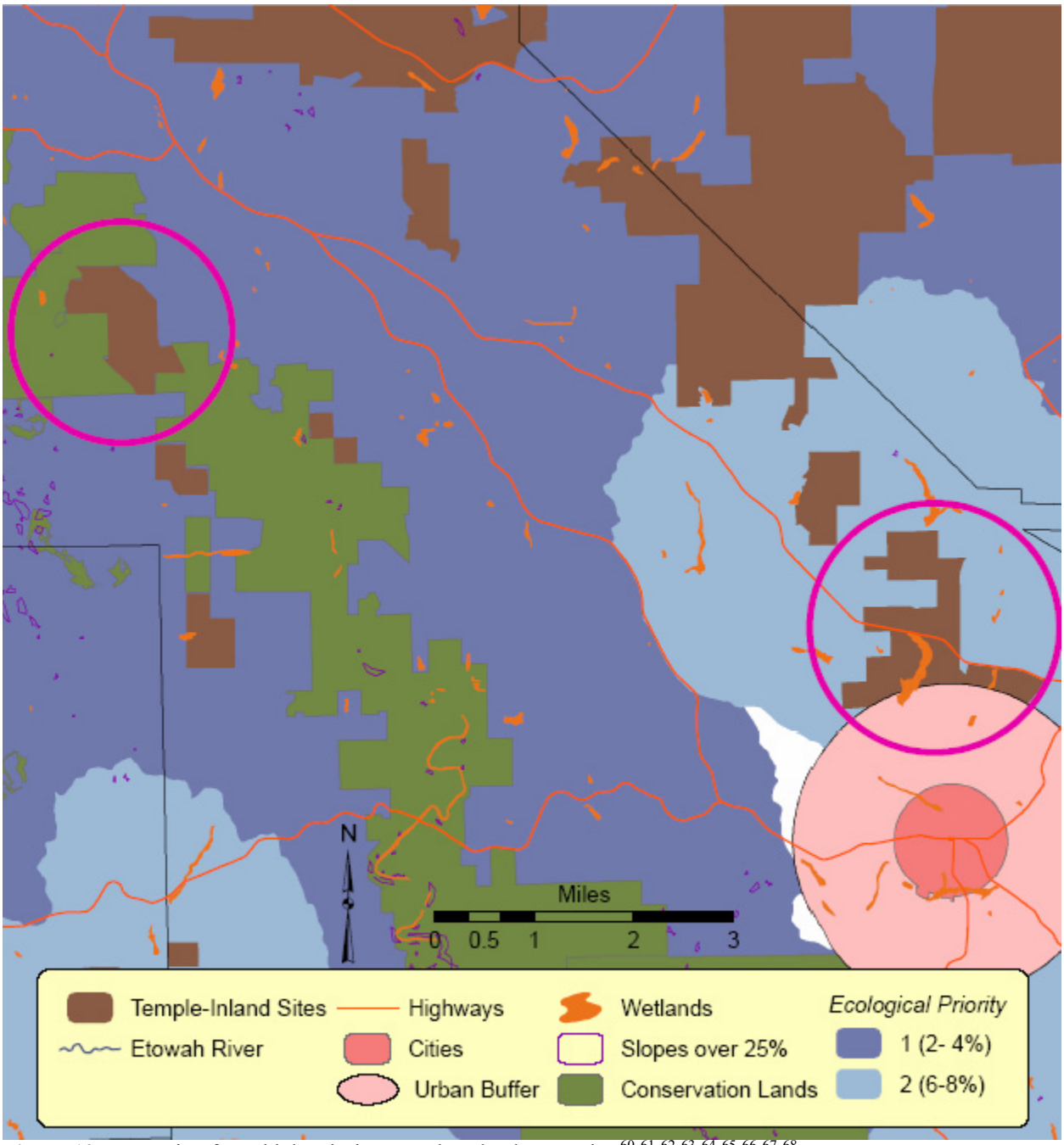

Figure 19: Zoom-in of two high-priority Temple-Inland properties [60] [61] [62] [63] [64] [65] [66] [67] [68]

Summary

A variety of features may prove desirable in a conservation site. These include ecological factors, as well as traits that may provide for long-term economic and/or social

sustainability. Because of the extreme importance of protecting imperiled aquatics within the Etowah, however, this selection process focuses mainly on environmental features and traits that support long-term ecological health. The process described in this chapter is applied with the intent of quickly sorting among Temple-Inland properties in the Etowah watershed to identify a single study site, which will be further assessed in Chapter 4. The same process, however, could be similarly used to systematically rank all Temple-Inland landholdings within the watershed. Alternately, the process could be modified to broadly rank properties within the entire Temple-Inland portfolio; this would require assessment of more features over a greater area, though, and would likely provide less detailed results.

Notes

[1] Georgia Boundaries, electronic map (Georgia Dept. Transportation, 2000).
[2] Alabama Boundaries, electronic map (United States Geologic Survey, 1990).
[3] Georgia City Boundaries, electronic map (Georgia Dept. Transportation, 2000).
[4] Alabama-Coosa-Tallapoosa Basin Hydrography, electronic map (United States Geologic Survey, 2000).
[5] Counties of Georgia, electronic map (Georgia Dept. Community Affairs, 2000).
[6] David Newman, correspondence as reported by Oliver Drose, 2004.
[7] ACT Hydrography.
[8] Counties of Georgia.
[9] Temple-Inland Landholdings in Georgia, electronic map (Temple-Inland, Inc., 2004).
[10] Georgia, Advisory Council for the Georgia Land Conservation Partnership, Georgia Land Conservation Partnership Plan (N.p.: n.p., 2004) 20.
[11] Sensitive/Priority Areas in the Etowah Basin, electronic map (Seth Wenger, 2004).
[12] ACT Hydrography.
[13] Counties of Georgia.
[14] ACT Hydrography.
[15] Counties of Georgia.
[16] Sensitive/Priority Areas.
[17] Seth Wenger and Carrie Straight, "Combined Ranges of all Imperiled Fish Species with Areas of Possible Extirpation" (Athens: U Georgia Inst. Ecology, Apr. 2002), 9 Feb. 2005 <http://www.rivercenter.uga.edu/research/aquatic.htm>.
[18] ACT Hydrography.
[19] Counties of Georgia.
[20] Georgia Conservation Lands, electronic map (Natural Resources Spatial Analysis Lab, 2003).
[21] ACT Hydrography.
[22] Counties of Georgia.
[23] Georgia City Boundaries.
[24] Highways of Georgia, electronic map (Georgia Dept. Transportation, 1997).
[25] ACT Hydrography.
[26] Counties of Georgia.
[27] Georgia National Wetlands Inventory, electronic map (United States Fish and Wildlife Service, 2004).
[28] ACT Hydrography.
[29] Counties of Georgia.
[30] Georgia 10-Meter Digital Elevation Model, electronic map (Natural Resources Spatial Analysis Lab, 2004).
[31] FedStats, "Georgia MapStats," 14 Nov.2004 <http://www.fedstats.gov/qf/states/13000.html>.
[32] Samuel Breyfogle, personal interviews and email correspondence, 2005.
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[67] Georgia NWI.
[68] Georgia 10-Meter DEM.

CHAPTER 4

SITE INVENTORY

Factors influencing the Etowah watershed have been discussed, and a single Temple-Inland property has been selected for further study. Before progressing to planning, design, or management options, site conditions must be assessed. Site inventory defines context and parameters, from which limits and guidelines for successful future land-use are established. Physical factors, such as climate, moisture, and soil type, for example, may favor some vegetation types over others. Awareness of site history may help understand effects of past uses on current conditions, describe a reference for goals of any restoration efforts, or identify areas of cultural significance. Inventory of the selected Temple-Inland parcel and Dawson County, in which it resides, will consider history, ecology, infrastructure, population, land-use, and economic concerns to assemble a better understanding of the land within its context. Insight gained will later be applied towards the development of sustainable, site-specific land-uses and management options.

Location

Temple-Inland's Amicalola property, number 15507, is located in mid-central Dawson County, an area of the southern Blue Ridge (Figure 20). The site covers 488.36 acres that lie within two U.S.G.S. topographic quadrangles: Amicalola and Nelson.

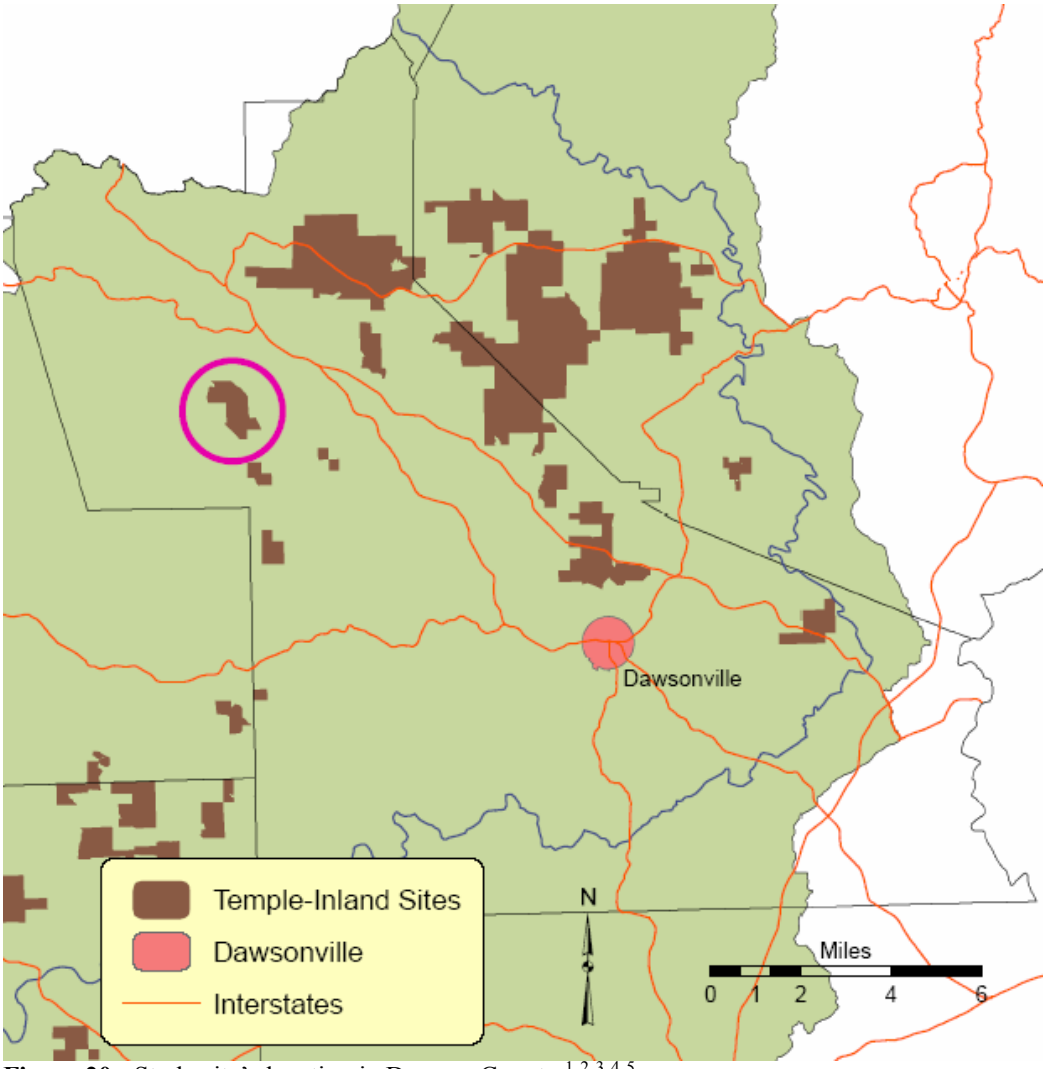

Figure 20: Study site's location in Dawson County [1 2 3 4 5]

History

The Appalachian Mountains reached their peak elevations between 325 and 250 million years ago.[6] Since then, they have been slowly weathering, producing the Blue Ridge and piedmont physiographic provinces. The ancient nature of the regional landscape and a lack of major geologic disturbances have allowed an extended evolutionary period and the development of many endemic species, as evidenced in the disjunct distributions in southeast Asia and the southeastern U.S. of genera that were once widespread.[7] Historic climatic cycles have also

affected regional species diversity: the glacial periods of the past 40,000 years induced the southern migration of northern species and the movement of regional species into sheltered, lowland river valleys. "During the peak of the most recent glaciation (the Late Wisconsin Continental Glaciation; 18,000 yr. B.P.), the southern Blue Ridge was likely in northern hardwood-conifer forest, and the Georgia Piedmont in a mixed forest of oak, hickory, and southern pines."[8] Habitat-specific species persist during the modern interglacial period within microclimates suited to their needs, which are varied and abundant due to diverse regional physiography.[9]

The landscape has also been greatly influenced by human interactions. Native Americans entered the southeast by 10,000 B.C.[10] The abundance, biodiversity, and rich soils of the Etowah watershed served these peoples as a great resource. Resident Native Americans, regionally known as the Etowah, initially lived as nomadic hunter-gatherers who traveled river valleys and selectively grew native plants.[11] By 1000 B.C., however, the Etowah had already started clearing large sections of land for villages and fields, subsisting primarily on cultivated natives like sunflower and squash, and building burial mounds.[12] Both sociopolitical structure and agricultural technique had become highly complex by 900 A.D.; this Mississippian period was characterized by maize-dominated large-scale food production, far-reaching and highly-populated chiefdoms, and the trademark construction of large earthen mounds[13]. By this time, the Etowah landscape was already significantly altered: forests had been burned for open-space, native food and timber species had been artificially selected, and non-native species had been introduced for agriculture.[14] This period ended prematurely, though, with the arrival of European explorers in 1539. Etowah populations were nearly decimated by disease; southern Native Americans, numbering around 1,700,000 before European contact, were reduced to an

estimated 170,000 by 1650.[15] Remaining Native Americans were driven from the Etowah area in 1830 with implementation of the Indian Removal Act.[16]

European immigration into the southeastern landscape was initially slow, allowing forests about 200 years to regenerate. By the early- to mid- 1700s, however, settlers were practicing slash-and-burn agriculture, grazing livestock, hunting, and capturing novel species for trade.[17] The discovery of gold in the Upper Etowah resulted in further degradation: extraction procedures used by thousands of hopeful settlers throughout the 1800s churned fragile stream bottoms and swept away river banks until the accessible gold was depleted around the turn of the century.[18] Such opportunistic resource uses ended in the clearing of millions of hectares of forest and the complete erosion of approximately 47% of all upland piedmont topsoil; the Southern Blue Ridge, though somewhat spared because of its less accessible terrain, also experienced deforestation and erosion.[19] [20] The devastating economic impacts of the Civil War and Reconstruction, however, with philosophical shifts towards resource conservation, inspired the 1930s development of long-term land management.[21] This and the increasing dominance of the timber industry supported forest regeneration, particularly on abandoned farmlands: timberlands increased by about two million hectares between 1950 and 1960.[22] Greenspace gains were quickly negated, though. Increasing populations and development pressures fueled the loss of nearly six million hectares of southeastern forest to urbanization and sprawl between 1960 and 1990.[23] This trend continues, though it is somewhat mitigated by the development of legislation, BMPs, and an increasing land conservation ethic.

The selected Temple-Inland study site, as part of the Etowah region, shares its history. Though Native American artifacts are not documented on the tract, it can be assumed the culture was present there, particularly because of the abundant stream presence, including Amicalola

Creek, a major tributary of the Etowah. Despite the site's occasionally rough topography, slight evidence of past agriculture can still be observed in lowland stream valleys. Soils further display the palimpsest of past land-use: they are exposed, eroded, and devoid of most topsoil. The parcel was cleared in 1954, at which point SMZs were established as buffers around watercourses; this is also the approximate time Temple-Inland purchased the property.[24] [25] The land, exclusive of SMZs, was again cut and replanted in loblolly pine in 1984.[26] In 2002, Temple-Inland staff estimated pine densities of non-SMZ areas ranging from 143.9 to 549.8 stems per acre and hardwood densities ranging from 1.9 to 17.2 stems per acre, with variations occurring primarily from the difference between the more recovered SMZs and the pine stands.[27] Ten acres of forest affected by southern pine beetle activity were also noted, indicating the need for tree-thinning. Such thinning occurred in 2004; pine stand density, not including SMZ areas, was reduced to 194.6 to 251.4 stems per acre.[28]

Ecology

Climate: North Georgia counties, excepting higher-elevation mountainous areas, experience climates fairly similar to each other. Summers are long, warm, and humid: average temperatures (in degrees Fahrenheit) range from daily highs in the upper 80s to about 90 and overnight lows in the mid-60s to low 70s. Thirty to sixty days each year reach 90 or above. Winters alternate between mild and colder periods, with average temperatures ranging from daily highs in the 50s to overnight lows in the 30s. Fifty to seventy days drop to 32 or below. Spring and fall are highly variable, with an average first freeze in late October to mid-November and an average last freeze in mid-March to early April.[29] The area receives measurable precipitation an average of 120 days each year totaling approximately 50 to 55 inches. Average annual snowfall is one to two inches over one to two days. Thunderstorms are common in spring and summer

and heard an average of 50 to 60 days. Driest months are typically September and October, and the wettest is March.[30]

Surface water: Amicalola Creek (Figure 21) originates in northern Dawson County and winds 24 miles through the county until its confluence with the Etowah to the southeast. This is the primary watercourse through the site. Like many other assessed streams of the Coosa Basin, the Amicalola is classified as impaired by fecal coliform pollution (likely from non-point sources) based on the 2002 monitoring cycle;[31] this violates the Clean Water Act and must be amended by implementation of anti-degradation measures, including total maximum daily loads (TMDLs) for total coliform pollution and regular monitoring.[32] As of May 17, 2004, TMDLs were established for 58 stream segments in the Coosa Basin for such fecal coliform pollution: 200 counts per 100 mL flow during summer months, and 1000 counts per 100 mL flow during winter months.[33]

Several small feeder streams also flow through the site: these tributaries include twenty-two first-order streams with on-site origins, two first-order streams with off-site origins, one second-order stream with an off-site origin, and one stream of unknown order with an off-site origin; many of these merge with each other to form second-order or higher watercourses before their confluence with the Amicalola, and at least one is ephemeral or no longer flowing. Site watercourses are mapped based on USGS and Temple-Inland data (Figure 22). These waterways wind several miles through the site, approximately 1.62 miles of which are classified as seasonal, primary trout streams.[34] [35] No lakes or delineated wetlands are present. Lowland areas near streams, however, were flooded with standing water when visited in February 2005.

Figure 21: On-site view of Amicalola Creek (February 2005)

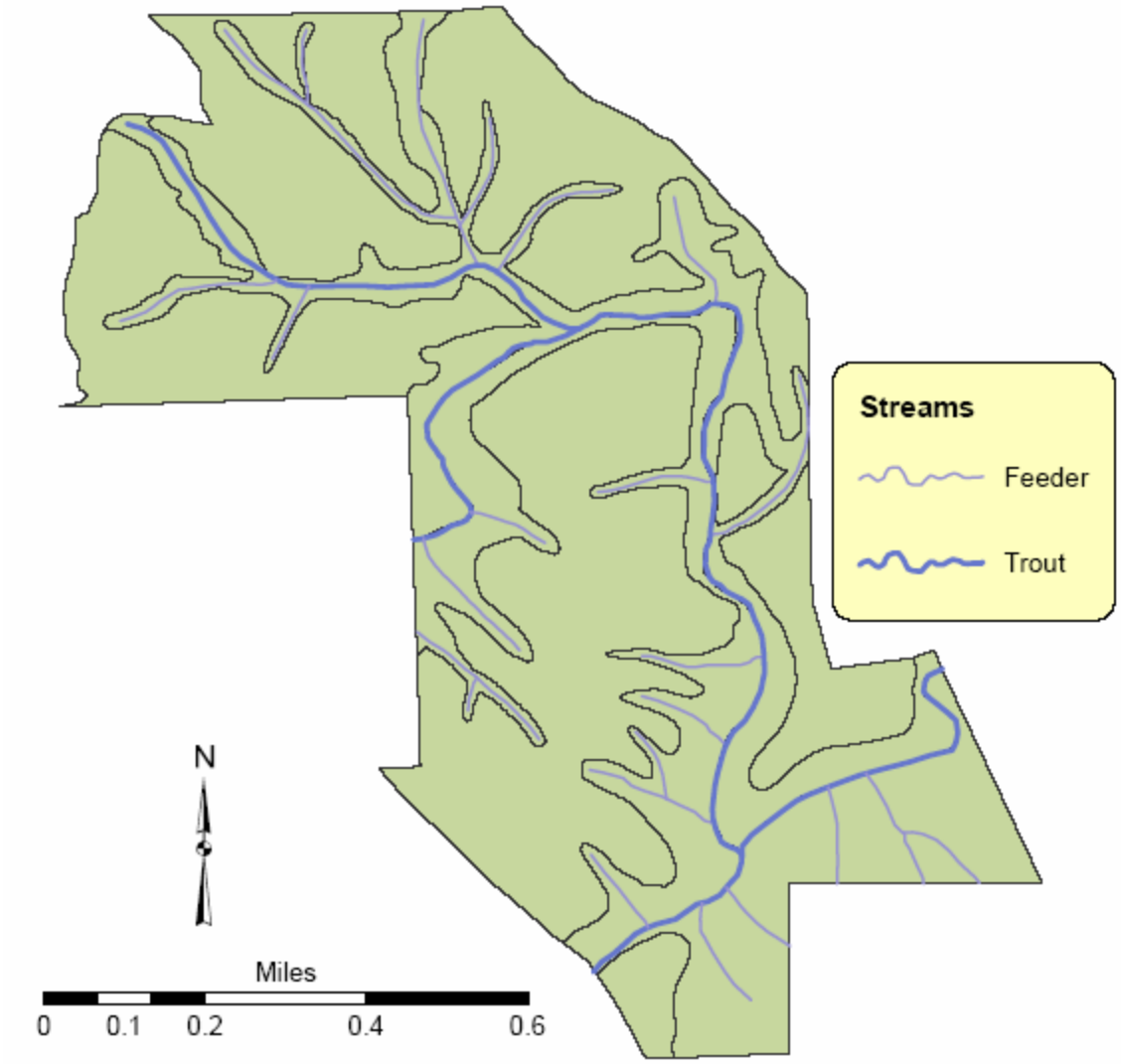

Figure 22: Surface water [36] [37]

Geology and soils: North Georgia features primarily igneous and metamorphic rocks. The region of Dawson County in which the selected site is located has two major rock formations: granite gneiss, an igneous rock, occurs primarily at elevations ranging from 1,250 to 2,500 feet; Ashland Schist, which is a blend of mica gneiss and mica schist, occurs at elevations of approximately 1,400 to 3,000 feet.[38] Deposits along drainages "consist of stratified gravel, sand, and micaceous silt."[39] The gradual weathering of these geologic formations has formed the primary parent materials of area soils; such parent materials have largely determined soil chemical and mineralogical properties. The Temple-Inland site has two primary soil associations. Soils of the Cartecay-Toccoa-Congaree association are typically deep, somewhat poorly-drained to well-drained, and located in flood plains. Hayesville-Fannin-Edneyville association soils are moderately deep to deep, well-drained, sloping to steep, and found on broken ridgetops and irregular hillsides.[40] Between these two associations, eleven soil types have been surveyed on the site (Figure 23 & Table 5).

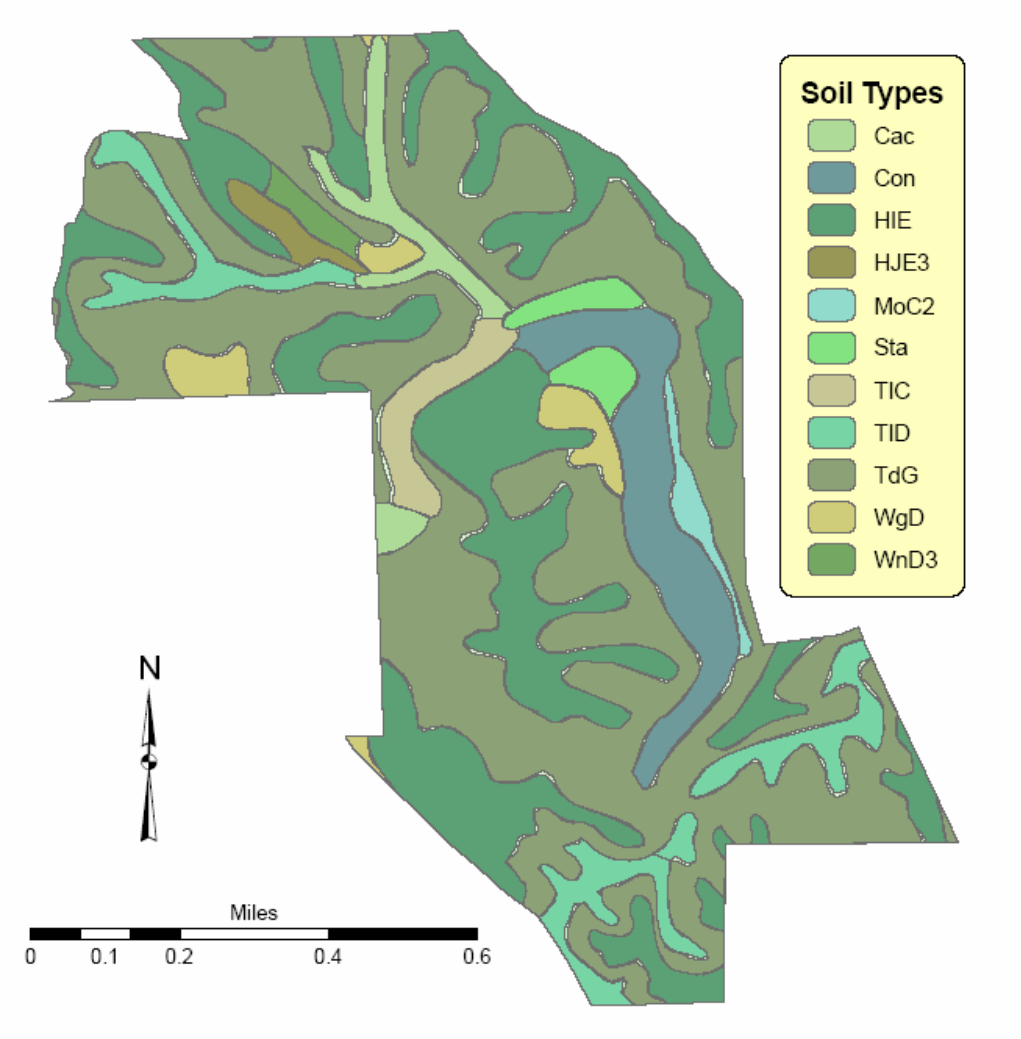

Figure 23: Soil types over the site [41] [42]

Table 6: Soils information, as coded to soils map (Figure 24) [43]

TYPE	EROSION	LOCATION	SURFACE	SUBSOIL	DEPTH	DRAINAGE	INFILTRATION	pH	FERTILITY
Cac- Cartecay complex	slight	narrow stream flood plains - subject to flooding	loamy sand to silt loam	mottled loam to loamy sand	typ > 6'	poor to moderately good	moderate to rapid	5.6 - 6.0	low
Con- Congaree & Starr	slight	flood plains, foot slopes, & drainage heads - subject to flooding	loam to fine sandy loam, rarely to silt loam	stratified silt loam & fine sandy loam	typ > 8'	good	moderate to rapid	5.1 - 6.0	moderate to low
HIE- Hayesville sandy loam	moderately severe to severe	gently sloping ridgetops & hillsides	sandy loam & fine sandy loam	fine sandy clay loam, fine sandy loam, clay, & clay loam	typ > 6'	good	moderate to moderately slow	5.1 - 5.5	low
HJE3- Hayesville sandy clay loam	severe	steep broken slopes & uplands	sandy clay loam; subsoil mixed with remaining surface layer	clay & clay loam	typ > 6'	good	moderately slow	5.1 - 5.5	low
MoC2- Masada fine sandy loam	moderate to severe	old stream terraces; along larger streams above flood plains	fine sandy loam mixed with subsoil	mottled sandy clay loam	typ > 8'	good	moderate	5.1 - 5.5	low
Sta- Starr fine sandy loam	slight	low stream terraces - subject to brief flooding	fine sandy loam	sandy clay loam & clay loam below	typ > 8'	good	moderate	5.1 - 5.5	moderate to low
TdG- Tallapoosa	moderately severe to severe	steep broken slopes & high ridges that follow streams	sandy loam to loam with pebbles & schist fragments	sandy clay loam	typ > 6'	good to excessive	moderate to rapid	4.5 - 5.5	low
TIC- Tusquitee loam	moderate to moderately severe	base of slopes, coves, & around drainage heads	loam	clay loam	typ > 6'	good	moderate to moderately rapid	5.1 - 5.5	moderate to low
TID- Tusquitee loam	moderately severe to severe	coves & small valleys	loam	clay loam	typ > 6'	good	moderate to moderately slow	5.1 - 5.5	moderate to low
WgD- Wickham fine sandy loam	moderately severe to severe	in saddles & along stream divides in foothills	fine sandy loam with fine & medium gravel	sandy clay loam & mottled sandy clay loam	typ > 7'	good	moderate to moderately slow	5.1 - 5.5	low
WnD3- Wickham sandy clay loam	severe	in saddles & around drain heads	sandy clay loam; subsoil mixed with remaining surface	sandy clay loam	typ > 7'	good	moderately slow	5.1 - 5.5	low

Topography: Elevation ranges from less than 1460 feet to slightly over 1700 feet (Figure 24), with slope varying from approximately 0% to just under 59% (Figure 25). Aspect varies over the site, and areas can be found facing all four cardinal directions (Figure 26).

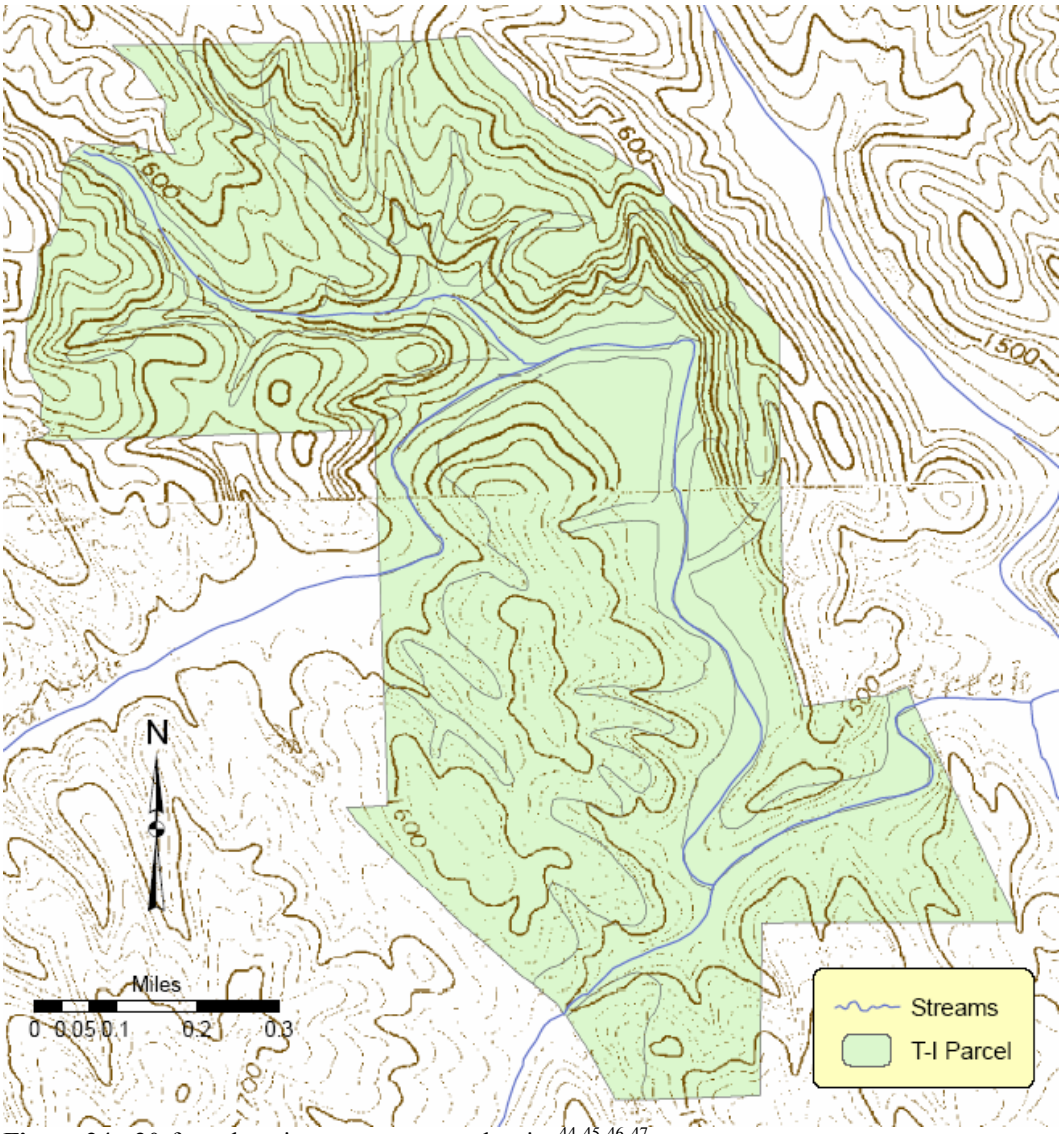

Figure 24: 20-foot elevation contours over the site [44] [45] [46] [47]

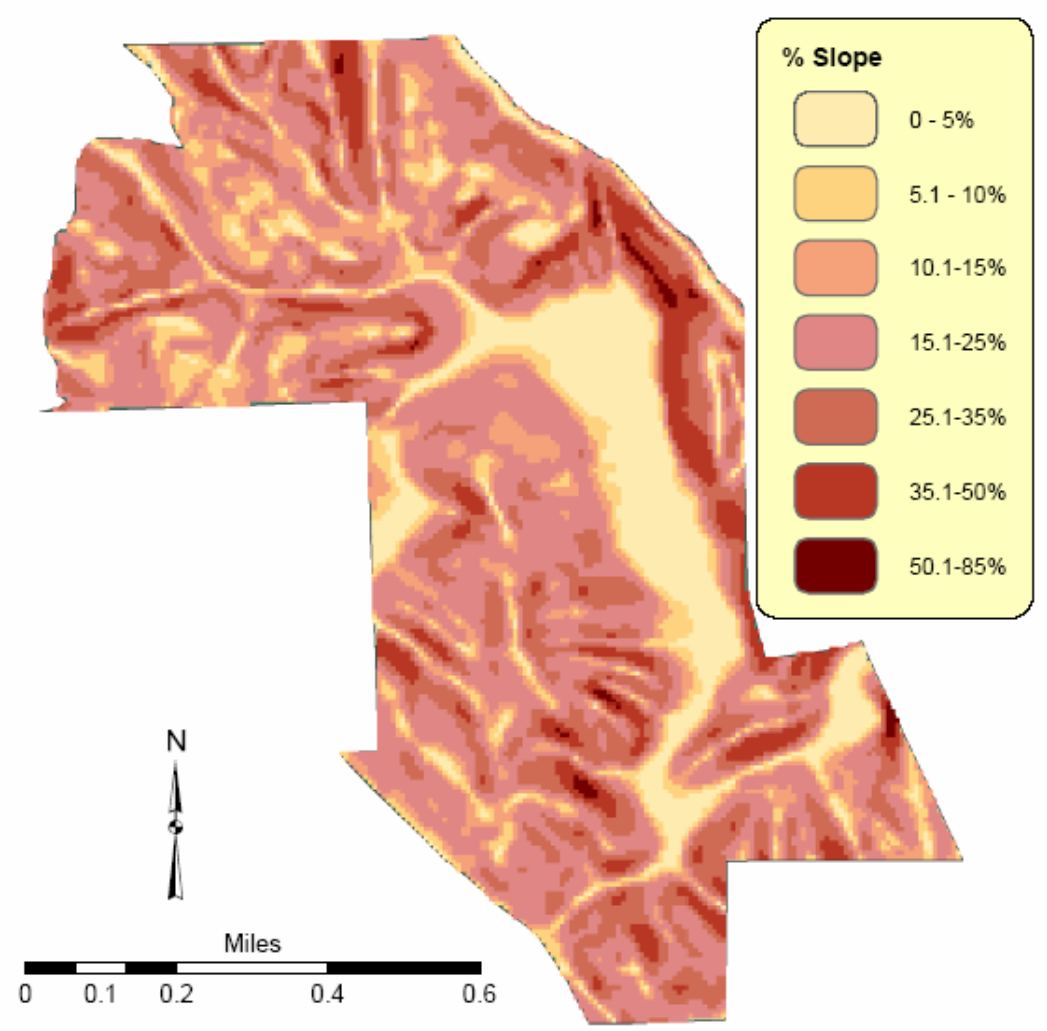

Figure 25: Percent slope over the site (based on 10-meter digital elevation model) [48] [49]

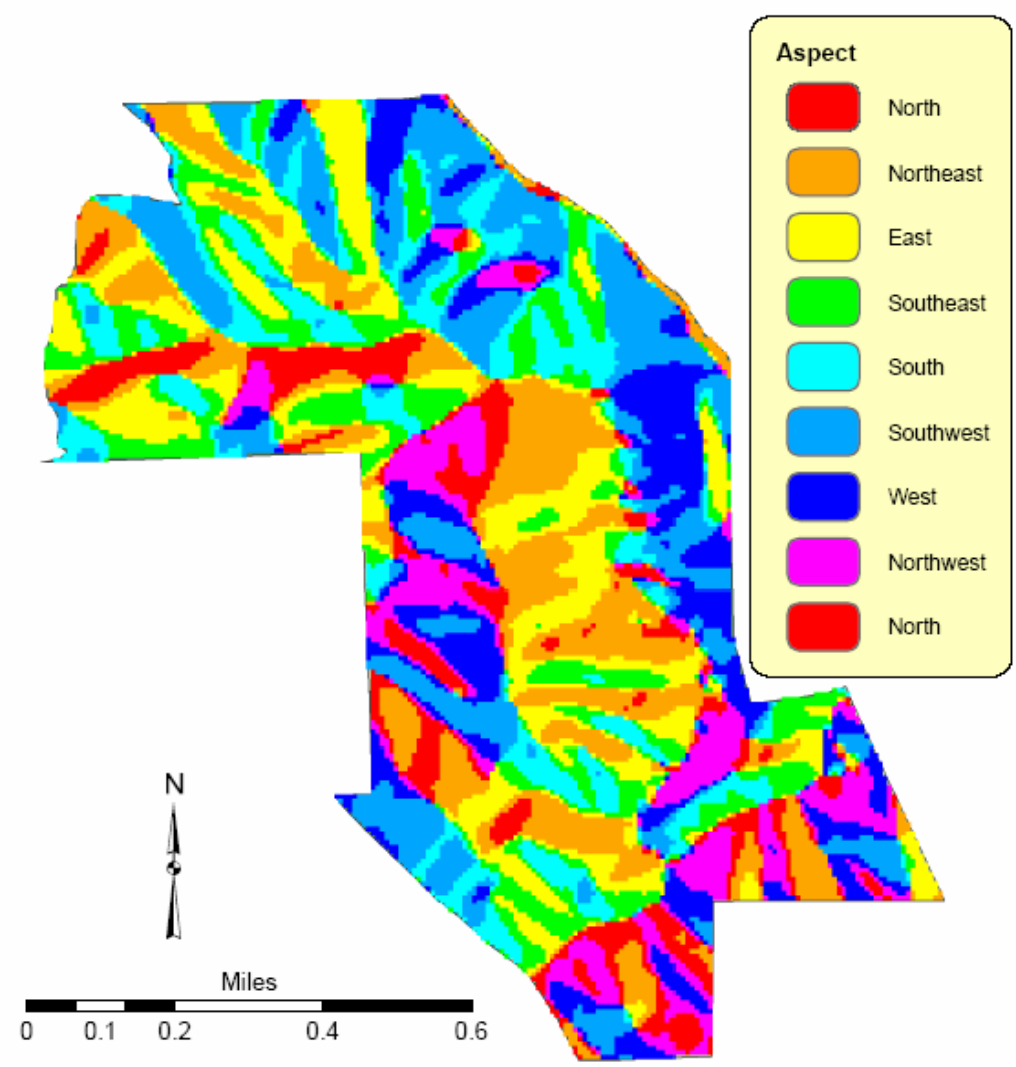

Figure 26: Aspect [50] [51]

Vegetation: Plant communities have varied with land uses and management practices. In accordance with maintenance as a timber stand, the land is now predominantly pine forest with a surprisingly diverse ground layer (Figure 27). Most areas have been managed according to forestry BMPs: they have been planted in pines, fertilized, treated to prevent unwanted species, thinned to allow maximum healthy tree growth, and regulated with periodic controlled burns.[52] Some regions have been more recently cut than others. Streamside management zones buffer waterways and are not harvested. Damper lowland areas have grasses, rushes, and ferns

interspersed with pine and occasional hardwood trees. Some areas of extreme slope are less readily accessible for timber harvest: portions have not been thinned recently, resulting in crowding and potential for disease or infestation; others have been essentially left alone, allowing further succession and reintroduction of more hardwood species. Additional areas, typically along roads and near hill crests, have been clear-cut, burned, and seeded in fescue; these are to serve as wildlife grazing locations and viewsheds to entice potential buyers (Figure 28).[53] General land cover types are mapped (Figure 29). Of the many species present, some of the more predominant are listed (Table 6).

Figure 27: Pine stand (February 2005)

Figure 28: Wildlife feed-plot with scenic view (February 2005)

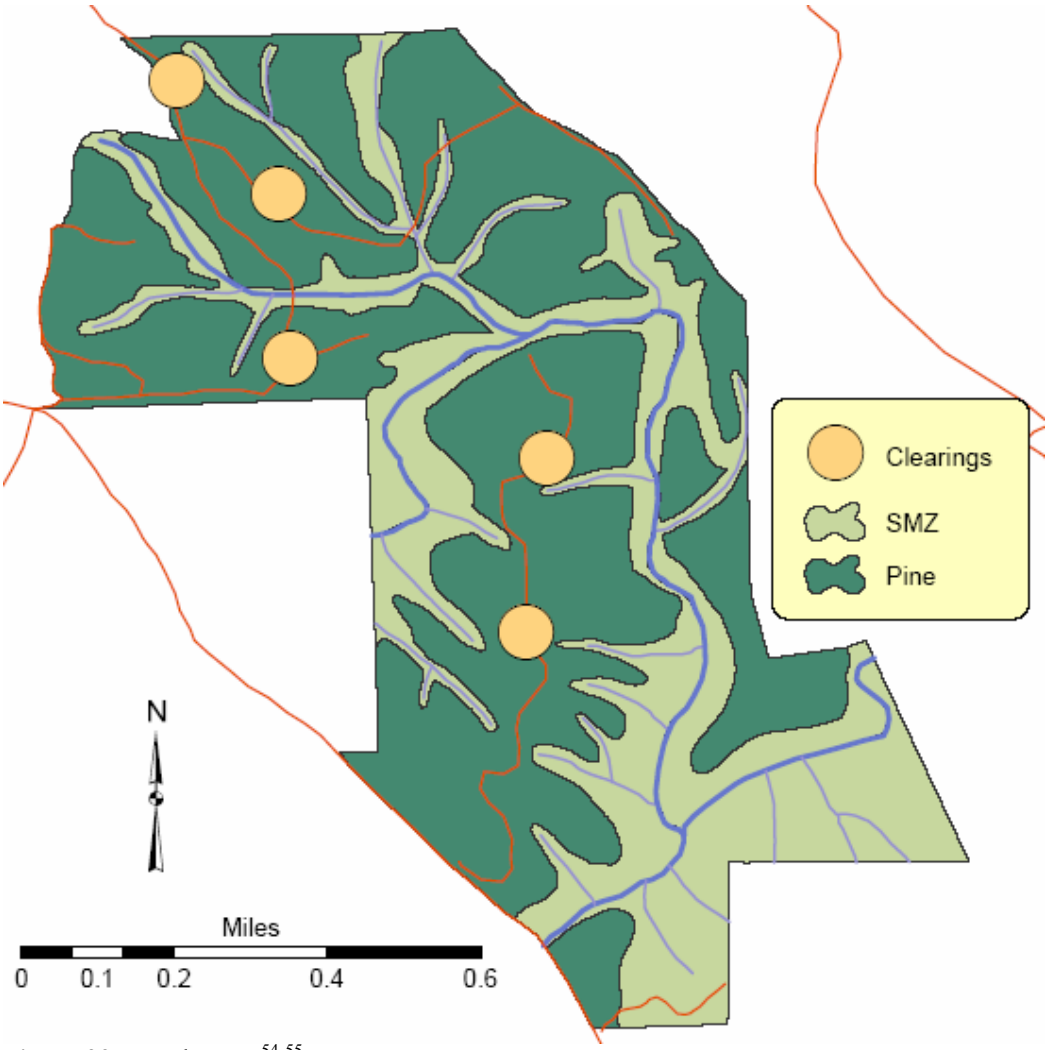

Figure 29: Land cover [54] [55]

Table 7: Vegetation observed on-site (* indicates invasive exotic species)

SCIENTIFIC	COMMON
Acer rubrum	red maple
Andropogon virginicus	broomsedge
Arundinaria gigantea	river cane
Asplenium spp	spleenwort
Campsis radicans	trumpet creeper
Chimaphila maculata	spotted wintergreen
Cladonia spp	reindeer moss
Festuca spp	fescue
Galax urceolata	galax
Hexastylis spp	wild ginger
Ilex opaca	American holly
Juncus tenuis	path rush
Kalmia latifolia	mountain laurel
Lactuca spp	wild lettuce
*Ligustrum sinense**	privet
Liquidambar styraciflua	sweetgum
Liriodendron tulipifera	tulip poplar
*Lonicera japonica**	honeysuckle
Lycopodium spp	club moss
Mitchella repens	partridgeberry
Oxalis spp	sorrel
Panicum spp	panic grass
Pinus strobus	white pine
Pinus taeda	loblolly pine
Pinus virginiana	Virginia pine
Polystichum acrostichoides	Christmas fern
Potentilla canadensis	cinquefoil
Quercus alba	white oak
Quercus rubra	Northern red oak
Rhododendron spp	rhododendron
Rubus spp	bramble
Smilax spp	briar
Solidago spp	goldenrod
Stipa avenaceum	needle grass
Symplocos tinctoria	horse sugar
Tortula ruralis (?)	star moss
Tsuga canadensis	Eastern hemlock
Vaccinium spp	berry
Viola spp	violet

The site's natural vegetation is believed to have been forest of mixed hardwoods and pines. While it is difficult to hypothesize its species composition as uninfluenced by humans, its restored state might be roughly anticipated through survey of a reference site. A nearby tract in

Dawson Forest Wildlife Management Area was periodically sampled from 2001 to 2003, as documented in Kruse's 2003 Master's thesis.[56] This site's use and management history paralleled that of the study site previous to about 1954, when it is estimated Temple-Inland purchased the Amicalola tract.[57] The reference site (as was the Amicalola property) was extensively harvested for timber in the 1950s; it has since been used for small-scale farming and livestock and, since its relatively recent lease by the Georgia Department of Natural Resources, has been managed by the Wildlife Resources Division for ecological repair via assisted natural regeneration.[58] Plant diversity there (Appendix A) is broad and suggests the site's potential species composition in thirty to forty years should pine stand management be abandoned.

Wildlife: As described in Chapter 2, streams and rivers of the Etowah watershed harbor a wealth of aquatic biodiversity, including eight federally endangered or threatened fish and mussel species, further likely candidates for federal listing, and five additional species classified as endangered, threatened, or rare by the state of Georgia; four of these species are unique to the watershed.[59] Due to time restrictions, other wildlife was not surveyed. Animals observed while on-site include one white-tail deer, one rabbit, several squirrels, and a pool of frog eggs. Deer tracks were also viewed in several places. Species that might be sustained can be estimated by intersecting predicted habitats with site location (Appendix B).

Corridors: The site not only hosts stream corridors, but also links two large tracts of existing conservation land to form one extensive corridor of vegetation and wildlife habitat (Figure 30). There is concern that the southern-most, 10,000 acre block of this conservation land is not protected in perpetuity: it is owned by the city of Atlanta and under consideration for development as a second metropolitan airport; regardless, the study site joins remaining lands and, in the event of such development, could prove even more significant to the protection of

aquatic and other species. Areas of such connectivity are becoming increasingly rare; they are vital to maintenance of healthy genetic pools of native species, though, and must be preserved in order to conserve regional biodiversity. An additional benefit of the site's position between conservation parcels is the close proximity and ready supply of source seed, which should help perpetuate a natural recovery process.

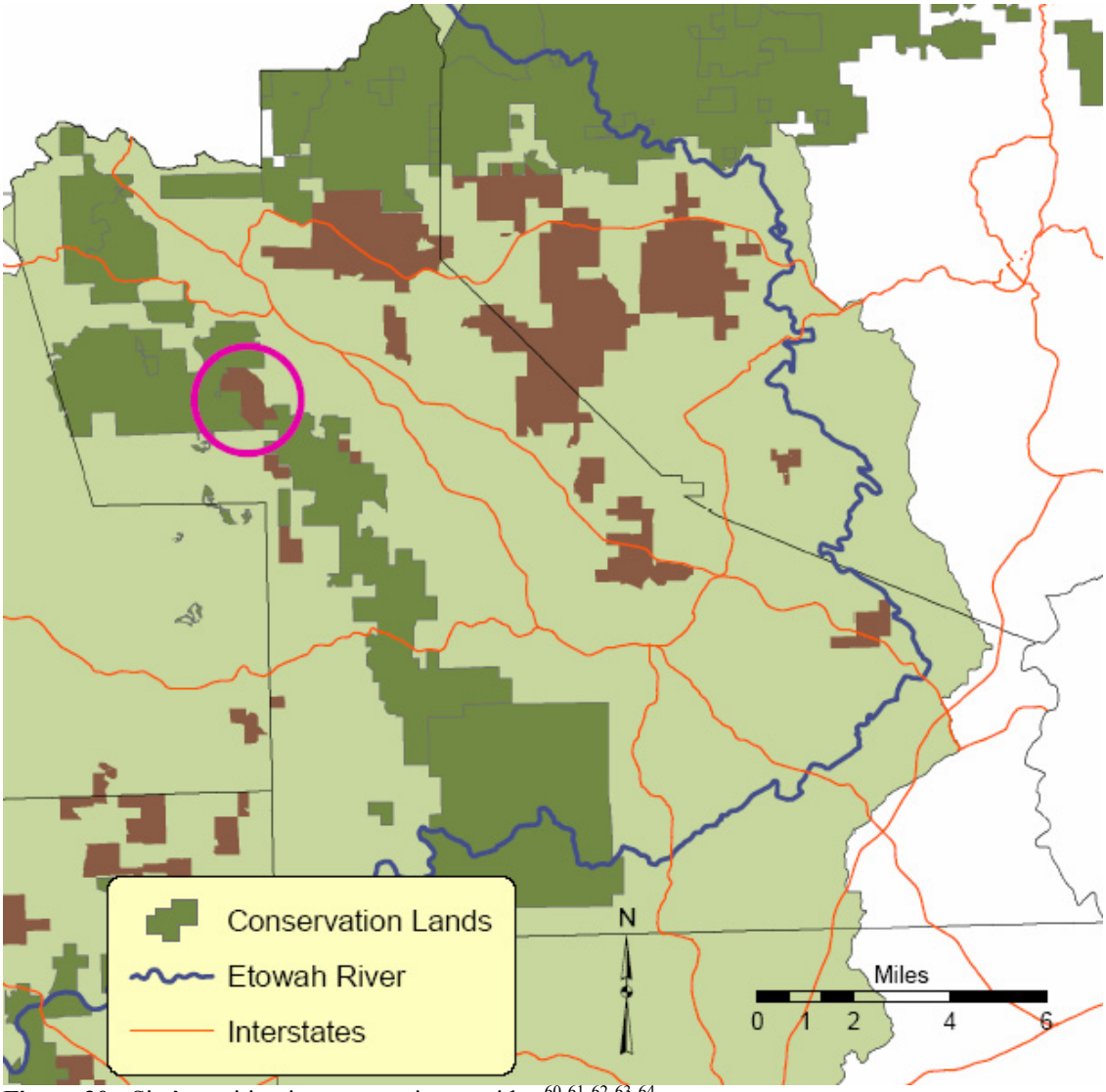

Figure 30: Site's position in conservation corridor [60] [61] [62] [63] [64]

Infrastructure

Utilities (electricity, gas, phone, water, sewer) do not serve the site, though some might be extended from nearby developments. Local suppliers of electricity and water/sewer are Amicalola Electric Membership Corporation and Etowah Water & Sewer Authority; natural gas is not currently available to this portion of Dawson County.[65] No buildings or structures other than entrance gates are present on-site. Bare earth roads allow access to selected areas (Figure 31). These roads are unsuitable to public use: though they are relatively well-placed, they expose compacted clay and are poorly graded with periodic steep slopes and uneven sections. A series of speed bump-like check dams span the roads to regulate water flow during rain events. Some sections near stream crossings have silt fences installed to help prevent further runoff and sedimentation. Four stream crossings are documented; all are facilitated by corrugated metal culverts in varying size and condition:

1. 30”-36” CMP – semi-satisfactory condition: pipe functioning, but pool formed at one end and erosion undercutting bank at other
2. 20”-24” CMP – very poor condition: metal of pipe bent at one end, erosion on both sides, drop-off with splash pool at one end, pipe diameter not sufficient for stream flow
3. 20”-24” CMP – satisfactory condition: pipe functioning and sufficient for stream flow, minimal erosion (likely more from runoff than culvert), surrounding road segment wet, road section and crossing likely unnecessary
4. 24” CMP – semi-satisfactory condition: pipe functioning, but pool formed at one end, road section and crossing likely unnecessary

Figure 31: Infrastructure [66] [67] [68]

Population

Dawson is the nation's 11th-fastest growing county; population increased by 69.7% between 1990 and 2000 (Figure 32) and an additional 16.1% from 2000 to 2003. Despite this boom, the county's estimated 2003 population still was only 18,575, with a density of 88 persons per square mile, about 62% of the Georgia average.[69] Of these, 619 people lived in Dawsonville, the county's largest town.[70] Residents, who are 49.8% female and 50.2% male, vary in race (Figure 33), age (Figure 34), and education.[71] Comparison of Dawson County and Georgia demographics offers some insight into the county's character: residents are more predominantly

caucasian, slightly more represented in the 18- to 64-year age class, and somewhat less educated (18.1% compared to 24.3% holding Bachelor's or higher degrees) than their fellow Georgians.[72]

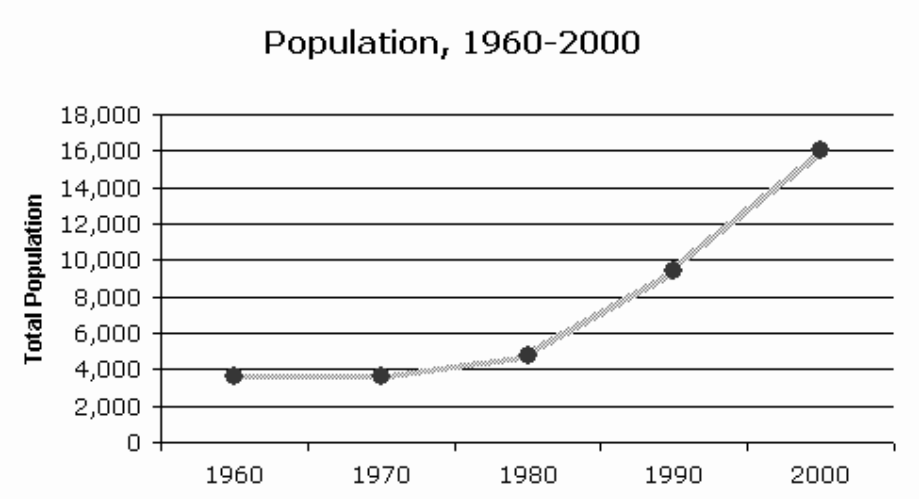

Figure 32: Dawson County population growth [73]

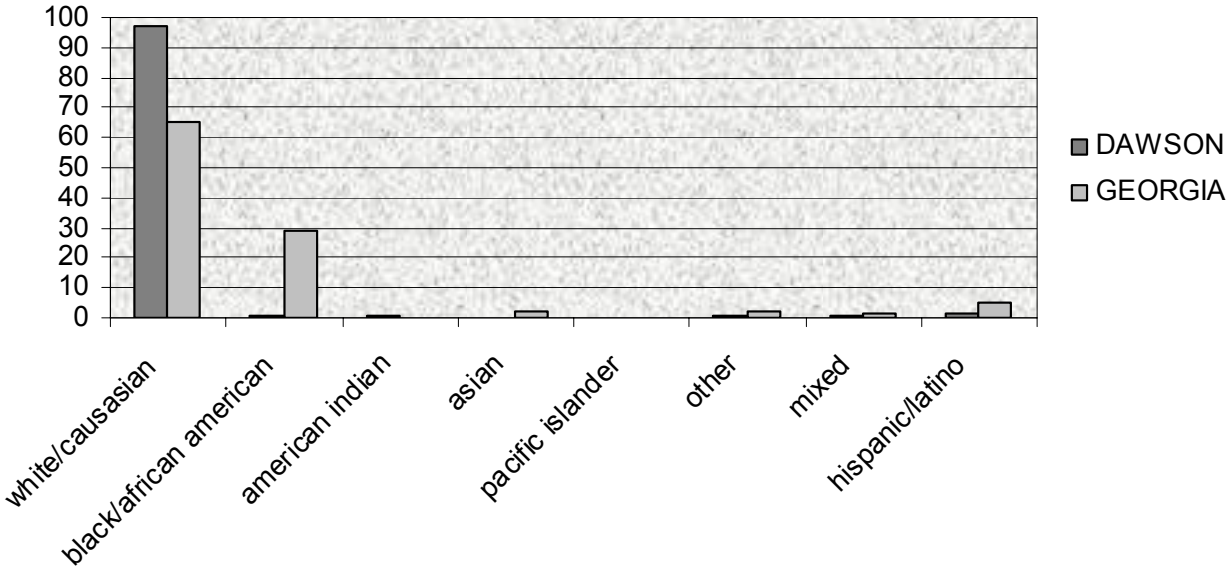

Figure 33: Dawson County & Georgia demographics by percent race [74]
NOTE: "hispanic/latino" classification does not indicate race, but rather ethnicity.

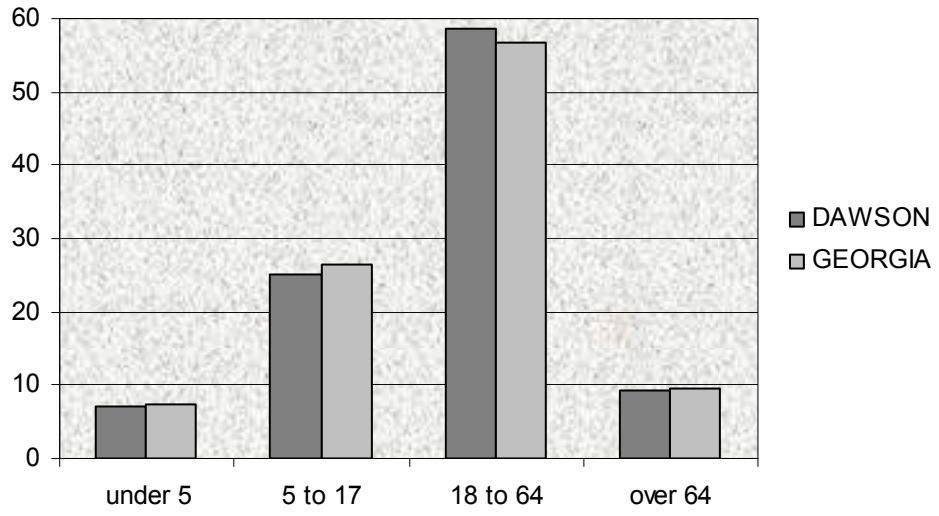

Figure 34: Dawson County & Georgia demographics by percent age class [75]

Perhaps because of either the county's still rural character or its lower percentage of college graduates, there is also a lower per capita personal income ($25,462 compared to $27,794) and average earnings per job ($22,344 compared to $35,881). Dawson County has a lower unemployment rate than either the state or U.S. Approximately 34.5% of residents work within the county, and 52.8% of persons working in Dawson live there; these figures may indicate a greater resident work force than employment opportunity.[76] 3.2%, or 258 residents, were recorded as employed by agriculture, forestry, fishing/hunting, or mining industries located in the Dawson County.[77]

A 2002 survey polled Etowah residents, including 405 residing in upper watershed counties, on their views of relevant environmental issues.[78] Upper Etowah statistics were calculated separately from those of the lower; no other demographic characteristics presented significant variation. Upper watershed respondents indicated over 70% awareness of living in the Etowah basin. Further, at least 50% supported water protection policies, and 94% were interested in public policy.[79] 92% considered aquatic biodiversity essential to watershed health,

though the highest-ranked reason for water quality protection was maintenance of drinking water.[80] Many respondents were uninformed of their drinking water source and most often cited either Lake Lanier (though this response may be accurate for parts of Dawson County) or no idea. Wastewater discharge, industrial waste, and septic leaks were considered greater watershed threats than erosion, runoff, or sedimentation. Respondents were also primarily uninvolved in environmental organizations – only 9% were active, due mostly to lack of either time or information.[81]

Land-Use

As previously explained, Dawson County has yet to become densely populated. The county has no hospitals or airports; residents must instead seek service in neighboring areas. There are only five public schools, two private, and no colleges or other higher education institutions.[82] Dawson offers a wealth of scenic and natural resources, though, including Amicalola Falls State Park, Chattahoochee National Forest, Lake Lanier, Dawson Forest Wildlife Management Area, and two parks.

Forestry is currently the single largest land use in both unincorporated Dawson County (38.1%) and Dawsonville (35.1%). In comparison, residential use comprises only 16.8%.[83] This is projected to quickly change, however, as county population continues to increase. It is predicted nearly all lands managed for forestry will be reclassified by 2025, leaving only a 500-acre buffer stretching from Dawson Forest in the southwest to the Dawson-Lumpkin County boundary in the northeast, with the intent of its shielding the mountainous northwestern part of the county from expanding southeastern development.[84] About half the county's agricultural fields will also be subdivided and developed so that, despite a 4.8% projected increase in parks and conservation lands, there will be a total decrease in county green spaces from 79% to

39.4%.[85] Such predictions forecast extreme aesthetic, economic, ecological, and social changes over a short period, as seen in comparing existing land use (Figure 36) with projected 2025 use (Figure 37).

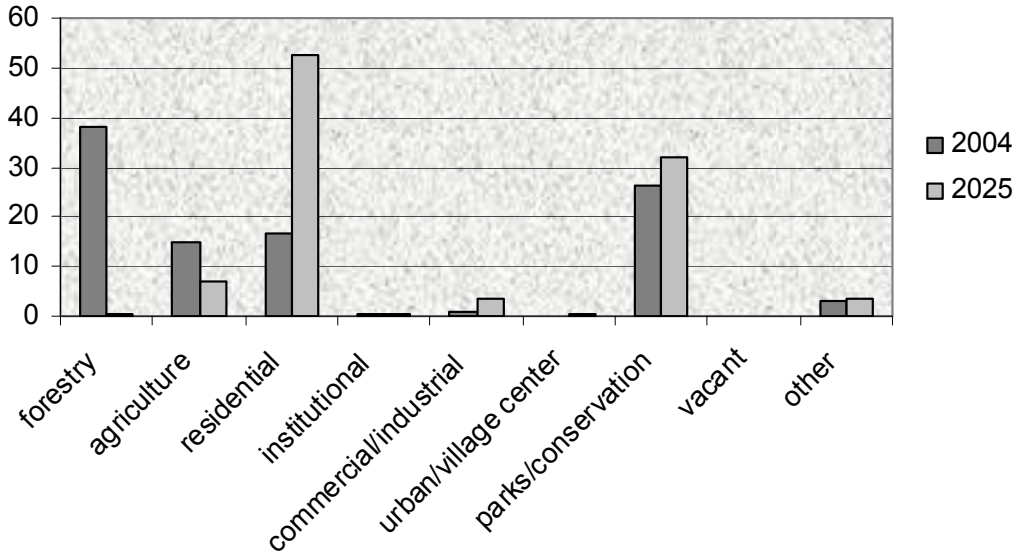

Figure 35: Percent land use in unincorporated Dawson County (does not include Dawsonville) [86]

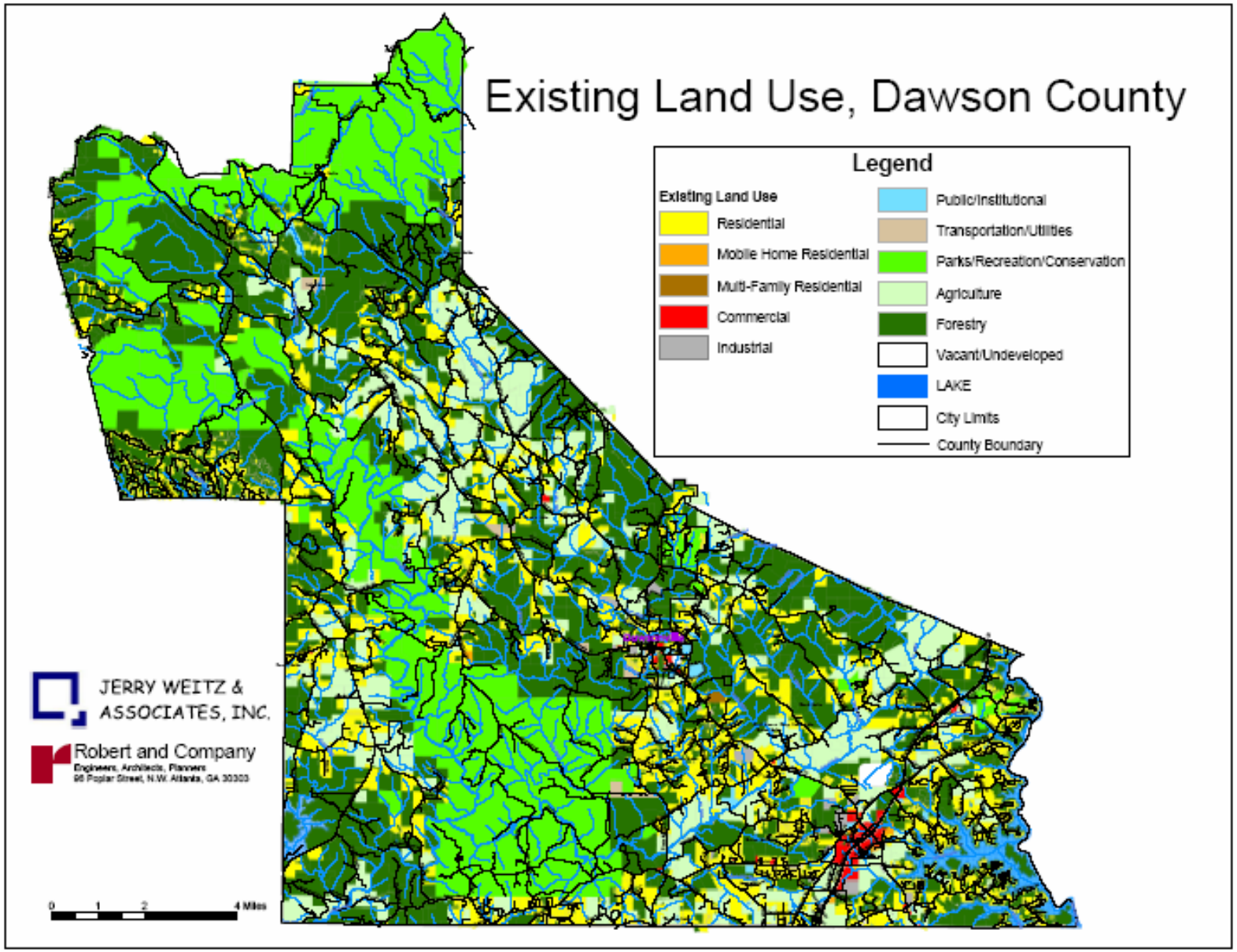

Figure 36: Current Dawson County land-use [87]

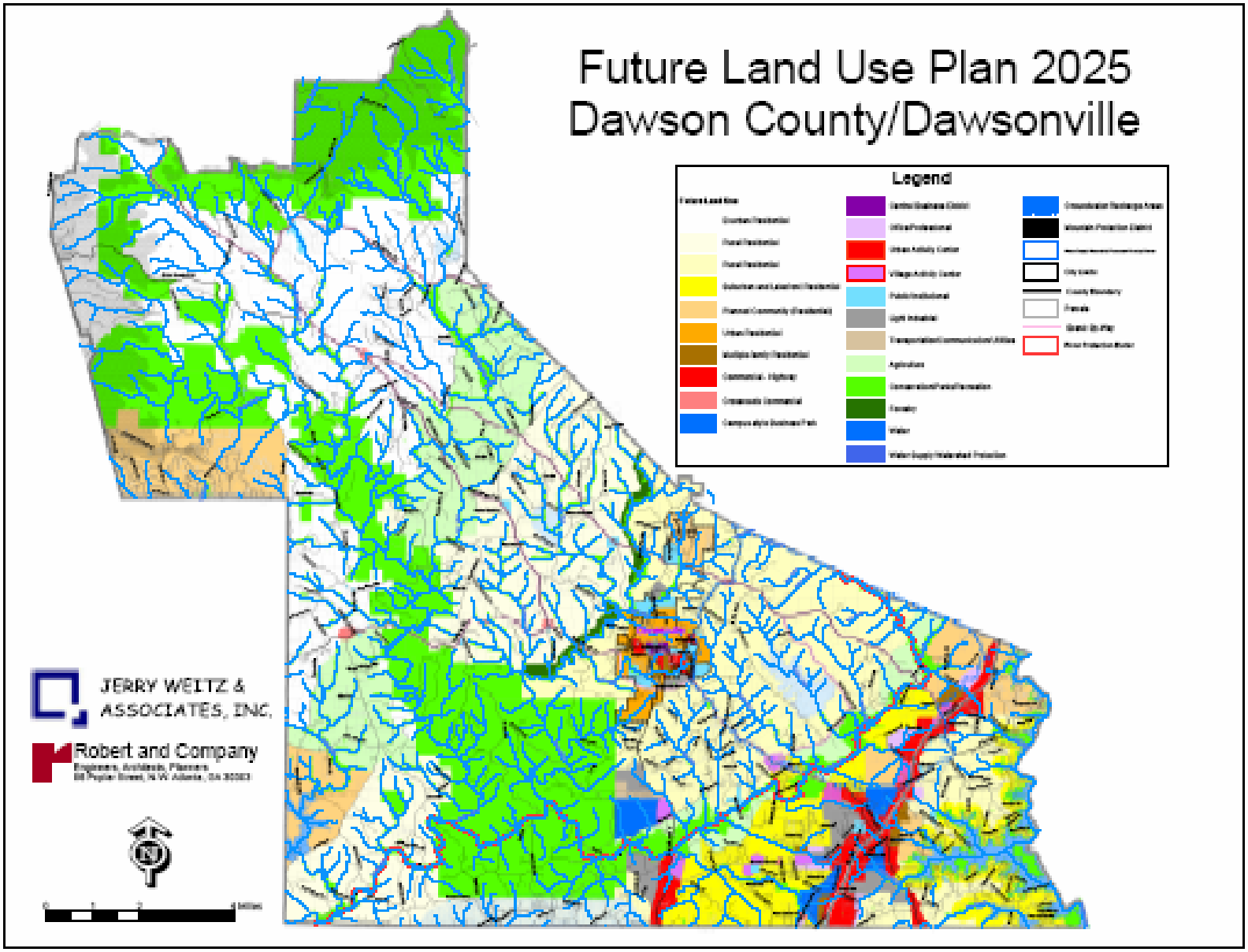

Figure 37: Projected 2025 Dawson County land-use [88]

Special Economic Considerations

As of 2002, Temple-Inland owned a total of 8163 acres in Dawson County. Those acres were worth an average of $1606.08 each at fair market value. Property tax over the same area averaged $15.05 per acre per year.[89] At these rates (which are now likely higher due to inflation and rising Dawson County property values), the Amicalola study site could be sold for approximately $765,313 and costs about $7171 each year in property taxes. The annual lease of hunting permits also contributes to site income at the approximate rate of $8 per acre; all acres are currently leased for this use.[90] As mentioned in Chapter 2, understanding revenue generated and taxed assessed for the site is vital: Temple-Inland owns the land for the purpose of earning profit and maintains a responsibility to its shareholders to do so; should the company be asked to consider retaining property ownership, a long-term plan to generate at least as much revenue as the property could be sold for, plus the amount of yearly property taxes, should be provided.

Summary

The selected Temple-Inland property has a rich history of human interaction. Despite centuries of alteration and impact, however, it remains of high ecological value for its position as a bridge between existing conservation lands, its restoration potential, and its protective buffering of imperiled waters. Other than dirt roads and culverted stream crossings, the site is undeveloped and is supported by no utilities. This is projected to change over the coming twenty years, though; increasing population and development demands will likely induce sale of all to nearly all forestry lands within Dawson County. Surveyed residents are typically aware of such threats but are often uninformed and/or inactive in environmental policy and protection, meaning they may not greatly impact the future of timberlands such as the Amicalola tract.

Notes

[1] Alabama-Coosa-Tallapoosa Basin Hydrography, electronic map (United States Geologic Survey, 2000).
[2] Counties of Georgia, electronic map (Georgia Dept. Community Affairs, 2000).
[3] Temple-Inland Landholdings in Georgia, electronic map (Temple-Inland, Inc., 2004).
[4] Georgia City Boundaries, electronic map (Georgia Dept. Transportation, 2000).
[5] Highways of Georgia, electronic map (Georgia Dept. Transportation, 1997).
[6] Lisa Marie Kruse, "Vascular Flora of the Upper Etowah River Watershed, Georgia," thesis, U Georgia, 2003, 13.
[7] Kruse 16.
[8] Kruse 16.
[9] W. H. Martin and S. G. Boyce, "Introduction: The Southeastern Setting," Biodiversity of the Southeastern United States, ed. W. H. Martin et al (New York: Wiley, 1993).
[10] Kruse 21.
[11] Tom Gibney et al, "The Etowah River: Currents through Time," U Georgia, 2000, 1.
[12] Gibney 2.
[13] Gibney 3.
[14] Kruse 22.
[15] Gibney 6.
[16] Gibney 7.
[17] Martin and Boyce.
[18] Gibney 9.
[19] Martin and Boyce.
[20] Kruse 22.
[21] Martin and Boyce.
[22] Martin and Boyce.
[23] Martin and Boyce.
[24] Temple-Inland Landholdings.
[25] Samuel Breyfogle, personal interviews and email correspondence, 2005.
[26] Temple-Inland Landholdings.
[27] Breyfogle 2005.
[28] Breyfogle 2005.
[29] National Oceanic & Atmospheric Administration, National Weather Service, "What's Typical in North Georgia," 27 Feb 2005 <http://www.srh.noaa.gov/ffc/html/clisumlst.shtml>.
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CHAPTER 5

LAND-USE OPTIONS

Etowah timberlands no longer generate sufficient revenue to validate their continued management for forestry alone, so companies such as Temple-Inland are planning property sale and/or development. As the impending threat of land loss to urban sprawl increases, interest in conserving remaining forestlands will also grow, as will the imperative to identify and plan means of doing so. The following land-uses and conservation tools suggest some of the more appropriate strategies for helping private landholders either maintain ownership of or responsibly sell or develop such ecologically significant Georgia forestlands. These are then matched against site resources and needs to assemble a menu of feasible options.

Sustainable Forestry: Timber, Pine Straw, Pine Bark, Biomass Fuel, and Carbon-Sequestration

Timber: While Georgia's traditional forestry market is declining, an interest in sustainable and local forest products, such as those supplied by SmartWood, may potentially increase. This interest may be mitigated by the potentially higher prices of such products, but improving technologies and greater environmental awareness should help build a profitable market. Several resources of varying suitability might also be stacked with timber harvest to form a portfolio of long-term profit-generating lands.

Pine straw: The dropped needles of pine trees, also known as pine straw, can be harvested for use as exceptional-quality mulch. This requires fairly even tree spacing and minimal understory and ground layer. Assuming an average of 175 bales produced per acre, pine straw sales can generate a net revenue of approximately $505 per acre per year.[1]

Marketability of this mulch, however, depends on needle length and resin content. Longer needles are less prone to blowing away in stronger storms or winds; they also facilitate easier, more efficient harvest and baling.[2] Higher resin content extends product durability.[3] Consumers in the southeastern US, who form the primary user-group of this market, therefore prefer the longer needles and higher resin content of slash and longleaf pines to those of loblolly, white, Virginia, and shortleaf pines. As timber companies most often cultivate loblolly pine throughout the Etowah, pine straw sales are not necessarily a strong resource option. There is potential to expand the market through parts of the mid-west, though, where such mulch is not readily available, and shorter needles would be more readily accepted.[4] Feasibility would depend on the economics of shipping such a low-density product over the increased distance; shipping costs may exceed revenue.

Pine bark bagging: Pine bark is produced as a mill residue and often treated as waste. This by-product can be stored and bagged for various uses, including mulch and material for cleaning oil spills.[5] Either of these uses could be profitable through both material sale and decrease in landfill/disposal cost. Proper storage, however, requires sufficient open space (material can be piled no higher than 15 feet) and maintenance, such as checking for fungal growth, watering, and fire-suppression. Improperly-stored pine bark often develops fungus that, when used as mulch, actually causes plant death. Once infested, bark must be re-hydrated over a period of about two weeks in order to be safe for use.[6] Of secondary concern: mulch doesn't provide as much profit as other potential uses of bark, such as biomass fuel generation, as described below.

Biomass fuel sale: Biomass fuel is an energy source produced from organic matter, typically created of renewable resources replaceable within five years.[7] Industries are gaining

interest in such renewable energy because of concurrently increasing power demands and decreasing fossil fuel supplies. Of the four current processing technologies – direct fire, co-fire, gasification, and pyrolysis – only large-scale gasification is competitive with average conventional electricity without subsidy beyond a standard 1.8 cent per kWh federal tax incentive for biomass use.[8] Because current technology limits economic feasibility, and the low density of biomass restricts its reasonable shipping distance so that fuel supplies must be produced near an electrical plant, biomass fuels supplied less than 2.6% of Georgia's electricity in 1999.[9] Biofuel is projected to become increasingly competitive, however, and could potentially generate approximately 12% of the state's total. Georgia could supply and operate an estimated 50 large-scale gasification units, each adding about $10 million to the local economy, 69 jobs, and over $700,000 in new tax receipts.[10] Of particular interest to Georgia's timber companies: most Georgia biofuels are wood by-products or residuals, which constitute the most efficient type available because of their high BTUs (heat values). Further, pine bark has a lower BTU cost than natural gas, the second-lowest-cost fossil fuel, and wood chips and wood residue both have lower BTU costs than petroleum.[11] This option, because of the need for an electrical generator in the vicinity and sufficient supply to fuel it, requires regional-level planning.

Carbon sequestration: Carbon sequestration is the process of harvesting atmospheric carbon dioxide, usually through absorption and storage in plants and soils. Trees constitute a particularly good medium for sequestration: a stand of loblolly pine in Georgia can store from one to four metric tons of carbon per acre per year.[12] Each million acres of managed forest could potentially sequester 5% to 20 % of the emissions generated in producing Georgia's electricity.[13] Such harvest can be quantified and valuated in terms of credits, which can be traded for money or permits to release increased emissions. Though the U.S. has yet to set national standards or

accept terms of the Kyoto Protocol, an international agreement to reduce greenhouse gas emissions in developing nations, many states are planning to commence emissions trading and sequestration. Georgia passed the Carbon Sequestration Registry Act in 2004; this establishes a methodical framework but lacks means of fund allocation or implementation. A drawback for owners of existing forestlands is that credits are awarded only for new, additional timber stands; forestry companies can earn credits, though, as they harvest and replant their stands. Temple-Inland currently holds membership to the Chicago Climate Exchange (CCX), a self-regulated marketplace for international carbon trading. This has proved unprofitable, however, because the company failed to sufficiently reduce mill emissions, against which sequestration was internally traded.[14] Sequestration and trading profits could be augmented through combination with biomass fuel generation; such pairing could range from trading creating a no-net-increase in carbon release by internally trading emissions from biomass to using thinning to simultaneously increase sequestration potential of remaining trees and maximize production for biofuel.

Low-Impact Development

Forest reserve communities: Forestry companies such as Weyerhaeuser and St. Joe are successfully marketing "forest reserve" communities. These areas are formed through subdivision of tracts into 5- to 40-acre parcels that support both residential development and conservation values. Depending on guidelines, buyers may develop a small portion of their site, while leaving the remainder unimproved. This remainder can either remain forested or be sustainably harvested, often following suggestions of or contracted through the seller. Weyerhaeuser, for example, has divided a 4,400-acre site in Washington into 20-acre lots, which are selling for $140,000 to $250,000.[15] Development is confined to one acre per lot and must meet restrictions that limit impervious surface and maximize sustainable material use. The rest

of the site remains in timber. Forestland designation provides buyers the incentive of property tax breaks, and the area's proximity to Seattle offers the dual benefits of escape to wilderness and accessibility of civilization. Approximately eighty percent of these lots have sold since the project's inception in 2002.[16] A variation of this idea is to sell small lots that border a community-owned natural area.

Planned developments: Conservation subdivisions and other planned developments can also meet combined residential and environmental needs. These residential developments often designate a higher percentage of land as natural in order to maintain aesthetic and wilderness qualities. "Big Canoe," for example, encompasses 7600 acres in Pickens and Dawson Counties, Georgia. Fitting with the development's concept of "blending private residences and recreation with the beauty of the environment," about thirty percent of its acreage is set aside for greenbelts and recreational areas, including the 400-acre Nature Valley tract.[17] A common strategy used by developers to make such projects financially feasible is to cluster residences more closely than zoning would normally permit; rights to do this can be obtained with implementation of a conservation subdivision ordinance or through trade or purchase of the building rights for other land areas either regionally or within a single parcel.[18] This will likely grow in use as increased awareness makes planning commissions more receptive. Application within the Etowah watershed may also increase with the HCP's development of a model conservation subdivision ordinance, which is currently in process.[19]

Other Low-Impact Uses

Recreation leases: Lease of timberlands for recreational use provides another means of generating funds while conserving natural integrity. Though some recreation activities, such as mountain biking and ATV use, negatively impact trails and thoroughfares, others affect land

relatively little. Among these low-impact uses are hunting and fishing. Temple-Inland currently leases much of its acreage, including the entire area of the selected study site, to hunting groups and individual hunters, with an average lease rate of $6-$8 per acre per year.[20] Fishing leases may also be pursued, with rates depending on river type and fish available. An additional benefit is increased public interest in and awareness of the land being leased: leasing to the public allows them opportunity to experience, enjoy, and develop interest in the protected ecosystem.

Camps: Sale or lease of lands for campgrounds also supports low-impact land-use. Though not all camps carry soft development (many install amenities like flush toilets), they still support multiple values. People gain access to "natural" lands, where they may continue to develop conservation values, while funds generated through their visits help ensure longevity of timberlands. Land conservation within campgrounds can be indefinitely provided for through placement of conservation easements prior to sale; easements also gain tax deductions. Primary markets for camps include institutional organizations, specials needs groups, and charitable foundations of big corporations; local Boy Scout organizations, for example, are currently seeking further campgrounds to expand their portfolio.[21] Marketing lands through camp brokers might prove most effective in reaching potential buyers.

Eco-cemetery: There is a "growing national movement to protect and restore land through memorializing those who have died."[22] Eco-cemeteries in the U.S. apply the ideologies of environmentalism and the home funeral movement towards the dual purpose of providing beautiful living memorials to the dead and conserving ecologically sensitive or imperiled lands.[23] These cemeteries offer places for low-impact burial in natural areas. Sites vary in size, perhaps ranging from 25 to 400 acres, but must be both large enough to ensure permanence and be of conservation value and small enough to be well-managed. Tracts are typically also ecologically

significant, as are Etowah lands, and possess restoration potential, as do forestry lands. A portion of funds from each burial is saved in a permanent endowment to pursue and maintain restoration and conservation efforts. Low-impact, sustainable use is maintained through a series of restrictions: use of only biodegradable casket or shroud materials; no vaults or other underground constructions; no embalming fluids; only native material burial markers, such as flat, indigenous field stone or native plants; no new trail construction without approval of management staff; interment by either low-impact machinery or manual labor; low-density burial – typically 30-100 per acre, as opposed to 800-3000 per acre at traditional cemeteries; and no burials within designated stream/water buffers, which are typically 150 feet or more from any water supply[24]. Additional needs are few. Access roads and trails facilitate transport and visitation. Further trails may support recreational walks. A visitor center/business office is recommended, as is a shelter or chapel. GIS/GPS locators linked to a computer database provide visitors with tools for easier future navigation of grounds. Staffing needs are minimal: likely only a manager/public contact with periodic ecological consults and manual labor tasks.[25] Green burials should ultimately provide an increasing market and user group, as they cost only a fraction of traditional burial.

Native plant nursery: Developing consumer environmental awareness is increasing a demand for native plants, as opposed to invasive and/or exotic species. Benefits of planting with natives include lower water needs, lower fertilization needs, and protection of regional biodiversity. This once niche preference is gaining popularity and becoming main-stream, which provides a reliable market for native plant production. Investing lands in production could, therefore, provide a relatively low-cost/high-return option. This fits well with Temple-Inland's current situation: many species for propagation already exist on Temple-Inland properties, and it

would support existing efforts to restore sites for increased aesthetics and eventual sale. Minimum area required is 50 to 100 well-drained acres over the complete production cycle.[26] The site would need inspection and licensure before commencing sales. Initial investments would include facilities and machinery. Other costs would include labor, plant materials, fertilizer, lime, taxes, and building and machinery depreciation. Nursery stock maintenance would, thus, require about $2,000 to $3,000 per acre per year. Variable potential income, though, ranges from $35,000 to $200,000 per ten-acre block.[27] *NOTE: financial figures taken from a 1989 publication; please increase by 10% to estimate 2005 values.

Education and community resource: Lands made accessible to the public could serve as a great educational or community resource. In Georgia, mitigated lands placed under conservation easement and also dedicated to Georgia public use and benefit also gain higher credit amounts.[28] These areas can provide recreation, meeting places, and outdoor classrooms that share contact with a natural world becoming increasingly less-known. Should Wilson's statement that, "the only way to carry biodiversity safely through the bottleneck of this critical period is by a combination of scientific and technological innovation, abatement of population growth, and environmental education, guided by a redirection of moral purpose," prove correct, public access to conserved lands will be vital to sustained biodiversity.[29] Equally important to scientific knowledge of the environment are the "ways in which humans evaluate this knowledge and create meaningful interpretations of their experienced life-world and their own position within it … as part of this interactive pattern, education seems to be important to change long-term developments … to adjust our social systems to perceived global change."[30] Public lands ultimately benefit not only current users, but also long-term social development and environmental health by increasing awareness and helping adjust interactions.

Fee-Simple Conservation Sale

Likely the simplest, most long-term available means of preserving ecologically significant lands is fee simple sale to either the state or a conservation agency. Funds for such purchase may be levied from any number of sources; among the most likely to serve timberlands in Georgia are the Land & Water Conservation Fund State Recreation Grants, Forest Legacy, and the HCP Acquisition Fund.[31] Government purchase of large amounts of acreage, however, shifts the existing balance between privately and publicly owned lands, which the State considers unfavorable.[32] Further, there are not sufficient funds to buy all imperiled, ecologically significant tracts. Georgia lags behind the southeastern average of percent land protected. If the State were to attempt to reach the average, and land were priced at an average of $2,500 per acre, it would cost approximately $1.9 billion in fee simple land purchases. In comparison, the State hopes to access only slightly over $2 million for such purposes.[33] Fee simple purchase can not be relied upon as a primary means of land conservation, but rather treated as a special option for highly significant lands where environmental value precludes other economic uses or for areas designated for public access.

Public-Private Partnerships

An increasingly available tool for either purchasing land for conservation purposes or helping private landowners maintain their acres is the development of public-private ventures. Partnerships can help the state conserve funds, keep lands under private ownership, and open greater accessibility to grants and matching-fund programs. In order to most efficiently preserve lands and avoid conflicts, partnerships require a shared vision, effective leadership, and commitment.[34] The state can facilitate operations, but other involved parties must participate as active stakeholders. Two successful examples involved the partnership of the Conservation

Fund, International Paper, state government, and others: approximately 75,000 acres on Tennessee's Cumberland Plateau were protected, resulting in an area that simultaneously sustains public recreation, wildlife habitat, and sustainable forestry; a further 260,000 acres in New York were preserved by planning a conservation easement over most of the land.[35] [36] [37]

Fund-Generating Conservation Tools

Conservation easements: A conservation easement is a tract of land that has been protected from potential development through a legal agreement between the owner and either a government branch or a land trust. A landowner typically retains the title and the right to various uses, such as the right to harvest timber, but relinquishes all development rights. Benefits to the landowner can include federal and state income tax deductions for a charitable donation and decreased property taxes to reflect the site's diminished fair market value.[38] Some states, including North Carolina and South Carolina, also offer tax credits as incentive for installation of conservation easements. Though Georgia does not currently offer such credits, Governor Perdue's Land Conservation Partnership Advisory Council recommends instituting an income tax credit worth 50% of a donated property or easement's fair market value.[39]

Transferable development rights: The transfer of development rights from one area to another allows concentrated development in high potential regions and greenspace conservation of ecologically significant lands. Transfer often occurs regionally: Environmentally sensitive lands are designated "sending areas," from which development rights are severed and either traded or sold. Regions of high-density development potential are "receiving areas," which purchase or trade for the right to develop beyond zoning limits.[40] Such trading is currently under review by the Etowah HCP Steering Committee and would offer timber companies such as Temple-Inland the opportunity to more responsibly manage the future development of their

properties.[41] Companies might either trade internally throughout the region or sell rights to other developers. Similarly, trading rights within a single landholding might allow clustered development on one portion of a site, while conserving resources and natural aesthetics over the rest of the parcel. An example of such clustering is the residential development of conservation subdivisions, for which the HCP Steering Committee is also compiling an ordinance.[42] This option requires regional-level planning.

Mitigation: Mitigation seeks to compensate for unavoidable habitat loss and negative impact on aquatic function. Credits, or units of accrual/attainment of aquatic function, can be generated by a landowner by restoring, enhancing, or compensating for damaged lands.[43] Examples include the restoration of a buffer along a stream and the in-stream repair of any eroded banks. Siting criteria favor areas of high restoration/enhancement potential, mixed hardwood forests that were drained and converted to pine production, tracts with long-term potential to sustain protected functions, and areas with high potential for developmental intrusion, among other factors.[44] Mitigation plans must include means of monitoring and assessment and provisions for both perpetual management and protection of a site. The process is overseen and must be approved by the Mitigation Banking Review Team (MBRT).[45]

Selecting Site-Specific Options

The above-described options can be stacked with each other (Table 8). Also included in the table are recommendations for pairing options with variously ranked properties; such rankings are based on conservation value as determined by the process described in Chapter 3. The study site is ranked high-priority and carries inherent limitations in its resources and needs: Because it can sustain a maximum of only 4% impervious surface without further threatening watershed health, less than twenty acres can be developed; for this reason, low-impact

Table 8: Stacking Options and Recommendations (recommendations for overall tract rankings based on Chapter 2 information)
NOTE: * Denotes option that requires regional-level, as opposed to tract-specific, planning

OPTION	COMPATIBLE STACKING COMBINATIONS														RECOMMENDED FOR		
	TBS	BIO	CO2	DEV	REC	CAM	CEM	NUR	EDU	SAL	PAR	EMT	TDR	MIT	TOP	MID	LOW
TIMBER, BARK, STRAW (TBS)		X	X		X				X		X	X	X	X	X	X	X
*BIOMASS FUEL (BIO)	X		X		X				X			X	X	X	X	X	X
CO2 SEQ. (CO2)	X	X			X			X	X			X	X	X	X	X	X
PLANNED DEV. (DEV)												X	X	X		X	X
REC. LEASE (REC)	X	X	X						X		X	X	X	X	X	X	X
CAMP SALE (CAM)												X	X	X		X	X
ECO-CEMETERY (CEM)									X		X	X	X	X	X	X	X
NURSERY (NUR)			X						X			X	X	X		X	X
EDUCATION (EDU)	X	X	X		X		X	X			X	X	X	X	X	X	X
CONSERV. SALE (SAL)												X	X	X	X		
PARTNERS (PAR)	X				X		X	X	X			X	X	X	X	X	
EASEMENTS (EMT)	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
*TDRs (TDR)	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
MITIGATION (MIT)	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X

development is not considered. This decision is supported by the desire to limit all pollutants entering the watershed from the site, in keeping with ideals of the Clean Water Act. The site's forests do not produce sufficient logging residues to supply a biomass fuel generator, nor are neighboring forestry sites likely to invest in such an option while land values and development pressures are rising so dramatically. A successful system of carbon sequestration and credits for established timber stands has yet to be developed in the U.S. Site topography is too extreme, and lowland soils are periodically too flooded to support an eco-cemetery. Selected land-use options and conservation tools for the site, therefore, are narrowed; choices include education, recreation lease, public-private partnerships, TDRs, easements, mitigation, small-scale sustainable forestry, and –possibly- carbon sequestration in the future.

Summary

Land can be protected and conserved by a variety of methods. Property owner economic needs, however, can impose obstacles and limitations. Still, many means of sustainable land use are available. Timberlands can be sustainably grown and harvested, supplying a growing niche market. Carbon sequestration from large forest stands can earn credits during growth periods before harvest, and timber harvest residues can be used to generate electrical power. Land can be sold, or development rights can be severed. Any of a number of low-impact development options limit environmental impact. Other fund- or credit-generating strategies, such as mitigation banking, might also be employed. Conserved lands will also serve public benefit if made accessible for recreation or community education use. These strategies form the primary menu of land-use options from which those considered for application to the study site are selected.

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CHAPTER 6

RECOMMENDATIONS

As explained in Chapter 1, this paper seeks to assemble a sustainable management plan for the study site. Goals include helping preserve the Etowah watershed's ecology by reusing forestlands slated for eventual sale, supporting the landowner's economic needs by stacking land uses for maximum profit, and empowering the public by conserving resources and shifting common perceptions of and interactions with nature. The site has been inventoried, and land-use options have been selected based on the site's resources and needs. This chapter, in planning more detailed land-use applications for the site, seeks a feasible balance of goals to find a viable long-term plan.

Analysis

Based on the site inventory and assessment of Chapter 4, a composite analysis map is compiled (Figure 38). Buildable areas are shown in green, and non-developable land is in white. Also displayed are wildlife management plots and their viewsheds, culverts, points of access onto the site, and well-placed internal roads. This information will form the basis for most decisions on placement of site elements. Any development, for example, will occur on buildable land, and any scenic overlooks will be placed on wildlife feed plots because of the accessible views. Mitigation will be recommended where culverts are located. Roads will be maintained leading inward from points of access for minimum possible distances, and trails will be recommended to connect multiple points throughout. This information will be broken down as needed throughout the rest of this chapter.

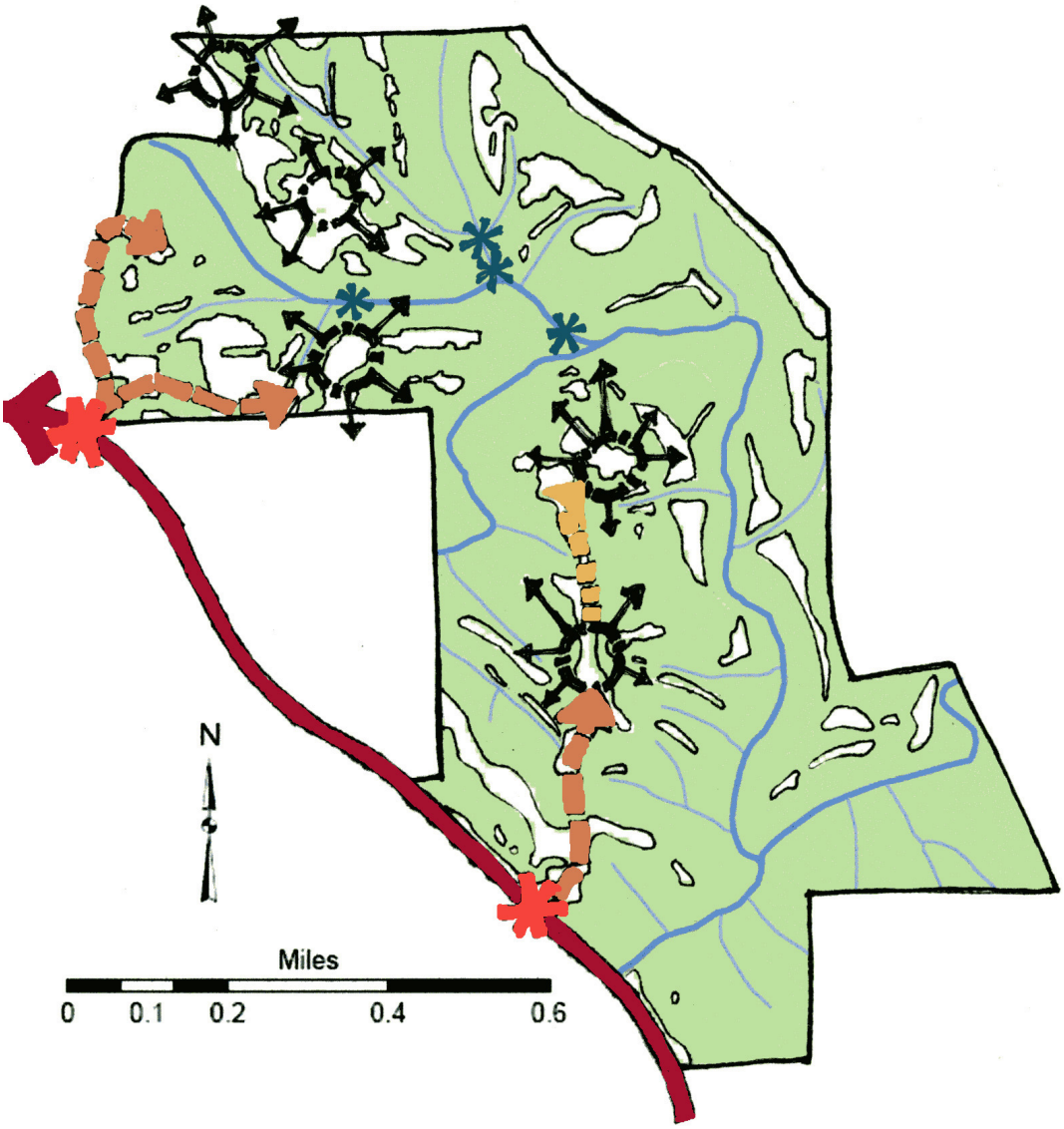

Figure 38: Composite analysis

Funding

It is recommended that public and/or private partners – state or branch governments, non-governmental organizations, or other groups – be sought to establish more complete, long-term conservation of the site. Collaboration can provide the benefits of matching fund initiatives and support of daily operations and maintenance throughout the site's future. Dawson County government, for example, includes an easement or buffer along the Amicalola River in its 2025

future land-use plan and, therefore, may show interest in helping fund the site's protection.[1] Other potential partners include the Nature Conservancy, Georgia Department of Natural Resources, and the Conservation Fund.

Grants and other aid should also be applied for, with facilitation of the application processes determined by members participating in the site's funding and conservation. Types of particular interest would be those funding or supplementing initial facilities development, farm/timberlands conservation, public recreational use, environmental education or water monitoring in support of the Clean Water Act. Examples are listed (Table 9).

Table 9: Sample of more likely funding sources [2] [3]

FUNDING SOURCE	2004 GEORGIA ALLOCATION	GRANT ALLOCATION
Cooperative Endangered Species Fund	unknown	---
EPA Environmental Education grants	---	to $25,000
Forest Legacy	$1,500,000	---
Good Neighbor Service-Learning grants	n/a	to $15,000
Land & Water Conserv. Fund State Rec. grants	$2,210,749	---
Laurie Otto Seeds for Education grants	---	unknown
Nature of Learning grants	---	to $5000
NSF Informal Science Education grants	---	unknown
Project Learning Tree GreenWorks! grants	---	unknown
TEA 21 Recreation Trails	$1,185,637	---
Wildlife Habitat Incentives	$520,000	---

Conservation

Development rights over the entire site, or as much of its area as possible, should be severed to secure its protection in perpetuity. Further, particular negative impacts to the site should be remedied. Performing these protective measures will not only help conserve the site and the watershed's endangered species, but also help generate funds that can be applied either

towards site management or reparation to Temple-Inland for loss of revenue – a possible $2 million at current rates – that could have been earned through the site's sale.

Streams should be mitigated via removal of four culverts in two streams, amendation of areas degraded due to culvert impact, and improvement of timber stands within associated riparian buffers, which can extend up to 200 feet plus two feet per percent slope.[4] Mitigation areas should also be placed under conservation easements and dedicated to public use and benefit, including some level of government or public site management; these provisions will increase credit generation of mitigation activities.[5] Completion as outlined over an approximate fifteen feet of stream length per culvert may generate an estimated minimum of 372 credits, but possibly double or more, for in-stream work alone (Table 10). Riparian buffer improvement and/or preservation can generate up to the same number of credits, bringing the minimum total to 744. These credits can be applied towards the establishment of a mitigation bank, which is a collection of earned credits that can be sold to companies or individuals planning projects with negative stream impact. Current 2005 market price for such a credit is about $45.[6] At this price, mitigation activities could earn at least $33,500, but possibly $67,000 or more. Requirements of such mitigation banking and mitigation typically include monitoring for seven years and use of adaptive management strategies.[7] Timber stand and native vegetation improvement within mitigation areas will also serve the purpose of providing a better seed source for natural regeneration of native plant communities over the rest of the site.

Table 10: Stream mitigation factors applied to four culverted areas [8]

FACTOR	CULVERT 1	CULVERT 2	CULVERT 3	CULVERT 4
structure removal	4	4	4	4
"excellent" monitoring	1	1	1	1
priority area	1	1	0.2	0.2
control	0.5	0.5	0.5	0.5
timing	0.1	0.1	0.1	0.1
sum-above factors	6.6	6.6	5.8	5.8
feet of stream	15	15	15	15
credits earned	99	99	87	87

Conservation easements both protect natural areas and provide financial relief to the landowner. These easements may either be sold or donated to a grantee, typically a government or land trust. Though assessment requires verification from the grantee of an easement, the study site could meet three of four conservation purposes eligible for tax benefits as described by the Internal Revenue Code, Section 170(h)(4)(A): it –potentially- provides outdoor recreation by and education of the general public; it protects a relatively natural habitat of fish and wildlife; and it preserves forested open space, yielding scenic enjoyment of the general public.[9] Easements appropriate to the site could take the form of riparian buffers, particularly the existing SMZs, which are mainly consistent with the fifty-foot model buffer ordinance, and any mitigation areas. Alternately, they could cover the extent of the site, should a willing grantee be found. Aside from possible revenue through sale, financial incentives include possibly increased mitigation credit generation, lower income tax for any loss in productivity, and lower property taxes reflecting any loss in the land's fair market value.[10] [11] Legal dedication of easements to Georgia public benefit can further increase credit generation in any mitigation areas.[12]

Transferable or purchasable development rights should be used as a fund-generating tool over any areas of the site not ultimately protected under easements. Treating the site as a sending zone will sever its development rights, while either other Temple-Inland property or the

land of a buyer will receive those rights and gain the option of building more densely. Receiving zones may be located within Dawson County or elsewhere in the watershed (Figure 39).

As mentioned in Chapter 4, Amicalola Creek is impaired by fecal coliform pollution, which violates the Clean Water Act and must, by law, be amended.[13] This provides even further incentive for mitigation efforts. Work by Temple-Inland to reduce non-point source pollution into the creek and to assist with water monitoring may open the company to federal grants and will increase governmental and public goodwill. There is also the possibility of establishing a future trading system for clean water.

Combined effects of mitigation, easements, and TDRs should sever development rights over the entire site. A possible scenario might include mitigation along two culverted streams and their banks at maximum buffer width of slightly over 200 feet, easements placed over remaining existing SMZs, and TDRs over the rest of the site (Figure 40).

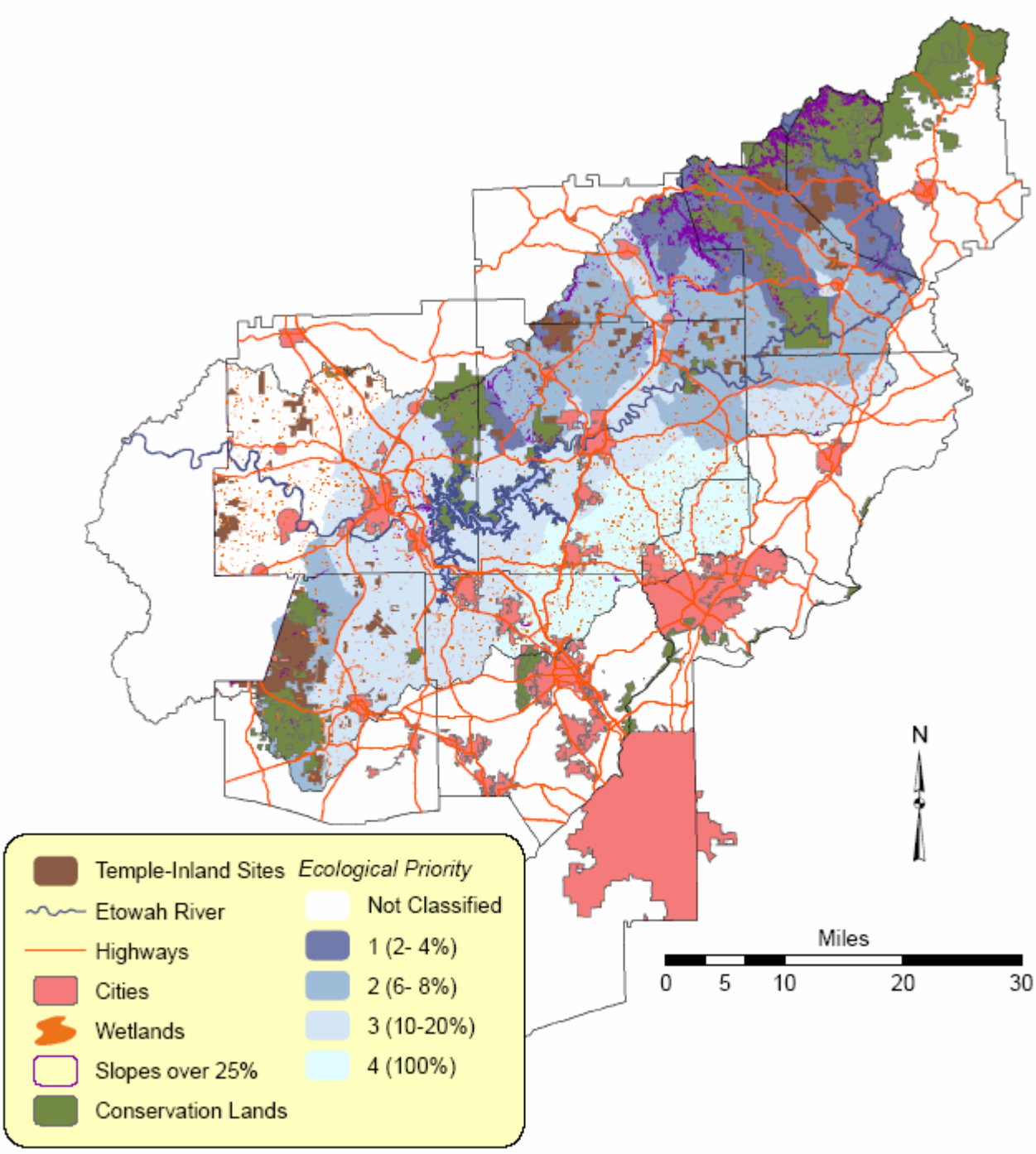

Figure 39: Temple-Inland properties with classification features to identify TDR zones [14] [15] [16] [17] [18] [19] [20] [21] [22]

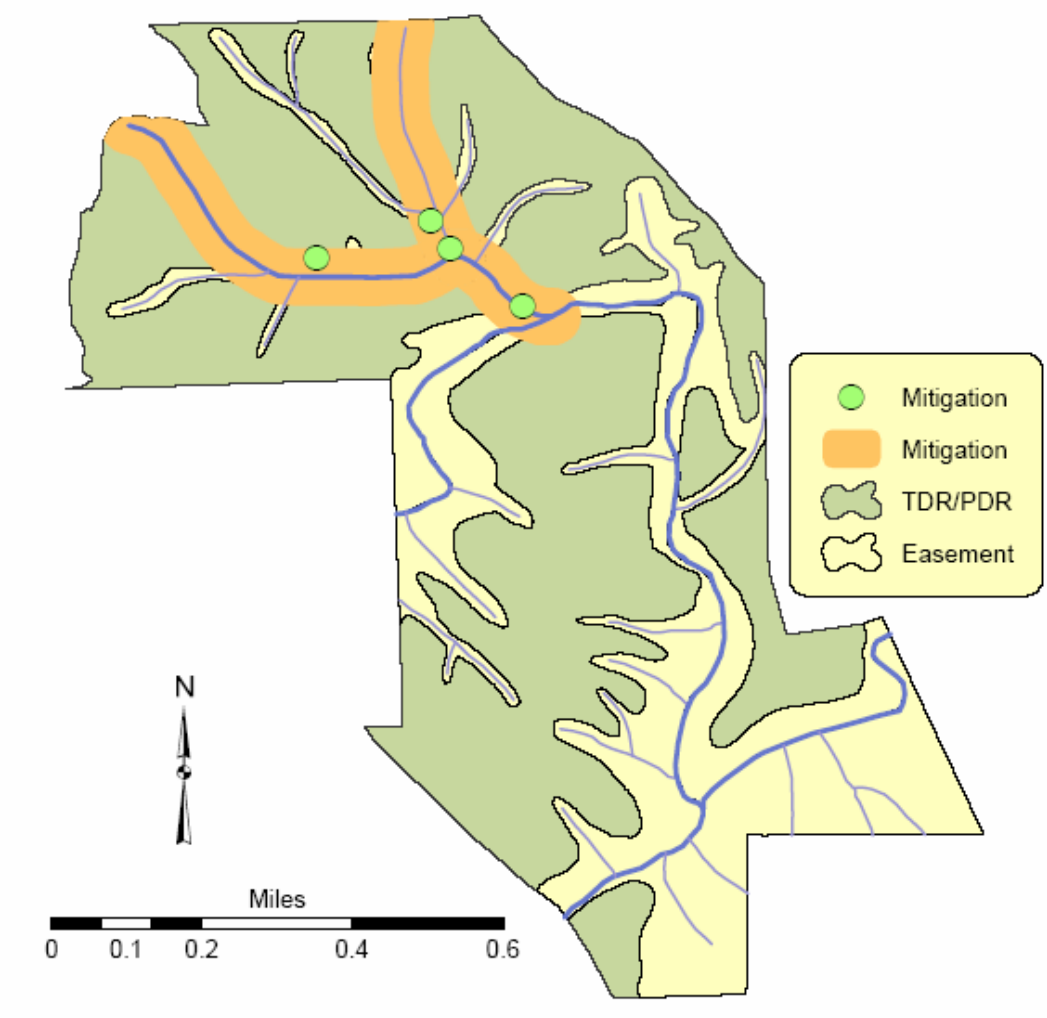

Figure 40: Plan to protect site by zones of mitigation and severing development rights [23] [24]

Facilities and Development

Facilities development is recommended to maximize the site's public benefit and future revenue-generating potential. To ensure lowest possible site impact and best-placed elements from such development, several factors are considered: desirable slopes are typically no greater than 15%, no disturbance should occur within riparian buffers, no impervious surface should be established within potential easements, and structures should not be placed on soils prone to flooding (Figure 41).

Figure 41: Developable land [25] [26] [27] [28]

Access points and internal roads are of utmost importance. Two existing entry points are suggested for continued use: one is restricted-access designed for permitted anglers and campers; the second serves as a primary access for day-use visitors. Continued use of only small segments of existing roads is planned. These roads should be more evenly graded and either paved (in the case of the primary access) or covered with gravel (for the restricted access) for easier driving conditions. Remaining sections of road should either be converted to other uses or ecologically restored. Parking will be allowed in designated campsites and visitor spaces. All roads and parking areas should be constructed to generate as little stormwater run-off as possible:

rain gardens, infiltration and drainage points, and use of porous paving or reinforced turf are recommended as possible with varied soils and rock depths.

A simple visitor center/office structure or, at minimum, a shelter with restrooms is also recommended and believed vital to increasing visitorship among varied demographics, such as age and gender. It should be easily accessible from the primary entrance; for ease and minimum construction cost, its suggested siting is on an existing clearing/wildlife feed plot; this area will also provide a scenic view of North Georgia mountain scenery for any visitor. Design features include sustainable technologies, particularly those that minimize stormwater impacts: a green roof, rooftop stormwater harvest, and rooftop solar energy harvest would help conserve site features, lower maintenance costs, and highlight ecological design solutions for visitors. Appropriate uses include educational programming, small-scale forestry workshops, company meetings, exhibits on watershed health or forestry, daily operations, and facility rentals. Installation of a septic system and drainfield will require an estimated additional 1500 square feet (based on estimates of use and soils information) of land without canopy or deeply-rooted vegetation;[29] alternately, composting toilets offer an even more ecologically-sound option. Also designated for the area surrounding the visitor center are trail heads, experimental native plant gardens, and necessary parking. Parking areas should support an estimated five cars on a daily basis and anywhere from an additional five to fifteen cars and one to three busses for overflow; these areas should be constructed with either porous paving or reinforced turf and include rain gardens and infiltration points for heavy storms. Canopy trees will also make these areas more pleasant.

A network of trails will lead visitors throughout the site. These are to be constructed of a mixture of existing dirt roads, logging tracks, and new pathways. A variety of habitats and

aesthetics are to be experienced: riparian, upland forest, lowland forest, clearing, mitigation, and small-scale forestry plot. The walking experience should also be supplemented by interpretive material, either recyclable pamphlet or outdoor signage. Stream crossings are incorporated into the system; these should be facilitated not by culverts, which can alter stream flow and impede fish passage, but by simple footbridges. Low-impact bridge construction for this application should follow several recommendations: keep all support structures out of the stream channel and off the banks; do not alter the channel; keep impervious surfaces of any support anchors away from the banks; and quickly revegetate (with native plants) all disturbed areas.[30] Smaller, additional paths should service all campsites and other areas as needed.

A proposed site plan incorporates recommended facilities and developments (Figure 42).

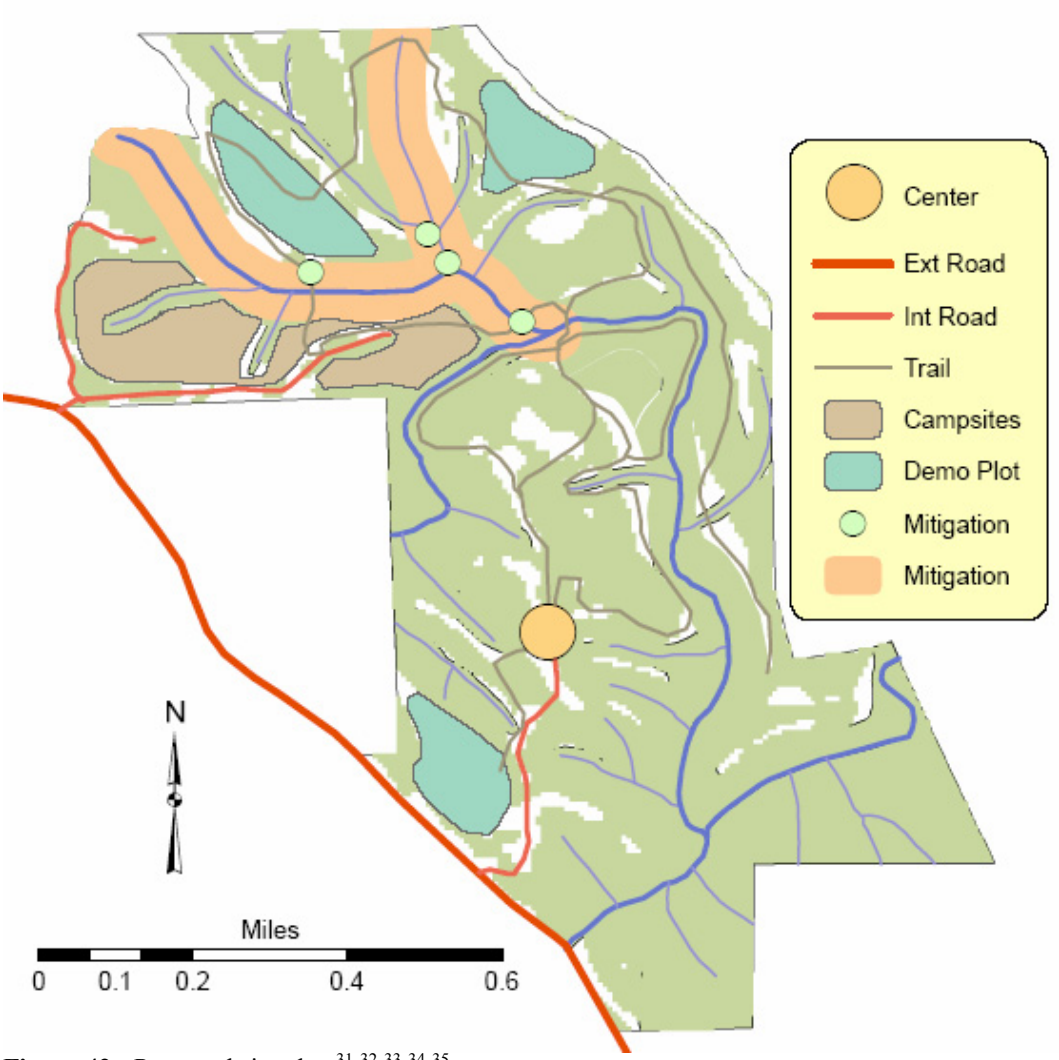

Figure 42: Proposed site plan [31] [32] [33] [34] [35]

Community Interaction

Two types of recreation lease are recommended to generate continued funds: seasonal trout fishing and primitive camp-site leases. Both would likely be leased on an annual basis. If trout fishing were to earn $50 per angler per day, as suggested by an outfitter to Temple-Inland staff, and a minimum of one person per weekday and two per weekend day were to use the site, trout fishing alone could generate approximately $14,000 per season.[36] The installation of fifteen campsites at an annual lease rate of $300 could earn an additional $4500. Funds

generated through recreation lease could be applied towards annual property tax payments and as profit for Temple-Inland.

Other forms of community interaction with the site should focus primarily on education. Because Dawson County's large timberlands are projected to be sold and subdivided into parcels with a minimum size of five acres by 2025, Temple-Inland may have a unique opportunity to provide workshops on small-scale sustainable forestry and periodic on-site expert forester hours.[37] These services may be supplemented by small-scale demonstration plots; a series of three could show timber management at different stages. Advisement and coordination of local timber cooperatives may also be timely and supportive of local community, while generating some small percent of profit for Temple-Inland.

Additional appropriate educational topics include forest systems, watershed ecology, site restoration, native plant propagation and use, human history within the watershed, human interactions with local ecosystems, and sustainability issues. Such educational experiences might be gained through formal programs, informal outdoors interactions, service-learning projects, and outdoor classroom-oriented activities. Further, opportunities for all ages and multiple education levels should be made available. Some items could generate revenue, while others would not. Participation in environmental education collaboratives, such as the Georgia Outdoor Classroom Council, would likely prove helpful, as would implementing programming detailed in Projects "Water Education for Teachers" (WET), WILD, and Learning Tree. Management and operation of such programming would likely be carried by collaborating partners more experienced in education. Certification and awards from the Wildlife Habitat Council, particularly their "Corporate Lands for Learning" program, and similar organizations could help generate good public relations and endorsements of on-site educational activities.[38]

Site Management

Daily operations should comply with Temple-Inland's designations and standards but be the responsibility of a collaborating partner. This would include maintaining visitor center hours, supervising volunteers, scheduling any facility rentals, educational programming, and any non-forestry grounds maintenance. Most operations are recommended to be implemented by volunteers, service-learning participants, students, and visitors under the coordination of staff. Ideal projects for such stakeholders, varying with experience and interest, include site restoration and monitoring, program facilitation, visitor center interpretation, trail construction and maintenance, and native plant propagation.

Mitigation banking requires "excellent" level monitoring of all restored areas. This entails collection of data on bank stability as well as vegetative, bird, mammal, reptile, and amphibian biota within riparian buffers and fish populations in the surrounded channel over a period of seven years.[39] Such monitoring and annual status reports are also required over any additional years it may take to sell the credits in the mitigation bank from the site.[40] This level of monitoring may be supplemented with additional testing and experimentation, particularly of water quality; this could be participated in by visitors and students, but must be handled carefully and coordinated by well-trained staff. Application of a dynamic landscape perspective and use of adaptive management strategies will help site managers adjust to unforeseen or changing circumstances in site ecology or modify unsuccessful mitigation procedures.[41]

The site is planned to generate profit for Temple-Inland over an approximate period of 40 to 80 years to compensate for the land's market value; after this time or earlier, should the company choose, Temple-Inland can either retain ownership of the property but allocate profits to its continued longevity or donate the site to the State or another collaborating partner.

Liability

The public use of private Temple-Inland property may generate concerns about liability. Two Georgia acts, however, alleviate some issues surrounding such liability. The Recreation Property Act aims to "encourage owners of land to make land and water areas available to the public for recreational purposes by limiting the owner's liability toward persons entering … for recreational purposes."[42] While this does not grant immunity from liability, it reduces the duty of care of landowners who directly or indirectly invite or permit public recreational use without charge. Of note is that an admission fee may not be charged; this does not, however, restrict all charges for specialized programs or uses, so long as spectators or typical visitors are allowed free entry and use of the site. Landowners may still be liable for "willful or malicious failure to guard or warn against a dangerous condition, use, structure, or activity."[43] Any public entity managing the site also receives reduced liability. This remains true on conservation easements, as under the Georgia Uniform Conservation Easement Act, which "shields public entities and charitable groups from liability for injuries that occur on land upon which they hold a conservation easement."[44]

Summary

Appropriate applications and uses for the site include means of conserving its ecological value in perpetuity, mitigating past impacts, developing facilities for public use, and increasing community interaction with the site and Temple-Inland. Many of these uses simultaneously generate income. Still, use of the study site for ecological and public benefit does not necessarily prove economically feasible in the short-term. It does, however, offer the potential of little to no financial loss, the possibility of long-term financial gain, and the much greater probability of generating good public relations for Temple-Inland both within the Etowah region and among

environmentalists. Good public relations can produce company loyalty, trust in a product name, and corporate good-will, thereby increasing benefits of sustainable use of the site. Further, such use and positive community interaction may help further Temple-Inland's position as an industry leader as our world becomes increasingly environment-conscious. Overall implications of site conservation are positive to the public and society, to economic welfare, and to a fragile ecosystem.

Notes

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[4] United States, Army Corps Engineers, "Compensatory Stream Mitigation Standard Operating Procedure" 2004, 30 May 2005 <http://www.sas.usace.army.mil%2FSOP.04.doc>.

[5] Army Corps Engineers.

[6] Robin Goodloe, telephone interview, May 2005.

[7] Army Corps Engineers.

[8] Army Corps Engineers.

[9] Nanette Nelson and Laurie Fowler, "A Primer on Conservation Easements and Greenspace for the Property Tax Division of the Georgia Department of Revenue" (Athens: U Georgia Inst. Ecology, 2002) 5.

[10] Nelson and Fowler 5.

[11] Army Corps Engineers.

[12] Army Corps Engineers.

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[14] Alabama-Coosa-Tallapoosa Basin Hydrography, electronic map (United States Geologic Survey, 2000).

[15] Counties of Georgia, electronic map (Georgia Dept. Community Affairs, 2000).

[16] Temple-Inland Landholdings in Georgia, electronic map (Temple-Inland, Inc., 2004).

[17] Sensitive/Priority Areas in the Etowah Basin, electronic map (Seth Wenger, 2004).

[18] Georgia Conservation Lands, electronic map (Natural Resources Spatial Analysis Lab, 2003).

[19] Georgia City Boundaries, electronic map (Georgia Dept. Transportation, 2000).

[20] Highways of Georgia, electronic map (Georgia Dept. Transportation, 1997).

[21] Georgia National Wetlands Inventory, electronic map (United States Fish and Wildlife Service, 2004).

[22] Georgia 10-Meter Digital Elevation Model, electronic map (Natural Resources Spatial Analysis Lab, 2004).

[23] Amicalola Site, map (Temple-Inland, Inc., 2005).

[24] Temple-Inland Landholdings.

[25] Amicalola Site.

[26] Temple-Inland Landholdings.

[27] Georgia 10-Meter DEM.

[28] C. L. McIntyre, Soil Survey of Dawson, Lumpkin, and White Counties, Georgia (Washington D. C.: USDA, Apr. 1972).

[29] Evans, Sally, et al., "Recommendations for Effective Septic System Management in the Upper Etowah Watershed" (Athens: U Georgia Inst. Ecology, 1999), 21 Apr. 2005 <http://www.rivercenter.uga.edu/education/etowah/documents/pdf/septic.pdf>.

[30] Audrey Baggett, Erica Chiao, and Tracey Harton, "Habitat Conservation Plan for the Upper Etowah River Watershed: Road Crossings – Effects and Recommendations" (Athens: U Georgia Inst. Ecology, 2001).

[31] Amicalola Site.

[32] Temple-Inland Landholdings.

[33] Temple-Inland and Georgia Roads, electronic map (Temple-Inland, Inc., 2004).

[34] Georgia 10-Meter DEM.

[35] McIntyre.

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CHAPTER 7

CONCLUDING THOUGHTS

This thesis assembles a cursory analysis of sustainable land-planning and -use strategies for an identified timberland property in the Upper Etowah watershed. The aim of sustainable development to meet the needs of the present without compromising the needs of the future is reflected in plans to both generate revenue and maintain forest cover on land that nurtures regional aquatic biodiversity, watershed health, and water supply, as well as provides scenic beauty. Ideally, the needs of environment, economy, and society are concurrently met in both the immediate and long-term. This is most viable here not through intensive site development, but in conservation and use for public benefit with selective stacking of income-generating strategies. As diagrammed in the Georgia Land Conservation Partnership Plan, such conserved land provides outdoor recreation and education, biodiversity, clean and abundant water, clean air, and cultural identity; these factors ultimately help protect natural and cultural resources, which in turn ensure continued quality of life and economic benefits.[1]

Success of this goal, however, depends on environmental awareness and embracing paradigms that assign value to long-term ecological, cultural, and economic health instead of immediate material gain. Culturing such a shift in pedagogy will require education – formal, informal, and popular; direct and indirect; interactive and passive. Educational opportunities are, therefore, included in site plans to help people, both visitors and landholders, to "see themselves as having the capacity to assess and act upon and address their own needs and concerns in becoming effective participants in the struggle for change."[2] If, as Spirn states, we are

storytelling people who need to relearn the language of landscape, we first need exposure to and interactions with that environment.[3]

While many land-use options considered in this paper currently offer relatively little economic gain, their feasibility and profit margins should primarily increase in the future. As natural resources become increasingly depleted and environmental impacts of our long history of interaction with the planet's ecosystems become more severe and apparent, we will likely seek more sustainable options. Such options may well include forestland uses such as carbon sequestration and biomass fuel generation, as described in Chapter 4. These currently offer little incentive but have a likely future. Organizations like Forest Trends recognizing environmental need and the common desire to put elements in terms of incentives, endorse the establishment of market systems for environmental products and services.[4] This seems the most accessible means of encouraging corporate ecological responsibility; future research might aim to determine others as well.

Additional future studies might consider whether a formula or process can be established for the best-possible use of timberlands in developing areas. This paper had initially sought more finite, number-driven strategies for the study site, which could then be extrapolated from to indicate potential options for other sites; this was not the outcome, however. Strategies explored here also need further specification before application to any property. Another point of curiosity and possible further research is the influence of public opinion: local public perceptions of the timber industry were not polled but might help determine what level of success such an endeavor as that described in this paper might experience. Further, knowledge of local opinion might serve as a baseline from which educational success could be measured.

Though sustainable management of the study site would not provide immediate financial incentive, the potential ecological and social benefits combined with long-term economic possibilities warrant close consideration. Such factors might be studied for comparable purposes on parallel sites.

Notes

[1] Georgia, Advisory Council for the Georgia Land Conservation Partnership, Georgia Land Conservation Partnership Plan (N.p.: n.p., 2004) 20.

[2] Budd L. Hall and Darlene E. Clover, "The Future Begins Today: Nature as Teacher in Environmental Adult Popular Education," Futures 29, Iss. 8 (1997): 738.

[3] Anne Whiston Spirn, The Language of Landscape (New Haven: Yale UP, 1998) 11.

[4] Forest Trends. 23 May 2005 <http://www.forest-trends.org>.

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APPENDIX A

ETOWAH VEGETATION WITH POTENTIAL HABITAT ON SITE

Contents of the following table are extracted from Lisa Kruse's Master of Science thesis, *Vascular Flora of the Upper Etowah River Watershed, Georgia*, and show plant species with potential habitat occurring on the studied Temple-Inland property. For purposes of this table, a series of abbreviations are used:

CS sandy island or beach on river
DS depressional or seepage wetland
WTR wide tributary ravine
OHE oak-hemlock forest with ericaceous understory
HW hardwood cove forest
OPH oak-pine-hickory forest
PE pine forest with ericaceous understory
EHB evergreen forest with ericaceous bluff

* denotes non-native species

	Habitat								
	Hydric		Mesic				Sub-Mesic		
Genus-Species	**CS**	**DS**	**WTR**	**OHE**	**HW**	**OPH**	**OPH**	**PE**	**EHB**
LYCOPODIOPHYTA - CLUB MOSSES									
Diphasiastrum digitatum			x				x		
Huperzia lucidula			x						
PTERIDOPHYTA - FERNS									
Adiantum pedatum			x		x	x			
Asplenium platyneuron				x		x	x	x	x
Athyrium filix-femina			x						
Botrychium biternatum		x	x						
Botrychium virginianum			x						
Dryopteris marginalis									x
Onoclea sensibilis									
Ophioglossum vulgatum			x						
Osmunda cinnamomea		x	x						
Osmunda regalis		x	x						
Phegopteris hexagonoptera			x		x				
Polystichum acrostichoides			x			x	x	x	

Pteridium aquilinum							x		
Thelypteris noveboracensis			x						
Woodwardia aureolata		x							
CONIFEROPHYTA - CONIFERS									
Pinus strobus			x	x		x	x	x	x
Pinus taeda						x	x		
Pinus virginiana			x			x	x		x
Tsuga canadensis			x	x				x	
MAGNOLIOPHYTA - MONOCOTYLEDONS									
Agrostis hyemalis							x		
Agrostis perennans	x		x						
Aletris farinosa			x				x		
Allium canadense			x						
Amianthium muscitoxicum			x						
Andropogon gerardi							x		
Andropogon virginicus						x	x		
Arisaema dracontium		x							
Arisaema triphyllum		x	x						
Arundinaria gigantea			x			x			
Brachyelytrum erectum			x						
Carex abscondita			x			x			
Carex atlantica		x	x						
Carex austrocaroliniana			x		x	x			
Carex blanda			x		x	x			
Carex crebriflora			x			x			
Carex crinita		x	x						
Carex cumberlandensis			x						
Carex debilis		x	x						
Carex gracilescens			x						
Carex gynandra		x	x						
Carex intumescens		x	x						
Carex laxiflora		x	x						
Carex leptalea		x							
Carex lucorum			x						
Carex lurida		x	x						
Carex manhartii			x						
Carex mitchelliana		x	x						
Carex nigromarginata							x		
Carex pensylvanica			x		x	x			
Carex platyphylla			x						
Carex prasina		x	x						
Carex ruthii		x							
Carex scabrata	x								
Carex styloflexa			x						
Carex torta	x								
Carex tribuloides	x								
Carex virescens			x						
Carex vulpinoidea	x								

Chamaelirium luteum				x		x			
Chasmanthium laxum			x			x	x		
Chasmanthium sessiliflorum						x			
Cinna arundinacea		x	x						
Clintonia umbellulata			x			x			
Corallorhiza odontorhiza						x			
Cyperus flavescens	x								
Cyperus strigosus	x								
Cypripedium acaule				x			x		
Cypripedium pubescens						x			
Danthonia spicata							x		
Dichanthelium boscii			x						
Dichanthelium clandestinum	x								
Dichanthelium commutatum			x		x	x	x		
Dichanthelium dichotomum	x		x			x	x		
Dichanthelium sphaerocarpon							x		
Dioscorea quaternata			x			x			
Dioscorea villosa			x			x			
Disporum lanuginosum					x				
Echinochloa crus-galli	x								
Eleocharis obtusa		x							
Erythronium umbilicatum			x						
Fimbristylis autumnalis	x								
Galearis spectabilis			x						
Glyceria striata	x	x							
Goodyera pubescens			x	x		x			
Hymenocallis caroliniana						x			
Hypoxis hirsuta			x			x	x		
Iris cristata			x			x			
Juncus acuminatus	x	x							
Juncus coriaceus	x								
Juncus debilis	x	x							
Juncus effusus	x	x	x						
Juncus gymnocarpus	x								
Juncus marginatus	x	x							
Juncus tenuis		x	x						
Juncus validus	x								
Kyllinga pumila	x								
Leersia oryzoides		x	x						
Lilium superbum							x		
Luzula acuminata			x						
Luzula echinata			x			x			
Maianthemum racemosum			x			x			
Medeola virginiana			x	x	x				
Melica mutica						x			
Muhlenbergia tenuiflora			x						
Panicum anceps	x								
Peltandra virginica		x							

Piptochaetium avenaceum							x		
Platanthera ciliaris			x				x		
Platanthera clavellata		x							
Poa autumnalis			x		x				
Poa pratensis			x						
Polygonatum biflorum			x		x				
Rhynchospora capitellata	x								
Rhynchospora glomerata	x								
Saccharum alopecuroidum							x		
Saccharum brevibarbe							x		
Sagittaria latifolia	x								
Schizachyrium scoparium							x		
Schoenoplectus purshianus	x	x							
Scirpus cyperinus	x								
Scirpus polyphyllus	x	x	x						
Scleria olignantha						x			
Sisyrinchium angustifolium							x		
Sisyrinchium atlanticum							x		
Sisyrinchium nashii			x				x		
Smilax bona-nox			x	x		x	x		
Smilax glauca			x	x		x	x		
Smilax hugeri			x						
Smilax rotundifolia			x	x		x	x		
Smilax tanmoides			x						
Sparganium americanum	x								
Sphenopholis obtusata							x		
Sphenopholis pensylvanica		x	x						
Spiranthes ovalis			x						
Stenanthium gramineum						x			
Tipularia discolor			x			x	x		
Tridens flavus	x								
Trillium catesbaei			x	x		x	x		
Trillium cuneatum						x			
Trillium rugelii			x						
Trillium vaseyi					x				
Uvularia perfoliata			x		x	x			
Veratrum parviflorum					x	x			
Xerophyllum asphodeloides									x
**Anthraxon hispidus*	x								
**Commelina communis*			x						
**Lolium arundinaceum*	x		x						
**Microstegium vimineum*			x						
**Miscanthus sinensis*							x		
**Murdannia keisak*	x								
**Narcissus pseudo-narcissus*						x			
MAGNOLIOPSIDA - DICOTYLEDONS									
Acer leucoderme						x			
Acer negundo			x						

Acer rubrum			x	x	x	x	x		
Actaea pachypoda			x		x				
Aesculus parviflora			x			x			
Aesculus sylvatica			x			x			
Aesculus x mutabilis			x		x	x			
Agalinus decemloba							x		
Ageratina altissima			x		x	x			
Agrimonia parviflora						x			
Agrimonia pubescens			x						
Agrimonia rostellata		x	x						
Alnus serrulata			x						
Amelanchier arborea						x	x		
Amphicarpaea bracteata			x						
Anemone lancifolia			x						
Anemone quinquefolia			x		x				
Angelica venenosa							x		
Antennaria plantaginifolia							x		
Apios americana	x								
Aralia racemosa				x	x	x			
Aralia spinosa							x		
Aristolochia serpentaria						x			
Arnoglossum atriplicifolium			x			x			
Asarum canadense					x				
Asclepias tuberosa							x		
Asclepias variegata						x			
Asimina parviflora			x			x			x
Aster divaricatus			x		x	x			
Aster dumosus	x						x		
Aster lateriflorus			x						
Aster macrophyllus						x			
Aster patens			x			x			
Aster pilosus			x						
Aster puniceus	x	x							
Aster retroflexus			x		x	x	x		
Aster sagittifolius						x			
Aster surculosis							x		
Aster undulatus				x		x	x		
Aureolaria laevigata									x
Baptisia tinctoria							x		
Betula lenta			x		x				
Betula nigra			x						
Bignonia capreolata			x			x			
Boehmeria cylindrica	x		x						
Calycanthus floridus						x	x		
Campanula divaricata							x		
Campsis radicans			x			x			
Cardamine angustata			x						
Cardamine diphylla			x						

Cardamine flagellifera			x						
Carpinus caroliniana			x						
Carya glabra						x	x		
Carya ovalis						x	x		
Carya pallida							x		x
Carya tomentosa			x			x	x		
Castanea dentata			x			x			
Castanea pumila							x		
Caulophyllum thalictroides					x				
Ceanothus americanus							x		
Chelone glabra		x	x						
Chimaphila maculata				x			x		
Chionanthus virginicus				x					
Chrysogonum virginianum			x			x	x		
Cicuta maculata		x	x						
Cimicifuga racemosa			x			x			
Cirsium altissimum							x		
Clematis virginiana		x	x			x	x		
Clethra acuminata								x	
Clitoria mariana						x	x		
Collinsonia canadensis		x	x			x			
Collinsonia verticillata				x	x	x			
Coreopsis auriculata			x						
Coreopsis major						x	x		
Cornus alternifolia					x				
Cornus amomum			x						
Cornus florida			x	x	x	x	x		x
Corylus americana							x		
Corylus comuta					x				
Cryptotaenia canadensis		x	x			x			
Cuscuta compacta			x						
Cynoglossum virginianum			x		x				
Decumaria barbara			x						
Desmodium glabellum						x	x		
Desmodium glutinosum						x	x		
Desmodium marilandicum						x	x		
Desmodium nudiflorum			x			x	x		
Desmodium paniculatum						x	x		
Desmodium perplexum						x	x		
Desmodium rotundifolium				x					
Diodia teres							x		
Diospyros virginiana						x			
Doellingeria infirma			x			x			
Elephantopus tomentosus			x				x		
Epifagus virginiana			x						
Epigaea repens				x					
Erechtites hieracifolia							x		
Erigeron annuus							x		

Erigeron pulchellus							x		
Erigeron strigosus							x		
Euonymus americana			x						
Eupatorium album							x		
Eupatorium fistulosum							x		
Eupatorium hyssopifolium						x			
Eupatorium perfoliatum	x								
Eupatorium purpurium			x			x			
Eupatorium rotundifolium							x		
Eupatorium serotinum	x						x		
Euphorbia pubentissima			x	x		x	x		
Fagus grandifolia					x	x			
Fraxinus americana			x			x			
Fraxinus pennsylvanica			x			x			
Galactia volubilis	x								
Galax urceolata				x				x	x
Galium circaezans			x			x			
Galium triflorum			x						
Gamochaeta purpurea	x								
Gaylussacia baccata			x			x	x		
Gaylussacia ursina							x		
Gentiana decora		x	x						
Geranium maculatum			x		x	x			
Gratiola virginiana	x	x							
Halesia carolina			x		x	x			
Hamamelis virginiana			x	x	x	x			
Helianthus atrorubens							x		
Helianthus decapetalus			x			x			
Helianthus hirsutus						x			
Helianthus microcephalus			x			x	x		
Helianthus resinosus			x			x			
Hepatica acutiloba			x		x				
Hepatica americana			x		x	x			
Heuchera americana					x				
Hexastylis arifolia				x		x	x		
Hexastylis shuttleworthii			x	x		x			
Hieracium gronovii							x		
Hieracium venosum							x		
Houstonia caerulea	x		x						
Houstonia longifolia							x		
Houstonia purpurea			x	x		x			
Hydrangea arborescens			x			x			
Hypericum hypericoides						x	x		
Hypericum pseudomaculatum						x	x		
Hypericum punctatum						x	x		
Ilex ambigua						x			
Ilex montana						x			
Ilex opaca			x			x	x		

Ilex verticillata		x							
Impatiens capensis	x								
Itea virginica				x					
Kalmia latifolia				x		x		x	x
Lactuca canadensis							x		
Lactuca floridana			x						
Laportea canadensis			x		x				
Lespedeza hirta							x		
Lespedeza violacea							x		
Liatris graminifolia							x		
Ligusticum canadense			x			x			
Lindera benzoin			x						
Lindernia dubia	x								
Linum striatum	x								
Liquidambar styraciflua			x			x			
Liriodendron tulipifera			x		x	x	x		
Lobelia amonea		x	x						
Lobelia cardinalis		x							
Lobelia inflata				x			x		
Lobelia puberula			x			x			
Lobelia spicata							x		
Ludwigia alternifolia	x	x							
Ludwigia decurrens	x								
Ludwigia palustrus	x								
Lycopus virginicus		x							
Lysimachia quadrifolia						x	x		
Magnolia acuminata			x		x				
Magnolia fraseri				x		x			
Melampyrum lineare			x			x			
Mimulus alatus	x	x							
Mitchella repens				x					
Monarda clinopoda				x					
Monarda fistulosa							x		
Monotropa hypopithys			x			x			
Monotropa uniflora			x			x			
Nyssa sylvatica						x	x		x
Obolaria virginica			x						
Ostrya virginiana			x		x				
Oxalis grandis						x			
Oxalis stricta			x						
Oxalis violacea			x			x			
Oxydendrum arboreum			x	x		x	x	x	x
Oxypolis rigidior		x	x						
Packera anonyma							x		
Packera aurea	x	x	x						
Panax quinquefolius			x		x				
Panax trifolius			x						
Parnassia asarifolia		x	x						

Parthenocissus quinquefolia			x		x	x	x	x	
Passiflora lutea			x			x			
Pedicularis canadensis			x						
Penthorum sedoides	x	x							
Philadelphus inodorus						x			
Phlox amonea							x		
Phlox carolina						x			
Phlox maculata						x	x		
Phryma leptostachya					x				
Pilea pumila		x	x						
Pityopsis aspera							x		
Pityopsis graminifolia							x		
Podophyllum peltatum			x						
Polygala polygama						x	x		
Polygonum caespitosum	x	x							
Polygonum punctatum		x							
Polygonum sagittatum	x	x							
Polygonum setaceum			x						
Polygonum virginianum			x						
Polymnia uvedalia			x						
Potentilla canadensis			x			x			
Potentilla simplex			x						
Prenanthes altissima			x			x			
Prenanthes trifoliolata			x						
Prunella vulgaris						x			
Prunus serotina			x			x			
Pseudognaphalium obtusifolium							x		
Pycnanthemum pycnanthemoides						x	x		
Pycnanthemum tenuifolium							x		
Pyrularia pubera			x						
Quercus alba			x	x	x	x	x		
Quercus coccinea						x	x		
Quercus prinus				x	x	x	x		
Quercus rubra			x			x	x		
Quercus velutina						x	x		
Ranunculus abortivus		x	x						
Rhexia mariana	x								
Rhexia virginica	x								
Rhododendron arborescens	x		x						
Rhododendron calendulaceum			x			x			
Rhododendron canescens						x	x		
Rhododendron maximum			x	x					
Rhus glabra							x		
Robinia pseudo-acacia						x	x		
Rubus argutus			x			x			
Rubus occidentalis			x						
Rudbeckia hirta			x			x			

Rudbeckia lacinata	x		x						
Ruellia caroliniensis						x			
Sabatia angularis						x			
Sambucus nigra		x	x						
Sanguinaria canadensis						x			
Sanicula canadensis			x			x			
Sanicula odorata			x		x				
Sanicula smallii			x	x		x			
Sassafras albidum							x		
Schisandra glabra			x						
Scutellaria elliptica				x		x			
Scutellaria integrifolia			x						
Sedum ternatum						x			
Senna marilandica			x						
Sericocarpus asteroides						x	x		
Silene stellata						x	x		
Silphium asteriscus			x				x		
Solanum carolinense			x						
Solidago arguta			x	x		x	x		
Solidago caesia			x			x			
Solidago canadensis						x			
Solidago curtisii			x		x				
Solidago nemoralis							x		
Solidago odora						x	x		
Solidago patula		x							
Solidago petiolaris							x		
Solidago rugosa							x		
Solidago speciosa						x			
Stellaria pubera			x		x				
Stewartia ovata			x						
Symplocos tinctoria							x		
Tephrosia spicata							x		
Thalictrum clavatum		x	x						
Thalictrum thalictroides			x		x	x			
Thaspium barbinode						x			
Thaspium trifoliatum						x			
Tiarella cordifolia		x	x		x	x			
Tilia americana			x		x	x			
Toxicodendron radicans			x			x	x	x	
Triodanis perfoliata							x		
Vaccinium arboreum							x		x
Vaccinium corymbosum			x			x	x		
Vaccinium pallidum							x		
Vaccinium stamineum						x	x		
Verbena urticifolia						x			
Viburnum acerifolium			x		x	x			
Viburnum cassinoides							x		
Viburnum prunifolium			x			x			

Viburnum rudum		x	x						
Vicia caroliniana							x		
Viola blanda	x	x	x	x	x	x			
Viola conspersa			x						
Viola hastata			x	x		x	x		
Viola palmata			x		x				
Viola pedata							x		
Viola primulifolia		x	x						
Viola pubescens			x						
Viola rostrata			x		x				
Viola rotundifolia	x		x						
Viola sororia		x	x			x			
Vitis aestivalis							x		
Vitis cinerea						x			
Vitis labrusca						x			
Vitis rotundifolia			x			x	x		
Waldsteinia fragaroides			x			x			
Waldsteinia lobata			x		x				
Xanthorhiza simplicissima	x		x						
Zizia trifoliata						x			
**Bidens aristosa*	x								
**Cichorium intybus*						x			
**Cirsium vulgare*				x					
**Daucus carota*							x		
**Deutzia scabra*						x			
**Dianthus armeria*	x								
**Kummerowia striata*							x		
**Lespedeza bicolor*			x						
**Leucanthemum vulgare*							x		
**Ligustrum sinense*			x						
**Lonicera japonica*	x		x			x	x		
**Mullugo verticillata*	x								
**Perilla frutescens*							x		
**Plantago aristata*							x		
**Plantago rugelii*	x								
**Polypremum procumbens*	x								
**Rumex obtusifolius*	x								
**Stellaria media*			x			x			
**Verbascum thapsus*							x		
**Vinca minor*						x			
**Youngia japonica*	x								

APPENDIX B

WILDLIFE WITH POTENTIAL HABITAT ON SITE

Contents of the following tables are extracted from vertebrate distribution data (Natural Resources Spatial Analysis Laboratory, Georgia Gap Analysis Project) and species of concern information (Georgia Department of Natural Resources). For purposes of these tables, the symbol * denotes species of special concern.

Table A: Amphibians

Scientific Name	Common Name
Acris crepitans	Northern cricket frog
Ambystoma maculatum	spotted salamander
Ambystoma talpoideum	mole salamander
Bufo americanus	American toad
Bufo fowleri	Fowler's toad
**Desmognathus aeneus*	seepage salamander
Desmognathus conanti	spotted dusky salamander
Desmognathus monticola	seal salamander
Desmognathus ocoee	mountain dusky salamander
Desmognathus quadramaculatus	blackbelly salamander
**Eurycea wilderae*	Blue Ridge two-lined salamander
Gyrinophilus porphyriticus	spring salamander
**Hemidactylium scutatum*	four-toed salamander
Hyla chrysoscelis	Cope's gray tree frog
Notophthalmus viridescens	Eastern newt
Plethodon glutinosus complex	slimy salamander complex
**Pseudacris brachyphona*	mountain chorus frog
Pseudacris crucifer	spring peeper
Pseudacris feriarum	upland chorus frog
Pseudotriton ruber	red salamander
Rana catesbeiana	bull frog
Rana clamitans	green/bronze frog
Rana palustris	pickerel frog
Rana sphenocephala	Southern leopard frog
Rana sylvatica	wood frog
Scaphiopus holbrookii	Eastern spadefoot toad

Table B: Reptiles

Scientific Name	Common Name
Agkistrodon contortrix	copperhead
Anolis carolinensis	green anole
Carphopis amoenus	worm snake
Chelydra serpentina	snapping turtle
Chrysemys picta	painted turtle
**Clemmys guttata*	bog turtle
Cnemidophorus sexlineatus	six-lined racerunner
Coluber constrictor	black racer
Crotalus horridus	timber rattlesnake
Diadophis punctatus	ringneck snake
Elaphe guttata	corn snake
Elaphe obsoleta	rat snake
**Eumeces anthracinus*	coal skink
Eumeces fasciatus	five-lined skink
Eumeces laticeps	broadhead skink
Heterodon platirhinos	Eastern hognose snake
Lampropeltis calligaster	mole king snake
Lampropeltis getula	common king snake
**Lampropeltis triangulum*	milk snake
Nerodia sipedon	midland water snake
Opheodrys aestivus	rough green snake
**Ophisaurus attenuatus*	slender glass lizard
**Pituophis melanoleucus*	pine snake
Regina septemvittata	queen snake
Sceloporus undulatus	fence lizard
Scincella lateralis	ground skink
Sistrurus miliarius	pigmy rattlesnake
Sternotherus odoratus	common musk turtle
Storeria dekayi	brown snake
Storeria occipitomaculata	red-bellied snake
Tantilla coronata	Southeastern crowned snake

Table C: Mammals

Scientific Name	Common Name
Blarina brevicauda	Northern short-tailed shrew
Canis latrans	coyote
Castor canadensis	American beaver
Cryptotis parva	least shrew
Didelphis virginiana	Virginia opossum
Eptesicus fuscus	big brown bat
Glaucomys volans	Southern flying squirrel
Lasionycteris noctivagans	silver-haired bat

Lasiurus borealis	Eastern red bat
Lasiurus cinereus	hoary bat
Lynx rufus	bobcat
Marmota monax	woodchuck
Mephitis mephitis	striped skunk
Microtus pennsylvanicus	meadow vole
Microtus pinetorum	woodland vole
Mustela frenata	long-tailed weasel
**Myotis leibii*	Eastern small-footed myotis
Myotis septentrionalis	Northern myotis
**Neotoma floridana*	Eastern woodrat
Nycticeius humeralis	evening bat
Ochrotomys nuttalli	golden mouse
Odocoileus virginianus	white-tailed deer
Peromyscus leucopus	white-footed mouse
Peromyscus maniculatus	deer mouse
Pipistrellus subflavus	Eastern pipistrelle
Procyon lotor	common raccoon
Reithrodontomys humilis	Eastern harvest mouse
Scalopus aquaticus	Eastern mole
Sciurus carolinensis	Eastern gray squirrel
Sigmodon hispidus	hispid cotton rat
**Sorex hoyi*	pygmy shrew
Sorex longirostris	Southeastern shrew
Spilogale putorius	Eastern spotted skunk
Sus scrofa	wild pig
Sylvilagus floridanus	Eastern cottontail
Tamius striatus	Eastern chipmunk
Urocyon cinereoargenteus	common gray fox
Ursus americanus	black bear
Vulpes vulpes	red fox
Zapus hudsonicus	meadow jumping mouse

Table D: Birds

Scientific Name	Common Name
Accipiter cooperii	Cooper's hawk
Accipiter striatus	sharp-shinned hawk
Agelaius phoeniceus	red-winged blackbird
Ammodramus savannarum	grasshopper sparrow
Anas platyrhynchos	mallard
Archilochus colubris	ruby-throated hummingbird
Baeolophus bicolor	tufted titmouse
Bonasa umbellus	ruffed grouse
Branta canadensis	Canada goose
Bubo virginianus	great horned owl

Buteo jamaicensis	red-tailed hawk
Buteo lineatus	red-shouldered hawk
Buteo platypterus	broad-winged hawk
Caprimulgus carolinensis	Chuck-Will's-widow
Caprimulgus vociferus	whip-poor-will
Cardinalis cardinalis	Northern cardinal
Carduelis tristis	American goldfinch
Carpodacus mexicanus	house finch
Cathartes aura	turkey vulture
Ceryle alcyon	belted kingfisher
Chaetura pelagica	chimney swift
Charadrius vociferus	killdeer
Chordeiles minor	common nighthawk
Coccyzus americanus	yellow-billed cuckoo
Colaptes auratus	Northern flicker
Colinus virginianus	Northern bobwhite
Columba livia	rock dove
Contopus virens	Eastern wood pewee
Coragyps atratus	black vulture
Corvus brachyrhynchos	American crow
Cyanocitta cristata	blue jay
Dendroica discolor	prairie warbler
Dendroica dominica	yellow-throated warbler
Dendroica pinus	pine warbler
Dendroica virens	black-throated green warbler
Dryocopus pileatus	pileated woodpecker
Dumetella carolinensis	gray catbird
Empidonax virescens	Acadian flycatcher
**Falco sparverius*	American kestrel
Geothlypis trichas	common yellowthroat
Guiraca caerulea	blue grosbeak
Helmitheros vermivorus	worm-eating warbler
Hirundo rustica	barn swallow
Hylocichla mustelina	wood thrush
Icteria virens	yellow-breasted chat
Icterus spurius	orchard oriole
Melanerpes carolinus	red-bellied woodpecker
Melanerpes erythrocephalus	red-headed woodpecker
Meleagris gallopavo	wild turkey
Melospiza melodia	song sparrow
Mimus polyglottos	Northern mockingbird
Mniotilta varia	black-and-white warbler
Molothrus ater	brown-headed cowbird
Myiarchus crinitus	great crested flycatcher
Oporornis formosus	Kentucky warbler
Otus asio	Eastern screech owl
Parula americana	Northern parula
Passer domesticus	house sparrow

Passerina cyanea	indigo bunting
Petrochelidon pyrrhonota	cliff sparrow
Picoides pubescens	downy woodpecker
Picoides villosus	hairy woodpecker
Pipilo erythrophthalmus	Eastern towhee
Piranga olivacea	scarlet tanager
Piranga rubra	summer tanager
Poecile carolinensis	Carolina chickadee
Polioptila caerulea	blue-gray gnatcatcher
Progne subis	purple martin
Quiscalus quiscula	common grackle
Sayornis phoebe	Eastern phoebe
Scolopax minor	American woodcock
Seiurus aurocapillus	ovenbird
Seiurus motacilla	Louisiana waterthrush
Setophaga ruticilla	American redstart
Sialia sialis	Eastern bluebird
Sitta carolinensis	white-breasted nuthatch
Sitta pusilla	brown-headed nuthatch
Spizella passerina	chipping sparrow
Spizella pusilla	field sparrow
Stelgidopteryx serripennis	Northern rough-winged swallow
Strix varia	barred owl
Sturnella magna	Eastern meadowlark
Sturnus vulgaris	European starling
Tachycineta bicolor	tree swallow
Thryothorus ludovicianus	Caroling wren
Toxostoma rufum	brown thrasher
Turdus migratorius	American robin
Tyrannus tyrannus	Eastern kingbird
Vermivora pinus	blue-winged warbler
Vireo flavifrons	yellow-throated vireo
Vireo griseus	white-eyed vireo
Vireo olivaceus	red-eyed vireo
Vireo solitarius	solitary vireo
Wilsonia citrina	hooded warbler
Zenaida macroura	mourning dove

APPENDIX C

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John Lock Operations Leader – Integrated Technology Temple-Inland Forest	Date
Byron Freeman Director Georgia Museum of Natural History The University of Georgia	Date