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Land Use Legacies and the Future of Southern Appalachia

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Southern Appalachian forests have apparently recovered from extractive land use practices during the 19th and 20th centuries, yet the legacy of this use endures in terrestrial and aquatic systems of the region. The focus on shallow time or the telling of stories about the past circumscribes the ability to anticipate the most likely outcomes of the trajectory of change forecast for the Southeast as the "Old South" continues its transformation into the "New South." We review land use research of the Coweeta Long Term Ecological Research (LTER) project that addresses the nature and extent of past and present human land use, how land use has affected the structure and function of terrestrial and aquatic communities, and the forces guiding the anticipated trajectory of change. Unlike development in the western or northeastern regions of the United States, the southeastern region has few practical, political, or geographical boundaries to the urban sprawl that is now developing.

Keywords aquatic communities, land use, land-use decision making, legacy, reforestation, southern Appalachia, terrestrial communities, urban sprawl

In different locations around the world and for diverse reasons, lands once dedicated to extractive use have been abandoned and forest vegetation has expanded (e.g., Foster 1992). Southern Appalachia is part of this pattern of change since the effective demise of subsistence agriculture and the transition to a manufacturing and service economy over the last 40 years. The apparent recovery of southern Appalachian forests from the history of their intense use during the second half of the 19th and first half of the 20th centuries nevertheless harbors the ghost of land use past (Jones et al. 1999). Our knowledge of the legacy of land-use past on terrestrial and aquatic

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systems has important implications for the bold decisions required in the next decade as the "Old South" continues its transformation into the "New South."

Determining the temporal and spatial properties of socioeconomic and biophysical systems across the region is critical to formulating public policies and management objectives tailored to regional needs. The focus on shallow time or the telling of stories about the past will only limit our ability to anticipate the most likely outcomes of the trajectory of change forecast for the Southeast (Wear and Greis 2002). The first and third cultures, science and social science (Snow 1959/1993), must truly partner (perhaps even seamlessly merge) to understand the contemporary gradient from neglected to highly engineered environmental systems that our responsibility to manage Earth entails (Vitousek et al. 1997).

We review land-use research of the Coweeta Long Term Ecological Research (LTER) project guided by three questions. (1) What is the nature and extent of past and present human land use? The past helps define the present and constrains the future, so that the spatially and temporally explicit reconstruction of past land use is the prequel to understanding the local and regional consequences of land-use change in the present and into the future. (2) How has land use affected the structure and function of terrestrial and aquatic communities? Previous work has documented land use, but the long-term impacts on organisms and the region as well as the duration and magnitude of these impacts after areas revert to "natural" disturbance regimes are poorly understood. (3) What forces guide contemporary land use and what is the anticipated trajectory of change? The ability of public policies or management objectives to recognize human ability and environmental structure will ultimately determine their chances of success relative to failure in the regional setting where they will be enacted (Golodetz and Foster 1997; Swetnam et al. 1999).

Research Context

The Coweeta LTER study area encompasses 60 counties in the Blue Ridge province of the Southern Appalachian Mountains (Figure 1), recognized geographically and socially as a distinct region of the continental United States (Bailey 1996; Markusen 1987; Whittaker 1966). Geographically, the Blue Ridge province begins at the New

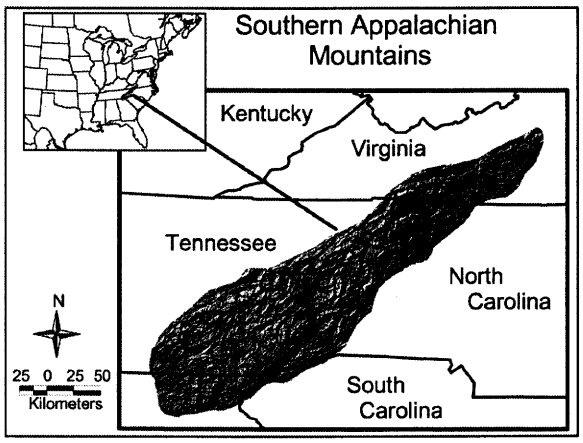

Figure 1. The southern Appalachian study area of the Coweeta LTER.

River divide in southern Virginia and extends south across western North Carolina and into north Georgia. Average summer temperatures on the higher peaks are comparable to those in central New England, 1400 km to the north, rather than those of the Piedmont of North and South Carolina and Georgia 100 km to the east and south. Precipitation is abundant at more than 1800 mm yr^{-1}, but with a distribution patterned by local mountain effects. Because the region is cooler and wetter than adjacent regions, the Blue Ridge province is a refugium for "northern" taxa from the last glaciation (Barnes 1991; Braun 1950) that intermixed with "southern" taxa to give rise to one of the most biodiverse North American regions.

Defining the southern Appalachian Mountains socially is a greater challenge. The people of Appalachia are said to be independent, religious fundamentalists with strong family ties living in harmony with nature yet traditional and fatalistic in their outlook (Philliber 1994). Such views are the direct legacy of the local-color narrative tradition of the early 20th century (Anglin 2002; Davis 2000). In this approach, crude geographic determinism based on the isolation and ruggedness of the mountains shapes the personality of its inhabitants. The stereotypical images of the region and its people that result from the application of this approach remain current in the popular press (e.g., *The Atlanta Constitution* June 15, 1997, A1).

A second tradition emerging after World War II linked to political and economic development portrays individuals in Southern Appalachia as mere pawns in ever-expanding market relations over which they have or had little or no control (Caudill 1963; Eller 1982; Rothblatt 1971; Salstrom 1994). Present conditions are typically viewed as the result of outsiders plundering the region's natural and social endowments. The peripheral economic position of southern Appalachia vis-à-vis other U.S. regions underlies an un-natural definition of Appalachia as a region extending from New York to Mississippi. The boundaries of this region have less to do with geography or society than the gerrymandering by congressmen during the creation of the Appalachian Regional Commission in the early 1960s (Davis 2000).

Recent southern Appalachian scholarship is moving away from stereotypes toward process and explanation. In this way, it is helping to overthrow the longstanding parochialism of southern history central to the two previous views on the southern Appalachian Highlands (Kolchin 2003). For example, ethnohistory now considers the forces creating ethnicity in the early contact period (e.g., Ethridge and Hudson 2002), while gender studies focus on how individual choice and expression create identity (e.g., Anglin 2002). These and other works (e.g., Axtell 1997; Davis 2000) collectively reveal the complex and intricate diversity of the region. There is not one South, but "many Souths" (Kolchin 2003), as a consequence of internal variation among groups defined ideologically, ethnically, culturally, and so on.

The Coweeta LTER (Gragson et al. 2002) builds from this recognized internal heterogeneity a research program to determine how humans impose their signature on ecological systems, and how humans then respond to the systems they helped create. The focus is on the iterative dynamics of the coupled socioeconomic–biophysical system across space and time. Many attempts at linking the socioeconomic and the biophysical realms derive from "general linear reality" (Abbott 2001). A caricature of this view is that human land-use decisions are monolithically governed by land rents, demographic pressures, and technological capabilities. The reciprocal approach followed in Coweeta LTER research focuses attention instead on the middle ground, where the agency of individuals and the properties of a place are expressed and blended in the process of change.

It is almost a truism to state that the temporal rhythms and spatial arrangements of human activities and their institutions shape and influence their surrounding ecological systems, and are in turn shaped and influenced themselves by the ecological systems in which they are embedded (Berkes and Folke 1998; Cronon 1983; Diamond 1997; Dove and Kammen 1997; Ostrom et al. 1999). Beyond stating that a reciprocal relationship exists, the challenge is to move historical insight to the practical needs of regional planning. The attention dedicated to global-scale processes of environmental transformation has led to ignoring the regional-scale processes ultimately more appropriate to addressing the current and emerging challenges faced by society.

Regional-scale estimates give recognition to the fact that policymakers, resource managers, and the public make decisions in response to local and regional conditions more so than to global conditions. For example, residents of the southwestern United States are more likely concerned about changes in water availability and fire frequency than residents of the southeastern United States who are more likely concerned about how changes in forest cover might affect their future recreational opportunities.

The Coweeta LTER is organized to address fundamental issues in the historical ecology of southern Appalachia by reconstructing when and where particular natural and human events occurred. Previous research on ecosystem responses to disturbance has primarily focused on a subset of important forces acting on large scales and/or short-time intervals, for example, the pattern and magnitude of wind damage from Hurricane Opal (Hunter and Forkner 1999; Wright and Coleman 2002). However, direct human disturbances such as farming, logging, mining, and road construction have altered more than 98% of the southern Appalachian landscape. History may be a rock, but the stories told by environmental historians provide so little guidance in the whirlpool of prophecy (Cronon 1993) that decision makers at all levels are asking social and ecological scientists for help with in southern Appalachia.

The gentrification of southern Appalachia reflects a process in which an aging, relatively impoverished local population is neither replaced reproductively nor economically by descent, and is subdividing former agroforestry lands into recreational properties for sale to relatively affluent residents from the large urban centers in the Piedmont. The gentrification of southern Appalachia combined with the legacy of past land-use practices on contemporary terrestrial and aquatic ecosystems has important implications for the future of the region. Bold decisions must be reached in the next few years. Will they be reactive or anticipatory? Will they focus on rescuing biophysical systems to the exclusion of socioeconomic systems? Will they attempt to reconcile protection and restoration with development and livelihood? By quantifying the spatial heterogeneity in disturbance legacies and the temporal heterogeneity of disturbance trajectories, researchers on the Coweeta LTER are calculating the duration and magnitude of consequences at different organizational levels. These will then be used to develop forecast scenarios of future social and ecological responses with the objective of building scalable estimates for processes of importance to decision makers responding to local and regional conditions.

Land-Use History

Agricultural self-sufficiency is one of the pervasive historic characterizations of southern Appalachia. However, as of the year 2000, less than 2% of the population

listed agriculture as their primary occupation and less than 3% of households were classed as rural–farm. The current rates of agricultural dependence and the distribution of the population are largely the consequence of social, political, and economic forces over the last 40 years. As such, present statistics tell us little about the overall transformation of southern Appalachia as a consequence of resource-extractive production—including agriculture, mining, and timbering—during the preceding 1000 years of intense human occupation. Nevertheless, disentangling the legacy of resource-extractive production from subsequent uses of the land is central to the pending decisions in the region as to the future residents want to have. We begin with an outline of the periods of land use for southern Appalachia as a basis for discussing terrestrial and aquatic consequences, and contemporary forces guiding land use.

Pre-European: 8000 BC To AD 1500

Humans have been a part of the southern Appalachian landscape since at least 8000 BC. The earliest sites are interpreted as temporary camps tied to more permanent settlements in the Appalachian piedmont to the east and the Tennessee valley to the west (Perkinson 1973; Ward and Davis 1999). Larger, more widely distributed settlements developed from 8000 BC to AD 800 in valleys, coves, and adjacent uplands. The populations at these sites were supported by hunting and gathering early in the period; domesticated plants, present as early as 2000 BC, only became widespread toward the end of the period (Chapman and Shea 1981; Purrington 1983; Yarnell and Black 1985). By AD 800, southern Appalachian societies had established active trade with native populations centered on the Ohio River to the north and in Georgia to the south. Land-use impact during this period was most pronounced near settlements and due primarily to the practices of hunting, gathering, and burning.

Archeological evidence points to the rapid, widespread adoption of intensive agriculture starting about AD 800. This period is also characterized by the development of massive ceremonial mound centers, villages with several hundred inhabitants, and highly stratified societies. By 1450 these settlements varied widely in size, from small farmsteads to large villages located in floodplain environments with small, temporary camps in adjacent uplands (Purrington 1983). Agriculture provided for as much as one-half the diet during this phase, with the balance provided by hunting and gathering. Human disturbance during this period was significant, particularly near large villages, due to the substantial clearing for agriculture as well as burning, hunting, and gathering (Dickens 1976; Yarnell and Black 1985).

Contact: AD 1500 to 1776

Although a series of Spanish expeditions brought the first Europeans to southern Appalachia during the first half of the 16th century, it wasn't until English traders arrived in the mid-1600s that there were lasting impacts on indigenous groups and the landscape. By 1670 there was a steady stream of traders and packhorses making their way to the eastern edge of the Blue Ridge, bringing with them tools, weapons, ornaments, and disease (Martin 1994). There are relatively few eyewitness accounts from the early contact period for the southern Appalachian Highlands. However, a 1701 report from coastal Virginia (the center of early trade until about 1710) noted that there was not the "sixth savage living within 200 miles of our settlements as

there were fifty years ago" (Lefler 1967, 252). The implication of this account is that introduced disease was ravaging native populations. Up through the middle of the 18th century, the Indian population of the southern Appalachian Highlands concentrated its distribution (population size is less easily determined) at fewer sites, and forest cover expanded on abandoned agricultural lands (Gragson and Bolstad nd). Euroamerican settlers began arriving in large numbers in the late 1700s. They cleared land for agriculture in the river valleys, as the Indians before them had, and grazed livestock in the adjacent forests.

Nationhood: 1776–1960

For the duration of the 1800s agriculture expanded from larger valleys and coves, to smaller side valleys, small coves, and lower slopes. After 1900, mining and logging began to compete with agriculture for access to land. During the early 1900s many mountain families settled in logging camps and coal towns, or became employed in the textile mills that were emerging at this time (Eller 1982; Salstrom 1994). During and after World War II, out-migration accelerated as hundreds of thousands of mountain people sought jobs in the industrial cities of the Midwest and the South (Davis 2000; Halperin 1990). Emigration peaked about 1960 as rural inhabitants sought employment elsewhere that could not be met in the declining agriculture- and resource-based industries in Appalachia. Most rural nonfarm households at present are concentrated near major cities surrounding southern Appalachia, such as Atlanta (Georgia), Knoxville (Tennessee), and Roanoke (Virginia).

New South: 1960 to Present

Southern Appalachia is currently undergoing a transformation with cascading effects on the economic, environmental, and social properties of the region. Settlement through the 1960s was concentrated almost exclusively in lowlands, on large flats, or near the confluence of rivers; since that time, the number of individual dwellings dispersed in loose clusters across the landscape, particularly on steep slopes and upland ridges, has increased significantly (Wear and Bolstad 1998). New inhabitants are seeking the relative isolation and the amenity of distant views afforded by houses built high on forested slopes. Substantial development is also taking place on previously farmed parcels near streams that are now reverting to forest. In the upper Little Tennessee River Basin the proportion of private forest land that was occupied by or adjacent to a building increased from 12% in 1950 to almost 32% in 1990 (Wear and Bolstad 1998).

Terrestrial and Aquatic Consequences of Land Use

Southern Appalachia in the 19th century is described as one of the most self-sufficient agricultural regions in the country (Salstrom 1994), despite the fact that a significant fraction of households during the century were producing below subsistence level (Halperin 1990; Weingartner et al. 1989). Between 1850 and 1900 in the Coweeta LTER study area, the number of farms increased 275% as the average farm area decreased by 66%; between 1900 and 1950, the number of farms increased by 14% as the average farm area decreased by 36% (Gragson et al. nd). Cattle and hog holdings increased at the same time that farm size decreased. This led to more

animals per unit area and an increase in soil compaction, which affected the capacity of the soil to retain moisture and increased runoff. By 1920, southern Appalachia had serious soil loss problems compounded by cattle grazing on saplings that slowed the rate of reforestation (Otto 1989; Salstrom 1994).

Agricultural land use intensification in southern Appalachia steadily increased between 1850 and 1950 while livelihood security decreased. To compensate for the ever-diminishing viability of family farms in the early part of the 20th century, many full-time farmers sought part-time wage employment in the developing mining, timber and manufacturing industries. After World War II, this strategy was no longer sufficient to compensate for the lack of self-sufficiency of household agricultural production (Dunaway 1996; Groover 2003; Otto 1989; Salstrom 1994). The eventual outcome was the Great Out-Migration that took place after World War II (Davis 2000; DeJong 1968). The New South that begins to emerge after 1960 marks a transition in the kinds of human activities affecting Southern Appalachia. However, the consequences of past land-use practices during the preceding 100 years are still very evident in the structure and function of contemporary ecosystems.

Terrestrial Ecosystems

In general, from AD 800 to the early 1900s regional carbon stocks decreased in southern Appalachia relative to increases in the amount of land subject to an agro-pastoral production regime. Agricultural production (measured as annual dry biomass accumulation) prior to the introduction of commercial mineral fertilizers in the early 1900s is only a small fraction of forest production (Davidson and Ackerman 1993). For example, above-ground net primary production in southern Appalachian cove and lowland forest sites typically ranges from 10 to 12 Mg biomass ha^{-1} $year^{-1}$. By comparison, nonfertilized agricultural plots typically produce less than 2 Mg biomass ha^{-1} $year^{-1}$; while productivity on fertilized agricultural sites is higher, it rarely reaches 50% of that observed on forested sites (Figure 2; Bolstad and Vose 2005).

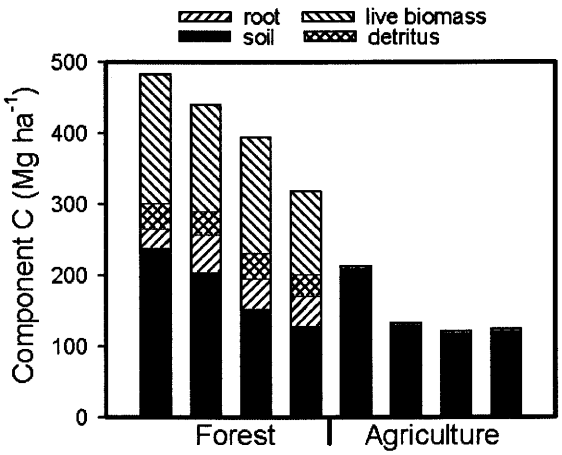

Figure 2. Carbon loss due to conversion of forest to agriculture is greatest in above-ground live biomass, woody debris, and root component relative to that lost in the soil component (based on Bolstad and Vose 2005).

Below-ground carbon on forest sites is largely contained in coarse roots and stumps. The majority of this stock is lost in the first few decades after sites are converted to agricultural use as soil carbon losses exceed carbon inputs (Bolstad and Vose 2004; Harris et al. 1977; Kalisz 1986). Soil temperatures increase, accelerating below-ground decomposition of existing carbon stocks as forest cover and its deadfall and litter inputs are reduced. When agricultural use of a site ends and forest is allowed to recolonize it, much of the above-ground live biomass recovers within the first century. Soil carbon stocks, however, can take several decades to several centuries to return to pre-forest-clearing levels (Schlesinger 1990). The implications of this delay are wide-ranging, since soils with large carbon stocks in the form of organic matter have increased water retention, improved aeration and tilth, and enhanced supplies of plant nutrients (Coleman and Crossley 1996).

Above-ground carbon stocks in southern Appalachia start to increase in the 20th century as (1) an ever-increasing number of farms were abandoned after 1900; (2) forest fires were systematically suppressed starting about 1910; and (3) federal programs to distribute fertilizer to farmers at reduced or no cost took hold after 1920 (Delcourt and Harris 1980; Salstrom 1994). The legacy of intense agropastoral land use, however, is evident in the present distribution of herbaceous and woody forest species. Intense land use of small patches leads to reduced liliaceous, old-growth, and mesophytic forest herb cover and an increased cover of weedy species (Figure 3; Pearson et al. 1998). Native mesophytic species typically found in small patches lack adaptations for long-range dispersal by wind or animals, while native species with such adaptations are equally abundant in small and large patches.

Modeling studies of trees using long-term seed dispersal data demonstrate large differences between species in the rates at which they colonize abandoned agricultural land (Clark et al. 1998). Even in closed stands only a subset of species predictably disperse seed to open sites, suggesting that dispersal limitations are a major obstacle to the rate of recolonization of abandoned agricultural fields. Species producing large quantities of well-dispersed seed such as birch (*Betula* sp.), maple

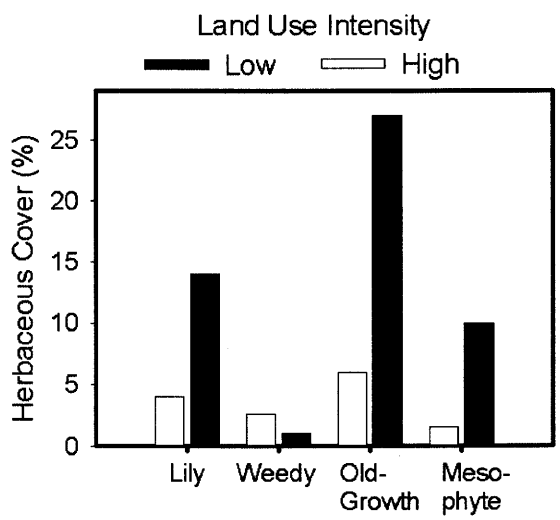

Figure 3. Herbaceous species diversity shifts to weedy species when patches are smaller or the intensity of past disturbance is greater (based on Pearson et al. 1998).

(*Acer* sp.), and poplar (*Liriodendron* sp.) have an advantage in establishing themselves over other species (Clark et al. 1999).

Aquatic Ecosystems

Land use has been most intense and persistent in floodplain and cove sites, with an impact on aquatic ecosystems through numerous pathways (Bolstad et al. 1998; Wear and Bolstad 1998). For example, conversion of forest to agriculture removes trees that both shade and deliver substantial quantities of matter and energy as leaves and woody litterfall to streams (Wallace et al. 1999). Streams traversing forests generally have higher diversity and abundance of clean-water benthic macroinvertebrates than streams traversing agricultural land (Harding et al. 1998; Jones et al. 1999; Richter et al. 1997; Warren et al. 2000). Forest streams, however, have lower fish diversity and abundance, largely consisting of introduced rainbow or brown trout that presumably ate or displaced most other species. Agricultural streams do not contain trout, but rather a mixture of native and introduced species that tolerate high levels of fine sediment and higher water temperatures (Scott and Helfman 2001; Scott et al. 2002).

Multivariate analyses of stream faunal communities have identified two clusters of sites: those linked to land in agriculture in 1950, and those linked to land in forest in 1950 (Harding et al. 1998). The groupings cut across current land use in southern Appalachia—most streams on land forested in 1950 had higher biodiversity than streams on agricultural land in 1950 irrespective of land use in 1990. This means that streams on currently forested land that was farmed within the past 50 years had fish and invertebrate communities comparable to streams on land currently in agricultural use, rather than being comparable to streams on forested land that had not been cleared within the last 50 years. The critical determinant is stream substrate, which is important at many life history stages of vertebrate and invertebrate organisms. The quality of stream substrate is most strongly related to past rather than present land use (Figure 4; Scott 2001).

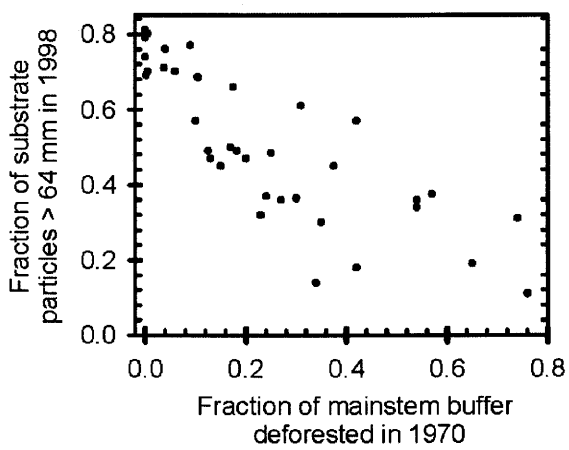

Figure 4. Fine sediment input to the substrate of small southern Appalachian streams depends more on past than present land use (based on Scott 2001).

Riparian corridor width has long been considered the most important determinant of the impact of land use on streams. However, Coweeta LTER research indicates that riparian corridor length may be as important as corridor width (Jones et al. 1999). Fish diversity and abundance in sampled streams were most strongly related to the length of unbroken forest immediately upstream from the sampling location. Invasive and sediment-tolerant species were most common where agricultural clearing extended more than 1 km upstream from the sampling location, and were least common on stream reaches where forest cover prevailed. Linear agricultural patches paralleling streams are associated with higher inputs of stream sediments. As upstream agriculture patch area and length increases, fish species that nest on the bottom and do not clean sediment from their nests decrease in abundance. Species that keep their nests free of silt increase in abundance (Scott et al. 2002). In summary, these findings suggest that nearly 50 years of forest regrowth fail to return southern Appalachian stream biota to that characteristic of forested streams.

Contemporary Forces Guiding Land Use

By the early 1960s Appalachia was described as "an island of distress in a sea of affluence" (Moore 1994), and some authors note that living conditions in the region were analogous to those found in many Third World countries (Falk and Lyson 1988). The creation in 1964 of the Appalachian Regional Commission had the objective of resolving the recognized economic disparity between Appalachia and the rest of the United States. The strategy of the commission was to build highways between population centers under the expectation that economic development would improve local access to educational, health, recreational, commercial, and industrial facilities, translating to improved overall quality of life. By reference to a matched control group of counties elsewhere in the United States, the fastest growing Appalachian counties showed superior economic, social, and public health gains (Isserman and Rephann 1995). Tourism and service sectors in particular benefited, growing as much as 600% in the first two decades of intervention. However, the gains are highly restricted in their geographic distribution across the politically defined region, prompting wide discussion about the overall success of the economic development program (Moore 1994; Wood 2001).

Southern Appalachian traditions changed substantially during and after the integration of the region into the larger national economy. As transportation networks developed, many Appalachian families abandoned a difficult, meager, and uncertain agricultural livelihood and moved to the periphery of the region to cities such as Atlanta and Cincinnati (Halperin 1990). Despite rural to periurban migration, some cultural traditions endure. The strong resistance to zoning or other land-use restrictions in southern Appalachia has been related to the strong tradition of individual and family independence, and the Southeast in general is characterized by scant or nonexistent zoning restrictions on rural and periurban private lands (Cho et al. 2003; Falk and Lyson 1988).

The other major change taking place in tandem with regional integration is the dramatic influx of immigrants from Southern and Northeastern states. These newcomers are on average wealthier, have more education, and have more urban interests than traditional southern Appalachian inhabitants (Conroy et al. 2003; Falk and Lyson 1988; Wear and Greis 2002). In addition to the amenities of place, they are

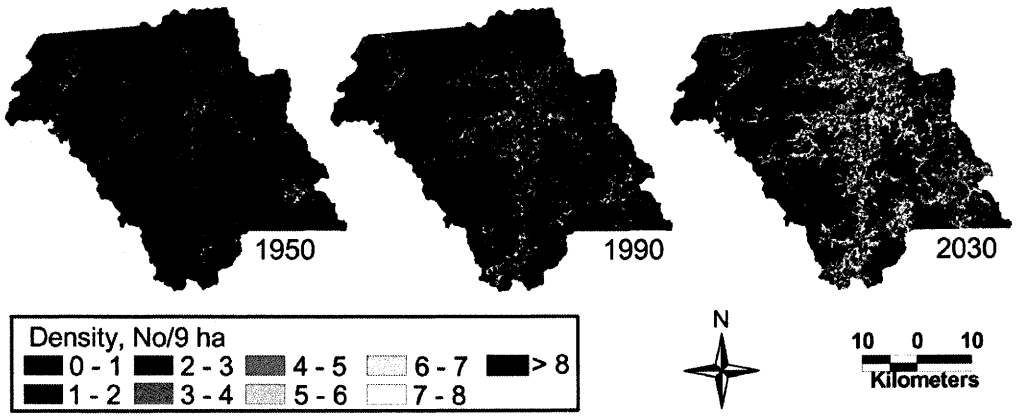

Figure 5. Actual and predicted building density for Macon County North Carolina—centered on the city of Franklin and traversed by State Highway 441.

attracted to southern Appalachian states such as Georgia and North Carolina by the low cost of living, light tax burdens, and absence of zoning restrictions. This influx of "outsiders" is tied to the gentrification of southern Appalachia, and to changes in the nature and pattern of land use across the region (Cho et al. 2005b; Conroy et al. 2003; Wear and Greis 2002).

The scant to nonexistent zoning restrictions on rural and periurban private lands lead to a notable absence in southern Appalachia of a systematic approach to sprawling development (Figure 5). This type of develop is the most commonly identified cause of changes to the structure and function of biodiversity across the region (Richter et al. 1997; Warren et al. 2000; Wright and Coleman 2002). Counties throughout the Southeast are now on the cusp of the transition in lifestyle and economy characterizing the New South, for which Atlanta is the financial hub and cultural center. Four-lane interstate highways such as I-85 and newly widened and improved state highways such as GA-441 serve as high-speed corridors connecting Atlanta with the Georgia and western North Carolina extension of southern Appalachia. Inhabitants expect the opportunities of a metropolis without the density of a city and are content to commute long distances on a daily basis for the sake of living on a lot large enough to function as a small farm.

The indifference to driving long distances in order to meet personal housing desires is suggested by the fact that house prices in sparsely developed urban communities are higher than comparable but more dense urban communities (Cho et al. 2005a). The response of urban communities to increased population density is to "push" development toward rural areas at the same time that the environmental amenities (e.g., proximity to a lake, higher elevations, greater access to streams and open spaces) "pull" households into rural areas.

Conclusion

Little change is forecast in the total area of Southeastern forests between 1995 and 2040, since forest losses to urban uses will be offset by conversion of agricultural land to forest (Wear and Greis 2002). However, urban development is forecast to concentrate in the eastern part of the region while forest cover will shift to the west.

The anticipated decrease in forest cover and increase in urban sprawl in the east have important socioeconomic and biophysical implications for southern Appalachia that are already appearing. These include decreases in water availability and quality, native habitats, biological diversity, and recreational opportunities. As residential density decreases, vehicle miles traveled increase, and this leads to increases in carbon monoxide, particulate matter, nitrogen oxides, and hydrocarbons, which deteriorate air quality. More houses at lower densities increases pressure on existing sewer systems and the increased stormwater runoff and sewage seepage impact flow regimes. Local governments are challenged in dealing with these issues because of their relatively modest tax revenues to refurbish existing or expand new service networks.

Current regional development predictions indicate formation of "Charlantingham" over the next decade—a megalopolis centered on Atlanta (Georgia) that will stretch from Birmingham (Alabama) to Greenville (South Carolina) with a projected population density that exceeds 100 people km^{-2} (Conroy et al. 2003; Tamman 2001). Atlanta has grown in the last 40 years from 1.39 million people living in 5 counties to 4.11 million people living in 20 counties. Unlike development in the western or northeastern regions of the United States, the southeastern region has few practical, political, or geographical boundaries to sprawl: There are no impassable mountains blocking development; "usable" land is abundant; and 69% of forest lands in the Southeast are privately owned (Wear and Greis 2002).

Counties and municipalities across the region struggle to adopt any type of land-use policy to anticipate and curb the future that is already starting to take place in the present. This reflects the inability to find the compromise between voluntary versus regulatory approaches: One quarter of homeowners protest any land-use policy on principle (Cho et al. 2005a). The response from state and local governments has been to resort to secrecy in decision making and to rely on authority to achieve the semblance of order (e.g., 2005 Georgia House Bill 218). This House bill, passed by the House and tabled by the Senate in the 2005 Georgia legislative session, was designed to exclude from public inspection records of any public agency engaged in a program of economic development. Economic development included certifying and locating solid waste, hazardous waste, or medical waste facilities; facilities for the disposal of sewage sludge or the handling of radioactive material; or electrical plants having a generation capacity of more than 25 MW.

There may be a solution to the impasse. Willingness to pay (WTP) for conservation easements reveals that newer homeowners and homeowners with higher income residing in rural and periurban communities place the highest relative value on conservation. Not surprisingly, the value of conservation increases with knowledge about conservation issues and home proximity to an area with specific environmental amenities. Assuming a 5.5% increase in the number of households, a 9.2% increase of conservation easement price, and a 2.7% discount rate per year, conservation easements with protest bids could reduce the rate of farmland loss by 40% to 46% over the next 10 years compared to the 1987–1997 loss rate (Cho et al. 2005b). (A "protest bid" is a negative response to a valuation question; while they can be counted as zero, they are included in this example because excluding them underestimates the mean WTP.) The revealed WTP for conservation easements suggests that homeowners would support a less regulatory and more voluntary type of policy. The challenge lies in whether the Old South in becoming the New South can articulate and implement a change in governance that allows for public participation in land use and conservation decision making.

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