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Applied Geography 25 (2005) 67–79
APPLIED GEOGRAPHY
www.elsevier.com/locate/apgeog

Sprawl and forest cover: what is the relationship?

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Abstract

For decades observers have expressed concern about losses of farmland to sprawl, but until recently they have neglected the effects of sprawl on forests. In this paper we examine how suburban real estate development affected forest cover in New Jersey between 1986 and 1995. Increases in development did accelerate losses of forest cover, primarily in the wealthy, suburban belt of communities that ring New York City. Forest cover remained stable or increased slightly in places with few forests or protected forests. Central place theory provides the most succinct explanation for the pattern of forest losses and gains across communities.

Keywords: Sprawl; Forests; Real estate development; New Jersey

Introduction

'Sprawl' denotes landscapes with extensive areas of single family homes on large lots and commercial strips with large parking lots. Automobiles provide the only widely used means of transportation in these places (Gillham, 2002:8). As it is commonly understood, sprawl involves the expansion of urban land uses out from a metropolitan core. The same process of metropolitan expansion that engulfs farmland on the metropolitan periphery also causes land abandonment in the metropolitan core. Although analysts typically refer to 'urban sprawl', a great deal of sprawl occurs outside of metropolitan areas (Daniels, 1999:40). To acknowledge this rural dimension to sprawl, we refer to 'sprawl' rather than 'urban sprawl' in our work.

Concern over the landscape transformations caused by sprawl is widespread. Canadian planners in Ontario worry about the losses of prime farmland outside of Toronto (Greenontario, 2003). Chinese planners have recently expressed concern about

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0143-6228/$ - see front matter
doi:10.1016/j.apgeog.2004.07.001

the expansion of cities into prime agricultural land in central and southern China (Tyler, 1994). Since the 1970s planners in the United States have called attention to the sometimes dramatic local declines in farmland caused by urban expansion (Burchell et al., 1998; Duany, Plater-Zybeck, & Speck, 2000). In addition, sprawl appears to consume large amounts of forest lands, especially in the eastern US (Burchell et al., 1998; Hasse & Lathrop, 2003; USDA Natural Resources Conservation Service, 2000). Sprawl may contribute to climate change by destroying carbon sequestering secondary forests and by encouraging the consumption of fossil fuels to heat larger homes and fuel longer commutes to work (Casperson et al., 2000). Sprawl induced forest loss also has far-reaching ecological consequences including declines in Neotropical migrant birds that breed in forest habitats (Robbins, Dawson, & Dowell, 1989), declines in water quality, and increases in erosion along streams that result from the replacement of forests by the impermeable surfaces that characterize built environments. Given this array of potentially negative environmental consequences, it seems important to assess both the type and magnitude of sprawl's impact on forests. We do so through an empirical analysis of suburban real estate development and forest cover change in New Jersey between 1986 and 1995.

While the forest destroying effects of residential expansion may seem quite obvious in some places, they are not clear in other places. In the southeastern United States urban areas like Atlanta and Charlotte expand into a largely forested hinterland, so sprawl clearly destroys forests in these locales. In the Middle West where farmland predominates in peri-urban locations around cities like Chicago, residential expansion causes large losses of farmland and only small losses of forest. What happens in landscapes like those outside of cities in the northeastern United States that contain a mix of forests and farmland? What happens in urban core communities that experience depopulation and deindustrialization when metropolitan areas expand outward? New Jersey provides a useful laboratory for answering these questions because it contains a declining urban core as well as two metropolitan areas (New York and Philadelphia) expanding into a mixed rural landscape containing both forests and farmland.

Theoretical background

For most of the 20th century analysts viewed landscape transformations around cities through the lens of central place theory (Von Thunen, 1875). Differences in distances from a central place impose variable transportation costs on actors in different locations, and these differences dictate the use of land in a place. In a related line of theorizing sociologists described urban land uses in terms of concentric zones with downtown areas surrounded by less densely populated 'zones in transition' containing 'backstage' land uses such as warehouses, landfills, factories, and slaughterhouses. Residential areas developed outside these warehouse zones (Burgess, 1974:97–98). As metropolitan areas expanded, each concentric zone expanded outward.

Social scientists made less use of central place theories after 1965. With the development of more efficient transportation systems after World War II differences in transportation costs between places began to decline, and agricultural landscapes began to diverge from Thunen-like models (Sinclair, 1967). Under these circumstances human geographers began to make less use of central place theories just as metropolitan expansion became more prevalent. Another shortcoming of the central place theories involved their neglect of the political dimension in land use decisions. As governments created zoning laws and commissions to administer the laws, the political dimension of land use decisions became more salient in processes of landscape change during the 20th century, and central place theory, with its focus on economic gradients, did not provide an obvious way to interpret the political dimension of land use decisions. Because players in the real estate development game (Feagin, 1983; Rudel, 1989) frequently use political institutions to achieve economic ends, the performance of political institutions should be interpretable in economic terms, and a modified version of central place theory that acknowledges political as well as economic influences could be useful for understanding variations in the sprawl–forest cover relationship.

Context: forests and metropolitan expansion in New Jersey

At the beginning of the seventeenth century forests dominated the New Jersey landscape. Native Americans cleared land for cultivation in select locations and managed the forests to increase game, but much of the state contained old growth forests (Matlack, 1997). During the next two centuries European colonists cleared nearly all of the forests for timber and agriculture. Between 1850 and 1950 forests regenerated as small farmers abandoned agriculture in upland areas as well as other locations. After 1950 another wave of landscape transformation, associated with suburban development, gathered force. When the construction of the Interstate Highway System lowered transportation coasts to centers of employment, locations outside of New York City and Philadelphia became more attractive sites for real estate development, and developers began to build subdivisions of single family homes. During one recent interval in this transformation, between 1986 and 1995, New Jersey exhibited a net loss of 86,884 acres of farmland and 38,242 acres of forests while it gained 135,739 acres of urban land. In the new neighborhoods people live at lower densities. Between 1980 and 1990 the state's population increased by only 5% while the amount of developed land increased by 11% (NJDEP land use/land cover database). These aggregated trends conceal interesting local variations. While the state as a whole lost forest cover, four counties and about one quarter of the municipalities gained forest cover between 1986 and 1995. Another 12% of the municipalities exhibited no net change in forest cover during the nine year period.

We describe and try to explain these varied patterns in the following pages. We begin by describing the geographical patterns of forest change in New Jersey. We then offer an explanation for patterns of forest change at the state level and explore how different regions within the state vary from the overall pattern.

Methods

The unit of analysis is the municipality. The land cover data was obtained for all municipal units in New Jersey ($N = 568$) for 1986 and 1995 from the New Jersey

Department of Environmental Protection (NJDEP) database (www.state.nj.us/dep/gis). To our knowledge, the existence of this type of spatial data is unique to New Jersey and provides an opportunity to conduct a statewide analysis of land use/land cover change that would not be possible in most circumstances. These are vector digital data based on color infrared aerial photos and wetland map layers, which depict 39 land cover types. The minimum map unit is 2.5 acres with a spatial accuracy of ± 33 ft (1995) and ± 80 ft (1986). For a more detailed description of data sources and quality see Hasse and Lathrop (2003). We reduced the original 39 categories into six land cover types including, forest, wetland, agriculture, urban, open water, and barren. Appendix A lists the 39 categories along with the six more general land cover categories. Forest includes land cover types ranging in successional stage from old fields with $<25\%$ brush cover to mature forest. Forested wetlands were grouped with wetlands, so our measure consists of well drained forest lands throughout the state. The database also includes total area (acres and km^2) of municipality. Using the total forest cover in each municipality in 1986 (acres), we calculated percentage of municipal area in forest cover, change in forest cover, and percentage change in forest cover. These measures made it possible to construct the map in Fig. 1 of the statewide pattern of forest cover change, using ArcGIS8.

Because we are as interested in forest gains in places with no appreciable real estate development as we are in forest losses in places with extensive real estate development, we have decided to use net changes in forest cover in assessing the sprawl–forest cover relationship. In their work on sprawl Hasse and Lathrop (2003) used a slightly different

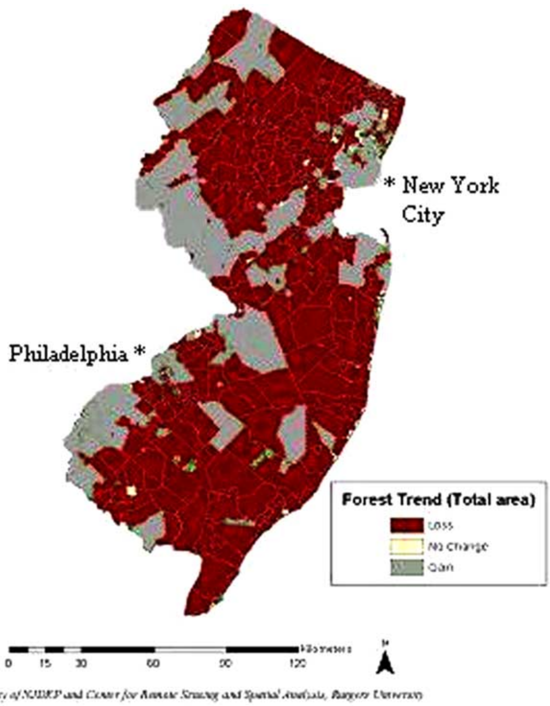

Fig. 1. Map of New Jersey showing net change in forest cover in each municipality from 1986 to 1995.

measure: the amount of forest lost to residential expansion in a community. In other words they measure the absolute loss of forest to real estate development in a community while we use a net measure of forest losses and forest gains in a community. Our use of the 'net' measure allows for the possibility that in some settings gains in forest on lands that have gone out of agricultural production will offset (and in this sense, mask) the losses of forest to real estate development in the same community. While useful for examining the effects of sprawl on forest cover in rural–urban fringe areas, the measure of absolute loss of forest to real estate development has a cost when it is used in a wider set of communities. It would miss the forest regrowth that might occur in densely settled core areas as humans leave these communities. Because we conceive of sprawl as both the outward advance of urban land uses into rural landscapes and the emptying out of the urban core areas, we wanted to use a measure that captured both of these dimensions. A measure of net change in forest cover does so, and for this reason we use it in the analyses reported here.

Socioeconomic variables were obtained from the NJ Municipal Data Books (Garwood, 1982; Horner, 1992). For each municipality, we collected data for 1980 and 1990 on population, per capita income, and the median value of a single-family home. Variables derived from these data are population density, change in population size, percentage change in population, and change in per capita income. To measure the intensity of real estate development in a place, we constructed three year moving averages of building permits for single family homes, first for 1978–1980 and then for 1988–1990. We then regressed forest cover change from 1986 to 1995 on these community characteristics. To explore the subregional variations in the statewide pattern, we created subsamples of municipalities in adjacent counties and analyzed the patterns of forest cover change in these places. These subsamples include 'old urban' (Essex, Hudson, Union counties), 'suburban' (Middlesex, Monmouth, Morris, and Somerset counties), 'amenity rich, exurban' (Hunterdon, Sussex, Warren counties), and 'mixed use, agricultural' counties (Burlington, Gloucester, and Salem counties). In our usage 'exurban' refers to an affluent, low density settlement pattern in which second homes are common and people earn most of their income from urban occupations.

Because the dependent variable in all of these equations is gains and losses of forest area, we needed to control for the size of municipalities, so each of these equations contains a municipality's area as a control variable. An examination of the residuals for each case revealed the presence of influential cases in each regression, but with the exception of the rural, mixed use subsample, the deletion of these cases did not change the results from the regressions in a significant way, so we have left them in the analysis. Collinearity diagnostics do not indicate major problems. For the statewide analysis the condition index, an indicator of multicollinearity, is less than 10. It approaches 15 in two of the subsamples.

Spatial autocorrelation, in which the effects from the independent variables of one unit influence processes in an adjacent units, can bias analyses like the ones reported here. The potential for spatial autocorrelation disturbances in a data set can be assessed by computing Moran's C, a measure of how much the scores on the dependent variable tend to cluster geographically. We computed Moran's C for three randomly selected subsamples of communities in the data set. The scores for the subsamples were 0.090, 0.053, and 0.095 on a scale of 0–1. They indicate little autocorrelation in our data.

Table 1
Means, standard deviations, and ranges of net forest, farmland, and urban land use changes between 1986 and 1995 in New Jersey municipalities

	Mean change (acres)	Standard deviation	Range (acres)
Forests	−67.33	198.30	−1369 to 929
Farmlands	−152.96	341.00	−2539 to 343
Urban land uses	+238.98	421.00	84–2717

Results

Statewide findings

Table 1 outlines the aggregate trends across municipalities. While all counties experienced increases in urban land, trends in forest and farmland varied from county to county. For example, while one county (Morris) lost more than 1800 acres of wooded land, an adjacent county (Hunterdon) gained more than 1000 acres of forest. Column one of Table 2 presents the results of the statewide multivariate analysis. The single most

Table 2
Regression Analyses on Forest Cover Change (acres)[a]

Variables*	(1) Statewide	(2) Old urban (EHU)	(3) Suburban (MMMSO)	(4) Amenity rich, exurban (HSW)	(5) Agricultural, ex-urban (BGS)
AREA	−3.658***	−4.874*	−5.501***	0.423	−0.002
	(0.470)	(2.036)	(1.282)	(1.738)	(0.681)
Acres of Barren	0.001	0.164***	0.166**	−0.732***	−0.036
Ground, ’86	(0.031)	(0.049)	(0.053)	(0.197)	(0.041)
Farmland change,	−0.299***	0.444	−0.246***	−0.195**	−0.234***
’86–’95	(0.020)	(0.698)	(0.042)	(0.060)	(0.050)
% in Forest, ’86	−169.377***	−169.035*	−483.657***	−158.195	−252.259*
	(37.323)	(78.732)	(85.551)	(113.247)	(107.921)
Single family home	−1.748***	−0.300	−1.578***	0.487	−1.111***
permits ’88–’90	(0.113)	(0.379)	(0.223)	(0.692)	(0.247)
Value of Homes, ’90	−0.028***	0.014	−0.023	−0.032	−0.119**
	(0.007)	(0.009)	(0.015)	(0.035)	(0.038)
Population in 1980	0.043	0.067***	−0.097	−0.1125*	0.028
	(0.026)	(0.021)	(0.097)	(0.460)	(0.153)
R	0.758	0.731	0.813	0.623	0.725
R^2 (adj.)	0.569	0.466	0.646	0.322	0.476
No. of cases	567	55	171	73	75

EHU: Essex, Hudson, and Union counties; MMMSO: Middlesex, Monmouth, and Morris counties; HSW: Hunterdon, Sussex, and Warren counties; BGS: Burlington, Gloucester, and Salem counties. Variable definitions: AREA, municipal area in acres; Barren Ground, ’86, acres of barren ground in municipality, 1986; Farmland Change, gains or losses in farmland, 1986–1995; % in Forest, ’86, percentage of municipal land area in forest; Single Family Home Permits, total number issued in 1988, 1989,and 1990; Value of home, median value of a single family home; Population in 1980, population of municipality in 1980.

[a] The upper figure in each cell is the unstandardized regression coefficient for that variable. The standard errors for that variable are in parentheses below the regression coefficients. Their ratio indicates the level of statistical significance. Significance levels are *($p < 0.10$), **($p < 0.01$), and ***($p < 0.001$).

powerful predictor of forest cover loss was the total number of single family home permits issued in 1988, 1989, and 1990. This finding confirms that sprawl destroys forests, even in the mixed forest and farm landscape of New Jersey. Sprawl occurs for the most part in the outer portions of the region where land is less expensive, but homes, reflecting the exclusive ambiance of the suburbs, are more expensive. Developers try to capitalize on the large differential in the prices of land and homes by building in these places. The findings also suggest several conditions that preserve forests in the midst of residential expansion. Municipalities that lost a great deal of farmland did not lose much forest. Developers prefer to build on agricultural land if it is available because they do not have to clear the land; for this reason the ready availability of agricultural land lessens the pressure to develop nearby forested land. Finally, communities with little forested land do not lose much forested land to development.

Subregional patterns

To ferret out subregional patterns in the sprawl–forest cover relationship, we mapped forest cover change across the municipalities of the state, classifying communities into three categories according to whether they saw increases, decreases or no change in the extent of forested land over the nine year period. Fig. 1 presents the map. The geographical patterns in the map suggest several distinct subregional processes of land use conversion. In the urban core close to New York City forested land increased; in a belt of suburbs running from north to south outside of the urban core, forests decreased; in the more rural northwestern and southwestern parts of the state a mixed pattern prevails, with clusters of communities gaining or losing forested land. To analyze these regional processes further, we created four subsamples of municipalities, one for the urban core, another for the suburbs, a third for amenity rich, exurban places in northwestern New Jersey, and a fourth in the mixed use, agricultural region of southwestern New Jersey. In the following sections we outline the findings from these regional multivariate analyses.

The old, urban core

Column two in Table 2 presents the results from the multivariate analysis of forest gains and losses in the old cities at the core of the metropolitan area. Forest gains occurred in cities that have extensive amounts of barren land. For example, Jersey City and Newark gained 207 acres and 64 acres of forest, respectively. These communities contain old, inactive landfills and brownfields that no one uses. The dumps are now afforesting, sometimes spontaneously, sometimes with the active intervention of restoration ecologists. Fig. 2 shows a reforesting lot in front of a warehouse a few miles west of New York City. Trees have also reoccupied barren lands in lots scattered throughout the densely settled residential neighborhoods of the region. Forests in cities provide valuable ecosystem services. Their rarity makes their aesthetic contributions to neighborhoods more noticeable, so local residents have welcomed the afforestation of vacant lots (Bolund & Hunhammar, 1999). Popular support for trees and small forests in these locales

Fig. 2. Afforesting Vacant Land (in front of a warehouse) in Northeastern New Jersey.

may also stem from the positive effect that trees usually have on local property values (Tyrvainen & Miettinen, 2000).

The suburbs

Column three in Table 2 presents the results from the multivariate analyses of forest gains and losses in these communities. Most of the forest losses occurred in the outer belt of suburbs where developers obtained permits for and built the most single family homes. Developers deforested the largest amounts of land in municipalities that contained extensive forests and few farms. Presumably, when developers could not find farmland to develop, they purchased forested land, cleared it, and built homes on the land. Here too, barren land reverted to forest. These patches of forest often emerge at the sites of old landfills, along the edges of construction sites, or on the shoulders of roads.

Amenity rich, exurban regions

Column four of Table 2 presents the findings from the rural, amenity rich communities in the northwestern portion of the state. The landscape in this region features agricultural valleys separated by forested ridges of the Appalachian mountains that run from the southwest to the northeast across the region. Some of the more expensive real estate developments occurred on the lower slopes of the ridges where new residents can enjoy scenic vistas from their homes, or, in one case, proximity to a local ski area. Here too farmland losses predicted forest persistence. Communities that lost farmland to residential development usually preserved their forests. Developers evidently found farmlands rather than forests to develop in these places. The survival of these forests in the face of development pressure reflects the difficulty of building on steep, forested slopes, coupled with state protection of some of the forests along some of the ridgelines.

Communities with small populations in 1980 retained more of their forests than larger communities in part because they frequently contained large tracts of already protected state forests or national recreational lands along the ridges. In contrast with the patterns in cities and suburbs where large amounts of barren land encouraged afforestation in the subsequent decade, rural–urban fringe communities with large amounts of barren land experienced large losses of forests. Here, barren land occurred in and around sites undergoing real estate development. Unlike barren lands in more developed communities, these places were adjacent to undeveloped forests and farmland on the outskirts of the small towns. In subsequent years the towns became growth poles in the region, leading to the destruction of nearby forests.

Mixed use, agricultural regions

The state also contains a predominantly agricultural region in the southwest that exhibited a pattern of residential expansion and forest cover change that differed markedly from the amenity rich, exurban places to the north. Column five of Table 2 describes the findings from the multivariate analysis of forest cover change in this region. The landscape features a mix of farmland, forests, and wetlands along the Delaware River and Bay. Between 1986 and 1995 communities that experienced large losses of farmland managed to retain their forests. These communities usually had extensive farmlands and little forest in 1986. Poorer communities that saw less building activity by developers also retained more forests than did wealthier communities that saw more building. The pattern of landscape change in this region resembles the pattern in many remote rural regions of the eastern United States. Some farmlands in poorer communities, experiencing little development pressure, reverted to forest when farmers decided to pursue non-farm occupations.

Discussion

The amount of low density, residential real estate development in a community proved to be the most accurate predictor of forest cover change during the 1986–1995 period in New Jersey. This finding confirms that urban sprawl destroys forests, even in a landscape that contains farmland as well as forest and is in agreement with earlier, similar studies (Hasse & Lathrop, 2003). Communities in wealthy suburban areas with large amounts of forest cover had the most forest to lose and accounted for the greatest losses of forest on a statewide scale. Communities with small amounts of forest throughout the state managed to preserve or even increase the extent of their forests. These communities exhibited the highest percentage loss of both forest and farmland to urban development (Hasse & Lathrop, 2003).

The spatial organization of forest cover change under conditions of residential expansion brings concentric zone theory to mind (Burgess, 1974). Central place theory continues to explain the spatial organization of land use in metropolitan areas because transport costs between home and work remain a salient feature in decision making about places of residence. As sprawl expands the size of metropolitan areas, each concentric zone expands outward along its perimeter. Patterns of personal and corporate investment drive the outward expansion of metropolitan areas. Builders convert fields and forests into subdivisions of single family homes on the periphery at the same time that households and businesses abandon old dilapidated neighborhoods in the 'zones of transition' outside center cities. The spatial patterning of investment and disinvestment produces modest gains in forest cover in the urban core and large losses of forest cover in the outer reaches of the metropolitan area. Some rural places remain outside feasible commuting distance to central places, and these places experience only modest losses of forest cover. Some of these rural and rural–urban fringe communities may even experience modest increases in forest cover if farmers continue to reduce the extent of their cultivated lands.

As the differences between the forces driving forest cover change in rural–urban fringe areas of northwestern and southwestern New Jersey illustrate, the impact of residential expansion on forests in rural areas depends in part on physical geographical factors. The scenic amenities in largely forested areas of northwestern New Jersey encouraged early efforts to protect these lands from development and raised the prices of the homes constructed in the region, producing an exurban landscape owned in large part by non-farmers. In largely agricultural areas of northwestern New Jersey, municipalities lost a high percentage of farmland to development (Hasse & Lathrop, 2003). Without a comparable level of scenic amenities, real estate developers in southwestern New Jersey built close to major roads. In so doing, they eliminated appreciable amounts of farmland and destroyed some forests, little of which was protected. These differences in trajectories of land use change between the two rural–urban fringe areas underline the importance of a rural region's physical geography in shaping the trajectory of change that emerges in a place. However, given the predictions by various researchers that New Jersey will experience the development of all available land by 2050 (Hasse & Lathrop, 2001), it is conceivable that these different trajectories may eventually converge to a single pattern of sprawl-forest loss without targeted efforts to preserve forests at the local and/or regional level.

One pattern that prevails throughout the state involves the persistence and expansion of small patches of forest in communities that had very little forest at the outset of the period under examination. This dynamic seems to prevail in both places far from and close to the center of metropolitan areas, and in this respect it points out the limitations of central place theory for explaining the sprawl–forest cover relationship. A more political, less economic explanation for this pattern may be necessary. When developers propose to build on one of the few remaining patches of forest in a community or when owners abandon barren ground in urban places, conservation minded residents frequently form organizations to contest a developer's plans or promote the regeneration of forests on barren lands. Sometimes, these local groups create coalitions and mobilize resources to rehabilitate or preserve scarce forests. In several disparate locales in New Jersey these conservation coalitions have been able to preserve and even increase the extent of forests in a community, even as they undergo real estate development. In one peri-urban municipality (Hopewell) where conservation coalitions have been especially active, about 7% of the town's land area reverted to forest between 1986 and 1995. Understanding the effects of these coalitions and the dynamics that determine their success or failure should become a priority for future research on the sprawl–forest cover relationship in the United States.

The setting of this study in New Jersey, the most densely populated state in the United States, inevitably raises questions about the applicability of its findings to other places.

A wide array of amenity rich, rural places in the United States and Canada have begun to experience extensive low density real estate development during the past fifteen years. Less amenity rich rural places on the fringes of smaller urban areas have also begun to experience some sprawl. These differences between more and less amenity rich rural areas recalls the contrast between the two rural–urban fringe areas of New Jersey and suggests that it may be replicated elsewhere in North America. Because these rapidly growing places, in the Rocky Mountains, in the lake districts of the Middle West, along the Atlantic coastline, and adjacent to the Boston to Washington megalopolis also have some older central places, they may exhibit to some extent the pattern of modest forest regrowth in older, built up areas coupled with extensive forest destruction in more suburban locations. If so, politically sensitive versions of central place theory, adapted to the physical geography of a place, might provide a useful analytical tool for understanding the sprawl–forest cover relationship wherever sprawl has begun to transform landscapes around central places.

Acknowledgements

We want to thank Rick Lathrop and David Tulloch for comments on an earlier draft of the paper. We would like to thank Steven Handel for the photograph reproduced in Fig. 2. Funds from New Jersey Agricultural Experiment Station grant No. 26307 facilitated this research. This research was supported by the New Jersey Agricultural Experiment Station (McIntire-Stennis Funds), Project No. 26307. An earlier version of this paper was presented at the 2003 meetings of the Rural Sociological Society, Montreal, Canada.

Appendix A

Type used in analysis	Land use/land cover categories in NJDEP database
Agriculture	Orchards/vineyards/nurseries/horticultural areas
	Cropland and pastureland
	Confined feeding operations
	Other agriculture
Barrenland	Extractive mining
	Undifferentiated barren lands
Forest	Deciduous forest (>50% crown closure)
	Deciduous forest
	Mixed forest (>50% deciduous with >50% crown closure)
	Mixed forest (>50% coniferous with >50% crown closure)
	Deciduous forest (10–50% canopy closure)
	Mixed deciduous/coniferous brush/shrubland
	Deciduous brush/shrubland
	Brushland/shrubland
	Coniferous/deciduous forest (>50% crown closure)
	Coniferous brush/shrubland
	Coniferous/deciduous forest
	Old field (<25% brush covered)

(*continued on next page*)

Type used in analysis	Land use/land cover categories in NJDEP database
Urban	Residential, rural, single unit
	Residential, single unit, low density
	Residential, single unit, medium density
	Residential
	Mixed residential
	Commercial services
	Transportation/Communications/utilities
	Recreational land
	Athletic fields (schools)
	Industrial
	Other urban or built-up land
Water	Artificial lakes
	Streams and canals
Wetland	Deciduous (shrub/shrub wetlands)
	Deciduous wooded wetlands
	Mixed forested wetlands (deciduous dom.)
	Mixed forested wetlands (coniferous dom.)
	Coniferous wooded wetlands
	Herbaceous wetlands
	Agricultural wetlands (modified)
	Managed wetland in maintained lawn

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