

THE MEDIATION OF A FUNCTIONAL-AESTHETIC LANDSCAPE IN NEW ENGLAND: NEW BRAINTREE, MASSACHUSETTS AND THE IDENTITY OF PLACE

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ABSTRACT: *From 1982 to 1996, the number of cattle in New Braintree, Massachusetts decreased by 88%, while during the same period, the human population increased by 33%. Examination of the changing New Braintree landscape, reveals that decision-making on land-use at the micro-level extends beyond the purely economic or socio-political. Mediation of environmental changes and conflict resolution begins in the ideological and within geographies of the mind, continues into and through the landscape and returns to the ideological. This paper examines ecological change in New England in light of the functional-aesthetic balance found within the nature-society dialectic finding that landscapes are the products of a mediation between natural processes and social desires. Change detection using Geographic Information Systems (GIS) and remotely sensed satellite data from 1971 and 1992 shows a relatively stable landscape ecology matrix with minor change in overall ratio between open and closed land despite the dramatic change in cattle and human population during the same period. This relative stability is attributed to the strong emphasis placed by the town on retaining the existing landscape, consistent with its own traditional pastoral identity.*

Keywords: *LUCC, Political ecology, GIS, Remote sensing, Place identity*

INTRODUCTION

When traveling through the Massachusetts countryside, one is reminded by old stone walls and relatively young trees of both an agricultural past and the resiliency of New England's forests. Between the years 1630 and 1870, forest cover in Massachusetts fell from 58% to 19% due to land clearing for agricultural production (Foster, 1992). Following the Industrial Revolution, New England declined as the agricultural center of the United States, and abandoned fields led to widespread reforestation. By 1980, 45% of Massachusetts was once again covered by forest (Foster, 1992). The present day landscape pattern represents a mosaic of cleared fields, reforested areas, and various stages of intermediate succession between the two. Still, Foster (1992) notes that "very little is known about the detailed pattern of deforestation and reforestation within any region of New England..."

Implications for LUCC (Land-Use and Land-Cover Change)

Land-cover, the bio-physical state of the earth's surface, is a manifestation of land-management decisions (land-use) and the natural environmental context (Ojima et al., 2005). The driving forces of land-use and land-cover change

(LUCC) that have been identified and discussed in the literature include demographics, political economy, political structure, cultural beliefs and attitudes, and technology (Turner et al., 1995). These driving forces, together with the earth's biophysical systems, form the framework of constraints and possibilities within which small-holders manage their land. A thorough understanding of LUCC must therefore merge the explanatory and predictive power of micro-scale research and the generalization possible with macro-scale studies in a nested hierarchy of scales. As Turner and colleagues note (1995), "A global subject of study requires a large number of case studies comparable in structure and content...(that) can be used to build micro and meso-scale models of land-use and land-cover change through time."

This paper is a case study of the changing landscape of New Braintree, a small rural town in central Massachusetts, with open meadows and rolling hills; a scene typical of pastoral landscapes from New England's past. Yet, New Braintree is no throwback to a romanticized past; it is a modern day rural town that held onto its agricultural identity longer than most towns in New England largely due to its cultural identity associated with cattle and dairying. The study examines LUCC in New Braintree by: (1) exploring the complex narrative of historical and contemporary driving forces and land-uses within the local, regional, and national political-

economy, and (2) using remote sensing and GIS analysis to examine the effects of this narrative on the landscape by detecting a change in land-cover from 1971 to 1992. Land-use in New Braintree, as the narrative will indicate, is inextricably linked with its identity (livestock), enabling New Braintree to retain its cattle and keep the land cleared when other agricultural towns in central Massachusetts were abandoned and afforested. Yet, between 1982 and 1996, the number of cattle decreased by 88%, from 1948 head of cattle (HOC) in 1982 to 429 HOC in 1996; New Braintree is a place in transition. This paper examines the driving forces behind this decrease and its subsequent impact on land-cover. Through examination of the changing New Braintree landscape from the seventeenth century through the present, one can question how the landscape itself plays a role in constructing a representation that influences not only land-use decisions but ecological function as well.

CONTENT

The seventeenth century was a period of great change for New England due in part to the introduction of the plow and domesticated grazing animals by European colonists (Cronon, 1983). Domesticated animals, such as cattle, initially grazed on the meadows that had been burned annually by the Indians and used as hunting grounds. Yet, as cattle populations increased and the meadow grasses were depleted, colonists were forced to clear more land. In 1666, the town of Braintree in Massachusetts, faced with such land pressure, petitioned the courts for

more land (Tufts, 1902). In 1715 the court granted 6000 acres in central Massachusetts that were, "noted for the excellence of its pastures,...(as) annual burning by the Indians kept the trees from growing up in the uplands" (Thompson, 1951). Residents of Braintree initially used this land, over 60 miles west, for "pasturing stock during the summer season" (Tufts, 1902) (Figure 1). Eventually, these summer cattle drives turned into a yearlong residence, and in 1751, the town of New Braintree petitioned for, and was incorporated into the Massachusetts Commonwealth. The original 6000 acres granted to the town (the eastern half of present day New Braintree) is situated on an upland and hilly region east of the Ware River Plain. Tufts (1902) stated that in 1796, New Braintree, "...for its bigness...exceeds any other town in the county in fine grazing land, as is evinced by the annual product of beef and dairy." The upland iron-rich soil provided excellent grassland, with nutrient-rich grasses and legumes (Thompson, 1951). Livestock, which flourished on these grasses, played a critical role in the town's economy and culture.

By the year 1776, New Braintree had 798 residents and 217 head of cattle (HOC) (Figure 2). Initially, the cattle were prized for the power, meat, leather, and dairy products they provided for individual households (Thompson, 1951). By the late 18th century in New England, beef production became a profitable venture (Foster, 1992), and cattle were fattened for the fall months and driven to the Boston market (Cronon, 1983). Yet, by the 1800's, according to George Tufts (1902), "New Braintree cheese had acquired an enviable reputation in Boston...(and) increased profits of the dairy over those of beef changed the business from fattening cattle

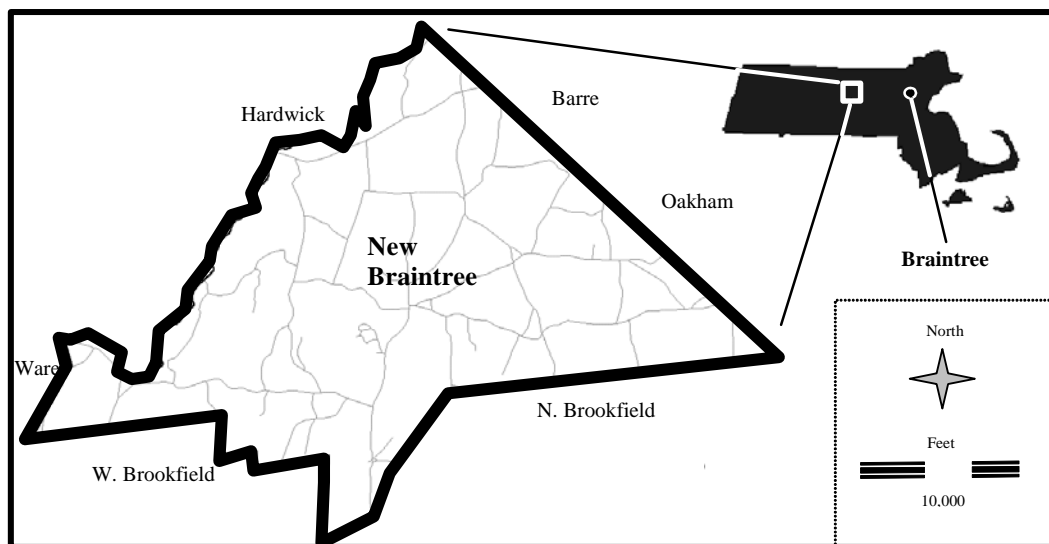


Figure 1. New Braintree and neighboring towns within Massachusetts.

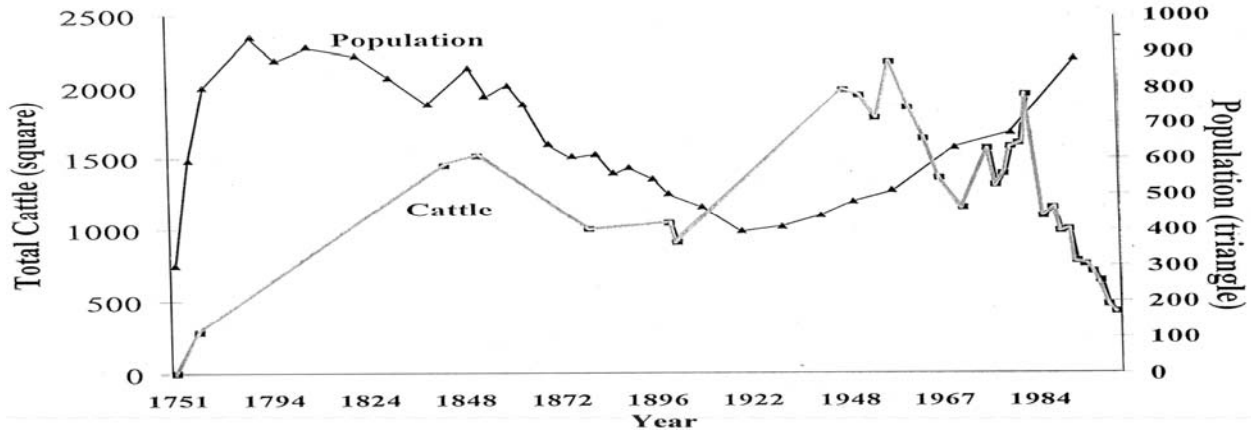


Figure 2. Cattle and human populations in New Braintree from 1751-1996 (Census Bureau and Town Records).

to making cheese". As the cheese industry in New Braintree profited, the number of livestock increased. In 1865, the Industrial Age reached New Braintree. Cheese production shifted from the home to the factory when a cheese manufacturing factory was built along the Ware River. The factory received over three million pounds of milk in one eight month period in the 1870's and produced over 134 thousand pounds of cheese in the year 1881 (Tufts, 1902). By the mid 1880's dealers in Boston and Worcester began to buy whole milk and New Braintree dairy farmers concentrated on exporting milk to these markets and not to the cheese factory. In 1886 the factory, with reduced supplies of milk, became a creamery, and was then abandoned shortly afterward (Thompson, 1951; Tufts, 1902). During this time (1820-1890), the Industrial Revolution and westward expansion of the United States significantly altered the New England cultural and physical landscapes. Manufacturing jobs in industrial cities such as Worcester, Boston, and Lowell, and a declining interest in agricultural production both pushed and pulled out-migration from rural areas (Foster, 1992). As economic opportunities increased in the expanding urban centers, and decreased in rural towns, the New Braintree population decreased steadily from 852 people in 1850 to 394 by 1920 (Figure 2).

In 1902, J.J. Healy (1902), Reverend of New Braintree, lamented that the "cheap and available labor...(that had helped to build the)...golden age of New England farmers half a century ago...(had) taken to the villages and cities in quest of more pay and less labor." The decline in population and dairy production is evident as the number of cattle dropped from 1514 HOC in the year 1852 to 904 HOC by the year 1904 (Figure 2). From 1867, the total number of cattle in Massachusetts began to steadily decrease as livestock production in the Midwest increased. Fueled by cheap land, locally grown fodder, and an

efficient and far-reaching transportation network, the livestock sector in the Midwest prospered. Subsequently, many New England farmers could not compete, and abandoned their fields to reforestation (Foster, 1992; Raup, 1966).

Inherited Landscapes, Myth, Geopietty and Place Identity

The reforestation of New England after pasture and cropland abandonment in the early twentieth century did not seem to affect New Braintree to the extent that it did many other towns in New England. For example, Petersham, Massachusetts, which had less than 20% forest cover in 1860, was 95% forest cover in 1992 (Foster, 1992), while New Braintree's forest cover in 1992 was approximately 58.8%. Why then did New Braintree hold onto its agricultural identity and retain its open pasture land? This is due, in part, to the strength of the livestock tradition developed over time through a connection between inhabitants and place identity. This is evident as the number of livestock in New Braintree actually increased dramatically from 904 head of cattle in 1904 to 2174 head of cattle in 1960. In 1982, there were still 1948 HOC in the town (Figure 2). The increase in livestock numbers, and reluctance of the residents to abandon the dairy life, is partly due to the rich tradition of dairy in New Braintree. Charles Gleason (1902), at the 150th anniversary of the town's incorporation stated that, "...through all the history of (New Braintree's) agricultural products, dairying has stood first." Pulido (1996) notes that production and land management is inseparable from cultural, social, and economic identity. Yet, this identity and land management is also inseparable from "place." In this case, the cultural, social and economic identity associated with livestock worked together to create a landscape that in turn helped to reinforce and

maintain itself. In functional terms, place acted as both constraint and possibility for residents. This can be traced over time as each successive historical layer, or landscape (palimpsest), with its own distinctive social institutions and ecological patterns is inherited by the next generation. Thus, land-managers make decisions due not only to tradition, but also due to inherited landscapes and existing land-covers because considerable effort (physical, economic and social) is required to alter production systems and land-covers. As such, place has a "residual" power to influence the decision-making process in land-management. The strength of place is not only expressed in functional terms through these existing land-covers and inherited production systems, but through the meaning that landscape maintains as the expression of a cultural identity as it is passed on to successive generations. This connection manifests itself in two ways: place myth and geopiety. These representations, while based on very personal experiences, carry considerable power in influencing the connection between place and its identity. Myths, while socially constructed, are reinforced over time through the landscape and through our attitude toward place; woven through place as a representation of our thoughts and actions. Through these myths, local inhabitants can positively reinforce their own genre de vie. Tuan (1979) used the term "geopiety," (borrowed from J.K. Wright) to describe this connection between people and their land. In New Braintree (as in many farming communities), geopiety is passed to each new generation through the daily activities that linked the people to the landscape livestock identity.

New Braintree in Transition

In 1982, there were 1,948 head of cattle in New Braintree. By 1996, despite the deep historical roots of the cultural identity and the residual strength of its landscape (both in function and meaning), the number of cattle dropped precipitously to 429 (Figure 2). Thus, New Braintree seemed to hold onto its livestock tradition until the early 1990's. This decline, 88% in 14 years, represents a significant shift in the social relations, nature and meaning (Sack, 1997) connected with New Braintree's landscape. Inherited landscapes, existing land-covers, sense of place and geopiety may explain why New Braintree held on to its agricultural identity longer than other towns in New England after the Industrial Revolution. Yet, this recent shift is better understood through examination of New Braintree's production system within the larger political, economic, and social context. Interviews with farmers in New Braintree and many who had "given

up their farms" or livestock production indicate two reasons for the decline in livestock and dairy; (1) increased cost of production and (2) rising real estate value of farm land in Massachusetts. Many New Braintree dairy farmers, following suggestions by Massachusetts USDA extension agents in the 1970's, began to rely on feed grains rather than grazing. This strategy placed pressure on the farmer to either provide sufficient hay from existing pastures, extensify their land holdings, or purchase supplemental hay during less productive times. By 1995 the combined price for 100 lbs. of hay, 100 lbs. of sorghum grain and 1 bushel of oats exceeded \$12.00 (Knight-Ridder Financial Commodity Research Bureau, 1997). Many farmers noted that these costs have become prohibitively expensive in the past few years, and were forcing many to sell their herds and/or their land. Additionally, in 1996 Massachusetts ranked fourth among states in cost-per-acre of farm real estate in the United States (USDA-NASS, 1997). The average value of farmland and buildings in Massachusetts rose from \$565 per acre in 1970 to \$5597 per acre in 1996, an increase of almost 900%. While some farmers expressed an interest in expanding their livestock holdings, rotational stocking and extensification is not economically feasible in a rural area where land is such a valuable commodity. These explanations point directly to economic and institutional forces as drivers of land-use change, and explain the reason for a shift in land-use and land-cover.

ANALYSIS

What effect do these land-use changes and the decrease in the number of cattle have on the land-cover? Foster (1992) states that, "...forests in New England are extraordinarily resilient...trees tend to dominate most upland sites unless substantial energy is expended to exclude them." Thus, once the land has been cleared, land managers and small holders must employ various technologies and approaches to retard or control vegetation succession in order to keep the land open and prevent reforestation. Niering and Goodwin (1974) describe this process of stabilizing or freezing the landscape in a desired ecological state as "arrested succession." Williams (1994) notes that, "...pasture is the easiest means of keeping the land from reverting to secondary forest." The extent to which livestock act as a tool of arrested succession is highly dependent on stocking rates (the number of animals per unit land) and characteristics of the pasture (Heitschmidt and Smith, 1993). If a pasture is cleared, and subsequently abandoned or the

stocking rate dramatically reduced, then through mechanisms of seed dispersal and vegetation succession, the vegetation cover will change over time. This is the process that led to the widespread reforestation of New England after field abandonment following the Industrial Revolution. This section examines whether the decrease in the number of cattle in New Braintree has led to a reforestation or other land-cover change. In order to answer this question, this study used a digital land-use map from 1971 (Figure 3) and SPOT multi-

spectral satellite imagery from September 1992 (Figure 3) to detect change in New Braintree's land-cover from 1971 to 1992. The study concentrated on the changes in vegetation within areas that were classified as pasture in 1971 in order to focus on the ecological impacts of the decline in the number of cattle in the town. The 1992 land-cover image was georeferenced (spatially corrected) with the land-use image from 1971 (Figure 3) in order to compare changes in land-cover from 1971 to 1992 through a GIS technique known as change detection.

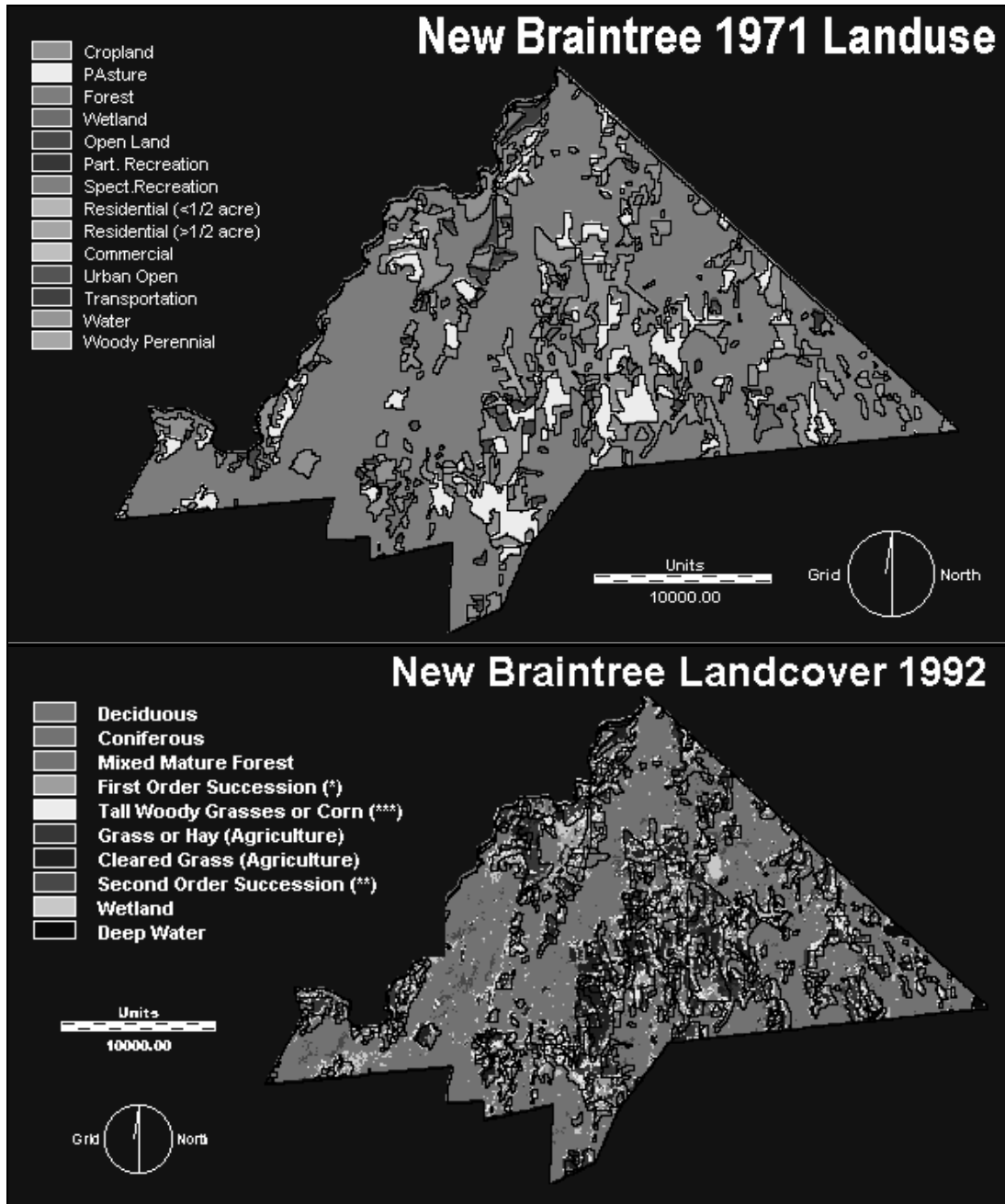


Figure 3. New Braintree Landuse 1971 and Landcover 1992.

RESULTS

The classification and cross-tabulation revealed two main classes of 1992 land-cover within parcels that were labeled as pasture in 1971: (1) open pasture land on which grazing may be possible with minimal labor input, and (2) re-growth on pasture land that would require a considerable labor effort to clear again. The first category (first-order succession) of pasture land was comprised in 1992 of grasses, sedges, shrubs, and unharvested corn that represent: (a) areas where livestock are grazed after harvest, (b) areas that have been converted to use for crops only, or (c) areas that are currently heavily grazed. These 397.14 hectares of land in 1992 were either still under agricultural production including grazing, or in early stages of fallow. The second category (second-order succession) is comprised of two sub-types: second-order succession and forest. Second-order succession is land dominated by 6' tall woody shrubs, young deciduous trees (10-15' tall), and young conifers (3-5' tall). The 13.8 hectares of second-order succession in these pastures represents re-growth after abandonment and non-use as the thick cover of tall woody shrubs prevents grazing. Re-forested pasture areas are comprised of 62.9 hectares of deciduous trees, 40.4 hectares of coniferous and 3.9 hectares of mixed forest. These two land-covers (second-order succession and forest) together comprised 121 hectares in 1992. This second category of land has passed a threshold whereby advanced vegetation growth prevents cattle from grazing, and clearing it for future use may be economically prohibitive. In 1971, according to the digital land-use map from 1971, there were 518.1 hectares of pasture land on 73 separate parcels. In 1992, there were 397.1 hectares of patchy and fragmented land (within the pasture land-use parcels) that had a land-cover on which grazing is still possible. Assuming that the 1971 pastures were open and conducive to grazing, this reflects a loss of approximately 121 hectares to second-order succession and mixed forest. On the other hand, despite the decline in the number of cattle during this period, there were 397.1 hectares of pasture land in 1992 that were kept open and still usable for either grazing or agriculture (Table 1).

Does rural gentrification have an impact on the landscape mosaic in New Braintree? More precisely, does the change in the proximate cause of arrested succession from grazing to haying, induced by rural gentrification, affect land-cover patterns and the ecological matrix? Change detection analysis between 1971 and 1992 reveals that 76% of the land-cover in New Braintree's 1992 pasture parcels was still conducive to grazing despite the drop in the number of cattle. Yet, in order to understand the effect that the change in proximate cause of arrested succession (from grazing to haying) has on the landscape pattern this number must be explicated spatially. Secondary growth in the pastures is spatially heterogeneous and dependent on soil, elevation, aspect, seed bank, and current land-use. For grazing purposes, many fields were historically cleared of forest cover down to riparian areas in order to provide access to water for cattle. Yet today, most haying in New Braintree is practiced with tractor, windrower, and bailer. These machines cannot maneuver on hills with a high degree of slope, or in very wet areas (where the hay is nonetheless non-productive). Therefore, we could expect to find re-growth along riparian areas and on steep slopes. A slope image of New Braintree was derived from a digital elevation model and compared spatially (overlayed) with the 1992 land-covers in order to test whether there is a correlation between slope and land-cover on areas of secondary growth. The results indicate that the average slope on "open" pasture land (cleared lands and first order succession) is 4.3 degrees, while the average slope on "closed" pasture land (secondary growth and forest) is 5.4 degrees (Table 1). Further, the analysis indicates that the average slope on cleared "hayed" fields is 4 degrees, while the average slope on areas of secondary growth is 5.9 degrees. These results would indicate that there is a strong correlation between proximate cause of arrested succession (grazing vs. haying) and pattern of re-growth.

Of "Resilient Farmers," "Country Commuters," and the Gentrification of Rural Landscapes

While Reverend Healy (1902) expressed concern for a declining population in the late nineteenth century, the population of New Braintree

Table 1. Open vs. Closed Pasture Land (hayed/grazed vs. secondary growth)

Classification	Cover Type	Average Slope (degrees)	Total Hectares
"Open" Pasture Land (hayed/grazed field)	Agricultural Fields 1 st Order Succession	4.3	397.1
"Closed" Pasture Land (short/tall forest)	Forest 2 nd Order Succession	5.4	121.0

actually grew steadily from the 1930's to 1990's. From 1980 to 1990 the population jumped from 671 to 891; an increase of 33% (Figure 2). Census data from 1990 reveal that while 573 residents remained in the same residence from 1985 to 1990, there was an influx of 247 new residents to New Braintree (27.7% of the total population in 1990). Of these 247 new residents, 145 came from a metropolitan area (urban or suburban), and 102 moved from a non-metropolitan area other than New Braintree. In 1990, the mean commute time to work was 29 minutes, and only 12.2% of the working residents defined themselves as 'self employed farmers' on 14 farms. The decline in agricultural production and increase in new residents that work outside of New Braintree indicates a shift from rural farming community to suburban community. Suburbanization occurs as employment, mobility and residential opportunities increase for urbanites and suburbanites who opt to live in the "countryside" and work either at home or in the city. Interviews with town residents in 1997 revealed two distinct identities of residents that expressed a vested interest in the landscape; the "resilient farmer" and the "country commuter." Resilient farmers have not given up their farms and still make a majority of their livelihood from agricultural products. These farmers, despite the economic pressure, recall New Braintree's farming identity as a positive force in their connection to place. Their geopiety is linked to the rich history of dairying in New Braintree, the sense of place that this offers and which they stubbornly refuse to lose. These resilient farmers take pride in their livelihood choice, take efforts to relate the hardships involved, and openly embrace the farming identity in defiance of any alternatives. On the other hand, the "country commuters," most of whom have migrated to New Braintree in the 1980's and 1990's, work outside of town in non-farm related employment. Country commuters noted the pastoral setting, country living and rich cultural heritage as the very reasons for moving to New Braintree. Tuan (1979) notes that landscapes are the fusion of both functional and aesthetic perspectives, a blend of foreground and background, ideological and ecological landscapes. Background to the country commuters, a pastoral setting and rural community, is the functional foreground for the resilient farmers. How do these two groups realize and mediate this functional-aesthetic landscape with each other and with the environment?

As noted before, arrested vegetation succession is dependent on a mechanism (proximate cause) to stabilize land-cover in a desired ecological state. When cattle are removed from pastures, and arrested succession is still desired, other means must

be found to stabilize the land-cover. According to the farmers in New Braintree, hay is a lucrative business. In 1996, the price received by farmers for 100 lbs. of un-baled hay exceeded \$4.00 (Knight-Ridder Financial Commodity Research Bureau, 1997). While country commuters do not actively "work" the land, they desire to live in a setting that is open and looks like a pastoral setting. Therefore, the "resilient farmer", "country commuter" and other residents work in conjunction with one another to keep the land clear through a complex network of user/owner relationships over individual land parcels. Many full or part-time farmers either lease or borrow fields to clear the alfalfa or other grasses that grow there for hay. In some instances, the "country commuters," who want to maintain a pastoral setting on their land, pay farmers to cut their hay. The farmer, in turn, is able to sell the cuttings (hay). Both sides see this as a win-win situation. "Outsiders," attracted by the pastoral landscape, actively and excitedly participate as "insiders" to maintain a landscape consistent with the traditional dairy identity. In this case, New Braintree's pastoral landscape, and the meaning associated with it, acts as a contextual link between the past and the future, thus helping to mediate between the ideological and ecological landscapes. A more thorough examination of this process will add to the understanding of changes in the rural countryside as small-holder agriculture declines in the United States and gentrification increases through suburbanization (see Cloke and Little, 1997).

Landscape ecologists (Forman, 1995) discuss landscape as a mosaic consisting of corridors, patches, and background matrix. This model is a useful tool to describe the change in ecological patterns resulting from the shift in land-use in New Braintree's pastures. Interpretation of the 1992 land-cover classification indicates that while "pasture" patches have decreased in overall area by 25%, re-growth within them is greatest on steep slopes and along riparian zones. The shape of pasture patches is highly variable throughout New Braintree, exhibiting both amoeboid and geometric forms. Therefore, the impact that re-growth has on patch shape is contingent on local conditions (slope, proximity to stream, method of cutting hay, etc.), although some general patterns are discernible. Vegetation in riparian areas bordering pasture parcels appear to be advancing both parallel to the stream course and in lobes along areas of high slope where haying is inefficient. These changes result in both an overall increase in stream corridor width and patch edge perimeter, while an overall decrease in patch interior size. These changes impact on the landscape's ecological function as habitat, conduit, filter, source

and sink for species found in Massachusetts central highlands (Forman, 1995). The background matrix, or dominant land-use and land-cover, in New Braintree is a mixed hardwood and softwood forest perforated extensively by agricultural fields of variable shapes, sizes and vegetation covers. This matrix shows minor change in overall ratio between open and closed land from 1971 to 1992. In 1971, 65% of New Braintree was forested, while 32.6% was open land. In 1992, New Braintree was 58.8% forested and 33.7% open land. While patches and corridors changed individually in size, shape, and function, the overall matrix appears relatively stable. This stability is attributed to the contemporary social network in New Braintree, and strong emphasis placed on retaining the existing pastoral landscape aesthetically.

CONCLUSIONS

This paper has explored the way in which landscapes act as the contextual link between the past and the future, and influence the process (through its centrality) by which social relations, meaning and nature interact within their geographic context (Sack, 1997). While “place” has gained agency within the geographic literature in the last few years, the ways in which landscape itself acts as a player in the process of change has rarely been explicated spatially within LUCC studies. This paper has begun to explore this process through examination of (1) the stories and myths associated with landscape and the social processes that perpetuate them, and (2) the residual power of land-cover to resist change due to the effort required to alter production systems. The meanings associated with the landscape by individuals and the community often translate into complex social processes that perpetuate, reinforce, and maintain both social and physical landscapes. All landscapes are a combination, in some proportional manner, of the “functional” and the “aesthetic” and exist along a continuum based on this proportion. Landscapes are indeed social products, the results of multiple actors with multiple perspectives and agendas at *multiple scales*, but also occur within the natural context. Both of these actors, nature, and society have power in influencing each other in a dialectic relationship (Peet and Watts, 1996). Recent work in Political Ecology (Rocheleau et al., 1996) has demonstrated that these actors do not share equal power or influence in constructing their landscapes or accessing resources. This paper demonstrates that landscapes are the products of the mediation between the variables that define this

power relationship; natural processes and social desires, myth and landscape. A more thorough examination of this mediation, the relationship between these variables and the role of the natural context will contribute significantly to our understanding of the abilities of rural communities to retain their identities and livelihoods in the face of exogenous and endogenous pressures to change. The result, in New Braintree, is a complex network of social relationships that function to keep the land clear, thus looking like the pastoral landscape consistent with its’ own traditional dairy identity.

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