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Socio-ecological regime shifts in New England (USA), 1620–2020

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Abstract

Relationships between nature and society are made manifest in the production of landscapes. Consequently, landscape changes indicate changes in the relationships between nature and society. Forged at regional scales over long periods of time, nature/society relationships, like natural and social systems, exhibit periods of equilibrium, stability, and incremental change that eventually give way to new periods of equilibrium, stability, and incremental change in which causal relationships have changed. The paper presents a landscape changebased, grounded theory periodization of the New England (USA) region's Anthropocene history. Its intent is to provide temporal boundaries within which processes, events, records, and artifacts can be examined within shared socio-ecological frames of reference, a first step in the development of new socio-ecologically-based historical narratives. Locating the "inaugural moment" of New England's Anthropocene epoch at the establishment of Plymouth Colony in 1620, the beginning of England's colonialization of this forested North American region, the paper presents and interprets regularity analyses of population density, land-use/land cover, and other data related to landscape shaping processes, identifying socio-ecological regime shifts from the aboriginal Late Woodlands regime to the English Colonial regime and subsequent shifts to the American Industrial regime in 1830 and the American Post-Industrial regime in 1970 along with their nested, subsidiary regimes. Previous periodizations of the region's history are discussed, and a narrative of the region's Anthropocene history is outlined based on the paper's periodization. It is observed that displacements of a socio-ecological regime serve as resources for the next regime, that ghosts of past regimes are present in today's environmental challenges, but that socio-ecological regime shifts are difficult to forecast.

Keywords

Anthropocene, environmental history, historical periodization, landscape change, regularity analysis

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> *Our fathers had plenty of deer and skins, our plains were full of deer, as also our woods, and of turkies, and our coves full of fish and fowl. But these English having gotten our land, they with scythes cut down the grass, and with axes fell the trees; their cows and horses eat the grass, and their hogs spoil our clam banks, and we shall all be starved.*
>
> Miantonomi, 1642 (Gardner, 1833, as cited in Salisbury, 1982: 154)

> [There has been a] *demand from some for a new understanding of history, one fit for purpose in the age we now call the Anthropocene – specifically, one that responds to the identification of humans as geological agents capable of profound and long-term effects on the biosphere and on non-human species*.
>
> Adeline Johns-Putra (2019)

Introduction

Most environmental histories are intended to help readers understand the past in order to support action in the present to change the future (Cronon, 1993). That is true here. No matter how the Anthropocene epoch is interpreted,[1] two things are clear. Anthropocene environments are nature/society hybrids, driven by the dynamic interactions of ecological and social processes, and Anthropocene landscapes are products of their biophysical and cultural pasts. New historiographies are required. Implying a possible Fourth Law of (Human) Geography – *a change in regional landscape dynamics evidences a change in human social dynamics* – this paper presents a historiography of the New England (USA) region (Figure 1) that is consistent with the perspective of historical ecology, that "social and biophysical processes so interweave that they can only be understood together" (Sluyter, 2002: 212). Consequently, histories employing socio-ecological frameworks are required to develop Anthropocene narratives that can be believed and acted upon in the present.

Figure 1. New England (USA).

Addressing climate change and environmental degradation, today's urgent existential crises, requires socio-ecological change (IPCC, 2022), and the socio-ecological frameworks that are fundamental to planning adaptation and mitigation efforts (Chapin et al., 2009) are best constructed with long-term, place-specific knowledge. However, the integration of social and ecological knowledge in American historiography has been problematic, given its over-emphasis on relationships between human actors and its neglect of the dynamics, assemblages, and networks of interacting human and nonhuman actors (Chaplin, 2015; Krauss, 2019). Addressing nature/society holistically (Sauer, 1956; Sluyter, 2005), what follows offers a quantitative, grounded theory-based delineation of the temporal intervals of shared causal relations in New England's Anthropocene history.[2] Identification of these socio-ecological contexts[3] is intended to support the writing of new histories of the region by aligning the causal contexts of such diverse factors as culture, material culture, natural resources, technology, economic organization, and environmental consciousness in multi-disciplinary, cross-disciplinary, and inter-disciplinary research (Stein, 2007; Nastar et al., 2018).

This contextualist approach to historical explanation is founded on four underlying hypotheses: (1) Past events influence events in the present and future; (2) Human action and the environment are co-evolutionary and cannot be separated (Chakrabarty, 2009; McGlade and Garnsey, 2006; Orlove et al., 2022; Sutter, 2013; Worster, 2010;[4] (3) Socio-ecological change is nonlinear (Scheffer, 2009; Sinclair et al., 2018;[5] and (4) Nature/society relationships are made manifest in the making of landscapes (Antrop, 2005; Jackson, 1984; Meinig, 1979; Nazarea, 2003). Consequently, changes in the long-term trends of basic landscape features such as landcover, land-use, and population density mark changes in underlying socio-ecological processes and can reflect otherwise hidden constellations of material, cultural, and political relationships (Hutton, 2017, 2020).

The paper engages four key concepts: (1) The *socio-ecological framework* is a wholistic approach to understanding human/nature relationships, addressing human society and nature as a unity. From a research perspective this is a synthesis of social science and ecology; (2) The *longue durée*[6] (i.e. long-term: centuries, millennia) is the most meaningful timeframe with which to examine and understand the integrated histories of landscape, region, culture, and climate (Braudel, 1995; Costanza et al., 2007; Dearing et al., 2010; Sinclair et al., 2018; (3) *Historical periodization* is critical to our understanding of the past. It compresses chronological time (i.e. natural time) by clustering events into periods of shared causality rather than narrating them as a single linear string of events (Gangatharan, 2008; Koselleck, 1985; [7] and (4) The *socio-ecological regime* embodies the view of history as discontinuous and is the set of relationships between causal social and natural processes in effect during a period of equilibrium, stability, and incremental change (Fischer-Kowalski and Rotmans, 2009; Kull et al., 2018; McGlade and Garnsey, 2006).[8]

Consisting of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, the six northeastern states of the United States, New England is oldest clearly defined region of the United States. New England was first formally recognized in 1620 when an English royal charter for the Plymouth Council for New England, a joint-stock company, was established to colonize and govern the region. Starting at the origin of the region, our subject here is the historical periodization of Anthropocene New England as revealed by landscape change. Jackson (1984: 7) described contemporary landscapes as synthetic, "man-made systems of spaces superimposed on the face of the land." Taking this synthetic view of landscape (Antrop, 2006), like other human artifacts, Anthropocene landscapes reflect and record the impacts of the human and non-human causal factors that have shaped their existence (Antrop, 2005; Krauss, 2019). Recognizing that socio-ecological change is discontinuous and that socio-ecological regime changes are marked by changes in landscape shaping processes, this study's periodization of New England's Anthropocene history is based on the changes in the trends in the region's landscape-related data, changes that

represent boundaries between time periods in which sets of causal factors have been in relatively stable relationship. Importantly, these shared causal contexts are starting points from which to investigate the causal factors themselves. As Cronon (1983), Merchant (1989), Foster et al. (1998), and others, have pointed out, New England and its landscapes are products of its past. Each successive socio-ecological regime developed on a foundation laid by the previous regime. To understand the socio-ecological relationships and processes that drove New England's forest area from 96% in 1620 of landcover to 71% in 1830 to 58% in 1870 to 82% in 2020 is to understand New England's Anthropocene history. To understand what drove New England's farmland area from over fifteen million acres in 1880 to about four million acres in 2020 and drove New England's population density from less than one person per square mile in 1620 to 237 persons per square mile in 2020 is to understand New England's Anthropocene history.

The paper marks "inaugural moment" of New England's Anthropocene epoch at the establishment of Plymouth Colony in 1620, the beginning of England's colonialization of this forested region of North America. From there subsequent points in time are identified that mark fundamental changes in the region's landscape making processes. Regularity analyses of population, land-use/landcover, and other U.S. Census Bureau, U.S. Department of Agriculture, and Harvard Forest (Harvard University) data are presented and interpreted, and a socio-ecological periodization is presented. Previous periodizations of New England history are discussed, and a narrative of New England's Anthropocene history is outlined based on the paper's periodization. The paper concludes with the observation that there are lessons to be learned from narratives of the region's socio-ecological change. The past is prolog. The socio-ecological displacements of one socio-ecological regime serve as resources for the next, the ghosts of past regimes are present in today's environmental challenges, but socio-ecological regime changes are difficult to forecast.

Socio-ecological regime turning points

Long-term changes in the trends of basic socio-ecological characteristics represent socio-ecological regime turning points or shifts, points of inflection between contrasting, persistent states of complex systems (DeYoung et al., 2008; Fitzhugh et al., 2019; Meyfroidt et al., 2018). Although they do not provide explanations or establish causality (Climo and Howells, 1976; Frankel, 1990; Lange, 1992), regularity analyses of time-series data can be used to identify regime turning points, and a range of applications have been developed to detect biological (e.g. ecosystem) and physical (e.g. climate) regime turning points (Andersen et al., 2009; Rodionov, 2005). However, these methods have primarily been applied to large datasets. Given the relatively small quantity of long-term, landscape-related New England data available, the data used in the present study were displayed visually to detect changes in decadal trends, an approach used by Bell (1989) to identify what he interpreted to be the first (1870–1930) and second (1950–1980) periods of New England agricultural decline. Bell used census data on the percentage of land in agriculture (1850–1982) and the ratio of improved to total agricultural land (1850–1920).

In this study, major landscape trend turning points[9] were identified for the region's Southern New England (S-NE) and Northern New England (N-NE) sub-regions as well as the individual states within these sub-regions,[10] using data from U.S. Census, U.S. Department of Agriculture, Harvard Forest and other sources, as follows:[11]

- Population density, 1620–2020
- Rural share of total population, 1790–2010[12]
- Farmland area, 1850–2020
- Forestland area, 1600–2020

- Lumber production, 1870–2020
- Dwellings/Dwelling units, 1850–2010[13]

Findings

Population Density [Figure 2a and b]: Southern New England's population density, less than one person per square mile (~0.4/km^2), increased to 72 persons/m^2. Then, the trend changed as a rapid increase began. This trend continued until population density was about 700 persons/m^2 (~270/km^2), when the increase in population density began to slow. Northern New England's population density, less than one person per square mile (~0.4/km^2), increased to about 25 persons/m^2 (~9.7/km^2). Then, the trend changed as the rate of increase slowed, continuing to 37 persons/m^2. (~14.3 km^2), when the rate of increase accelerated, continuing to 64 persons/m^2 (25/ km^2), when the rate of increase slowed.

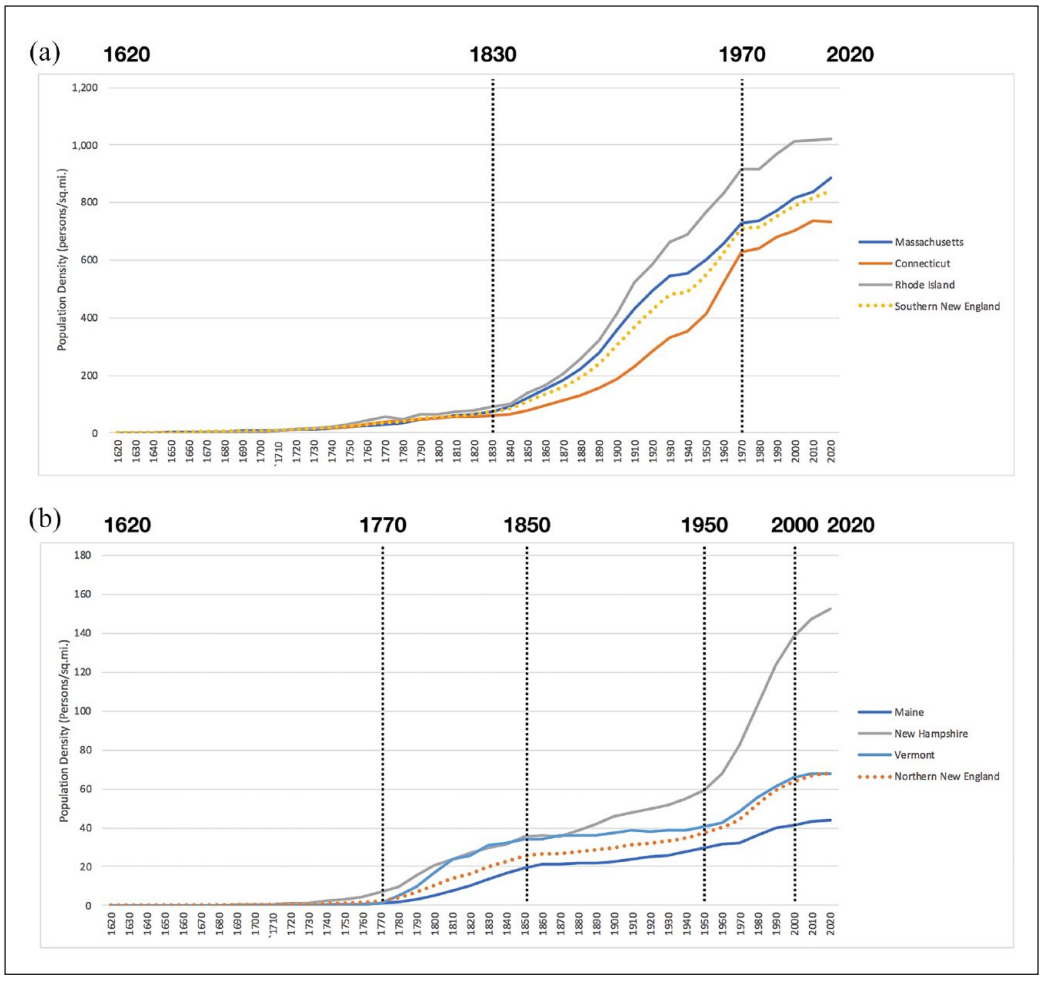

Figure 2. (a) Population density: Southern New England. (b) Population density: Northern New England.

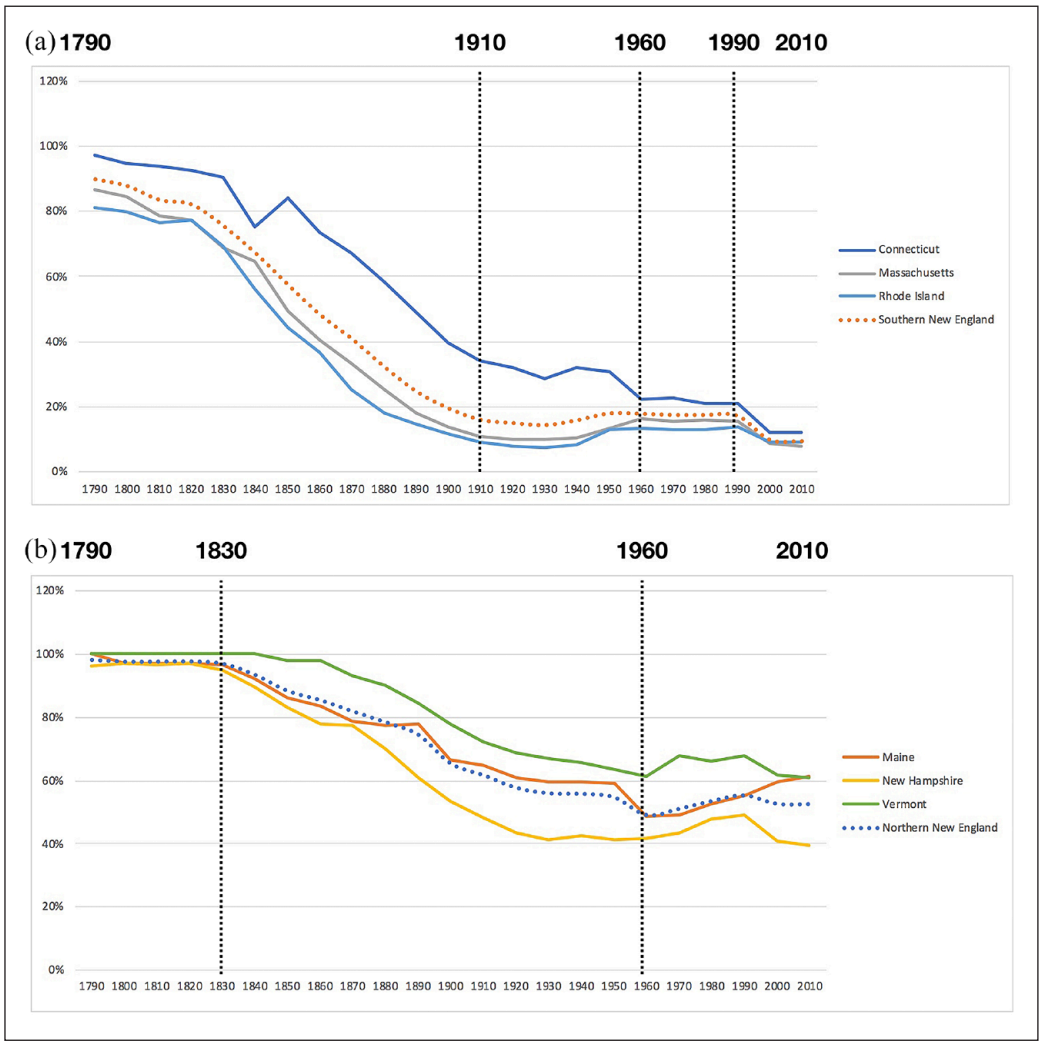

Figure 3. (a) Rural population share: Southern New England. (b) Rural population share: Northern New England.

Rural Population Share [Figure 3a and b]: Southern New England's rural population share, about 90% (1790) decreased to about 16% (1910), when it stopped decreasing and was relatively steady until about 17% (1990), when it began to decrease again. Northern New England's rural population share, about 98% (1790) decreased steadily to about 49% (1960), when it stopped decreasing.

Farmland Area [Figure 4a and b]: Southern New England's farmland area, about 6.2 million acres (1880) decreased about 80% to about 1.3 million acres (1970), when it stopped decreasing. Northern New England's farmland area, about 12.2 million acres (1850) increased about 26% to 15.4 million acres (1880) and held relatively steady at about 14.8 million acres (1900) when it began decreasing about 71% to about 4.3 million acres (1970), when it stopped decreasing.

Forestland Area [Figure 5a and b]: Southern New England's forestland area, about 8.2 MM acres (1600) decreased to about 2.8 MM acres (1870), when it began to increase, increasing to

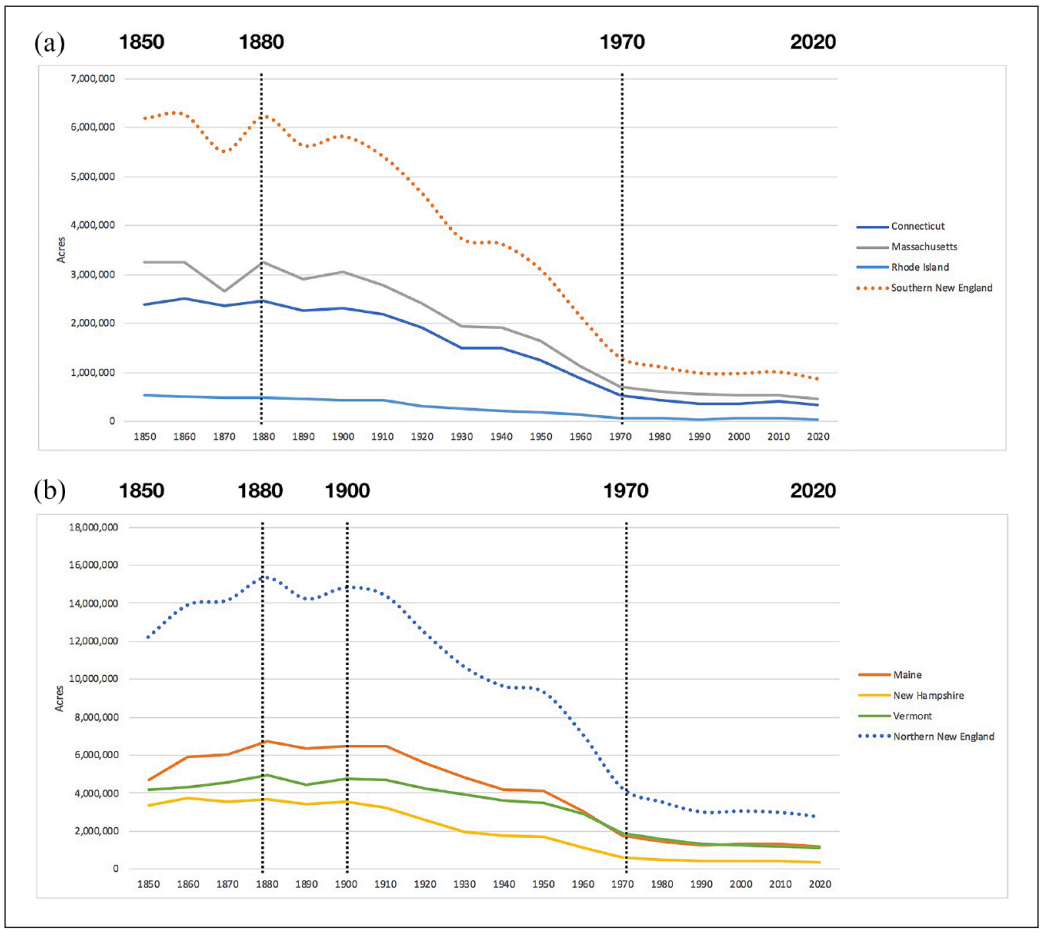

Figure 4. (a) Farmland area: Southern New England. (b) Farmland area: Northern New England.

about 6.1 MM acres (1970), when it began to slowly decrease. Northern New England's forestland area, about 30.4 MM acres (1600) decreased to about 20.1 MM acres (1880), when it began to increase, increasing to about 27.3 MM acres (1970), when it stopped increasing.

Lumber Production [Figure 6a and b]: Southern New England's lumber production, about 266 MM board feet (1870), increased to about 471 MM board feet (1900) and then decreased to about 88 MM board feet (1940), increased slightly to about 162 MM board feet (1990), and then decreased slightly. Northern New England's lumber production, about 1135 MM board feet (1870), increased to about 1733 MM board feet (1900), decreased to about 498 MM board feet (1930), increased slightly to about 640 MM board feet (1970), increased to about 1227 MM board feet (1990), and then, decreased slightly.

Dwellings/Dwelling Units [Figure 7a and b]: Southern New England's dwellings, about 0.2 MM dwellings (1850), increased to about 1.1 MM dwellings (1930) and then began to rapidly increase to about 4.8 MM dwelling units (2010). Northern New England's dwellings, about 0.2 MM dwellings (1850), increased to about 0.4 MM dwellings (1930) and then began to rapidly increase to about 1.7 MM dwelling units (2010).

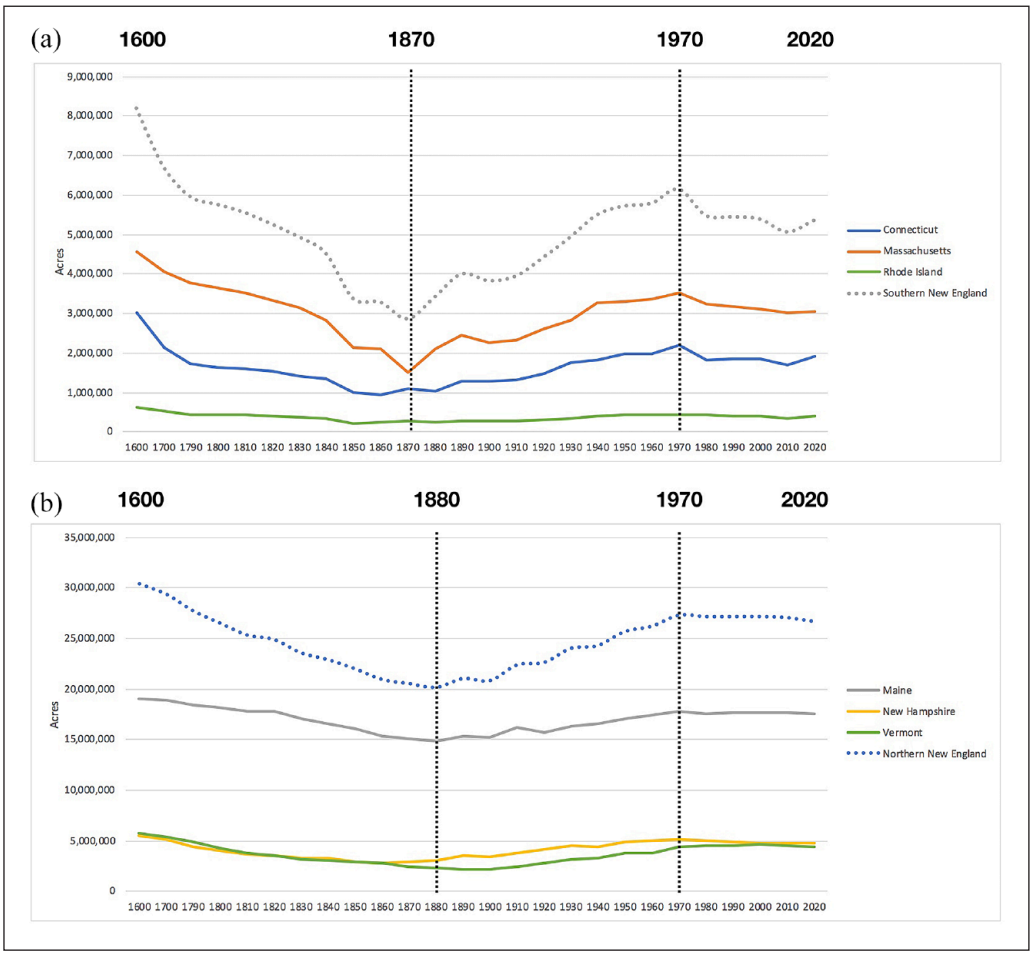

Figure 5. (a) Forestland area: Southern New England. (b) Forestland area: Northern New England.

Trend Turning Points [Figure 8a and b]: Trend turning points are indicated by ↑, ↓, and → symbols, indicating increasing, decreasing, and flattening (i.e. the direction of the trend moderates sharply without necessarily changing direction) trend changes. The darker gray bars in these figures indicated trend changes of multiple data series. The lighter gray bars indicate a trend change of a single data series. In Southern New England farmland area and forestland area trend turning points clustered (1870/1880), rural population share and lumber production clustered (1900/1910), lumber production and dwellings/dwelling units clustered (1930/1940), rural population share, population density, farmland area, and forestland area clustered (1960/1970), rural population share and lumber production clustered (1990), and a there was a population density trend turning point (1830). In Northern New England farmland area and forestland area trend turning points clustered (1880), farmland area and lumber production clustered (1900), lumber production and dwellings clustered (1930), population density, rural population share, farmland area, forestland area, and lumber production clustered (1950/1960/1970), and lumber production and population density clustered (1990/2000). There were individual trend turning points, population density (1770), rural population share (1830), and population density (1850). Trend turning points occurred

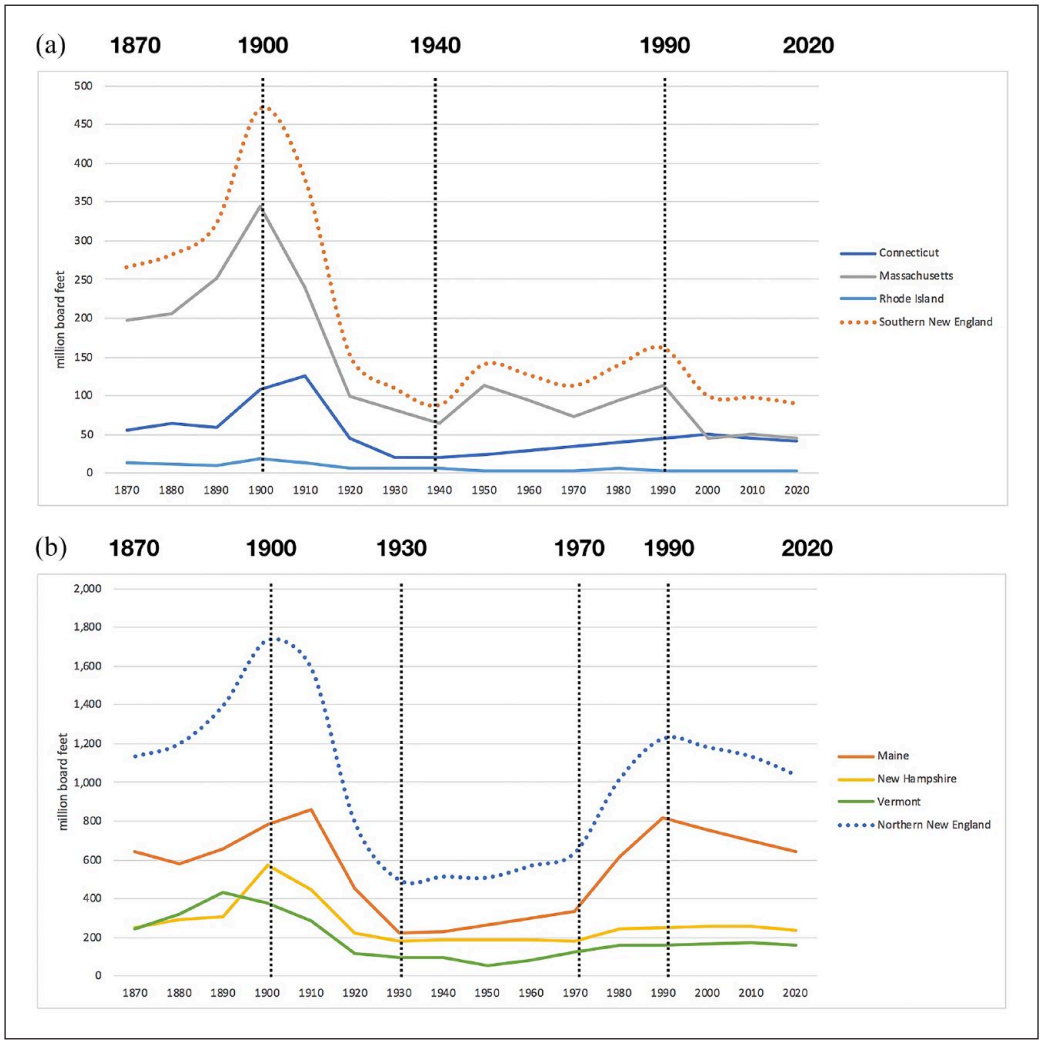

Figure 6. (a) Lumber production: Southern New England. (b) Lumber production: Northern New England.

in both Southern New England and Northern New England in 1830, 1880, 1900, 1930, 1960, 1970, and 1990.

Interpretation

Shifts in decadal landscape trends mark changes in the underlying, interrelated socio-ecological processes and relationships that, taken together, made up a socio-ecological regime. These shifts are either regime changes, indicating the beginning of a new socio-ecological regime, or nested, subsidiary regime changes, indicating change within an established regime. Importantly, causal relationships change from one regime to the next. Distinguishing between regime changes and subsidiary regime changes is a matter of interpretation. As yet, there is no theory regarding either

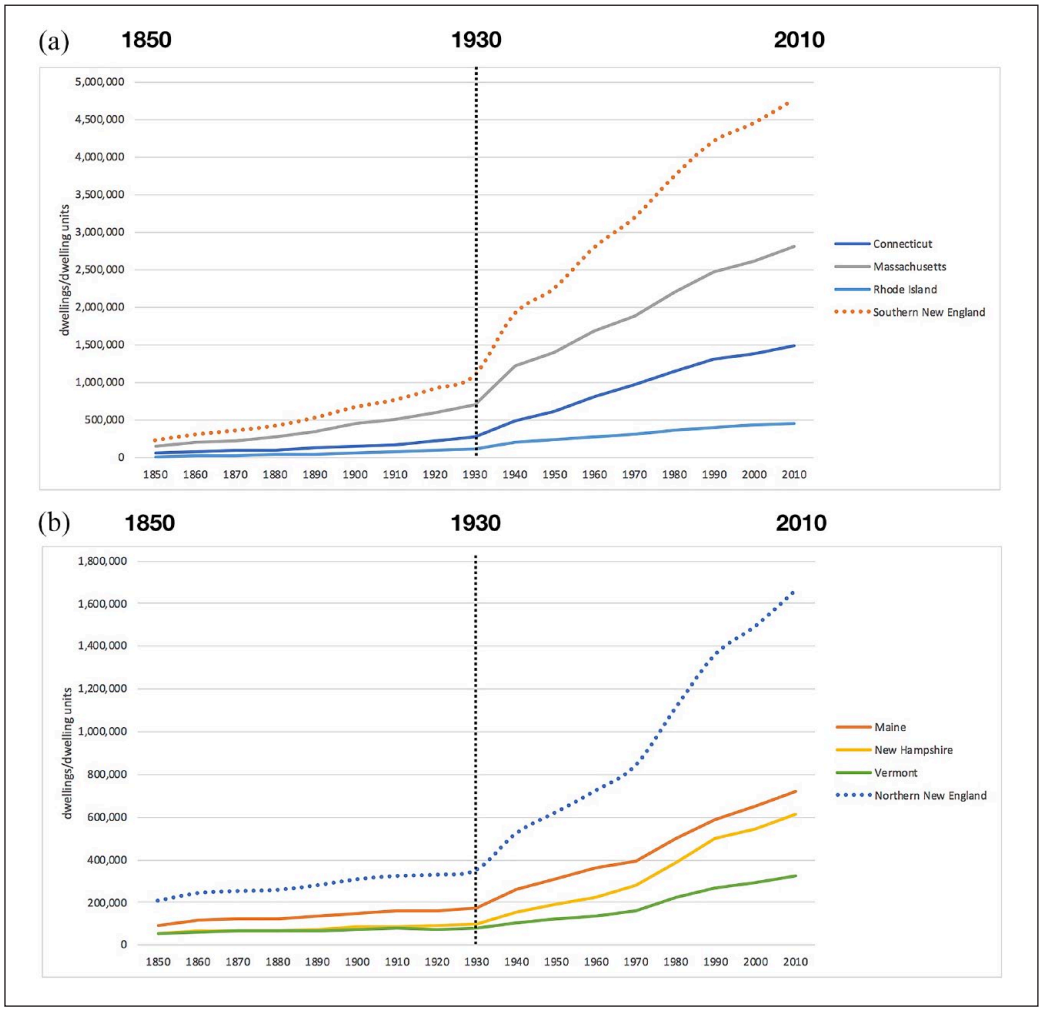

Figure 7. (a) Dwellings/Dwelling units: Southern New England. (b) Dwellings/Dwelling units: Northern New England.

the magnitude of these trend changes nor the relationships between the individual landscape-related statistics that can be applied here. Our interpretation of the structure of the landscape data trend changes, based on visual analysis of Figure 8a and b, is presented in Table 1.

New England's Anthropocene epoch began in 1620 when the Plymouth Colony was established by English settlers. This marked the end of the *Late Woodlands* socio-ecological regime and the beginning of a *English Colonial* socio-ecological regime . A secondary colonial regime shift occurred in about 1770.

The shift from the English Colonial to the *American Industrial* socio-ecological regime (1830–1970) occurred in about 1830. Secondary regime shifts occurred in about 1870/1880, in about 1930/1940, and in about 1950/1960. Tertiary regime shifts occurred in about 1850, and in about 1900/1910.

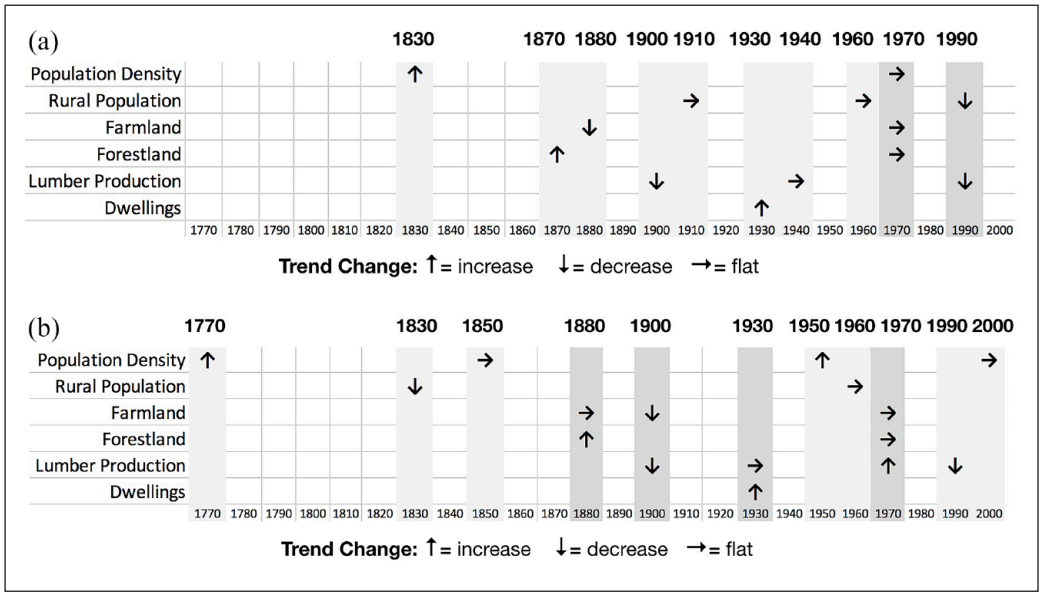

Figure 8. (a) Trend turning points: Southern New England. (b) Trend turning points: Northern New England.

Table 1. Anthropocene New England landscape periodization and associated trend changes.

1. ENGLISH COLONIAL REGIME (1620–1830)
1.1. 1620–1770: Increasing pop. density, farmland, lumber, dwellings; Decreasing rural pop. share, forestland
1.2. 1770–1830: Higher rate of pop. density increase N-NE
2. AMERICAN INDUSTRIAL REGIME (1830–1970)
2.1. 1830–1870/1880: Higher rates of pop. density increase S-NE and rural pop. share decline N-NE
2.1.1. 1850–1870/1880: Lower rate of Pop. density increase N-NE
2.2. 1870/1880–1930/1940: Begin farmland decline and forestland increase
2.2.1. 1900/1910–1930/1940: Declining lumber production; End rural pop. share decline S-NE
2.3. 1930/1940–1950/1960: Higher rate of dwelling unit increase; End lumber production decline
2.4. 1950/1960–1970: End rural pop. share decline; Higher rate of pop. density increase N-NE
3. AMERICAN POST-INDUSTRIAL REGIME (1970–present)
3.1. 1970-present: End farmland decline/forestland increase; Lower rate of pop. density increase S-NE; Higher rate of lumber production N-NE
3.1.1. 1990/2000-present: Lower rate of lumber production; Declining rural pop. share S-NE; Lower rate of pop. density increase N-NE

The shift from the American Industrial to the *American Post-Industrial* socio-ecological regime (1970-present) occurred in about 1970. A tertiary regime shift occurred in about 1990/2000.

Previous periodizations

The historian arranges elements of the historical field into either a natural or historical time chronicle in order to form a coherent historical presentation. Chronicles based on periodizations of

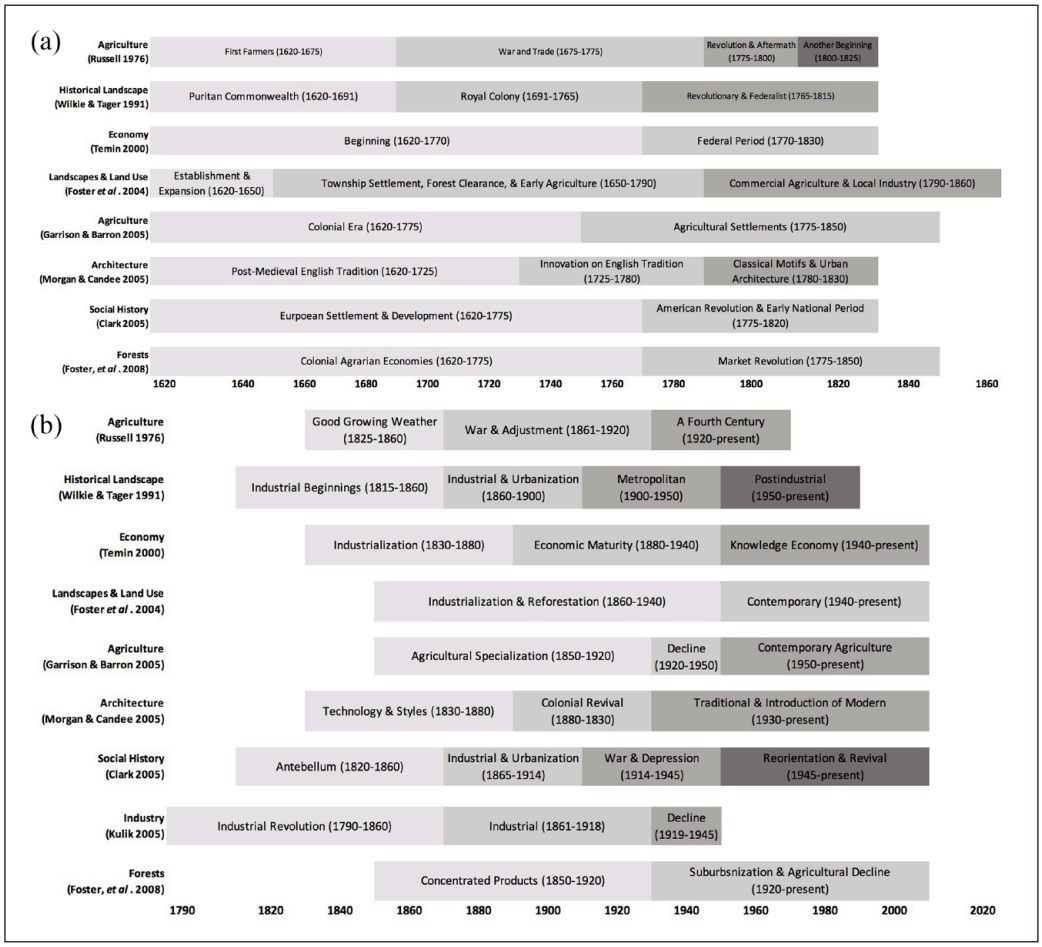

Figure 9. (a) Periodizations of New England's colonial era. (b) Periodizations of New England's industrial and post-industrial (to present) eras.

historical time are illuminating because they are based on analyses or perceptions of linked causal processes (e.g. nature, society), problem solutions (e.g. society), and/or evolution (e.g. nature). While there are no previous periodizations of New England's socio-ecological history, there have been natural[14] and historical time periodizations. Previous historical time periodizations of New England history from the beginning of the Anthropocene epoch to the present are presented in Figure 9a and b. Keeping in mind that the present study's periodization is based on landscape change and that the cited periodizations are based on a variety of other perspectives (i.e. social history, agriculture, landscapes and land-use, forests, industry, and architecture), the question is, how well do these previous periodizations align with the landscape-based periodization presented in Table 1? An alignment is expected, given that, in theory, the various individual perspectives exist within the socio-ecological regime framework.

First, it seems fair to say that, in general, the periodizations presented in Figure 9 align reasonably well with the periodization presented in Table 1. However, there is a case to be made for an additional subsidiary English colonial regime in the late 17th Century.[15] Several previous

periodizations have periods beginning in the early 1600s and ending in the mid to late 1600s or early 1700s. Most have periods beginning in the late 1700s. Although Merchant (1989) did not explicitly subdivide the colonial period, she recognized two important changes within the colonial period, the downfall of New England's Indian subsistence systems by the end of the 17th Century and a period of agricultural intensification and specialization for regional, national, and international markets beginning in about 1790. Wilkie and Tager's (1991) periodization of the historical landscape, the Foster et al. (2004) periodization of landscapes and land use, Garrison and Barron's (2005) periodization of agriculture, and the Foster et al. (2008) periodization of forests are quite close to the periodization presented in Table 1 once a secondary regime shift in the late 17th Century is included.

It also seems fair to say that the periodizations cited in Figure 9 are also fairly consistent with the present study's interpretation, if the end of the industrial regime and the developments of the post-industrial regime are ignored. Most have final periods that end in a present consistent with their dates of publication without reference to a post-industrial period, suggesting an inability or reluctance to address the post-industrial period during its early stages. These studies date the commencement of the industrial era from 1790 (Kulik, 2005) to 1865 (Clark, 2005) with a median date of 1830 (Temin, 2000), the date posited by the present study. There is less agreement on the ending date for the industrial period. It is worth noting that periodizations of agriculture (Garrison and Barron, 2005; Russell, 1976), Architecture (Morgan and Candee, 2005), and forests (Foster et al., 2008) are partially aligned with the subsidiary industrial socio-ecological regimes of the present study.

New England's Anthropocene history

Having presented a periodization of New England's Anthropocene socio-ecological history based on data related to landscape shaping processes (Table 1) and compared this periodization to other periodizations of the region's history (Figure 9a and b), the final task is to outline a narrative of the region's history based on the socio-ecological periodization. Based on Tables 1 and 2 presents an interpretation of New England's Anthropocene, socio-ecological regimes and subsidiary regimes. The *agricultural production for local use (1690–1770)* subsidiary regime was added based on other evidence (Merchant, 1989; Russell, 1976; Salisbury, 1982; Thomas, 1976).

Although preceded by European trading posts, New England's Anthropocene epoch's "inaugural moment" came in 1620 with England's establishment of Plymouth Colony. This "European invasion rejoined two ecosystems that had for the most part been diverging since the Pangean supercontinent fragmented some 200 million years previous" (Sluyter, 2002: 3). Preadapted to temperate zone environments, Europeans, their crops, and their livestock permanently shifted the ecological trajectories of New England (Crosby, 1986), as aboriginal lands were expropriated for use by English settlers (Salisbury, 1982). This settler colonial process "simultaneously transformed landscapes and obscured that transformation" (Sluyter, 2002: 230) by establishing legal and landownership structures to support the settlers' vision and the power relationships necessary to support that vision (Erickson, 2020; Wolfe, 1999). Indigenous historical material was destroyed, suppressed, looted, and ignored, as the surviving indigenous peoples were relegated to a racialized subaltern status (Chibber, 2014; Sharp, 2009). Not so coincidentally, the beginning of New England's *English Colonial* regime marks the beginning of the vast preponderance of the data and narrative literature related to the history of the region (O'Brien, 2010).

There is a strong argument for the global Anthropocene epoch having been initiated as a direct result of the expropriation of indigenous wealth by Europeans in the Americas. The establishment of settler states and the expropriation of indigenous wealth made the shifts of proto-capitalist European economies to capitalist economies possible and drove subsequent global economic,

Table 2. New England's Anthropocene, socio-ecological regimes.

1.	**ENGLISH COLONIAL REGIME** (1620–1830)
1.1.	Conflicting Indian & colonial subsistence systems (1620–1690)
1.2.	Agricultural production for local use (1690–1770)
1.3.	Agricultural production for markets (1770–1830)
2.	**AMERICAN INDUSTRIAL REGIME** (1830–1970)
2.1.	Expansion of industrial production (1830–1870/1880)
2.1.1.	Migration and Civil War (1850–1870/1880)
2.2.	Agricultural decline and continuing industrial expansion (1870/1880–1930/1940)
2.2.1.	Depleted forest resources & environmental action (1900–1930/1940)
2.3.	Depression, WWII, & post-war (1930/1940–1950/1960)
2.4.	Return to non-crisis conditions (1950/1960–1970)
3.	**AMERICAN POST-INDUSTRIAL REGIME** (1970-present)
3.1.	Information technologies & intensified environmental action (1970-present)
3.1.1.	Impacts of distributed information technologies & globalization (1990-present)

social, and ecological developments (Blaut, 1993; Sluyter, 2002). With each socio-ecological regime built on a foundation of the preceding regime, New England, in many respects, continues to function through a settler state structure today, with underlying frameworks reflecting power relationships hidden in plain sight. One needs only to examine the region's Black and Brown ghetto/reservations and environmental justice issues to see this in stark relief.

There is also a strong argument for the exploitation of energy resources as central to New England's Anthropocene development. Although not the driver, energy resources have shaped New England's development (Penna, 2020; Turnbull, 2021). The colonization of the lands of Algonquin-speaking peoples was made possible in part by the settlers' greater access to energy in the form of animal power and fuelwood. Subsequently, landscapes were remade to harness waterpower, remade again by fossil fuels, and are being remade again today to harness renewable energy sources.

English colonial regime (1620–1830)

Conflicting Native American and European subsistence systems, 1620–1690. With the establishment of Plymouth Colony in 1620, the *English Colonial* socio-ecological regime began to replace the *Late Woodlands* regime. English settlers successfully introduced a European ecological complex of animals, plants, and pathogens and an extractive approach to natural resources. Natural resource exploitation increased significantly. Population density, farmland, and lumber and dwelling production began to increase and rural population share and forestland began to decrease. New England's Anthropocene epoch had begun.

The settlement of the lands of the Abenakis, Mahican, Massachusett, Mohegan-Pequot, Narragansett, Nauset, Nipmuck-Pocumyuc, Passamaquoddy, Pennacook Confederacy, Pawtucket Pokanoket-Wampanoag, Wappinger Confederacy, and other Algonquin speaking peoples by English settlers had begun (Cook, 1976; Cronon, 1983; Delcourt and Delcourt, 2004; Wilkie and Tager, 1991). Although indigenous and colonizer societies both ran on organic energy, horses and oxen substantially increased the amount of mechanical energy available to the colonizers, and European metalworking technology in the form of axes and saws substantially increased the availability of wood, which would become the universal material of New England life, providing both energy and building materials (Hindle, 1981; Penna, 2020).

It has been estimated that there were about 150,000 Algonquin-speaking peoples in the region (Salisbury, 1982) before the Columbian Exchange (Crosby, 1972) and about half that in 1620 (Cook, 1976). Contrary to the myth of pre-European American emptiness or wilderness, native peoples modified and made productive use of their landscapes. The Algonquin speaking peoples' subsistence-oriented systems of production, horticulture, hunting, and gathering evolved in symbiosis with local ecologies. These productive precolonial landscapes disappeared, as diseases transmitted by early European visitors decimated the indigenous population, desettling native landscapes, which would ultimately be appropriated, remade, and reconceptualized by Europeans as forestland was cleared for farms (Carroll, 1973; Sluyter, 2002). Through "the application of property law, the settlers rapidly reconceptualized native spaces into parcels of private property" (Sluyter, 2002: 18).

Trade between the Plymouth Colony and Europe, soon to be replicated by other newly established English settlements in the region, brought the first truly global trade and an extractive approach to the region's natural resources, as mercantile capitalism used European capital to extract colonial resources, shipping them to England for processing. New England's first sawmill was established at York, Maine in 1623 (Defebaugh, 1907), introducing the first industrial production techniques to the region. Trade in timber flourished in response to the depletion of Europe's timber resources. "In a remarkably short period, much of the region was transformed from extensively forested to agrarian open and [landscapes], with interspersed and cut-over woodlands" (Foster et al., 2004: 72).

"A colonial ecological revolution, occurred. . . It resulted in the collapse of indigenous Indian ecologies and the incorporation of a European ecological complex of animals, plants, pathogens, and people. The colonial revolution extracted native species from their ecological contexts and shipped them overseas as commodities" (Merchant, 1989: 2), enabled by the massive genocide of indigenous populations (Yusoff, 2018). Surviving indigenous peoples were forced from their lands onto reservations. They were also indentured and enslaved. some captured during conflicts, especially King Philip's War, others kidnaped, or condemned through local settler court action. Many were sent to slave markets in the Caribbean (Newell, 2015; Salisbury, 1982).

Landscape dynamics changed. In coastal areas and in the Connecticut River valley systems of production were oriented toward both subsistence and mercantile trade. The native peoples adopted some settler techniques, and the settlers adopted some native techniques. However, colonial production altered the local ecology, undermining indigenous production, which created conflicts. These conflicts came to a head with King Philip's War (1675–1676) after which settler hegemony was firmly established. The surviving bands of Pequot, Massachusett, and other peoples located near concentrations of English settlers were confined to reservations. Groups that were able to retain land did so under English protection (Merchant, 1989; Salisbury, 1982).

Agricultural production for local use (1690–1770). Development continued along its now established trajectory (i.e. continued increasing population density, farmland, lumber and dwelling production and continued decreasing rural population share and forestland), as the establishment of English hegemony brought increased settlement especially of inland-upland areas. The majority of settlers employed an agroecological system that was a synthesis of Native American and medieval European techniques for subsistence and local use (Merchant, 1989).

After the revocation of the Royal African Company's slave trading monopoly in 1696, it became possible for all Englishmen to legally participate in the slave trade. With the economic returns from agriculture limited, by 1700 traders in Boston were supplying other colonies with African slaves, laying the foundations for New England's participation the lucrative triangular New England/

Africa/West Indies trading system, the "largest human population replacement in the past 13,000 years" (Lewis and Maslin, 2015: 174).

Agricultural production for markets (1770–1830). Development continued along the established trajectory (i.e. continued increasing population density, farmland, lumber and dwelling production and decreasing rural population share and forestland). However, enabled by improved transportation infrastructure, the shift from a subsistence oriented "extensive system" to a market oriented "intensive system" of land use in Southern New England brought higher land prices there, triggering a higher rate of increasing population density in Northern New England. Agricultural exports began in areas with access to seaports, and produce flowed to merchants in Boston, Salem, Newport, New London, and New Haven (Russell, 1976). This new wealth brought the Federal Period in architecture and other material culture (Morgan and Candee, 2005). Southern New England's agricultural surplus, lumber and wood products, fish, and manufactures, especially rum, were traded for sugar and molasses in the West Indies, for manufactured goods in Europe, and for slaves in West Africa. The West African slaves were traded in the West Indies for sugar and molasses. The sugar and molasses sold to distilleries in New England, and the rum it produced established many New England fortunes (Carroll, 1973; Greene, 1942). This slavery-based Atlantic economic system also drove the development of New England's shipbuilding industry (Bailyn, 2000). Liquor became New England' largest industry with nearly all of the exports of rum going to Africa to be exchanged for slaves (McCusker and Menard, 1985). "New England commerce was bound to a West Indies economy dependent on slavery and the slave trade" (Bailey, 1990: 384), and it provided the initial capital for the development of New England's cotton textile industry.

American industrial regime (1830–1970)

Expansion of industrial production (1830–1870/1880). The rate of population density increase accelerated in Southern New England and rural population share began to decline in Northern New England. In 1830 most New Englanders lived on farms. By 1880 most lived in cities. Although industrial methods and water power with its infrastructure of dams, canals, raceways, and millponds began earlier and then expanded, stimulated by the War of 1812 (Wilkie and Tager, 1991), by 1830 centralized mechanized production of textiles with large-scale, landscape reordering, water power infrastructures had proven profitable and with it the drive for economies of scale. Initially, industrial production was limited to rural waterfall sites, and mill towns were superimposed on the rural landscape. Negative changes in the agricultural economy incentivized farm families to work as artisans and mechanics, to seek outside employment in addition to their agricultural activities, and to migrate to industrial jobs in Southern New England. Steam power enabled industrial expansion in urban areas with access to anthracite coal, first through water and then through rail transportation (Pred, 1966).

Migration and Civil War (1850–1870/1880). While the rates of population density increase in Southern New England and rural population share decline in Northern New England continued, the rate of population density increase declined in Northern New England. The national railroad network expanded dramatically facilitating both access to more productive farmland in the West and access for Western agricultural and forest products to Eastern markets. By 1850 New England had lost most of its locational advantage, its seaports having lost trade to ports with better rail connections (Eisenmenger, 1967). Forest resources had become depleted, and the region was 58% forested by 1870. The economy of Northern New England deteriorated. Lumber production, personnel, and technology began to shift from New England to the Great Lakes States, and the amount of

lumber used in New England exceeded the amount harvested there (Judd, 1984). This reduction in lumber production began a change in the relationship between lumber and housing production, a material disconnect between New England's dwellings and its landscapes. By the 1880s coal had surpassed wood as the major source of energy. Although the cotton-textile industry suffered during the Civil War, manufacturing, especially of arms and munitions, expanded in Southern New England attracting workers from Northern New England.

Agricultural decline and continuing industrial expansion (1870/1880–1930/1940). As agricultural production intensified with mechanization, farms less well suited to mechanization became uneconomic, and farmland and forestland acreage reversed course as farmland began declining and the amount of forestland began to increase. New environmental conservation organizations were founded, new conservation legislation enacted at the state and federal levels, and new conservation reserves established. Manufacturing continued to expand with coal-fired steam power permitting industrial growth in areas without the potential for water power. For the most part this represented urban expansion, as urban growth and industrial growth came into closer association, enabled by an expanded railroad infrastructure, the replacement of wood energy by coal, and immigration of low-wage workers from Europe. Long-established industries declined following WWI as textile manufacturing, in particular, moved south to take advantage of lower wages and reduced regulation (Eisenmenger, 1967; Temin, 2000; Wilkie and Tager, 1991).

Depleted forest resources & environmental action (1900/1910–1930/1940). With the depletion of forest resources and the impacts of forest conservation policies, lumber production reversed course and began a sharp decline, and rural population share in Southern New England stabilized ending a long period of decline, as this subregion lost its advantage in manufacturing, reducing the need for industrial workers. With the curtailing of immigration after 1920, New England manufacturers' also lost their traditional access to low-cost unskilled labor (Eisenmenger, 1967), and urban growth slowed.

Depression, WWII, & post-war (1930/1940–1950/1960). The rate of dwellings/dwelling unit production increased, and, after several decades of sharp decline, lumber production stabilized, as the effects of the Great Depression, World War II and its aftermath impacted New England landscapes. Housing production was stimulated by the New Deal's response to the Great Depression's financial crisis, federal policies to house war production workers, and the GI Bill (Chambers et al., 2013; Fishback, 2017; Fishback and Wallis, 2012; Taylor, 2004). Lumber production was stimulated by housing and war production. Except for the period of World War II and the shift to wartime production, the regional economy continued to decline from the 1930s to the 1970s, as manufacturing firms exited the region (Bluestone and Harrison, 1982; Harrison and Kluver, 1989; Koistinen, 2014).

Return to non-crisis conditions (1950/1960–1970). With the return to non-crisis conditions and the end of wartime industrial production, rural population share stabilized ending a long period of decline. The rate of population density increase accelerated in Northern New England, driven by the greater accessibility provided by the regional completion of the interstate highway system. The recreation-tourist industry in Northern New England expanded, as did the market for second homes and the enrollments in educational institutions. Manufacturing expanded in Northern New England as firms from Southern New England sought lower wage workers (Lewis, 1972). Although the regional economy continued to decline, New England continued to be a competitive location for high-value specialized manufacturing requiring skilled workers, especially precision metalworking, high technology products based on WWII production, and industrial and technical paper (Eisenmenger, 1967).

American post-industrial regime (1970-present)

Information technologies & intensified environmental action (1970–present). The region's advantage in the development of new technology, derived from its universities' wartime research and experience in deploying knowledge industry workers, brought an end to the region's economic decline and the beginning of its *American Post-Industrial* socio-ecological regime (Browne and Sass, 2000; Krugman, 2000; Kulik, 2005). Representing an information-based, post-Fordist industrial revolution, this new, knowledge-based economy and its dramatically reduced information costs drove a shift to a service economy and significantly increased the potential of flexible manufacturing technology to achieve economies of scope. Production costs, the organization of work, and production geographies began changing as information technology increasingly dispersed, from mainframe to mini to personal computing and then through the internet and smartphones. Importantly, the cost to produce the first unit of a product (i.e. realizing the conception) now far exceeded the costs of subsequent production (i.e. reproduction). Organizational hierarchies flattened and managers were elevated out of the wage-earning class to be aligned with the interests of shareholders (Cohen, 2009). Supply chains began to globalize. Ex-urban and growth in the urban core was stimulated. Abandoned industrial sites brought heightened economic and environmental concerns. Greater awareness of climate change and the need for environmental sustainability shifted planning efforts across all of the sectors of society, and energy consumption per capita began to decrease (Wilkie and Tager, 1991). Advocates of environmental sustainability primarily focused on newer ecological and energy technologies, but there has also been a focus on self-sufficiency and the use of local natural resources through the preservation and/or the reintroduction of historic crafts and other practices from earlier periods, including farming, timber-frame construction, wood heating, and hand sewing (Williams, 2011). Heightened environmental concerns have also stimulated the revitalization local food production, and food supply chains have been reorganizing toward niche agriculture (Carroll, 2008). There has been new interest in Indigenous ecologies. The region's deep cultural history has been retrieved, as cultural performances of all kinds became an essential part of the process of branding and promoting postindustrial places (Stanton, 2007). Mixed use zoning facilitated the adaptive reuse of obsolete, typically textile-related, industrial buildings, which were retasked for high technology, culture, and housing (Hastings and Trumbull, 2011; Mullin et al., 1986; O'Donnell, 1995; Tager and Wilkie, 1991).

After many years of trending upward, the amount of forestland stabilized. Similarly, after trending downward for many years, the amount of farmland stabilized. While there has been forestland lost since 1985, mostly to low-density suburban development (Ducey et al., 2016; Olofsson et al., 2016; Thompson et al., 2017), this has not been enough to signal a reversal to a downward trend. The rate of population density increase in Southern New England slowed. After being relatively stable for 40 years, lumber production in Northern New England began to increase as previously cutover forests began to mature.

Impacts of distributed information technologies & globalization (1990-present). Facilitated by information technologies that support remote work, the decline of rural population share in Southern New England represents expansion at the urban fringe rather than rural population loss (Lokocz et al., 2011; Thompson et al., 2017). However, as dwelling units continued an upward trend, lumber production in Southern New England began to trend downward. This decline in lumber production appears to have been driven by globalization and the procurement of timber from sources with less environmental regulation than New England (Berlik et al., 2002). As a result of intensified environmental concerns, land conservation efforts intensified. The adaptive reuse concept has been extended to the region's housing stock, as the demand for new and upgraded housing has

increasingly been met by recycling obsolete existing structures and building materials. The increase in dwelling units has primarily been driven by demography (e.g. population increase, smaller family size) and the demand second homes in rural areas with natural and recreational amenities (Ducey et al., 2016; Johnson, 2012). After trending upward for 50 years, population density in Northern New England began to stabilize. The other landscape-related statistics also continued their sideways trends. All of the trends were impacted by slowed economic growth due to the globalization of supply chains and the Great Recession of 2008 (Johnson, 2012).

The Harvard Forest led, *New England Landscape Futures* project (Lambert et al., 2018; McBride et al., 2017; Thompson et al., 2020) modeled possible landscape futures to the year 2060 based on four generic, stakeholder-shaped scenarios with a fifth scenario based on the continuation of existing landuse/landcover trends observed between 1990 and 2010. Under this continuation of exiting trends scenario the loss of forestland continued, although not by enough to reverse the current sideways trend. There was little change in the amount of farmland, although there was a 37% increase in developed land. The rate of land protection far exceeded the rate of development. None of stakeholder-shaped scenarios exhibited new socio-ecological dynamics at play. Consequently, these scenarios exhibited no landscape trend reversals. However, they did exhibit significant differences in landscape qualities and the spatial allocation of landscape features. For example, there was a fivefold difference in the amount of high-density development, a twofold difference in the amount of protected land, and differences in the amount of farmland, population increase, and urban sprawl. The Harvard Forest has also produced a long-term vision for the regional future in which conservation efforts result in the retention of 70% of the landscape in forest, a three-fold increase in conserved land (Foster et al., 2010).

Conclusion

The historical periodization presented here was developed to provide a temporal framework for future, more detailed, explorations of Anthropocene New England's socio-ecological past. No matter how the individual socio-ecological regimes and subsidiary regimes presented here are labeled or described, they provide temporal boundaries within which processes, events, records, and artifacts can be examined within their common causal frames socio-ecological of reference. The fact that these boundaries were identified through analysis of data related to landscape making processes offers strong foundational validity for historical narratives employing the framework. Whether the concept of a Fourth Law of (Human) Geography, *a change in regional landscape dynamics evidences a change in human social dynamics*, is valid remains to be seen. However, this New England historical narrative certainly suggests that it is.

There are lessons to be learned from the region's past socio-ecological change. The most important lessons to be illustrated here are that socio-ecological change operates over long periods of time and that landscape shaping trends intersect. Although subject to interpretation, trend change in one landscape shaping process suggested the advent of a new subsidiary socio-ecological regime, and concurrent trend changes in multiple landscape shaping processes suggested the advent of a new socio-ecological regime. The end of one socio-ecological regime set the stage for the next regime. The dislocations appearing at the end of a regime often created resources for the next regime, as underutilized social and economic assets and natural resources become available for use. For example, after European diseases decimated native populations at the end of the Late Woodlands regime, English settlers took advantage of abandoned native lands, using them as resources for newly introduced European crops and livestock. At the end of the English Colonial regime the rural economy weakened, incentivizing farm families to provide the labor required to expand industrial production, ushering in the American Industrial regime. As the industrial

economy weakened at the end of the American Industrial regime, the concept of adaptive reuse took hold as brownfield sites and abandoned factory buildings were converted to meet the infrastructural needs of new information technology and service-based enterprise.

New England's Anthropocene epoch began as an English colonial project and continues today in a post-industrial phase influenced by its aboriginal, colonial and industrial pasts. The region's origin in settler colonialism with its extractive approach to natural resources, its accumulation of wealth through the slave trade (Bailey, 1990; Bailyn, 2000; Greene, 1942; Sluyter, 2002), and the long-lasting influence of "first effective settlement" (Zelinsky, 1973) make for a present well populated by the ghosts of the English Colonial regime. Like other ghosts of past ecologies and landscapes (Gan et al., 2017; Gregory, 2004; Inamdar et al., 2021; With, 2007), these are with us today embedded in our attitudes, relationships, and institutions. Continuities between the colonial past and the present are routinely reaffirmed and reactivated in the present, as we ignore aboriginal agroecological systems and land management practices (Anderson and Barbour, 2003; McCann, 1999a, 1999b),[16] import timber and other commodities from unsustainable sources, import products produced under oppressive labor regimes, and maintain our own racialized systems of oppression. This colonizer's model of the world diminishes "our ability to address effectively the global challenges we face in the postcolonial present" (Sluyter, 2002: 5).

It is difficult to envisage future socio-ecological change, no doubt in part because we are so imbedded in the logics of present relationships. The 2015 Paris Agreement calls for limiting global warming to 1.5°C, which translates into the achievement of net zero carbon dioxide emissions by 2050. So, we know that socio-ecological change is going to occur. Yet, as demonstrated by the *New England Landscape Futures* project, framing inputs by professional resource managers, land use planners, and policy makers and sophisticated forecasting tools only forecast alternate versions of incremental change. Indeed, our current tertiary, post-industrial socio-ecological regime is likely to continue but only until either the effects of climate change, the impacts of mitigation policies, or geopolitical events drive a shift to a new subsidiary socio-ecological regime.

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Notes

1. The Anthropocene epoch is a contested concept (Bauer and Ellis, 2018; Edgeworth et al., 2019; Hamilton, 2015; Haraway et al., 2016; Höfele et al., 2022; Johns-Putra, 2019; Lewis and Maslin, 2015; Malm and Hornborg, 2014; Moore, 2016). Here, the Anthropocene has been adopted as a heuristic to understand the current epoch (Larsen and Harrington, 2021; van der Leeuw, 2020; Westermann and Höhler, 2020), because as Westermann and Höhler (p. 581) noted, it has been "wildly successful for exploring and navigating the temporalities, spatialities, and ecologies that come with reconceptualizing human and social history in relation to earth history." Although less wildly successful, alternate heuristics such as the Plantationocene, Capitalocene, Chthulucene, and Necrocene (Barua, 2023; Haraway, 2015; McBrien, 2016; Moore, 2016), also represent interpretive lenses through which to view nature/society hybrids. We disagree with Simon's (2017, 2020) notion of the collapse of storytelling as a vehicle for understanding the Anthropocene. It is only classical Eurocentric storytelling that has collapsed.
2. It must be observed that other socio-ecological frameworks are possible. The use of U.S. Census, U.S. Department of Agriculture, and Harvard Forest datasets, in particular, constrain the analysis through the mindsets, concepts, definitions, operations, and procedures at work in these organizations. The 10 year

interval of U.S. Census data is particularly important in this regard, as it provides the temporal structure of the analysis.

3. It has been observed that, rather than fully integrated, research by interdisciplinary teams focusing on coupled human and natural systems has largely been divided into separate natural and human components. Thus, the degree to which two-way linkages are actually examined has been limited (Shin et al., 2022). However, collaboration between a diversity of disciplines can be facilitated by frameworks, which identify the temporal contexts of socio-ecological change. By structuring patterns of continuity and change, periodization of environmental history has been cited as a key aid in helping investigators to better understand coupled human-natural systems through time (Steen-Adams et al., 2015).
4. While humans have only ever been able to act in ways that the environment affords (Chemero, 2003; Gibson, 1979), in the Anthropocene epoch all major environmental change has a societal component, and all major societal change has an environmental component. The environmental challenges of the Anthropocene epoch are consequences of relationships between humans and the natural world, and it is well recognized that synthesizing social science and environmental data is necessary for the production of knowledge useful in addressing contemporary environmental challenges (Dick et al., 2018; Haberl et al., 2006; LeBrasseur, 2013; Redman et al., 2004).
5. Periods of equilibrium and stability are followed by transitions to new periods of equilibrium and stability. Within each socio-ecological period (i.e. regime or nested secondary or tertiary regime) change is incremental because ecosystems have the ability to accommodate a degree of change while maintaining the integrity of their functions, and human societies have the ability to accommodate change by innovating solutions to problems. These accommodations take the form of successive, linked solutions (Holling et al., 2002; Kubler, 1962).
6. The longue durée approach to history and historical time originated with historians associated with the journal, *Annales d'Histoire Économique et Sociale* (today *Annales: Histoire, Sciences Sociales*). Notably including Marc Bloc, Lucien Febvre, and Fernand Braudel, whose historiography privileged long-term social history, these historians focused on local and regional history. They stressed social structures as explanatory forces, an approach that posited that events can be explained by being set within their contexts. Consequently, historical time is marked by changes in context. It is nonlinear and phased with some phases being more significant than others (White, 1973). The longue durée approach was employed by this study as the appropriate time-frame for application of an integrated, co-evolutionary paradigm for understanding historical processes (McGlade, 2006).
7. This is done on the basis of the historian's perception of the relatedness of events with respect to cause and effect (i.e. the relationships between the events to be explained and other events that came before). Periodization is central to theories of history and time and the difference between natural and historical categories of time. White (1973) positioned the historian between the historical field (i.e. the unprocessed historical record and other historical accounts) and the audience. In White's model, the historian arranges elements of the historical field into a chronicle (i.e. events organized in the temporal order of their occurrence). Then, the chronicle is organized into a story through interpretation and abstraction, a further arrangement of events to form a coherent presentation of historical process. This arrangement of events relies on historical periodization. In discussing material culture and artifacts, Kubler (1962: 99) referred to absolute (i.e. natural, chronological) and systematic (i.e. historical) time and historical periods as "envelopes, which all have different contours in the sense that they are durations defined by their contents." In this study, the contents are landscapes. Unspoken by Koselleck, Gangatharan, White, and Kubler is their anthropocentric conception of time, which is the frame of the present study. However, it should be noted that other temporalities exist (Batalla, 2022; Rose, 2012), although none are fully accessible to humans.
8. Consistent with the view of history as discontinuous, McGlade and Garnsey (2006: 15) defined socio-ecological regimes as "distinctive human-environment signatures or ecohistorical regimes [which] constitute particular social, environmental, politico-economic interactions that define structural attractors as self-organizing emergent phenomena." Kull et al. (2018: 27) defined socio-ecological regimes as denoting "behaviors, conditions, and interconnected processes that are perceived to be characteristic, stable, and self-sustaining in reference to a particular phenomenon of interest." Fischer-Kowalski and Rotmans (2009) refer to socio-ecological regimes as social-metabolic regimes. In short, a socio-ecological regime

represents a set of behaviors, relationships, rules, and institutional structures such that socio-ecological outcomes are repeated with only gradual change during the life of the regime. Socio-ecological regimes are disrupted by the transition to a new period of equilibrium, stability, and incremental change, resulting from new relationships between causal processes. Subsidiary regimes can be nested within larger scale regimes. Regime transitions and the associated changes in causal relationships are critical to understanding environmental history.

9. Distinguishing between trend turning points and trend fluctuations can be a subjective judgment. Here, the most contentious judgments related to Southern New England lumber production between 1940 and 1990 and Northern New England dwellings/dwelling units between 1930 and 2010. In the former the short durations and in the later the small magnitudes of the trend changes were the bases of the judgments.
10. To be clear, neither the New England region nor its subregions, Southern New England (S-NE) and Northern New England (N-NE) nor the individual New England states (i.e. Connecticut (CT), Maine (ME), Massachusetts (MA), New Hampshire (NH), Rhode Island (RI), and Vermont (VT)) represent socio-ecological systems. However, socio-ecological systems exist within and across their boundaries. The region is not ecologically homogeneous. Confounded by elevation, soils, and solar aspect, Southern and Northern New England represent the southern and northern American portions of an ecological gradient of vegetation composition that was first established between 10,000 and 8000 years ago and today is generally recognized as the New England-Acadian Forest ecoregion, which consists of a mix of boreal and temperate tree species (Noseworthy and Beckley, 2020). The individual states are political sub-divisions, each with a slightly different European settlement narrative.
11. See the Data Sources section, below. The vast majority of the data were sourced from United States Bureau of the Census reports. Data on forest land were sourced from the Harvard Forest Data Archive (HF013). Beginning in 1950 lumber production data was pieced together from other listed sources.
12. The Census Bureau has been consistent in its definition of rural as all territory not defined as urban. However, the Bureau's definition of urban has changed over time. No adjustments were made to the Bureau's rural population data. In the censuses of 1880, 1890, and 1900, places were deemed urban based on minimum population sizes of 8000, 4000, and 2500 inhabitants, respectively. Beginning in 1910, the minimum population threshold categorized as an urban place was set at 2500. The Census Bureau revised the urban definition for the 1950 census by adopting the urbanized area concept, to better account for increased growth in suburban areas outside incorporated places of 50,000 or more population. The Bureau designated as urban any area that contained at least 2500 people within its boundaries. In 1960, the Bureau adopted a population density threshold of at least 1000 people per square mile for urbanized areas. Beginning in 2000, all urbanized areas and urban clusters were delineated solely on population density, without reference to place boundaries.
13. Beginning with the 1940 census, the Census Bureau began reporting the number of dwelling units rather than the number of dwellings. Consequently, the basis of the number of dwellings in the 1930 census is different from the basis of the number of dwelling units in the 1940 census. No adjustments were made to the data. The increase in units between 1930 and 1940 is partly due to this change in basis. The term "dwelling" as used in the 1930 census and earlier is comparable to the term "residential structure." The term "dwelling unit" as used in the 1940 census is roughly comparable to the number of families. However, the 1940 census also includes entirely vacant structures, which were not included in the earlier censuses.
14. Typically, long term natural time periodizations have grouped events by century.
15. Only the decadal population density series is complete from 1620. The forestland area and rural population share series are complete by decade from 1790.
16. However, efforts to reclaim indigenous spaces have begun (Brooks, 2008; Grande et al., 2015; Johnson and Murton, 2007).

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