The Effects of Land-Use and Historical Disturbances on the Modern Day Landscape

The landscape in New England has been subjected to many forms of disturbances for hundreds of years, from Native American land management practices, to the clearing of the forests for agriculture by European settlers (Foster et al. 1992, Fuller et al. 1998). These different trends in land-use types have had an effect on the vegetation and wildlife that are able to flourish in this area. As the landscape continues to be altered by human land use, it is important to understand the historic characteristics of the landscape to be able to manage the land in manner that is beneficial to the native flora and fauna. It is also important to identify the most appropriate baseline for restoring a landscape to its historic origins (Litvaitis 2003).

Disturbances to a landscape can be natural such as hurricanes, windstorms, and forest fires or human induced such as agriculture, logging, development, and the introduction of invasive species. These disturbances not only affect the landscape immediately, but also can have long lasting effects (Foster et al. 1992, Fuller et al. 1998). Human induced disturbances, mainly certain land-use practices, have a profound long term effect on the landscape and can alter the vegetation, wildlife and even change the effects that a natural disturbance regime will have on the landscape (Foster et al. 1998). To understand how certain land-uses act as disturbances, researchers utilize historic public records of land ownership and vegetation profiles acquired through town records, as well as sophisticated pollen carbon dating techniques. By relating the dominant vegetation types with land-se practices during a specific time period, researchers can learn how these human disturbances are affecting the landscape (Foster et al. 1992, 1998). Long-term ecological research sites have been an important resource in understanding how landscapes are affected over long periods of time (Foster et al. 2003). Many of the studies reviewed for this project were conducted by Harvard researchers at the Harvard Forest in Massachusetts. Having an area with large amounts of modern day information, as well as historic information allows researchers to better understand the processes involved with disturbances and succession.

Many studies have been conducted on the effect of the European settlement in New England. Prior to this event, very little active land management occurred. Native Americans occasionally used fire to clear areas, however this practice was not as common as once thought (Foster and Motzkin 2003). When Europeans arrived in New England, they began altering the landscape for agricultural purposes. This diminished the amount of forested land in New England substantially. Eventually, as more of the U.S. was settled and New England began industrializing, farmers relocated to the Midwest and many of the farms were abandoned. This allowed the farmland to begin reverting to forested habitats (Foster et al. 1992 and 1998, Litvaitis 2003). By comparing
the vegetation composition of New England pre-settlement to modern day, researchers found that while the amount of forest is comparable, the composition of the forests has been altered a great deal (Fuller et al. 1998, Foster et al. 1992, 2003, Foster 1992).

Historic natural disturbances have also played a large role in shaping the current landscape. Using the same techniques of combining historical vegetation profiles and land-use data, researchers are able to see the effects of known historic disturbances. For example, the 1938 hurricane greatly affected New England, and by looking at information before and after that particular time period, researchers can learn what characteristics of the historic landscape made it more susceptible to damage from high winds (Boose et al. 2001, Foster and Boose 1992). Similarly, historic forest fire regimes can be studied in similar ways (Foster 1982). Information on how landscapes are affected by wind and fire also provide tools for land managers to make decisions on preparing for natural disturbance events.

The reason I chose this topic to research was to learn more on how historic disturbances have played a role in altering the abundance and distribution of wildlife species in New England. Because the New England landscape has changed a great deal over the past 300 years, certain wildlife species have experienced declines in populations and range while others have flourished in the changing landscape (Litvaitis 1993, Foster et al. 2002). The New England cottontail is an example of a species that experienced a rise in population numbers during the early periods of farm abandonment and reforestation, but has since declined as the landscape has trended towards more mature forests and fewer early successional habitats (Litvaitis 1993). While it is unclear what the populations of this species were like in pre-settlement times, it is clear that the current population and distribution of this species will not remain sustainable and the species is in danger of being extirpated from many areas in its range (Litvaitis 2003).

While there is a surprising amount of information available on the New England landscape over the past several hundred years, I would like to see more studies on what baseline is most reasonable for restoring the habitats that have been most impacted by land-use changes and disturbances. There does not seem to be a consensus on whether it is reasonable, or beneficial, to try and manage landscapes to better resemble the pre-settlement characteristics. Compared to the rest of the country, New England has a great deal of restored forest areas, but I would be interested to learn more about how the differences in the composition of these forests, compared to pre-settlement forests, effect the persistence of certain plant and wildlife species. It would also be interesting to see the studies that I reviewed applied in different areas and focused on different land use types. For the most part, these studies focused on areas that are now protected forests, but it would be interesting to see more work done on the effects of historical disturbances on wetlands, aquatic systems, and other land-use types. Overall, I found this topic very interesting, and was impressed with the wide range of data collection techniques for studied landscapes in different time periods. An important theme that was consistent in all of these studies, and in many other studies in the

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landscape ecology field is that there need to be clearly defined goals and an understanding of the underlying ecological processes for any land management to be successful. Fuller et al. (2003) made a point that was consistent among all of the studies that I reviewed, which was the importance of and need for a greater understanding of the land on a broad temporal scale and an awareness of the legacies of past land-uses and disturbances in formulating appropriate conservation and management objectives.

Annotated Bibliography


The authors of this paper used historical information on hurricanes in New England, including personal records and meteorological data, to model the damage of 67 hurricanes from 1620 to 1997. There was a great deal of variation in the timing of the hurricanes, but the amount of damage was related to the forest structure and land use of the area at the time of the hurricane event. This paper was interesting because it showed a relationship between disturbance type and forest type. The best example that was shown in the paper was a comparison of two hurricanes with equal strength and their effects on a specific site. The first hurricane hit in 1815, when the site was only 15% forested. The damage caused by wind in this event was much less than when a similar hurricane hit the site in 1938, when the site was much more forested. This example illustrates that the effect of a disturbance on the landscape is directly related to the land use and vegetation associated with the landscape.


This paper looks at the spatial, temporal, and vegetation patterns before and after large fires in the boreal forest of Labrador. The author found that the meteorological patterns were similar in all of the historical burns that were studied: high average temperatures and low levels of precipitation. While this is a fairly obvious conclusion, the author further examined the patterns and found that the temperatures were high and precipitation was low in the short window of time right before the fire event. These results lead to the conclusion that precipitation levels during the winter months don't have much affect on the likelihood of a forest fire.


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This study examines the relationship between land use and vegetation characteristics within the Prospect Hill tract of the Harvard Forest in Massachusetts. The study area is unique because there is a great deal of historical data on the dominant vegetation as well as land ownership and land use. The results indicated that land use, vegetation and impacts of natural disturbances are all related in that the current land use determines subsequent vegetation types, which then affects future human uses of the land and the impact of natural disturbances. Much like in similar studies it was also found that because of the past land uses and patterns of disturbances in New England, the forests of the northeast are mainly of even age and similar composition. Because the study site was unique, in that Harvard has acquired the land over many years, it would be interesting to see this study applied to an area with different land use patterns and different rates of fragmentation and development.


For this study, models were created to assess wind damage caused by the 1938 hurricane. Detailed forest stand data was available for the study area before and after the hurricane, and this data was used to create a model that could identify features of the landscape that were more susceptible to damage from strong winds. Amount of damage was assessed using a GIS and categorized based on slope, aspect, soil drainage and cover type. It was found that areas with tall conifers were the most likely to have high levels of damage. This paper was interesting because it combined modern modeling techniques with historic information. Because the 1938 hurricane was very strong and caused a great deal of damage, these models can be used by land managers to identify areas that are more susceptible to damage by hurricanes in the future.


In this study, the authors used paleoecological, denrological and historical studies of a woodland area to determine the effects on the landscape of different land uses over a 300-year period. From the results of this study on vegetation patterns, they determined that there is little evidence of the prior vegetation composition apparent in the current landscape. I found this particular result very interesting because they describe how the landscape overall has been reforested after the clearing that took place during the settlement period for agricultural purposes, yet the composition of the forests has not reverted back to its original form. This fact demonstrates the large impact that both large-scale and small-scale disturbances have on the landscape.

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Certain types of land use can act as disturbances to the landscape, and in this paper the authors are examining the effect that historic land use has on a landscape, and how it compares to a natural disturbance regime. This is similar to many of the other papers in that they use historical records to identify dominant plant species in different time frames and compare it with the land use type during the same period. They also compare the results with a study that uses carbon dating of pollen to see if historical records are a reliable source of information. The result that I found most interesting from this study is that the modern day forests are somewhat homogenized, and do not show the same species to climate relationship that was evident pre-settlement and during colonial times. An interesting follow-up to this result would be to explore whether this homogenization has any relationship to climate change whether the land can be managed to combat that issue.


Like many of the other papers I reviewed, this compares historical and modern day landscapes. However, this paper focuses on how the changing landscape has affected wildlife populations in New England. The authors focus on wildlife species in 6 categories: 1.) Those that were declining but are now recovering, 2.) Species that were uncommon but are now increasing, 3.) Species that have been extirpated or are extinct, 4.) Species that have experienced a range extension naturally, 5.) Species that have been introduced to the area, and 6.) Species whose numbers have remained stable over a long period of time. I found this paper very interesting because it takes a different perspective on the comparison of historical and modern landscapes, and even explores the ideas of wildlife causing natural disturbances. The idea of wildlife disturbances is clear when looking at how deer interact with the landscape. Because large mammal predator species are widely extirpated from New England, large browsers such as deer and moose have had the opportunity to expand in population size. These large population sizes can have a substantial effect on the vegetation composition of the forests and other areas in which they browse, and without the large predators to keep their populations in check, the landscape will not be able to fully return to historical conditions.


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This paper explores the historical predominance and importance of coastal grasslands, shrubland and heathlands in New England. Rather than collecting new data for this study, the authors interpret the existing data to determine if today’s openland habitats were important historically, and what land uses lead to the creation of these habitats. I liked this paper because the authors provide a new perspective on data that has been presented in other papers. They also question the current land management techniques and whether they are even necessary if the goal is to restore a historically accurate landscape. They found that the previous assumption that Native Americans performed a lot of burns and created many openland habitats had been overestimated, and that at the time of European settlement most areas that are now open were forested at the time. This is particularly interesting because it again raises the question of how should we conserve the landscape, and which historical time period is the most appropriate model for these efforts?


This article explores the effects of land-use on current landscapes. The authors site examples of how landscapes have changed over many years due to human impacts from areas in the U.S. grasslands, the northeast, and Puerto Rico. Land-use has an effect on not only the vegetation, but the carbon and nitrogen, soil and sediment, woody debris on forest floors, and the wildlife. They also provide suggestions on managing a landscape with the intent of restoring historical conditions. I found this paper interesting because they covered many examples of how landscapes have been affected by human disturbances, and examples on how to restore a landscape to how it was during a certain time frame. One criticism is that I would have liked to see more discussion on whether it is feasible to restore landscapes after several hundred years of continued disturbance, and how that would affect the current flora and fauna of an area.


This study examines the forest compositions before and after European settlement in New England. The authors used pollen counts from sediment cores, and carbon dating to determine the plants that were present over the past 1000 years. They found that the forests in New England have changed drastically and have not reverted to pre-settlement conditions despite an overall lack of large-scale disturbances. I found the methods used in this paper incredibly interesting and unique, and the fact that the authors could determine what plant species were in the area 1000 years ago is pretty

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amazing. I also found this paper interesting because the results of this study can be tied in patterns of wildlife species decline over the same time period and shed some light on possible causes of these declines.


This paper discusses how certain wildlife species have reacted to the changing landscape in New England. The author focuses on early successional wildlife species and how their populations have been affected by settlement, farm abandonment, and reforestation. He specifically mentions the New England cottontail, bobcats, and migratory passerines. There was not a specific study in this paper, but more of a review of the data available on these early successional species, and what it means for their future populations. The main conclusion that was drawn from the existing data was that because of farm abandonment and the resulting reforestation, many forests in New England are now mature, even aged forests stands that do not provide adequate habitat for species requiring early successional forests. In addition, the continued fragmentation that occurs on the landscape will further limit the available habitat for many species. While this paper was interesting and easy to understand, it would be interesting to apply a detailed historical landscape analysis to try and quantify the differences between forests before settlement, after settlement and in modern times.


This article poses the question: what historical baseline should we be using for managing the forest landscape? Unfortunately, this question is never definitively answered. The author cites many previous studies comparing the historical and modern day landscapes, but mentions the need to look at more than vegetation and land use profiles, more specifically the need to look at the effect of beaver flowages and soil composition. While beaver flowages do play a significant role in shaping several habitat types, I assume it would be rather difficult to find historic records of this disturbance type in the pre-settlement time period. One thing that I did like about this article was the suggestions for management of shrubland and thicket habitats in New England. While his suggestions don't necessarily fit in with the idea of managing to recreate pre-Columbian landscapes, they are useful management techniques for restoring an important habitat type.

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