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Rediscovering the lost archaeological landscape of southern New England using airborne light detection and ranging (LiDAR)

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ABSTRACT

Recently, light detection and ranging (LiDAR) data has been made publicly available for the states of Connecticut, Massachusetts, and Rhode Island in New England, a geographic region in the northeastern United States. Despite the wide range of archaeological studies that have been undertaken with LiDAR on a global scale, few published studies exist in the United States, and no published studies exist for the northeastern US, which has a unique historical and geomorphological landscape. This landscape is densely forested, and archaeological studies in this region highlighting how humans have historically shaped the New England landscape can benefit greatly from the use of LiDAR. This paper contributes to the growing international dialogue regarding the use of LiDAR for archaeological studies by providing examples of features that have been discovered in this region, how these features can be interpreted in conjunction with historical documents and used for reconnaissance surveys, and how these interpretations can contribute to theoretical anthropological perspectives regarding how humans divide and use the landscape. Our analysis has positively identified numerous archaeological sites that have not been previously recorded by archaeological studies.

1. Introduction

Airborne light detection and ranging, more commonly known as LiDAR, has become a well-established resource used to enhance spatial knowledge of the archaeological and cultural landscape in Europe, Central America, Canada and limited locations in North America including the United States (Chase et al., 2011; Cowley, 2011; Crutchley, 2009; Crutchley and Crow, 2009; Devereux et al., 2008, 2005; Doneus et al., 2008; Gallagher and Josephs, 2008; Harmon et al., 2006; Lasaponara et al., 2010; Masini et al., 2011; Millard et al., 2009; Opitz and Cowley, 2013; Pluckhahn and Thompson, 2012; Rosenswig et al., 2013; Werbrouck et al., 2009). Many of these archaeological studies make use of LiDAR as a means to view the terrain and archaeological features below the forest canopy, though there are also studies that have been undertaken in non-forested landscapes (Harmon et al., 2006), and new research has shown it is possible to locate underwater archaeological sites as well (Doneus et al., 2013). Case studies vary by geographic location, time period and culture, yet all have used LiDAR data in a similar manner. Digital visualization and processing techniques have also been developed and refined that allow archaeologists or interested parties to manipulate the data in different ways after it is collected (Bennett et al., 2012; Hesse, 2010; Kokalj et al., 2011; McCoy et al., 2011; Štular et al., 2012; Verhagen and Drăguţ, 2012). Despite the growing literature and range of studies regarding the use of LiDAR that examine cultural resources and archaeology with LiDAR, very few have used data gathered in the United States, and few published studies exist for New England and its unique landscape. The disparity of published literature regarding LiDAR use in the United States and New England specifically for any type of archaeological analysis is unprecedented given its history and apparent widespread use in Europe and Central America. As a result, there is a great need for such research in this region to not only complement existing international studies, but to provide an assessment of the archaeological and cultural landscape in New England as measured through LiDAR.

This study will contribute to the growing international dialogue regarding LiDAR and its use for studying the archaeological landscape, and specifically will contribute new data regarding the types of features present in New England's unique historical and geomorphological landscape and their relationship to how humans have historically shaped and experienced the New England landscape. Prior to European colonization, small areas of forest were cleared for agriculture, and landscape-altering agricultural activities were conducted by Native American groups (Cronon, 1983; Garman et al., 1997; Merchant, 1989). The arrival of European

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colonists in the seventeenth century brought drastic changes to the predominantly forested landscape as English-style agriculture was imposed and thousands of acres were cleared of forest (Cronon, 1983). Agricultural lifeways gradually declined beginning in the mid-nineteenth century, causing once-maintained fields and agricultural landscapes to revert back to forest. Forests now prevail on the landscape in many parts of southern New England, obscuring features of that once-agrarian past such as old roads, building foundations, stone walls, mills, or dams – reminders that the landscape is itself an artifact (Rubertone, 1989). In aerial and satellite imagery, these features are often hidden from view by a dense forest canopy; but by using LiDAR as others have done, these features become visible for identification and analysis.

Recently, airborne LiDAR data has been made publicly available for the New England states of Connecticut, Massachusetts, and Rhode Island. In this geographic region, which is predominantly forested, LiDAR is a vital tool for archaeological landscape studies because it allows the archaeologist or interested party to see not only the terrain beneath the dense New England forest canopy, but also to see that terrain at a much higher resolution than was previously possible. This paper presents preliminary results regarding the use of airborne LiDAR in southern New England to identify and interpret specific types of archaeological and cultural features that comprise the unique New England landscape. This will not only lead to a more comprehensive understanding of the historical human impact on the New England landscape, but will also allow for the identification of new archaeological sites or landscape features prior to archaeological reconnaissance surveys and analysis in areas that are inaccessible for fieldwork. This study will contribute to the growing international dialogue regarding LiDAR and its use for studying the archaeological landscape. Specifically, it contributes new data on the visualization and analysis of the types of features associated with New England's unique historical and geomorphological landscape, which also have global applications.

2. Study areas

Though southern New England has been considered part of the growing "megalopolis" encompassing cities and towns from Boston to Washington D.C., forests tend to dominate the southern New England landscape, obscuring features of a once-agrarian past. Northeastern Connecticut, specifically, has been called "America's megalopolitan park" because of its extensive forests and lack of development (Berentsen, 1996). Though this area did not see the wide-spread industrialization of the nineteenth century, it has not always been as forested as it is today. Some areas still maintain their agricultural landscapes of fields and pastures lined with stone walls; others have become completely reforested. Reforestation of this region appears to have varied both temporally and spatially, and by using LiDAR, the variability of reforestation can be assessed at the scale of individual fields in many cases.

The three towns chosen for this study were Ashford, Connecticut (CT); Tiverton, Rhode Island (RI); and Westport, Massachusetts (MA) (Fig. 1). Because this was a preliminary study, small representative areas of each town were chosen for data visualization and analysis. These towns were all chosen because of their rural character; a trait typically indicative of low levels of urban or industrial development that is associated with excellent

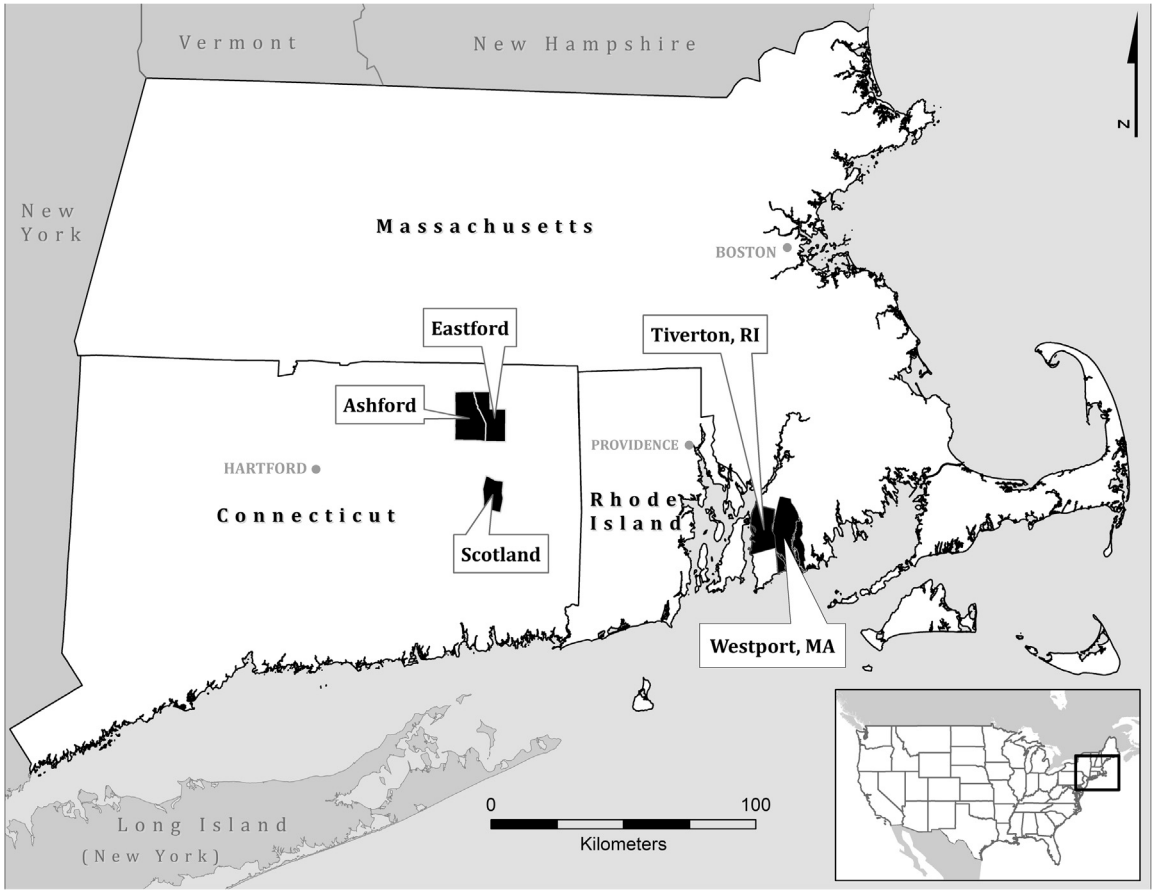

Fig. 1. Study area with focus areas indicated.