Graduate Research Plan Statement

Title: Investigating Maine's Indigenous Fire Prehistory to Inform Forest Management Under Global Change

With climate change amplifying underlying environmental issues, modern wildfires have become enormous devastating forces, costing lives, our natural resources, and billions of dollars. Early US Forest Service practices focused on fire suppression as a management tool, which increased the presence of underbrush, snags, and flammable material in forests[1]. Though these practices have changed, those initial management plans coupled with drought, eco-tourism, and rising temperatures have led to the large-scale, uncontrollable, high-intensity fires in the West that, as of October 1, 2020, have burned nearly 7.7 million acres this year[2]**.**

In contrast, indigenous fire management has played an important role in the ecology of many North American landscapes for thousands of years. Native peoples used fire to clear the land for cultivation, promote healthy and diverse food-rich forests, and facilitate diverse wildlife habitat[3]. These practices have largely been excluded in modern forest management plans. By the 1970's the Forest Service began utilizing indigenous knowledge to set controlled burns in the West, Southwest, and Southeast, but not in the mixed hardwood forests of the Northeast[1], where fire is not widely considered to be an important process[4]. However, there have been large-scale destructive fires in the last century, like the Great Fire of 1947 in Maine. This drought-intensified fire consumed 17,188 acres, destroyed 240 buildings, and cost over $23 million in property damages[5]. As climate change is causing warmer temperatures and droughts in the Northeast[6], there remains a critical need to understand the long-term history of fire (both natural and anthropogenic) in this region.

Most of our academic knowledge about indigenous fire use in New England is largely based on journals and other written accounts by European settlers. However, those records lack the perspectives of indigenous people, and only explain fire use post-contact[7]. Historical observations and Wabanaki oral knowledge indicate that, within the last 500 years, Native peoples used fire to clear land for agriculture, and to improve hunting grounds south of the Kennebec River in Maine. Penobscot place names describe areas that experienced regular burning. For example, Schoodic (*skudek*) Peninsula, a part of Acadia National Park, means "burnt-land"[8].

Long-term fire records from lake sediment cores and tree rings have provided another valuable source of information about the relationships between fire, climate, vegetation, and people in the American West, Midwest, and Southeast, but are still lacking for the Northeast, including New England. A recent study synthesizing charcoal patterns across New England found no evidence of pre-European anthropogenic fire use, but this reflected a regional fire record that would not highlight the more localized scale at which indigenous peoples would have been burning[4]. Charcoal records in the Northeast have primarily been taken from large bodies of water[9], which are biased towards large regional fires, instead of local, low intensity fires, which would have been the types of fires Native peoples used for land management[4]. Therefore, while previous paleoecological studies have been important for understanding the large-scale fire prehistory of New England and its relationship to climate, they are poorly suited to the study of anthropogenic fires. And, by failing to partner with Native scholars and incorporating oral knowledge of past land use, such studies mask indigenous peoples' expertise and contributions to the health of the landscape[10].

Intellectual Merit

My research goal is to reconstruct localized fire records in Maine to better understand fire as a prehistoric land management tool in New England. I will take a multi-pronged approach to this work: 1.) I will conduct an actualistic study to identify the signals of localized understory burns and small patch clearings in the charcoal and pollen records of forest hollows and small ponds. 2.) In collaboration with members of the Penobscot Tribe, I will collect sediment cores from small ponds and forest hollows near settlements and prehistoric hunting grounds to examine whether small-hollow cores can identify local, small-scale burning. 3.) I will then synthesize these findings with existing geoarchaeological, climate, and pollen records to assess the relationships between population and cultural shifts, climate, vegetation, and fire histories across scales. All of the necessary equipment and facilities to carry out this project are available at the University of Maine Climate Change Institute, and Dr. Gill is building tribal partnerships via collaborations with Penobscot faculty at UMaine: Dr. Darren Ranco, director of the WaYS program, and Dr. Bonnie Newsom, archaeologist. Partnership opportunities are also available at Acadia National Park through the National Park Service.

Many fire-use studies focus on written accounts, the charcoal record, and tree scaring to reconstruct past fire regimes, but researchers have historically excluded indigenous communities when studying past human land use. My project will contribute to a more accurate historical record of prehistoric land use by better matching the tools to the questions to characterize anthropogenic fire histories and impacts. This project will also add to our understanding of charcoal records taken from small hollows. In contrast with the pollen record, hollow-based fire records are lacking, which limits our ability to interpret stand-scale fire impacts[11].

Broader Impacts

Though fire is not considered to be an important process in the Northeast, with climate change exacerbating existing environmental issues, it is becoming an increasingly dangerous threat. This past summer, drought conditions and increased eco-tourism due to COVID-19 resulted in a summer of over 900 high-intensity, destructive fires in Maine[6]. Maine's economy depends on logging and tourism[12] and drought-induced fires put both of those industries at great risk. This study seeks to understand low intensity fires and will inform conservation and management practices. Such fires clear underbrush and snags, reducing the fuel load for uncontrolled fires. This would make Maine's forests safer while also reducing tick populations by burning shrub species that foster these disease vectors[13]. Cleared underbrush would improve forest health by reducing canopy competition and eliminating weaker diseased trees. All of these benefits could increase timber quality and forest health, boosting two of the state's major industries during a time of economic uncertainty.

The Wabanaki Confederacy is a collection of Eastern Algonquin tribes including the Penobscot, Passamaquoddy, Mi'kmaq, and Maliseet people. I plan to use my research to contribute to the Native American Graves Protection and Repatriation Act (NAGPRA) by providing supporting evidence of long term tribal habitation. This project will contribute to a long-term collaborative relationship with local tribes and will provide critically needed information in support indigenous sovereignty claims. I also intend to collaborate with the NSF-funded Wabanaki Youth in Science (WaYS) program at UMaine. WaYS trains Wabanaki youth in both tribal knowledge and scientific approaches through summer camps and internships. I intend to include Wabanaki students in my project by bringing groups of students out into the field and mentoring students in the lab to learn sediment coring and paleoecological techniques.

References.

[1]Forest History Society. *US Forest Service Fire Suppression*. [2]Congressional Research Service.

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