Monitoring Maine's Moose Population and its Response to Climate Change

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Background

Maine has long been known for its large population of moose. In fact, the state has the second largest moose population in the US, second only to Alaska. As of 2012, there were an estimated 76,000 moose in the state of Maine (*Moose* 2021). This has since fallen to between 60,000 and 70,000. New Hampshire's moose population has dropped over 50% in that same time (*Moose (alces alces)*). It is suspected that this decline is a result of the increased frequency of winter tick infestations, shorter winters, and a changing landscape (Pierre-louis, 2018).

Motivation

Maine's climate is and has been warming as a result of anthropogenic climate change (figure 1). As a result, the state's winters are getting shorter and shorter every year, and this allows for increased incidence of parasites and disease being found in moose (Pekins & Kantar, 2018). The winter tick is the leading cause of death in moose under a year old (*Moose* 2021), which has a drastic impact on the successful reproduction rate of the species (see figure 3). Moose are slowly losing their habitat and food sources to climate change too, as the current maple-beech-birch and spruce-fir forests moose are found in transform into more of an oak-pine and oak-hickory forest (figure 2).

Hypothesis

Maine's moose populations will continue to decline over time as a result of climate change. More specifically, the moose population will be most effected by an increase in winter tick infestations and losing their habitat and food sources due to a change in regional forest composition.

Literature Sited

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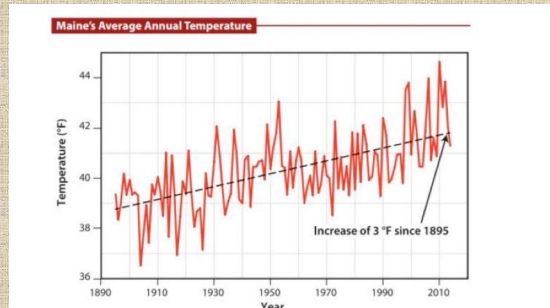

Figure 1: A temperature graph displaying a 3°F increase in mean annual temperature for the state of Maine overtime starting in 1895. (Photo courtesy of noaa.gov)
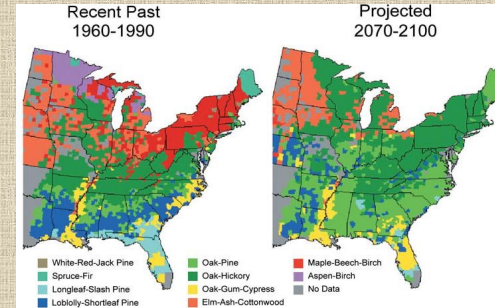

Figure 2: This map shows the projected shift in forest type over the next 50-80 years for the eastern United States. Moose are currently found in maple-beech-birch forests and spruce-fir forests. The projection shows neither of these forest types existing on the east coast after 2070. (Picture courtesy of epa.gov)

Study Design

To measure the change in forest composition, extensive sampling and analysis over the next 100 years will be necessary. However, in the meantime an observational study using forest inventory data collected by the Oxford county forester can be conducted to examine how and at what rate southern Maine's forests have seen a change in composition over the last 20 years. Oxford county (see figure 4) is the best region to study because it has large expanses of maple-beech-birch forests perfect for moose habitat and is one of Maine's southern counties, meaning it is projected to see a change in forest composition sooner than the counties to the north (figure 2). Since calves are more likely to perish from an infestation of winter ticks (Pekins & Kantar, 2018), a mark-recapture method will be used to mark 1-year old calves with GPS tracking collars, monitor their range and activity, and recapture monthly to count any winter ticks found on the moose. Calves reach reproductive age at 2 years, so the study will follow them for the 6-months before their brooding season. The study will be conducted in a 100 square kilometer area encompassing northern Somerset and Franklin counties (see figure 4) and moose will be recaptured and analyzed once monthly for winter tick presence between the months of May and November. The study will start in May because that is when ticks and moose become more active and end in November because winter and brooding season will be commencing, and the ticks will no longer be able to survive (*Moose*, 2021).

Figure 4: Map of Maine and its counties. (Map courtesy of mapofus.org.)

Intended Analysis

To interpret the data collected from this study, the population growth model will be used to show the change in abundance (response variable) based on how many calves die as a result of winter ticks before reaching reproductive age (predictor variable). The observational study of forest vegetation will likely show a change in composition (predictor variable) and correspond with a change in the abundance of moose in Oxford county. This data can be used to predict how the counties to the north will see a change in vegetation and moose abundance over the next 20 years.

Figure 3: A cow moose that has been infested with thousands of winter ticks. Moose have been known to carry up to 100,000 ticks at a time (Pierre-louis, 2018). (Photo courtesy of NH Fish and Game, Dan Bergeron)