Witter, L. A., C. J. Johnson, B. Croft, A. Gunn, and L. M. Poirier. 2012. Gauging climate change effects at local scales: weather-based indices to monitor insect harassment in caribou. Ecological Applications 22:1838-1851.
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Abstract

Climate change is occurring at an accelerated rate in the Arctic. Insect harassment may be an important link between increased summer temperature and reduced body condition in caribou and reindeer (both *Rangifer tarandus*). To examine the effects of climate change at a scale relevant to *Rangifer* herds, we developed monitoring indices using weather to predict activity of parasitic insects across the central Arctic. During 2007–2009, we recorded weather conditions and used carbon dioxide baited traps to monitor activity of mosquitoes (Culicidae), black flies (Simuliidae), and oestrid flies (Oestridae) on the post-calving and summer range of the Bathurst barren-ground caribou (*Rangifer tarandus groenlandicus*) herd in Northwest Territories and Nunavut, Canada. We developed statistical models representing hypotheses about effects of weather, habitat, location, and temporal variables on insect activity. We used multinomial logistic regression to model mosquito and black fly activity, and logistic regression to model oestrid fly presence. We used information theory to select models to predict activity levels of insects. Using historical weather data, we used hindcasting to develop a chronology of insect activity on the Bathurst range from 1957 to 2008. Oestrid presence and mosquito and black fly activity levels were explained by temperature. Wind speed, light intensity, barometric pressure, relative humidity, vegetation, topography, location, time of day, and growing degree-days also affected mosquito and black fly levels. High predictive ability of all models justified the use of weather to index insect activity. Retrospective analyses indicated conditions favoring mosquito activity declined since the late 1950s, while predicted black fly and oestrid activity increased. Our indices can be used as monitoring tools to gauge potential changes in insect harassment due to climate change at scales relevant to caribou herds.