What is Winter? A Socio-Ecological Reckoning

ALEXANDRA R. CONTOSTA, NORA CASSON, SARAH J. NELSON, AND SARAH GARLICK

ABSTRACT

In temperate, seasonally snow-covered ecosystems globally, winter is increasingly recognized as a critical period for regulating ecological, biogeochemical and socio-economic processes, both during the winter season and throughout the year. In these areas, winters are characterized by below freezing temperatures and sustained snowpacks, both of which are disappearing. Traditional seasonal definitions based on astronomical or meteorological reckonings are out of sync with this socio-ecological experience of weather and do not capture how the timing of winter could shift in a context of changing climate. Here we propose a new reckoning of winter that can vary in space and time: we define a socio-ecological winter as a period of sustained temperatures below freezing and snow accumulation that together regulate ecological and biogeochemical processes and the services they provide to society, both during winter and annually. To explore this new reckoning, we examined 100 years of meteorological data across seasonally snow-covered areas of eastern North America. Trend analysis demonstrates that winters have become shorter across the region, at a rate of up to two days per decade. This is consistently due to an earlier onset of spring, although at many sites there is also a significant trend towards a later end of fall. Within winters, conditions have become more variable, with significant increases in the number of days above freezing temperatures, that winter rain occurs, and that bare ground exists instead of snow cover. Together, these indicators show a trend toward losing the conditions that define winter across our region.