



Climatic control of ultraviolet radiation effects on lakes

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ABSTRACT: Ultraviolet radiation (UVR) damages most biota, yet little evidence exists for its long-term effects on natural ecosystems. We used paleoecological techniques at three low-elevation lakes to show that algal abundance in lakes was depressed 10-fold by UVR during the first millennium of lake existence. Likewise, analysis of data from a lake near treeline showed that algal biomass declined 10-25-fold both early in the lake history and during the last ~4000 yr, when inputs of UVR-absorbing dissolved organic matter (DOM) declined despite constant nutrient levels since ~10,000 $^{\circ}\text{C yr}$ before the present. This rapid ($-1.25\% \text{ yr}^{-1}$), sustained ($>600 \text{ yr}$) suppression of algal abundance arose from directional climate change that reduced DOM inputs and occurred despite initial reservoirs of photoprotective DOM that are typical of most boreal lakes. Hence, we conclude that many lakes may be vulnerable to order-of-magnitude declines in algal abundance arising from future climate-DOM-UVR interactions.

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