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IS ULTRAVIOLET RADIATION CONTRIBUTING TO A DECLINE IN BOREAL TOADS?



photo by Steve Corn

Keywords: amphibians, boreal toad, *Bufo boreas*, ultraviolet radiation, population decline

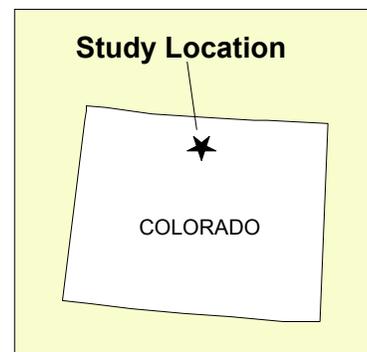
Background & Management Issues: The increased ultraviolet-B (UV-B) radiation resulting from ozone depletion is an attractive hypothesis to explain widespread declines of amphibians, especially in regions without obvious habitat destruction or pollution. However, while some researchers have documented developmental abnormalities, reduced hatching success, and mortality in amphibians exposed to UV-B radiation, other researchers have not found convincing links between increased UV-B radiation and amphibian mortality. Interpretation of these conflicting results is confounded because of the variety of methods used in the different studies.

Over the past 20 years populations of boreal toads (*Bufo boreas*) in the southern Rocky Mountains have undergone a severe decline in relatively pristine areas. The cause(s) of this decline are unknown. Boreal toads are listed as "Endangered" by the State of Colorado and are also a candidate for Federal listing. In Colorado, boreal toads typically breed from mid-May through June when solar intensity is at its maximum, making them vulnerable to any detrimental effects of increased UV-B radiation.

Project Objectives:

To conduct a field experiment in Colorado similar to one previously conducted in Oregon by researchers who found increased mortality of boreal toad embryos exposed to UV-B radiation.
To evaluate UV-B radiation as a cause of the decline of boreal toads.

Project Description: Field experiments were performed in May and June 1994 in an alpine pond and lake in Rocky Mountain National Park, Colorado, USA. At each site, boreal toad eggs from recently deposited clutches were distributed in petri dishes outfitted with UV-B radiation filters. The filters blocked either ~20%, ~50%, or ~100% of the UV-B radiation in ambient sunlight. The dishes were perforated to allow for water circulation and anchored in shallow water. After the embryos hatched, the numbers of developing (normal and abnormal) and undeveloped embryos in each dish were counted. Remote-sensing data from various satellites were used to calculate the amount of UV-B radiation reaching each study site.



Results: No differences were found in the hatching success of boreal toad embryos exposed to varying levels of UV-B radiation. These results are contrary to similar studies in Oregon that documented increased mortality of boreal toad embryos after exposure to varying levels of ambient UV-B radiation. Several possible explanations for these contradictory results exist, including differences in

experimental design, presence or absence of a pathogenic fungus, and geographic genetic variation. Overall, boreal toads in the Oregon study were probably not exposed to higher doses of UV-B radiation compared to the toads in this study. Results of this study do not support UV-B radiation alone as the cause of the decline

of boreal toads during the past 20 years in the southern Rocky Mountains. Nevertheless, because of the contradictory results from other studies, UV-B radiation cannot be dismissed as playing a role in the widespread decline of amphibians such as the boreal toad.

Management Implications:

- ❖ Additional research is necessary to determine the role of UV-B radiation in declining amphibian populations. In the mean time, managers should strive to prevent habitat loss and fragmentation, which have been shown to play an indisputable role in declining amphibian populations.

Publications / Products:

- ❖ Corn, P. S. 1998. Effects of ultraviolet radiation on boreal toads in Colorado. *Ecological Applications*. 8(1): 18-26. **Leopold Publication Number 315.** [Read the abstract here.](#)
- ❖ Corn, P. S. 2000. Amphibian declines: Review of some current hypotheses. *In*: Sparling, D. W.; Bishop, C. A.; Linder, G., eds. *Ecotoxicology of Amphibians and Reptiles*. Pensacola, FL: Society of Environmental Toxicology and Chemistry: 639-672. **Leopold Publication Number 424.** [Read the abstract here.](#)

For additional information...

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Photo courtesy NPS