



The Impact of Climate Change on the Karner Blue Butterfly



photo by: USFWS; Joel Trick



photo by: aeicole2010

Climate change is having a tremendous impact on many different organisms. One of these is the Karner blue butterfly.

What is Climate Change?

Human activity has greatly increased the amount of CO₂ and other greenhouse gases in our atmosphere. This has contributed to changes in our global climate. Over the past 100 years the Earth's average temperature has risen by 1.4 degrees Fahrenheit.¹ As a result, oceans are warming, ice caps

are melting, sea levels are rising, weather patterns are changing, and organisms are being impacted. The current rate of extinction is 1,000 to 10,000 times the natural rate, and climate change is playing a role.²

Current State of the Karner Blue Butterfly

Karner blue butterflies (*Lycaeides melissa samuelis*) have a wingspan of about one inch. Their appearance differs based on gender. The top of the male's wings are solid purplish-blue with a black and white border. The top of the female's wings are blue in the center and brown along the outside, with black dots surrounded by orange crescents along the trailing edge. The Karner blue is currently on the federal endangered species list. It was added to the list in 1992 after years of habitat loss, fire suppression, and habitat fragmentation contributed to its population decline. Since then, much work

has been done to improve Karner habitat. Carefully managed prescribed burns help ensure that populations of wild lupine, the Karner's only source of food, remain plentiful. Karner populations are monitored each year. Despite the extra protection this butterfly has received through the Endangered Species Act, the Karner blue is still struggling to survive. Karner blue butterflies must deal with the implications of climate change, which is playing a role in the growth, development, and reproductive patterns of this butterfly species.

Karner Blue Research

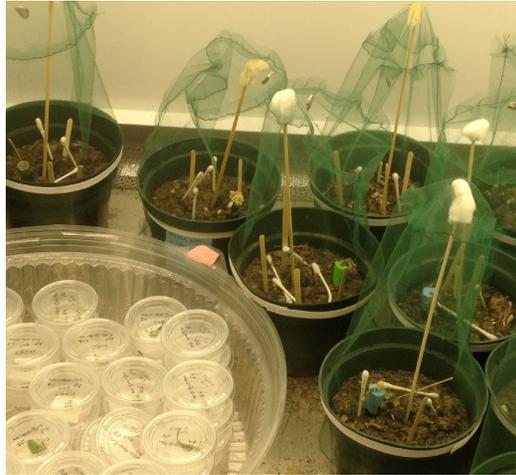


Photo by Jill McNabney

Plastic cups holding larvae and larger containers holding adult females and eggs are kept in one of four chambers maintained at different temperatures to test the effects of a warming climate on Karner development.

Dr. Jessica Hellmann at the University of Notre Dame is working with Dr. Ralph Grundel of the United States Geological Survey (USGS) to research the impacts of climate change on the Karner blue butterfly. Several different experiments are currently underway to see how a warming climate is changing the development, reproductive patterns, and behavior of these butterflies. Preliminary results from Dr. Hellmann's lab have shown that the warmer the temperature Karners experience (during all stages of development), the less time it takes for the butterflies to develop. More rapid development time means less time spent eating, and results in smaller and lighter weight butterflies. Additionally, each successive generation (brood) develops



Photo by Tammy Patterson

Data loggers measuring ambient air and soil temperatures help researchers identify microclimates that will be suitable for Karner survival at Indiana Dunes National Lakeshore in the future.

more quickly than the prior generation and produces yet smaller butterflies. Smaller butterflies are likely to produce fewer eggs. In nature, Karner blue butterflies generally go through two generations each year. Eggs laid in late summer over-winter and hatch in April when the larvae have lupine leaves available for food. During unusually warm summers, Karner blues have been observed to enter a third generation. Results from Dr. Hellmann's lab have shown that in temperatures just a few degrees warmer than historic averages, these butterflies will go through both a third and fourth generation. This is problematic for wild Karners who attempt additional generations for several reasons.

Implications for Wild Karners

As human activity accelerates climatic warming, the endangered Karner blue butterflies respond with more rapid growth rates and altered reproductive patterns. When warmer climates trigger more than two generations per summer, the smaller Karners which develop will lay fewer eggs. In mid- to late summer, wild lupine plants can also die back while the extra generations of Karner larvae are still looking for food. Without food, Karner blues may not become adults. Without adults, no eggs will be laid. In each scenario, the number of Karners that survive into the next year dramatically decreases. Karner populations are already incredibly low. With so few

Karner blues it is increasingly important for every individual to contribute to the next generation of the species. Based on these findings, the researchers at Notre Dame and the USGS, and managers at Indiana Dunes National Lakeshore are developing mitigation strategies to help the Karner blue escape extinction. Strategies include providing more suitable habitats for lupine and potential relocation of Karner blue butterflies to different areas with suitable microclimates. Scientists are currently working to identify such suitable microclimates within Indiana Dunes National Lakeshore.

¹ Chivian, E. and A. Bernstein (eds.) 2008. Sustaining life: how human health depends on biodiversity. Center for Health and the Global Environment. Oxford University Press, New York.

² <http://www.epa.gov/climatechange/basics/>