

# Butterflies and Climate Change

by Astrid Caldas

Climate change is among the biggest challenges of this century, not because the Earth has not gone through drastic climate changes before, but because the changes happening now are compounding other, severe problems faced by the environment. There are more species in danger of extinction than ever before, and climate change only adds to that number. Human activities have degraded the quality of the landscape so much that species and habitats may have less capacity to respond to environmental threats –including a changing climate. Therefore, it is essential that new, effective conservation plans include a climate adaptation component, either from early stages or as a later inclusion. That is especially true with butterflies.

Many studies have already shown that butterflies are among the species that have responded the most to climate change, usually in the form of northward or elevation range shifts. Federally listed as endangered, ‘Quino’ Variable Checkerspot is an example of a butterfly population that is directly threatened by climate change and habitat destruction

Climate change will also affect species’ life cycles, flight times, essential interactions, and ultimately survival. There are many documented instances of disruption of essential interactions of butterflies with their foodplants, most notably of Edith’s Checkerspots and the mismatched timing with their caterpillar foodplants.

Recently, a number of researchers have warned that the common biological effect of shifting towards earlier-timed reproduction can have multiple and cascading effects. Species lacking adaptability may have reduced fitness, increased mortality, and disrupt a whole food web which had evolved to thrive when there was a synchronous timing of resources that can no more be found.

Climate change can also affect flight times in butterflies. Warmer temperatures will result in more generations of multiple-brooded species, but how this will affect egg-laying periods and other life traits that are determined by photoperiod (which is unchanged by climate change) is unknown.

Butterflies will respond to climate change differently depending on species, and even the same species may have a different response to climate change depending on the specific location where it is found. Population characteristics and constraints, as well as interactions with biotic and abiotic factors, are expected to be localized and in many instances unique.

Matthew Aardema, and his co-workers, recently discussed the issue of local adaptation in butterfly conservation, and the usefulness and importance of strategies such as captive rearing, habitat restoration, and managed relocation. Their main point is that depending upon the location and characteristics of the population, different conservation strategies are called for. We may need reintroductions and assisted migrations of species whose populations are declining and that have adequate, available habitat that could sustain a viable population under a warmer climate. Ann and Scott Swengel have suggested that other strategies based on the natural stability of habitats may be successful in keeping local populations stable under climate change and human disturbance.

But it’s not all gloom and doom! For instance, there may be some cases where climate change and global warming might have a positive effect on the survival of a butterfly species. In a 2011 paper, Anouk Cormont and collaborators found that some species’ dispersal ability, as measured by flight duration and behavior, increased with increased temperatures. The authors



Jeffrey Glassberg

*‘Quino’ Edith’s Checkerspots may not warm up to their changed climate. April 3, 1998. Jacumba Mtn, San Diego Co., CA.*

suggest that this could be a positive factor in overcoming habitat fragmentation and the ability of the species to persist under new conditions.

Where am I going with all this? My main point is that if conservationists are aware of the importance of climate change in shaping future scenarios, and realize that conservation practices that have worked in the past may not work anymore, they can adapt those practices to include climate change stressors and synergies, and still come out ahead.

In order for such conservation plans to be developed, there is a pressing need for a better understanding of how climate affects butterflies and moths, and also their essential interactions. Various studies have recently reviewed butterflies under the light of climate change, describing how butterflies and moths are responding to unprecedented – and many times faster – changes in their environment.

Unfortunately, the number of such articles is surprisingly low and somewhat worrisome. In a recent issue of the Journal of Insect Conservation dedicated exclusively to Lepidoptera conservation, one article, by Robert Wilson and Ilya Maclean, included a literature review of all papers published on

ISI Web of Science between January 2005 and December 2009 about climate change and/or biodiversity. Only 9 out of 73 papers that showed a link between climate change and declining biodiversity studied insects, eight of which dealt with Lepidoptera. These papers showed butterflies to be very sensitive to climate change, but there is much we still don’t know. I would advocate for not only more climate-related studies, but also for a return to more basic, natural history studies that can shed light on environmental and ecological traits that are important for a species. With more of those in hand, we can at least have a shot at designing more effective conservation plans.

Last but not least (and I hate to say this) European scientists are well ahead of United States scientists in the understanding of patterns of butterfly response to climate change. For every climate-related butterfly study in the United States there are at least 10 in Europe. We really need to step up to the challenge: If we, and future generations, are to keep enjoying butterflies for years to come, we need more climate change-related studies, and we need to be aware of climate change effects on butterflies. 🦋