

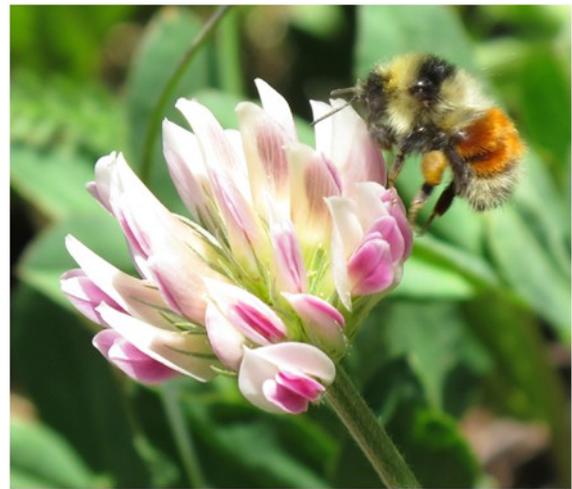
CRITICISM MISMATCHED: RESPONSE TO DE KEYZER ET AL. 2016

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Recent bee declines have been widely publicized, alarming many in the public and scientific community. In their critique of our 2015 study on bumble bee tongue length evolution, de Keyzer et al. (2016) express concern that our results will be used to support *laissez faire* conservation. In our response, we clarify that we do not advocate for reliance on evolution to conserve bees. While the alpine bumble bees in our study have evolved quickly in response to flower deficits, their populations are buffered from *multiple* stressors that affect species living at lower altitudes (such as pesticides and habitat loss). The combined effects of these stressors pose serious threats to bee populations globally and should be addressed with active, concerted conservation efforts.

While de Keyzer et al. concede that bumble bee tongues are shorter now than they were 40-50 years ago, they question whether this change is adaptive. They describe several alternative hypotheses that may affect tongue length. We address each of these alternative hypotheses in our response and elaborate on the support for our claims. We highlight evidence presented in numerous other studies and in the supplementary materials of our own study that refute their alternative explanations. We conclude that the evidence strongly supports a change in selection regime. Historically, the long-

tongued specialist bees were favoured, because they could extract a lot of energy-rich nectar from their deep-flowered host plants. Now that flowers are scarce in the alpine, bees must forage from a greater diversity of flowers to support their energetic needs, resulting in selection for shorter, more energy-efficient tongues.



Bombus sylvicola forages on *Trifolium dasyphyllum*. As flowers have become scarce in the alpine, bumble bees have expanded their diet, visiting many species they once bypassed. Photo credit: Jennifer Geib.