



If the timing of phenological activity (e.g. flight period, nesting) of an animal species (dark blue curves) undergoes a timing shift from time (1) to time (2), this shift could reduce the overlap (green shading) with the phenological timing (e.g. flowering, fruiting) of its primary plant food resource in this location (light blue curve) resulting in phenological mismatch (Figure A). The resulting asynchrony could be lessened in three ways:

- **Resource Extension:** by extending the timing of the plant resources, the overlap at time 2 is increased (Figure B)
- **Supplemental Resources:** If the focal animal species can accept alternative food resources, adding another complementary plant species (red curve) into the community could also reduce mismatch (Figure C) **Consumer Extension**: Similarly, asynchrony may be reduced if the timing of the focal animal species itself can be extended (Figure D)

Acknowledgements

This work is a collaboration between Point Blue Conservation Science and UC Berkeley. This material is based upon work supported by the National Science Foundation Graduate Research Fellowship under Grant No. 1049702. Any opinion, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation. Photos by Alexander C. Yang.

Mismatch Managed? Strategies for buffering phenological asynchrony

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Photo by Alexander C. Yang

SUMMARY

- Predictions of mutualistic species becoming mismatched in time due to climate change call for novel conservation strategies.
- We call scientists to propose and test effectiveness of potential strategies to address mismatch concerns.
- We propose increasing the duration of phenological timing as one possible strategy for buffering phenological asynchrony impacts.
- Strategies to extend phenological duration could include resource and consumer extension, as well as providing supplemental resources.
- Current techniques for managing biodiversity can achieve the strategies proposed, and system resilience to phenological mismatch may not require considerably novel approaches.

Techniques to lengthen phenological duration:

- 1. Planting a suite of species with diverse blooming and fruiting times
- 2. Planting a variety > of genotypes in one location

3. Utilizing diverse microclimates (e.g. north & south aspects)

mowing)

5. Planting on a

across the

season

variety of dates

Day of Year tivity

Day of Year

- 4. Manipulating Activity density (e.g. grazing,
 - enological

Day of Year

Day of Year



Day of Year



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