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Forests, Lands, Natural
Resource Operations
and Rural Development

Phenological mismatches influence biocontrol in a changing climate

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Put my
face here!

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David Ensing, with Tyler Nelson & Dr. Chandra Moffat

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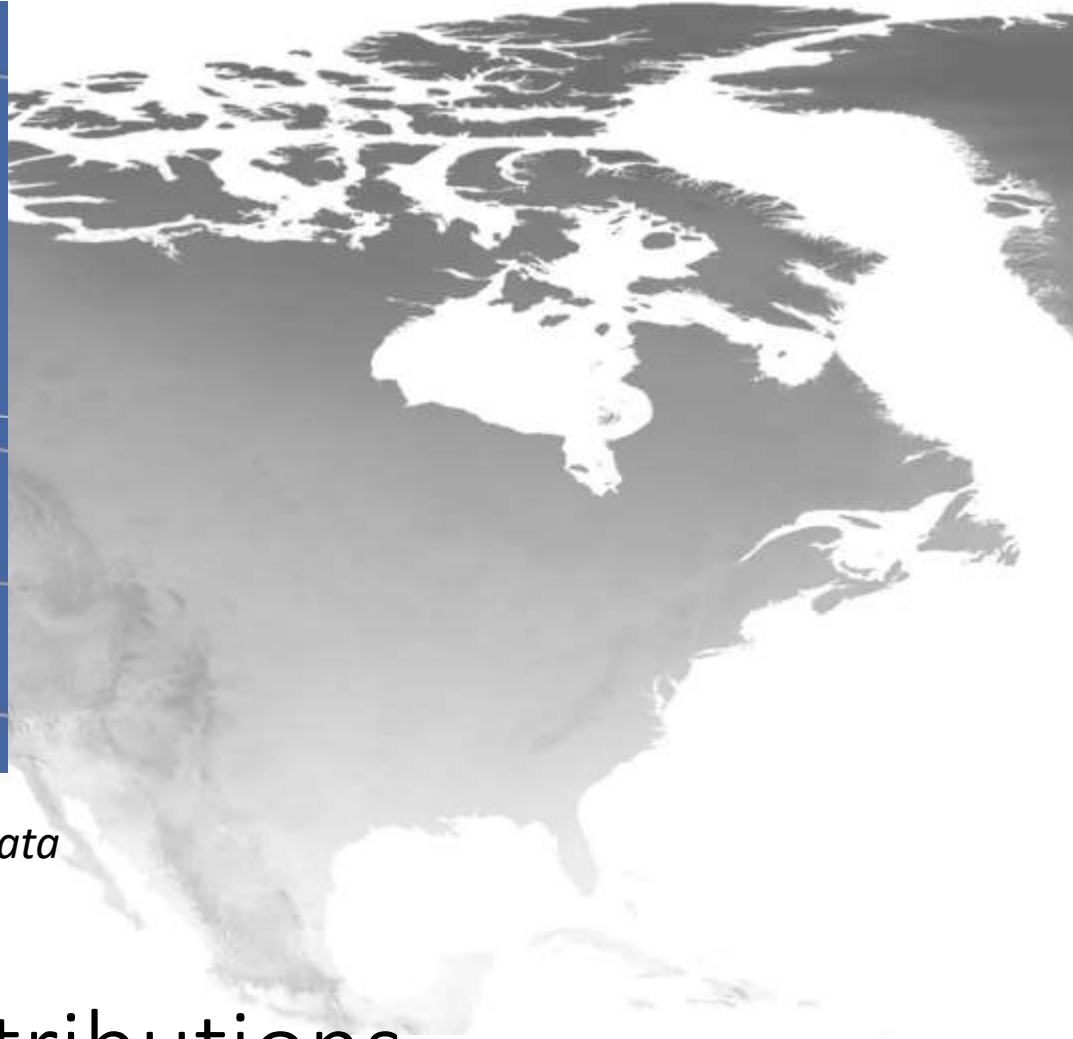
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Geographic species distributions





Yellowdevil hawkweed, *Pilosella glomerata*
(Ensing, Moffat, and Pither 2013)

Climate defines distributions...

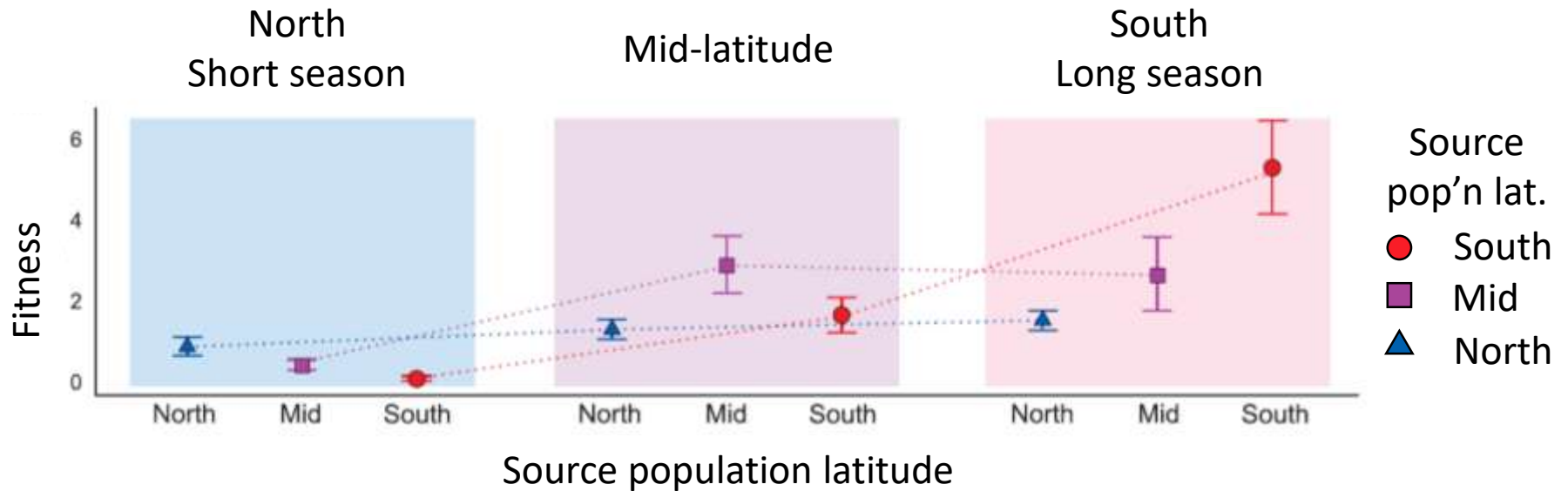


Yellowdevil hawkweed, *Pilosella glomerata*
(Ensing, Moffat, and Pither 2013)

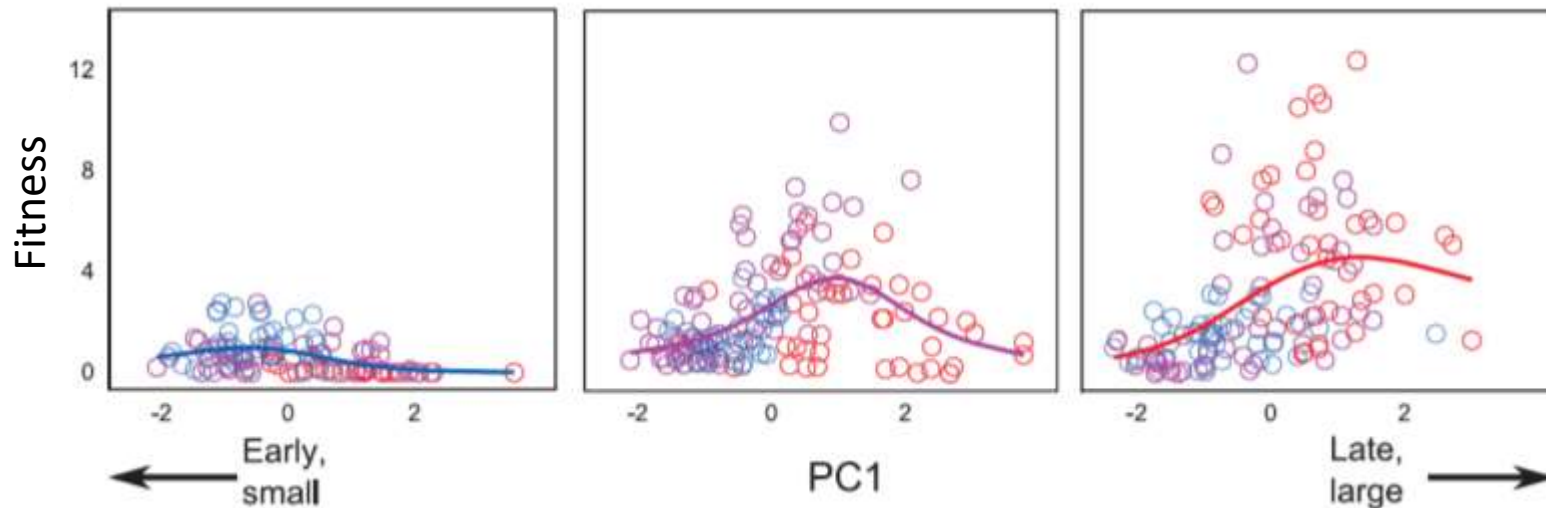
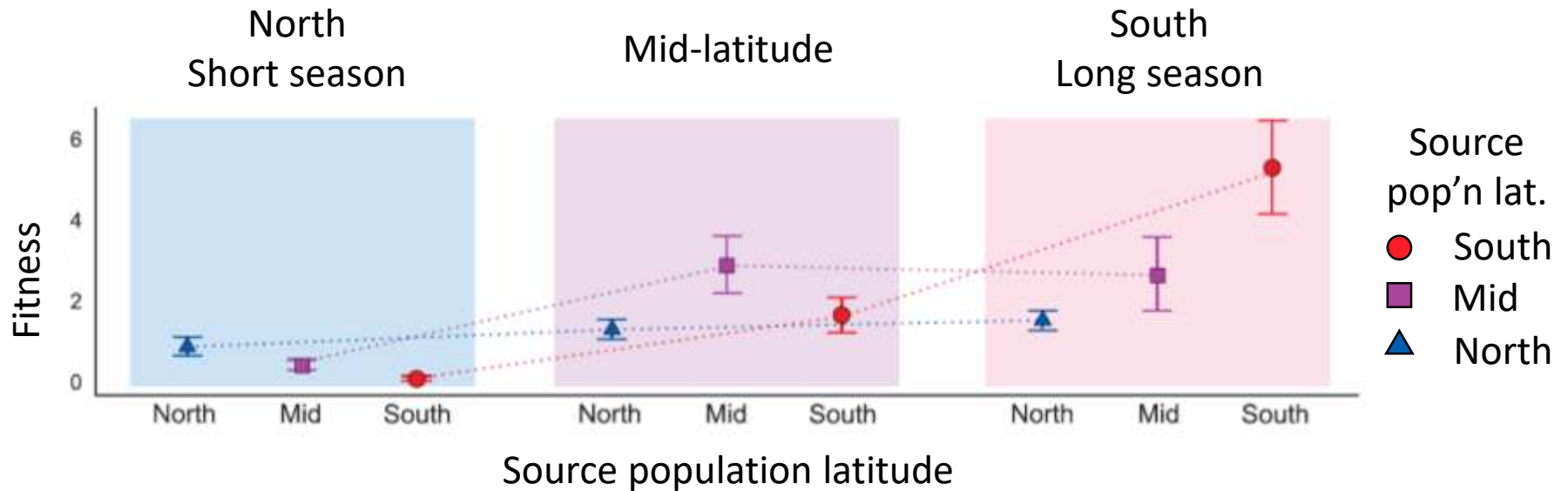
Purple loosestrife, *Lythrum salicaria*
(Colautti et al. 2010; Colautti & Barrett 2013)

Climate defines distributions and invasives
adapt to local climates...

...and the mechanism is phenology

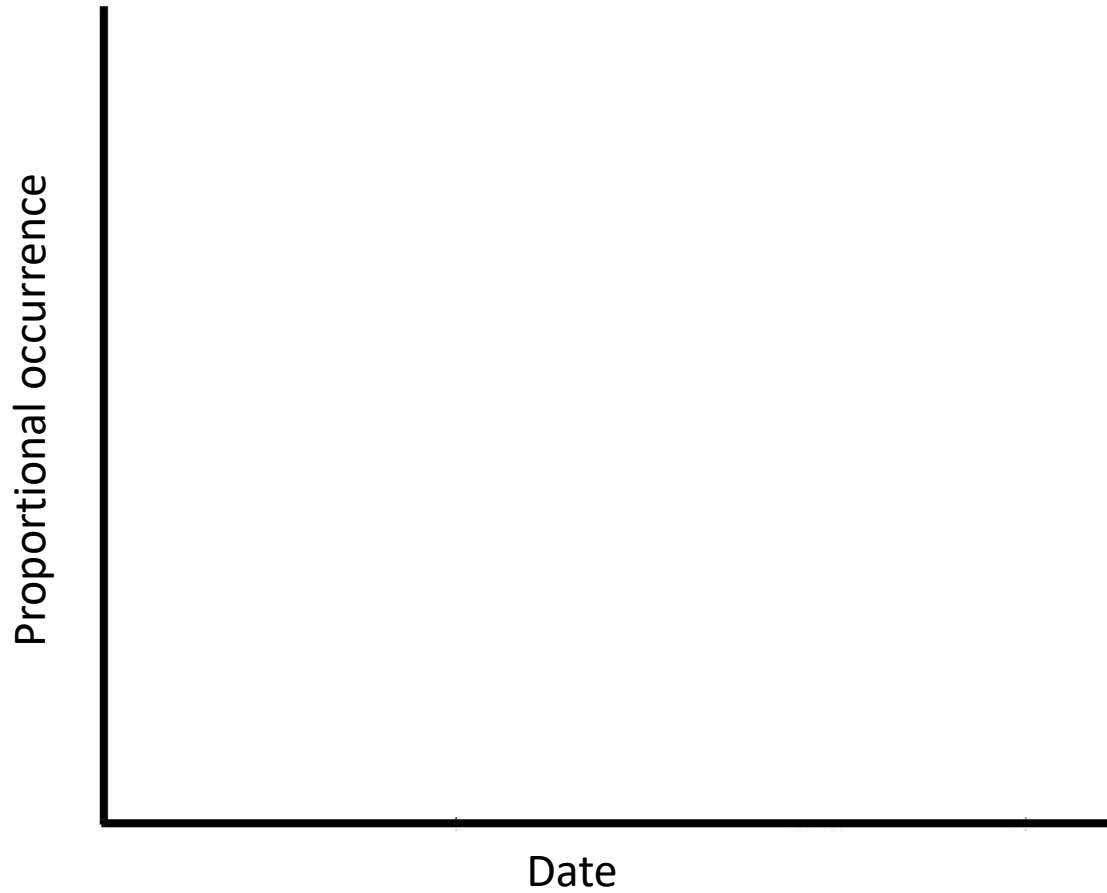


...and the mechanism is phenology

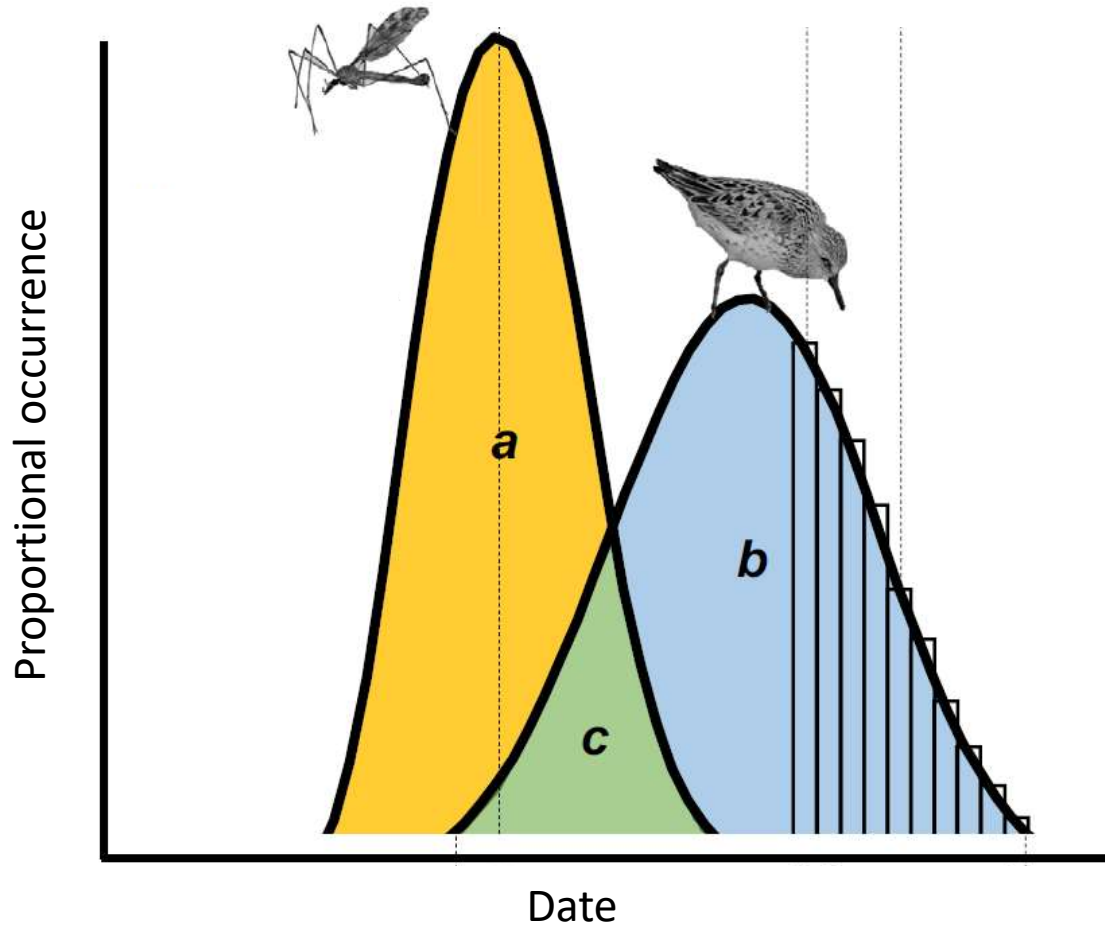


(Colautti et al. 2010; Colautti & Barrett 2013)

Mismatches

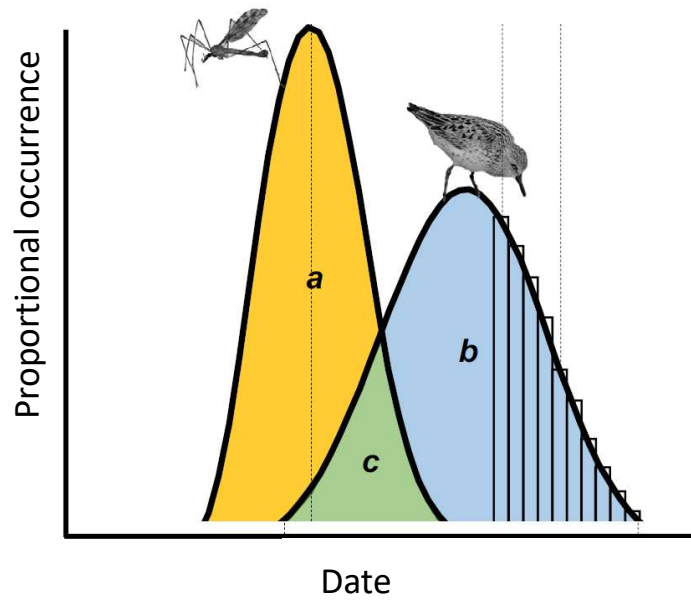


Mismatches

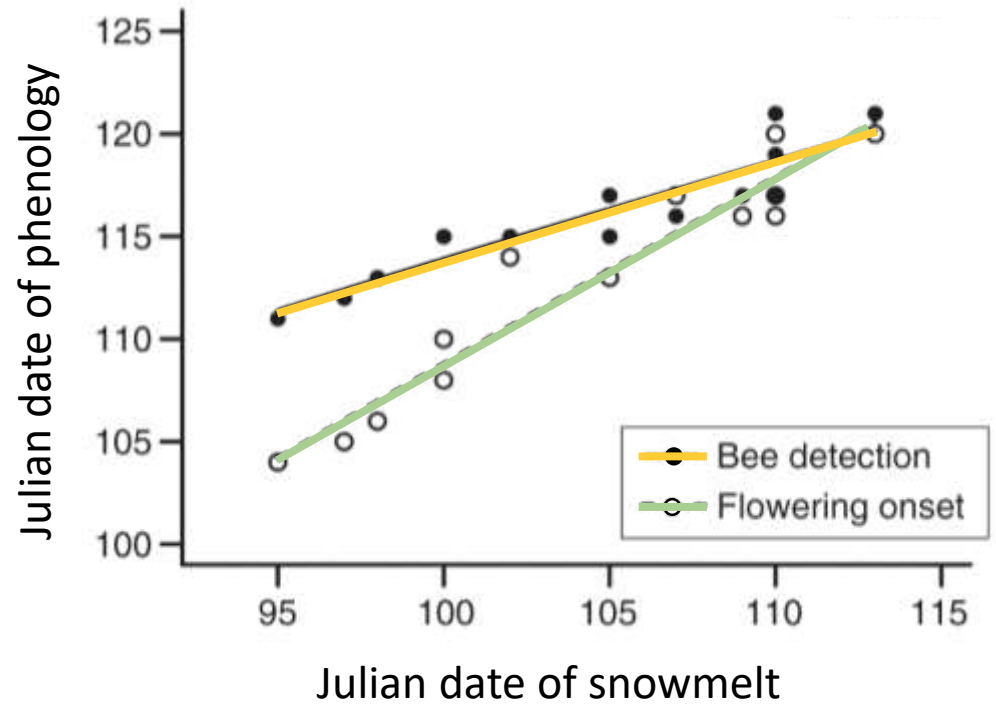


(Miller-Rushing et al. 2010; Kwon et al. 2019)

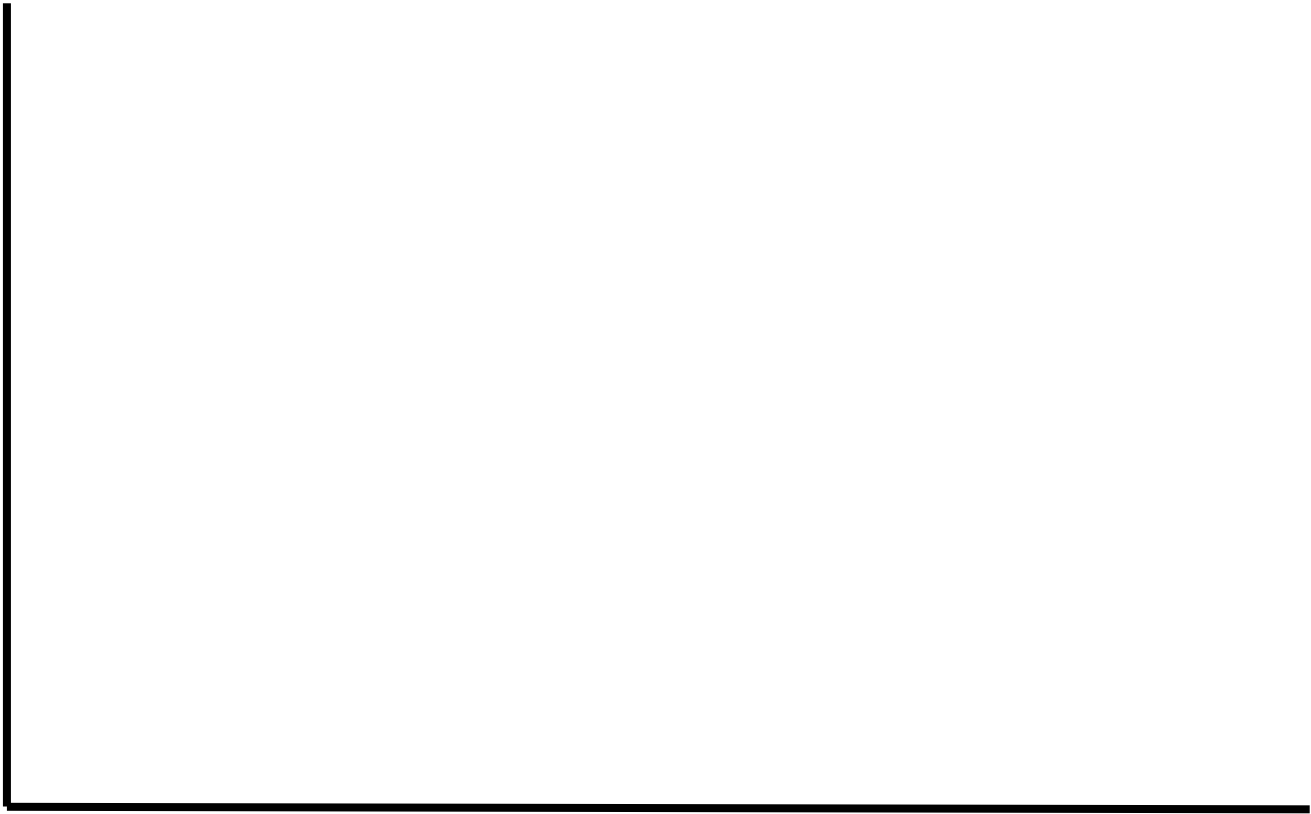
Mismatches



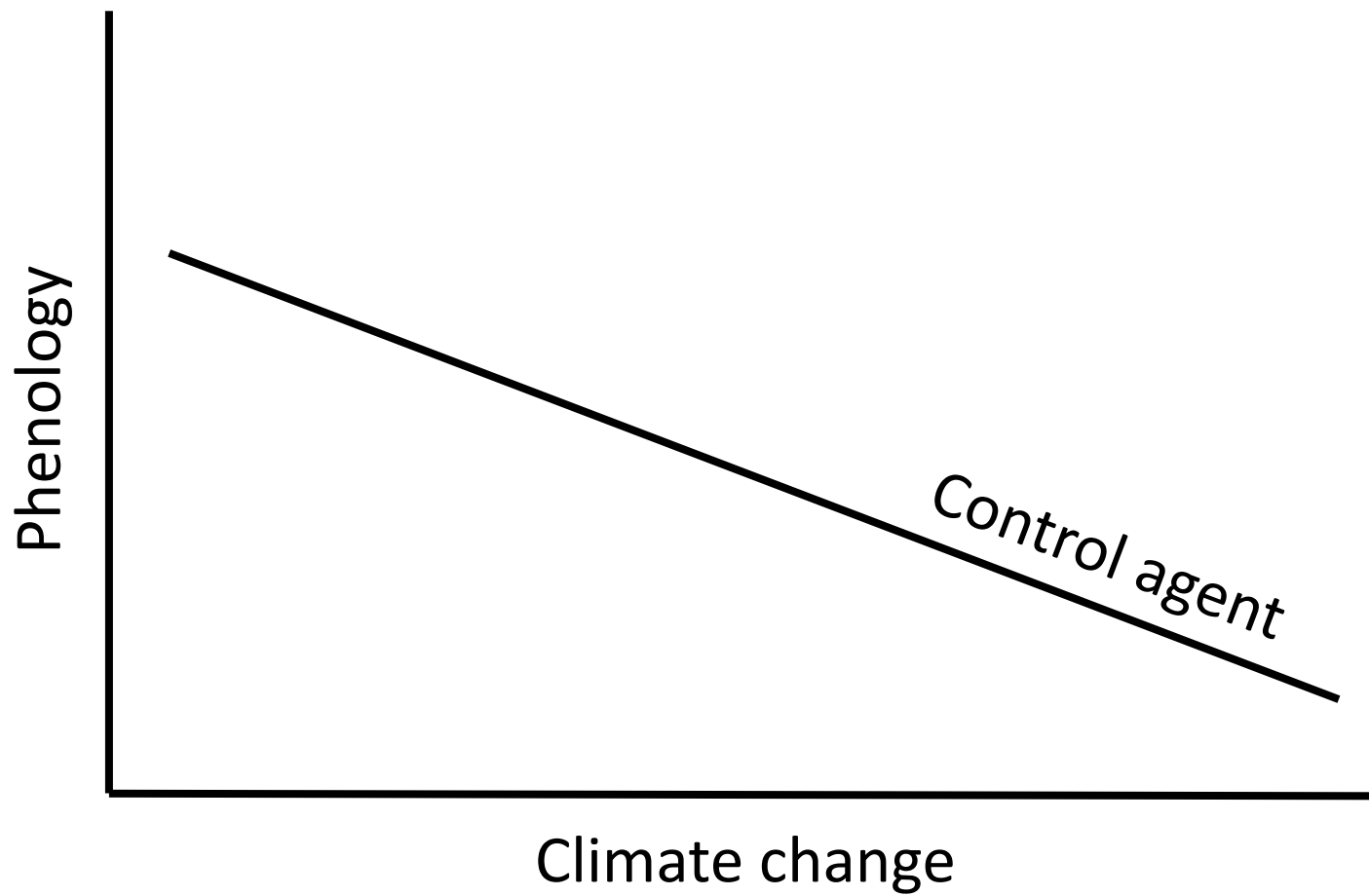
(Kwon et al. 2019)

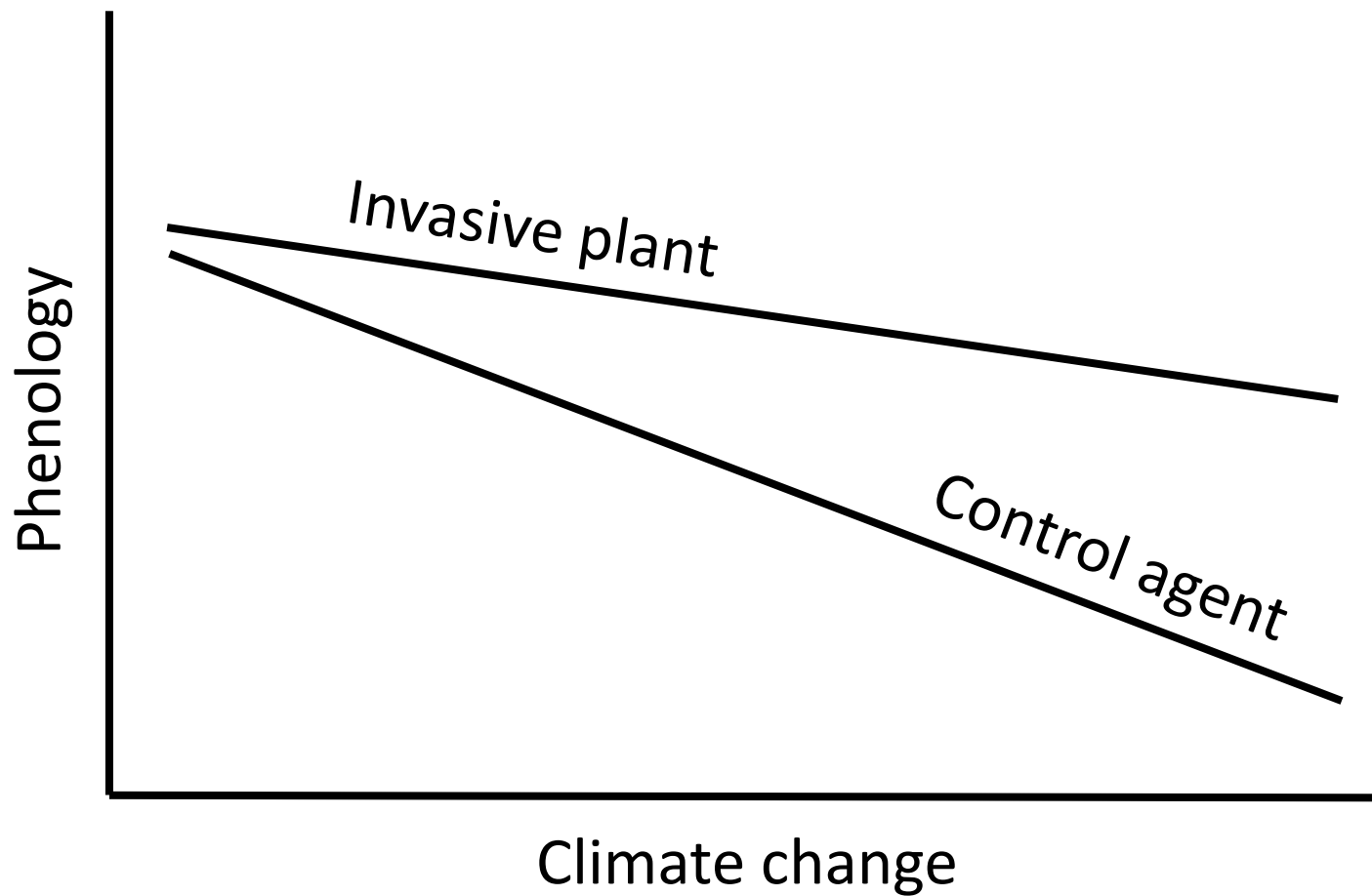


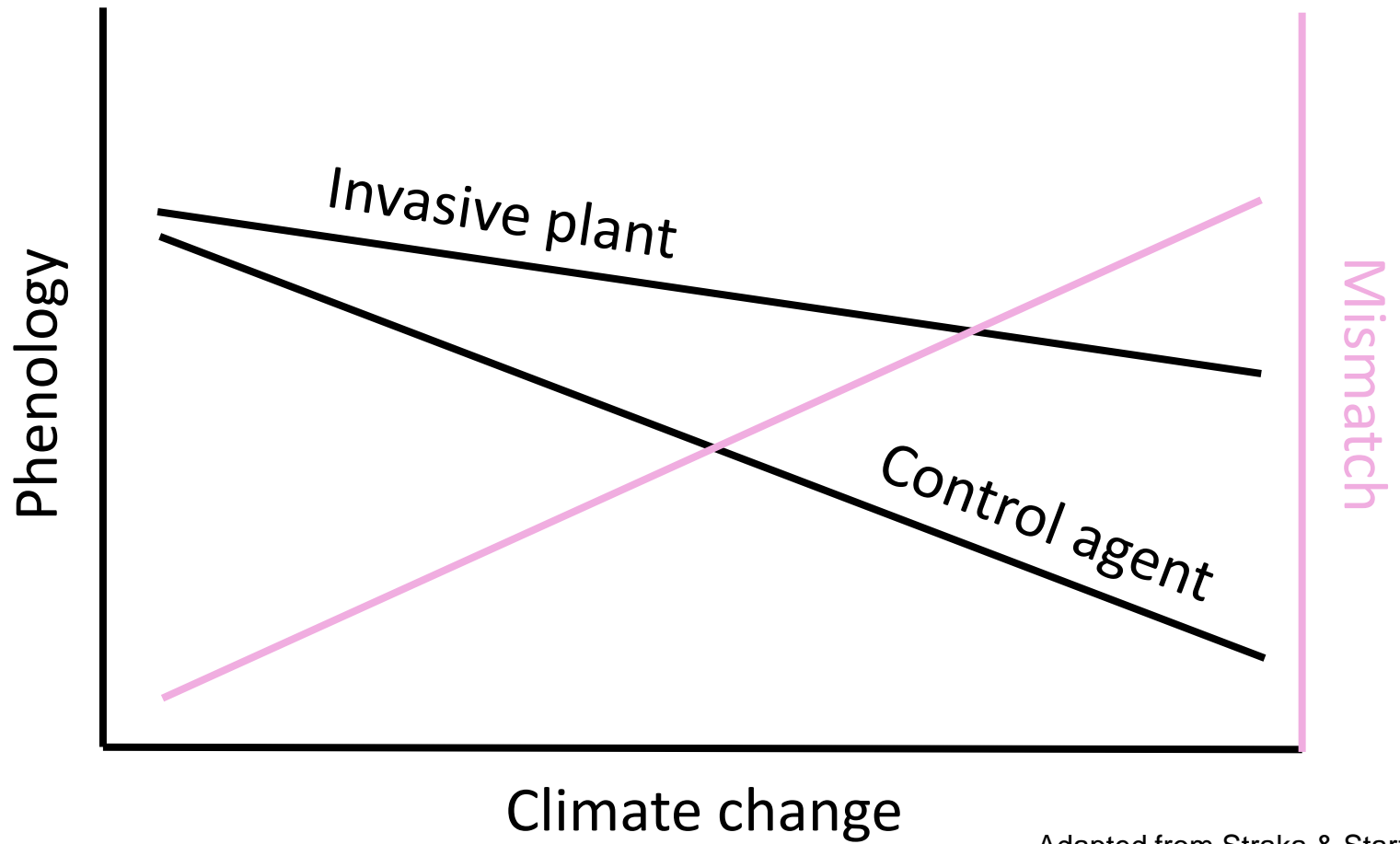
(Kudo and Ida 2013)

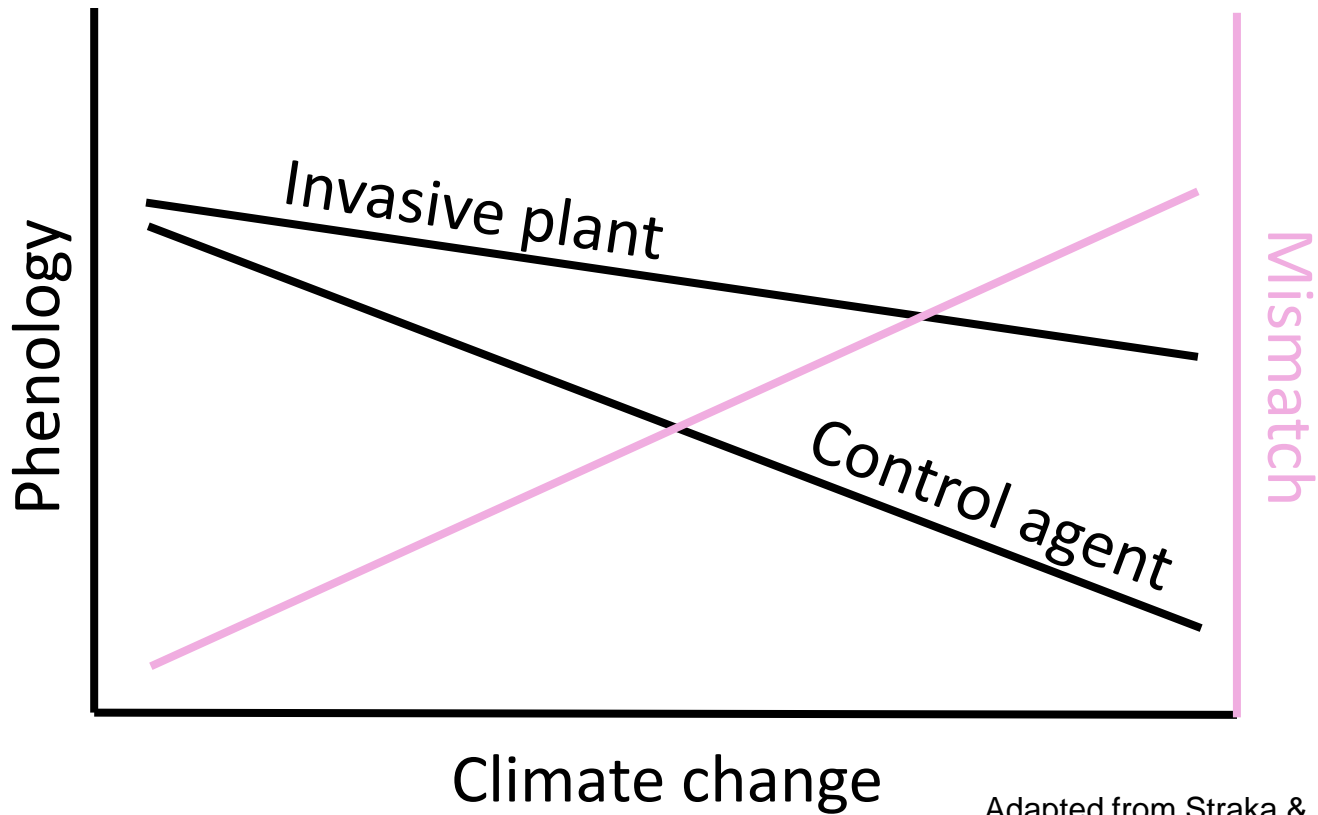


Climate change

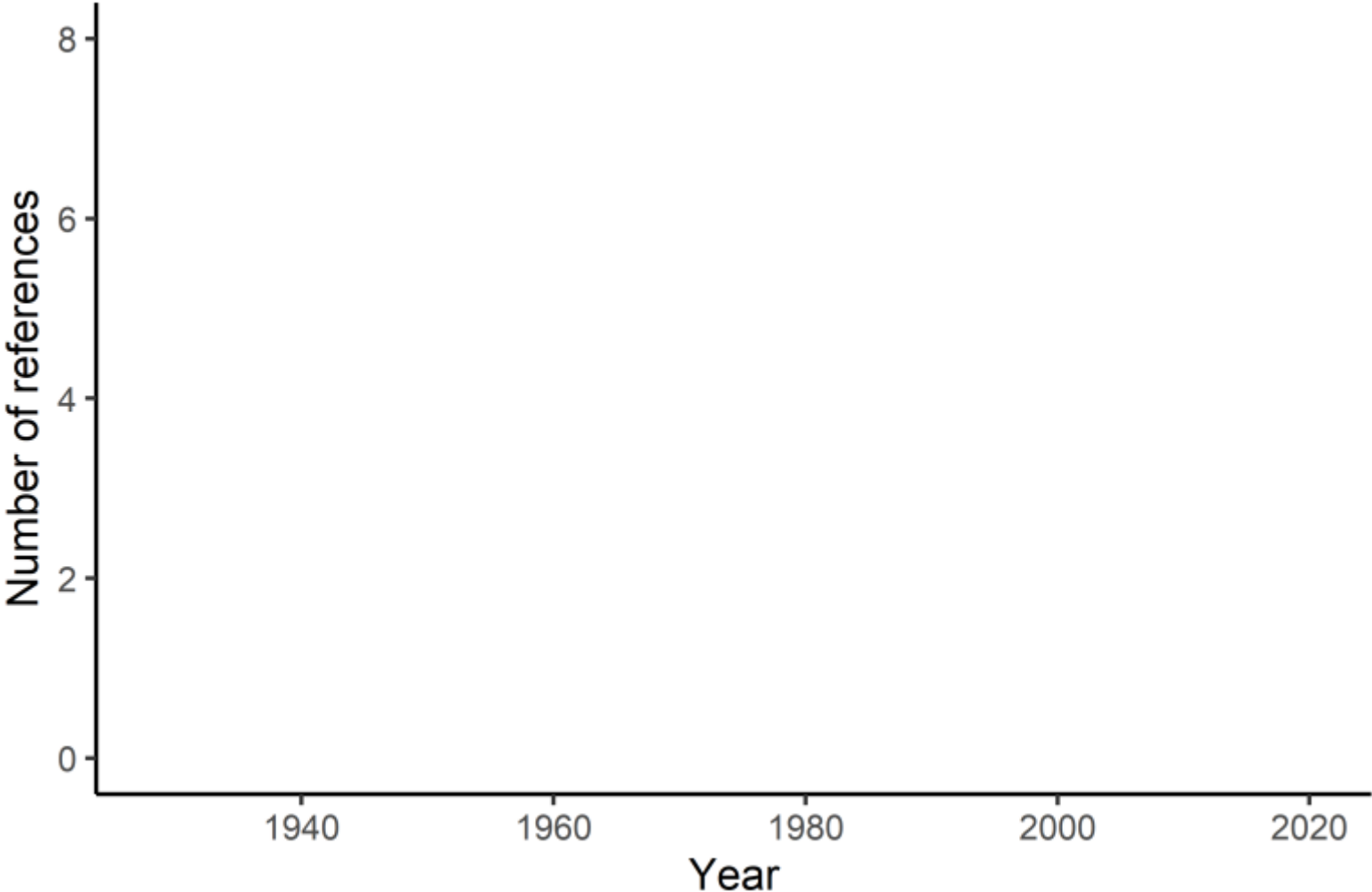




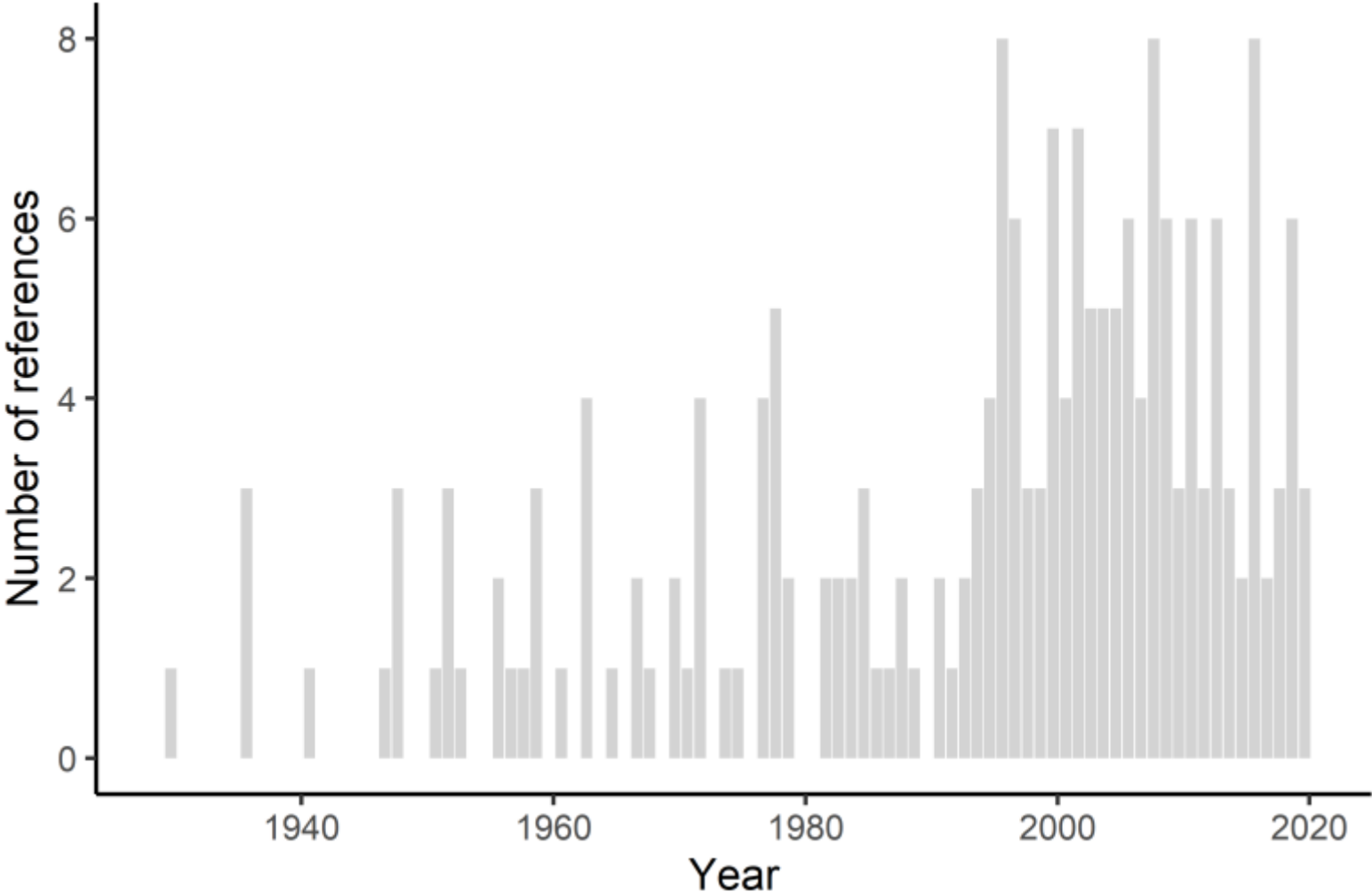




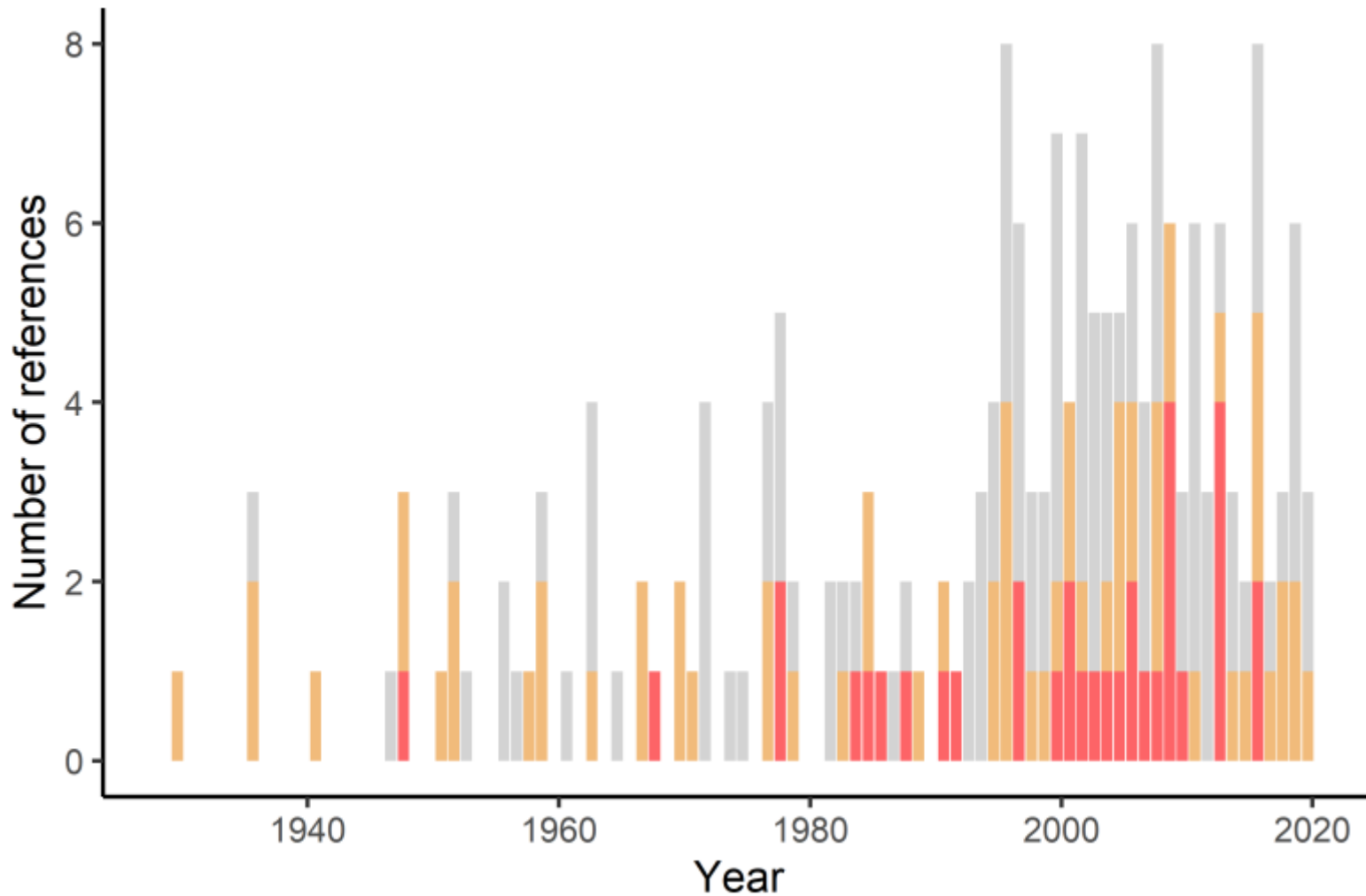
Literature review



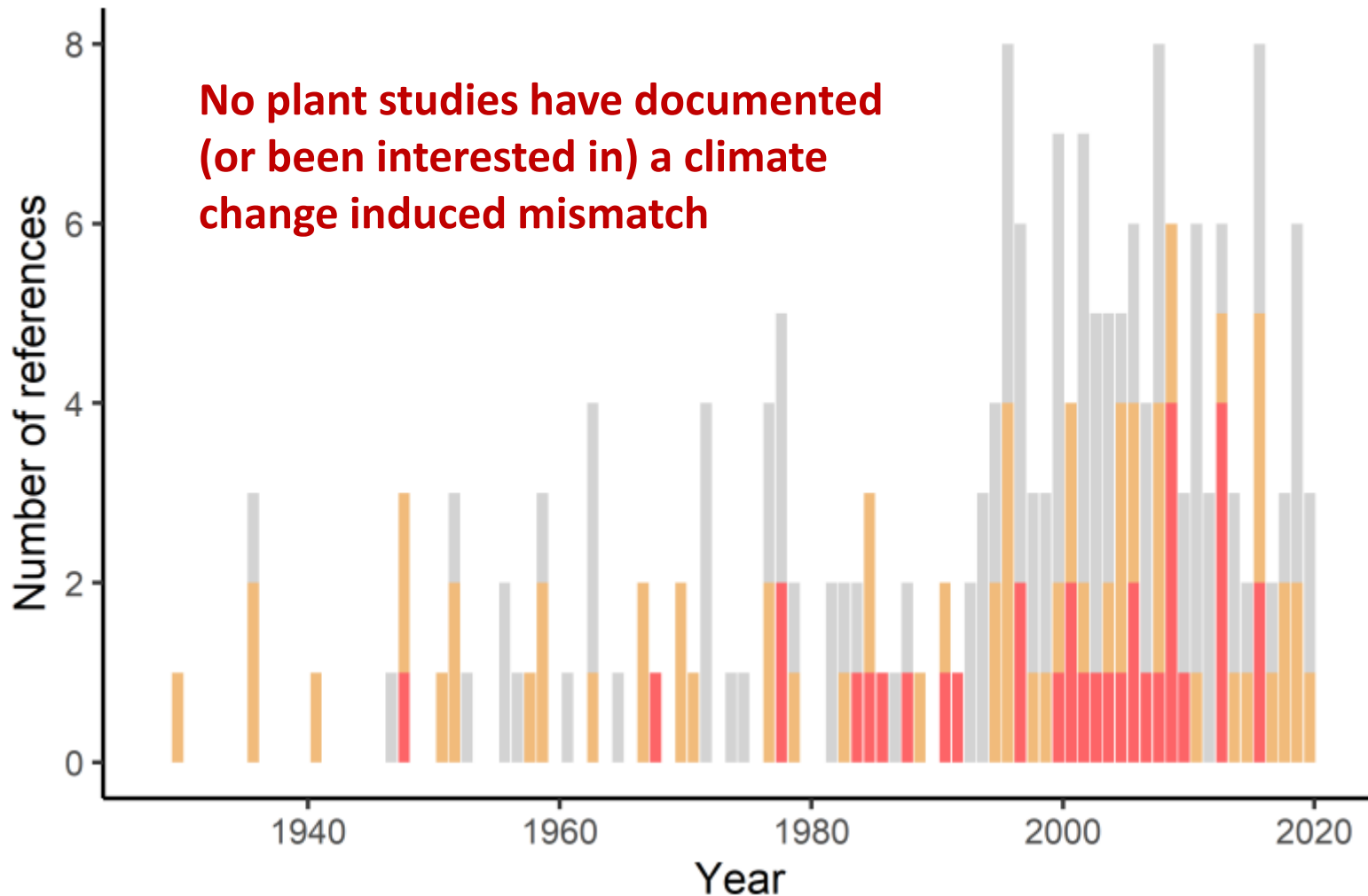
Literature review – 198 articles



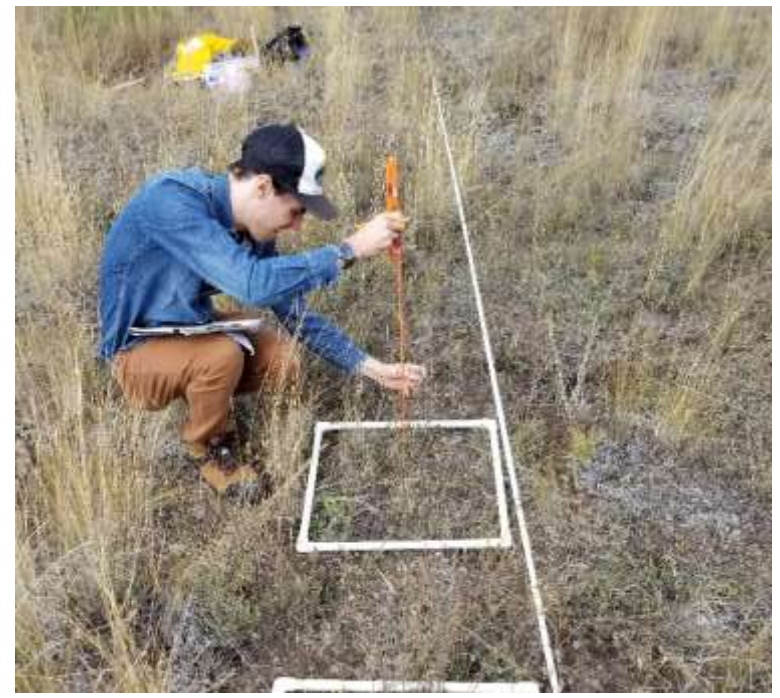
- Insect target ($n = 71, 36\%$)
- Plant target ($n = 39, 20\%$)
- Not primary articles ($n = 88, 44\%$)



- Insect target ($n = 71, 36\%$)
- Plant target ($n = 39, 20\%$)
- Not primary articles ($n = 88, 44\%$)



Spotted knapweed
(Centaurea stoebe ssp. micranthos)



St. John's wort
(Hypericum perforatum)





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Thanks!



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