Understanding urban centers as ecological traps for avian migrants

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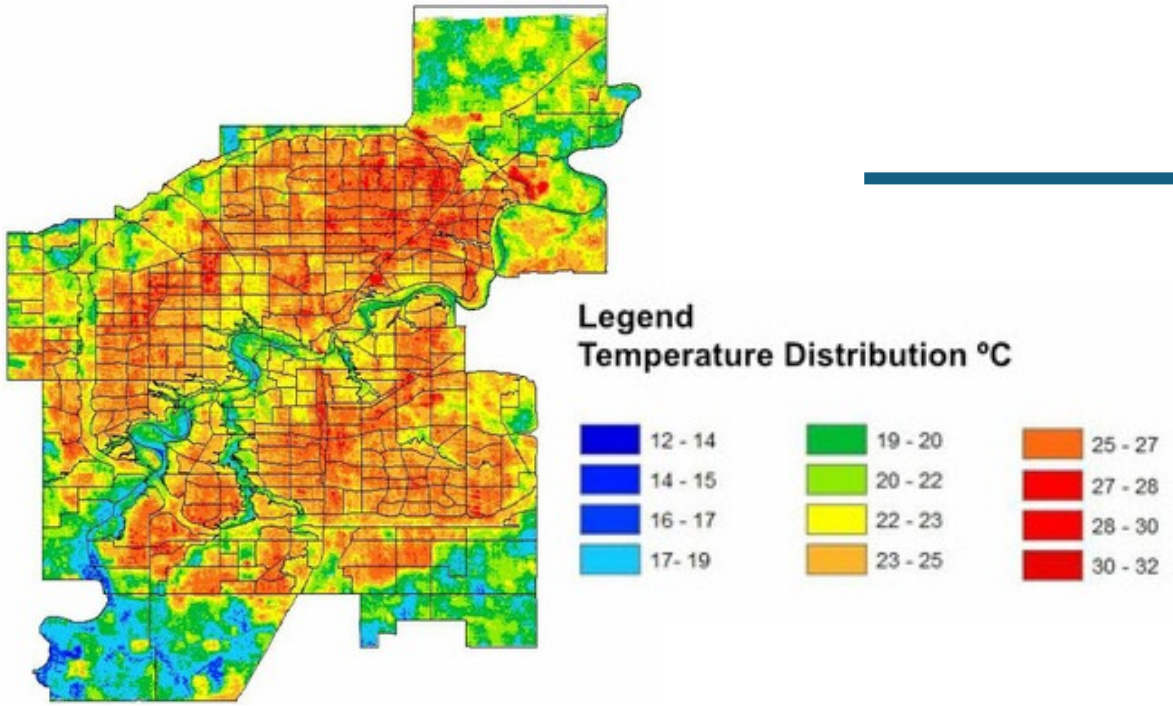
Higher temperatures in urban areas alter seasonal processes

Urban heat island

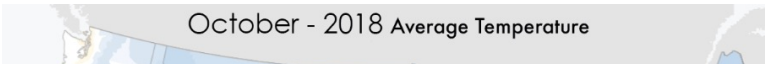


Welegedara et al. 2023.
Sustainable Cities and Society

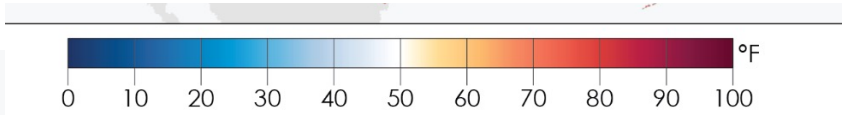
Later end-of-growing season

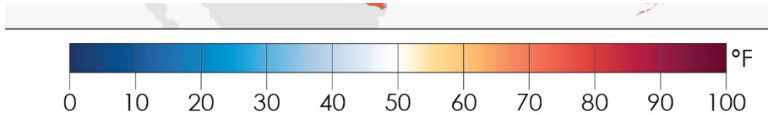
Earlier start-of-growing season

Migration phenologies may synchronize with seasonal land surface changes that ***limit*** migratory progress



Could higher temperature and extended growing seasons in cities effect bird migration phenology?

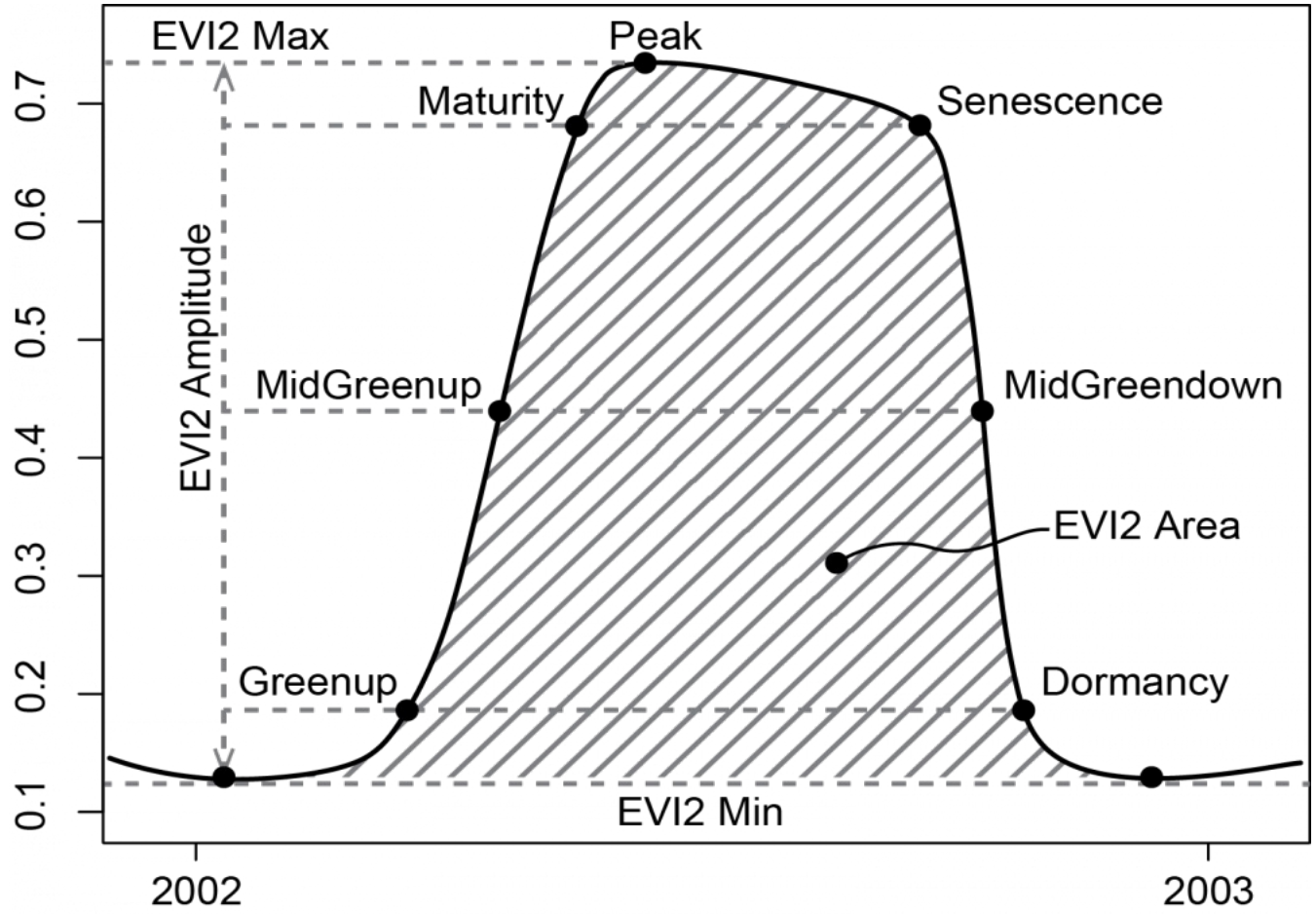




Land Surface Phenology shows how the greenness of the land surface changes over time

MODIS

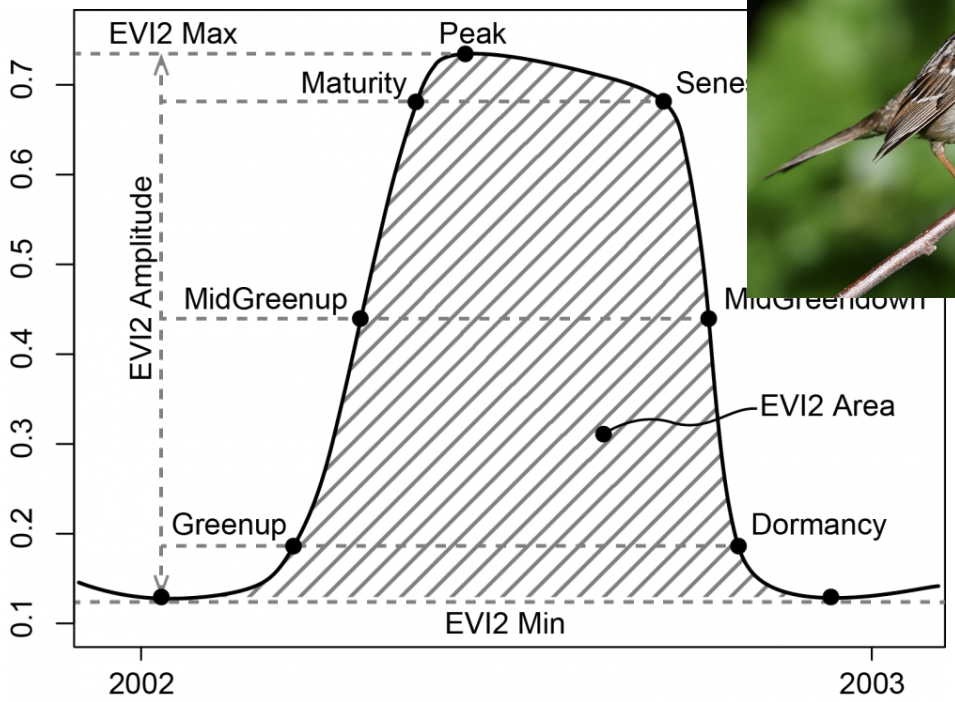
Moderate Resolution Imaging Spectroradiometer



USA National Phenology Network. 2019.

Migration phenologies may synchronize with peaks in resource abundance

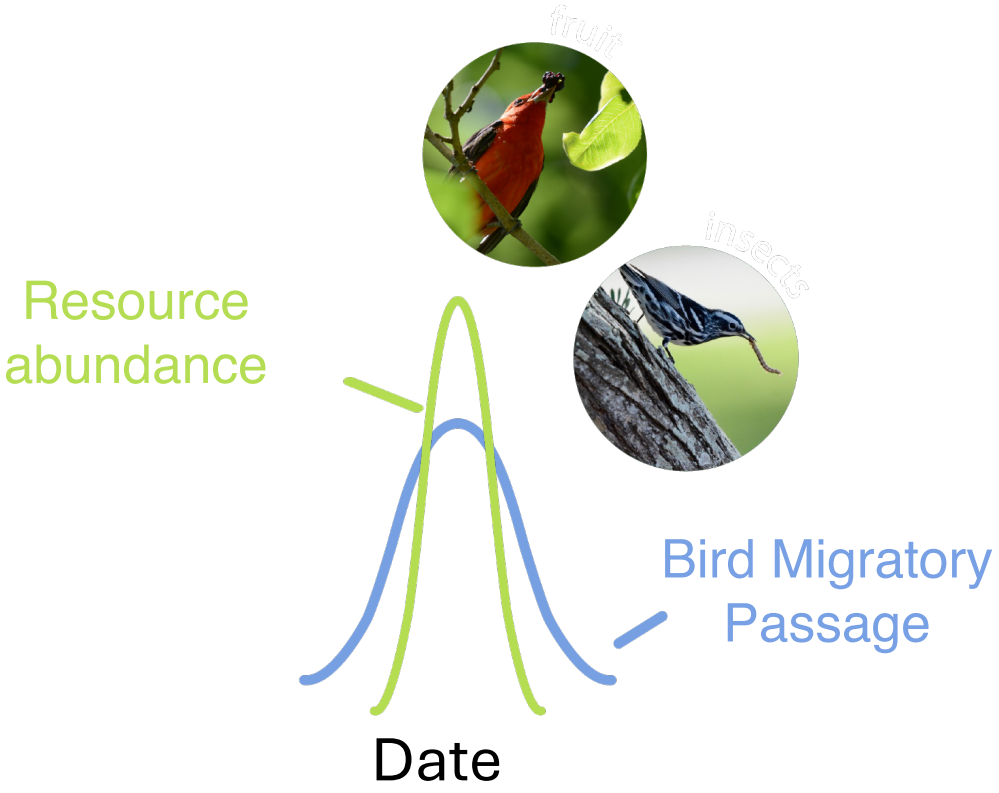
May follow the “green wave” northward

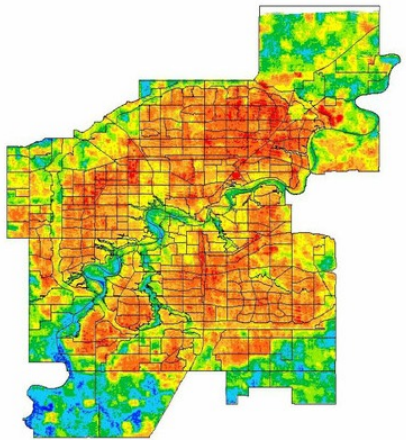


USA National Phenology Network. 2019.

May follow a wave of aquatic insect emergence

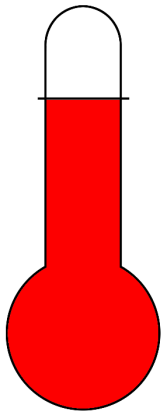
Changes to resource phenology
→ Phenological mismatches or asynchronies





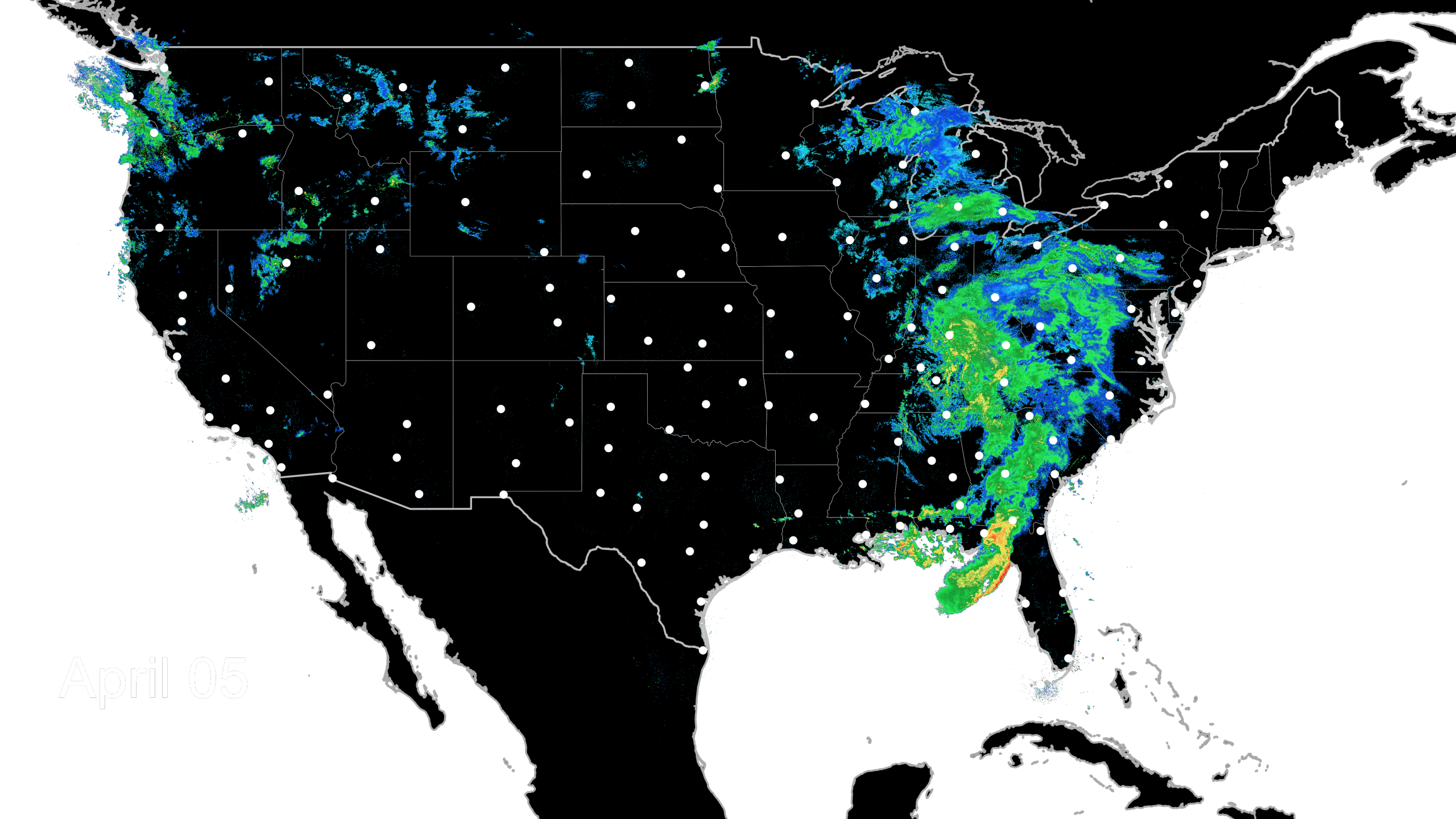
Research objective: Identify conditions that bird migration tracks across latitudes

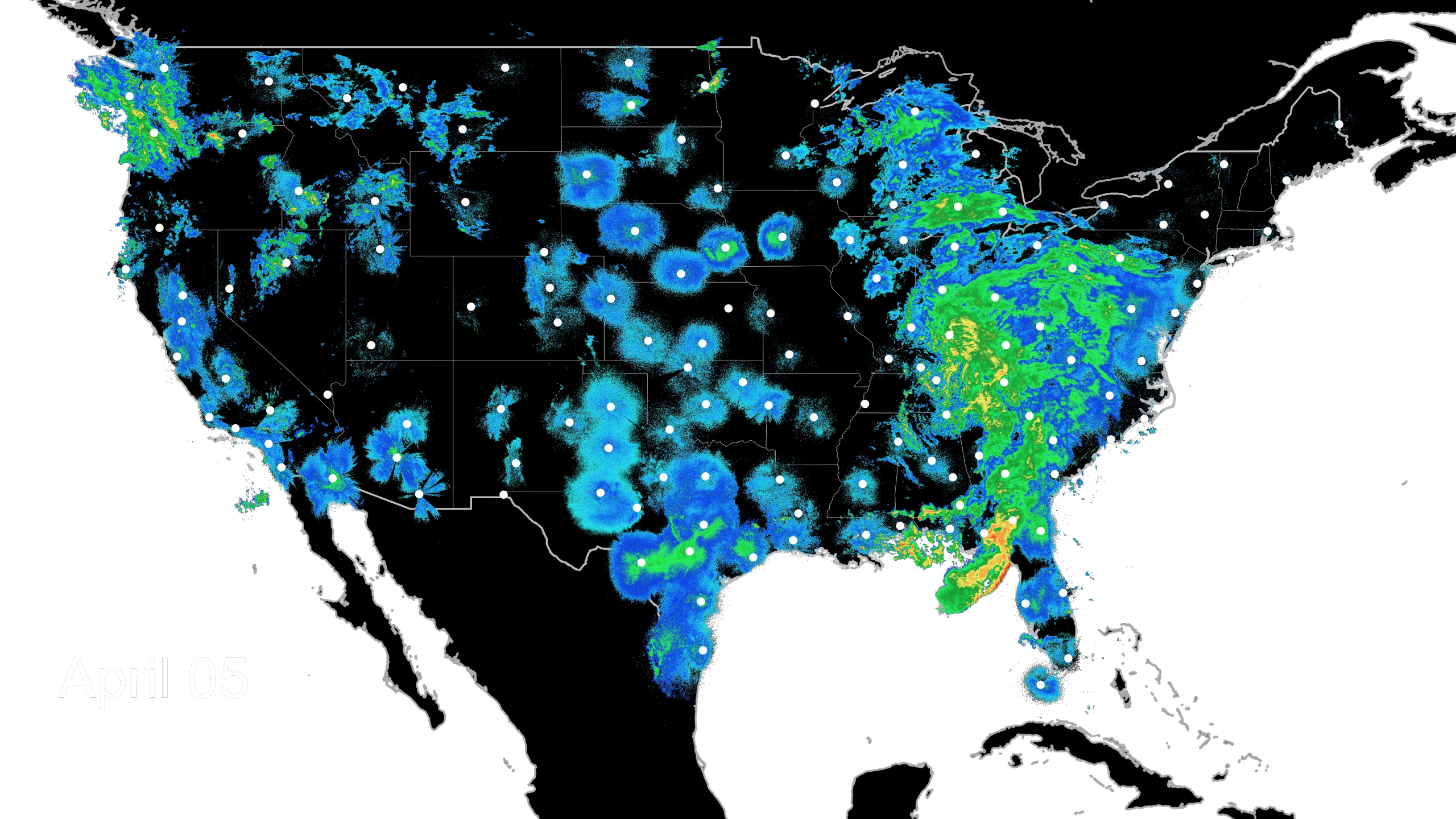
Texas Parks and Wildlife

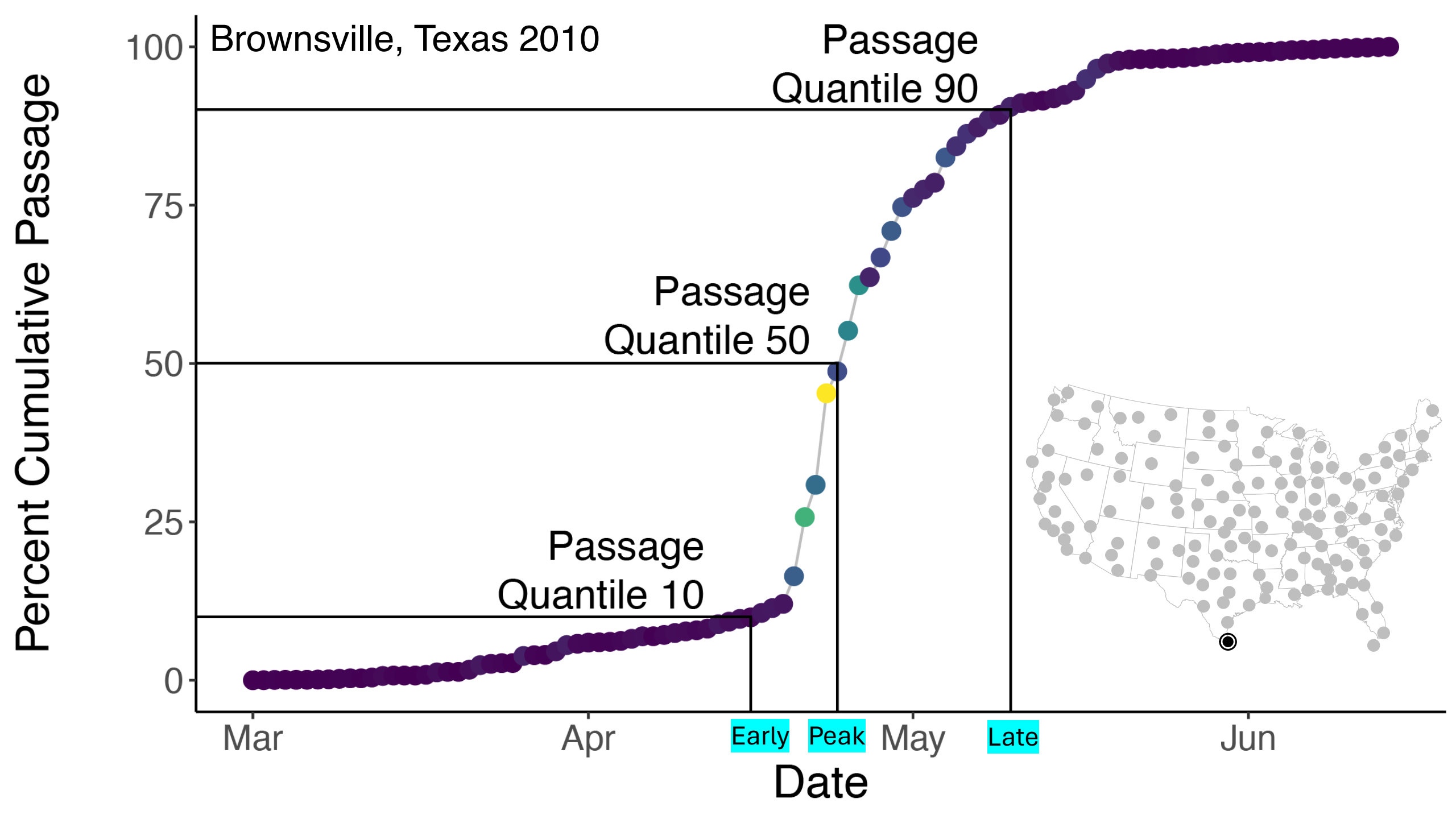


106ºW

87ºW

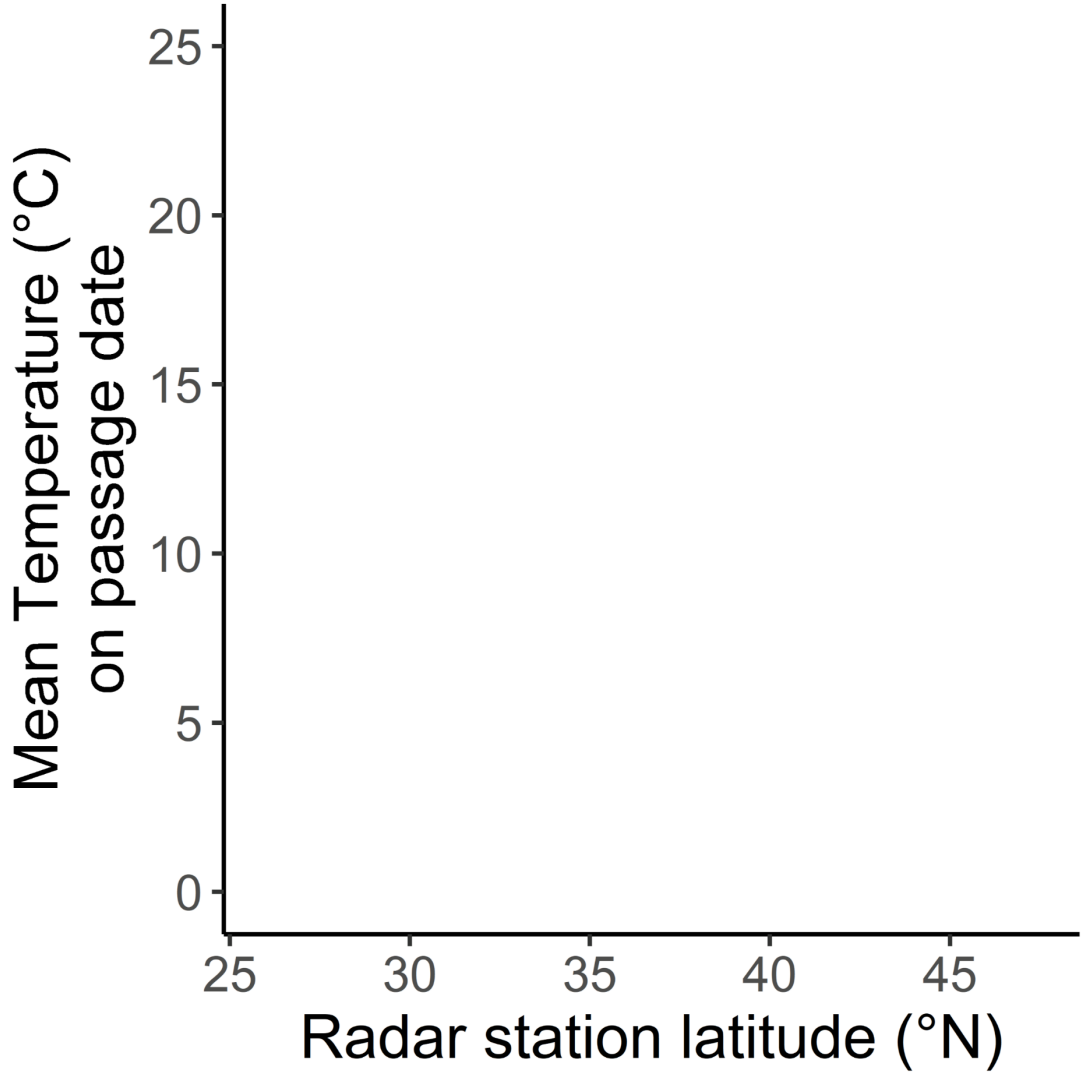

April 05


April 05


Brownsville, Texas 2010
Passage
Quantile 90
Passage
Quantile 50
Passage
Quantile 10
Percent Cumulative Passage
100
75
50
25
0
Mar
Apr
Early
Peak
May
Late
Jun
Date

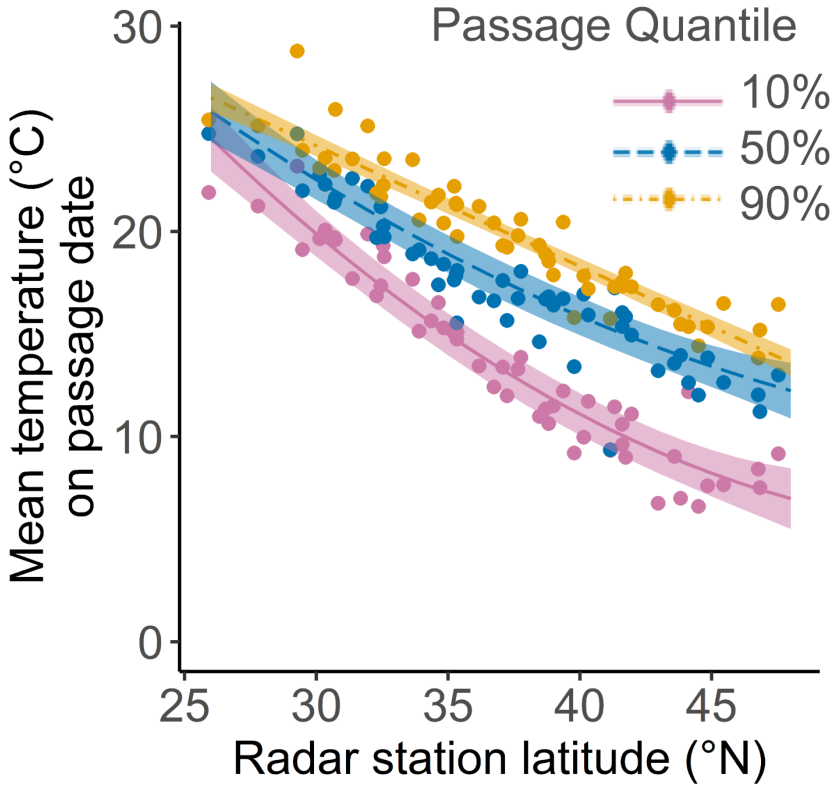
Did migration phenology track temperature across latitudes?

- Mean daily temperature on 10%, 50%, and 90% passage dates from NOAA's North American Regional Reanalysis (NARR)
- Averaged across 80-km buffer for each radar/year



Spring migration phenology did not synchronize with temperature

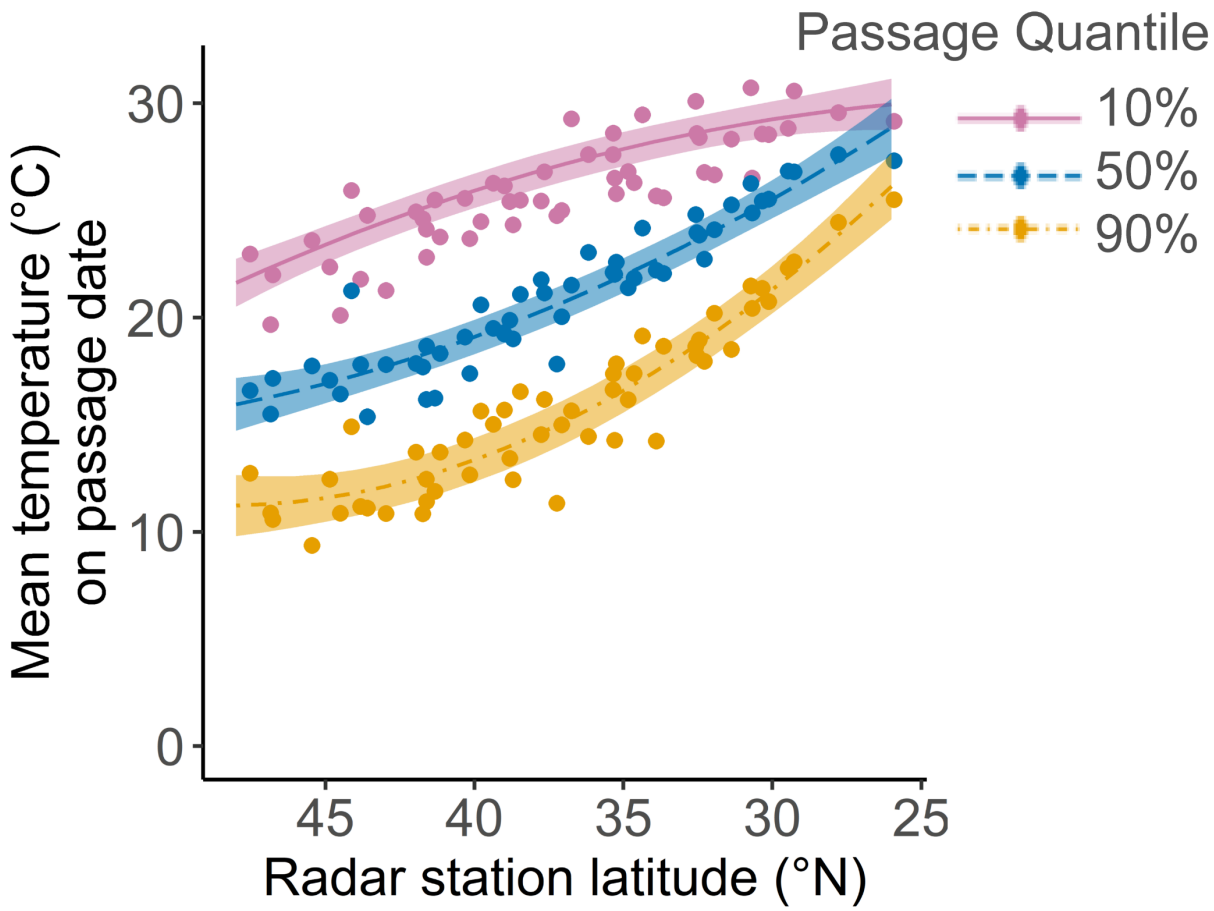
Peak migrants experienced >13˚C drop in temperature



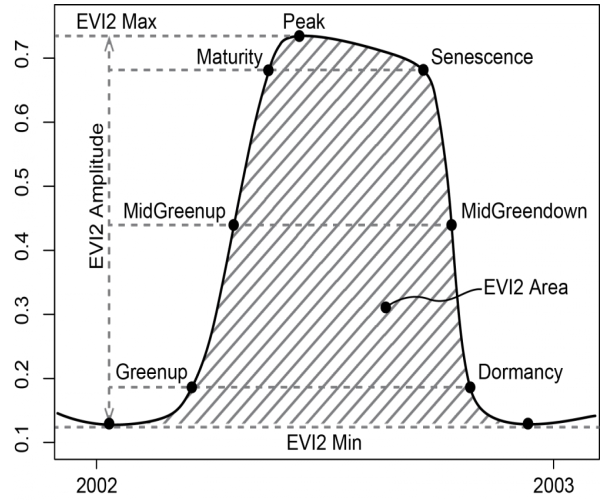
Migration occurred earlier on warmer years

Fall migration phenology does not synchronize with temperature

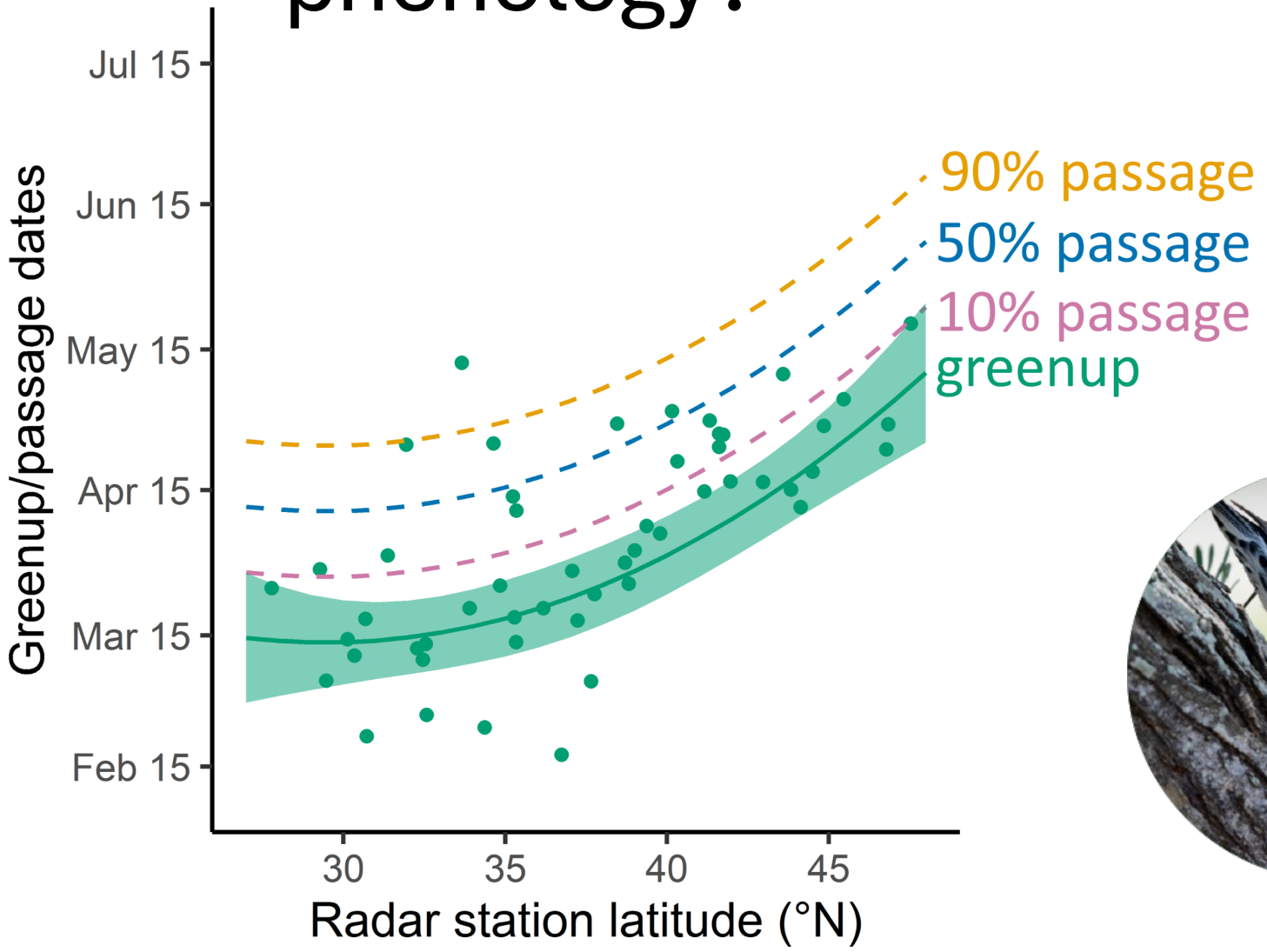
Peak migrants experience a 13˚C increase in temperature



Did migration phenology track land surface phenology?

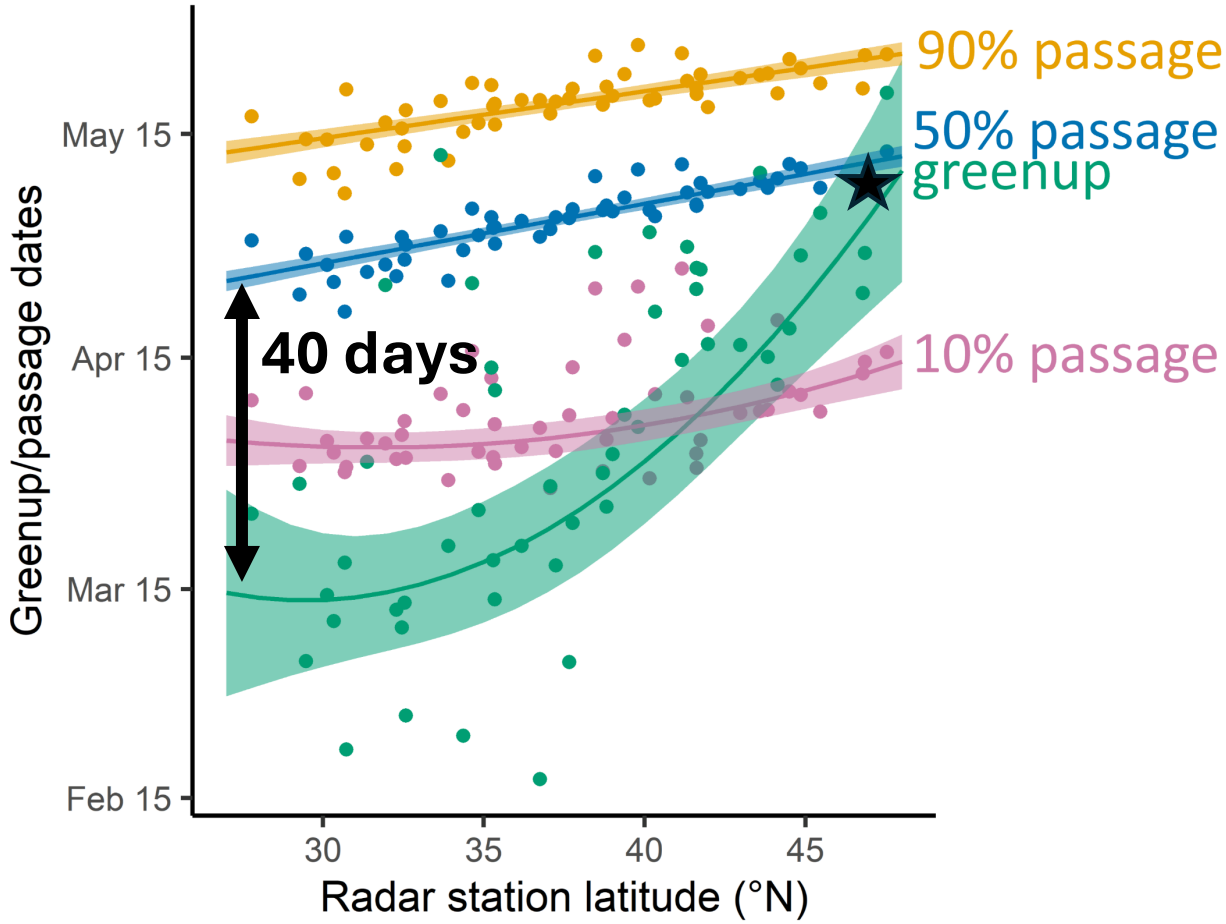


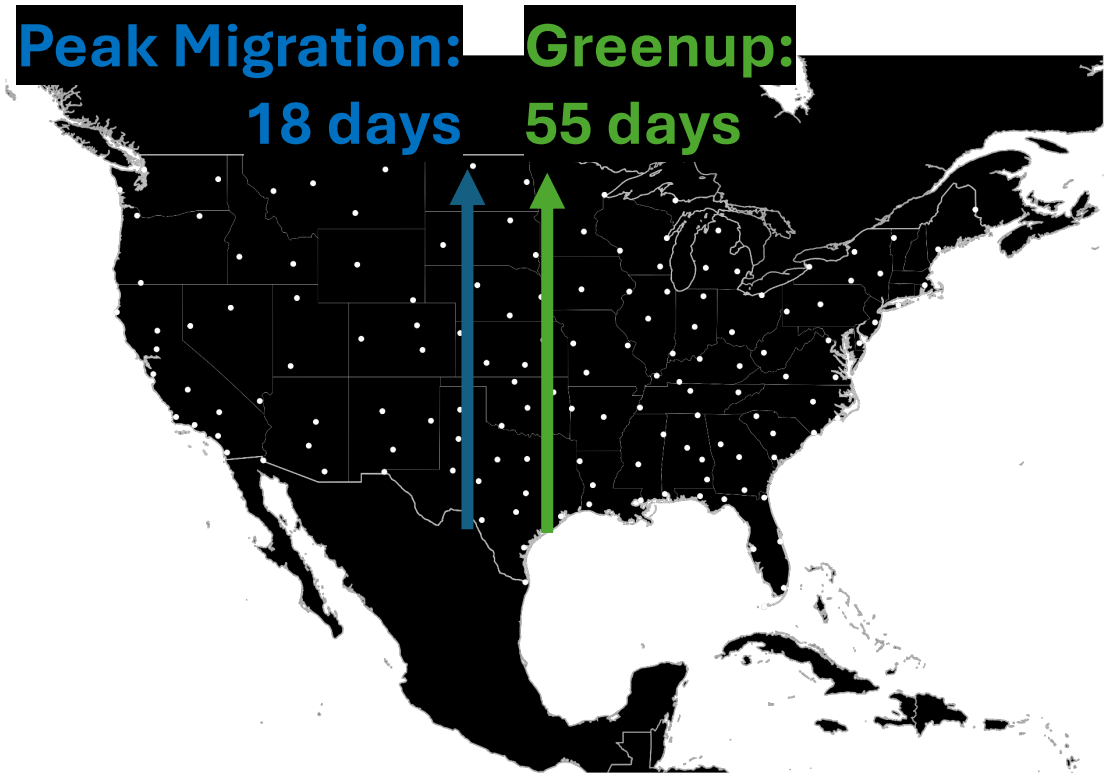
USA National Phenology Network. 2019.



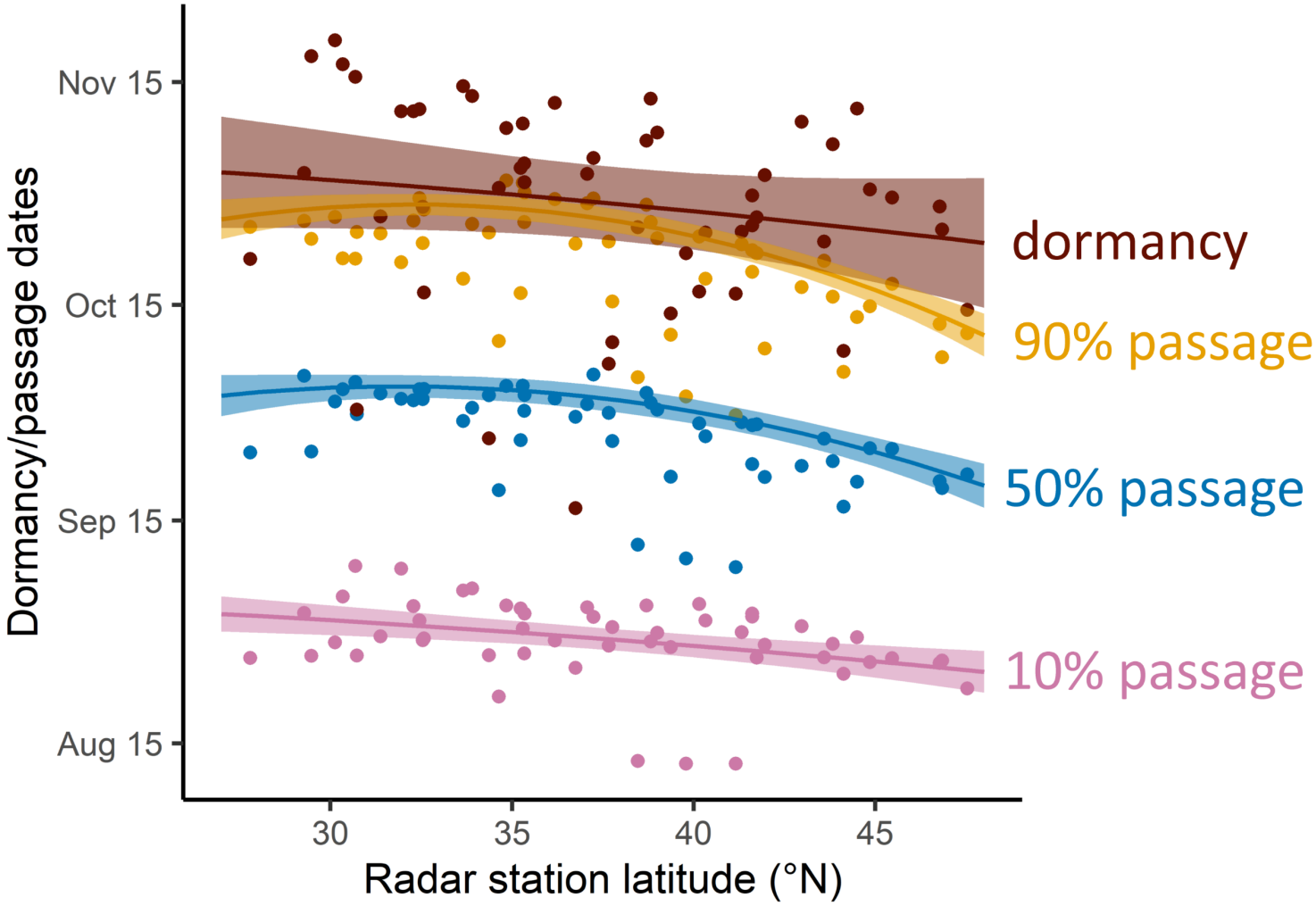
- Greenup and dormancy dates from MODIS MCD12Q2
- Averaged across 80-km buffer for each radar/year

Spring migration phenology did not coincide with land surface phenology

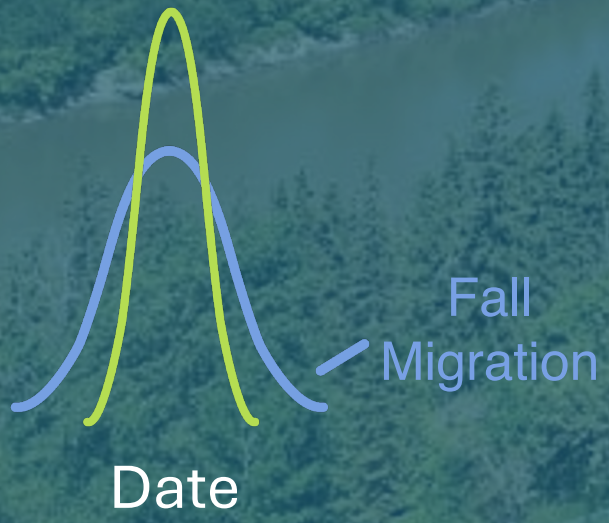


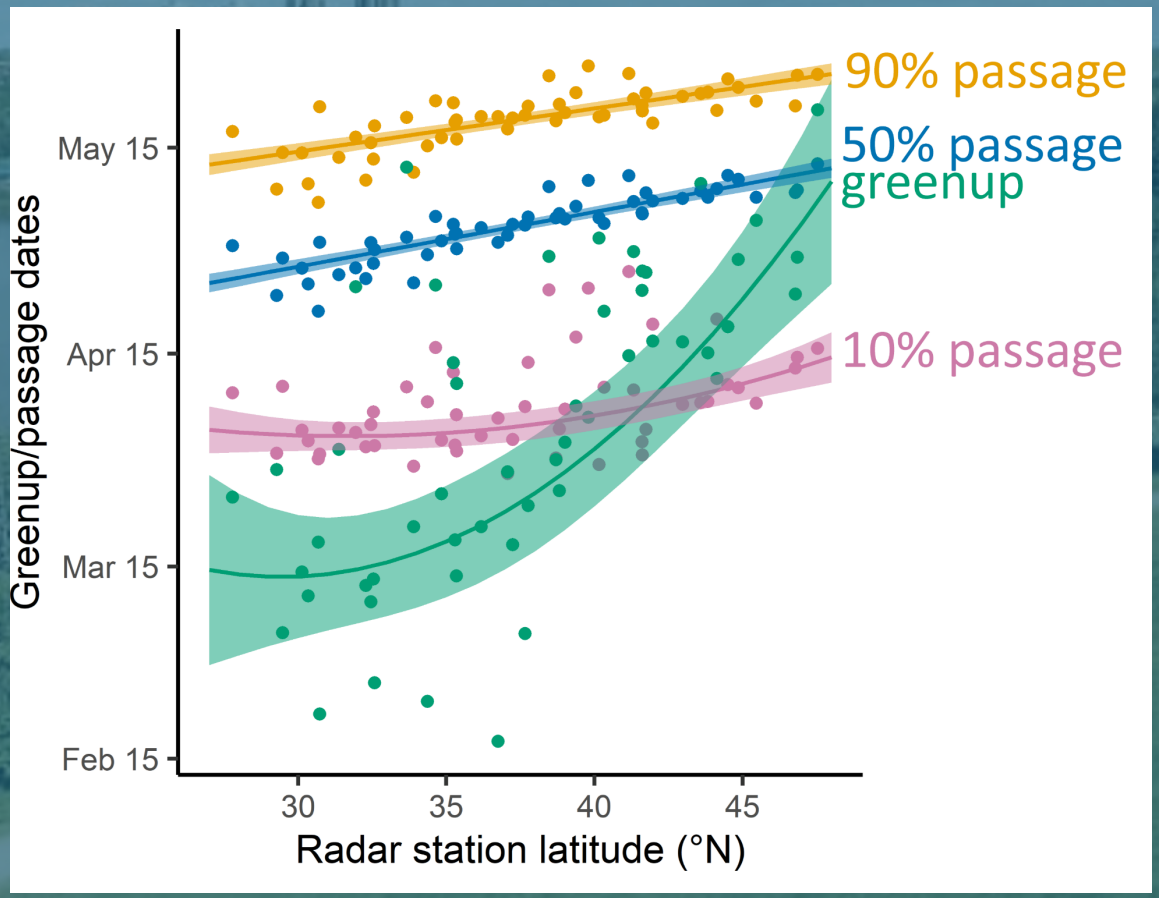


Fall migration phenology coincided with dormancy



Changes to land surface phenology in cities may reduce resource availability of **fall** migrants





Advancing spring migration may lead to phenological mismatches at breeding grounds

Acknowledgements

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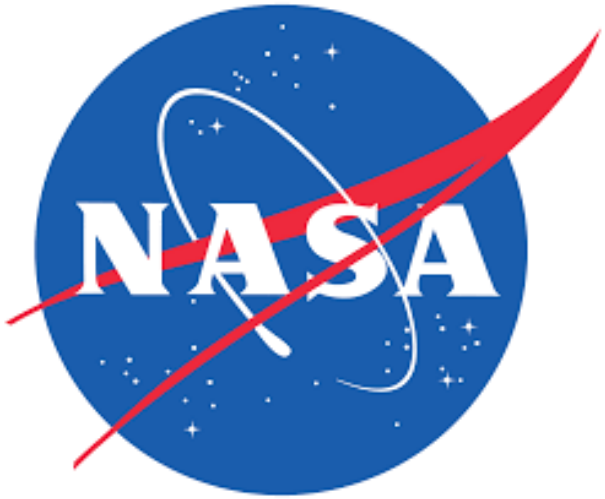
Coauthors:

- **Monika A. Tomaszewska**, Center for Global Change and Earth Observations, Michigan State University
- **Geoffrey M. Henebry**, Center for Global Change and Earth Observations and Department of Geography, Environment, and Spatial Sciences, Michigan State University
- **Kyle G. Horton**, Department of Fish, Wildlife, and Conservation Biology, Colorado State University



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Questions?

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