

Introduction

- After breeding, many species of birds leave their temperate breeding ranges to overwinter in milder climates.

-While many birds that breed in North America overwinter in the tropics, over **200 species of short-distance migrants** settle into winter ranges throughout the temperate zone.

- In order to persist, these birds need to **fuel their metabolisms**, especially under the energetic demands of thermoregulation during cold winters. They need to procure enough food to do this **while coexisting with resident birds**.



Objective: Characterize geographic patterns of energy use by migrant passerines across North America in order to understand the environmental factors that allow them to persist within winter bird communities

Predictions

Energy use will be limited by food availability during the winter. This will differ between dietary guilds:

Granivores: Habitats with **high productivity in late summer** provide **a pulse of seed production** that migrants can utilize through the winter. Deserts, Great Plains, agricultural lands.

Insectivores: Migrant insectivores will primarily rely **on winter productivity**. They should persist in habitats with **mild winters**.

Methods

Data

Abundance data for passerines was obtained from the Audubon Society's Christmas Bird Count for 1,815 sites.

Diet data from Birds of North America Online.

Migratory Status determined using maps from naturereserve.org

Climate data from worldclim.org and **agricultural cover** from the Center of Sustainability and the Global Environment at the University of Wisconsin-Madison.

Energy use: The field metabolic rate of an individual (B) scales predictably with body mass (M):

$$B = cM^b$$

c : Normalization constant (10.5 kJ/day/g in birds¹)

b : Allometric scaling exponent (0.713 in passerines²)

Taking into account the metabolic requirements as well as the abundances of individuals highlights the roles of **migrant birds as consumers within ecosystems**.

Analysis

I used linear regression analysis to determine which environmental variables were the best predictors of energy use by resident and migrant granivores and insectivores.



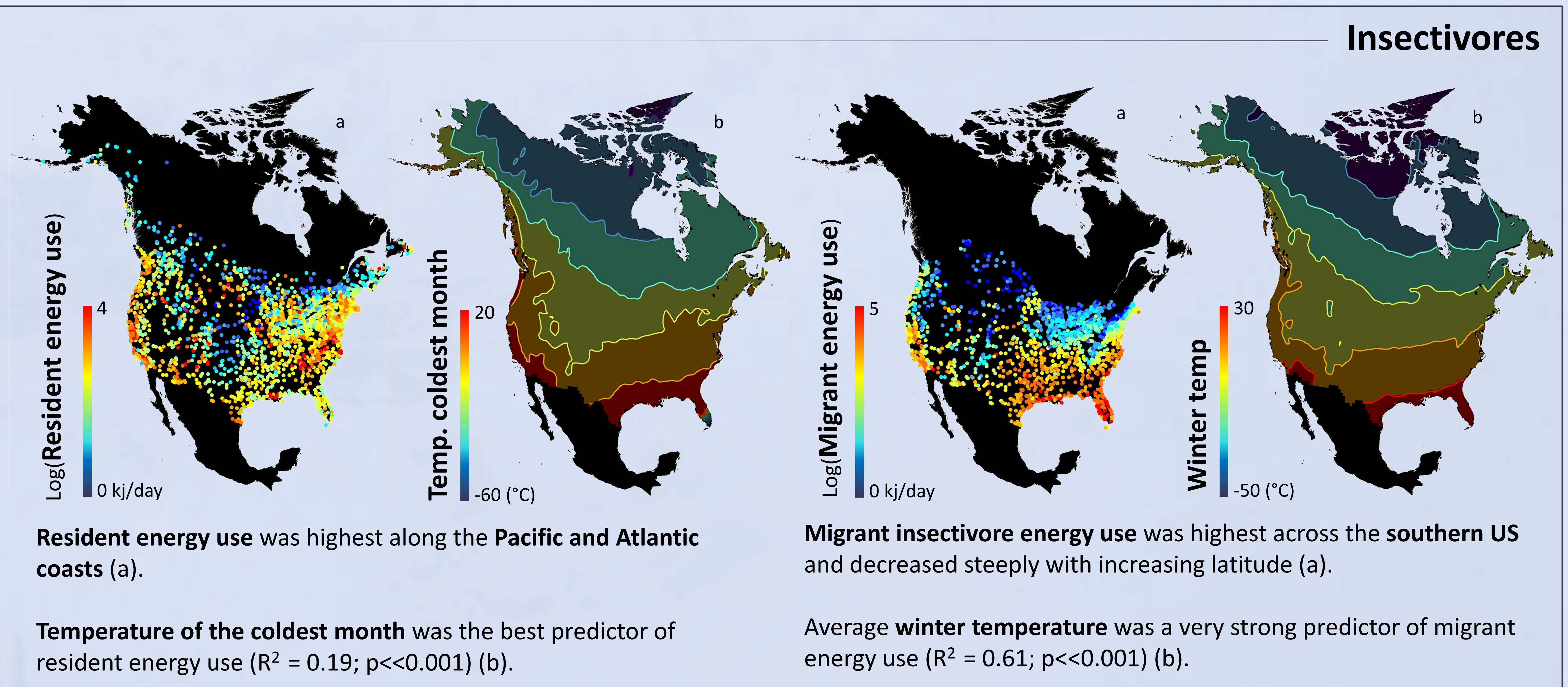
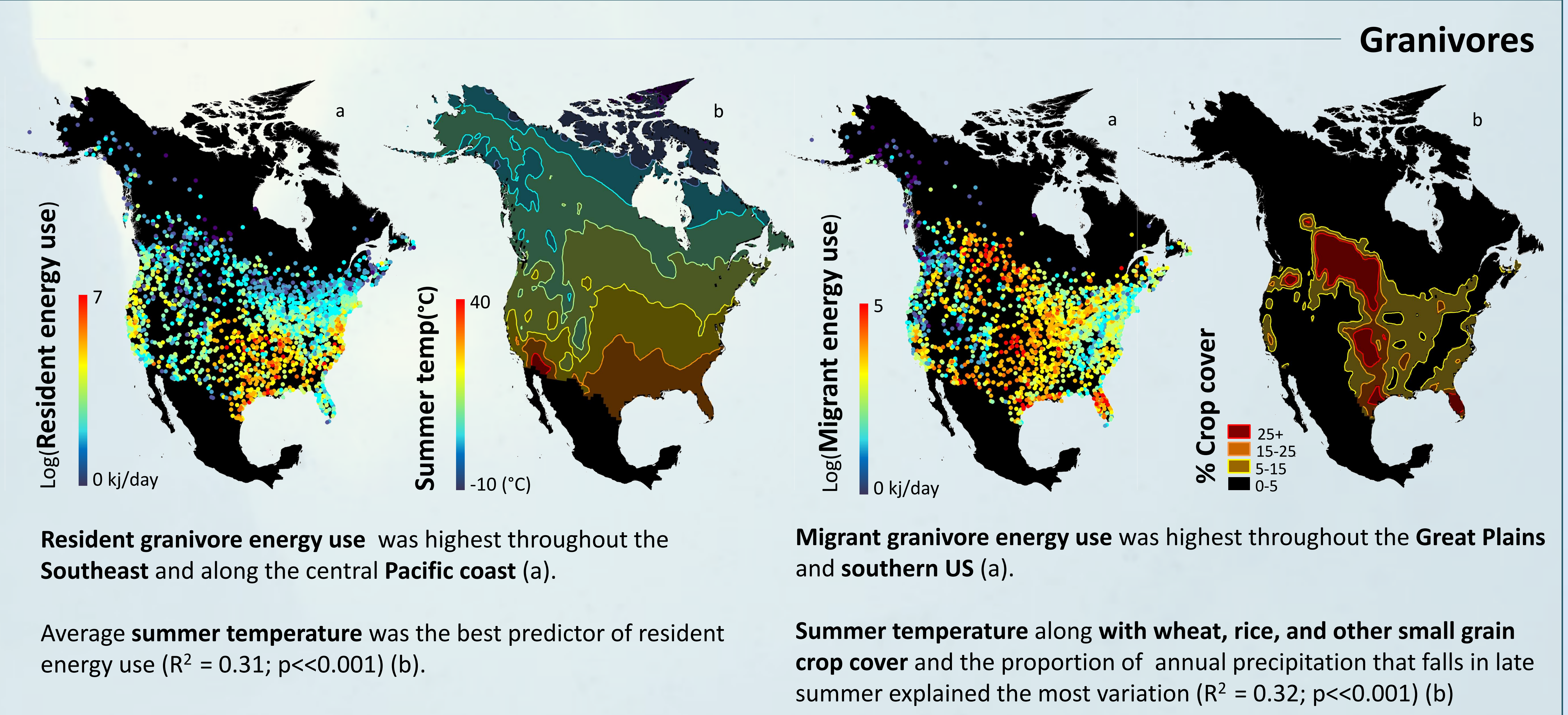
The contribution of migrants to North American winter bird communities

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Results



Conclusion

Using a **metabolic perspective** and **macroecological** approach reveals that the **energy use** of migrant and resident birds in winter communities is **tied to the seasonal dynamics of resource production** as predicted.

- **Insectivorous migrants** are tied to resources produced during the winter. Their energy use is highest where **mild winters allow for an abundance of insect prey**.

- **Granivorous migrants** are able to inject themselves into winter bird communities by utilizing **late summer seed production** in habitats that receive most of their precipitation during **warm summers**.

- In colder climates, migrants persist on the **post-harvest waste from agricultural crops**.

- **Agricultural land** seems to play a role in supporting overwintering migrants, but **may have a negative effect on community diversity**.