Army cutworm moths at moth aggregation sites originate from heterogeneous sources

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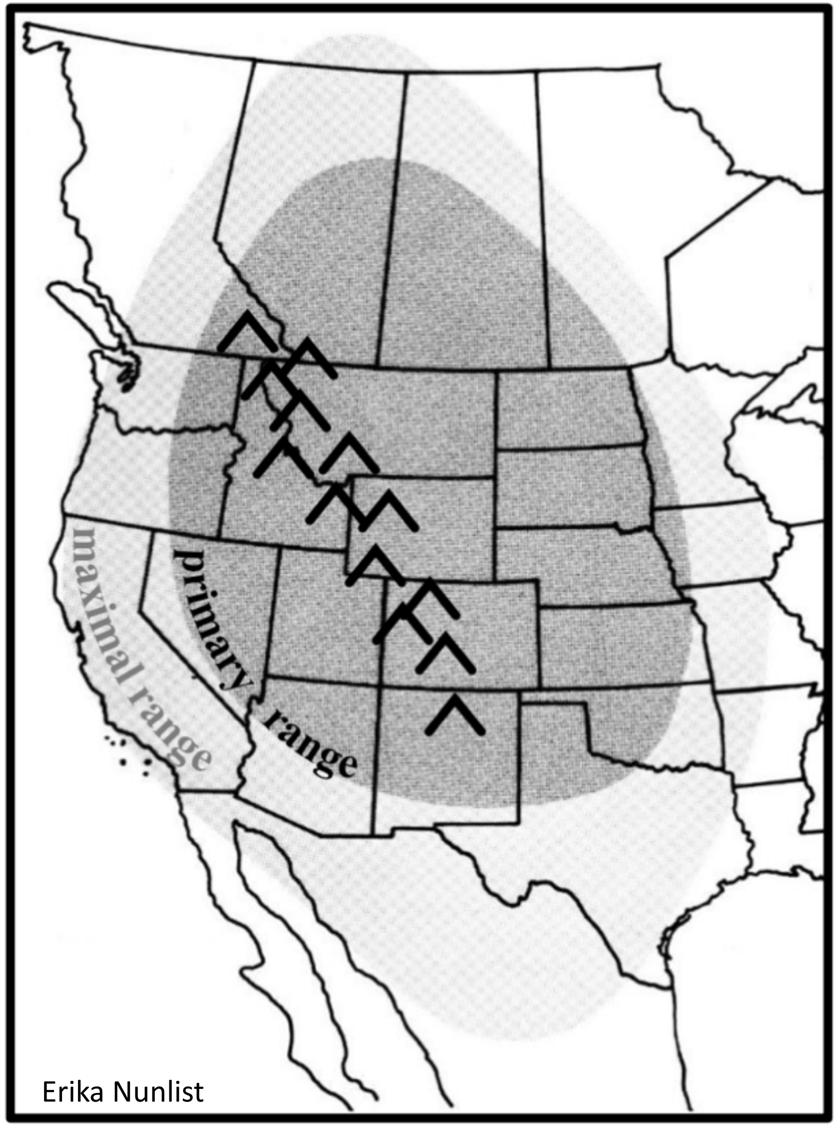
Yellowstone Subcommittee Meeting

Low elevation ecology

- Larvae are found throughout Great Plains
- Feed on variety of cultivated and non-cultivated crops
- Sporadic pests; outbreaks occur somewhat randomly
- Eggs are oviposited in the fall



Migratory period: Spring

Topographical map of the United States. (2018). *Encyclopaedia Brittanica, Inc.*

Alpine ecology

= 0.5 kcal

Remaining questions:

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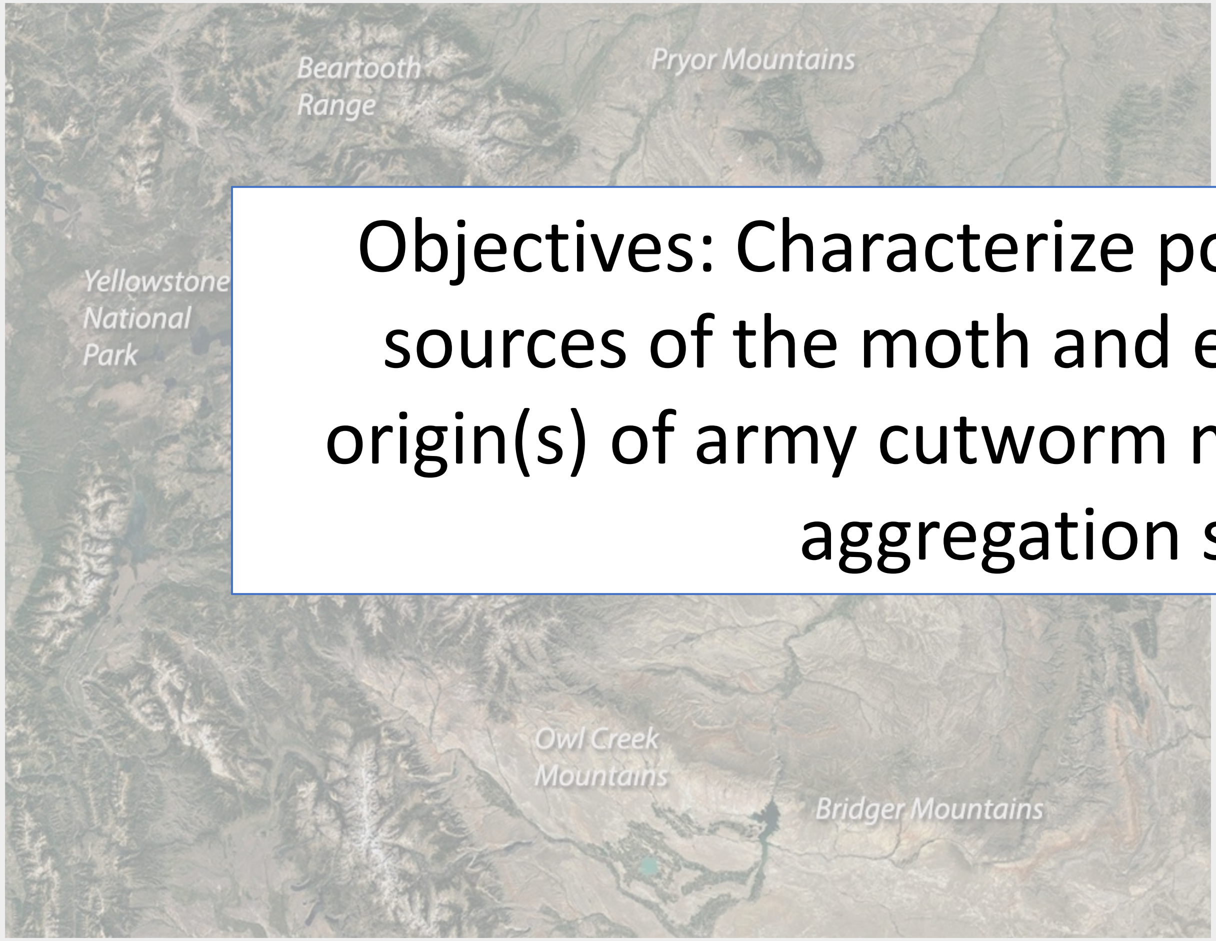
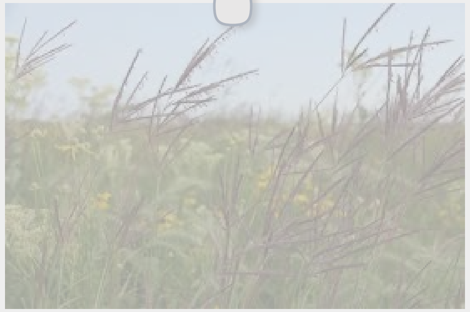
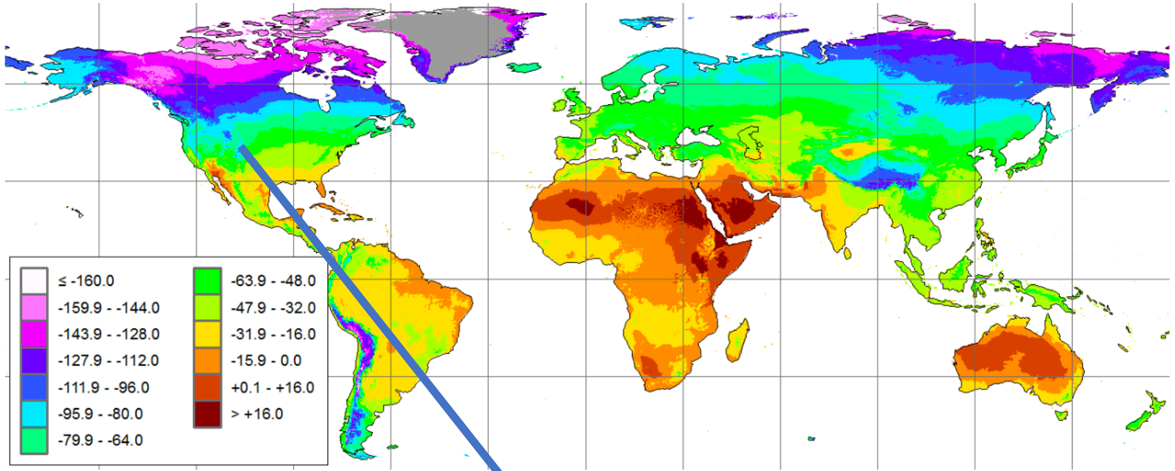


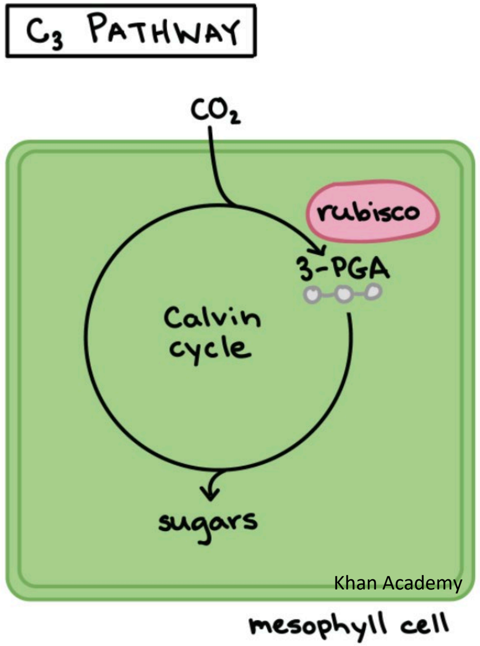
Objectives: Characterize potential larval food sources of the moth and establish the natal origin(s) of army cutworm moths at focal moth aggregation sites.

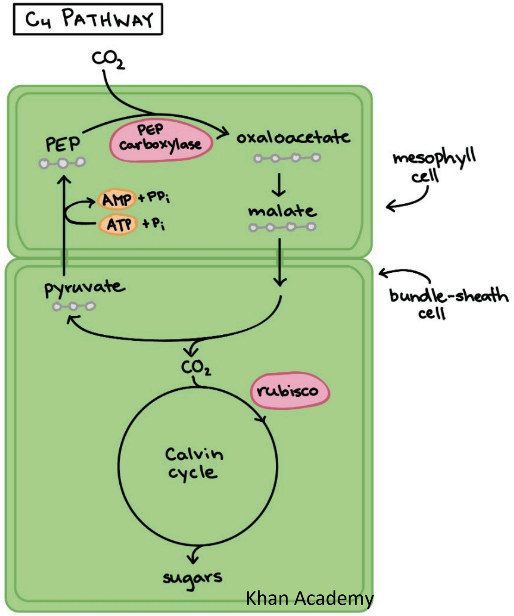




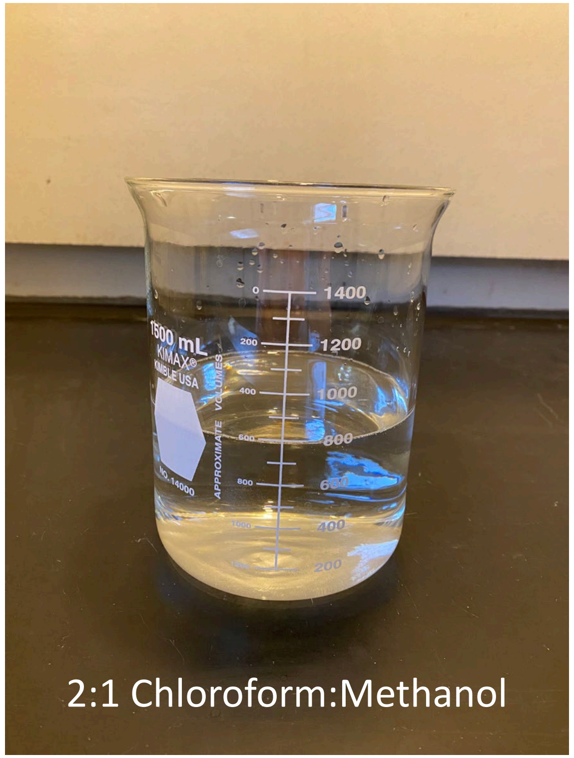
Using stable isotopes to determine origin and feeding habits

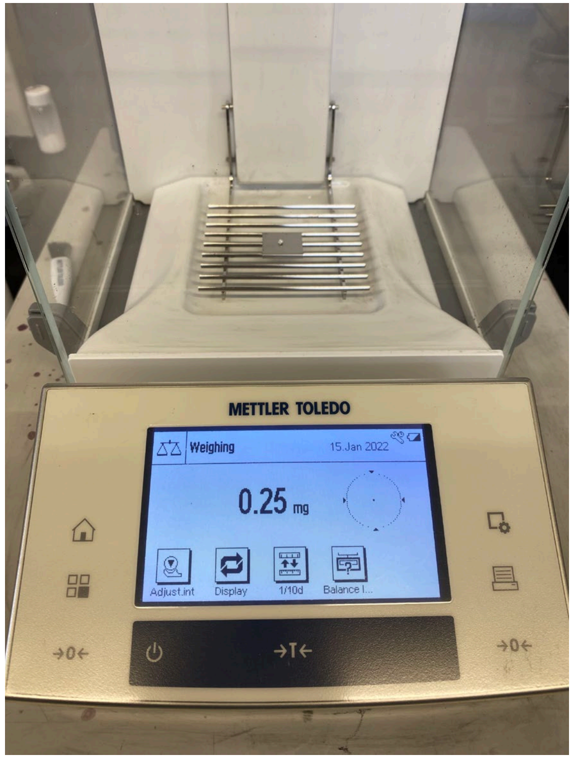
- Stable hydrogen (δ^2H): Natal origin
- Stable carbon (δ^{13}C): Feeding on C3 or C4 plants





Methods: Summer collection





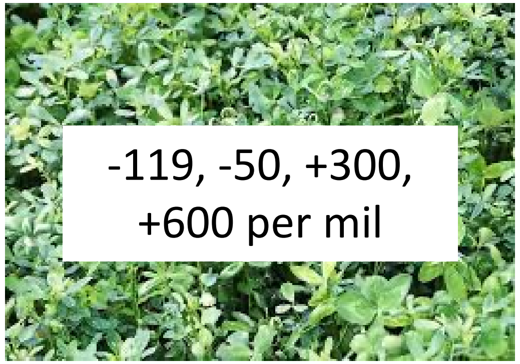
Methods: Stable isotope sample preparation

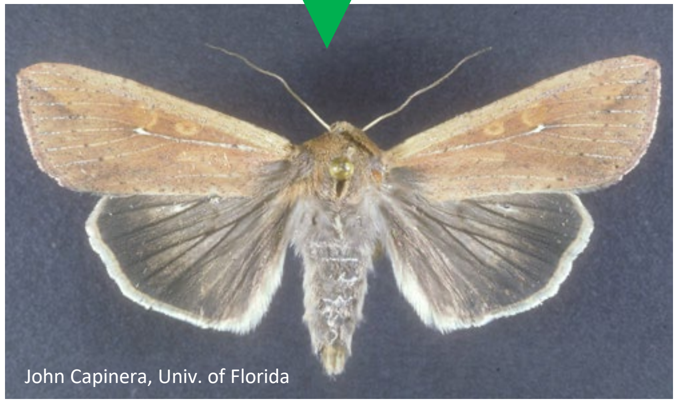
Results I: Larval feeding habits of migrants

$\delta^{13}C$ (‰ VPDB[1])				
Year	Location	*n*	Mean ± SD	95% CI
2020	B	6	-27.0 ± 0.8	-27.9 – -26.1
2021	B	33	-26.7 ± 2.3	-27.5 – -25.9
2017	A	29	-27.6 ± 1.4	-28.2 – -27.1
2018	A	29	-26.7 ± 1.2	-27.2 – -26.3
2020	A	25	-27.3 ± 1.3	-27.8 – -26.8
2019	C	17	-27.0 ± 3.7	-27.5 – -23.7
2020	C	23	-27.0 ± 1.0	-27.4 – -26.6
2021	C	43	-27.2 ± 1.0	-27.5 – -26.9

[1]Vienna Peedee Belemnite

Methods: Creating a tissue-specific isoscape

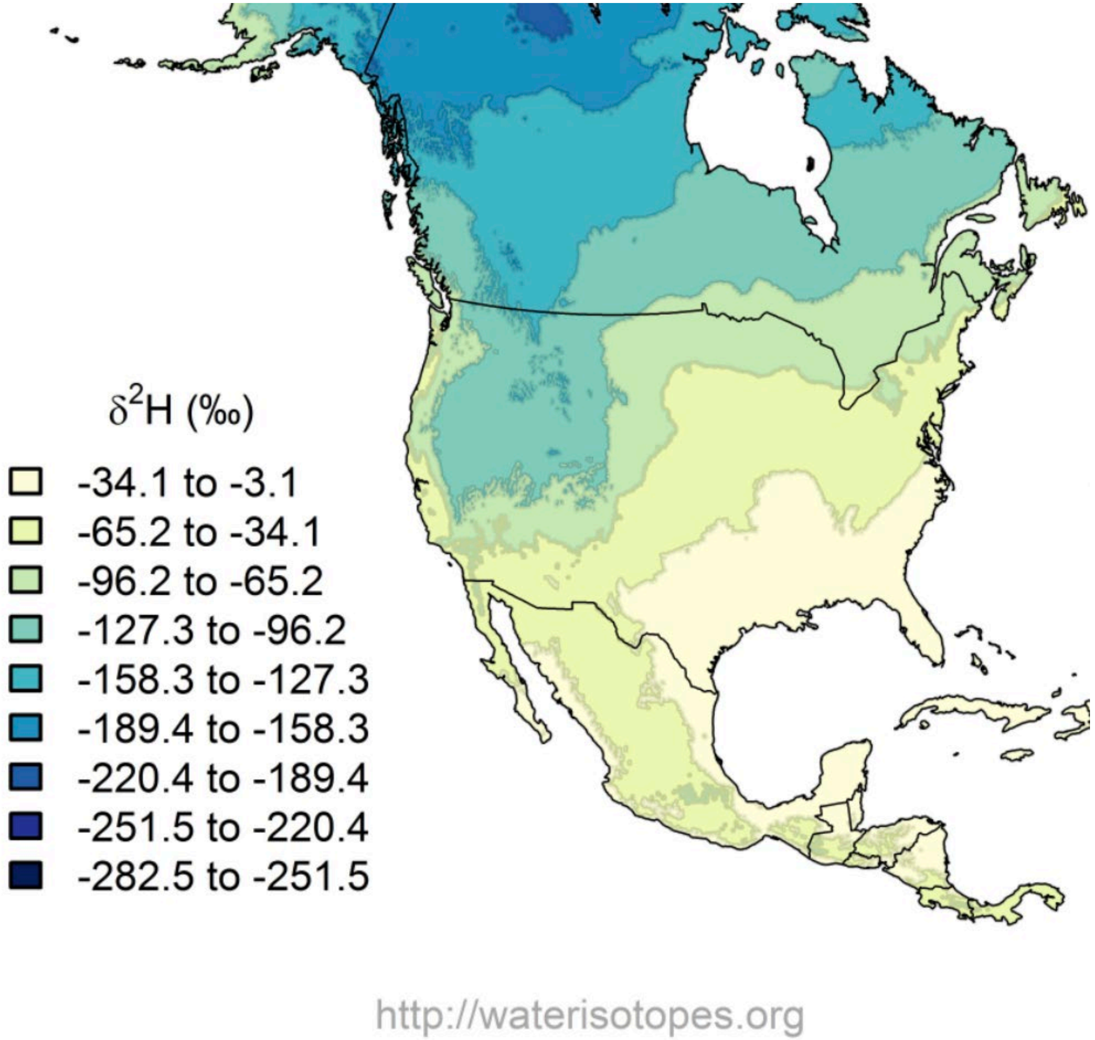




Mythimna unipuncta

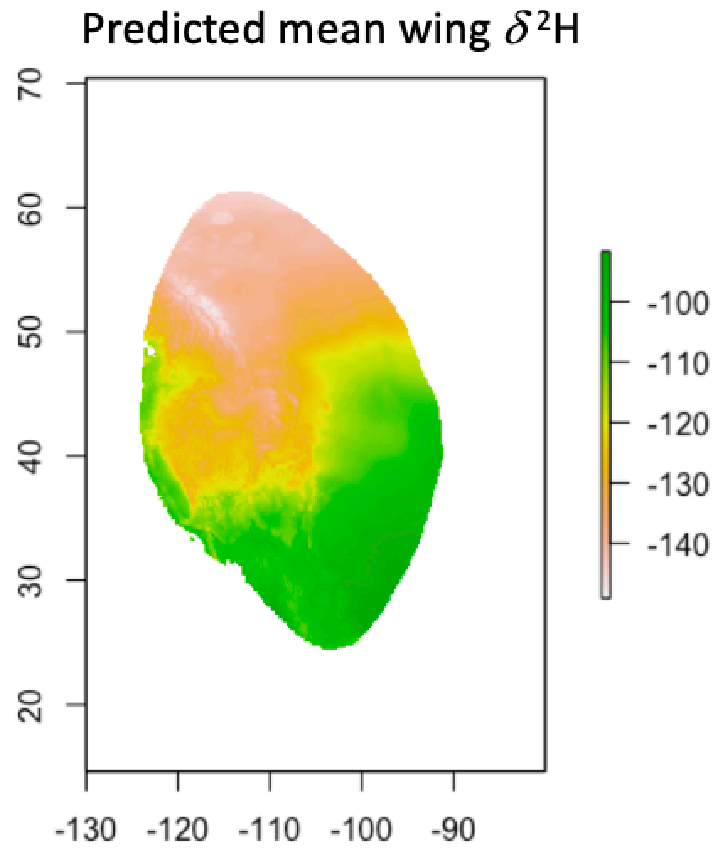
$$y = -84.4 + 0.40x$$

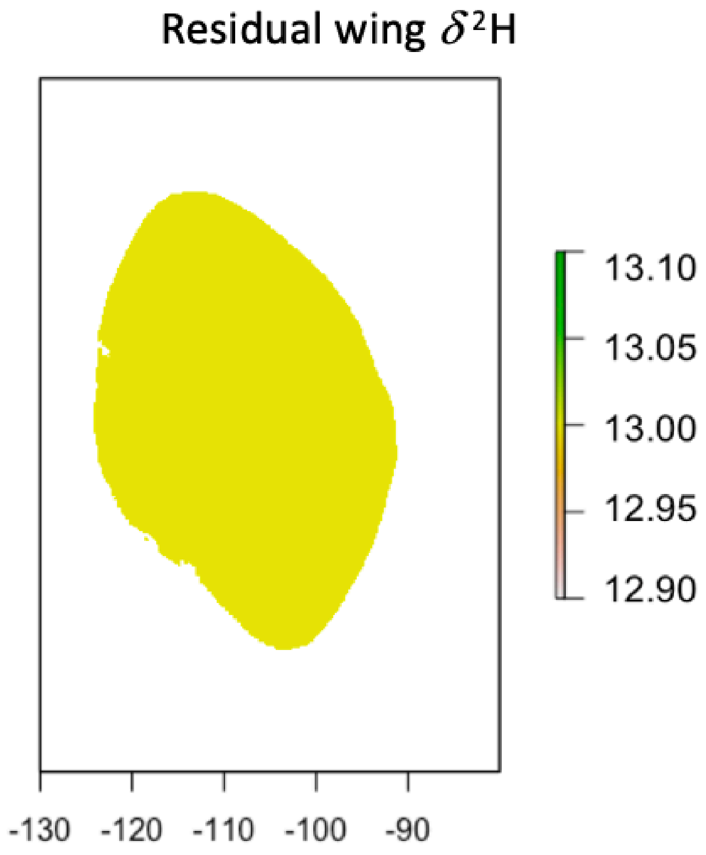
$R^2 = 0.96$

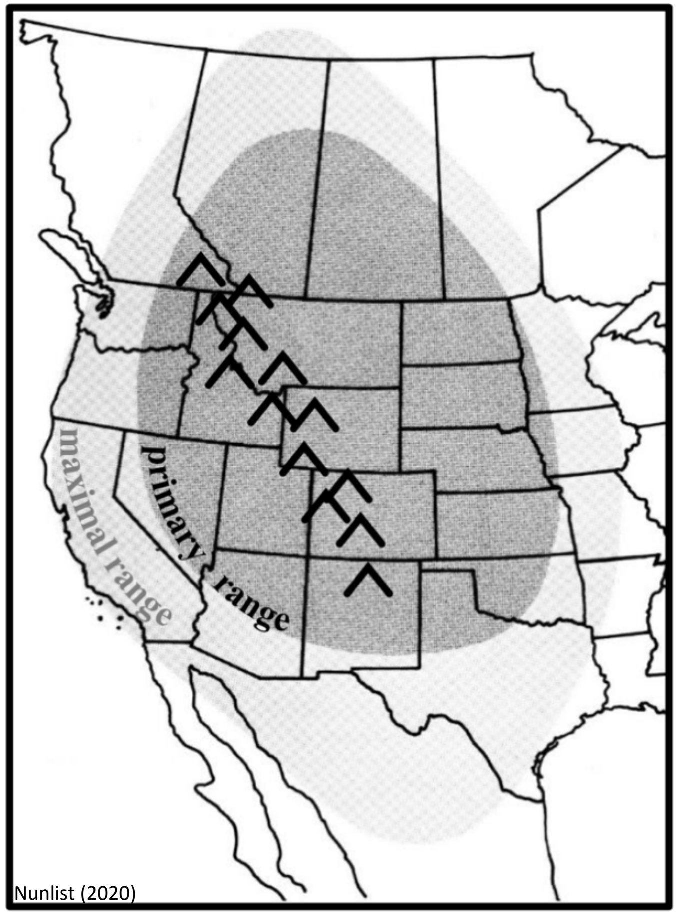


Ma, C., Vander Zanden, H. B., Wunder, M. B., & Bowen, G. J. (2020). assignR: An r package for isotope-based geographic assignment. *Methods in ecology and evolution, 11*(8), 996-1001.

Methods: Tissue-specific isoscape

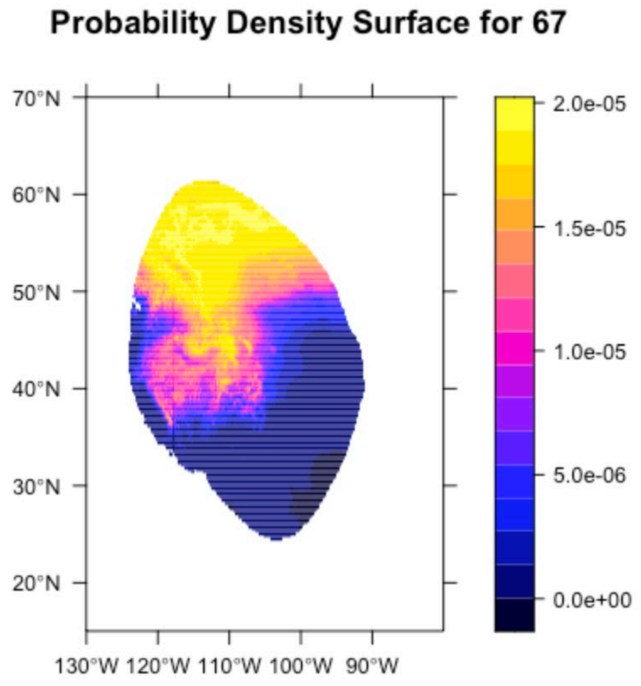


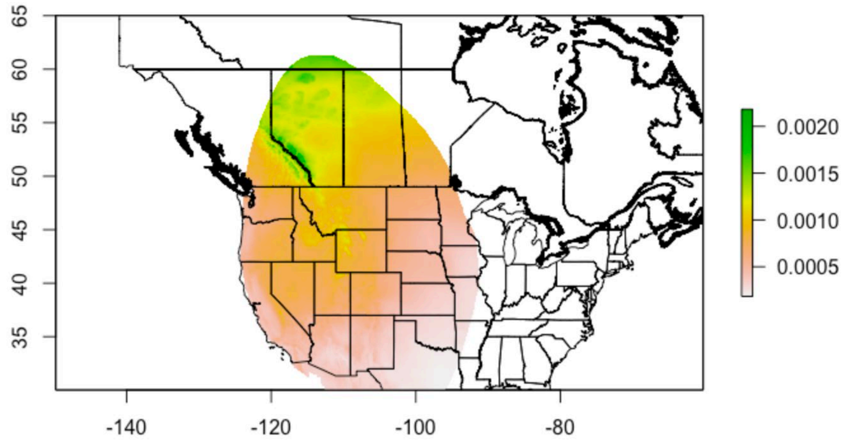


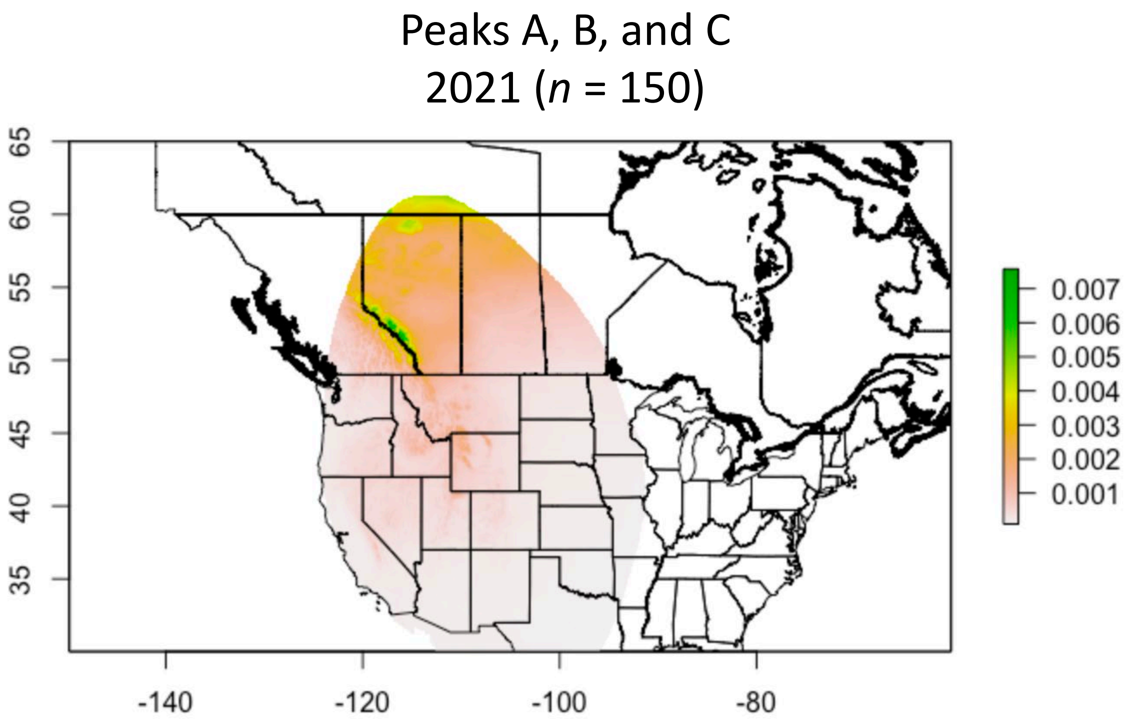


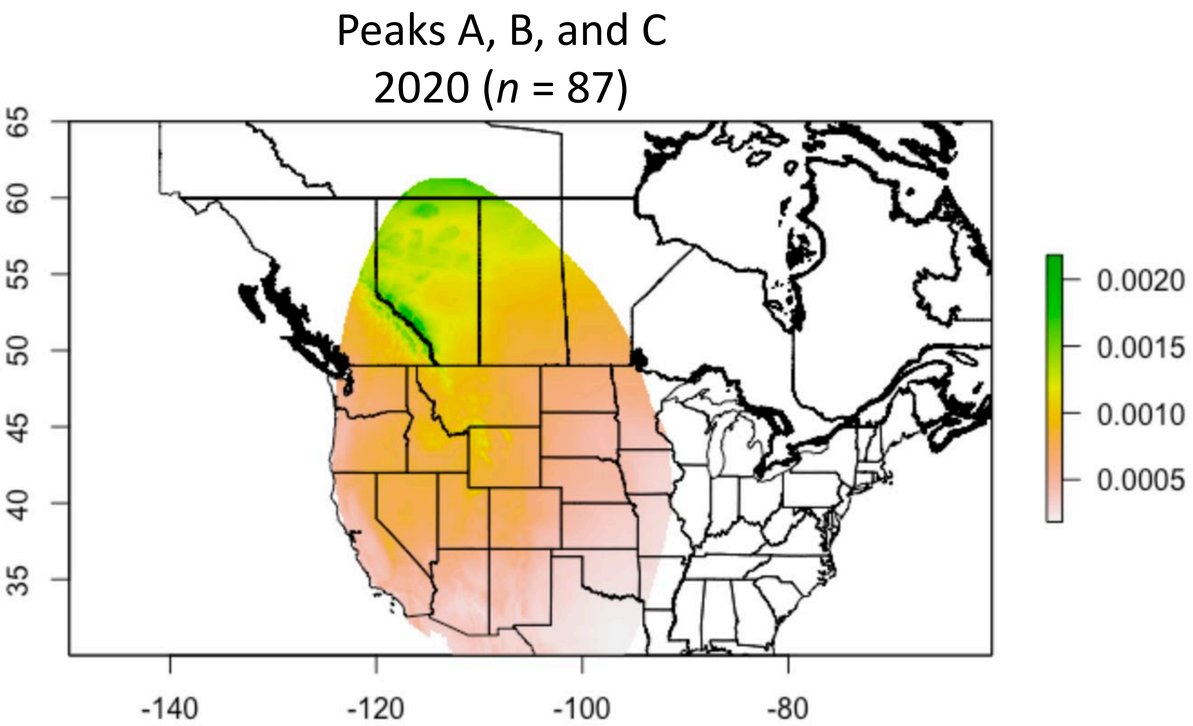
Methods: Calculating probability of origin

1. For each individual sample, calculated the probability of origin for each raster cell (top right)
2. Grouped samples by mountain range and year
3. Aggregated probabilities across groupings
4. Final product (bottom right): Map illustrating probability of origin for a group









Results II: Probable natal origin

- Across all years, probability of origin was highest in British Columbia, Alberta, and the southern border Northwest Territories; followed by Montana, Wyoming, and Idaho
- During more mixed years (e.g., 2020), low-moderate probability of origin was found throughout entirety of Great Plains

Concluding points

- Migrants rarely fed upon C4 plants as larvae, indicating that corn and prairie grasses were not an important source of food
- Strong evidence for north --> south movement during the spring
- Migrants of the Absaroka Range had highest probability of origin in the lower third of Canada and low/moderate probability of origin in Montana, Wyoming, and Idaho

Dr. Hillary Robison

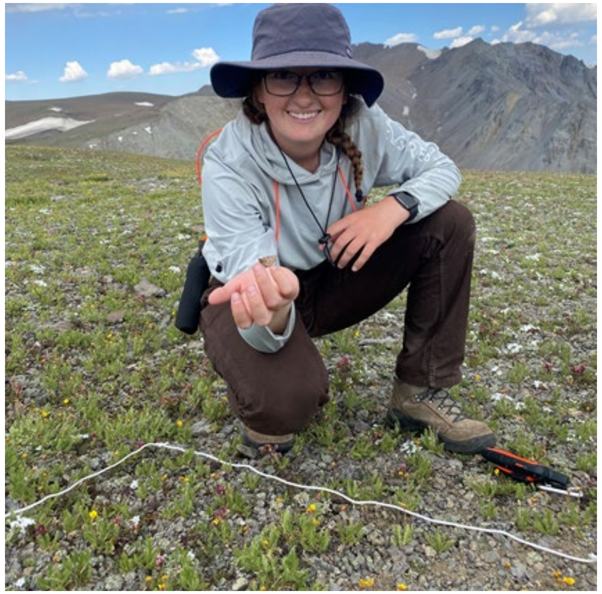
What are the implications for grizzly bears?

Because moth aggregation sites were "supplied" by migrants of varying origins, moth populations at aggregation sites are likely insulated against regional declines in larval populations of the Great Plains and interior plains.

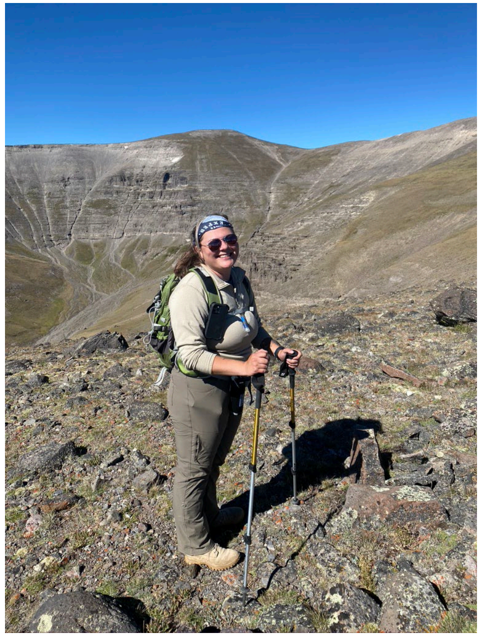
Heather Brown










Acknowledgments

Organizations

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People

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