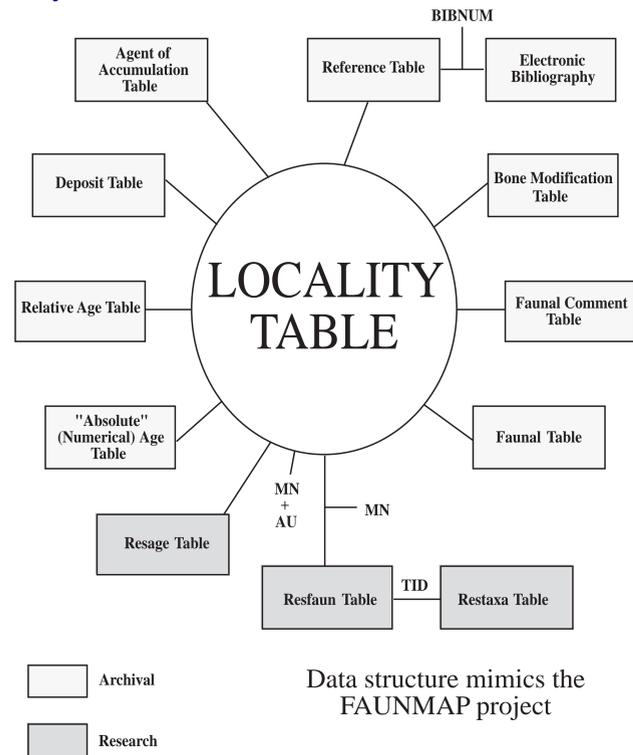


Project Overview

We are building a GIS-linked database of Miocene mammal occurrences in the United States in order to test ideas about how physical environmental perturbations contribute to evolutionary and biogeographic change. The database and analyses are designed around Arc/Info. Species occurrences are linked to pertinent locality information and age criteria in a relational database. Published literature and well-identified museum collections provide the primary data.



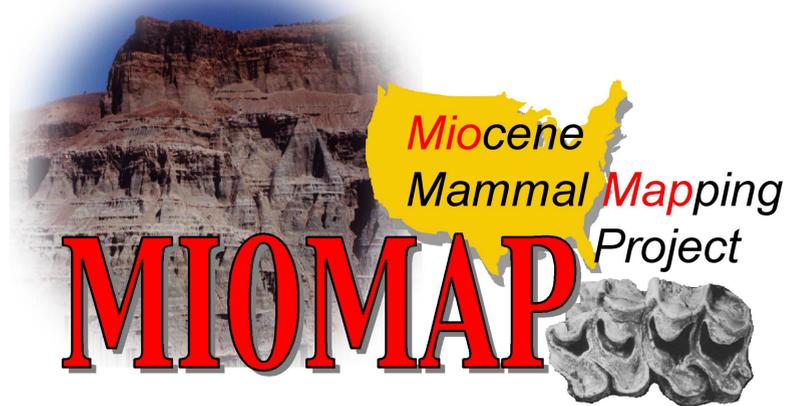
Database Goals

Produce interactive maps of geographic occurrences of mammal taxa through the Miocene, with an associated database of geographic and temporal information, all served on the internet.

Build interfaces for using standard museum data in GIS analyses.

Join forces with other data accumulation efforts.

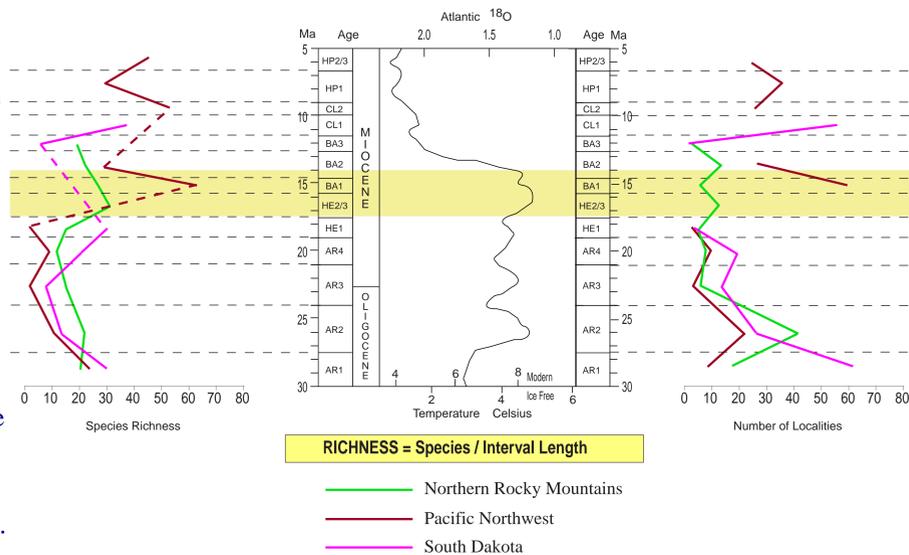
Funded by
National Science Foundation
WHERE DISCOVERIES BEGIN



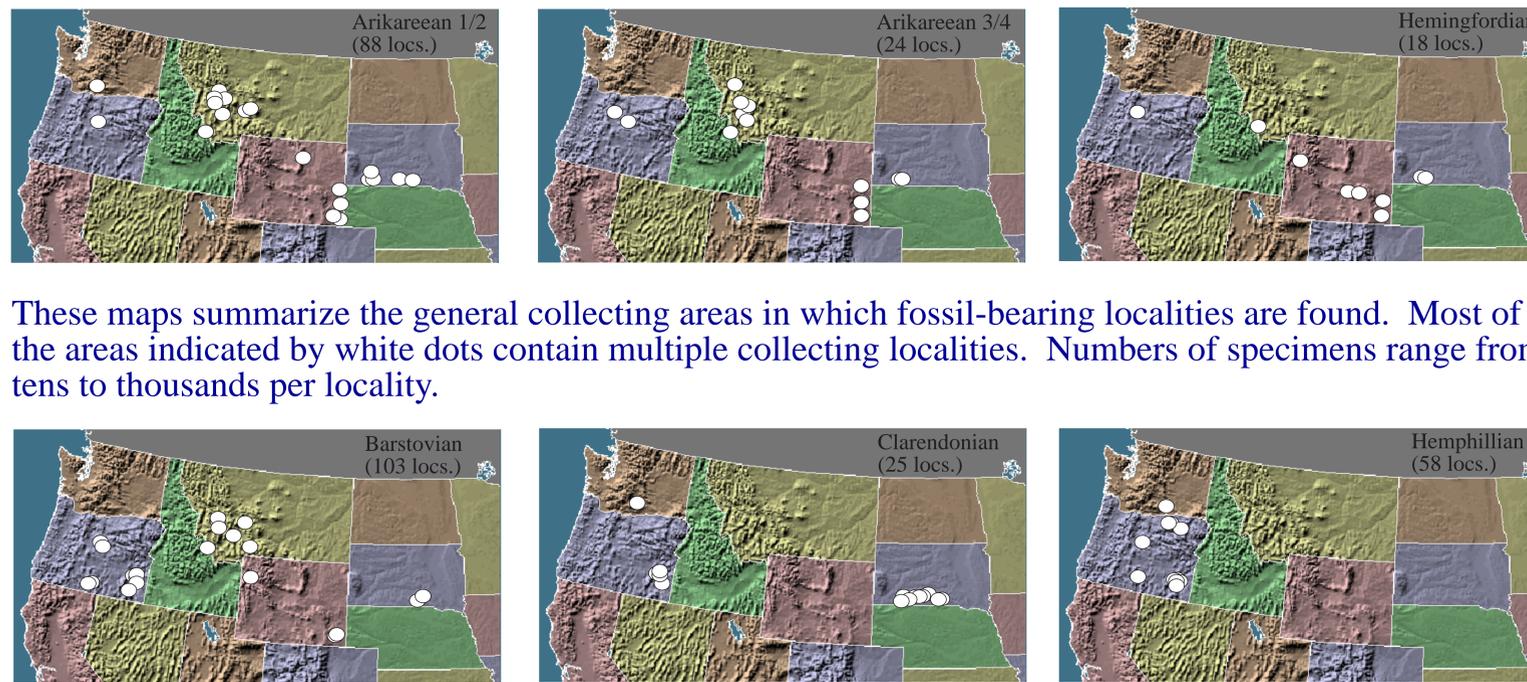
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Preliminary Results

Species richness (at right, measured as species/million years) appears to decrease during the Arikareean with a jump in diversity occurring coincident with the Miocene Climatic Optimum ~14-18.5 Ma (highlighted in yellow), in all three geographic regions (Northern Rocky Mountains, Pacific Northwest, and South Dakota) based on data from the localities noted on the maps below. This is followed by a sharp decrease in diversity in the middle/late Barstovian and an increase in species richness in the Clarendonian.



However, these patterns may be due to sampling biases, such as the number of localities sampled (graph at left), the depositional environment, or the collecting methodology. For example, the drop in diversity throughout the Arikareean coincides with a decrease in the number of localities. In addition, a lack of data during key time intervals (He1 and He2/3) prevent an accurate interpretation of the data using this estimate of the data using this estimate of species richness. Alternative methodologies (lower right of poster) may be more appropriate.



These maps summarize the general collecting areas in which fossil-bearing localities are found. Most of the areas indicated by white dots contain multiple collecting localities. Numbers of specimens range from tens to thousands per locality.

Research Goals

Contribute to evolutionary theory by clarifying the role of the physical environment as a motor of evolution.

Examine the interplay between habitat fragmentation and faunal turnover rates to understand the effects of global change.

Decipher the time scale at which environmental changes are most likely to affect mammalian faunas.

Methodology

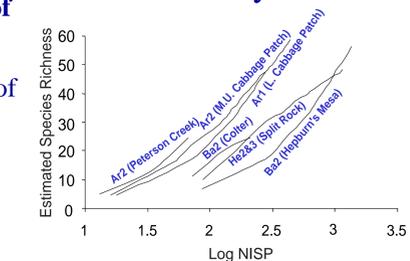
	Tectonic Event (million-year scale)	No Tectonic Event
Sustained Climate Change (million-year scale)	Miocene Rocky Mountains Miocene Great Basin	Miocene Great Plains
Cyclical Climate Change (thousand-year scale)	Pleistocene Rocky Mountains Pleistocene Great Basin	Pleistocene Great Plains

Species richness patterns will be compared across geographic regions and through time. This allows testing of hypotheses about the relative importance of tectonic and climatic changes in driving diversity patterns.

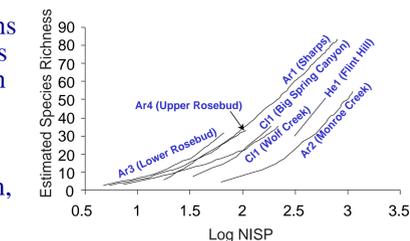
Bootstrap comparisons of major collecting areas

As estimated from the log of the number of individual specimens (NISP), estimated species richness from individual localities appears to decrease across the Miocene Climatic Optimum in the northern Rockies and the plains of South Dakota. Both regions show peak alpha diversities during the early Arikareean (note exception in Ar2 of South Dakota) with lower diversity levels in the Hemingfordian, Barstovian, and Clarendonian. Trends are less clear from the Pacific Northwest data, but most Barstovian localities exhibit lower richness than Arikareean localities. The Pacific Northwest data also point to a large increase in diversity during the early Hemphillian changing to low diversity levels in the late Hemphillian.

Northern Rocky Mountains



South Dakota



Pacific Northwest

