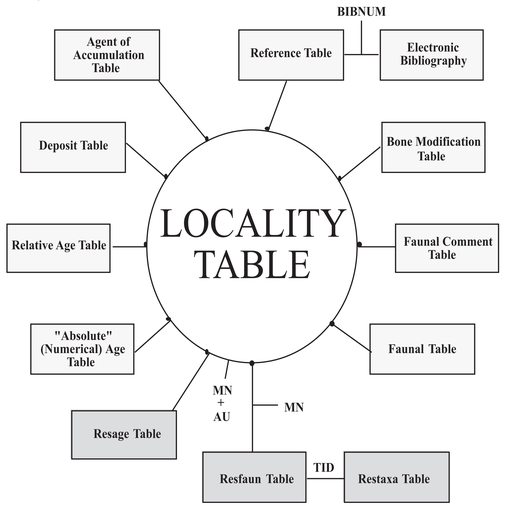
Project Overview

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.



Data structure mimics the FAUNMAP project

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.

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National Science Foundation
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MIOMAP

Miocene Mammal Mapping Project

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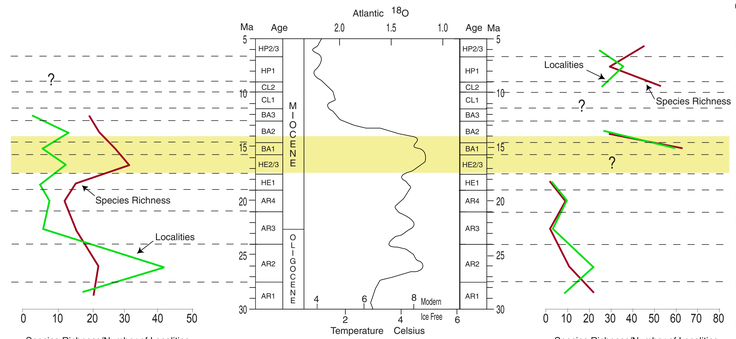
Preliminary Results

Northern Rocky Mountains

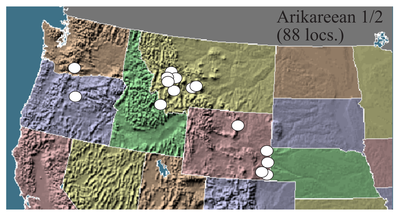
Species richness in the Rockies appears to increase coincident with the peak of the Miocene Climatic Optimum ~14-18.5 Ma (highlighted in yellow), based on data from the localities noted on the maps below. However, this may be due to sampling bias, such as the number of localities sampled (red line at right), the depositional environment, or the collecting methodology. For example, the low species richness levels in the Ar4 and He1 time periods are among the most poorly sampled intervals.

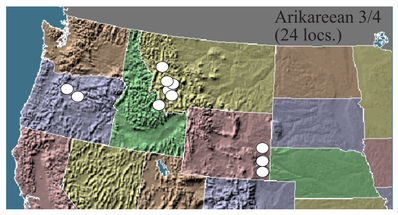


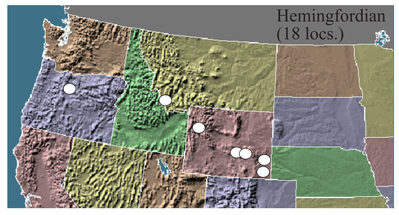
RICHNESS = Species / Interval Length

Pacific Northwest

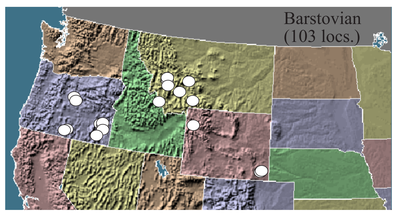
Species richness in the Oregon/Washington region shows a similar pattern to that seen in the Rockies (low diveristy prior to the Miocene Climatic Optimum, peak richness during it). However, it appears that sampling bias (the number of localities sampled) and a lack of data during the key time intervals (He1 and He2) prevent an accurate interpretation of the data using this estimate of species richness. Alternative methodologies (lower right of poster) may be more appropriate.

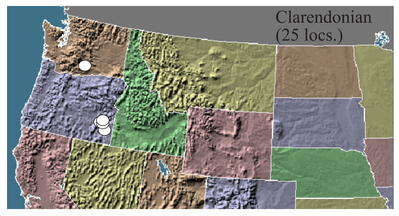


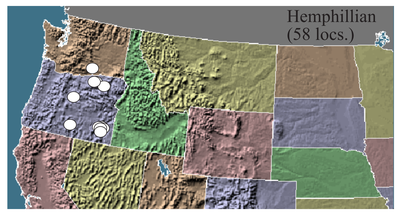




These maps summarize the general collecting areas in which fossil-bearing localities are found. Most of the areas indicated by white dots contain multiple collecting localities. Numbers of specimens range from tens to thousands per locality.







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.

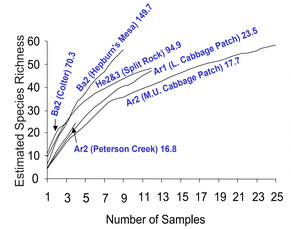
Decipher the time scale at which environmental changes are most likely to affect mammalian faunas.

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*

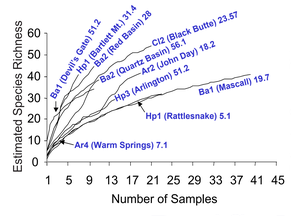
Species richness patterns will be compared across geographic regions and through time. This allows testing of hypotheses about the relative importance of tectonic and climatic changes in driving diversity patterns.

Northern Rocky Mountains



Bootstrap comparisons of major collecting areas

Left graphs (above and below): Apparent differences in richness result from a bias introduced by differing numbers of specimens per locality. Right graphs: As estimated from the log of the number of individual specimens (NISP), richness appears to decrease across the Miocene Climatic Optimum in the northern Rockies. Trends are less clear from the Pacific Northwest data, but most Ba1 and Ba2 localities exhibit lower richness than the Arikareean localities.



Pacific Northwest