**1: Data and Research questions:**

Paper link:

<https://www.pnas.org/doi/10.1073/pnas.2004289117>

Before I describe the data and how it relates to the research question, allow me to first explain the authors research question.

Currently, there is ambiguity over the validity of the ecological niche conservation hypothesis. The idea that ecological niches are conserved over time is a fundamental assumption for a variety of ecological niche modelling approaches. As these ecological niche models are used to inform both conservation efforts and climate change models, it is important that ecological niche models accurately model the stability of ecological niches over time. But, interestingly the authors cite multiple studies with results that directly contradict or support the ecological niche conservation hypothesis, depending on which model of ecological niches they use.

The paper is a meta-analysis of a collection of these studies, investigating the role of statistical model and author bias in their support or criticism of the evolutionary niche conservation hypothesis, as well as performing a synthetic meta-analysis of the results of the papers studied, in order to assess the ecological niche conservation of different species across different climates directly using a cutting edge model approach.

Description of the data:

Though the studies collected by the authors are diverse, they all contain a comparison of observations of a species in its native and invasive habitat. Though from the perspective of the meta-analysis, it consists of 86 papers/observations. From each, they extracted:

* Author/paper information
* Species/ native and non-native occurrences/ intentionality and year of introduction
* details of modelling technique used by the authors, relevant parameters informing niche model, relevant predictors used by the author
* conclusion of the author over if ecological niches conserve over time
* conclusion of the entire study if the niche conserved over time

The observations were each paper, the features: the model technique used, the parameters used for the model, and results of that paper.

Relating the data to the research question

This data relates to the research question in two ways, first it allows for the investigators to assess the role of author and statistical model selected in the upholding of the niche conservatism hypothesis. Second, it allows the authors of this study to synthesize the results of these studies with their cutting edge model to pass judgement on the niche conservatism hypothesis. Especially the difference of niche dynamics between invasive and native clades, as well as between species groups.

An additional question I could ask with this data is relating non-native niche success to the intentionality of introduction/year of introduction. The hypothesis being, if a species was unintentionally introduced at an early year, it is likely that it is because they will find more extreme competitive success respective to native species. If a species was introduced at a later year, it is unlikely they have the extreme evolutionary success of the notorious invasives.

**2: Visualizations**

A screenshot of a computer

Description automatically generated This shows the similarity between native and non-native niches on the x axis, and the natural log of the ratio between the “niche breadth” of those niches. Niche breadth is measured as the % of environmental niche that is realized by the species. The “possible” environmental niche is always larger than the realized niche of organisms. A ratio of niche breath larger than 0 shows that the native niche is larger than the non-native niche. A niche similarity larger than .5 shows these two niches occupy similar positions in environmental space. The similarity of niches is determined by the Sorsen similarity index.

Each data point is an observation of the species niches in the component papers, allowing for multiple dots of the same species--though in my case technically a feature from the perspective of the meta-analysis.

The authors break up this plot into a composite of all species on the left, and plots to the right split up into taxonomic groups.

This figure was included because it allows a characterization of the relation between changes in niche size and niche similarity, a relation extremely important to the characterization of niches in the context of climate change. If niche similarity is taken to be comparable to changing environmental conditions of course. As niche similarity becomes lower, a difference in ratio between niche breadth emerges. If we look to the taxa group plot to the left, it is clear that different taxa groups exhibit different niche breadth dynamics as native and non-native niches become less similar.

This contributes to the authors hypothesis because this leads to the conclusion that niche conservation over time is related to the taxa groups, as niche similarity takes on a temporal significance in this larger context.

A screenshot of a computer

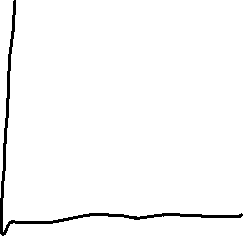
Description automatically generated

This plot shows Niche similarity for species introduced between different continents. The continents on the top representing the native continent of each species, the bottom the introduced niche. The width of each arrow represents the number of species that are introduced. The transparency of each arrow represents the average niche similarity across all species within that arrow.

As for how this contributes to the author’s hypothesis, it allows for broad inference about the structure of climatic niches globally. The niche similarity between species invasive to NA or AU from the EU is much higher than the niche similarity of species introduced from NA or AU to the EU. It shows the dynamics of climatic niches was not symmetrical across continents.

A figure that may be useful to add:

They have no figure showing a distinctive role of the statistical model used by researchers correlated to the conclusions of those studies. There is also no figure showing the diversity of the species that makeup these taxanomic groups. This study can be interpreted as investigating the biasing roles of models and author leanings in prediction of environmental niche conservation. It would be useful to add a dot plot figure showing a # of species observed on the y and if niche conservation was upheld in the study on the x. Like this (I apologize for the terrible):



This would attempt to show the role of *something* like sampling bias behind conservation or no conservation decisions, as currently they just allude to its role but show no plots describing it.

**3: downloaded files:**

I downloaded 4 files, first a readme containing a brief description of the files I downloaded. Very handy.

Second: an xslx file named “name\_match\_R\_MS” which has is metadata for the dataset describing what each of the column names mean.

Third, the main dataset, an xlsx file named “PNAS\_Lui\_DatasetS1” with 927 Rows and 40 columns. This contains all the papers and the species they mention, and the models they use.

The last file is a zip file that contains all the R code used to generate the figures.