**Diversity through Time**

Key question:

Does environmental change maintain diversity by influencing colonization and extinction of different species?

Aim 1: Establish whether diversity is stable through time.

Alternates:

Diversity is stable through time

Diversity increases through time

Diversity decreases through time

🡪 In the aggregate, diversity is not stable through time (RichnessSampSizeThruTime-all.pdf). Some periods of increasing diversity (18-10.5, 3-0), some periods of decreasing diversity (10.5-3). At no time is diversity stable.

But, diversity dynamics may differ by region

Is addition or dissipation of diversity associated with climate change?

When species colonize, where are they coming from?

When species disappear, where are they going?

Choose a site

For each time slice, calculate initial diversity

What is diversity at next time slice?

If it increases, which species appear?

Where did they come from?

If it decreases, which species disappear?

Where did they go?

**Prediction**

If diversity is influenced by climate-driven migration, most colonizations will come from similar direction and more extirpations will go in similar direction

Sites with increases in diversity through time (e.g., negative slopes) should be in north

Sites with decreases in diversity through time (e.g., positive slopes) should be in south

**Result**

In fact, get the opposite. Centroid of the negative slopes (with increasing diversity through time) is farther south, indicating most sites are more southerly than the neutral sites.

The sites with positive slopes (indicating diversity declines through time) are all over, a subset of the neutral ones.

**Further questions:**

Are there differences in the timing of increases and decreases? E.g., sites that go back farther in time, into glacial periods, may be more likely to show negative slopes (increases in div) because started out with few species.

Sites that start in the Holocene may be either neutral or positive slopes (decreases in diversity).

Try: segmented regression. For those sites that extend beyond 10,500 (break point in mean richness), see if there is a break point and if so, at what year.

Why are sites losing species?

And is climate change related to increases or decreases?

Are increases or decreases related to starting richness or regional richness?

For locations with adjacent sites showing opposite patterns, does their temporal extent differ?

**Question 1: Is pollen richness stable through time?**

**Question 2: Are changes in pollen richness related to climate changes?**

**Question 3: Are there spatial patterns to pollen richness change?**