Plaeoecology in the Okanagan Highlands

Explore the climate of the Okanagan Highlands in the Early Eocene by examining the current climate conditions of the nearest living relatives of fossilized flora from that region and period.

Look at the fossil picture cards and the fossils that go along with them, where included. Use the ID guide one the nearest living relatives to identify the genus of each card.

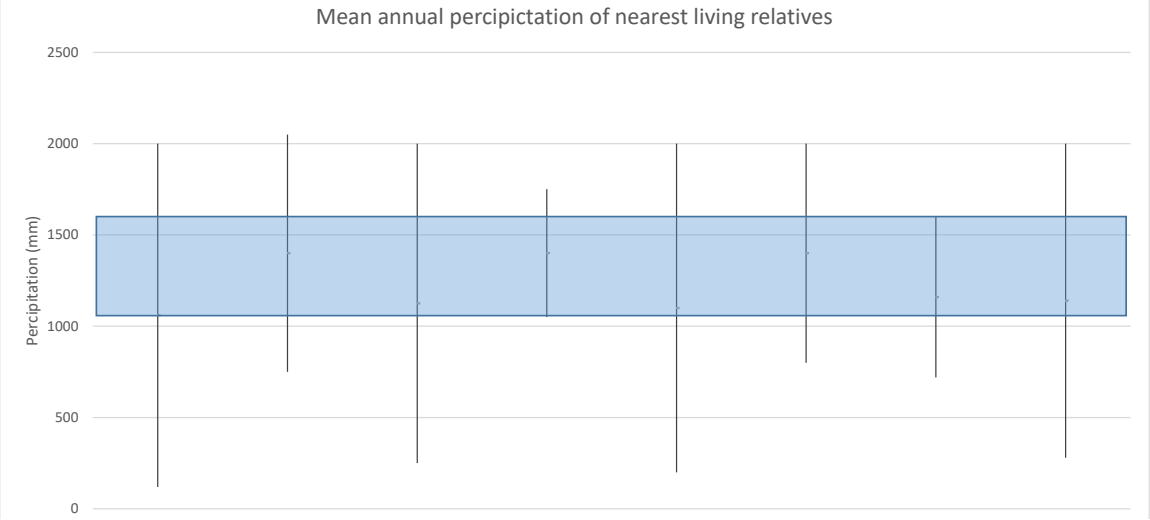
Fossil Card number	NLR of fossil plant	Genus of fossil plant
1	*Gingko biloba*	*Gingko*
2	*Pinus*	*Pinus*
3	*Metasequoia glyptostroboides*	*Metasequoia*
4	*Taxodium*	*Taxodium*
5	*Sassafras albidum*	*Sassafras*
6	*Psuedolarix*	*Pseudolarix*
7	*Alnus*	*Alnus*
8	*Comptonia peregrina*	*Comptonia*

On graph paper, plot the climate parameters (found in the ID booklet) for each nearest living relative. Draw a separate graph for each climate parameter, so three graphs in total. The overlap of the ranges for a given parameter for all NLRs can be used to estimate climatic conditions in the Okanagan Highlands in the Early Eocene. On each graph, draw two lines to enclose the limiting range for the climate parameter.

What is the limiting range of tempertures for the MAT? 13 °C 15 °C

What is the limiting range of temperature for the CMMT? 0 °C 8 °C

What is the limiting range of percipitation for the MAP? 1050 mm/yr 1600 mm/yr



This is an example of what your graph could look like.

Discuss your results with your neighbouring groups. Are your graphs identical or are there some slight differences? Why might scientists want to include results from previous experiments in their results?

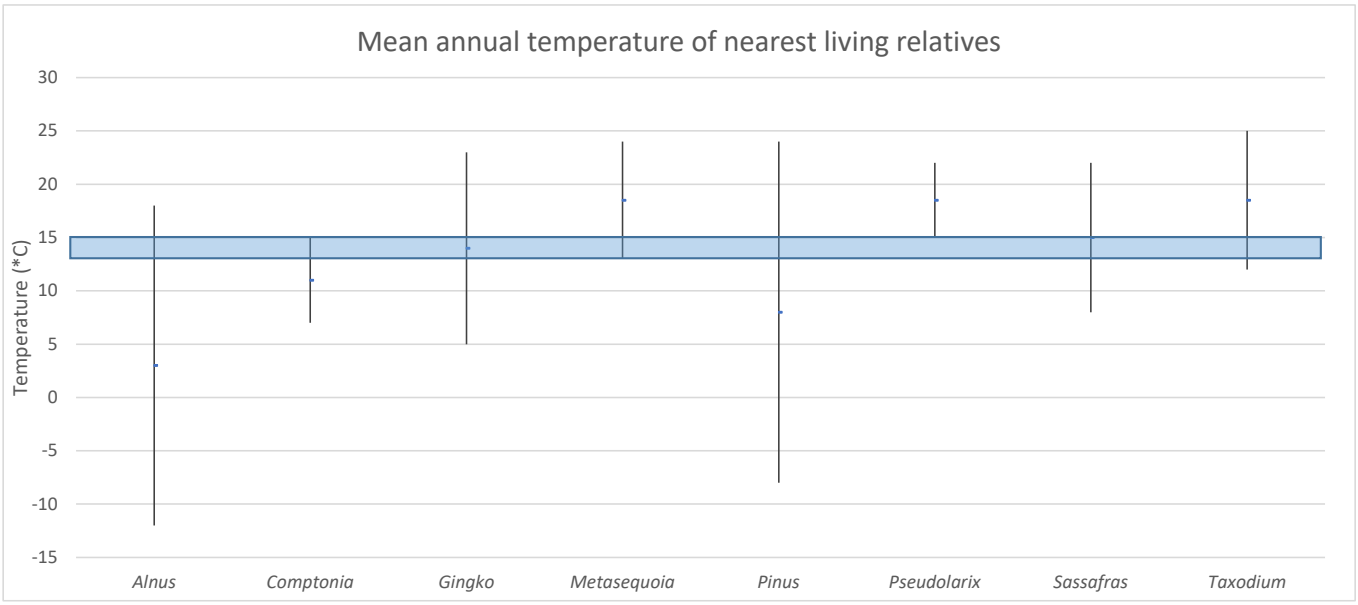
The graphs should show identical ranges of climate parameters for the Early Eocene Okanagan Highlands, but the setup of the graphs will be different, depending on how each group labels the axes of each graph.

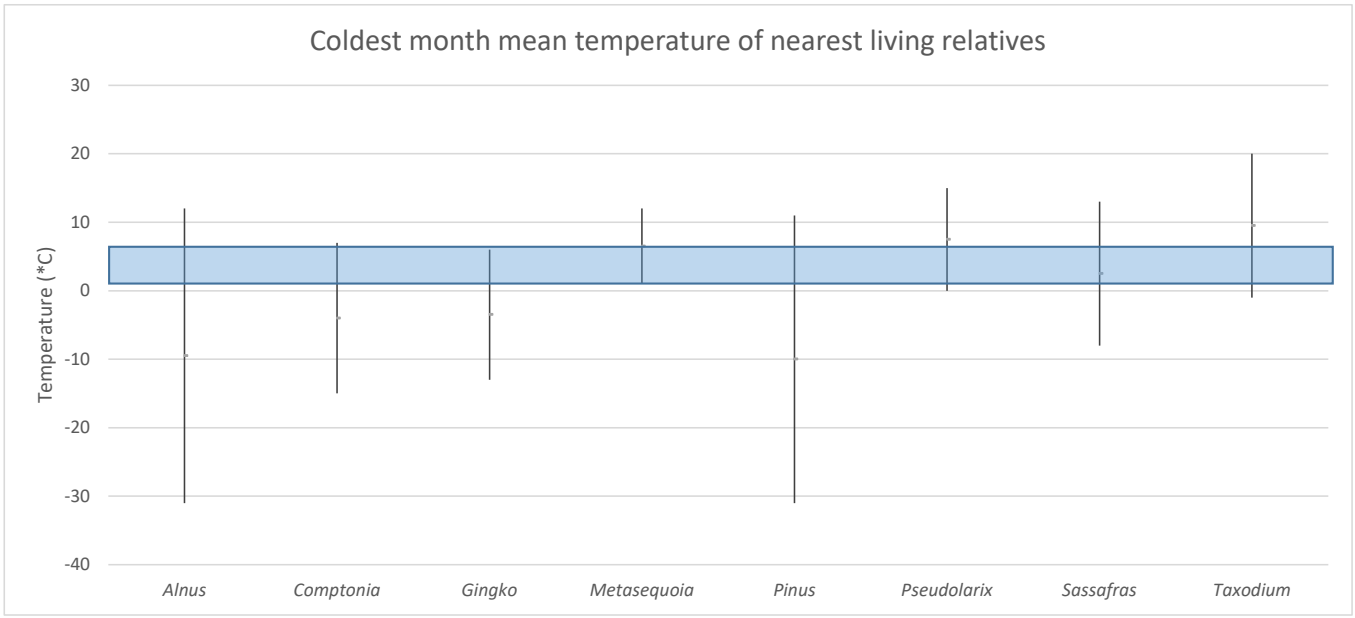
What are the limitations of using NLRs to estimate climate parameters for ancient environments? What factors might prevent this method from providing an accurate estimate?

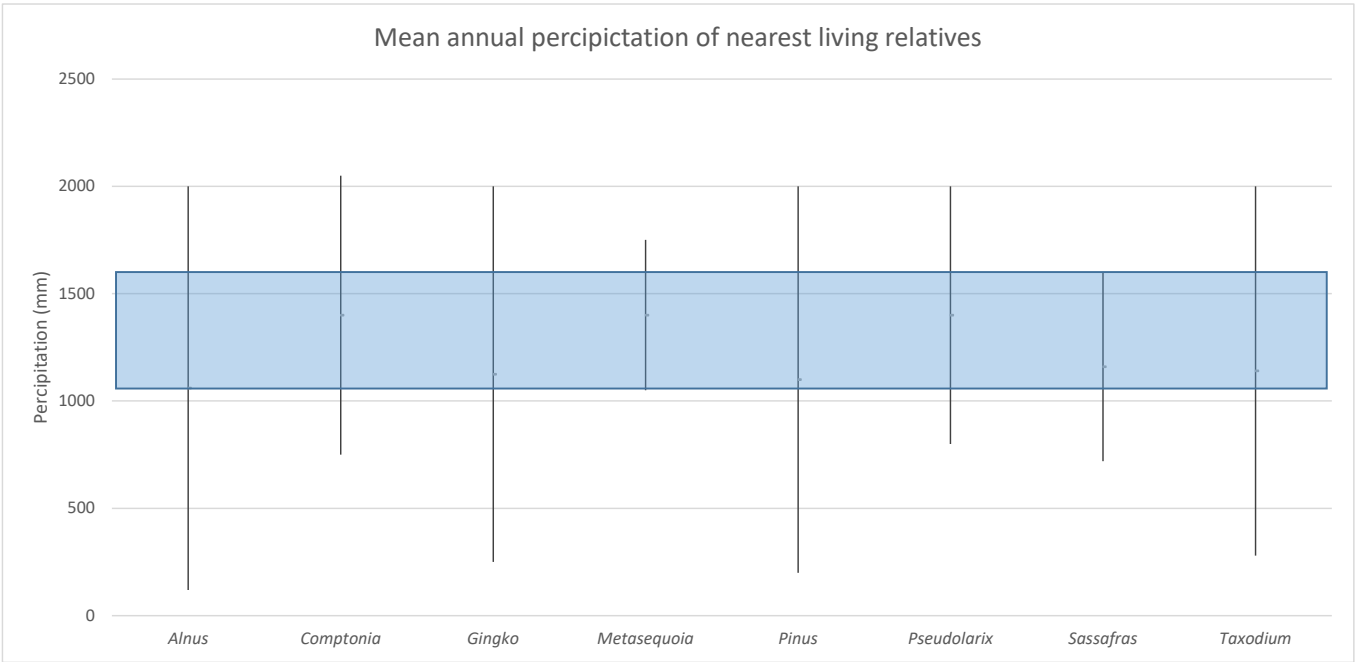
For NLRs to provide accurate estimates of past environments, modern NLRs must have similar climatic tolerances to the related fossil plants from the ancient environment. The more time has elapsed between the ancient and the modern environment, the more difficult it may be to find NLR that are reasonably similar in their environmental tolerances to fossil plants. This method would work better for relatively recent environments, e.g., those from millions or tens of millions of years ago vs. those from hundreds of millions or billions of years ago. Also, if ancient environments are drastically different from modern environments, the NLRs may have been subject to natural selection for very different climatic conditions for a long period of time and their range of climate parameters may not be accurate predictors of the range of tolerance of the fossil plants.

Eight fossil plants and their NLRs are used to estimate climate parameters for Okanagan Highlands in the Early Eocene. How would using a larger or a smaller number of fossil plants and their NLRs be expected to affect the accuracy of these predictions?

The larger the number of fossil plants and NLRs included in this analysis, the more narrow and more accurate the estimated climate parameters of the ancient environment would be expected to be. In answering this question, ask groups of students to randomly chose three NLRs from their graphs and estimate the range of climate parameters based on those taxa. Then compare these new predicted climatic ranges among groups and to those based on eight taxa. Assuming that the groups' random choices of NLRs are different, their estimates of climate parameters from the early Eocene in the Okanagan Highlands may be quite different from one another. They will likely be different and broader than the estimates based on 8 fossil taxa. Greenwood et al (2005) used 64 plant taxa and NLRs to estimate these climate parameters.


Mean annual temperature of nearest living relatives
Temperature (*C)
30
25
20
15
10
5
0
-5
-10
-15
Alnus
Comptonia
Gingko
Metasequoia
Pinus
Pseudolarix
Sassafras
Taxodium


Coldest month mean temperature of nearest living relatives
Temperature (*C)
30
20
10
0
-10
-20
-30
-40
Alnus
Comptonia
Gingko
Metasequoia
Pinus
Pseudolarix
Sassafras
Taxodium


Mean annual percipictation of nearest living relatives
Percipitation (mm)
2500
2000
1500
1000
500
0
Alnus
Comptonia
Gingko
Metasequoia
Pinus
Pseudolarix
Sassafras
Taxodium