Salix arctica showing slow signs of adaptation to warmer climate

Has the Salix arctica growing season temperature increased?

Chart, scatter chart

Description automatically generatedChart

Description automatically generated

Figure 1: there seems to be a small trend that the temperature of the growing season of Salix arctica is increasing. Done using python.

Chart, scatter chart

Description automatically generatedChart

Description automatically generated with medium confidence

Figure 2: the R analysis shows a linear regression model that illustrates the trend. Each dot is a day of the growing season. Note: the adjusted R-squared value is very small so it only accounts for a small proportion of the variability. The data used seem to satisfy the normality, linearity and constant variance assumptions required to fit a linear regression model (i.e the data lines up in the normal q-q plot (normality), and the residual vs fitted and scale-location plots show no trend (linearity and constant variance). Done using R.

We know that the temperatures are rising on Qikiqtaruk-Herschel Island and that the phenology of Salix arctica is changing in response1. In particular, its growing season has shifted. However, has the actual temperature during the growing season remained (relatively) constant over the years? To fill this knowledge gap we can contrast the temperature during the growing seasons over the years. I processed the data and plotted a) the daily temperature for the growing season every year and b) the average temperature of these growing season using python. Then, I input the processed data onto R to carry out a linear regression model. The model showed an increasing trend(average temperature of growing season = -259.20567 + 0.13280\*Year). The correlation is small (adjusted R-squared < 0.05) but there is strong evidence for it (p-values < 0.01). To investigate this topic further we could monitor this same data in the coming years and then reapply the model to see whether the trend is coincidental or not. I believe this is a very interesting question, because it assesses the survivability of the Salix arctica in the event the temperatures at the site keep rising as has been happening in the past years. Several plant species have exhibited adaptation to the changing climate234. I would say that the Salix arctica is adapting to grow in a warmer environment but possibly not quick enough to survive.

# References

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# Code

The first part of the code is done on python using pandas, numpy, seaborn, and matplotlib.

The second part of the analysis is done in R.

All the figures used are stored in the folder called figures (there are some extra figures there).

The processed data frames I exported to carry out the second part of the investigation in R are stored as csv files in the my\_data\_frames folder.

# Data

The data I used is from the documents qhi\_temp\_2017.csv and qhi\_phen\_with\_before\_2017.csv from the data folder from Qikiqtaruk Ecological Monitoring (<https://github.com/ShrubHub/QikiqtarukHub>). I am using this data as the data are publicly available using a Creative Commons Attribution 4.0 International copyright (CC BY 4.0). Data are fully public and it is referenced by citing the paper (Reference 1).