BIOL432
Group: "Rvengers"
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Dataset(s) Used:

Climate:

https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

Species:

http://data.ec.gc.ca/data/species/protectrestore/tofino-mudflats-shorebird-surveys-british-columbia/tofino-mudflats-shorebird-surveys-british-columbia-survey-counts-all-years/

http://data.ec.gc.ca/data/species/protectrestore/tofino-mudflats-shorebird-surveys-british-columbia/tofino-mudflats-shorebird-surveys-british-columbia-survey-counts-all-years/tmss-shorebirds-counts-all-years.xlsx

Canadian-wide survey:

https://www.canada.ca/content/dam/eccc/documents/pdf/cesindicators/canadian-species-index/2019/canadian-species-index.pdf

Questions Asked:

1. Are there any significant climate trends observed in the last XXX-XXX years?
2. If a climate trend is observed from a location of interest, are there any species impact? Watch out for things such as population, and migration patterns.
3. Is there a causative relationship between trends seen in certain species population and climate trends?

Project Summary:

The first selected data source is a climate database provided by the Government of Canada. The second data source is a survey of shorebirds found in the Tofino Mudflats, located in British Columbia. The third, is a species index for all of Canada, that encompasses a wide range of species and environmental systems across the country. From these data sources, relevant climate stations throughout British Columbia will be used to assess climate patterns. We will be using 30-year periods (e.g. 1976-2005, 2021-2050, 2051-2080) to compare our time-based climate data as well as any potential impact on species population. The third dataset will be used as a broader scope to compare the correlative relationship between the climate data and species records across the country. The use of 30-year periods is a scientific convention based on the statistical guideline that a minimum of 30 points of data are required to reliably determine a mean. Looking at mean values provides a simple sense of the direction and general magnitude of change.

The first step in our project is conducting analysis on our long-term climate data for any signs of significant change and trends. We will be considering factors such as temperature, water temperature, humidity, rainfall, snow fall, etc. Since climate data can be noisy, we may need to include pre-processing steps for high quality data. Different techniques can be used for preprocessing such as regex, dealing with missing values, duplicates, identifying outliers and resolving any inconsistency problems. Data conversion methods learned in class will also be of use to achieve a desired format. If data sets are large, skills learned in class regarding command line (Unix/Linux) will be used. At this step, we will employ techniques such as average of some variables (e.g. Temperature), annual analysis and visualization tools including ggplot2 or raster+plot used for heat maps, time series graphs, and explorative analysis.

After our climate screening stage, we will focus on some of the more significant trends and attempt to find a causative relationship between climate trends and species presence and absence. The details of this stage may vary depending on time, we may only be able to look at a few numbers of species. At this stage, we hope to observe changes such as species population density and distribution. Certain migration patterns may potentially be linked to the observed climate trend. Some of the potential techniques used at this stage involve various regression models with a statistical significance test. The Mann-Kendall test can be used to assess monotonic trend significance (if any are observed). To visualize our data, we can use ggplot2 functions or spatial overlay graphs; our species data holds various attributes including location and occurrence information. In R, we can use the new rWBClimate found on Github to visualize species occurrence over time with temperature (or any other factor). We can also use density plots to visualize species population patterns.

Links Used:

https://climateatlas.ca/atlas-guidebook/interpreting-climate-data
https://link-springer-com.proxy.queensu.ca/chapter/10.1007/978-3-642-34062-8_64
https://link-springer-com.proxy.queensu.ca/content/pdf/10.1007%2F978-3-642-34062-8.pdf
https://www.r-bloggers.com/overlaying-species-occurrence-data-with-climate-data/