Coding Project Notes

Historical weather data from the government of Canada was used as much as possible by finding monthly means for each community in Ontario by searching latitude/longitude. Those were available until up to about 2006.

After that – used modelling website by community.

USING GRIDDED VALUES

Results:

Model of result on year (not counting anything else) – just change in EAB abundance over time

Slight increase, but no statistically significant results (p = 0.6 (intercept – when year is 2002) and 0.5 (with every year – coefficient)).

Hypothesis 1 – according to our test models, no significant results. Therefore can’t say conclusively that there’s a change in EAB abundance over time

Over time, is there an interaction between the year and community, like was there one community that saw a significant difference as time went on? No, no significant p-values

JUST individual communities, not by type

Makes sense seeing as how some communities were only mentioned once or twice

Model is going over the years, then the communities and then their interactions – looking at each one individually. If one community is only mentioned once, obviously it won’t see much change over the years. No singular community saw significant.

Model 2: effect of latitude and longitude and their interaction on the result

Year, latitude and longitude

Good way to look at whether latitude and longitude has an effect, do latitude and longitude have an effect on community type? Like are they more likely to be categorized as rural in a given latitude/longitude? Yes, which correlates with what we know, such as that northern Ontario is more rural while southern Ontario is more urban.

Over the years, did lat/Long effect on EAB detection?

Statistically significant!

Community type has an effect hypothesis, and we’ve shown that there is an effect by lat/long on community

**Everything was done over the years**

Model 4:

Community type – chi square, does it effect presence of EAB?

Statistical significance!

GLM model – over the years, did community type have an effect on the detection of EAB?

Yes

Intercept is when the year is 2002 and community type is rural. With every year, there was a decrease in detections in rural communities. When year is 0 (2002) and community type is urban, theres a much lower initial value, but as the years increase there are increased detections

RESULTS

* Model 1: Has EAB abundance changed over the years in different Ontario communities?
  + Modeling the effect of time on EAB abundance
    - No significant P-values
  + Modeling the effect of time on EAB abundance by community
    - Significant values, but could be due to the extremely small sample size of some communities. Maybe use figure here about several communities dominating the observations despite there being a total of 154 communities. Some communities are only represented by 1 or 2 observations within the dataset.
    - To mitigate this, we decided to treat “year” as a discrete variable in the model and to test for significance using an ANOVA.
  + A graph with a number of bars

    Description automatically generated
    - As you can see, the observations are skewed through the years. The greatest number of observations happened between the years 2003 and 2010, which corresponds with some of the first recorded incidences of the EAB in North America. The most-important takeaway from this graph is the frequency of observations within this dataset changed significantly more over time than the abundance of EABs did. Furthermore, this change in observation frequency over the years makes it harder to compare and contrast detection rate through the years.
* Model 2: Longitude and Latitude
  + Modelling the effect of longitude and latitude and their interaction on EAB detection
    - Highly significant p-values
    - Plotting demonstrates how concentrated EAB detection is in one particular region
  + A map of canada with red dots

    Description automatically generated
  + Is there a relationship between coordinates and community type?
    - Yes! Significant p-values
    - This is in line with what we know about rural and urban distribution across Ontario
  + A map of canada with green and grey dots

    Description automatically generated
  + Is there a relationship between coordinates and mean temperature?
    - Yes! Significant p-values
  + A map of the north and the north

    Description automatically generated
    - EAB detection correlates with higher average temperatures, certain given latitude and longitude coordinates, and appears to have some correlation with community type. This one is a bit trickier to untangle because rural communities dominated the observations in the dataset (31,765 observations in rural communities vs. 6,236 observations in urban communities).
* Model 3: Community Type
  + Modelling the effect of community type on EAB abundance
    - Using a Pearson’s Chi-squared test returned a significant p-value
  + A graph of a diagram

    Description automatically generated with medium confidence
    - There were a total of 31,765 observations made in communities categorized as “rural”. Of those, 458 detected the presence of emerald ash borers, while 31,307 did not.
      * That’s a 1.44% detection rate in rural communities
    - There were a total of 6,236 observations made in communities categorized as “urban”. Of those, 460 detected the presence of emerald ash borers, while 5776 did not.
      * That’s a 7.38% detection rate in urban communities
  + A graph of a number of people

    Description automatically generated with medium confidence
    - As you can see, observations in rural communities greatly outnumbered those in urban communities (NOTE THE DIFFERENT Y AXIS SCALES)
  + Increasing urbanization in Ontario
    - Look at stats Canada projections
      * Urbanization is increasing, will this favour the spread of invasive pests across Ontario?
      * More studies are needed!
    - Perhaps forests that are left to their own devices select for resistance. 1% of resist ash trees in forests?
      * Cite sources!
* Model 4: Temperature
  + Modeling the effect of temperature on EAB detection
    - The effect of temperature on EAB detection is statistically significant!
  + A graph with red and blue dots

    Description automatically generated
    - Our results show that the dataset appears to have assessed more communities that have colder average temperatures in the latter half of the study. However, emerald ash borers were not detected in communities with average annual temperatures of less than ~4˚ C.
* Model 5: Community Type AND Temperature
  + Assessing the effect of temperature, community type, and their interaction on EAB detection
    - The significant effects came from:
      * Average annual temperature
        + P = 6.83e-12
      * Community type (urban)
        + P = 2.71e-5
      * Interaction between year and average temperature
        + 6.01e-12
      * Interaction between year and community type
        + 3.03e-5
    - The highest degree of significance was derived from the predictor variable “annual average temperature”, as well as its interaction with year.

Commmunities

* Arnprior
  + 1
* Atikokan
  + 38
* Bradford West Gwillimbury
  + 1
* Brantford
  + 1
* Cornwall
  + 1
* Connaught
  + 20
* Drumbo
  + 1
* Dubreuilville
  + 13
* Dufferin county
  + 61
* Earlton airport
  + 12
* Elk lake
  + 19
* Englehart
  + 28