Jackson Mitchell, 20161433

Northern Expansion of the Blacklegged Tick into Eastern Canada

PROBLEM

In Canada, up to 1997, the only known population of the blacklegged tick, Ixodes scapularis, was in Long Point, Ontario.[1,2] "Now, blacklegged tick populations have been increasingly observed in eastern Canada, particularly in regions bordering endemic areas in the United States to the south."[3] With this range expansion of this tick vector, Ixodes scapularis, there is an increasing risk of Lyme disease in Canada.[4]

OBJECTIVE

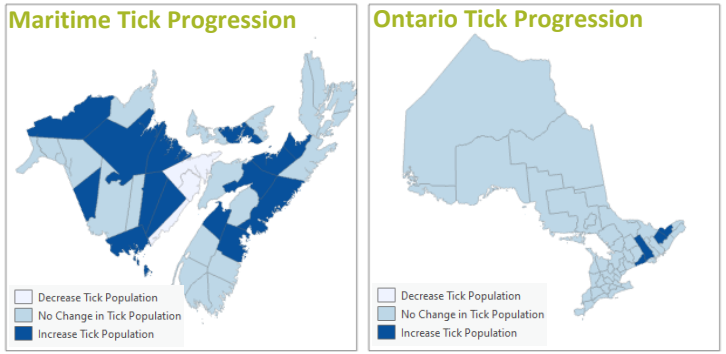
Determine whether there is enough data to demonstrate a geographical advancement of blacklegged ticks, into Eastern Canada and is it linked to climate change.

METHODS

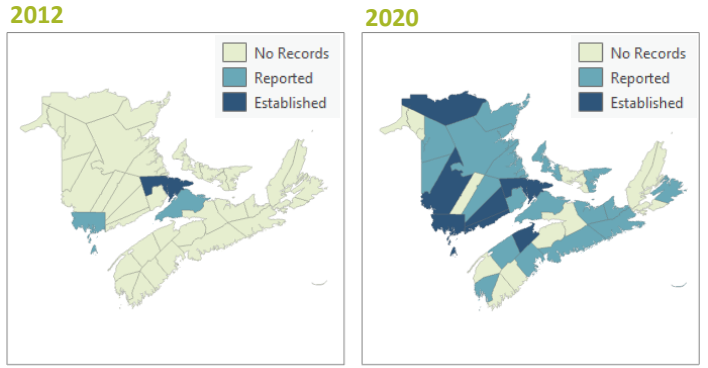
- Created population progression choropleth maps using sourced tick point data in ArcGIS Pro. Two study time frames were chosen. Tick populations from the years 2012-2016 were compared to the populations from the years 2017-2021.
- Created maps showing the tick progression in the US using 20 years of CDC tick surveillance data.
- I used tick data collected from the only source available in the Open Government Portal, Mount Allison University/Government of New Brunswick to create tick surveillance maps of for the years 2012 and 2020 for the Maritime region with the criteria being;
  No Record = 0 ticks,
  Reported = less than 10 ticks,
  Established = more than 10 ticks

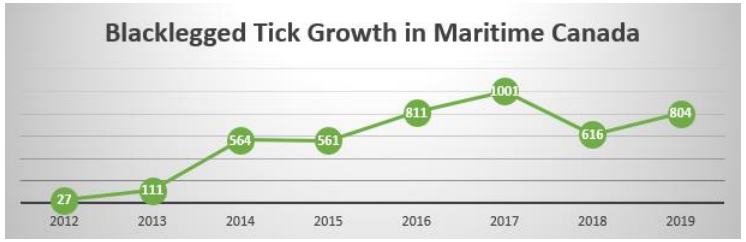
RESULTS

Blacklegged Tick Population Progression in Eastern Canada (2012-2016 to 2017-2021)

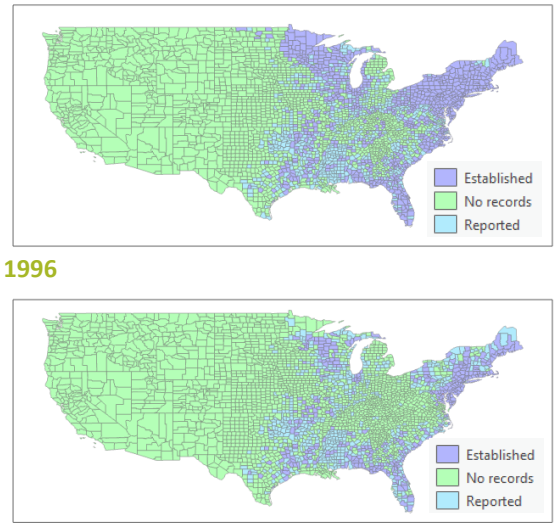


Blacklegged Tick Surveillance of Maritime Canada

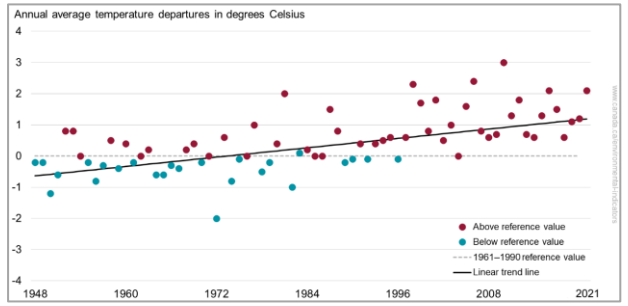




Maps for US tick surveillance.



Climate Change in Canada



Source: Environment and Climate Change Canada (2022) Adjusted and homogenized Canadian climate data.

DISCUSSION

According to, Environment and Climate Change Canada, the annual average temperature in Canada has increased at roughly twice the global mean rate and further warming is unavoidable.

How do the effects of a warming climate influence and support the northern expansion of the Blacklegged Tick?

- Increases in daily average temperatures can improve tick activity, reproduction, development rates, abundance and survival.
- Can lead to establishment and distribution of tick populations.
- Will allow for introduction into new sustainable regions by migratory hosts.

CONCLUSION

Mapping the 20 years of CDC tick surveillance data shows a significant increase in distribution of ticks, especially in regions bordering eastern Canada. Mapping the tick progression over a 9 year time span in eastern Canada does show a increase in tick populations especially in the Maritimes. Mapping ticks reported in the Canadian Maritime regions over a period of 8 years demonstrates a visible increase in the occurrence of ticks and an overall trend in the increasing tick populations in Eastern Canada. The Government of Canada graph shows that the annual average temperatures were consistently above or equal to the reference value from 1997 onward. This warming trend coincides with the expansion of blacklegged ticks in Canada.

NEXT STEPS

For the next steps I will use both my tick and weather data that I have collected and try to prove the connection between increasing tick populations and increasing temperatures.

MORE INFO

Tick surveillance is important. Small changes in tick distributions and tick abundance in the coming years could have large impacts on the incidence of Lyme disease.[5] As Lyme disease risk continues to spread northwards, anticipating and rapidly detecting the location of newly established tick populations would help public health authorities implement local prevention measures.[6]

[1] Ogden, N.H., St-Onge, L., Barker, I.K. et al. Risk maps for range expansion of the Lyme disease vector, Ixodes scapularis, in Canada now and with climate change. International Journal of Health Geographics 7, 24 (2008). https://doi.org/10.1186/1476-072X-7-24 [2] Lindsay R, Artsob H, Barker I. Distribution of Ixodes pacificus and Ixodes scapularis re concurrent babesiosis and Lyme disease. Canada Communicable Disease Report. 1998 Aug 1;24(15):121-2. English, French https://publications.gc.ca/collections/collection_2015/sc-hc/H12-21-24-15-eng.pdf [3] Talbot, B., Slatculescu, A., Thickstun, C.R. et al. Landscape determinants of density of blacklegged ticks, vectors of Lyme disease, at the northern edge of their distribution in Canada. Scientific Reports 9, 16652 (2019). https://doi.org/10.1038/s41598-019-50858-x [4] Bouchard, C., Leonard, E., Koffi, J.K., Pelcat, Y., Peregrine, A.S., Chilton, N., Rochon, K., Lysyk, T.J., Lindsay, L.R., and Ogden, N. (2015). "Special report: The increasing risk of Lyme disease in Canada.", Canadian Veterinary Journal, 56(7), pp. 693-699. https://profils-profiles.science.gc.ca/en/publication/special-report-increasing-risk-lyme-disease-canada [5] Kotchi SO, Bouchard C, Brazeau S, Ogden NH. Earth Observation-Informed Risk Maps of the Lyme Disease Vector Ixodes scapularis in Central and Eastern Canada. Remote Sensing. 2021; 13(3):524. https://doi.org/10.3390/rs13030524 [6] Ripoche M, Bouchard C, Irace-Cima A, Leighton P, Thivierge K (2022) Current and future distribution of *Ixodes scapularis* ticks in Québec: Field validation of a predictive model. PLOS ONE 17(2): e0263243. https://doi.org/10.1371/journal.pone.0263243