Dartmouth

Detection of Spatial Association between Lyme Disease and Environmental Factors in New Hampshire

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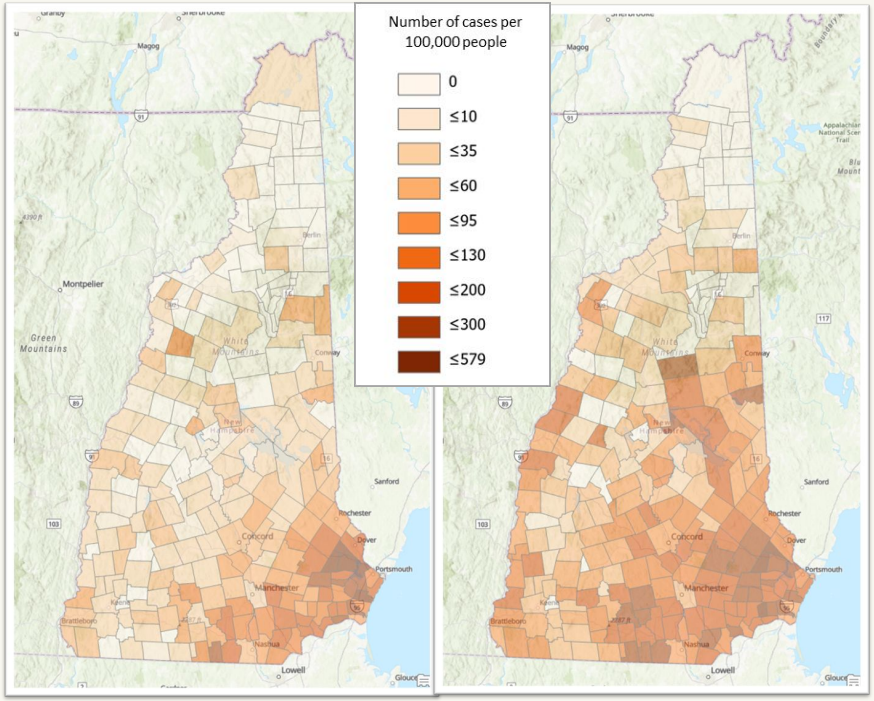
Introduction

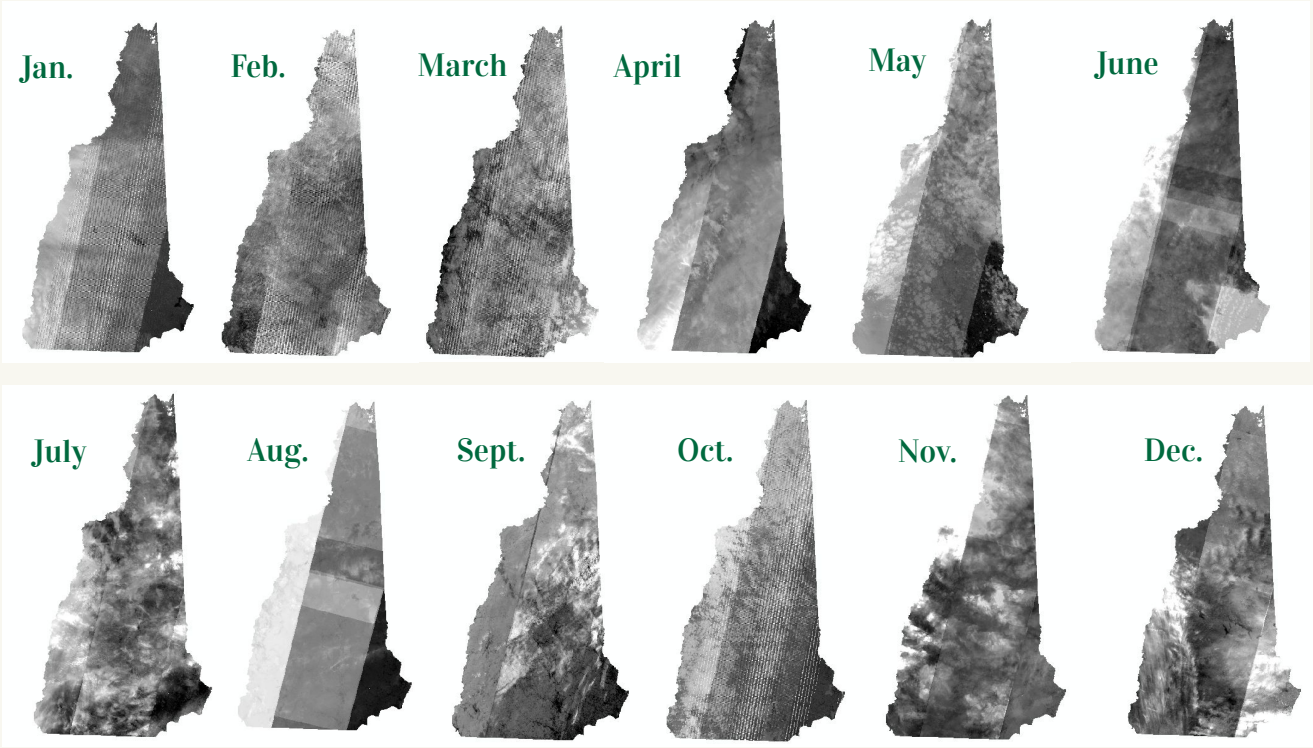
- In this study, we examined how Lyme Disease varies with certain environmental factors in New Hampshire (NH) in 2013.
- On the Lyme Disease (LD) side, we used the data published by the NH Department of Health and Human Service (DHHS), which is town-level, age-adjusted rate data for two 5-year periods: 2004-2009 and 2010-2014.
- On the environmental side, we focused on surface temperature. This surface temperature data are from the USGS Landsat 7,8-9 Collection 2 (C2) Level 2 Science Product (L2SP).
- Using ArcGIS, we processed the environmental raster layers into a usable form to then calculate the correlation between LD and the surface temperature data.

Lyme Disease Data

- Two time periods:
  2005-2009 and 2010-2014
- Age-adjusted rate
- Town-level: 259 towns in NH
- Source: NH DHHS



NH Monthly Average Surface Temperature, 2013



Source: USGS

Methodology

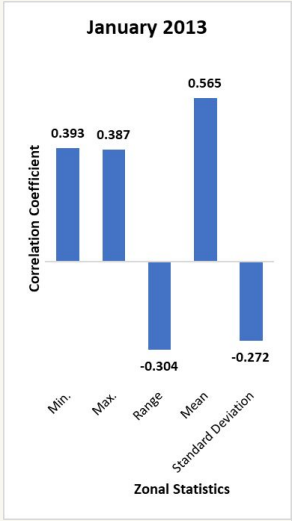
1. We downloaded surface temperature data from the USGS Landsat 7, 8-9 Collection 2 (C2) Level 2 Science Product (L2SP) for 2013

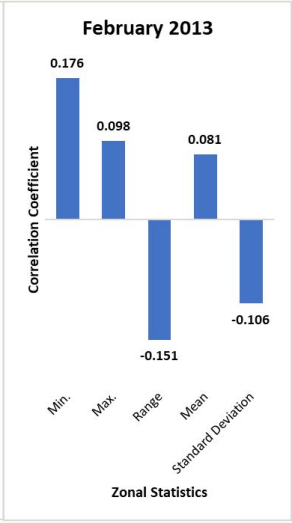
2. Using ArcGIS, we processed the environmental raster layers into a usable form by: (**i.**) converting surface temperature to NH State Plane, (**ii.**) clipping them to New Hampshire spatial extent, (**iii.**) mosaic and averaging multiple monthly parts into an integrated layer for each month, and (**iv.**) calculating the zonal statistics[(2)] of surface temperature values using town polygons.

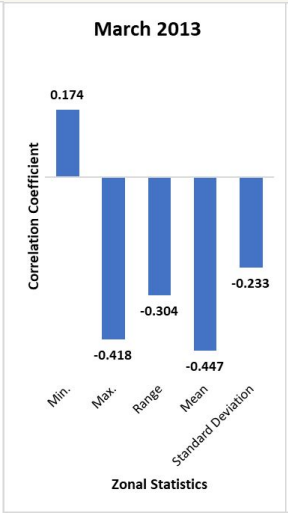
3. Finally, we calculated the correlation coefficient between LD and surface temperature zonal statistics.

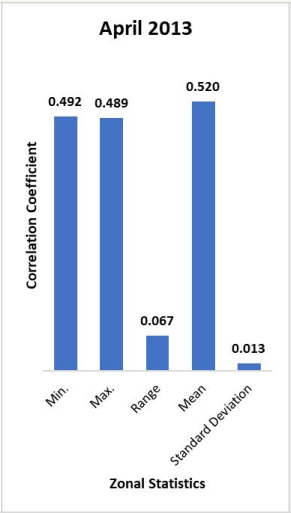
(l) These were min, max, mean, range, and standard deviation

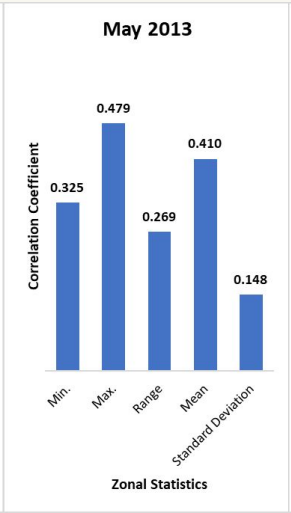
Results: Correlation Coefficient between Disease Rates (2005-2009) and Surface Temperature during Jan. - June 2013

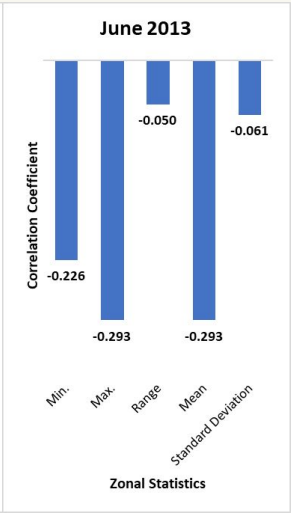




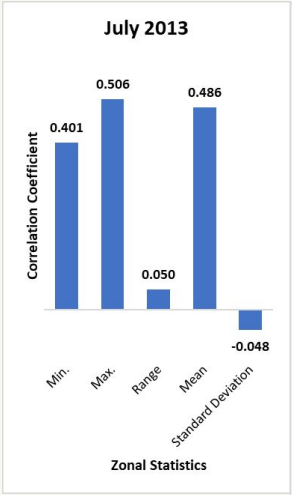


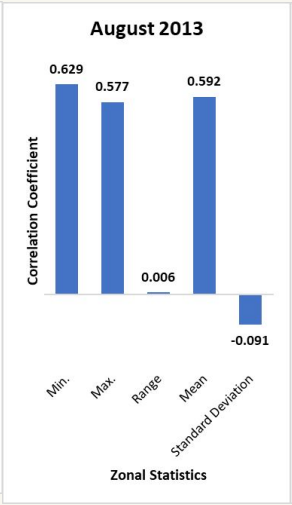


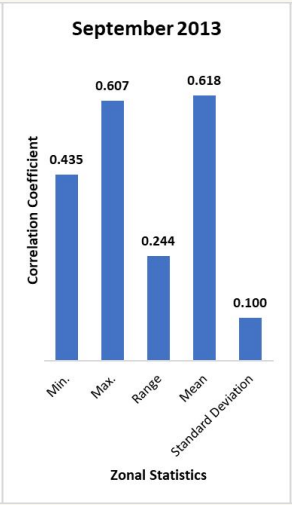


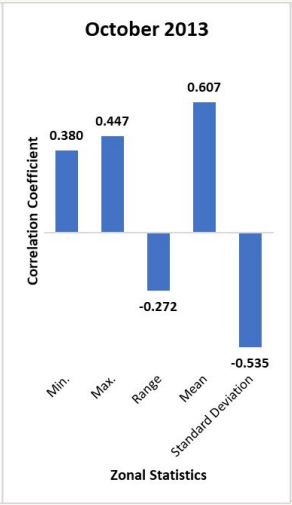


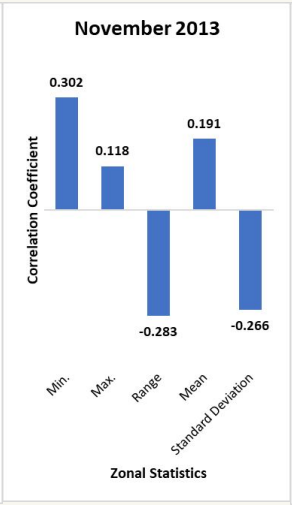
Results: Correlation Coefficient between Disease Rates (2005-2009) and Surface Temperature during July - Dec. 2013

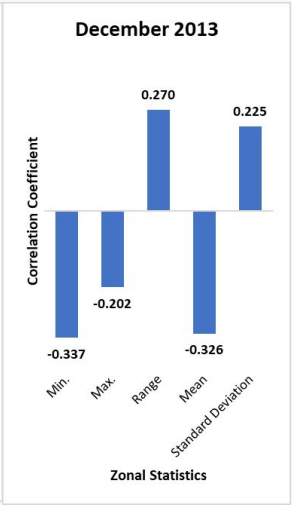




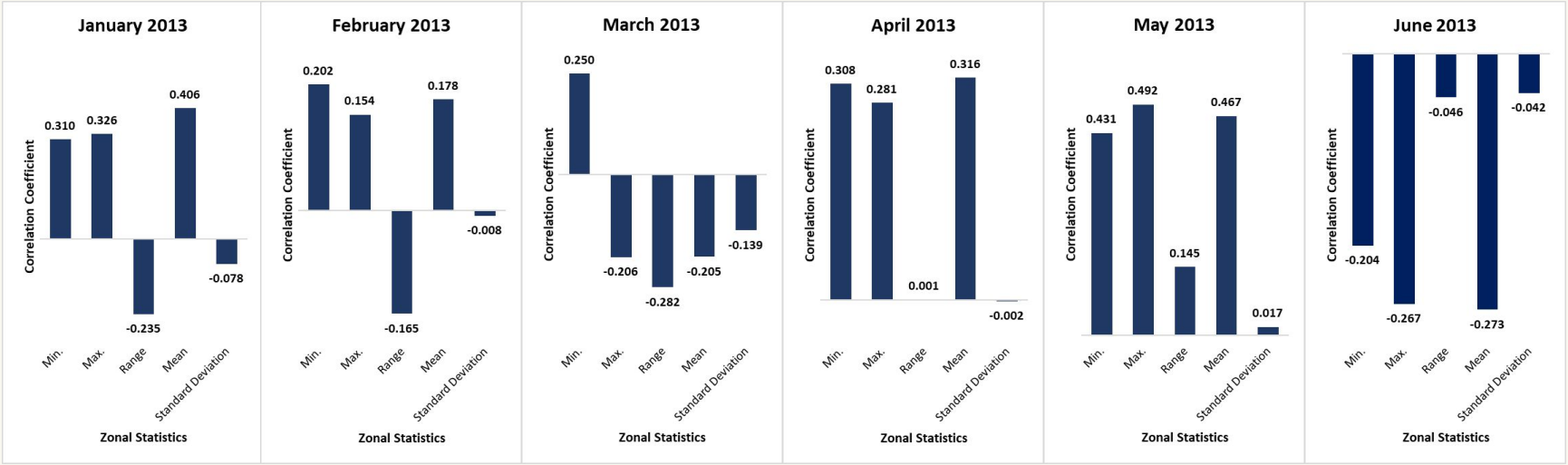




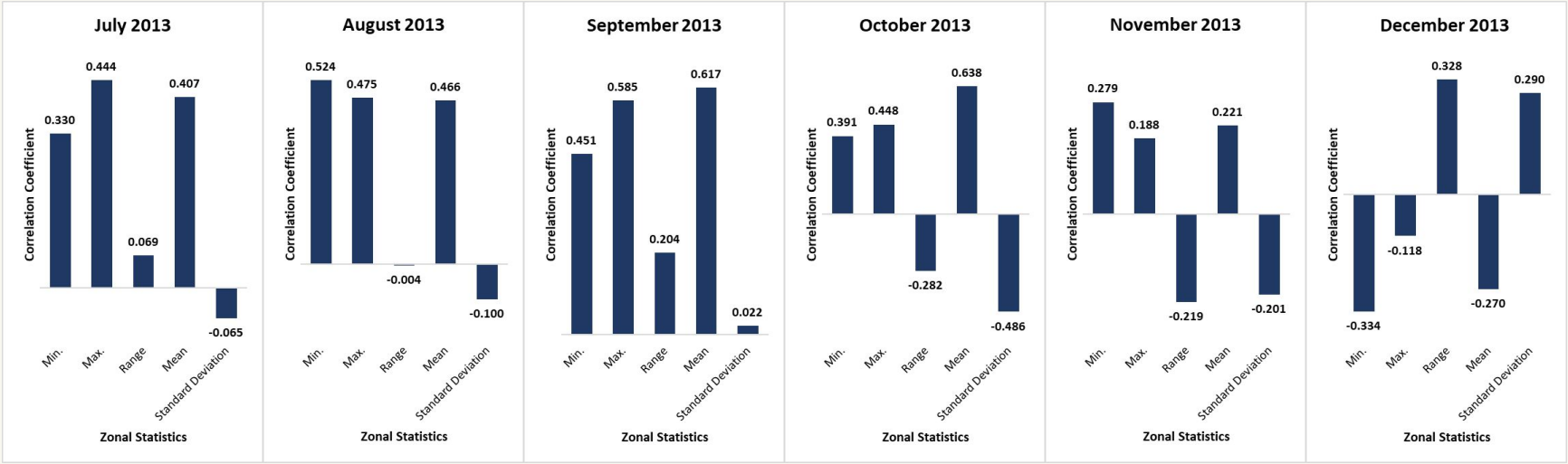




Results: Correlation Coefficient between Disease Rates (2010-2014) and Surface Temperature during Jan. - June 2013



Results: Correlation Coefficient between Disease Rates (2010-2014) and Surface Temperature during July - Dec. 2013



Discussion

- From the correlations, we can see that the strongest ones tend to be min., max., and mean
- The strongest correlations between the 2005-09 disease rates and min. occur in April and the late summer, August-September. The same comparison but for 2010-14 rates sees relatively strong correlations for October too, and May replaces April. Notably, December and June have negative correlations, with December's being stronger
- For max., the same trend generally follows that of the 05-09 and min. correlations. In the 10-14 correlations, October again is included among the strongest correlations. Interestingly, the negative correlations occur in March and December across both time periods
- For the mean, the correlations take a different route. The strongest occur in early-mid fall across both 05-09 and 10-14, and the second highest in the spring. Interestingly, January correlates relatively highly in 05-09. In terms of negative correlations, they take place in March and December in 05-09 and June and December in 10-14.

Conclusion

- Our findings in the previous slide might suggest that as tick season arrives in the spring and late summer/early fall (Corliss, 2021), cases are more strongly correlated with surface temperatures.

- The stronger presence of October in the 2010-14 case rate correlations might indicate that this month's newer relation to disease rate could extend the temporal risk of contracting Lyme Disease.

- This study could be improved by considering more years and more geographies beyond New Hampshire. This would help us better examine how Lyme Disease varies with environmental factors like surface temperature

References

- Corliss, J. (2021, August 5). *Tick season is expanding: Protect yourself against Lyme disease.* Harvard Health Publishing Blog. https://www.health.harvard.edu/blog/tick-season-is-expanding-protect-yourself-against-lyme-disease-202108052564
- NH DHHS (https://wisdom.dhhs.nh.gov/wisdom/index.html)
- USGS Landsat Data Earth Explorer (https://earthexplorer.usgs.gov)