



The Havoc of the Spruce Budworm: Where Are They Now?

Kellyanna Merrill

GIS and Human Geography student at Monroe Community College, in partnership with University of Maine and the National Science Foundation



Where do budworms thrive?

For Figure 1 we are focusing on locations in Maine where there has been a consistent growth in the Spruce Budworm (SBW) year over year starting in 2016 to 2023. This map's aim is to understand what kinds of habitats the SBW thrives best in over space and time in relation to two factors: tree species and elevation.

Despite the Spruce Budworm's name, it is actually the Balsam Fir tree the SBW is most attracted to in the Maine region, which is why we've isolated the coverage to only Balsam Fir.

Methodology

Values of less than 9 percent of total biomass are displayed as "no color" to showcase how the Balsam Fir prefers areas of lower elevation. The result derived from this is that SBW themselves are more likely to reside and thrive in lower elevations because of their host species' preference. For Figure 2 we queried and "selected by attribute" within our SBW population dataset until we could see where there had been up to a 5 year increase in the same location year over year.

Discussion

Only one location was 1.3 meters above average for the region, but the other two locations are significantly below average in their elevation location (-2.3 and -6.4 meters below average), which provides strong evidence for the hypothesis that SBW thrive over time in lower elevations. Unfortunately, the Tree Species data we have is limited to a western block of Maine and does not expand eastward enough to see if this correlation tracks with the Balsam Fir coverage, but an educated guess would be that it does.

5 Year Steady Increase from 2016-2020

Westmanland, county of Aroostook
Pheromone moth trap average increases starting in 2016:

- 2016 - 3 SBW
- 2017 - 29.5 SBW
- 2018 - 44 SBW
- 2019 - 82.7 SBW
- 2020 - 186.3 SBW

132 CM above average elevation

T10 R6 WELS, an unincorporated township in county of Aroostook
Pheromone moth trap average increases:

- 2016 - 9.7 SBW
- 2017 - 13 SBW
- 2018 - 50.7 SBW
- 2019 - 53.3 SBW
- 2020 - 97.3 SBW

-229 CM below average elevation

Merrill, in Aroostook County
Pheromone moth trap average increases:

- 2016 - 7.3 SBW
- 2017 - 11.7 SBW
- 2018 - 12 SBW
- 2019 - 37.3 SBW
- 2020 - 55 SBW

-644 CM below average elevation

Why It Matters, Thesis Statement, and the Research Challenges

The eastern Spruce Budworm (SBW) is one of the most damaging creatures to the forests of North America. They feed on spruce trees (white, black, and red spruce), but in the state of Maine they have the biggest appetite for Balsam Fir trees. When SBW populations are endemic (no outbreaks taking place) they typically go unnoticed and cause no great damage. But after several catastrophic outbreaks in the last 100 years that have resulted in widescale forest defoliation (an already strenuous dilemma without the rising prevalence of forest fires in Canada and the United States), forestry experts and researchers have devoted themselves to monitoring their presence and exploring best practices around damage-control.



Quebec is currently experiencing a severe outbreak of the SBW that has defoliated over 15 million acres of fir/spruce stands. We can expect that this outbreak will not stay contained to Quebec, and the next big SBW epidemic is knocking on Maine's door. There are simple and effective measures we can take in advance to either mitigate or completely prevent further destruction that would otherwise have widespread implications on the job market, lumber industry, and environment & wildlife well-being. The measures required are transparent communication between researchers, landowners, land-managers, and government officials at a county and state level. We also need organized SBW trap-tracking and to monitor when, where, and how often insecticides are used.

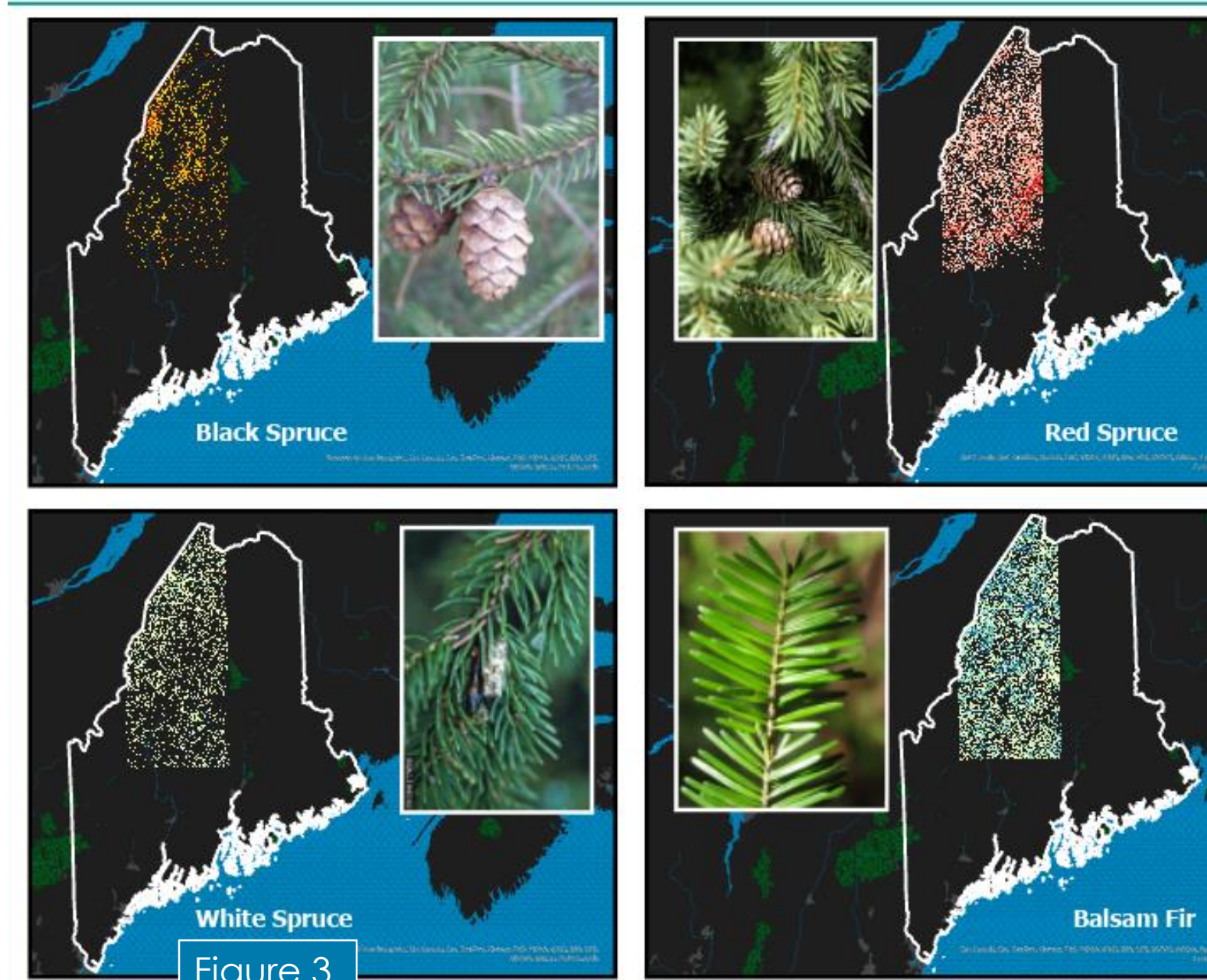
One factor that needs more attention is more rigorous investment. During the scope of this project, we have had to evaluate data very carefully because there are certain things we cannot know for certain. We cannot know if the SBW traps that were recorded in different years were all collected around the same time of year, or how often they were evaluated by field workers, if the averages calculated were all collected using the same number of samples. With 602 SBW moth traps across Maine, it is not feasible with existing funding to recruit hundreds of field researchers to collect this data in person with coordinated intervals, so it is often relegated to workers from different industries who happen to be "going that way" anyway.

The second missing factor is organized cooperation on data sharing between Canadian and American research institutions. Unfortunately the nature of separate institutions with their own independent funding means political boundaries (i.e., state and national borders) are a limiting factor in the research—and yet, the budworms are not limited by these boundaries.

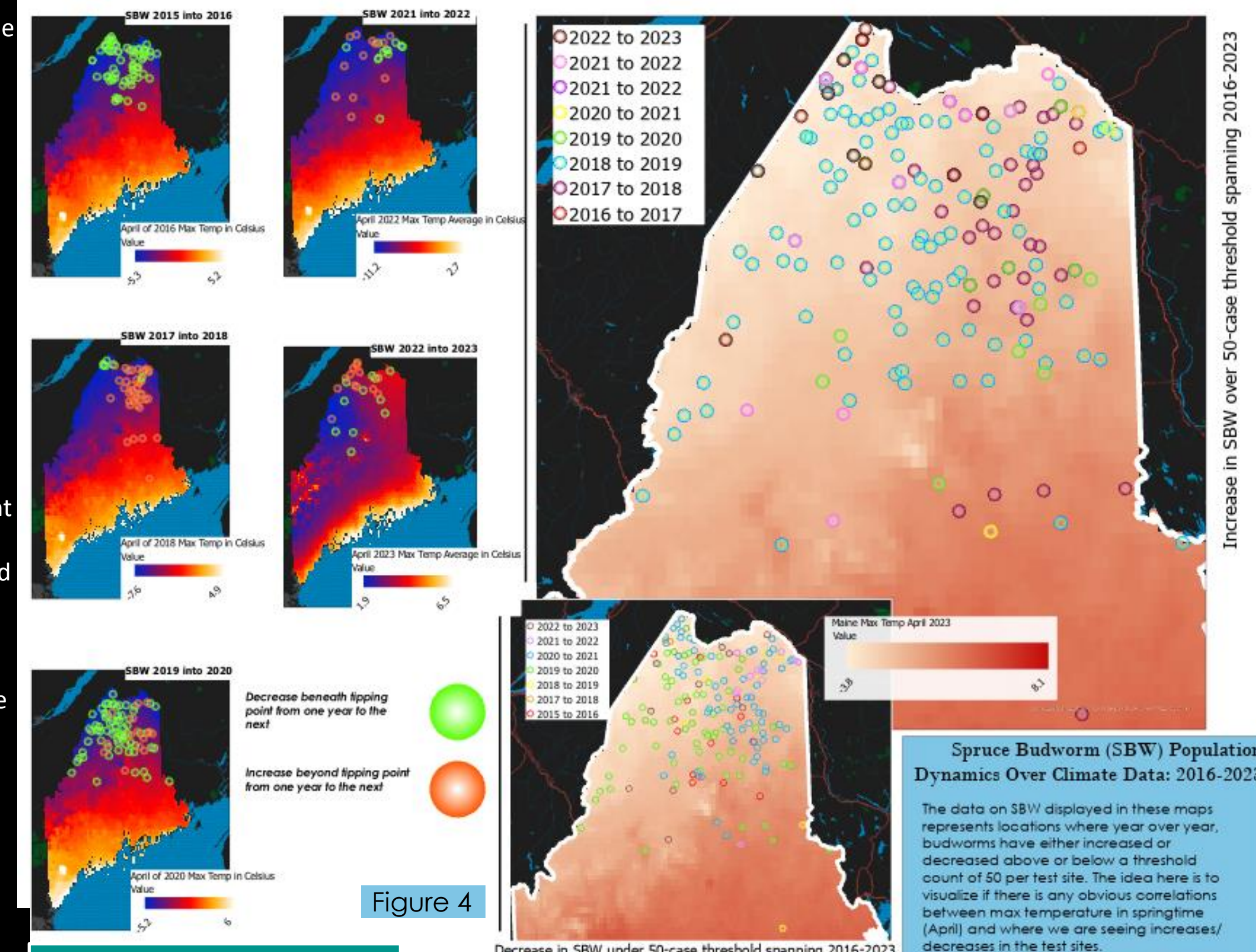
They are, however, limited by physical geography: tree species, maturity of host species, elevation, and climate.

Project Statement

For the scope of this project we are primarily focusing on elevation and climate. Our goal is to understand what kinds of habitats the SBW thrives best in while examining three key factors— tree species, elevation, and climate. Where can we observe obvious spatial patterns over time and landscape in relation to the SBW? My hypothesis after this research is we can expect to see an adaptation of the SBW to the warmer climate conditions, or they will migrate north to a more forgiving climate.



Thrive or Decline: Budworms and Climate

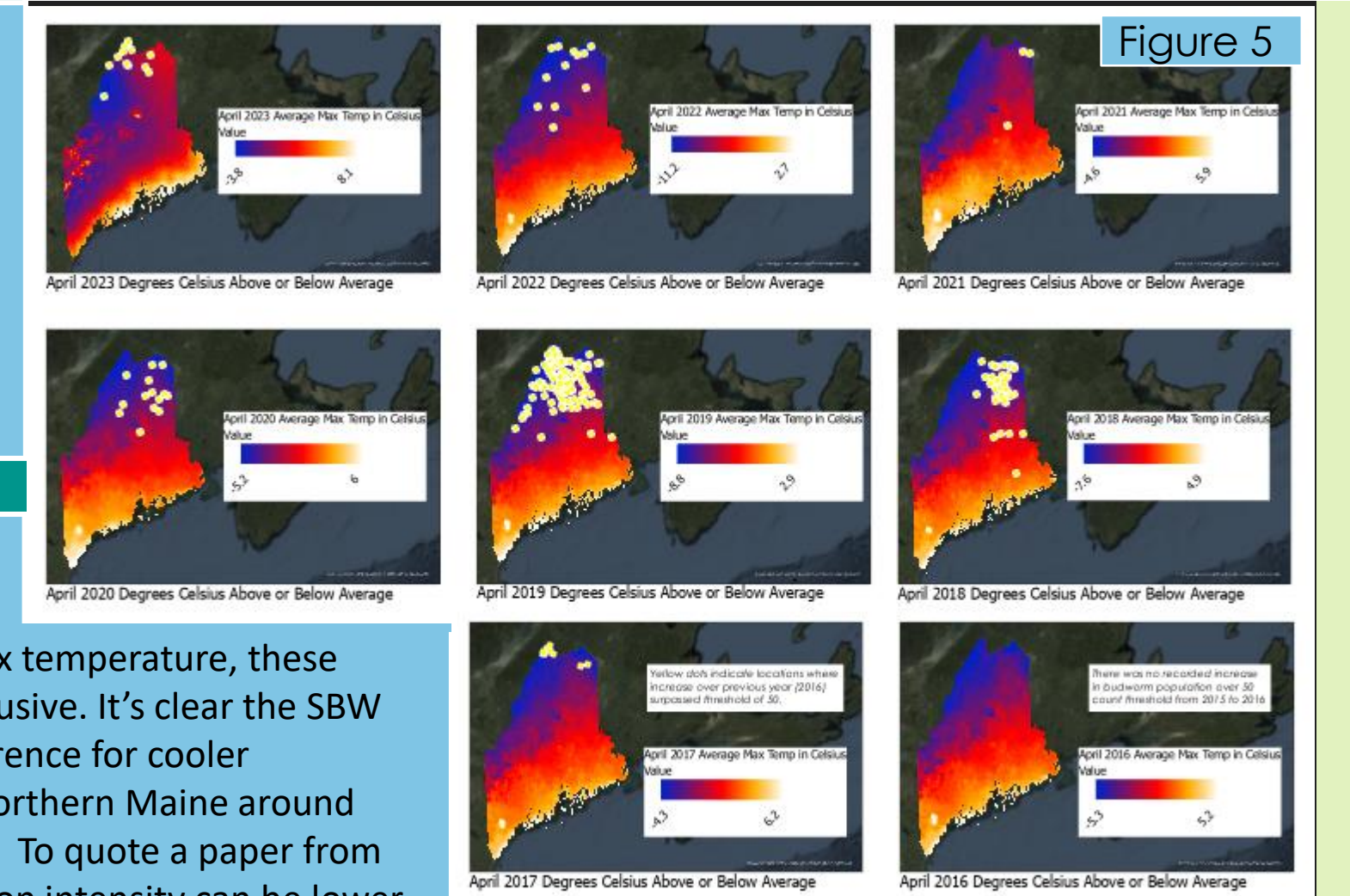


Methodology

In Figure 4 we isolated for increase/decrease from one year to the next to discern whether there is a spatial pattern with max temp. In Figure 5 we specifically only isolated increases and displayed every year we have SBW moth counts for.

Discussion

As far specific population fluctuation in any location



Results

It remains to be seen how severe the upcoming outbreak will be, but the shifting climate conditions in Maine do set up unprecedented conditions for all wildlife. We may find that SBW is no longer well-suited for the warming environment in Maine— or, we may see the SBW adapt to the changing conditions. During the scope of this project we have narrowed down that SBW is likely to be found in lower elevations in cooler environments in the northwest, perhaps in part due to New Brunswick's own preventative measures taken in the east.

References

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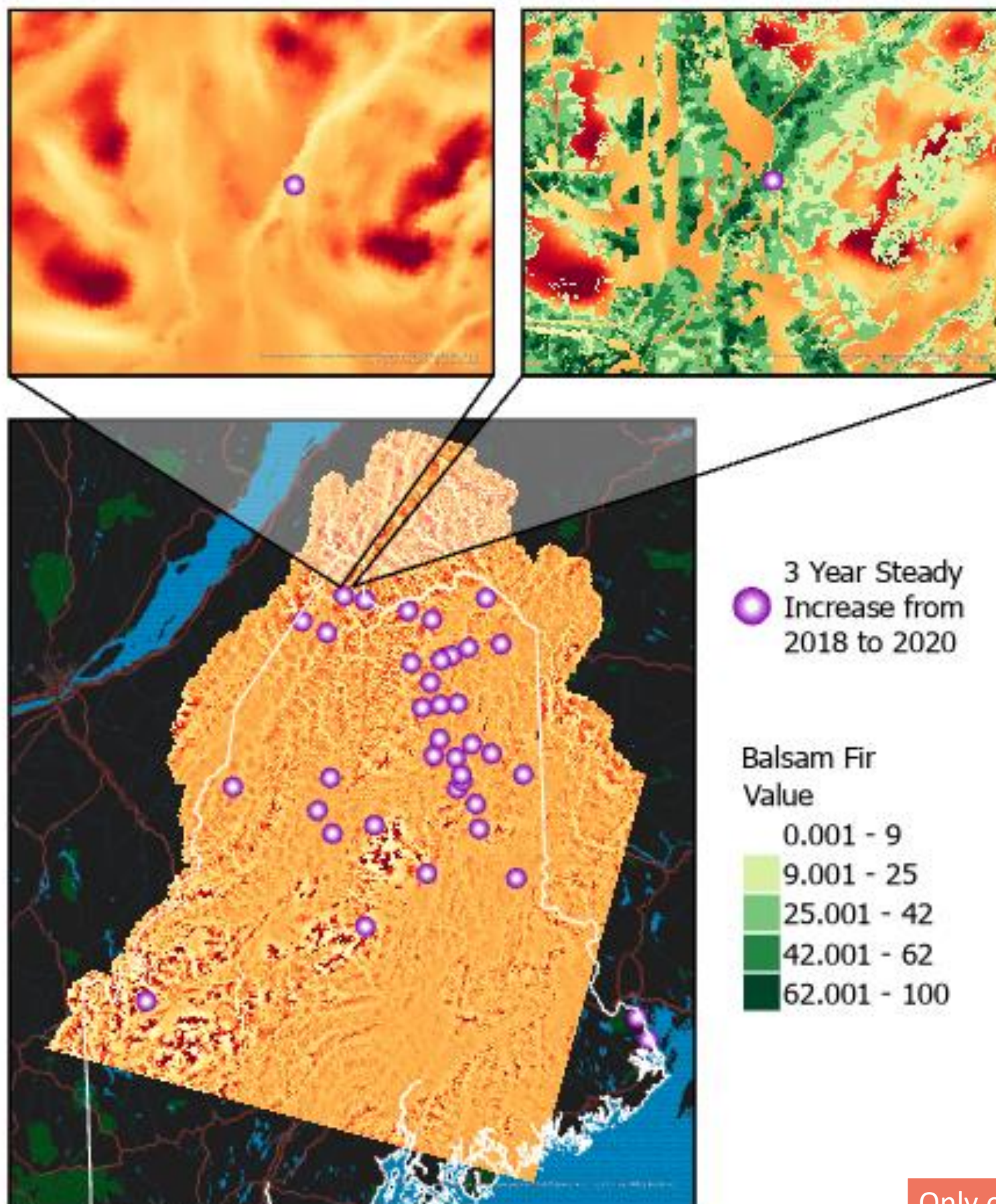


Figure 1: BroadScale Elevation Value. Elevation units are in centimeters above or below average for entire raster area displayed.

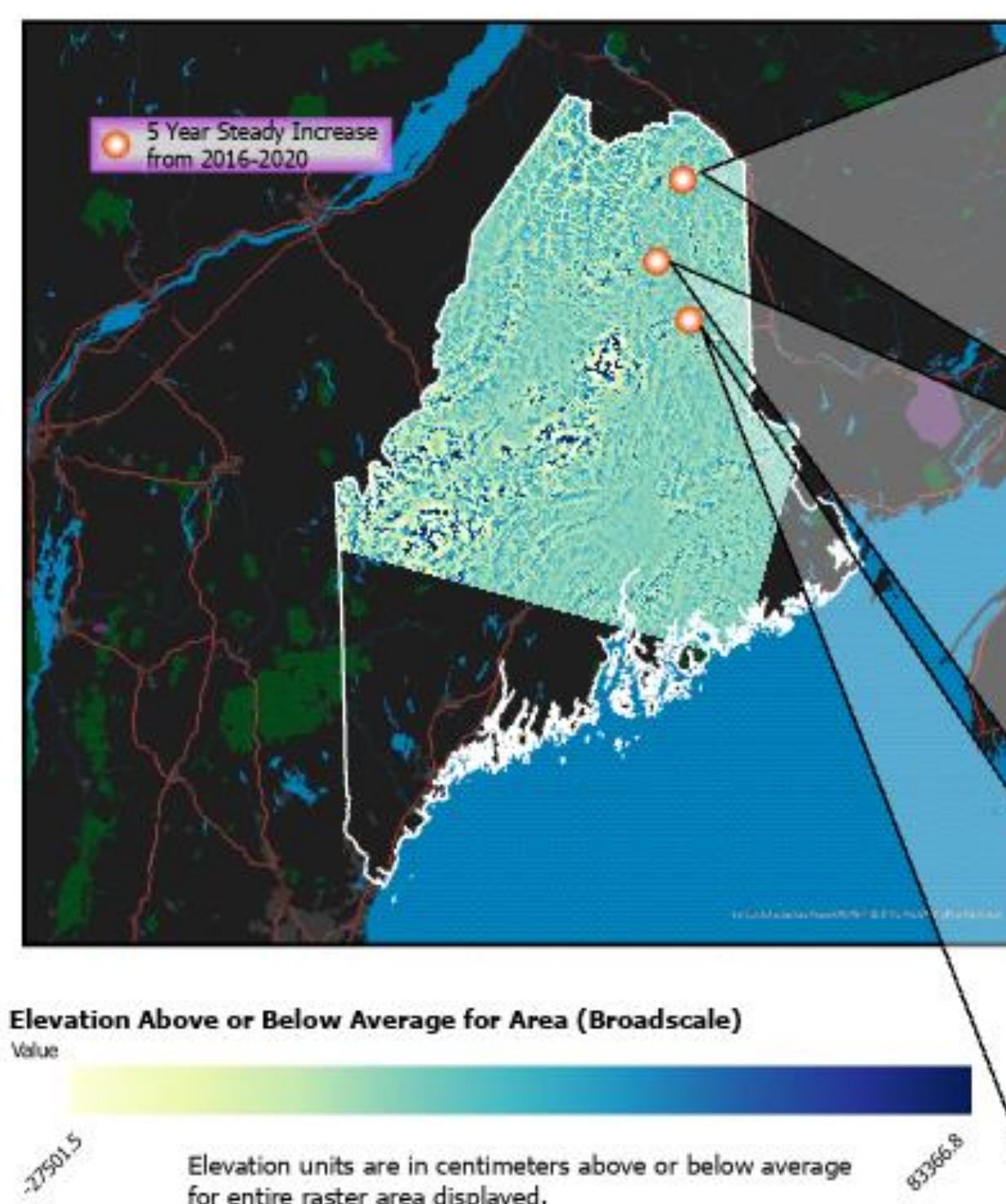


Figure 2: Elevation Above or Below Average for Area (BroadScale). Elevation units are in centimeters above or below average for entire raster area displayed.