Mosquito control has become a priority for Massachusetts public health initiatives, and the Massachusetts Mosquito Control Project serves many cities and towns to protect against the environmental threat mosquitoes can bring. In 2018, there were 24 reported human cases of West Nile Virus, a rare but serious disease most often spread by a mosquito bite. Mosquitoes breed in areas of stagnant water and certain types of wetlands. The Central Massachusetts Mosquito Control Project state in their Larval Control Program outline that they have started to prioritize surveys of wetlands in order to control mosquito emergence. They define their surveillance standards as the following wetlands: Shallow Marsh, Shrub Swamp, Coniferous Wooded Swamp, Deciduous Wooded Swamp, and Mixed Trees Wooded Swamp. Another criteria was that these wetland areas should be 5 acres or greater. Since this program is focused on central Massachusetts, this project hopes to use this information that designates suitable mosquito breeding grounds and apply it across the state of Massachusetts to ultimately recommend treatment areas for aerial larvicide. Improving and refining treatment measures will hopefully lead a reduction in the mosquito population and a decrease in infection opportunities and mosquito-borne illnesses.

### Methods

The methodology that was used to come up with the recommendation for best mosquito treatment areas was to divide Massachusetts by county. Since there was county-level data for both reported West Nile Virus cases as well as population levels, it was possible to compare if there was a particular region where infection was more likely, and this would be normalized across populations per county. These event likelihoods would then be matched against the suitable wetland types for mosquito breeding grounds.

Selection was used to isolate the suitable types of wetlands to only those 5 acres and greater. After a particular region (county in this case) had been identified, clipping and density analysis were used to determine the areas that had the greatest concentrations of suitable wetlands (towns in this case). Upon identification of the best-fit towns, a dissolved buffer radius of two miles was calculated around each of these towns, which was based on the average distance a mosquito can fly from its place of birth.

### Results

The results of this analysis were the towns in Massachusetts that were the most likely to be breeding grounds for mosquitoes, while factoring in population density and past infection rates. Maps 1 and 2 are meant to be comparative, and from these maps there are similarities in the color schemes between counties with a high number of West Nile Virus cases compared to the population levels of each county. The cases were normalized across population numbers per county, and each map was compared against the suitable wetland types in order to determine the county where intervention against mosquitoes could be most effective.

Map 3 displays Middlesex County, which the analysis determined would be the most appropriate treatment site. However, this project hoped to refine the location of aerial larvicide treatment to ensure the most effective results at the lowest risk to public health. Map 4 shows the areas where the wetland types are the densest, and from there six towns were identified as potential treatment sites. Map 5 factors in the average flight radius of a mosquito during its lifespan, which could be valuable information since the treatment plan is aerial larvicide and can cover a wider surface area. This was estimated from the average flight distance of a mosquito in its lifetime (1-3 miles), so buffers surrounding the town at 2 miles give an approximate idea of mosquito location.

### Conclusions

Based on the geographic analysis conducted in this study, the researchers would recommend these locations within Middlesex county to mosquito control groups as a potential larvicide treatment site. Further analysis can be used to identify other zones based on the layers that were created in this analysis (suitable wetlands over 5 acres), to mitigate the risk that mosquitoes pose to public health.