



Mapping the Occurrence of West Nile Virus in Relation to Land Use / Land Cover in Morris County, NJ

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Background

Morris County hosts a wide variety of environments from highly developed, urban districts to rural farmland. This diversity of land also opens up a myriad of habitats for different mosquito species. Each species has a preferred habitat, set of host species, and life stage requirements. These species also serve to host their own set of pathogens and disease such as West Nile virus (WNV) carried by *Culex* species such as *Culex pipiens*.

This past season Morris County Mosquito Control received 2,810 service requests from all over the county and high amounts of precipitation from late August into early October. Land use/land cover (LULC) can be used as indicator for local environmental factors and may impact what mosquito species can establish themselves in which locale. For example, a large concentration of impervious surfaces may result in runoff water pooling and creating breeding habitat in area. Using trap data collected in the field, New Jersey land use/land cover, and impervious surface map layers, this project aims to visualize the presence of mosquito-borne disease and hosts within Morris County. By recognizing the conditions and locations where WNV is likely to occur one can focus public health efforts toward mitigating the spread of disease more effectively.

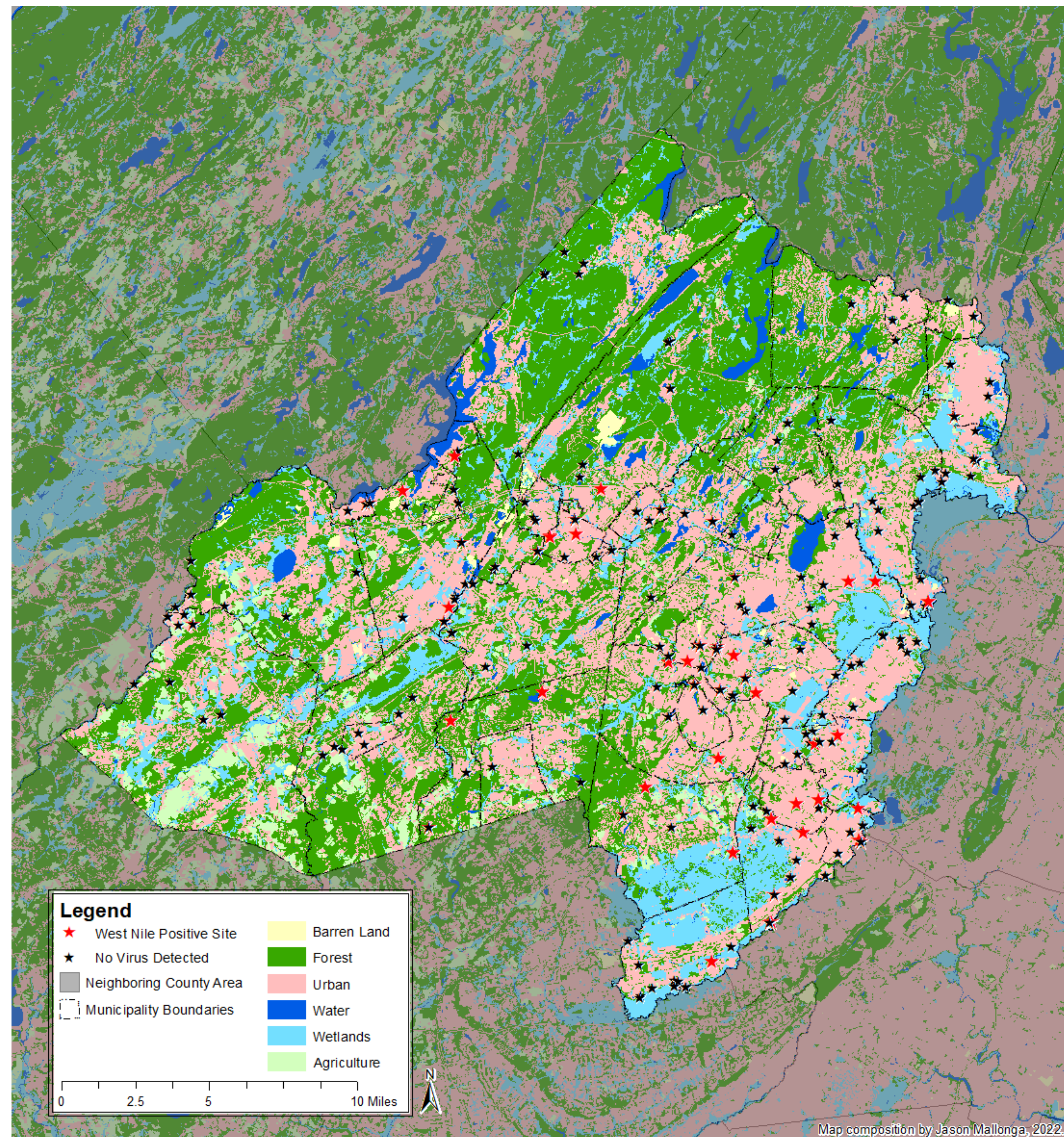


Figure 1. This map displays trap locations and land cover classification within Morris County throughout the 2021 season. 63 of the 467 areas trapped tested positive for the presence of West Nile Virus (WNV). No other mosquito borne diseases were identified.

Data & Methods

Trap data was collected throughout the 2021 season from May 11th to October 21st using the Frontier Precision's Fieldseeker application. A variety of sampling apparatuses were used including: resting boxes, NJ light traps, CDC traps and Gravid traps.

"Land Use/Land Cover of New Jersey 2015" and "Impervious Surface of New Jersey from Land Use/Land Cover 2012 Update" map datasets provided by the New Jersey Department of Environmental Protection Bureau of GIS were used to create a set of maps displaying the conditions inside Morris County and the surrounding area.

Results from the trap data were plotted and symbolized onto multiple maps showing the land use/land cover and impervious surface percent coverage to qualitatively show the distribution of WNV positive locations in relation to local environmental conditions.

Sources

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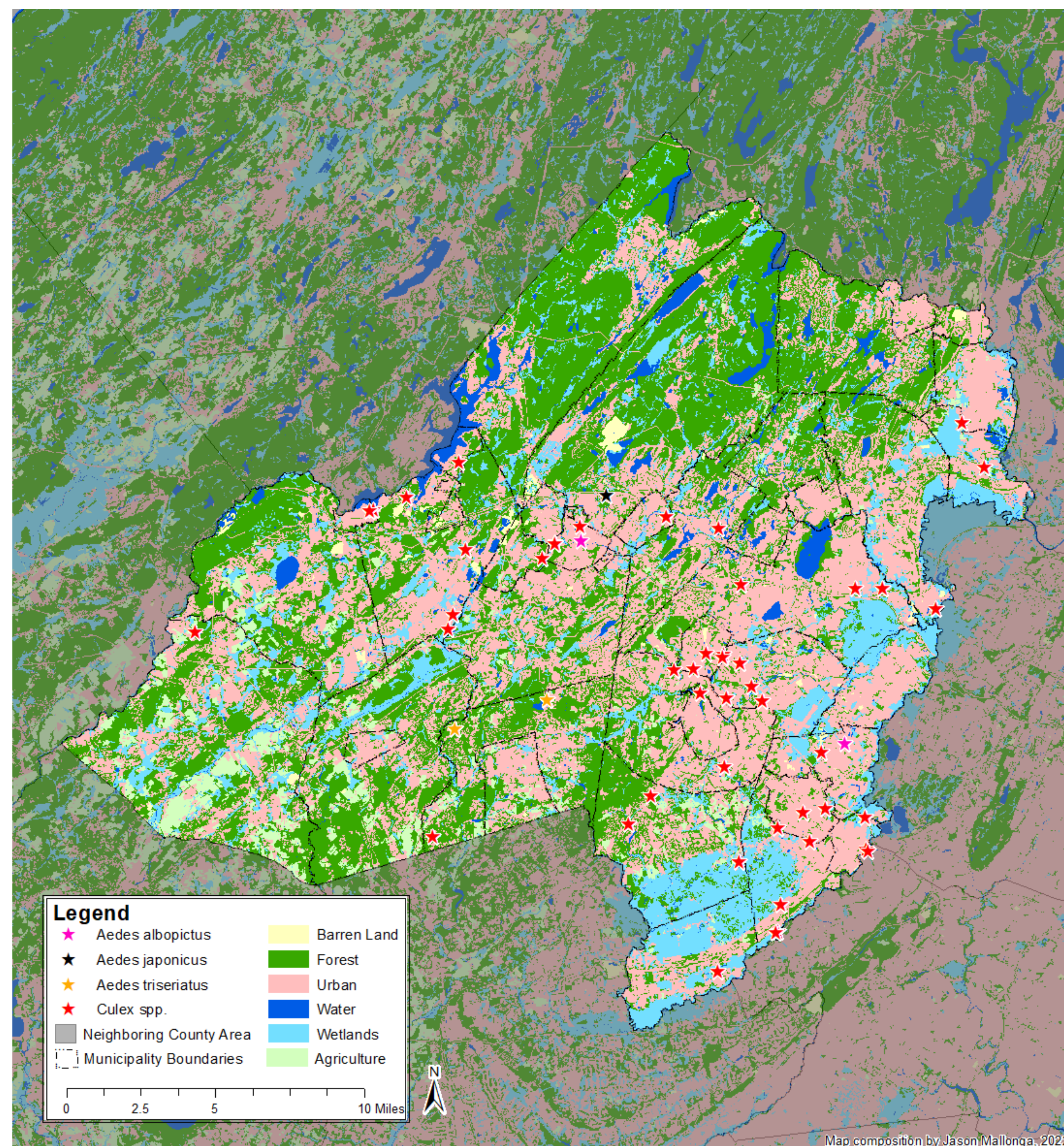


Figure 2. This map displays WNV positive trap locations, mosquito species, and land cover classification within Morris County throughout 2021. The majority of species carrying WNV were of the *Culex* genus, but there were also several other carriers from the *Aedes* genus. 5 of the 63 WNV positive sites had an *Aedes* species present.

Observations & Future Considerations

- All WNV positive sites occurred at trap locations using gravid trap meaning that the positive results may be skewed towards the breeding females of a species
- Culex* species were expected to be the majority of the host carrier species for WNV, but several other species of *Aedes* tested positive as well. Future projects could investigate the overlap between each species' feeding, resting, and breeding habits.
- WNV heavily occurred later in the season with 57 of the 63 positive sites were found in August (35) and September (22). As *Culex* mosquitoes take more blood meals from different avian hosts, the possibility of disease transmission due to an increase in viral load amongst bird species. Consequently, cases of WNV usually peaks at this time of the year.
- Areas with less than 5% impervious surface cover tend to have a land use/land cover classification of: "Forest, Wetland or Water."
- The occurrence of positive sites may be skewed towards areas designated as "Urban" since most trap locations are concentrated in those areas. There may be WNV positive areas in harder to reach areas such as Forests and Wetlands. On the contrary, *Culex* species are known to breed in features such as catch basins, storm drains, gutters, tires, etc. which are found in developed areas with higher impervious surface cover.
- As climate change intensifies rainfall, drought, and season duration, what practices and policies are necessary to alleviate the build up of standing water and mosquito habitat?
- What other environmental and infrastructural conditions can be used to predict the occurrence of WNV and its carrier species?

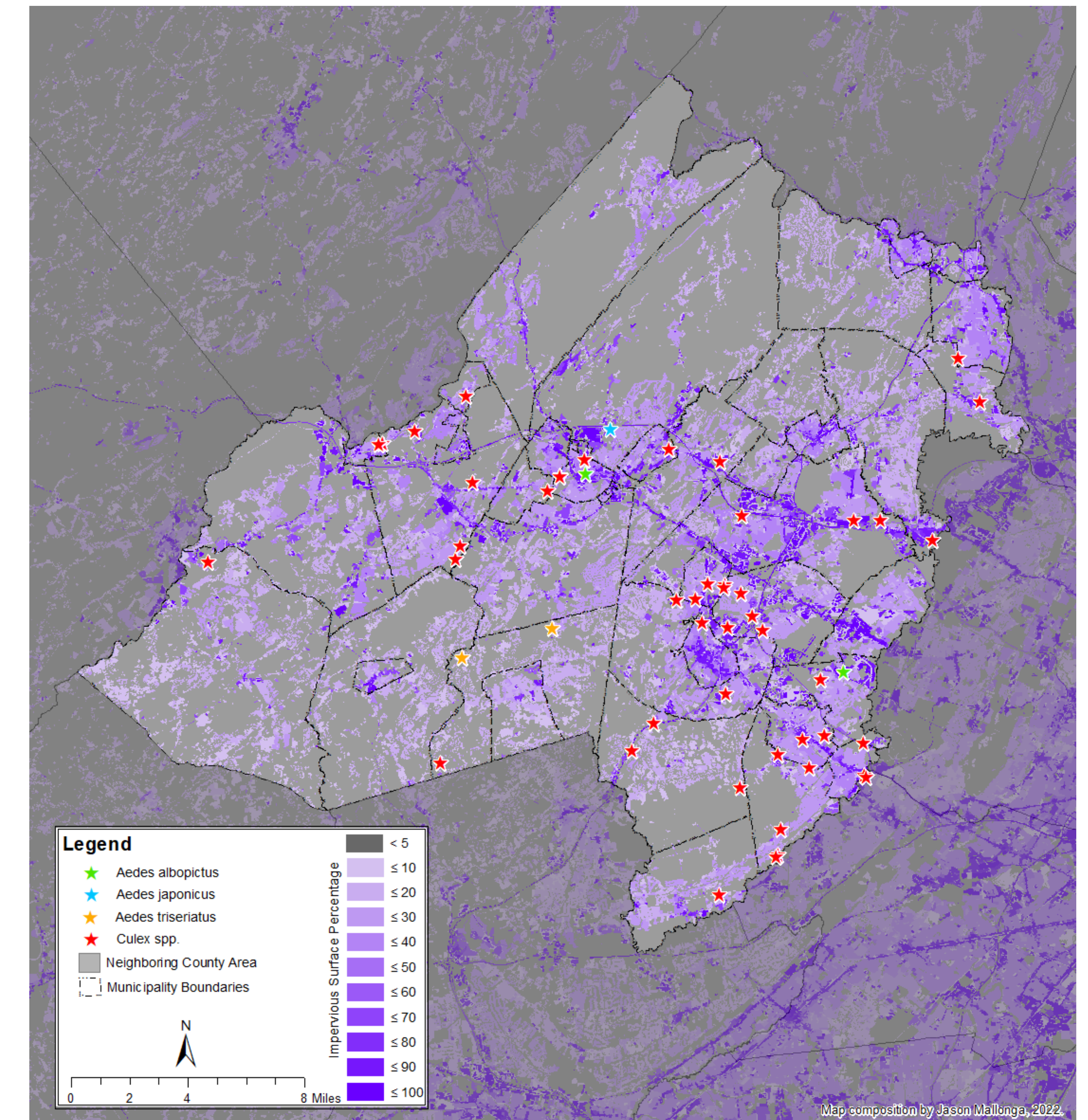


Figure 3. This map displays WNV positive trap locations, mosquito species, and impervious surface cover percentage within Morris County throughout 2021. Most positive testing sites are found in and around areas with high impervious surface percentages. These locations are characterized by urban land use and high development.