

Vector Borne Disease Risk Mapping in Mobile County, Alabama

Video Presentation Transcript

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Thank you for listening to the Mobile NASA DEVELOP team's presentation of risk mapping in regards to vector-borne diseases.

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In comparison with other areas of the country, Mobile County has a higher susceptibility of West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE). Furthermore, recent studies have revealed the debilitating long term health issues caused by WNV and EEE. Also, the adulticiding and spraying routes of the Mobile County Health Department of Vector Control needed more efficient and scientific modifications in order to prevent infection. Our partners that would benefit from this study would be the Mobile County Health Department and the Mobile Department of Vector Control.

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Some of the objectives of this project were to identify habitats of vectors using hydrologic and geologic resources, habitats of reservoirs using land classifications, and identifying areas of vulnerable populations using Census Data. By putting all of this data together, a single risk map was constructed.

The area studied was the county of Mobile, AL, during the months of May through November. These months were chosen because these are the peak months in mosquito reproduction.

Our partners could benefit from the study in the following ways: More efficient spraying routes could be implemented. Public awareness campaigns could be conducted for preventative measures which, in turn, could decrease the prevalence of WNV and EEE in the area. The detailed land classification maps created in this study could be used in later studies. A detailed workshop would be conducted with the partners so that they knew exactly how to use the programs and data in a way that would serve them the best.

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The satellites and sensors that were used were ASTER from the *Terra* satellite, the Thematic Mapper on the *Landsat 4 & 5* satellites, and *TRMM*. Ancillary data, which included Mobile County GIS layers and Census Data, were acquired from Mobile County, Census Bureau, and other sources as seen on this slide. The data were acquired from several locations, including WIST, GloVis, Giovanni, and the USDA.

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One of the first aspects that needed to be analyzed before the creation of risk maps was the different vector species in the county. Only two vectors were identified in the area: *Aedes albopictus* and *Culex quinquefasciatus*. *Ae. albopictus* is a strict container-breeder and thrives in urban and suburban areas,

tire disposal sites, and landfills. *Albopictus* is an aggressive biter because its reproductive lifecycle is dependent upon the frequency of feeding. *Albopictus* will feed on whatever is most abundant in its environment. For this urban species, its primary food source is humans while its second choice is birds (jays, finches, and crows). Birds are critical in the transmission cycle of WNV and EEE. After a mosquito feeds upon an infected bird, the virus resides in the midgut of the mosquito until it escapes to the salivary glands. Once a mosquito is infectious, the vector can then transmit the disease to humans, birds, and mammals, causing a chain of infection. This is called horizontal transmission. Another form of transmission is transgenerational transmission. This is when the virus is transmitted from the parent vectors to their progeny. This perpetuates the disease in times of vector dormancy.

The other vector, although less common, is the *Culex quinquefasciatus*. It prefers more natural breeding areas such as wooded, rural areas near shallow water. Because of this, it tends to feed primarily upon birds of prey and secondly on humans. Although horizontal transmission is still the primary way of transmission, like the *albopictus*, vertical transmission is more common in this species than in the *albopictus*.

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For both WNV and EEE, there are 3 types of infection: Asymptomatic, Systemic (flu-like), and Encephalitic (severe). For both viruses, it is rare that the victim contracts the encephalitic type of infection. The long-term effects include paralysis, cognitive disorders, and movement disorders. These severe cases usually lead to encephalitis or meningitis. In EEE, a third of all cases end in death, but it is much rarer than WNV. Those who are primarily at risk for these viruses are those under the age of 15 or older than the age of 50.

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The map on the right shows the combination of the vector breeding grounds. These are the most likely breeding areas of both vectors shown on one map. The map on the left is the buffered combination of both vector species habitats buffered to 300m to account for flight range. These areas are most likely to contain adult mosquitoes of either species.

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A single land classification map was created for Mobile County. The land classification map was performed to identify reservoir habitats which included vegetation (for the birds of prey) and urban (for the jays, finches, and crows). These types of birds have been proven to have a higher capability of carrying WNV or EEE.

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These maps show the areas of overlap with mosquitoes and birds. This gives a good reflection of where genesis of disease could occur. The map on the left shows where the mosquito source (un-buffered) and bird habitats overlap, while the right map shows where the mosquito habitats (buffered) and bird habitat overlap.

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This slide shows the final vulnerable population map. Most of the vulnerable population is concentrated in the city of Mobile and its surrounding suburbs.

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By intersecting the bird and mosquito habitat map and the population density map, the total risk map was created. This map is based on an at-risk population density of 100 persons per square mile. This is easily changed to different densities (75, 500, 1000 persons per square mile) to meet the partner's needs. The red represents areas that have all of the risk factors: infected birds, mosquitoes, and vulnerable persons, to create the full chain of infection.

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By completing the study, detailed vector and reservoir habitat maps were created along with a specific vulnerable population map. The risk map can be used to identify areas of higher risk where the chain of infection is present. In conclusion, vectors and reservoirs inhabit the entire county. Therefore, all should take preventative measures when going outside during the summer months. However, the risk map did show areas of higher risk. These areas include areas of high urbanization, areas near water, and areas near major roads. This could be used by the Mobile Department of Vector Control to create a more targeted approach in vector management efforts.