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Item No. 1 of 1

ACCESSION NO: 0406863 **SUBFILE:** CRIS
PROJ NO: 5410-32000-014-15S **AGENCY:** ARS 5410
PROJ TYPE: USDA COOPERATIVE AGREEMENT **PROJ STATUS:** TERMINATED
START: 06 JUL 2004 **TERM:** 30 APR 2009

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USE OF GEOGRAPHIC INFORMATION SYSTEM (GIS) METHODS TO UNDERSTAND SPATIAL PATTERNS OF MOSQUITO VECTORS OF WEST NILE VIRUS

OBJECTIVES: The objective of this cooperative research project is to conduct geo-spatial analyses of climatic and bio-geographic factors that influence the distribution and vector competence of Culex tarsalis in the inter-mountain West. This mosquito species is a very competent vector of WNV, and using GIS to analyze and interpret climatic and bio-geographic factors that support mosquito populations will define spatial patterns where risk for exposure to WNV is high for humans, livestock, and wildlife populations. The same methods will be applied to assess risk of a potential Rift Valley fever virus introduction.

APPROACH: The goal is to be able to predict areas and conditions of high and low risk for WNV. This will focus mosquito control programs and call attention to the need for use of personal protection methods (insect repellents). Vector-borne diseases are the product of habitats that support vector populations, ambient temperatures that enhance rates of larval development and virus amplification, and wildlife species that serve as donors of virus ingested during vector blood feeding. Using GIS, it will be possible to predict geographic areas and seasonal patterns that are necessary for outbreaks of arbovirus to occur. GIS methods provide powerful tools for spatial analysis of climatic and biogeographic factors that promote vector competence among mosquito populations. We will use satellite imagery and ground-based data to define environmental profiles for habitats and areas that support populations of C. tarsalis. These data will define most suitable habitats and best conditions for the species and serve as a basis for predictions of where and when this mosquito is most abundant on a larger spatial scale. Climatic data superposed on the spatial abundance of C. tarsalis will enable predictions of maximum risk for WNV transmission, and potentially, Rift Valley fever virus.

PROGRESS: 2004/07 TO 2009/04
Progress Report Objectives (from AD-416) The objective of this cooperative research project is to conduct geo- spatial analyses of climatic and bio-geographic factors that influence the distribution and vector competence of Culex tarsalis in the inter- mountain West. This mosquito species is a very competent vector of WNV, and using GIS to analyze and interpret climatic and bio-geographic factors that support mosquito populations will define spatial patterns where risk for exposure to WNV is high for humans, livestock, and wildlife populations. The same methods will be applied to assess risk of a potential Rift Valley fever virus introduction. Approach (from AD-416) The goal is to be able to predict areas and conditions of high and low risk for WNV. This will focus mosquito control programs and call attention to the need for use of personal protection methods (insect repellents). Vector-borne diseases are the product of habitats that support vector populations, ambient temperatures that enhance rates

of larval development and virus amplification, and wildlife species that serve as donors of virus ingested during vector blood feeding. Using GIS, it will be possible to predict geographic areas and seasonal patterns that are necessary for outbreaks of arbovirus to occur. GIS methods provide powerful tools for spatial analysis of climatic and biogeographic factors that promote vector competence among mosquito populations. We will use satellite imagery and ground-based data to define environmental profiles for habitats and areas that support populations of C. tarsalis. These data will define most suitable habitats and best conditions for the species and serve as a basis for predictions of where and when this mosquito is most abundant on a larger spatial scale. Climatic data superposed on the spatial abundance of C. tarsalis will enable predictions of maximum risk for WNV transmission, and potentially, Rift Valley fever virus. Significant Activities that Support Special Target Populations Research in this project centered on the development of habitat and temperature-based models that can be used for risk assessment in mosquito- borne illness, specifically West Nile and Rift Valley fever viruses. Geographic Information System (GIS) technologies were developed to create point-based and spatially explicit models of both mosquito habitat and risk of virus transmission. Case studies were performed in Wyoming and California for West Nile Virus using a retrospective approach. Theoretical models for future risk based on global climate change were developed for both West Nile Virus and Rift Valley fever. The WNV degree day modeling project was field tested in California in 2007-2008, and was modified to include new data on virus replication rates and host susceptibility. These changes were incorporated into a new model along with modifications to match additional field conditions and the inclusion of a higher resolution thermal profile. This new model had an excellent match to field data in CA. Data for additional states are being added to the model to further validate its use. The computer model has now been published. The degree day model was also used to determine the most at-risk areas for RVF becoming established in the continental US. It focused on five states, four of which (Minnesota, California, Texas, and New York) were chosen because of their identification as high risk for RVF introduction by pathways analysis and the fifth (Nebraska) chosen for its central location and large livestock industry. Highest levels of risk were found in parts of California and Texas. Locations where RVF introduction would have the greatest potential impact to the livestock industry were in California, Texas, and Nebraska. This analysis is currently in preparation. ADODR monitoring activities to evaluate research progress were through meetings, email and phone calls.

PUBLICATIONS (not previously reported): 2004/07 TO 2009/04
No publications reported this period.
