UNH, State, Private Industry, NASA To Tackle Lyme Disease

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DURHAM, N.H. – Armed with satellite imagery, field samples, human Lyme disease case data, and mathematical models, an interdisciplinary research team from the University of New Hampshire, the New Hampshire Department of Health and Human Services, and the private sector will conduct work on the ecology and risk factors of Lyme disease in New Hampshire and neighboring states in an effort to eventually identify "hot spots" and issue early warning to help prevent human exposure and disease. The project will expand an emerging field of research at UNH that applies space technology to study disease ecology and address public health issues.

The research team, comprised of five UNH professors, a private sector scientist, and two state public health officials, was recently awarded nearly $750,000 by the National Aeronautics and Space Administration to conduct the work for a three-year period beginning January 1, 2008.

That such work is needed in the state is made clear by the numbers: while human Lyme disease cases have doubled across the U.S. over 15 years, New Hampshire has experienced a nearly 16-fold increase in cases of the tick-borne disease from 1997 to 2006 – from 39 to 617, or about 47 cases per 100,000 people in 2006. Surrounding New England states have also seen increases greater than the national average.

Despite this rapid increase, the state currently lacks much of the capacity for doing the tick surveillance, data integration, and epidemiological modeling necessary to respond to the public health needs of this disease. Moreover, changes in climate, land use, and socio-economic conditions in the near future are likely to further alter the patterns and dynamics of coupled human-environmental systems thereby substantially affecting the pathogen-vector-host relationships of infectious diseases.

Over time, the team will build the capacity to identify potential hot spots for transmission of Lyme to humans thus making an early warning system possible. This infrastructure could also be applied to the study and tracking of other vector-borne diseases such as Eastern equine encephalitis, West Nile virus, both of which have shown up in the state, and the deadly form of avian flu, which has the potential to appear in the U.S., including New Hampshire.

"That predictive ability is something we'll achieve down the road," says project co-investigator Xiangming Xiao of the UNH Complex Systems Research Center within the Institute for the Study of Earth, Oceans, and Space (EOS). Xiao specializes in the applications of satellite remote sensing and geographical information systems (GIS) technologies to ecosystems

science and natural resources. He adds, "Before we can make predictions we have to build the research and education capacity."

Ultimately, that capacity will involve combining the remotely sensed data with data from a new systematic tick surveillance and testing program. In turn, these data will be integrated into a mathematical model to generate a diagnostic and a predictive capability. The remotely sensed data includes highly detailed biophysical and biochemical information derived from satellite-based optical and radar imagery of the landscape favored by white-tailed deer and small rodents – important hosts for the tick species responsible for transmitting Lyme disease.

"Lyme is an emerging disease in the state," says project co-investigator Jason Stull, who holds a dual appointment as the State Public Health Veterinarian with the New Hampshire Health Department and as assistant clinical professor in the UNH Department of Health Management and Policy. "Information provided by this project will be critical in order to better understand the ecology and human risk of Lyme disease in the state, which in turn will directly assist in its prevention and control," Stull adds.

The successful proposal, entitled "Enhancing Research and Education Capacity for Integration of Earth Observations, Infectious Diseases Ecology and Public Health in New Hampshire," is part of NASA's Experimental Program to Stimulate Competitive Research.

The federal EPSCoR program is designed to assist states in establishing an academic research enterprise directed towards a long-term, self-sustaining and competitive capability that will contribute to the states' economic viability and development.

NASA's EPSCoR program in the state is managed by the New Hampshire Space Grant Consortium – one of 52 university-based consortia around the country funded by the space agency. Space Grant is a national network of colleges and universities that contributes to the nation's science and technology enterprise by funding research, education, and public service projects.

UNH research professor David Bartlett directs the state's Space Grant program and also is the principle investigator on the Lyme project. Bartlett notes that the recent award will galvanize an emerging area of research strength at UNH and across the state.

"Applying space technology to disease ecology is a promising new field, and this project will further develop existing technologies as well as help initiate a training program for students in a variety of fields," Bartlett says. He adds, "This innovative collaboration of specialists in remote sensing, geographic information systems, ecology, and public health places New Hampshire to lead future efforts in the state, in the region, and around the globe."

The long-term goal of the research team is to establish a center of excellence in the application of geospatial technology – satellite remote sensing, global positioning systems, and GIS – for disease ecology and public health at UNH. The program aims to substantially raise the competitiveness of research programs in the state and to promote economic development and job opportunity in the fields of geospatial technology, science, mathematics, and health in New Hampshire.

Other project investigators include scientist Rob Braswell of EOS, Ernst Linder of the UNH Department of Mathematics and Statistics, Rosemary Caron of the UNH Department of Health Management and Policy, state epidemiologist José Thier Montero of the Department of Health

and Human Services, and William Salas, president and chief scientist of Applied Geosolutions in Durham.

For further information on the New Hampshire Space Grant Consortium and the state's EPSCoR program, visit http://www.nhsgc.sr.unh.edu, and http://www.epscor.unh.edu, respectively.