**Review of Sin Nombre Virus Infections in Deer Mice Study**

In this paper the authors combined RS and GIS techniques to assess the environmental factors influencing Sin Nombre virus (SNV) contraction in deer mice, the primary rodent host. 119 field sites sampled in the Walker River Basin in western Nevada and east-central California in 1995, 1996 and 1998 were used. Spatial patterns and statistical relationships between site characteristics and infection rates were analyzed to retroactively classify rodent infection status and estimate prediction accuracy. Results can be applied to identify landscape characteristics with greater human risk from SNV, the agent associated with Hantavirus pulmonary syndrome.

Remotely sensed images from Landsat Thematic Mapper were used to generate 100 hectare unit maps of eight major vegetation types to act as indicators of environmental characteristics. Slope, vegetation density and hydrology were acquired by integrating a USGS DEM, the USGS 1:100,000 scale digital line graph dataset, and the normalized difference vegetation index (NDVI). The presence of SNV infections was inferred from antibody data, classifying sites into Status 1 (one or more antibody-positive animals) and Status 2 (two or more antibody-positive animals, or 10% antibody seroprevalence). Each Status is then classified as either positive (active infection present) or negative (active infection absent).

Each GIS variable was categorized according to its relevance to each of the eight vegetation types and relevant variables were divided into high and low ranges. These binary classes were then intersected in GIS to produce distinct environmental conditions for each vegetation type. Relationships between infection status and the landscape variables were examined using a canonical linear discriminant function analysis (DFA) and sites retroactively classified according to expected infection status. Two analyses were formulated: the vegetation approach and the DFA. The vegetation approach analysis was based on possible relationships between infection status and a pre-existing vegetation classification relevant to SNV infections. It provided an overall accuracy of 76% for Status 1 and 59% for Status 2. Positive classification was more accurate than negative classification for both classes. The DFA generated a linear function that distinguished the properties of positive and negative sites. It produced an overall accuracy of 74% for Status 1 and 82% for Status 2. Negative classified sites were more accurate than positive. Negative sites were associated with low elevations and sparse vegetation that occurs most often in salt desert scrub. Positive sites were of higher elevation with denser but less uniform vegetation, while slope and distance to stream factors were less important.

Some issues with the paper were related to the modest degree of measurement error for the study. Deer mice populations were estimated by counting the number of animals captured during a three-day trapping session. This may not be long enough to capture a statistically significant number of individuals for interpolation. If the mice were released after capture, they may have been captured again, distorting infection and population statistics. The study was also unable to incorporate weather and climate data, due to the sparse network of monitoring stations in the area. Further, produced maps were hard to read and lack basic cartographic elements.

We gave this paper 8/10: the high prediction accuracy signified the authors’ sound logic. The DFA was a good choice as it determined if a set of variables was effective in predicting categorical (e.g. landscape type) membership. Authors noted complicating factors: rapid rodent population turnover, non-infectious but antibody-positive mice, and migration. They opted for a large sample size to capture ecologic diversity and provide statistical replicates of sites with similar characteristics. Sampling of rodents and vegetation types was kept systematic. Authors compared strengths and weaknesses of analyses, the RS images, and GIS variables. Most shortcomings of the paper were already recognized, and referenced in their margin of error.

**Bibliography**

Boone, J. D., McGwire, K. C., Otteson, E. W., DeBaca, R. S., Kuhn, E. A., Villard, P....St. Jeor, S. C. (2000). Remote Sensing and Geographic Information Systems: Charting Sin Nombre Virus Infections in Deer Mice. *Emerging Infectious Diseases*, *6*(3), 248-258. https://dx.doi.org/10.3201/eid0603.000304.