

# Vector-borne disease management on the Colorado Plateau

By Vanessa Lo

Vector-borne disease management on the Colorado Plateau is plagued by complicated health department oversight on the federal, county and tribal level. This has led to inconsistent surveillance or testing, lack of integrated priorities, and lack of communication between agencies. Additionally, much of the surveillance currently occurring is reactionary to occurrences of human infection, rather than preventative. Marisa Donnelly, a UC Davis graduate student in epidemiology recently spoke on the current state of vector-borne disease management.



Photo: Common vectors (clockwise from top left): soft tick, dog tick, mouse, flea.

## What are vectors?

Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. Often, these vectors are bloodsucking insects which ingest disease-causing microorganisms from an infected host, and inject it into a new host at the next blood meal. Common vector insects include mosquitos, ticks, fleas, and flies. However, rodents can also be vectors, transmitting diseases through urine and feces, as well as serving as indirect vectors by hosting ticks and fleas. The frequency of

transmission through these vectors is dependent on human-vector contact, and environmental factors such as temperature and water availability.

## Vector-borne diseases on the Colorado Plateau

The more common diseases found in the Colorado Plateau include relapsing tick-borne fever, rocky mountain spotted fever, hantavirus, and the plague. Their main characteristics are summarized below in table 1. Other less common diseases include tularemia, West Nile, and St. Louis encephalitis. Relapsing tick-borne fever and hantavirus are often linked to rustic mountain cabins that are not rodent proofed, and tend to experience increased outbreaks when rodent populations increase due to favorable weather conditions such as the end of drought.

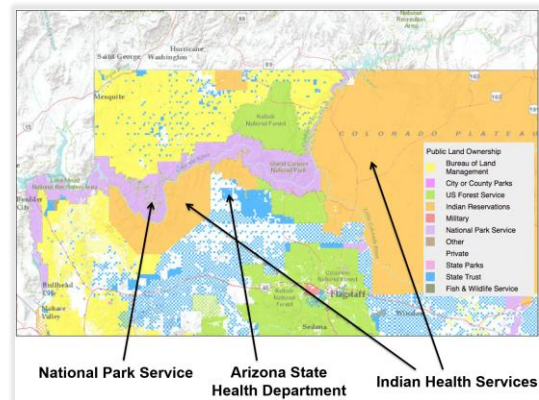


Photo: Public land ownership in the Grand Canyon area and respective health department oversight.

## Land ownership and oversight

The state of Arizona is delineated by 15 separate counties, each running its own health department, surveillance, and testing procedures. Coconino county, which encompasses a majority of the Grand Canyon, is particularly complex, with intertwined ownership among the National Parks Service (NPS), Arizona State Health

Department, and Indian Health Services (IHS). The IHS serves 21 different tribes, and is federally funded from the US Department of Health and Human Services. As a result, levels of buy-in from different tribes, and collaboration with NPS, state, and county health administrative services is inconsistent and overall lacking in connectivity.

Coconino county has ongoing surveillance for West Nile and St. Louis encephalitis. However, surveillance for plague and hanta is reactionary to incidences of human infection. Samples must be sent to state laboratories, as the county does not have its own laboratory facilities. The county has some involvement with the NPS, but no involvement with IHS. Similarly, the NPS has oversight within the Grand Canyon National Park, yet has no laboratory services in Arizona. It also employs only reactionary surveillance to human infection. In contrast, the state of Arizona has a strong connection with IHS and tribal entities, with collaboration in education, training, funding, and lab work. Because this diverse group of agencies and entities have different relationships with one another, a major overhaul of the current vector-borne disease management methods are needed.

Table 1: Vectors, pathogens, treatment, and symptoms of the most common Colorado Plateau vector-borne diseases.

Disease	Vector	Pathogen	Treatment	Symptoms
Relapsing tick-borne fever	Soft ticks	Bacteria	Antibiotics	Recurring fever, headache, myalgia, chills, nausea
Rocky mountain spotted fever	Dog tick	Bacteria	Antibiotics	Fever, chills, severe headache, myalgia, nausea, vomiting, paralysis, deafness, rash
Plague	Fleas	Bacteria	Antibiotics	<i>Bubonic</i> : fever, headache, chills, swollen lymph nodes <i>Septicemic</i> : fever, chills, extreme weakness, abdominal pain, death of tissue in extremities <i>Pneumonic</i> : rapidly developing pneumonia, chest pain, bloody mucous, respiratory failure
Hantavirus	Rodent urine and droppings	Virus	None	Fatigue, fever, muscle aches, dizziness, chills, nausea, vomiting, diarrhea, abdominal pain, coughing, shortness of breath

## Management and Policy Solutions

Speaking to a group of UC Davis students on February 21<sup>st</sup>, 2018, epidemiologist Marisa Donnelly outlined suggested management and policy changes to streamline vector-borne disease management. The most important solution is creating an integrated pest management program. This would create an ecosystem-based strategy that focuses on long-term prevention and frequent monitoring using biological control, habitat manipulation, and modification of cultural practices. Another solution to tackle the complexity of oversight is to create guidelines for collaboration with the Arizona Department of Health Services. This would guarantee use of state laboratories to analyze samples, establish surveillance routines, and create preventative practices by modeling rodent, tick, and mosquito populations. Lastly, streamlining funding and increasing funding for these critically important public health issues is needed.

When asked what the most important vector-borne disease to tackle was in terms of human health impact, Marisa stated that rocky mountain spotted fever should be prioritized due to its staggeringly disproportionate effect on tribal communities, with 300x greater incidence and 15x greater fatality rates than the US average.