This winter and spring we conducted the first experiment in the new elk research facility. The findings from that study are exciting and are an important step in improving our understanding of transmission of treponeme-associated hoof disease (TAHD). Our preliminary results indicate that TAHD can be transmitted to otherwise healthy elk through exposure to soil contaminated with hooves from affected elk.

The study is the graduate degree project for WSU Master of Science student Zach Robinson. Zach grew-up in Longview, Washington, seeing the devastating effects of the disease. He developed a drive to learn more about TAHD and how we might be able to manage it. Meeting this goal begins with understanding how TAHD is transmitted to an elk.

In this study we asked the question, can TAHD be transmitted to healthy captive elk through soil contaminated by hooves of affected elk? Six healthy captive elk obtained as calves from central Washington lived in individual biosecure stalls, each with their own feeder and waterer. Wood shavings were used as bedding in a portion of the stall, while soil covered about one quarter of the stall. We obtained the soil from a forested natural area in the Mount St. Helen’s area (where herbicides had not been used) so it was representative of a highly affected location. During dry periods, soil was moistened with water from a sprinkler.

We worked with the Washington Department of Fish and Wildlife (WDFW) and Northwest Indian Fisheries Commission biologists to obtain hooves from freshly killed elk with TAHD. We placed the hooves in an ultra-cold freezer (-112 ° F) within 24 hours of death to preserve bacteria and other germs living on the hooves. Four of the six study elk were exposed to these affected hooves. We also collected normal hooves and used them to expose the remaining two study elk. These two elk served as control animals that were treated identically to the treatment elk except for the source of the hooves.

On the day of a study treatment, hooves were thawed, sampled for diagnostic testing, and then minced and mixed with soil to make a treatment inoculum. We placed 5 ml (about a teaspoonful) of the inoculum between the toes on each foot and held it in place with a wrap on two feet of each elk. This ensured contact between the foot and inoculum. Another 4.9 liters (about 1.3 gallons) of the inoculum was mixed with soil in each pen. Treatments were repeated at 2-4 week intervals between October and March.

We observed early lesions suggestive of TAHD in the four treatment elk 2-3 months post-study initiation. By 4 months, all four treatment elk had moderate grade lesions indistinguishable from TAHD in wild elk. A veterinary pathologist confirmed TAHD in all four treatment elk by examining a section of a hoof biopsy under a microscope. Neither of the control elk exposed...
to normal hooves developed visible or microscopic foot lesions, indicating that the affected hoof material was the source of lesions in treatment elk.

Additional testing is underway to determine the type of bacteria present by sequencing bacterial DNA in hoof lesions. Preliminary results have detected Treponema bacteria in samples of lesions from treatment elk, but not from control elk. We will also use this DNA sequencing technique to search for Treponema bacteria in soil from the pens. This will be a technically challenging task, but such a finding would lend further support for the soil as a reservoir of disease-causing bacteria.

These preliminary results indicate that TAHD can be transmitted through soil contaminated with affected hooves. The findings also provide further evidence that TAHD lesions are a result of an infectious disease. These are encouraging preliminary results.

In the coming months, Zach will work with WSU faculty to complete his master’s degree requirements by conducting additional laboratory analyses, analyzing data, and writing an article for submission to a scientific journal. The article will be reviewed for scientific rigor by other experts prior to publication, which will finalize the results. If all goes as planned, in 2022 the study will be published and Zach will graduate from WSU and start a career in wildlife management.

Additionally, we are currently conducting a follow-up study in the pens to ask the question of whether TAHD can be transmitted to otherwise healthy captive elk through soil contaminated by live elk with TAHD. We are also planning additional studies that would be needed to confirm the infectious cause and to identify the specific disease-causing bacteria involved. We will also need to conduct further experiments to understand factors that may increase or decrease the likelihood that an elk will contract the disease.
Summary of the process used on treatment elk to investigate TAHD transmission through soil. Control elk were handled similarly, except hooves for inoculum were collected from normal elk.

Collect hooves from carcasses of wild elk affected with TAHD.

Place hooves in ultra-cold freezer for storage.

On day of study, thaw hooves and collect diagnostic samples. Mince hooves and mix with soil to make an inoculum.

Immobilize captive study elk and collect diagnostic samples.

Place soil inoculum between the toes of study elk and hold in place with foot wraps. Place additional inoculum in pen soil.

Observe elk and repeat treatment at 2-4 week intervals. When visible lesions of TAHD appear, collect diagnostic samples, including a foot biopsy.

Examine biopsy to confirm diagnosis of TAHD.

End study

Study elk in pen with soil. Note wraps on feet to hold inoculum in place for contact with the foot.