Overview of elk habitat and treponeme-associated hoof disease in relation to herbicide use

Kyle Garrison

Elk Specialist, Washington Department of Fish and Wildlife

Elk in Washington

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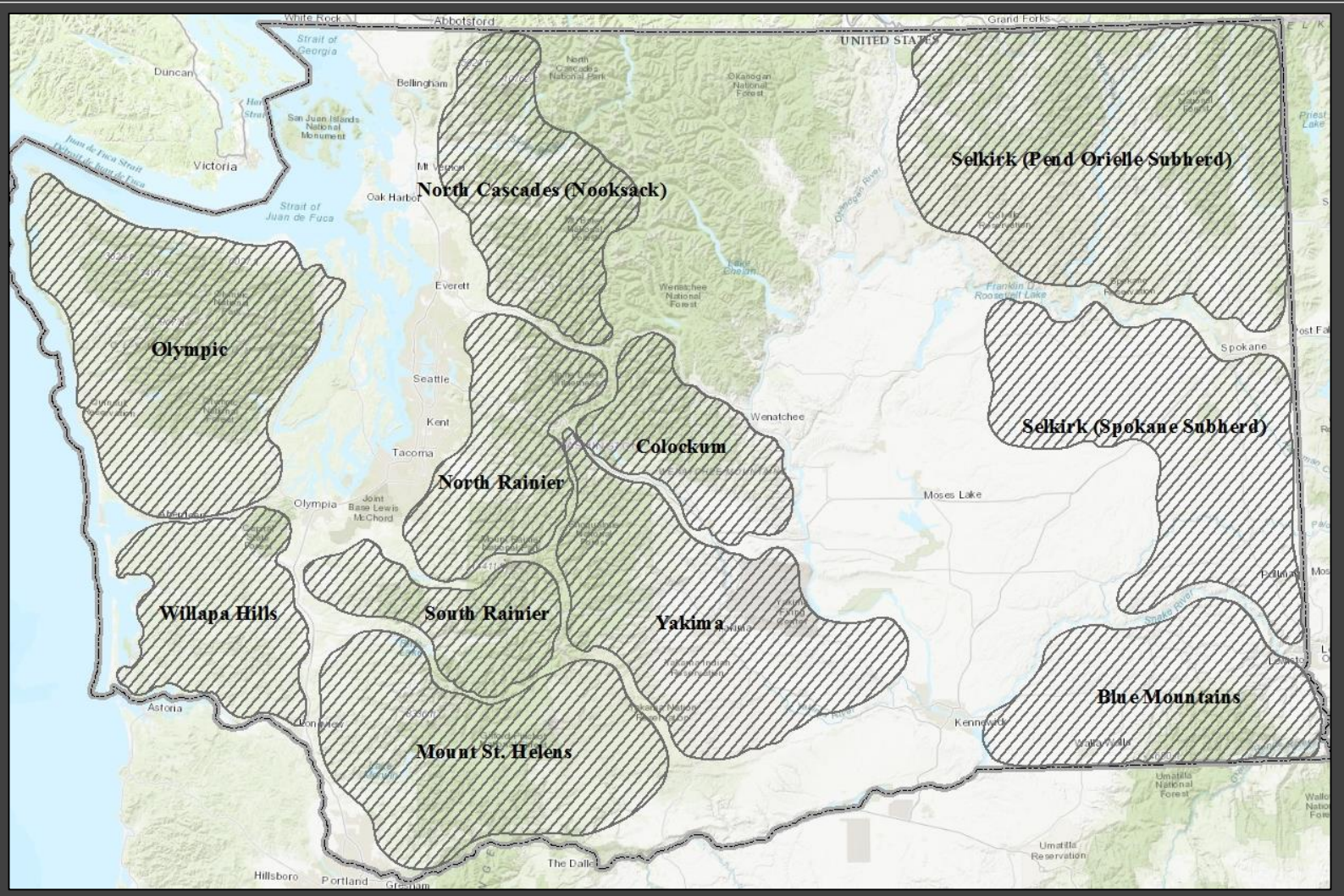
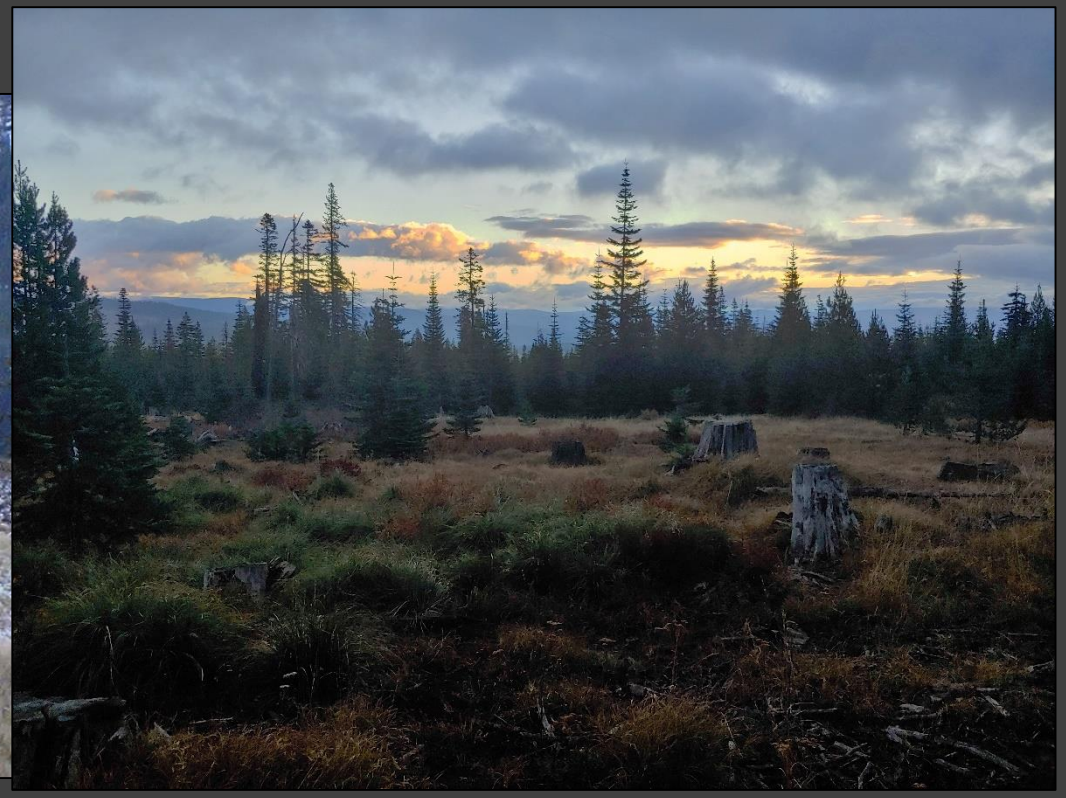
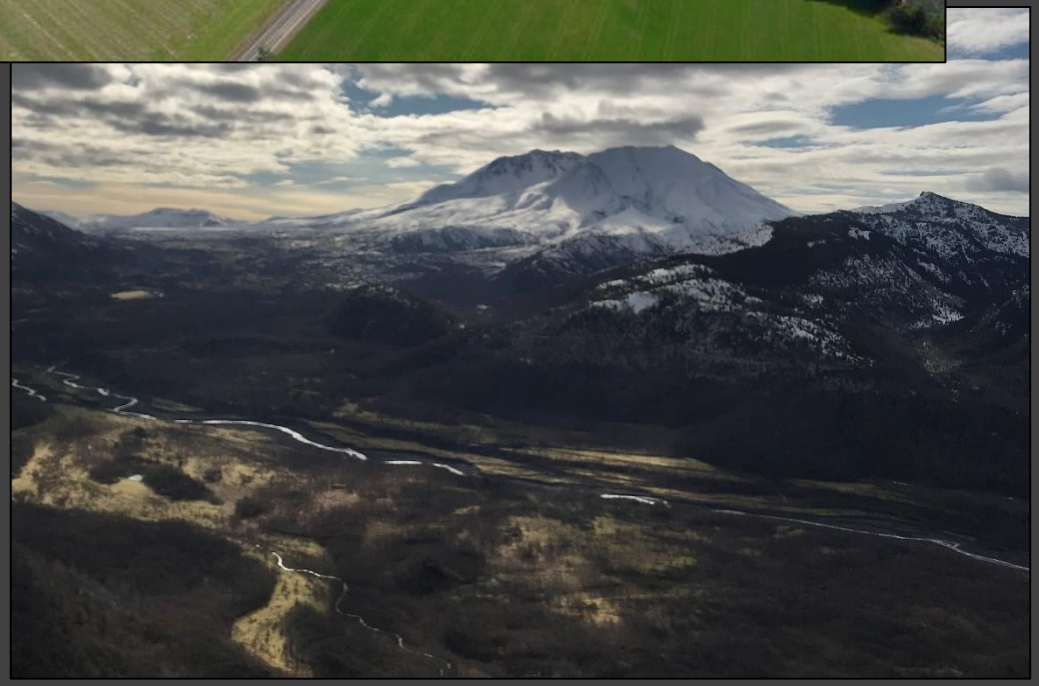


Elk habitat

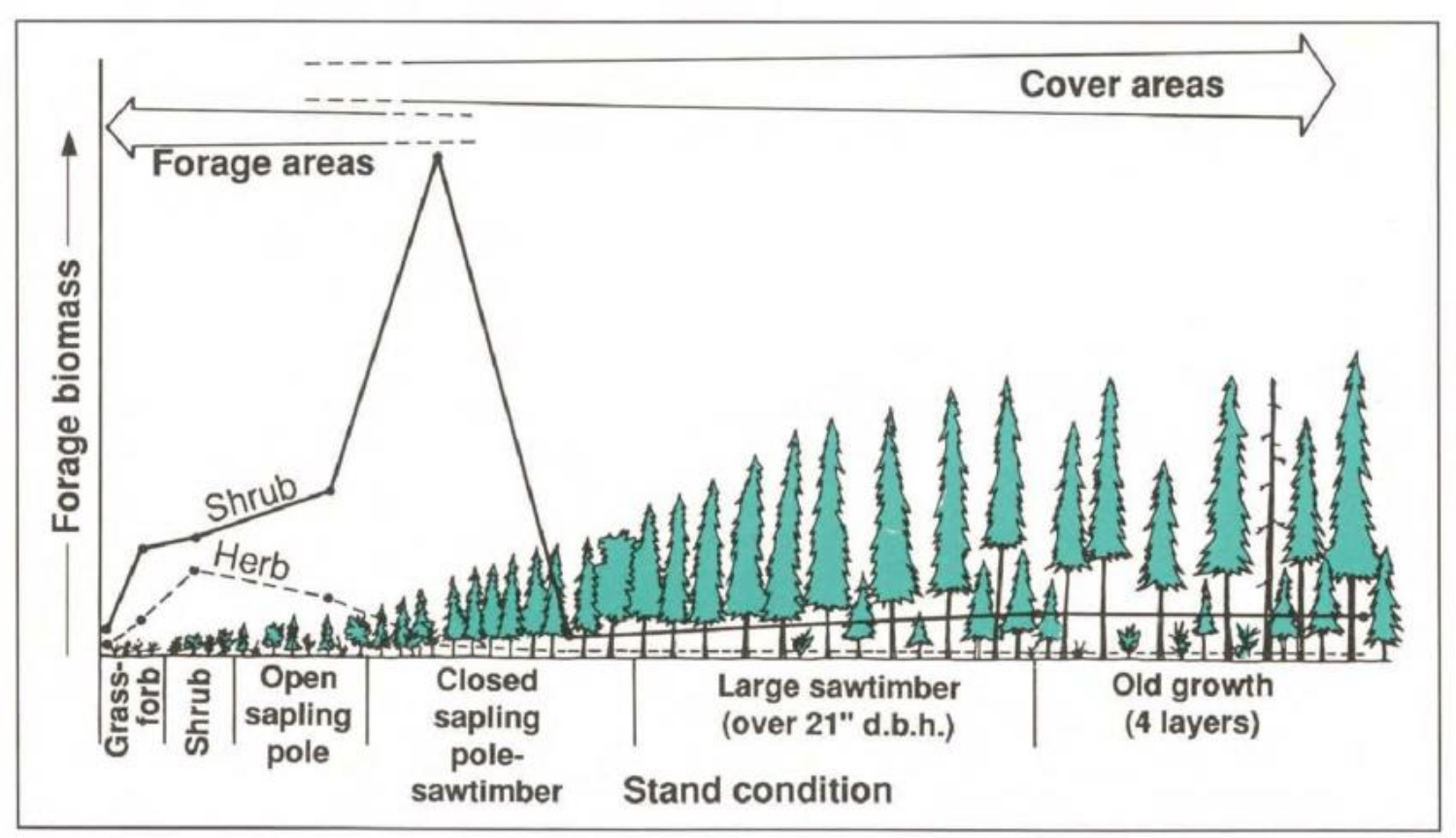
- Areas where an elk's needs for food, water, shelter are met
- Elk are highly adaptable and exist in diverse habitat types in Washington

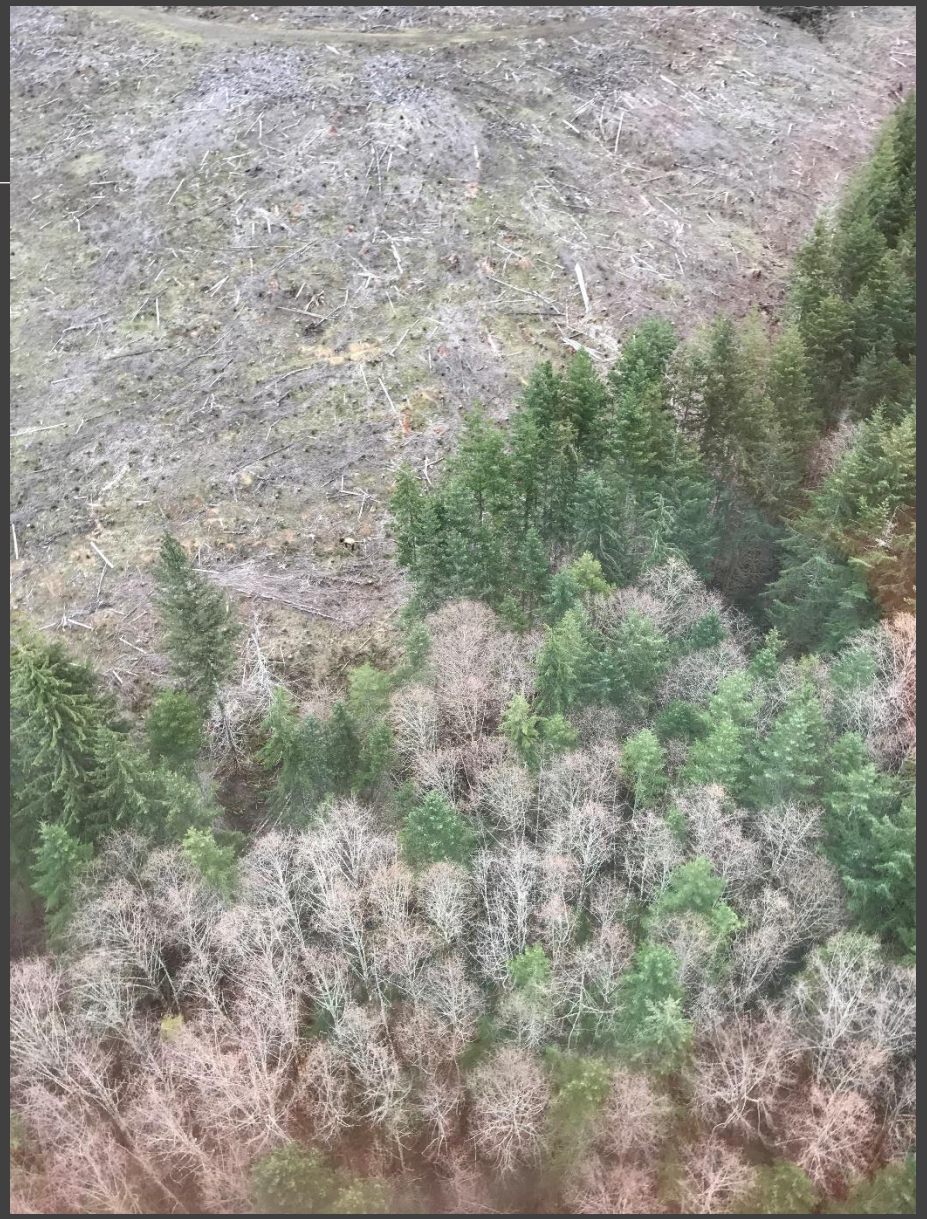


Elk habitat



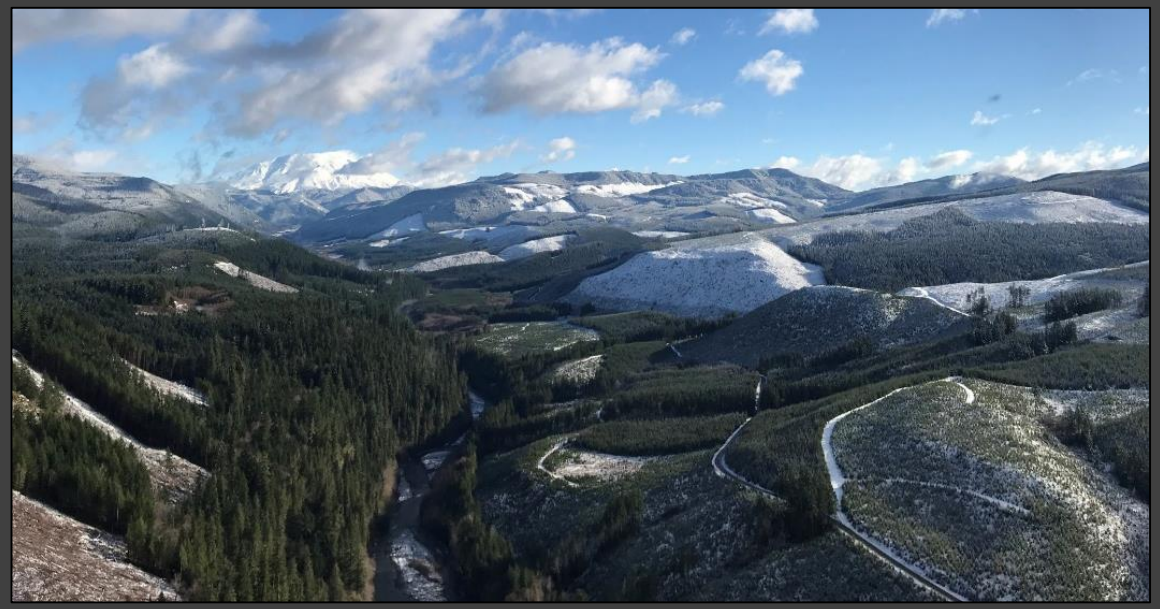
Elk habitat


Cover areas
Forage areas
Forage biomass
Shrub
Herb
Grass-forb
Shrub
Open sapling pole
Closed sapling pole-sawtimber
Large sawtimber (over 21" d.b.h.)
Old growth (4 layers)
Stand condition



Herbicide habitat impacts

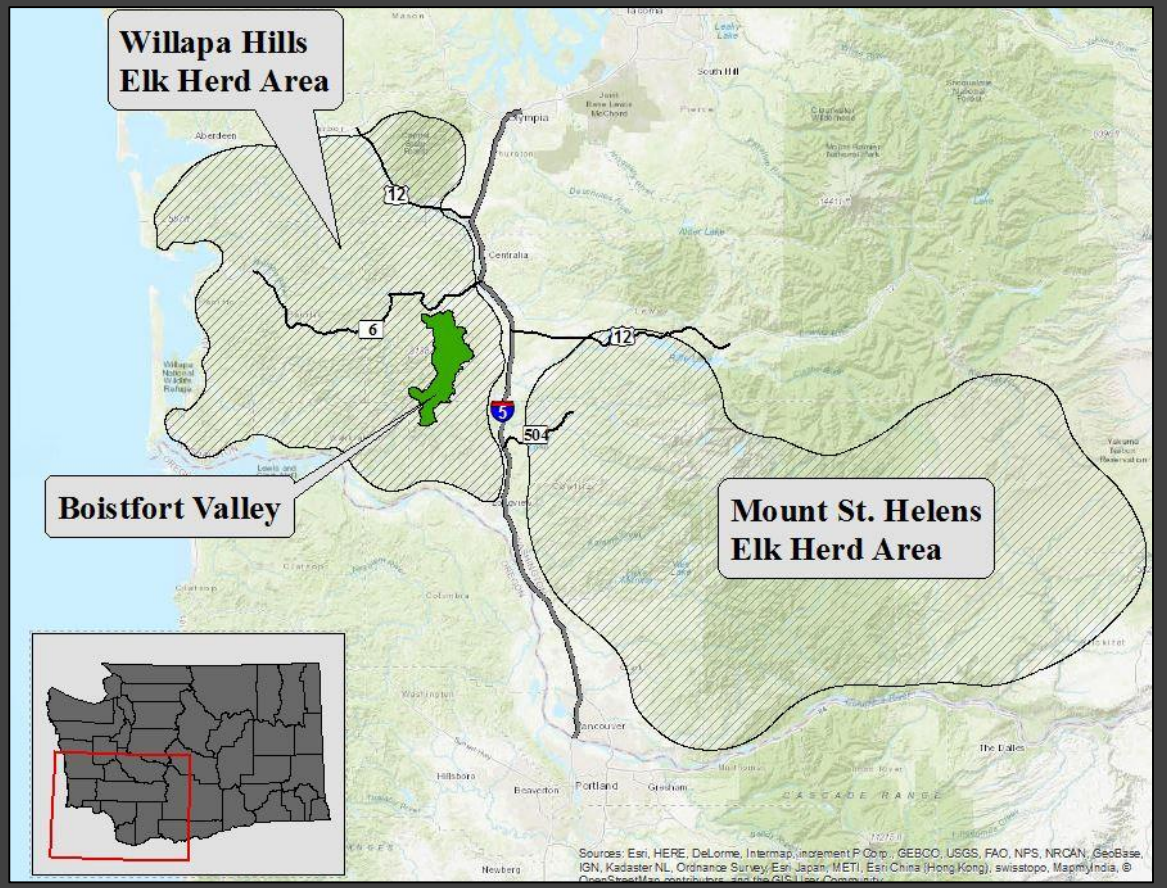
- Herbicides applied post-harvest target grasses and broad-leaf plants that provide forage for elk
- Herbicides cause an immediate reduction of available elk forage and generally grasses/broad leaf plants are at levels too low for elk to forage efficiently
- Impact is short lived (<3yrs), after which forage in herbicide treated stands recovers to levels seen in untreated stands
- Overall, despite immediate reductions in forage post-herbicide application, wide-spread mixed age stands likely provide a stable and higher forage base for elk



Additional resources

- Geary, A.B., and E.H. Merrill. 2014. Succession, herbicides, forage nutrition and elk body condition at Mount St. Helens, Washington. Final research report. University of Alberta. 205 pp.
- Lyon, L.J., and A.G. Christenson. 2002. Elk and land management. In North American elk: Ecology and management, eds. D. E. Toweill and J. W. Thomas, 557-81. Washington, DC: Smithsonian Institution Press.
- National Council for Air and Stream Improvement, Inc (NCASI). 2009. *Forest herbicide effects on Pacific Northwest ecosystems: A literature review.* Technical Bulletin No. 970. Research Triangle Park, NC: National Council for Air and Stream Improvement, Inc.
- Tatum, V.L. 2004. Toxicity, transport, and fate of forest herbicides. Wildlife Society Bulletin 32:1042-1048.

Treponeme-associated hoof disease

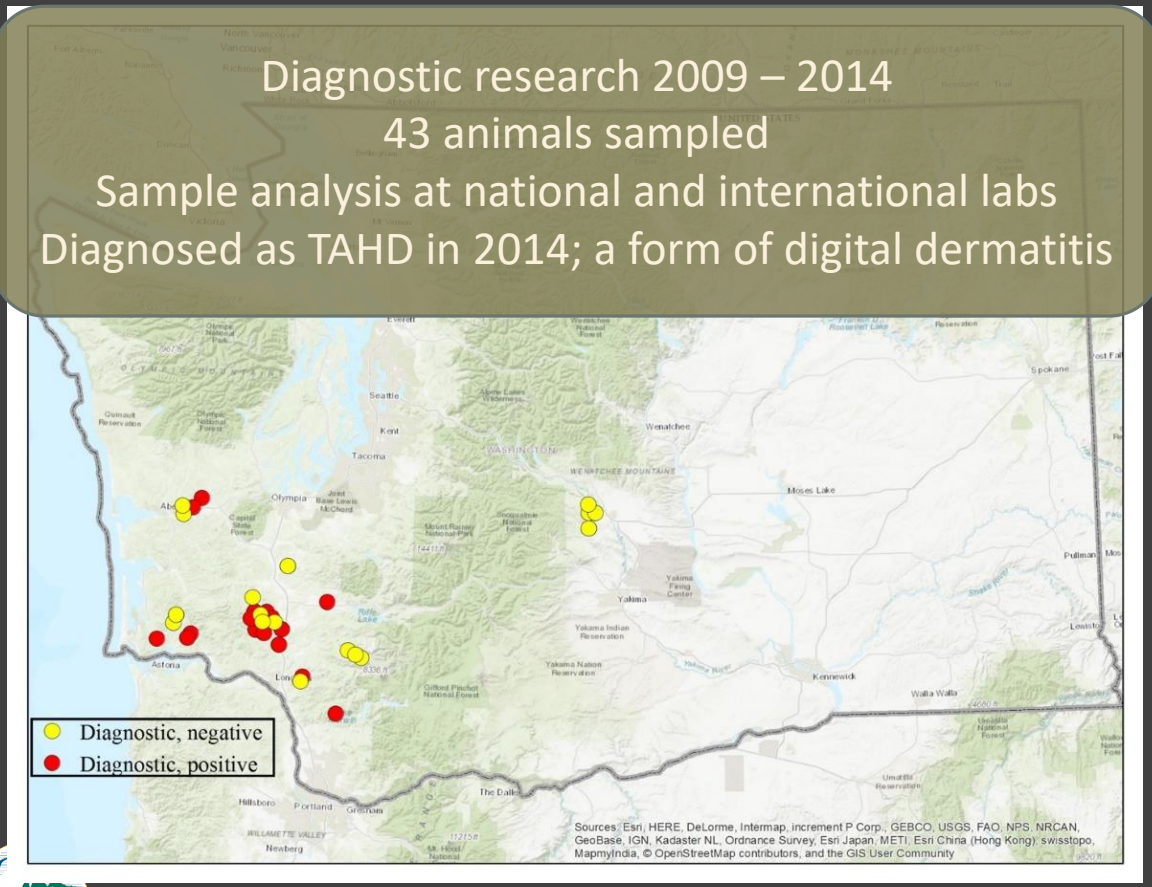


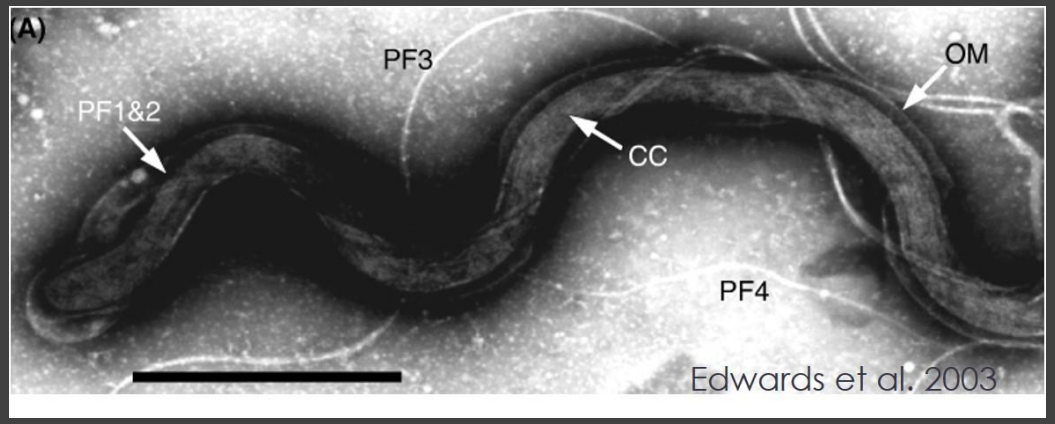
Treponeme-associated hoof disease

Treponeme-associated hoof disease

Diagnostic research

Diagnostic research 2009 – 2014
43 animals sampled
Sample analysis at national and international labs
Diagnosed as TAHD in 2014; a form of digital dermatitis





SEVERE HOOF DISEASE IN FREE-RANGING ROOSEVELT ELK (*CERVUS ELAPHUS ROOSEVELTI*) IN SOUTHWESTERN WASHINGTON, USA

Sushan Han[1,3,4] and Kristin G. Mansfield[2]

[1] Washing
7034, US
[2] Washing
[3] Current
University
[4] Corresp

Isolation of Digital Dermatitis Treponemes from Hoof Lesions in Wild North American Elk (*Cervus elaphus*) in Washington State, U

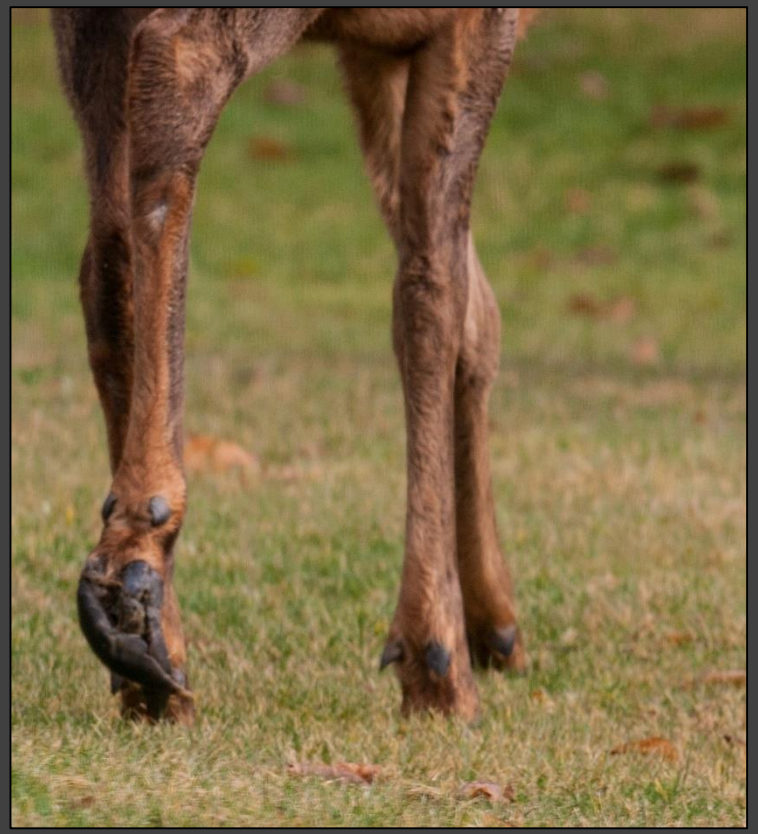
S. R. Clegg,[a] K. G. Mansfield,[b] K. Newbrook,[a] L. E. Sullivan,[a] R. W. Blowey,[c] S. D. Carter,[a] N. J. Evans[a]

Department of Infection Biology, Institute of Infection and Global Health, School of Veterinary Science, University of Liverpool, Liverpool, United Kingdom[a]; Wash
Department of Fish and Wildlife, Spokane Valley, Washington, USA[b]; University of Liverpool and Wood Veterinary Group, Gloucester, Gloucestershire, United Kin

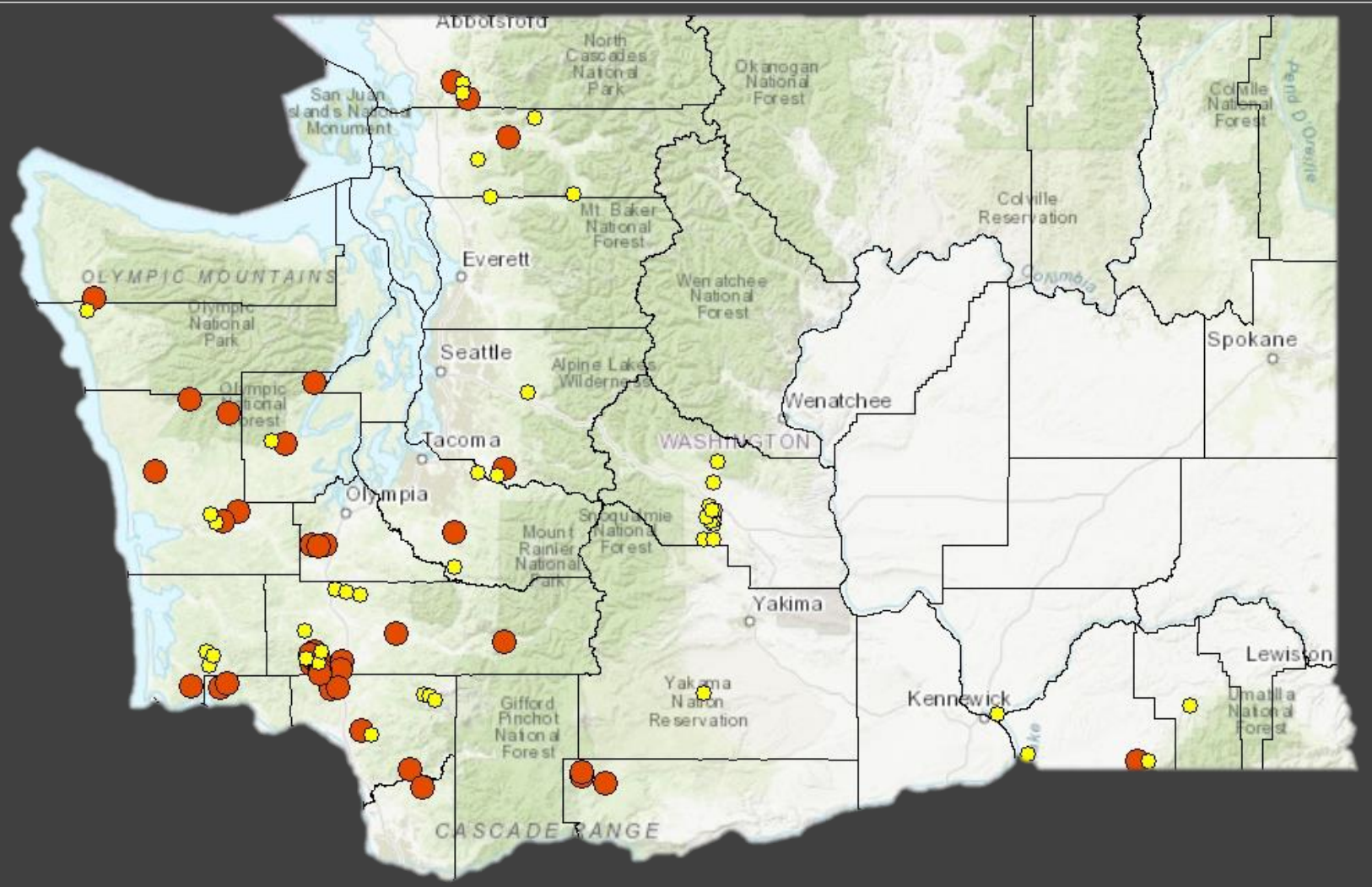
Digital dermatitis

- First documented in dairy cattle in Europe in the 1970s
- Now affects cattle, sheep, and goats (only cattle in U.S.)
- Present in ~70% of US dairies; causes ~50% of lameness cases
- No effective vaccines, some treatments for livestock
  - High recurrence rates
  - Domestic treatments are generally impractical for free-ranging elk
- Despite decades of research, many questions remain

- Transmission not well understood - possibly transported to new areas by infected elk, human mediated
- Multiple species of bacteria suspected to play a role in the disease's initiation and progression
- Multiple factors are suspected to play a role in disease susceptibility at individual and population levels; e.g., nutrition



TAHD distribution



Disease is present in 14 Washington counties

- TAHD Negative
- TAHD Positive

- A consistent suite of bacteria are found in TAHD lesions, notably bacteria of the genus *Treponema,* similar to a common livestock disease called digital dermatitis
- No known evidence that herbicides can directly cause hoof disease lesions
- No known evidence to suggest a mode of action contributing to hoof disease of commonly used herbicides
- Research into indirect effects of herbicides e.g., elk habitat or physiological impacts may yield greater insight into the disease

Additional resources

- Clegg, S. R., Mansfield, K. G., Newbrook, K., Sullivan, L. E., Blowey, R. W., Carter, S. D., & Evans, N. J. (2015). Isolation of digital dermatitis treponemes from hoof lesions in wild North American elk (Cervus elaphus) in Washington State, USA. *Journal of clinical microbiology*, *53*(1), 88-94.
- Han, Sushan & Mansfield, Kristin. 2014. Severe hoof disease in free-ranging Roosevelt Elk (*Cervus elaphus roosevelti*) in southwestern Washington, USA. Journal of wildlife diseases.
- Han, S., Mansfield, K. G., Bradway, D. S., Besser, T. E., Read, D. H., Haldorson, G. J., ... & Wilson-Welder, J. H. (2019). Treponeme-associated hoof disease of free-ranging elk (Cervus elaphus) in Southwestern Washington State, USA. *Veterinary pathology*, *56*(1), 118-132.
- Hoenes, B.D. et al. Assessing the Potential Effects of Treponeme Associated Hoof Disease (TAHD) on Elk Population Dynamics in Southwest Washington. *In prep*. Washington Department of Fish and Wildlife. https://wdfw.wa.gov/publications/01974
- National Council for Air and Stream Improvement, Inc (NCASI). 2009. *Forest herbicide effects on Pacific Northwest ecosystems: A literature review.* Technical Bulletin No. 970. Research Triangle Park, NC: National Council for Air and Stream Improvement, Inc.
- Tatum, V.L. 2004. Toxicity, transport, and fate of forest herbicides. Wildlife Society Bulletin 32:1042-1048.
- Wilson-Welder, J. H., Alt, D. P., & Nally, J. E. (2015). The etiology of digital dermatitis in ruminants: recent perspectives. *Veterinary Medicine: Research and Reports*, *6*, 155.

Questions?