

Elk Hoof Disease in Western Washington



**WDFW Hoof Disease Public Working Group Meeting
15 August 2017**

Agenda

- **Welcome**
- **TAHD Diagnostics**
- **Hoof Disease Prevalence/Distribution**
- **Hoof Disease Survival Study**
- **Washington State University partnership**
- **Next steps**
- **Public Testimony**

Public Testimony

- **Members of the public are requested to fill out a Public Testimony Form**
- **Members of the public will be requested to provide their public testimony to the HDPWG in the order the Public Testimony Forms were received**
- **Each member of the public wishing to relay their comments will have 3 minutes each to do so**
 - **This time frame is provided to allow the opportunity for all members of the public to provide their testimony to the HDPWG**

Hoof Disease Public Working Group

- **Understanding hoof disease in elk is a priority and WDFW is committed to the sound management of these important resources**
- **WDFW established the Public Working Group as we believe it is important to work together as we try to better understand and address this issue**
- **The purpose of this Working Group is to provide the opportunity to:**
 - **share information about the hoof disease phenomenon and WDFW activities,**
 - **discuss research and management questions with regard to hoof disease and solicit feedback, and**
 - **public outreach**

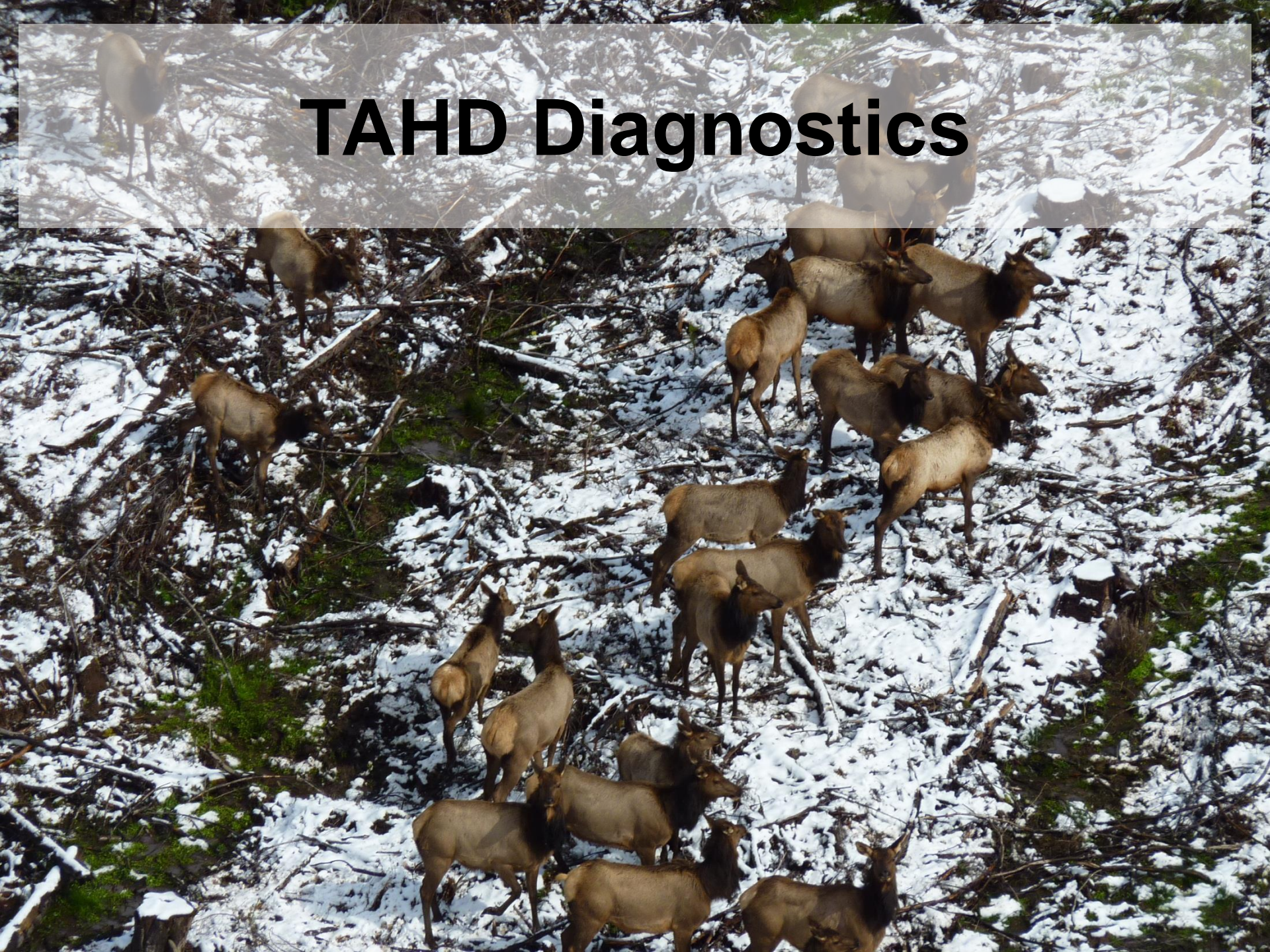
Changes

- **HDPWG:**
 - **RMEF - change to Bill Richardson**
- **WDFW:**
 - **3 Regions of Western Washington**
 - **Anis Aoude – Game Division Manager**
 - **Policy Lead**
 - **Kyle Garrison – Hoof Disease Coordinator**

Prioritized Efforts

- **Prioritized efforts to address and inform management:**
 - **Better understand prevalence of hoof disease in elk herds in Southwest Washington,**
 - **Better understand the distribution of hoof disease in elk herds in Southwest Washington,**
 - **Understand the impacts of hoof disease on elk survival and productivity, and**
 - **Remove elk severely affected with hoof disease**
 - **Euthanasia Protocol**

TAHD Diagnostics



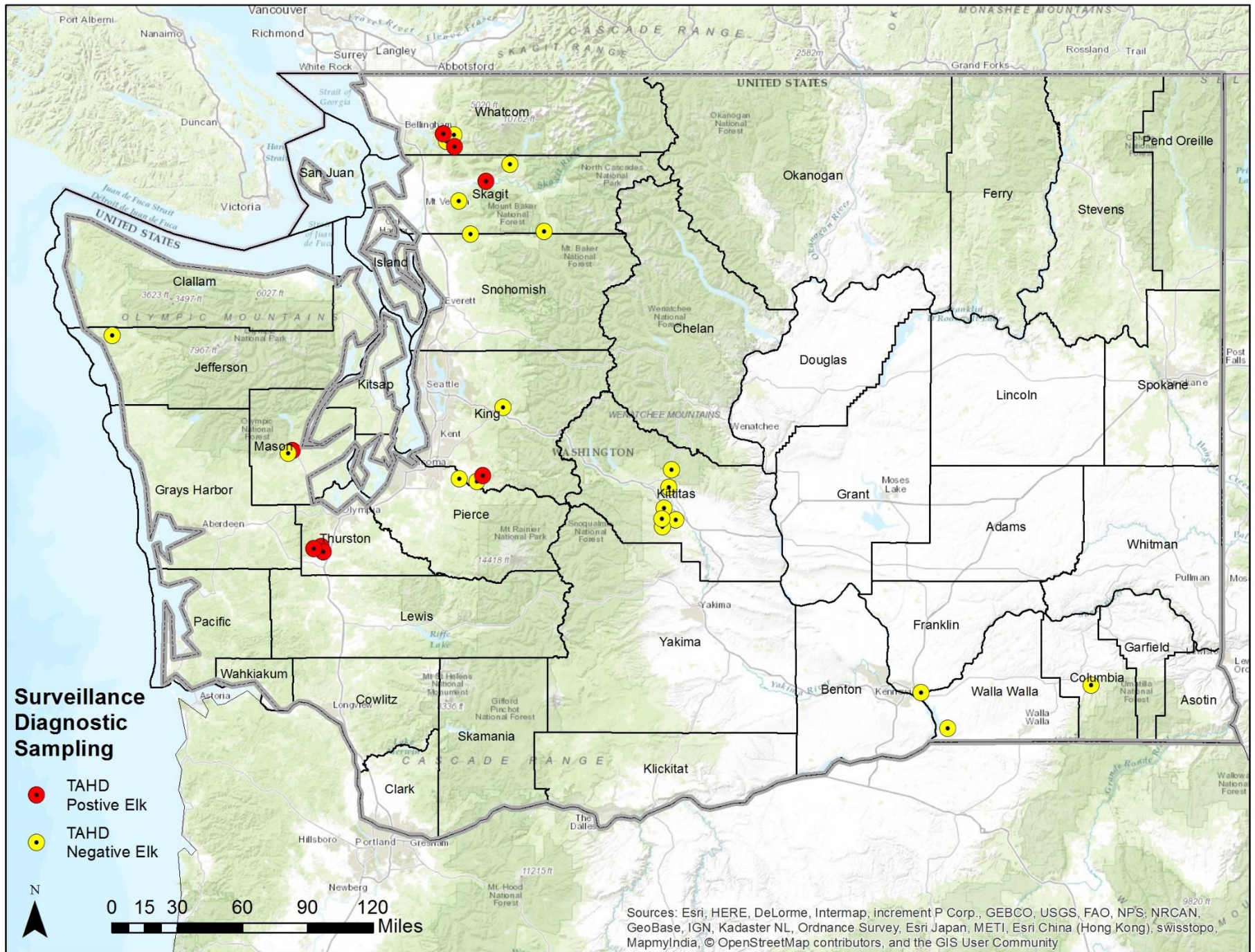
Summary

- **2014 Diagnosis of treponeme associated hoof disease (TAHD)**
- **Since then:**
 - **Working collaboratively with US Department of Agriculture and Colorado State University on many of the identified research and information needs identified by both the Technical Advisory Group and the Public Working Group**
- **TAHD of elk is a rapidly progressive disease**
- **There is little evidence thus far of recovery from TAHD**

Summary

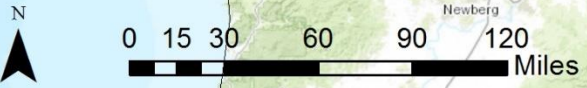
- **Confirmed TAHD positive elk in:**
- **(2016) Skagit, Mason, Thurston, and Whatcom Counties**
- **(2017) King County**





Surveillance Diagnostic Sampling

- TAHD Positive Elk
- TAHD Negative Elk



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Summary

- **Biomedical Investigations:**
 - Laboratory research of TAHD is ongoing with continued partnership from the USDA and Colorado State University
- **Current efforts are focused on:**
 - Identifying other bacteria in addition to treponemes that may be involved in the development of TAHD,
 - Evaluating the immune response of elk to TAHD bacteria, and
 - Refining our understanding of disease progression in individual elk

Ongoing Research

- **Identifying other bacteria besides treponemes that might be involved in the development of TAHD**
- **Evaluating the immune response of elk to these TAHD bacteria**
 - **inform our knowledge of whether the elk eventually become immune to the disease**

Ongoing Research

- **Evaluate whether blood can be tested for evidence of previous exposure to the bacteria that cause TAHD**
 - **Using archived serum from 2005, 2010, and 2015 captures**
- **Continue monitoring disease progression**
- **Continue to investigate etiology of TAHD**
- **Continue to evaluate cellular and humoral immune response in relation to severity level of TAHD and disease progression**

Future Research

- **Liver and kidney trace mineral concentrations (Se, Cu, Zn)**
 - **Possible impacts on immunological and hoof health**
- **Test feces and oral and rectal swabs for presence of causative TAHD bacteria**
 - **Evaluate potential routes of transmission**
- **Inoculate healthy domestic sheep with infectious material from elk hooves**
- **Investigate potential genetic basis for resistance/susceptibility to TAHD**
 - **Natural selection over time?**

Understanding Hoof Disease Prevalence/Distribution



Prevalence and Distribution

- **Informs management**
- **Important when communicating with our constituents**
- **Have employed 4 primary tools**
 1. **Online reporting tool**
 2. **Citizen science**
 3. **Aerial Surveys**
 4. **Hunter Questionnaire**

Online Reporting Tool



WASHINGTON DEPARTMENT OF FISH & WILDLIFE

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- Wildlife Health
 - Elk Hoof Disease
 - Frequently Asked Questions
 - Report Limping Elk Observations
 - Report Dead Elk with Hoof Deformities
 - Elk Hoof Disease Public Working Group
 - Game Meat Safety

Found Injured Wildlife?

Contact a local Wildlife Rehabilitator

-- List by County --

For more information contact a WDFW Regional Office

Washington Department of Fish & Wildlife

Main Office
Natural Resources Building
1111 Washington St. SE
Olympia, WA 98501
360-902-2200
[Get Directions](#)

Mailing Address
600 Capitol Way N.
Olympia, WA 98501-1091

Phil Anderson
Director

Wildlife Health

How to report elk showing signs of hoof disease

State wildlife managers are seeking the public's help in determining the incidence and geographical distribution of hoof disease in southwest Washington elk herds.

The area of the map marked with **green hash lines** below is of primary interest in this effort, because more information is needed about the disease in that area. The department already has a substantial amount of documentation on diseased elk in the primary area of infection, which is marked with red crosshatches.

If you see elk that are limping or dead/harvested with hoof deformities in the area marked with **green hash lines**, please report your observations on this website.

As a reference point, the two colored/hash and crosshatched areas are divided into numbered Game Management Units ([view GMU map](#)).

Once you have submitted a report, a red "X" will appear on the master reporting map on the main [Hoof Disease page](#).

The Washington Department of Fish and Wildlife thanks all who contribute to this important effort.

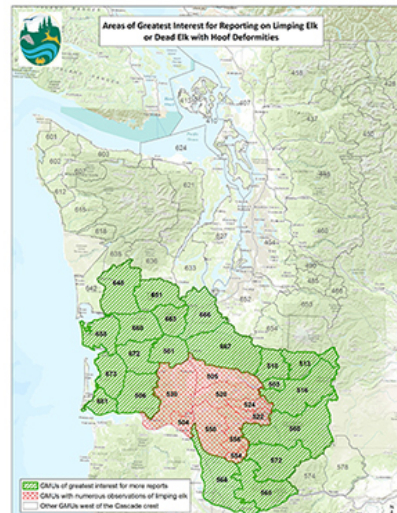
Help Monitor Hoof Disease

Wildlife managers are seeking reports on elk with hoof deformities observed in specific areas of southwest Washington.

[Report Limping Elk](#)

[Report Dead Elk with Hoof Deformities](#)

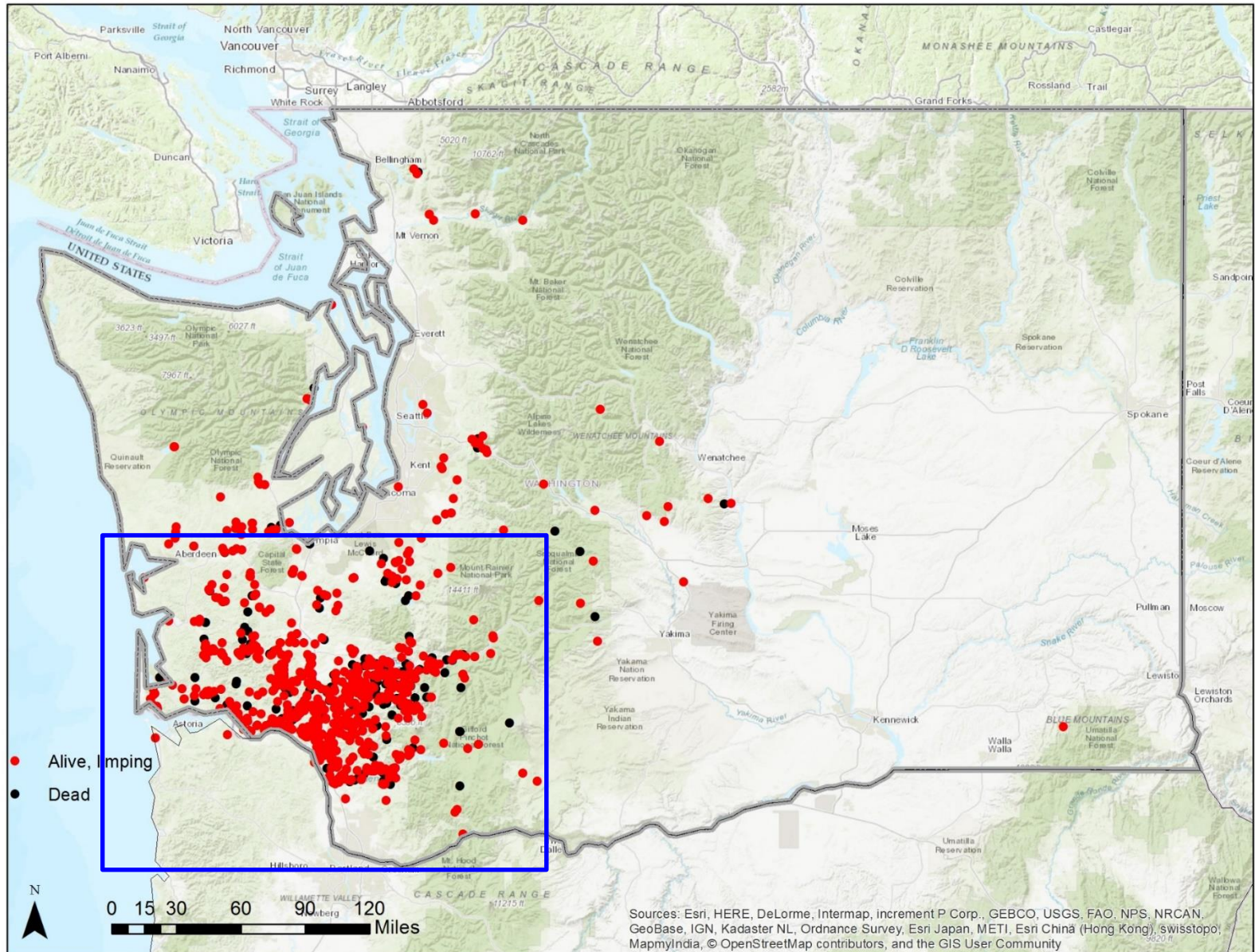
Areas of Greatest Interest for Reporting on Limping Elk or Dead Elk with Hoof Deformities



Online Reporting Tool

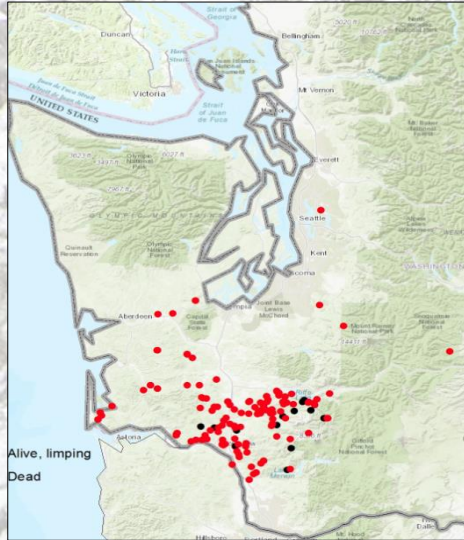
Year	Dead	Limping	Total
2012	31	109	140
2013	41	183	224
2014	52	194	246
2015	39	120	159
2016	27	138	165
2017	14	66	80
Total	204	810	1014

Online Reporting Tool

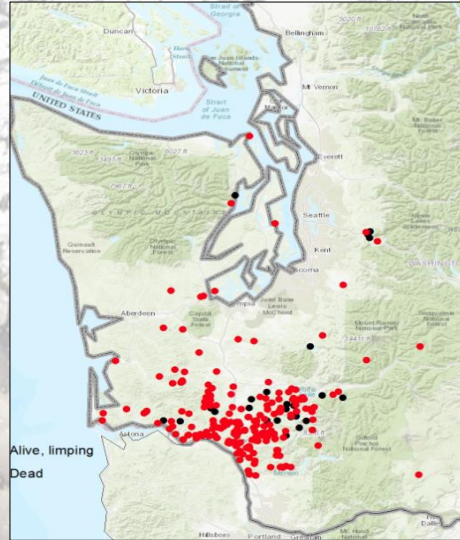


Online Reporting Tool

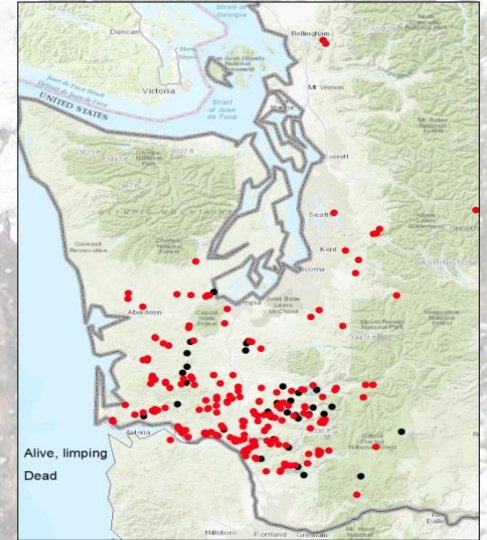
2012



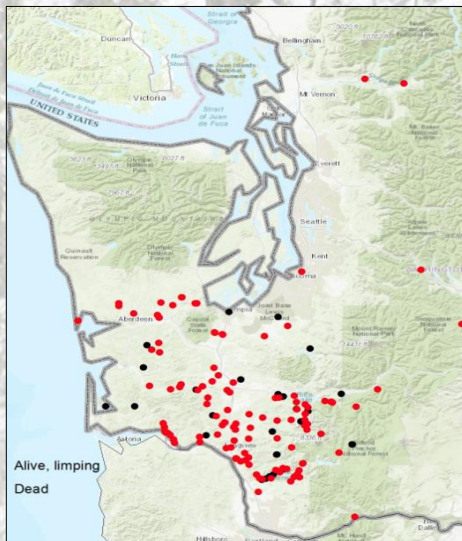
2013



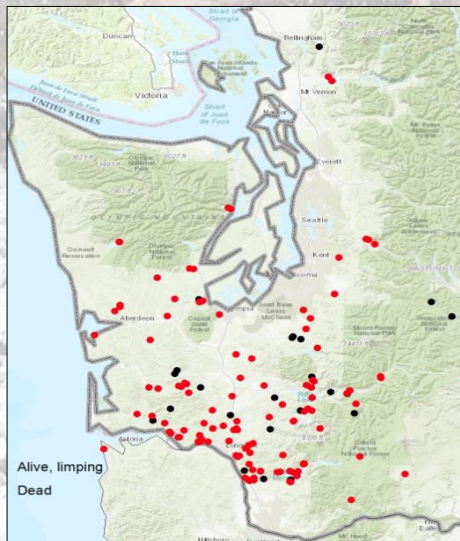
2014



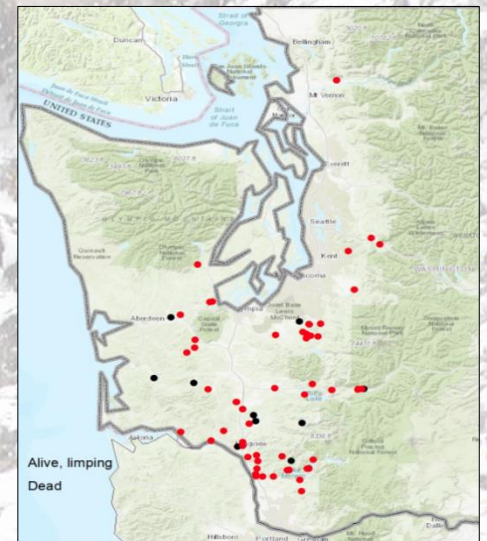
2015



2016

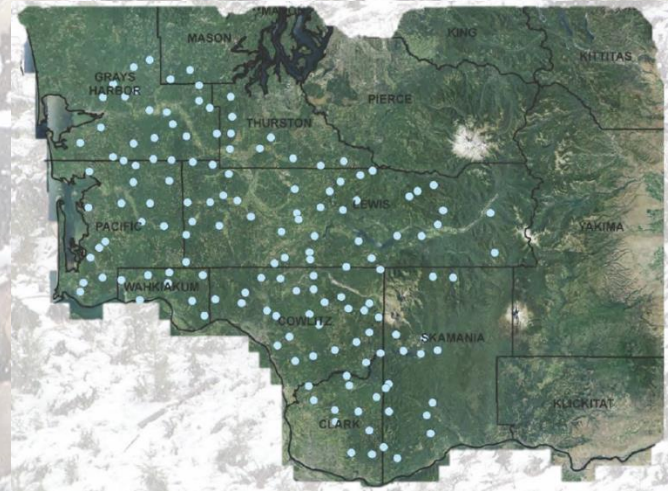


2017

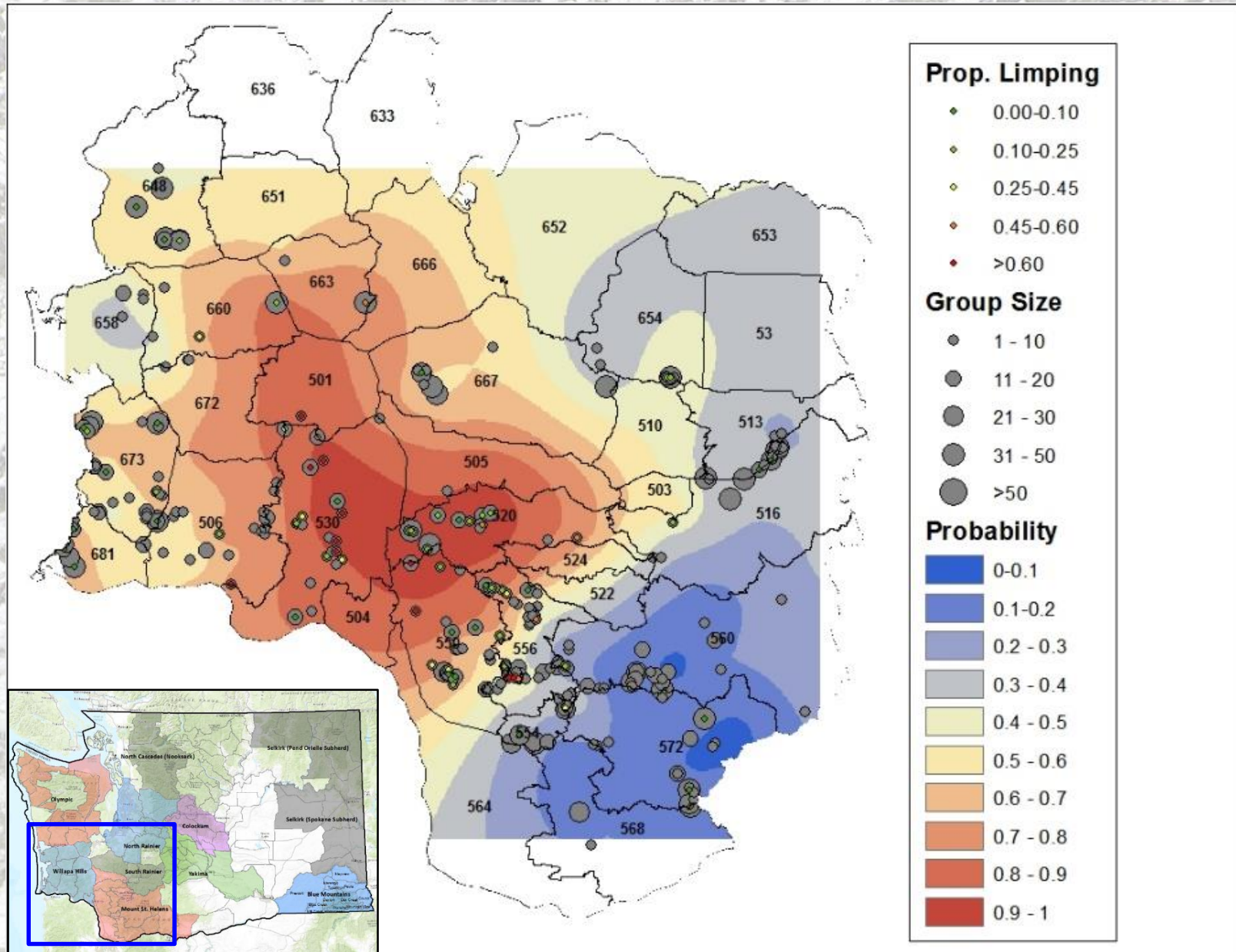


Citizen Science

- Spring 2015
- 223 Volunteers
- 283 groups observed (~2,600 elk)
- Raw Data
 - 6-8% of elk observed were limping
 - 29% of groups had ≥ 1 limping elk
- Detection related to survey conditions
- Corrected at group level
 - 48% of groups had ≥ 1 limping elk
 - Ordinary Kriging prediction
- Many logistical challenges

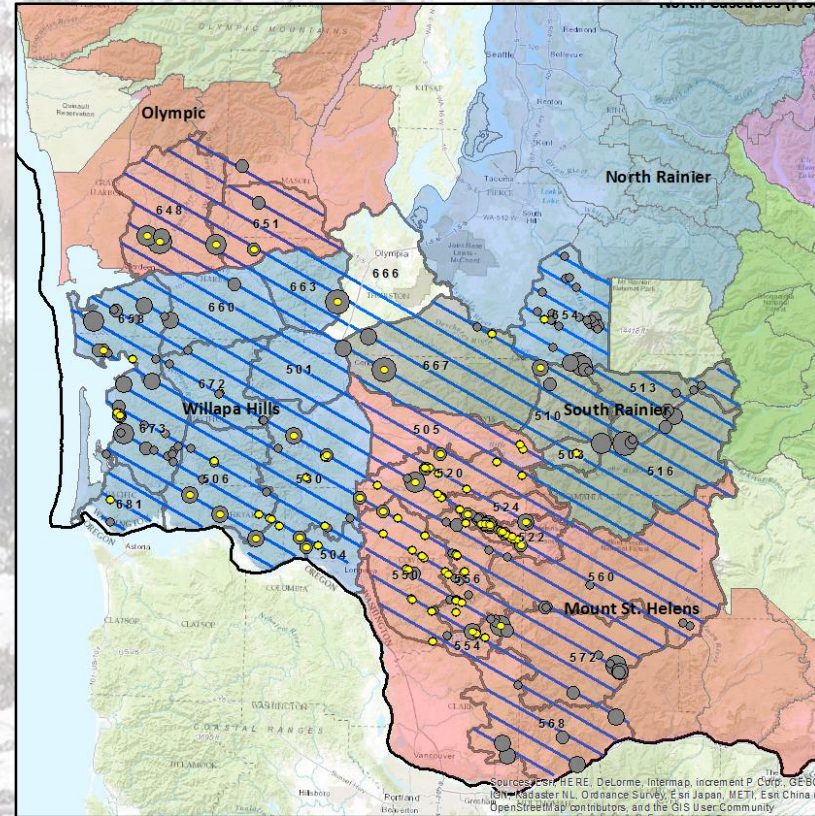


Citizen Science



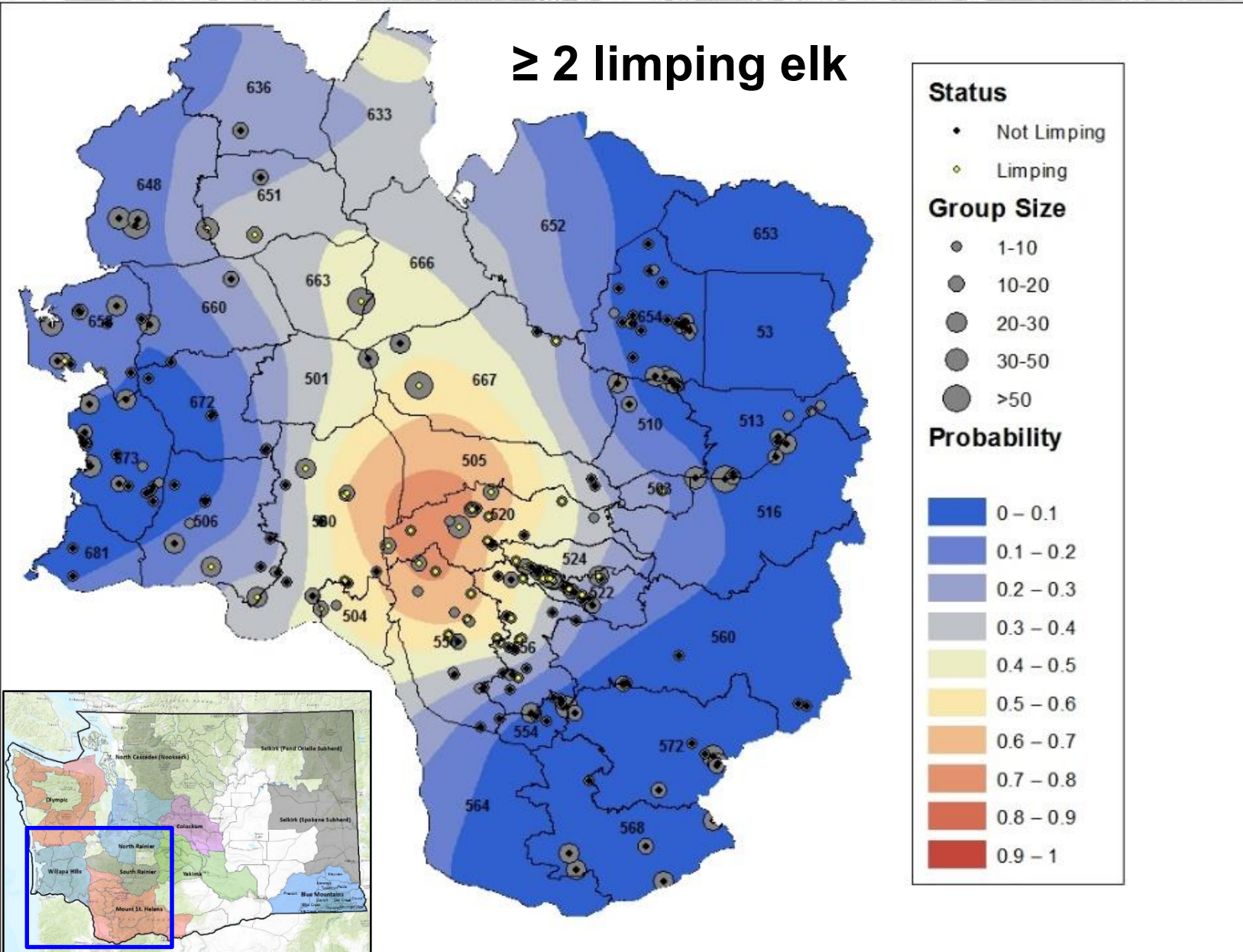
Aerial Surveys

- Spring 2017
- Transect-based
 - ~2,100 miles
 - Observed each group for ≤ 2 minutes
- 271 groups observed
 - ~2,800 elk
 - 226 usable data points
- Raw Data
 - 42% of groups had ≥ 1 limping elk
 - 23% of groups had ≥ 2 limping elk
- Detection related to % cover
- Indicator Kriging prediction



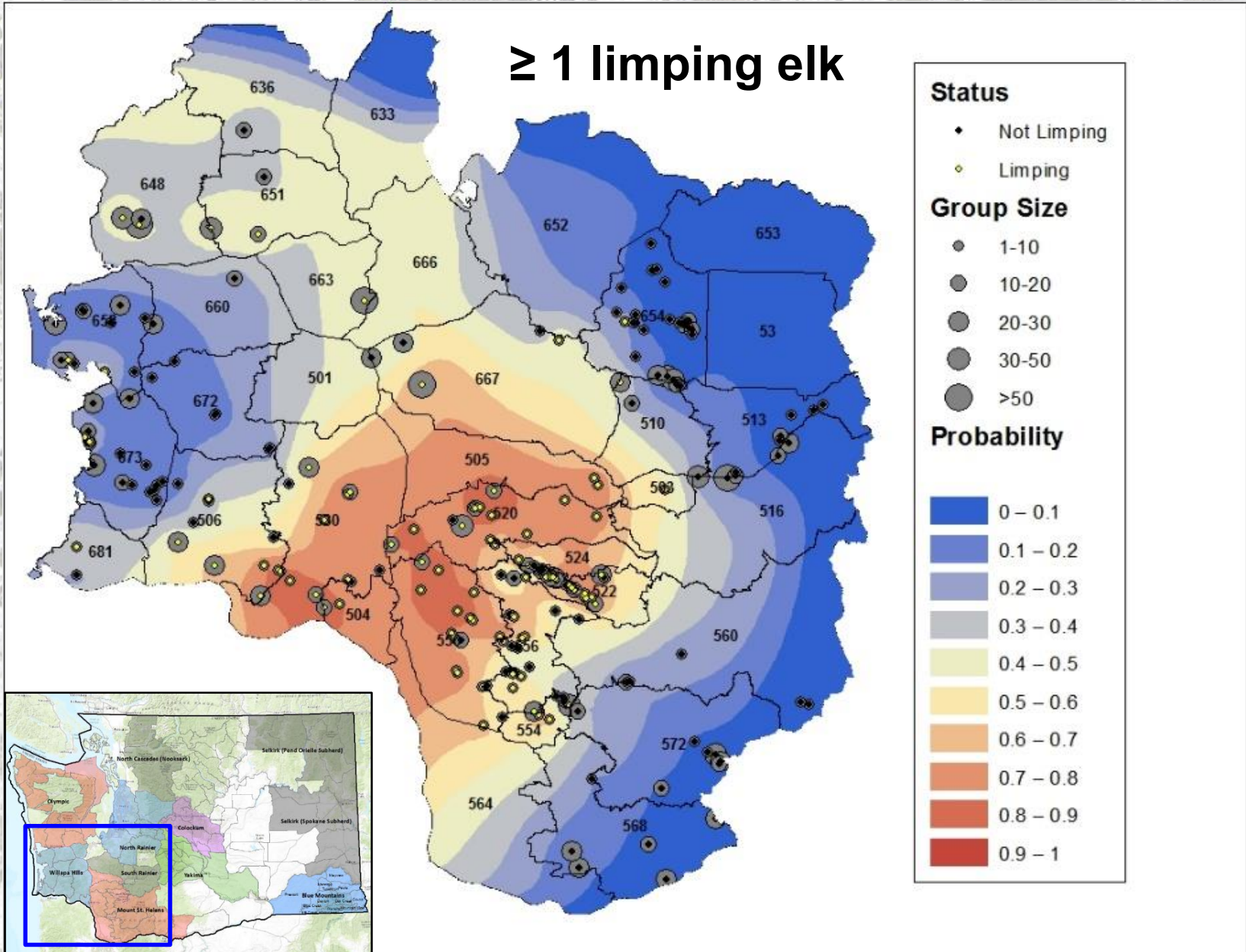
Aerial Surveys

≥ 2 limping elk

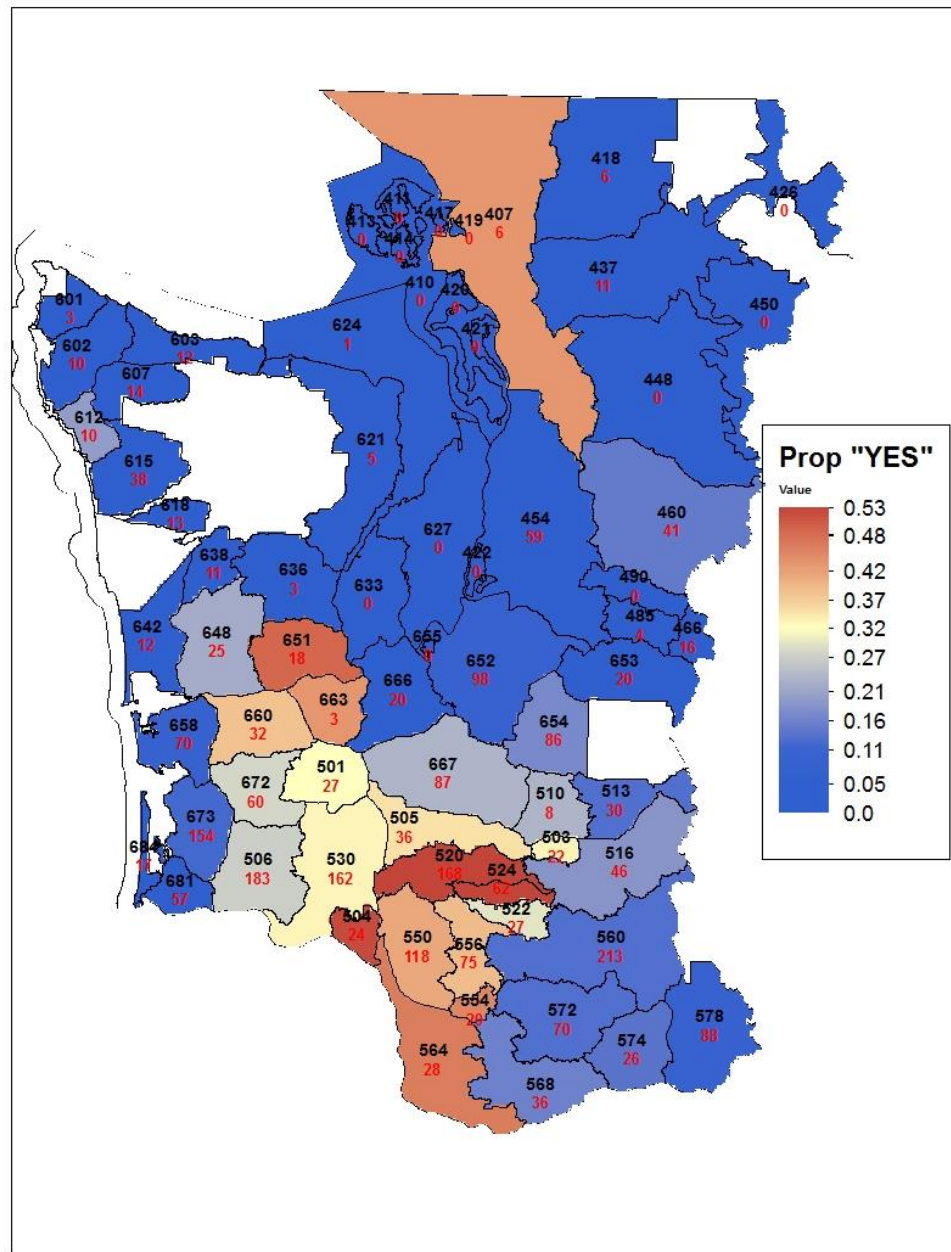


Aerial Surveys

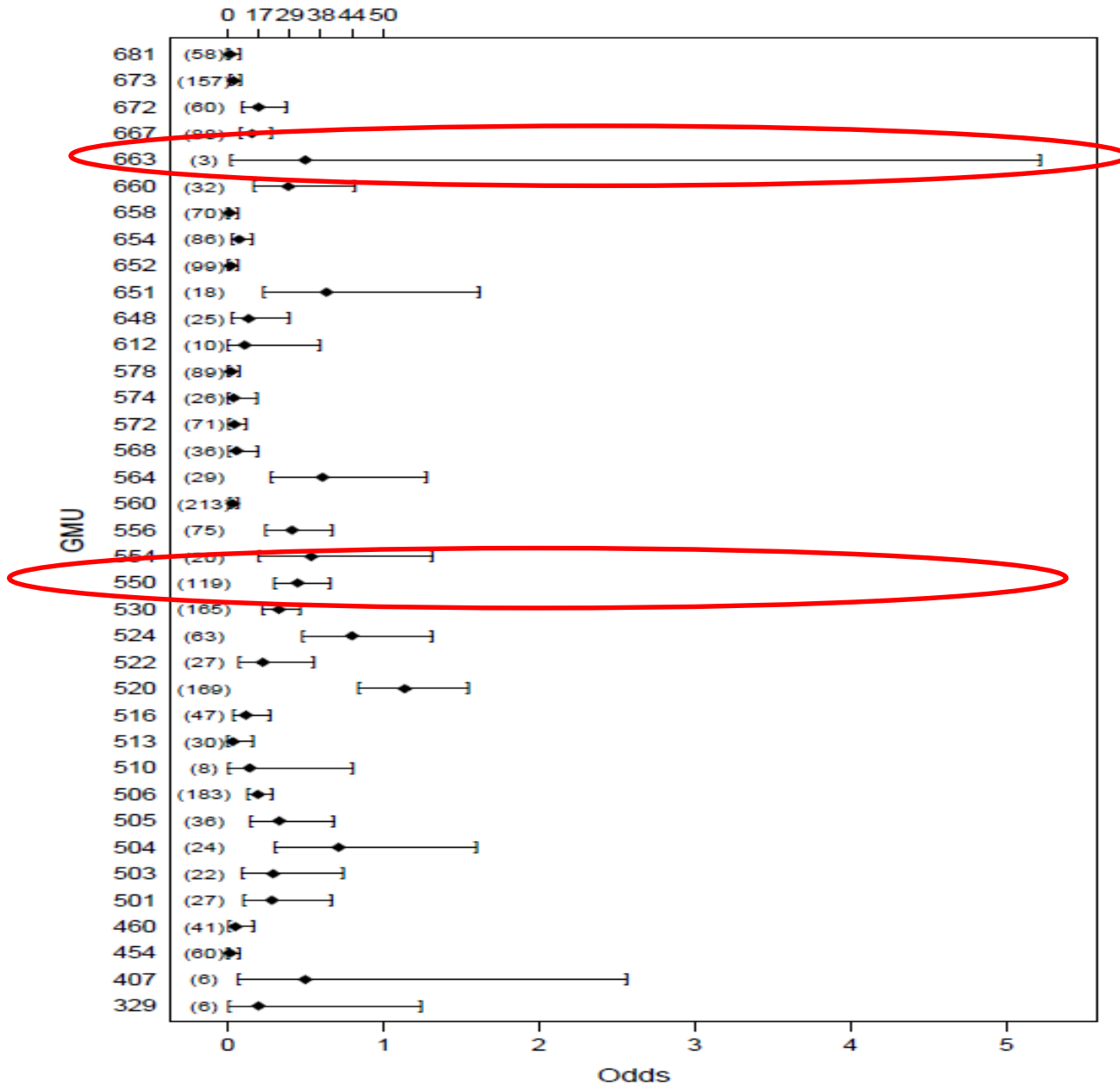
≥ 1 limping elk



Hunter Questionnaire



Hunter Questionnaire

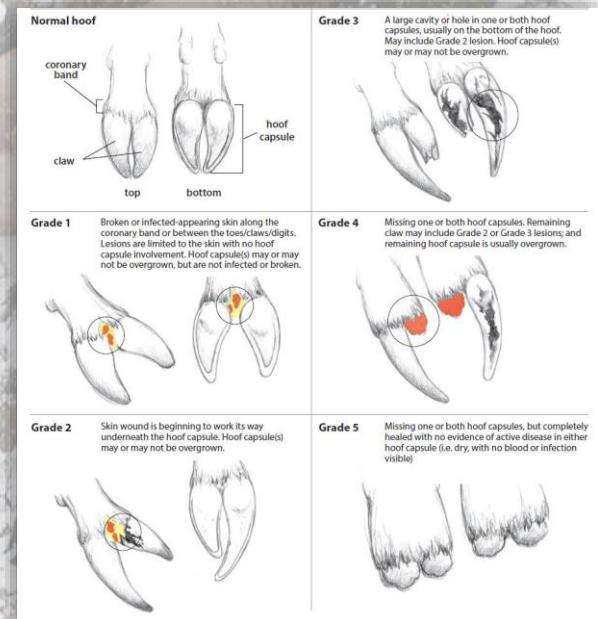


Hunter Questionnaire

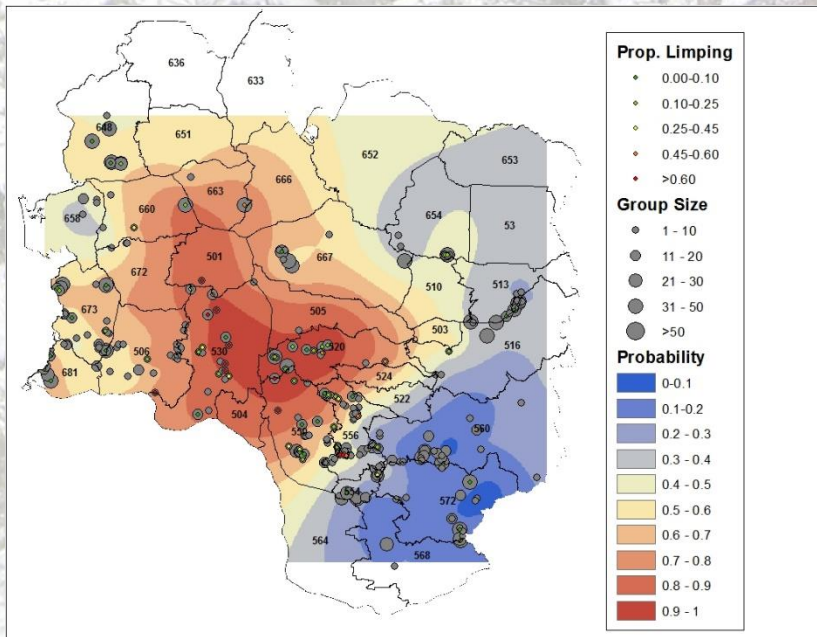
- How many “yes” responses are actually TAHD?
- Requested participation from ~500 permit hunters in the MSH and Willapa Hills
 - “In your opinion, did any of the hooves from the elk you harvested appear to be deformed or exhibit any abnormalities”
 - Requested they submit their hooves for formal evaluation

- ~70-75 samples submitted
 - 52 complete samples
 - 25 had TAHD (48%)
 - 27 were normal (52%)

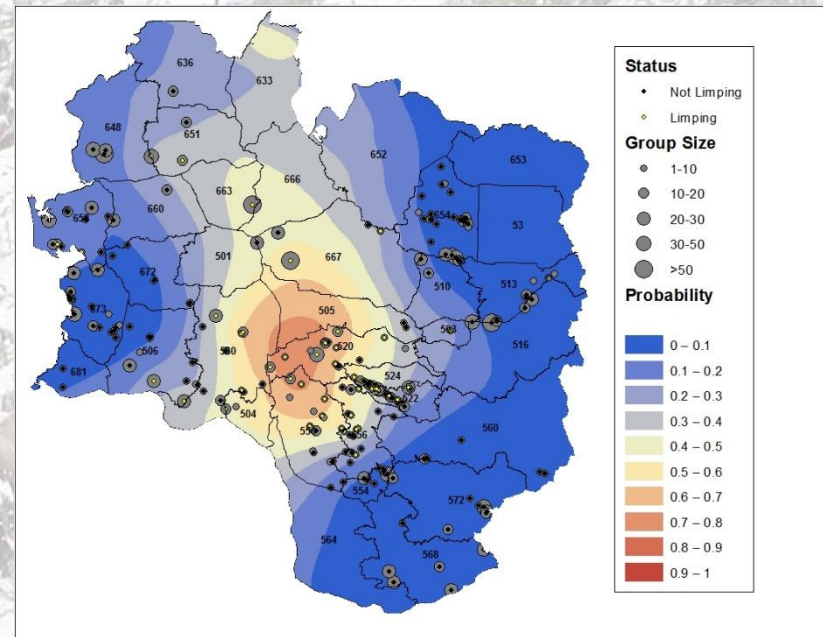
- False(+) rate of 4%
- False(-) rate of 48% (early and late stages)
- False(-) rate of 27% (late stages)



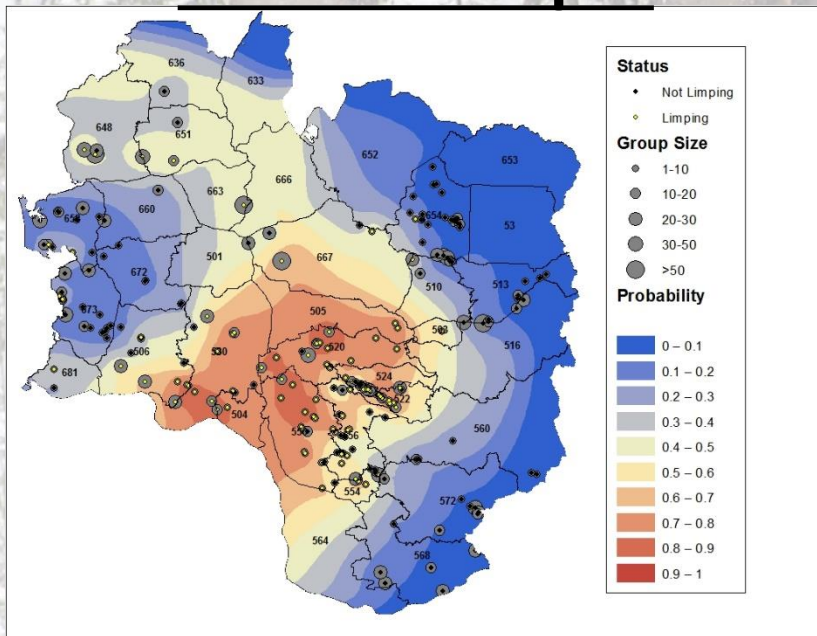
Citizen Science



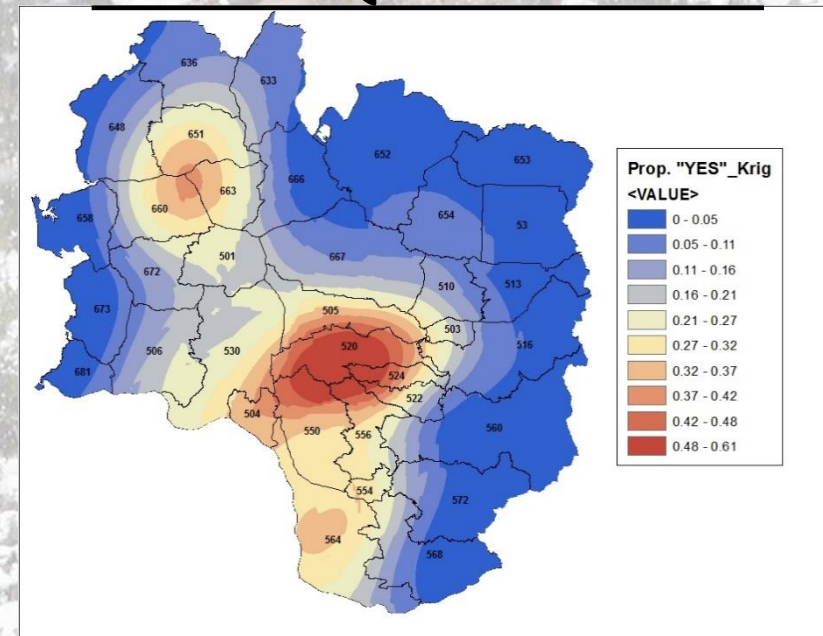
Aerial-2 Limpers



Aerial-1 Limper



Hunter Questionnaire



Hoof Disease Survival Study



Hoof Disease Study

Potential Effects of TAHD

- May reduce survival of affected elk
- Secondary effect on nutritional condition
 - Reduced probability of conception
 - Limit the ability of a cow to support a calf
- Alter the way affected elk use the landscape

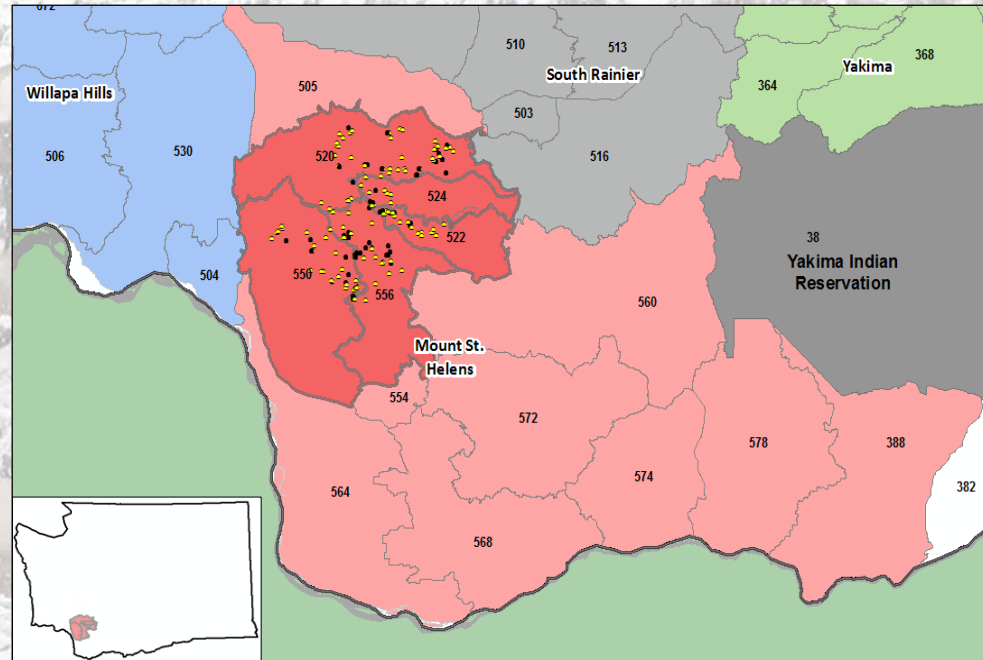


Study Objectives

- Objective 1: Estimate the effects of TAHD on survival of adult (>2 years old) female elk**
- Objective 2: Determine cause-specific mortality rates for adult female elk that have TAHD**
- Objective 3: Estimate the effects of TAHD on the pregnancy rates of adult female elk**
- Objective 4: Estimate the effects of TAHD on elk productivity (i.e., survivorship of calves)**
- Objective 5: Estimate the effects of TAHD on the level of condition adult female elk are able to achieve in autumn.**
- Objective 6: Increase our understanding of how TAHD progresses in individual elk, and whether affected elk may recover from the disease.**

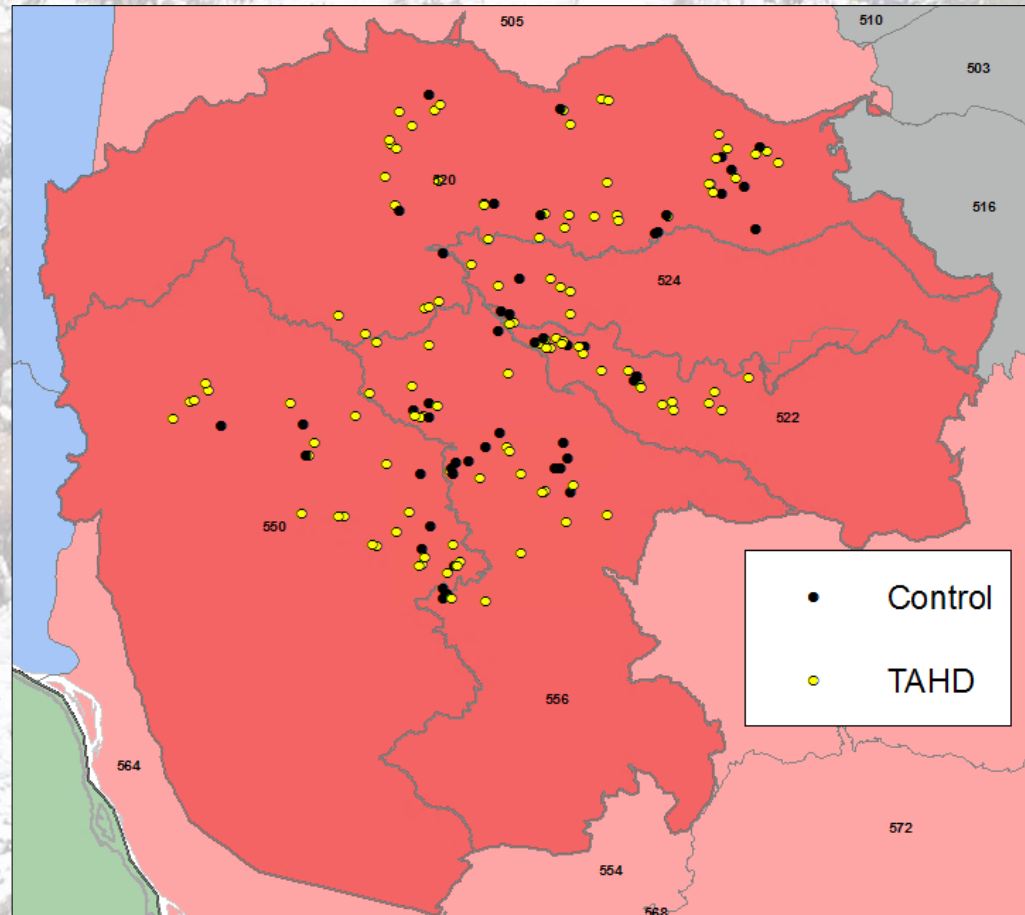
Study Area

- 5 GMUs that represent core range of MSH herd
- Within endemic area
- Same study area as McCorquodale et al. (2014)
- Minimizes stochastic variability independent of TAHD



Capture and Marking

- **Captures in Feb. 2015, Dec. 2015 & 2016**
 - 169 capture events
 - 116 individual elk
 - 53 recaptures
- **Marked 112 elk**
 - 82 TAHD
 - 30 Controls
 - 3:1 ratio



Capture and Marking

- Removed upper canine to estimate age via cementum annuli
- Assessed body condition
- Determined pregnancy and lactation status
- Measured chest girth to estimate body mass
- Examined hooves

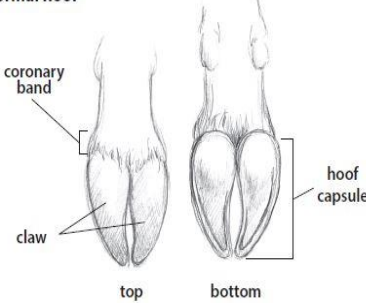
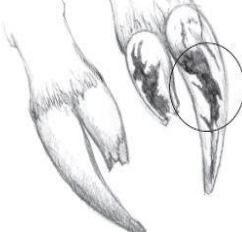
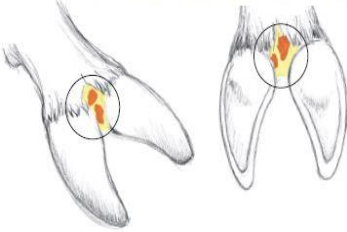
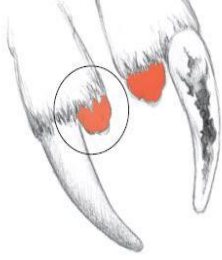
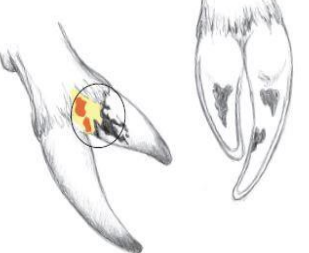
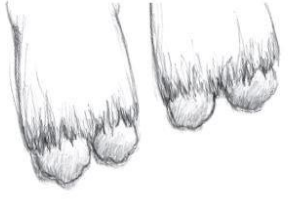


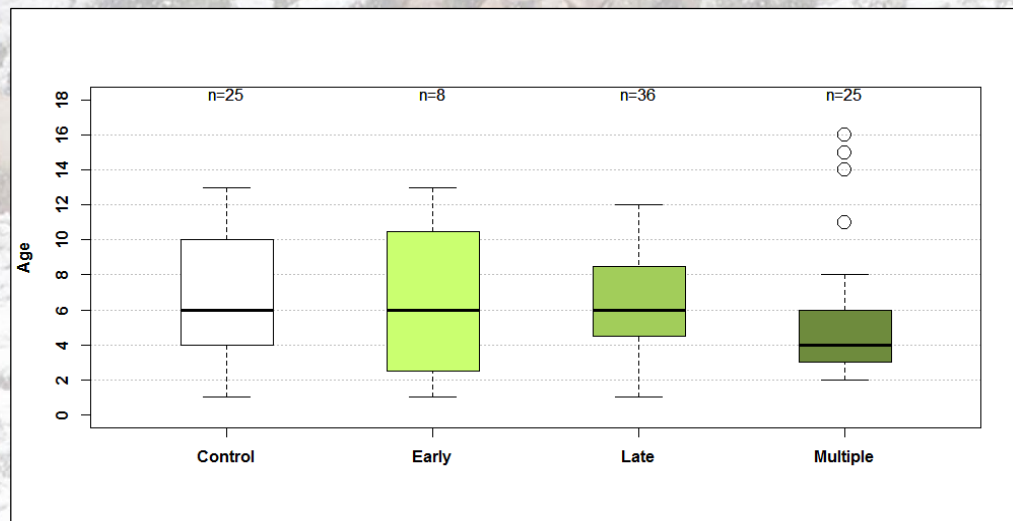
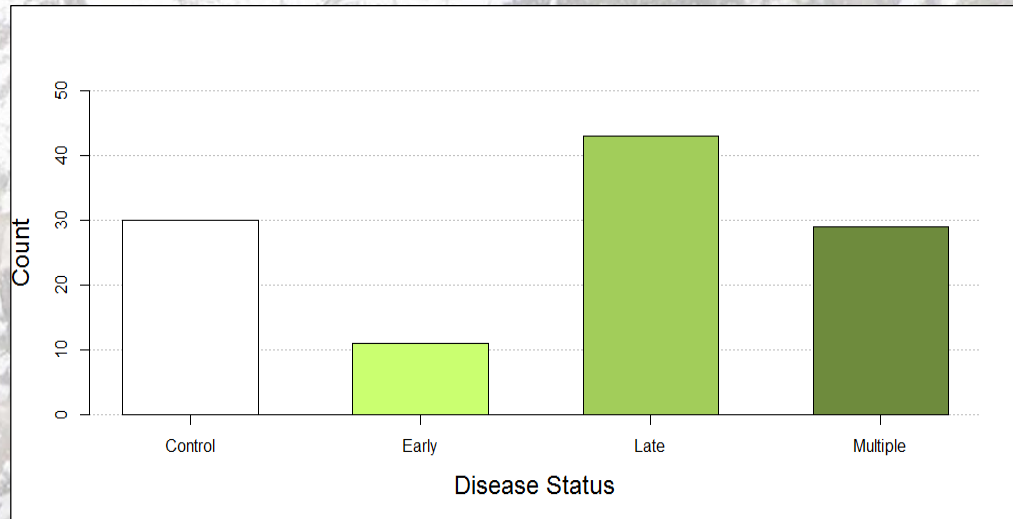
TAHD Observations

- Have observed wide variation in hoof disease severity ($n = 82$)
 - Involved rear hooves = 1.00
 - Involved just 1 back hoof = 0.76
 - Involved front hooves = 0.12
 - Involved just front hooves = 0.00



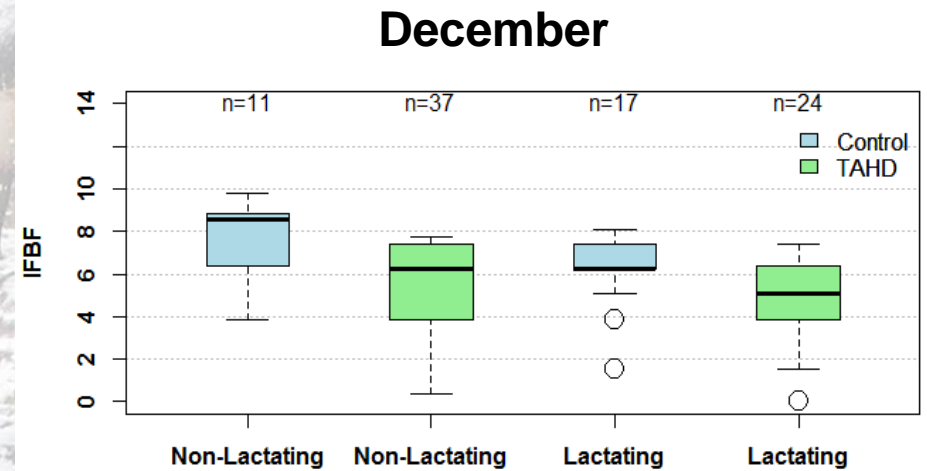
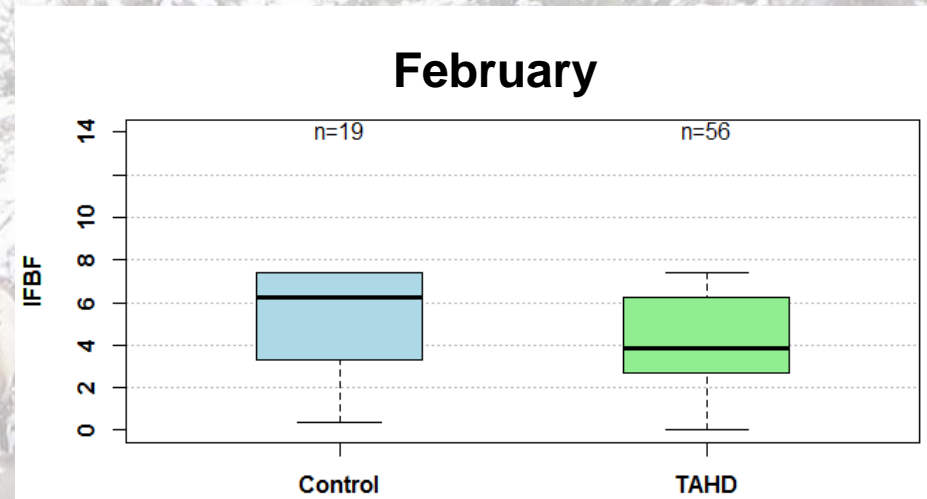
Disease Severity

<p>Normal hoof</p>  <p>top bottom</p>	<p>Grade 3 A large cavity or hole in one or both hoof capsules, usually on the bottom of the hoof. May include Grade 2 lesion. Hoof capsule(s) may or may not be overgrown.</p> 
<p>Grade 1 Broken or infected-appearing skin along the coronary band or between the toes/claws/digits. Lesions are limited to the skin with no hoof capsule involvement. Hoof capsule(s) may or may not be overgrown, but are not infected or broken.</p> 	<p>Grade 4 Missing one or both hoof capsules. Remaining claw may include Grade 2 or Grade 3 lesions; and remaining hoof capsule is usually overgrown.</p> 
<p>Grade 2 Skin wound is beginning to work its way underneath the hoof capsule. Hoof capsule(s) may or may not be overgrown.</p> 	<p>Grade 5 Missing one or both hoof capsules, but completely healed with no evidence of active disease in either hoof capsule (i.e. dry, with no blood or infection visible)</p> 



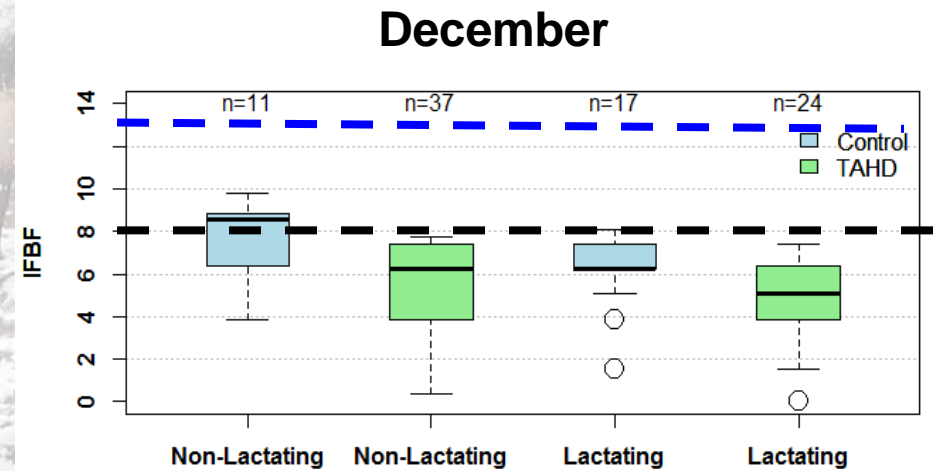
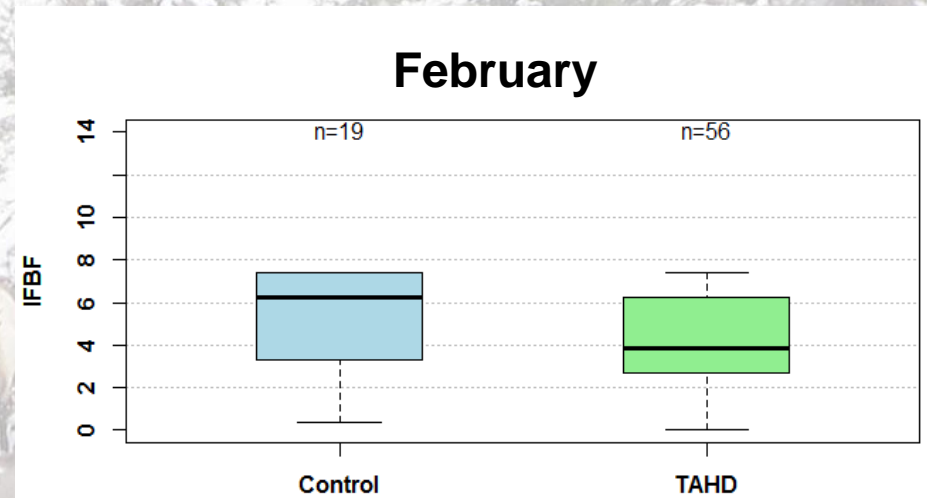
Body Condition

- **Mean % IFBF**
- **Lactating Elk**
 - TAHD = 4.9 (4.1-5.8)
 - Control = 6.1 (5.3-7.0)
- **Not Lactating**
 - TAHD = 5.3 (4.7-6.0)
 - Control = 7.6 (6.1-9.0)

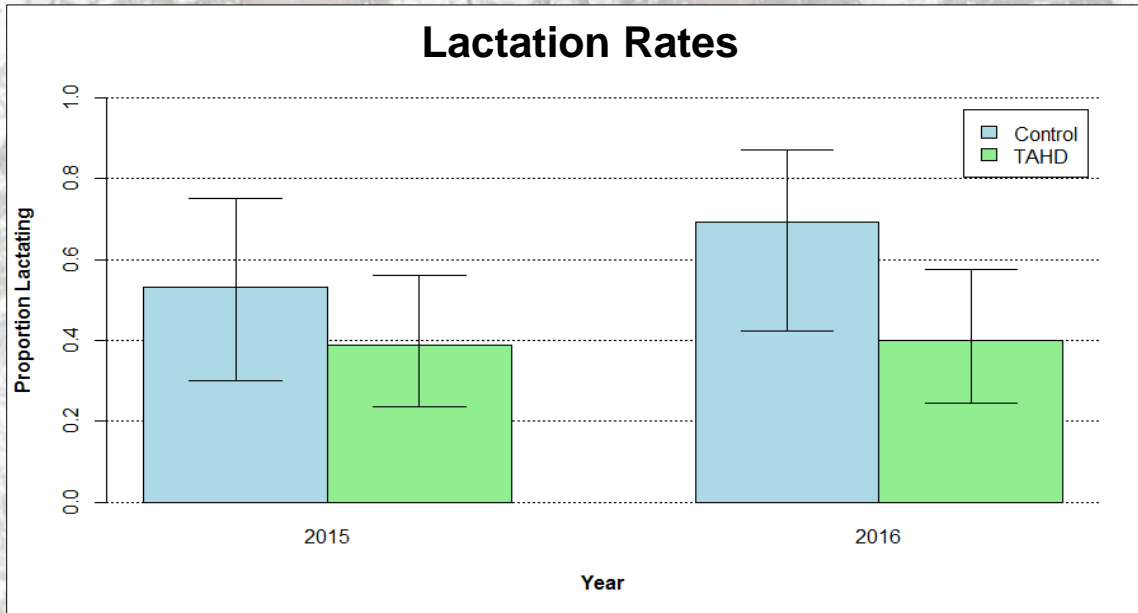
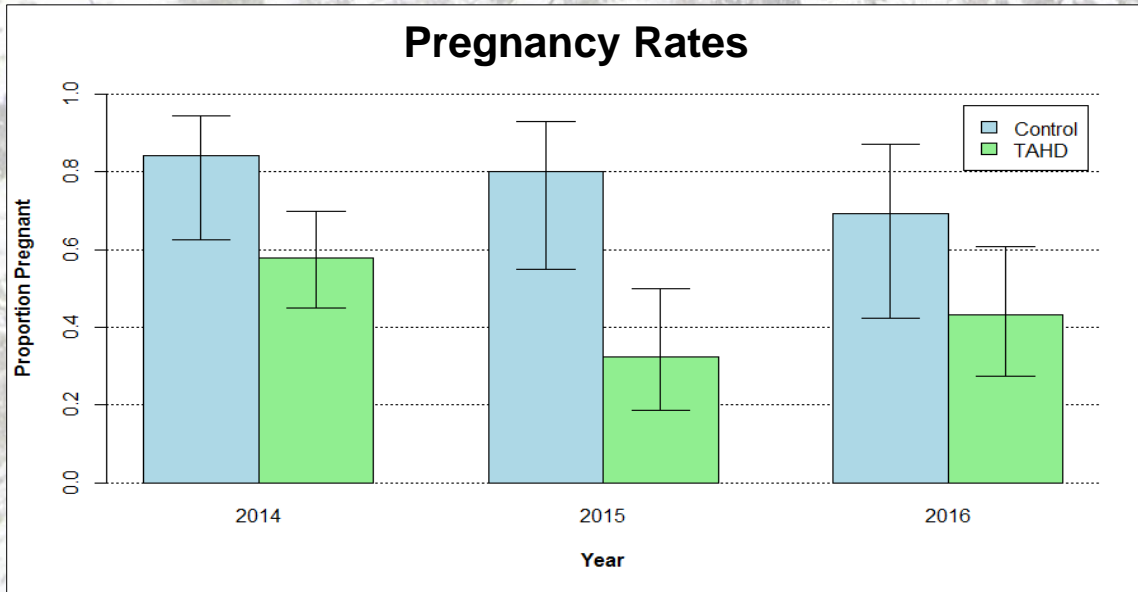


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Pregnancy and Productivity



Calf Survival

2015

TAHD = 0.62 ($n = 13$)

Control = 0.60 ($n = 10$)

2016

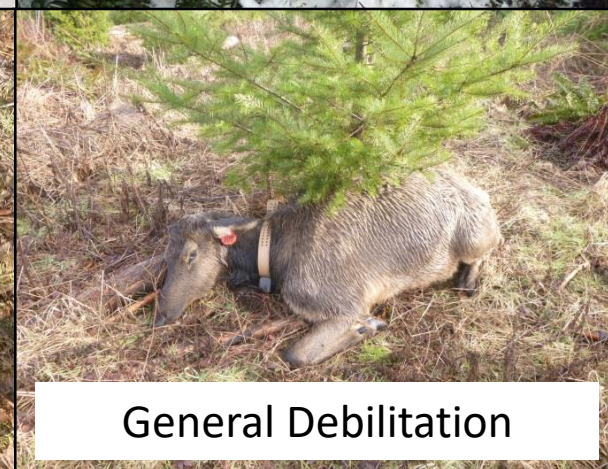
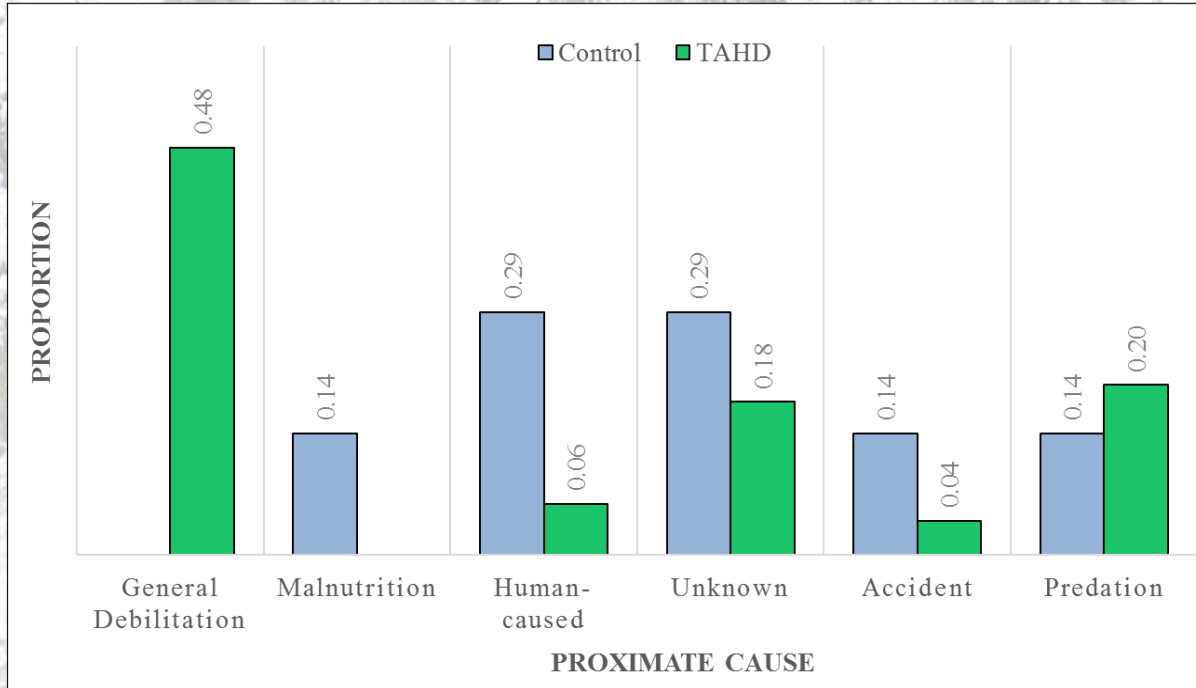
TAHD = 0.75 ($n = 8$)

Control = 0.50 ($n = 6$)

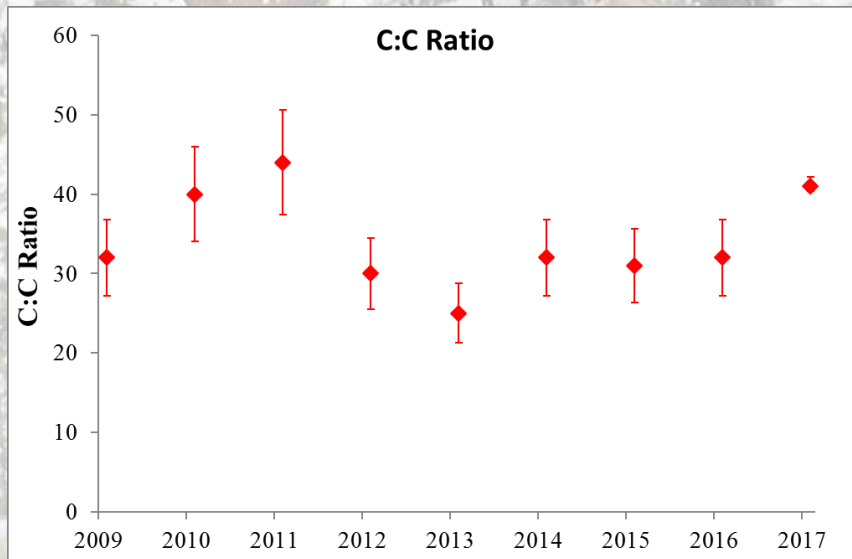
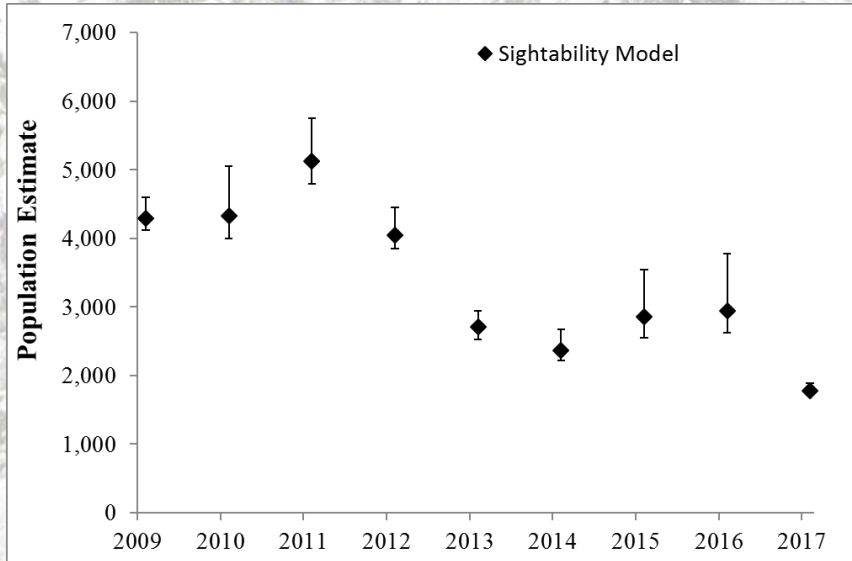
Survival

Season	2015		2016	
	TAHD	Control	TAHD	Control
Project Initiation	0.39 (0.29-0.48)	0.61 (0.41-0.81)		
Annual	0.68 (0.57-0.79)	0.79 (0.61-0.97)	0.59 (0.48-0.70)	0.78 (0.60-0.97)
Summer	0.93 (0.86-0.99)	0.93 (0.81-0.99)	0.94 (0.87-0.99)	0.94 (0.81-0.99)
Autumn	0.92 (0.85-0.99)	0.85 (0.65-0.99)	0.91 (0.84-0.99)	1.00 --
Winter	0.80 (0.70-0.90)	1.00 --	0.68 (0.57-0.80)	0.83 (0.66-0.99)

Cause of Mortality



Population Monitoring



Washington State University Partnership



WSU Partnership

- **2017: Senate Bill 5474 passed and funded by Washington State legislature**
 - **Identifies WSU role in monitoring and research of TAHD**
 - **Work collaboratively with WSU on existing and ongoing body of work and partnerships**

Next Steps



Next Steps

- **Continue to evaluate methodologies**
 - **Hoof assessment; Mandatory harvest reporting tool**
- **Hunter-harvested hoof collections Fall 2017**
- **Continue survival study**
- **Expansion of WAC 220-413-200 to include GMUs 407, 418, 437, 454, 633, and 636**
- **Continue diagnostic research to address management and research questions**
- **Update outreach materials**

Next Steps

- **Work with WSU to assess/prioritize/address information needs**
- **Continue to be adaptive as we learn from these efforts with respect to management and research**
- **Public Working Group:**
 - **Change purpose and expand to reflect geographic scope of disease**
- **Management Working Group:**
 - **Work with tribal partners on management options**

Thank you
....any questions....



Treponeme-associated hoof disease in Elk in Western Washington: Timeline of Events, Diagnostics, Research, and Management Efforts

1990's

- Sporadic reports of hoof deformities in the Cowlitz River Basin

2008

- The number and geographic extent of reports of elk with abnormal hooves and lameness increases significantly

2009

- WDFW conducted the first clinical investigation of affected elk in March
- WDFW conducted a survey of hunters for an initial understanding of prevalence and distribution of limping elk

2010-
2011

- Reviewed results from 2009's diagnostic investigation and hunter survey to guide future efforts
- WDFW investigated differences in copper and selenium levels between affected and unaffected elk
- WDFW consulted with national and international expert in wildlife diseases

2012

- WSU College of Veterinary Medicine faculty convened to advise on diagnostic investigations
- WDFW held a public meeting to share information regarding the hoof disease phenomenon
- WDFW developed an online hoof disease reporting tool and added informational materials to the WDFW elk hoof disease webpage

2013

- WDFW conducted diagnostic collections of elk in March and August
- WDFW formalized the Hoof Disease Technical Advisory Group, comprised of external researchers and veterinarians, to advise WDFW on diagnostic testing results, additional diagnostic approaches, and possible management options
- WDFW formalized the Hoof Disease Public Working Group with the purpose of sharing information, discussing management options and research questions, and providing public outreach
- Developed a Hoof Disease Health/Safety Fact Sheet in partnership with the Department of Health

2014

- WDFW conducted diagnostic collections of elk in January
- Hoof Disease Public Working Group meetings in February and May
- Hoof Disease Technical Advisory Group reviewed results and reached consensus statement on treponeme-associated hoof disease in elk
- Washington Fish and Wildlife Commission adopted new rules to leave hooves on site from harvested elk in an attempt to minimize the spread of TAHD in elk
- WDFW hired a Hoof Disease Coordinator
- WDFW implemented a pilot prevalence study with volunteers
- WDFW conducted outreach for public assistance to report limping or suspected hoof diseased elk

2014

continued

- WDFW developed a euthanasia criteria for severely affected elk based on input from HDTAG, HDPWG, and Department staff
- WDFW began developing a long term elk survival study to evaluate the effects of hoof disease on elk survival and productivity
- WDFW disseminated diagnostic results in scientific forums and peer-reviewed articles
- Washington Legislature approved \$200,000 supplemental budget for TAHD research
- \$180,000 Pitman-Robertson funds dedicated to hoof disease efforts
- \$8,000 RMEF funds for laboratory analyses of TAHD samples
- \$250,000 legislative request for 2015-2017 biennium

2015

- TAHD research published in peer-reviewed journals in January and May
- WDFW initiated a long-term study in February to understand the effects of TAHD on elk survival and productivity
- WDFW conducted a large-scale citizen science effort to better understand the prevalence of elk TAHD in southwest Washington
- WDFW submitted a SEPA checklist for euthanizing elk severely affected by TAHD
- WDFW conducted a hoof collection and severity scoring pilot study to help quantify TAHD prevalence
- Hoof Disease Public Working Group meeting in December
- Aerial captures of adult female elk in Mount St. Helens to replace collar losses in the survival study

2016

- Continued monitoring of TAHD distribution through WDFW's online reporting form
- Diagnostic sampling for collaborative research with Colorado State University and USDA on microbial profiling of TAHD with comparison to domestic livestock Digital Dermatitis microbial profiles
- WDFW diagnostic collection of elk in Mason, Thurston, and Whatcom Counties
- Confirmed TAHD positive elk in Skagit, Mason, Thurston, and Whatcom Counties
- Implemented a hunter questionnaire and hunter-harvested hoof collections to estimate TAHD distribution
- Aerial captures of 43 adult female elk in Mount St. Helens for survival and productivity study

2017

- Continued monitoring of TAHD distribution through WDFW's online reporting form
- Conducted aerial prevalence surveys for TAHD in southwestern Washington
- WDFW diagnostic collection of elk in western Washington – 3 in King (GMUs 454 and 460), and 1 each in Skagit, Columbia, and Kittitas counties
- Confirmed 1 positive TAHD diagnosis in King County (GMU 454)
- Ongoing research collaboration with Colorado State University and USDA on TAHD and elk immune response
- Senate Bill 5474 passed and funded defining Washington State University's role in hoof disease monitoring and research
- Expansion of 2014 WAC 220-413-200 to include GMUs 407, 418, 437, 454, 633, 636
- Analysis of hunter questionnaire and hunter-scored hooves for prevalence and distribution estimation
- Ongoing research collaboration with Colorado State University and USDA on TAHD, including disease progression and elk immune response
- Planned hunter-harvested hoof collections
- Planned publication of peer-reviewed TAHD research article
- December elk captures for Mount St. Helens survival and productivity study