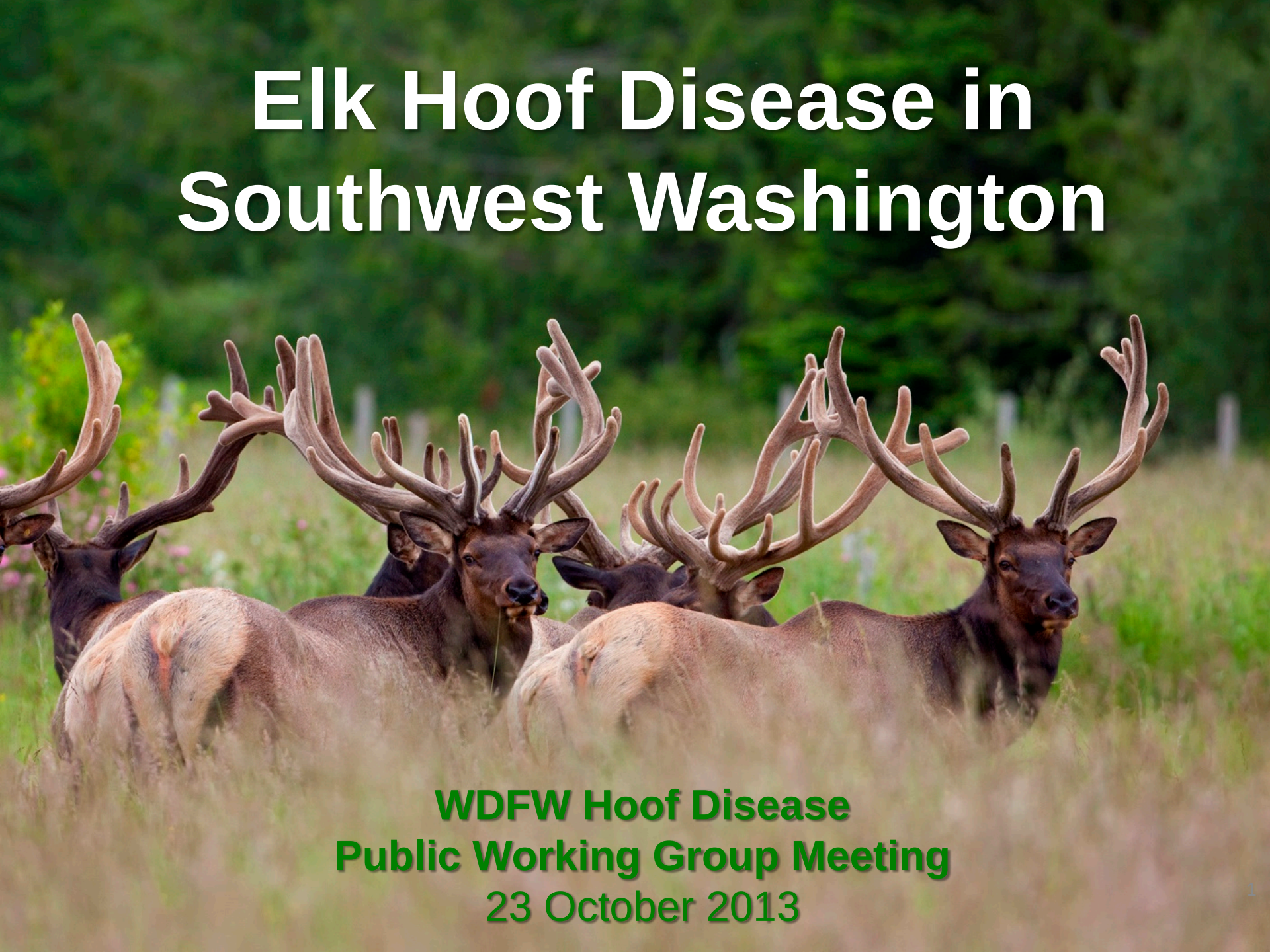
Elk Hoof Disease in Southwest Washington



WDFW Hoof Disease
Public Working Group Meeting
23 October 2013

Agenda

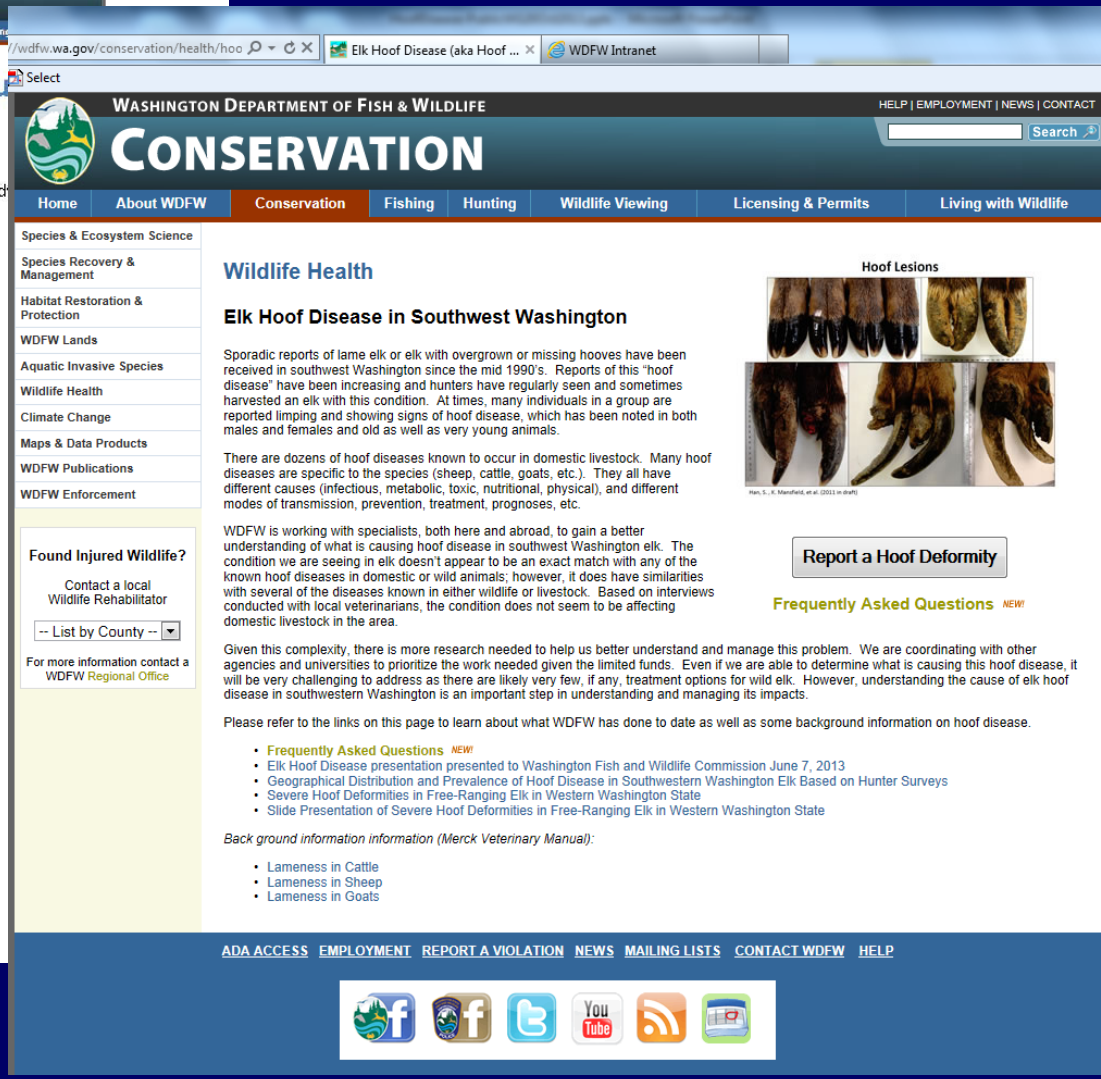
- Welcome
- Introductions
- Purpose of Meeting
- Overview of Management and Disease History of Elk in Southwest Washington
- Overview of WDFW Hoof Disease Investigations and Findings to Date
- Introduction of Management Discussion
- Next steps
- Public Testimony

Purpose of Meeting

Hoof Disease Public Working Group

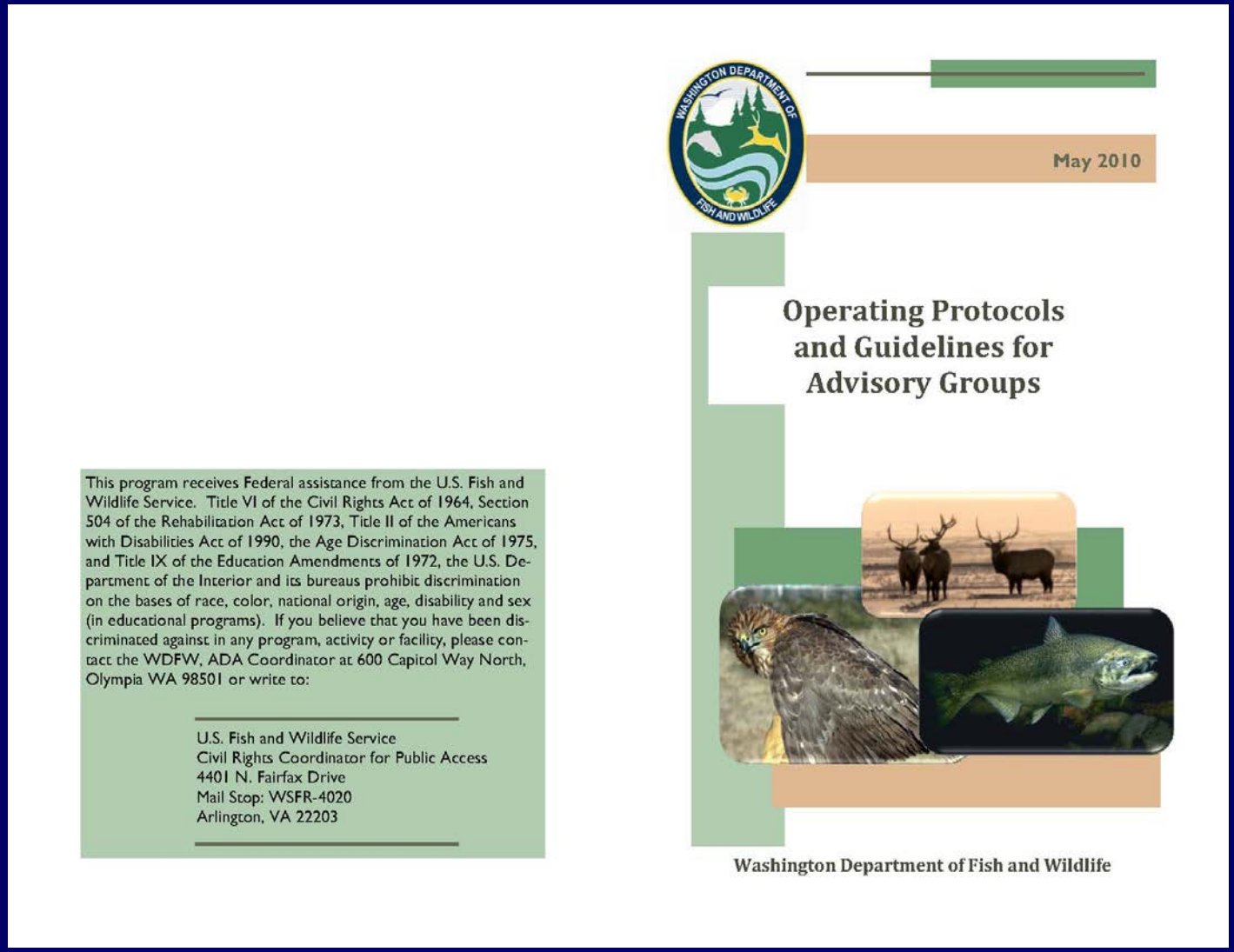
- The prevalence and geographic scope of hoof disease in elk in Southwest Washington has increased significantly
- Understanding this issue is a priority and WDFW is committed to the sound management of these important resources
- WDFW established the Public Working Group as we believe it is important 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,
  - discuss research and management questions with regard to hoof disease, and
  - public outreach

Websites



http://wdfw.wa.gov/conservation/health/hoof_disease/

Operating Protocols and Guidelines for Advisory Groups



May 2010

Operating Protocols and Guidelines for Advisory Groups

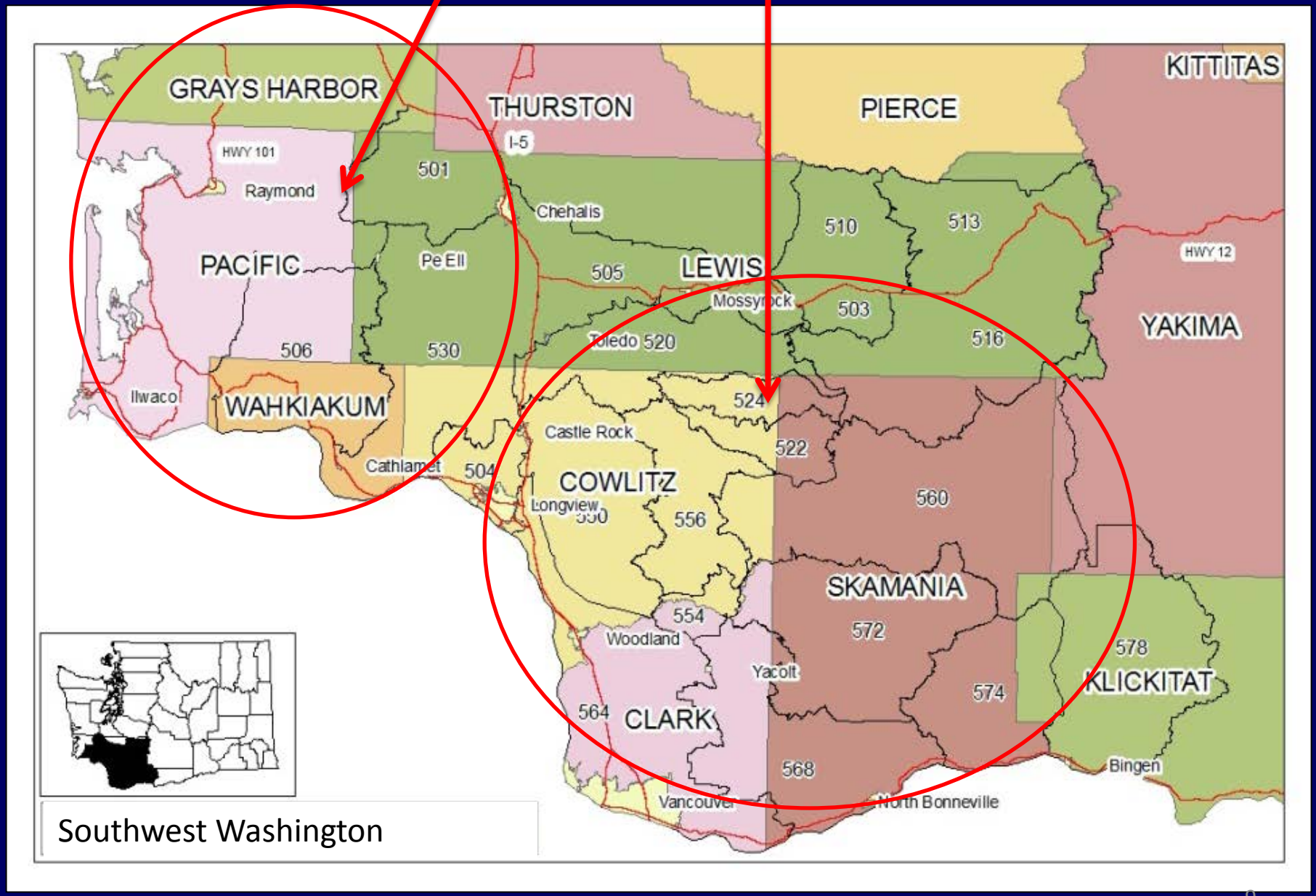
Washington Department of Fish and Wildlife

Management and Disease History of Elk in Southwest Washington

Elk in Southwest Washington

- Two herds:
  - Willapa Hills: Roughly bounded by the Pacific Ocean, I-5, Grays Harbor, and the Columbia River
  - Mt. St. Helens: Roughly bounded by I-5, the Cascade Crest, US Hwy 12, and the Columbia River

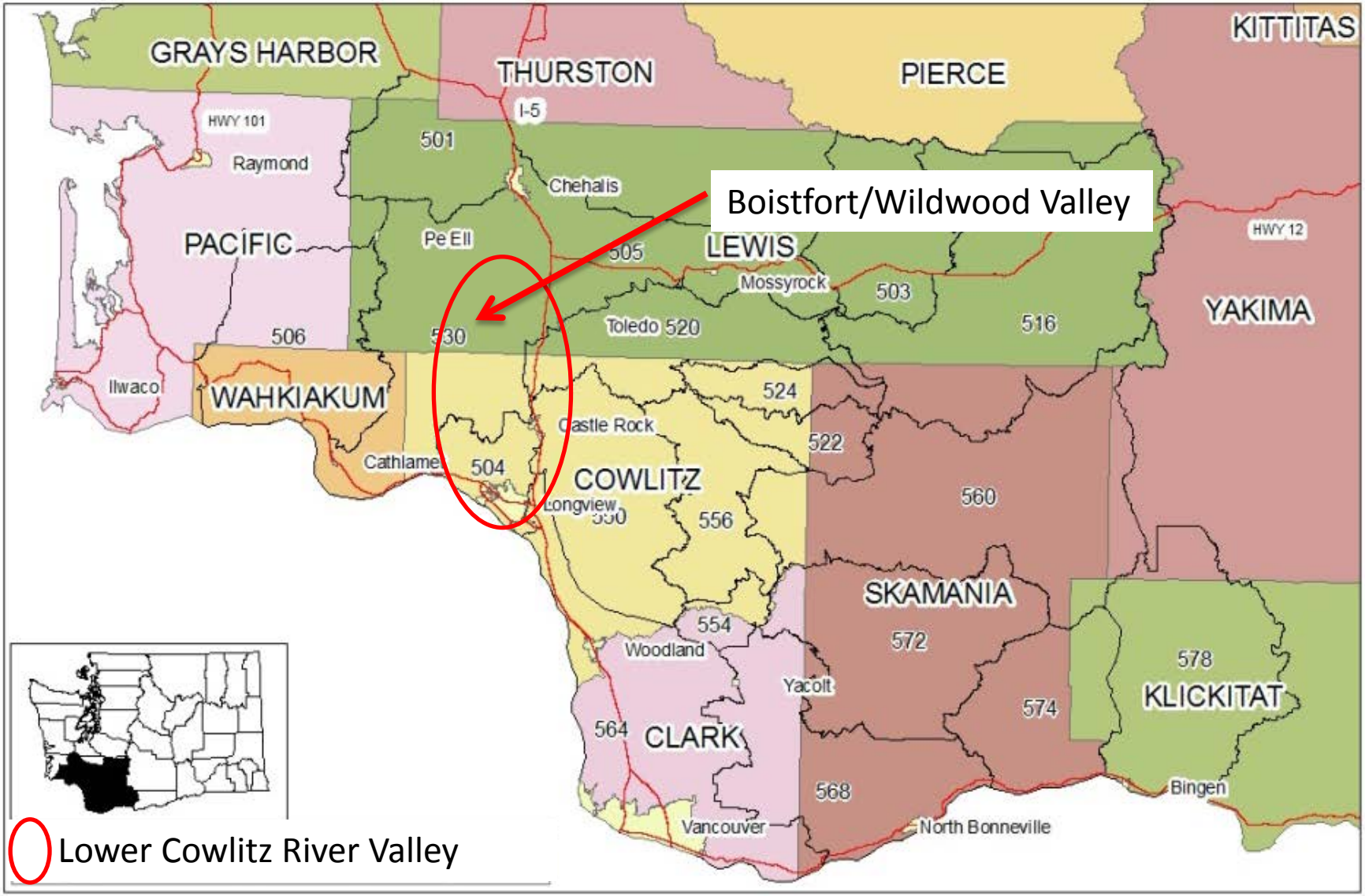
Willapa Hills and MSH Elk Herds



First Reports of Limping Elk

- Mid-1990s
  - Lower Cowlitz River Valley
  - Most reports were from the agricultural areas of the Boistfort/Wildwood Valley
  - Hunters reported harvesting elk with “rotten” hooves that were limping
  - Enforcement was called to dispatch sick and limping elk in the Boistfort/Wildwood Valley
- Reports increased throughout the 2000s

Initial Reports



Boistfort/Wildwood Valley

- Agriculture
  - Dairy cattle, pasture, some crops (corn for silage, etc.)
  - Nutritious forage for elk as well!
- Commercial Forest
  - Surrounds the valley
  - Intensive forest management (clearcutting, herbicide, and fertilizer application)
  - Provides cover and some forage
- Combination of these habitats creates the potential for high recruitment and survival of elk

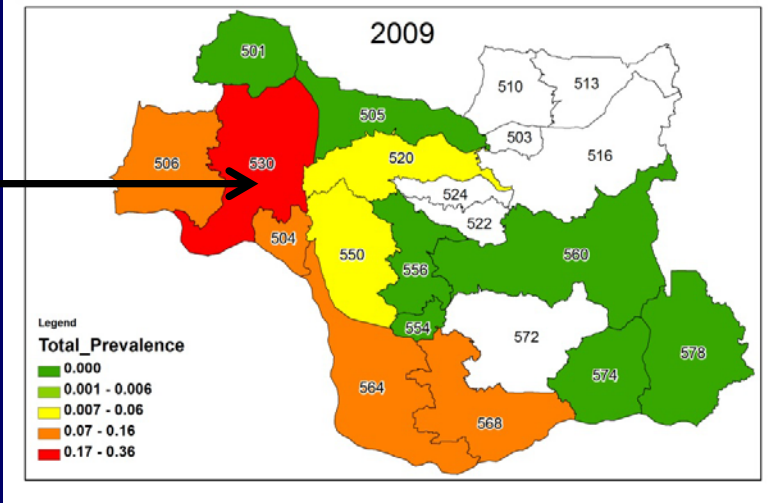
Boistfort/Wildwood Valley

- Elk numbers
  - High elk use in the valley since 1960s. First elk crop damage complaints.
  - Anecdotal valley population estimate of 200-500 elk (highest use in winter/early spring)
- Elk management
  - In 1968 the valley was designated an elk damage zone by WDFW commission
  - Reduce population by hunter harvest of antlerless elk in order to alleviate elk damage to agriculture
  - Hunting season goes from September-January and most antlerless harvest is by special permit drawing

2008-2010

- Reports increase significantly
- Agency formalizes its investigation
  - First elk collection in 2009
  - Questionnaire of hunters in the area who had observed limping elk

Boistfort/Wildwood Valley

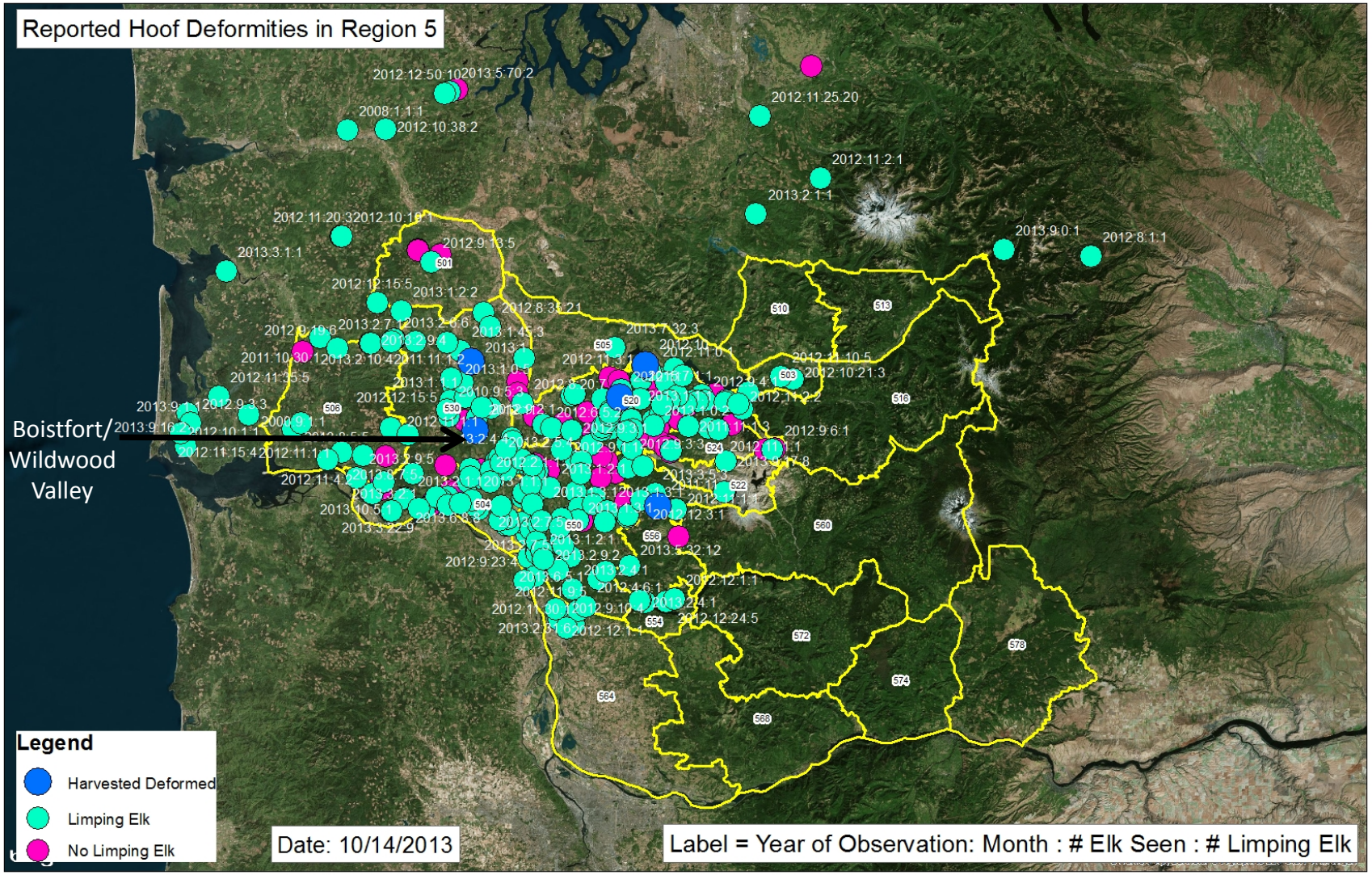


2012-2013

- Public meeting in Longview (September 12, 2012)
- WDFW Elk Hoof Disease webpage
- Online hoof disease reporting tool on WDFW website

Online Hoof Disease Reporting Form

Helps WDFW better understand the distribution and observations of hoof disease by reporting observations

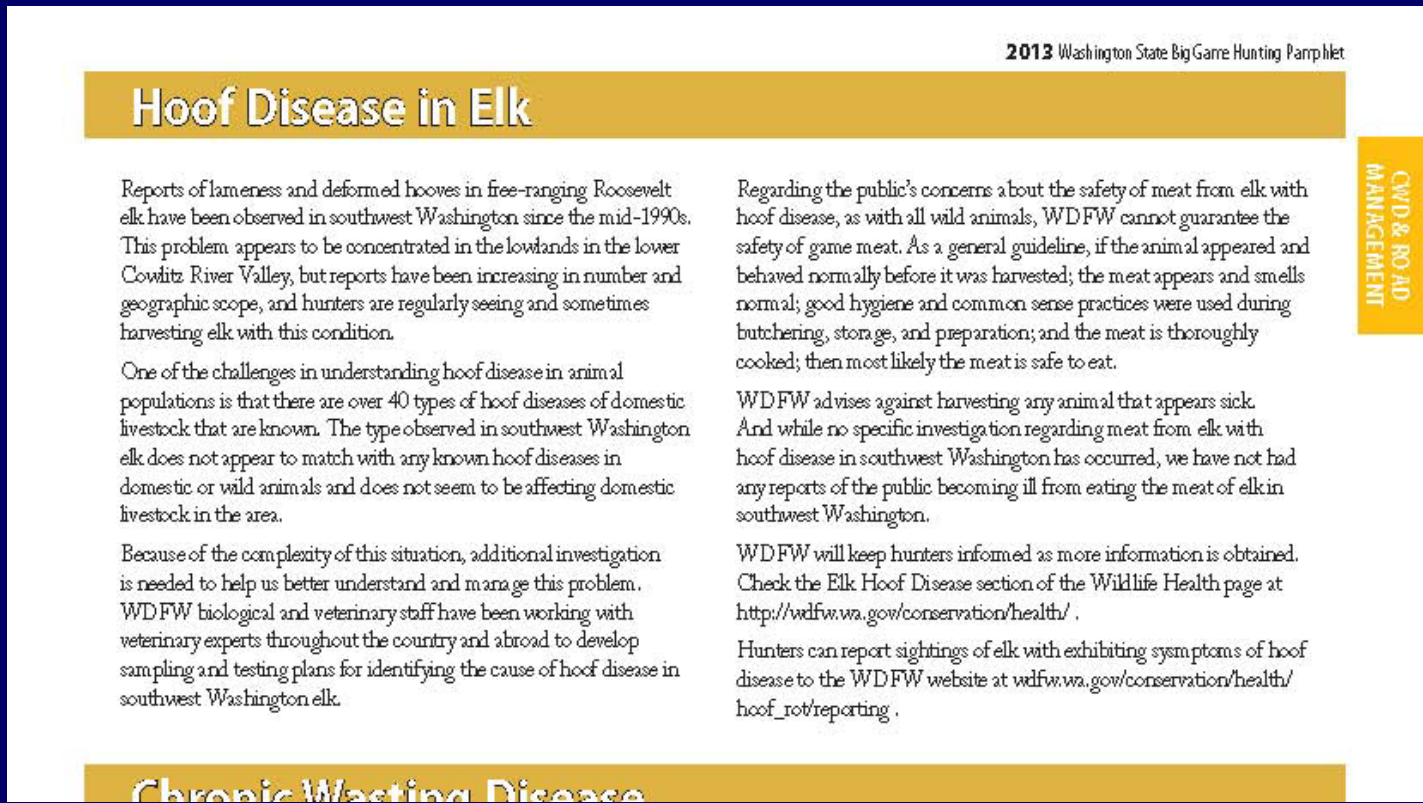


2012-2013

- 2013 - Two elk calf collections (March and August) took place with guidance from collaborative veterinary expertise
- Hoof Disease Technical Team (WDFW, WSU, DOH, ODFW, USDA)
- Hoof Disease Public Working Group

2012-2013

- Hoof Disease Health/Safety Fact Sheet in partnership with Department of Health
- Information in 2013-2014 hunting pamphlet



Hoof Disease in Elk

Reports of lameness and deformed hooves in free-ranging Roosevelt elk have been observed in southwest Washington since the mid-1990s. This problem appears to be concentrated in the lowlands in the lower Cowlitz River Valley, but reports have been increasing in number and geographic scope, and hunters are regularly seeing and sometimes harvesting elk with this condition.

One of the challenges in understanding hoof disease in animal populations is that there are over 40 types of hoof diseases of domestic livestock that are known. The type observed in southwest Washington elk does not appear to match with any known hoof diseases in domestic or wild animals and does not seem to be affecting domestic livestock in the area.

Because of the complexity of this situation, additional investigation is needed to help us better understand and manage this problem. WDFW biological and veterinary staff have been working with veterinary experts throughout the country and abroad to develop sampling and testing plans for identifying the cause of hoof disease in southwest Washington elk.

Regarding the public's concerns about the safety of meat from elk with hoof disease, as with all wild animals, WDFW cannot guarantee the safety of game meat. As a general guideline, if the animal appeared and behaved normally before it was harvested; the meat appears and smells normal; good hygiene and common sense practices were used during butchering, storage, and preparation; and the meat is thoroughly cooked; then most likely the meat is safe to eat.

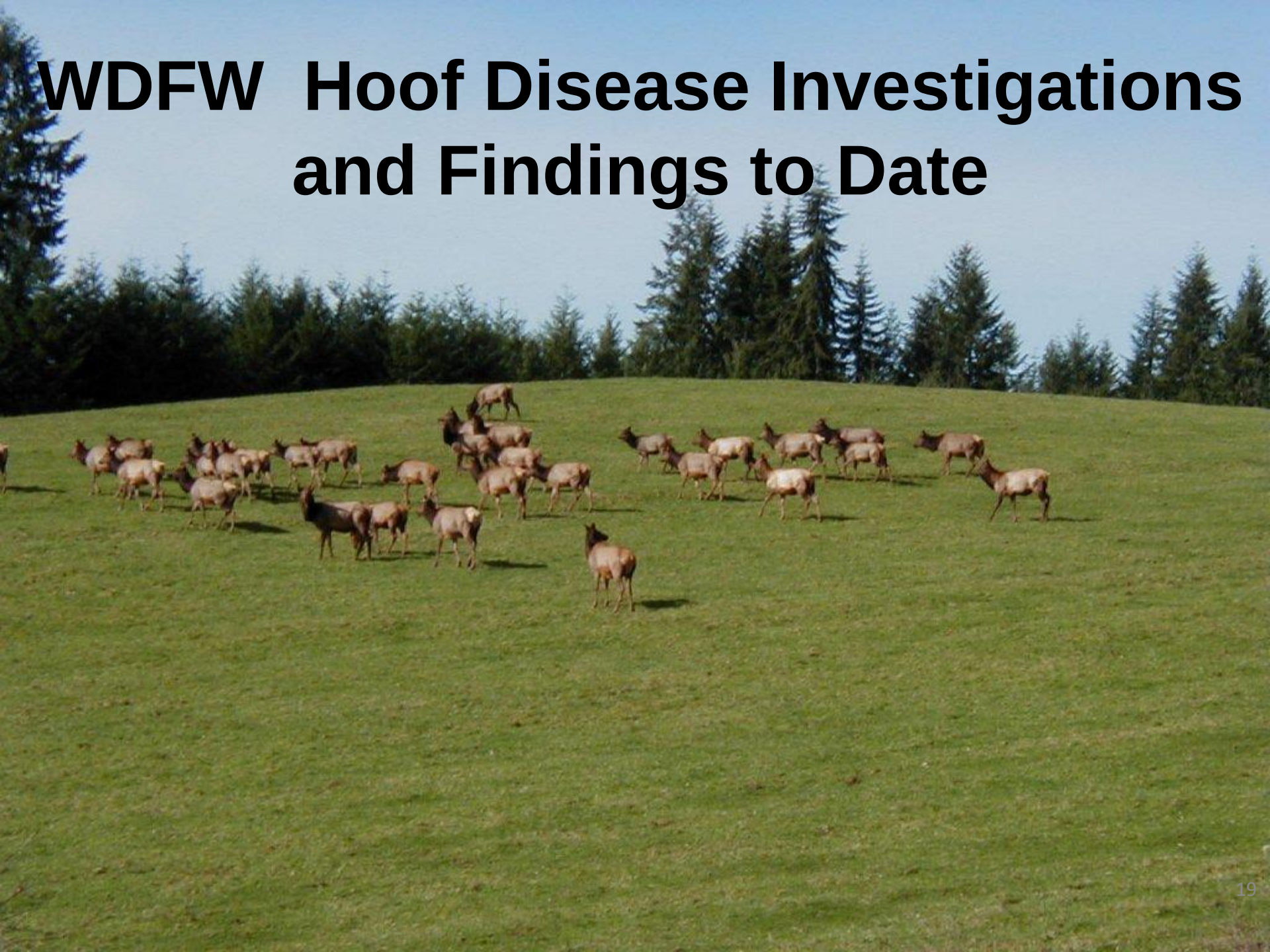
WDFW advises against harvesting any animal that appears sick. And while no specific investigation regarding meat from elk with hoof disease in southwest Washington has occurred, we have not had any reports of the public becoming ill from eating the meat of elk in southwest Washington.

WDFW will keep hunters informed as more information is obtained. Check the Elk Hoof Disease section of the Wildlife Health page at http://wdfw.wa.gov/conservation/health/ .

Hunters can report sightings of elk with exhibiting symptoms of hoof disease to the WDFW website at wdfw.wa.gov/conservation/health/hoof_rot/reporting .

Chronic Wasting Disease

WDFW Hoof Disease Investigations and Findings to Date



Wild Ungulate Hoof Diseases

- Usually sporadic and many different causes
- Below are photos from an elk, a moose, and a mule deer, each with a different hoof disease, all collected during Fall 2012 in Eastern WA



SW Washington Elk Hoof Disease

- Males and females equally affected
- All ages
- Any hoof
- No reports of increase in domestic livestock hoof diseases in the area

Examples of Deformed Hooves

Novel Hoof Disease in Elk?

Spillover from Domestic Animals?

- Foot Rot of Domestic Sheep
- Digital Dermatitis of Dairy Cattle
- CODD of Domestic Sheep

Diagnostic Investigation Partners

Assistance of Veterinary Personnel From:

- WDFW
- Washington State University
- University of Washington
- ODFW
- Oregon State University
- University of Wisconsin
- Tufts University
- WSDA

Samples Sent to Veterinary Diagnostic or Research Labs At:

- Washington State University
- University of Idaho
- Colorado State University
- University of Wyoming
- University of Liverpool (U.K.)
- USDA National Veterinary Services Laboratory
- USDA National Animal Disease Center

Collections

- **2009** : **Adult elk with chronic lesions**
  - 3 unaffected elk -- East of I-5
  - 5 affected elk -- Cowlitz River Basin

- **2013**: **9-10 month elk with acute lesions**
  - 3 unaffected elk -- Pacific County
  - 4 unaffected elk -- Yakima / Kittitas County
  - 9 affected elk -- Lewis / Cowlitz County

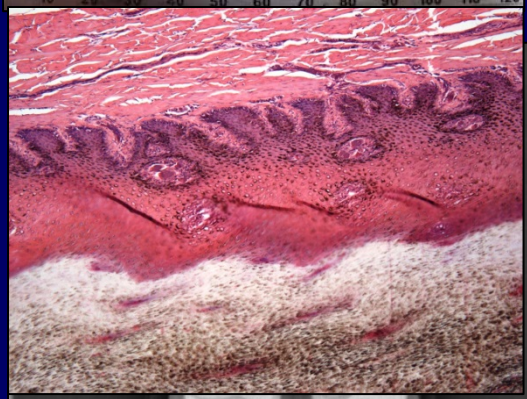
- **2013**: **3-4 month calf elk with acute lesions**
  - 2 unaffected elk -- Grays Harbor County
  - 5 affected elk -- Lewis County

2009 Diagnostic Investigation

- Gross necropsy
- Radiology
- Histology
- Parasitology
- Virus isolation
- Trace minerals
- Routine bacteriology

2009 Diagnostic Results

- Primary hoof disease with no other tissue involvement
  - Deformed / overgrown claws, Broken / sloughed claws, Sole ulcers, Variable soft tissue lesions, Chronic–active laminitis
- Chronic, non-specific changes in the hooves
- Non-specific bacterial overgrowth
- Copper and selenium deficient

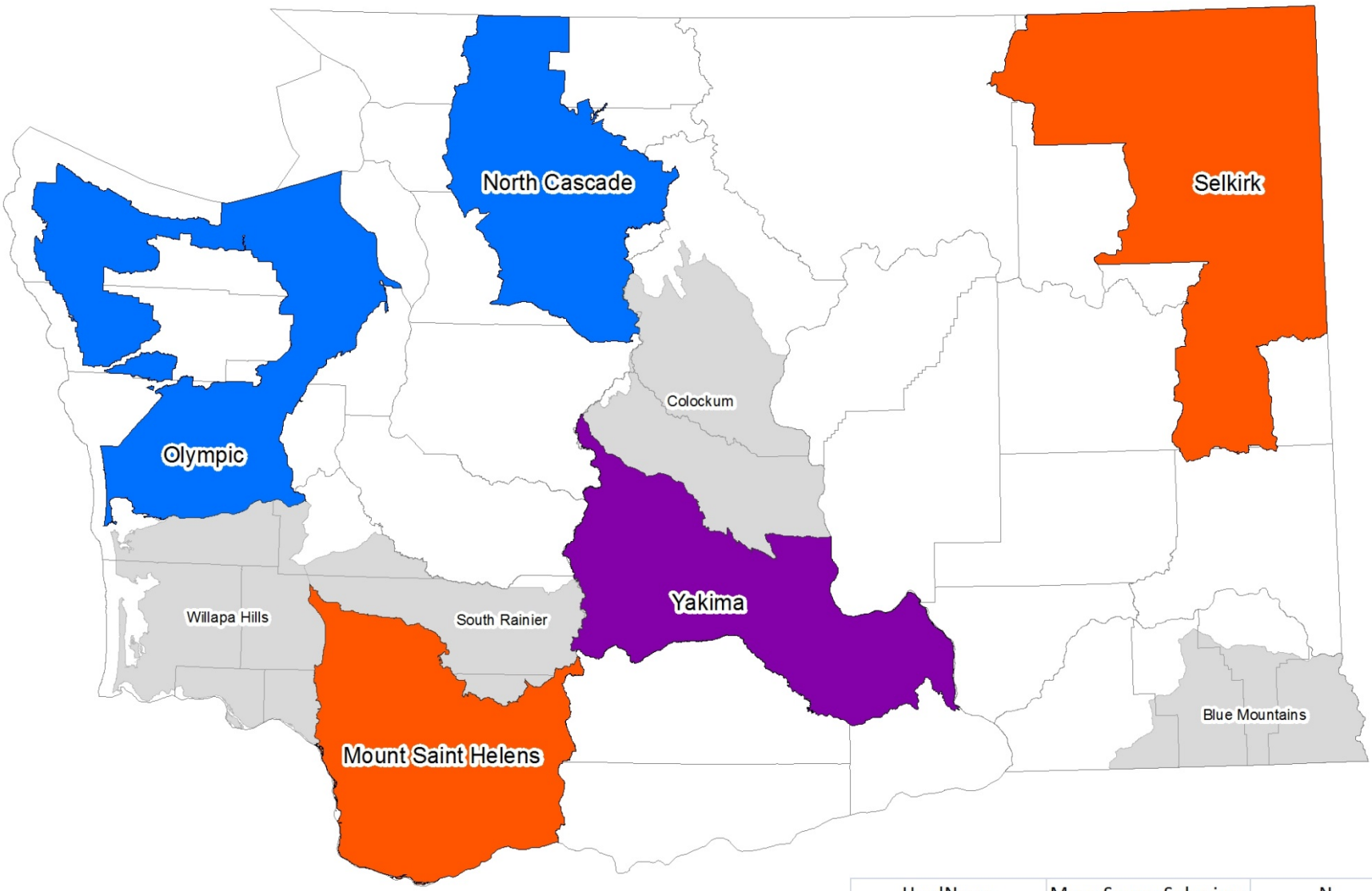


2009 Collection: Gross Hoof Lesions

Han, S. , K. Mansfield (*J Wildl Dis* 2014)

2009 Diagnostic Conclusions

- Non-specific chronic changes of hooves indicate:
  - need to sample animals earlier in the disease
- Non-specific bacterial growth indicates:
  - need for specialized microbiology techniques
- Follow-up analysis needed to assess the significance of low Copper and Selenium levels (completed in 2012)



HerdName	Mean Serum Selenium	N
Selkirk	0.0319	34
Mount Saint Helens	0.0337	82
Yakima	0.0486	3
Olympic	0.0537	27
North Cascade	0.0557	10

Winter 2013 Effort

Winter 2013 Effort

- Collection of younger animals (9-10 months old)
  - Presumably in the earlier stages of the disease, which improves the chances of identifying the original cause
  - Three different study sites
- Specialized Microbiology
  - University of Liverpool
  - USDA National Animal Disease Center

Sampling and Testing of Hooves

Routine bacteriology at Washington State University (WSU)

- ✓ Completed, one isolation of bacteria (*Fusobacterium necrophorum)* otherwise NSF

Specialized bacteriology at University of Liverpool

- ➢ Ongoing

Radiology at Colorado State University (CSU)

- ✓ Completed, no significant primary lesions

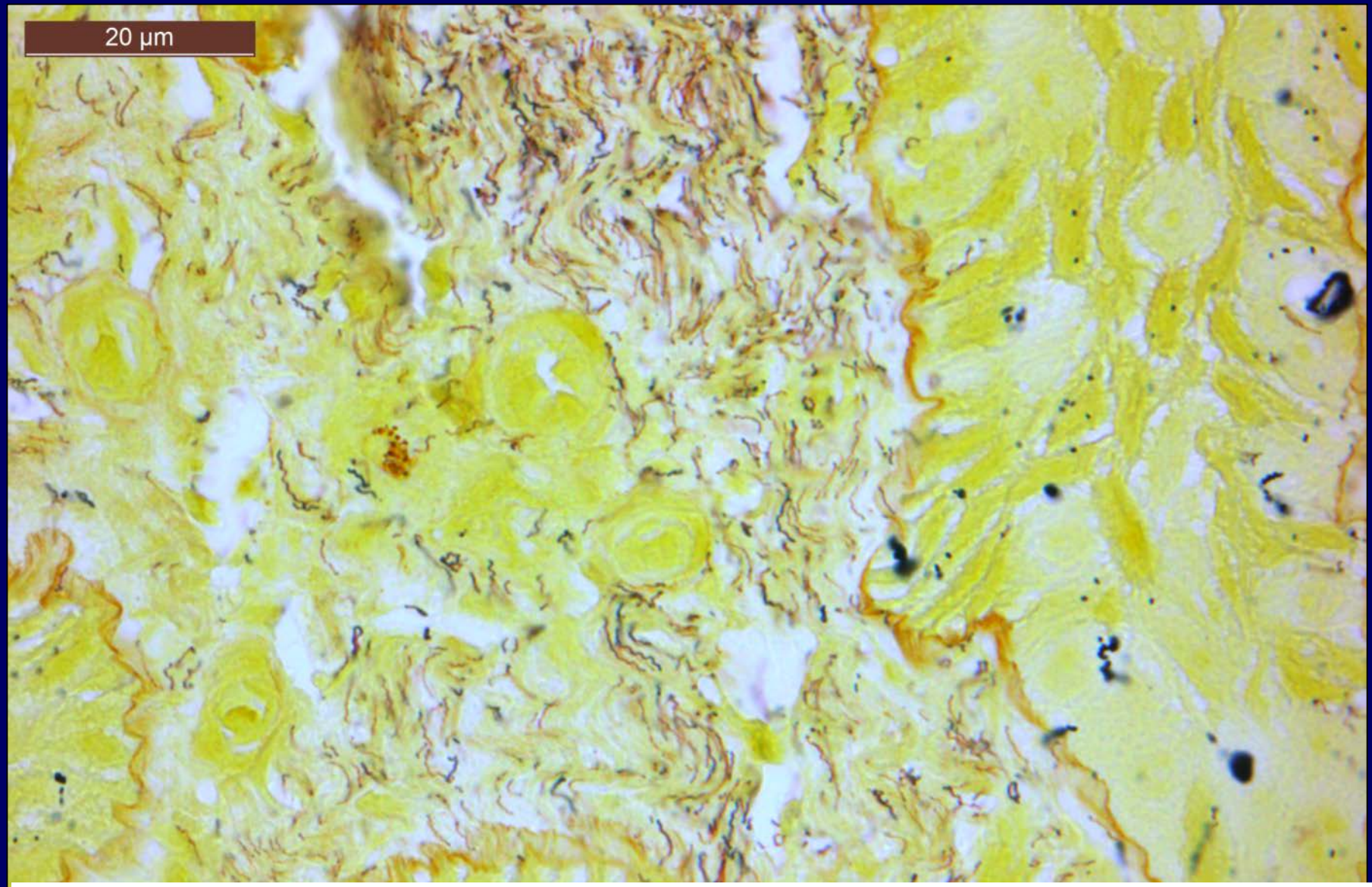
Virology at University of Wyoming

- ✓ Completed, an adenovirus isolated from one eastside control, otherwise NSF

Sampling and Testing of Hooves

Histology (microscopic examination) at CSU

- ✓ Completed
  - Spirochetes are the cause of disease in cattle and CODD in sheep (recent disease in US)
  - Spirochetes found deeply invasive in elk tissue



Spiral bacteria associated within deep hoof lesions – Steiner's stain
Detected in all juvenile elk with hoof lesions (4 of 9 elk)
Not detected in intact and normal hooves (5 of 9 elk)

Sampling and Testing of Hooves

Histology (microscopic examination) at CSU

- ✓ Completed
  - Spirochetes are the cause of disease in cattle and CODD in sheep (recent disease in US)
  - Spirochetes found deeply invasive in elk tissue
  - Are they the cause of the disease or secondary invaders to an already diseased hoof?
  - Need further analyses to understand if primary or secondary
  - Most likely playing a role as an infectious agent

Multiple hoof biopsies collected and stored at WDFW Wildlife Health Laboratory

- Possible future studies

Additional Sampling and Testing

Histology of Organs and Tissues, including Muscle, at WSU

- ✓ Completed, no evidence of significant inflammation or infection above hooves, even in severely affected individuals
  - Disease limited to hooves: Other tissues, including meat, are not affected

Trace Minerals at University of Idaho

- ✓ Completed, low selenium and copper, as expected - possible impacts on general health and immunity

Parasitology at WSU

- ✓ Completed, similar parasite loads in all 3 groups

Serology (infectious agent exposure) at WSU and USDA National Veterinary Services Laboratory (BVD, EHD, BT, MCF, VSV)

- ✓ Completed, no significant antibody exposure
  - ➢ Hoof pathogen serology ongoing at USDA NAD

Multiple tissues and other samples collected and stored at WDFW Lab

- ❖ Possible future studies

Winter 2013 Diagnostic Results Summary

Findings very similar to 2009

- Chronic hoof changes even in 9 month old calves
- Confirmed that disease limited to hooves;
    - Other tissues, including meat, are not affected

Specialized microbiology ongoing

Specialized Microbiology

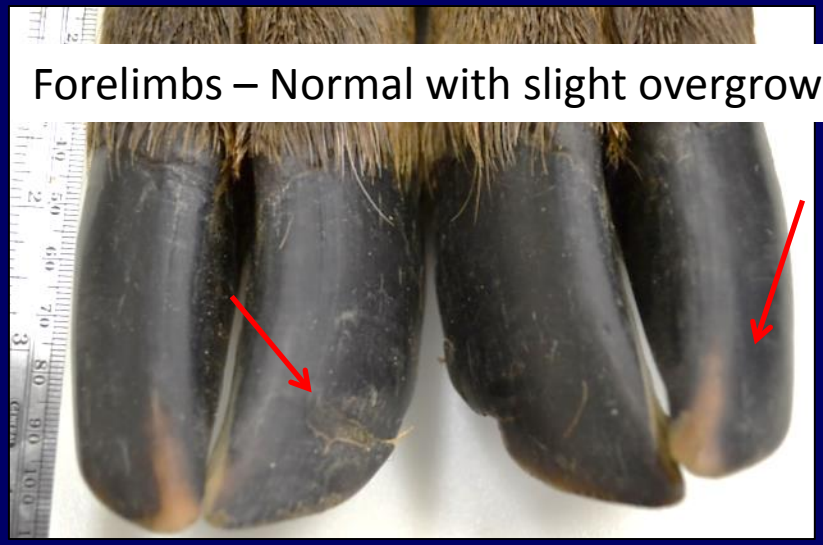
Current diagnostic efforts are focused on specialized bacteriology testing to rule out known infectious hoof disease organisms

Including bacterium in:

- *Treponema* sp. – to date Spirochete detection associated with this species but not conclusive
- *Dichelobacter nodosus*
- *Fusobacterium necrophorum*
- *Gugenheimia bovis*

Examples of HD in 9-10 month old elk

Lewis County EL-13-011



Summer 2013 Effort

- Collection of even younger animals (3-4 months old)
- Hoof biopsies for bacteriology
  - University of Liverpool
  - USDA/ARS/NADC
  - Bank at WDFW lab
- Hooves
  - CSU for histology & special stains

Summer 2013 Effort

- Lung, liver, kidney, spleen, peripheral LN
  - Histology at WSU
- Serum
  - USDA/ARS/NADC for serology
  - Bank at WDFW lab
- Liver and Kidney
  - Bank at WDFW lab

Summer 2013

Coronary and sub-coronary hoof wall defect, superficial

Summer 2013 Results Summary

- Organ histology completed
  - Disease limited to hooves; Other tissues, including meat, are not affected
- All other diagnostics are still ongoing
  - i.e., Determine primary or secondary causes
- Specialized microbiology ongoing **(University of Liverpool and USDA)**
  - Isolation attempts from August collections
  - Sequencing of any isolates for known hoof disease pathogens

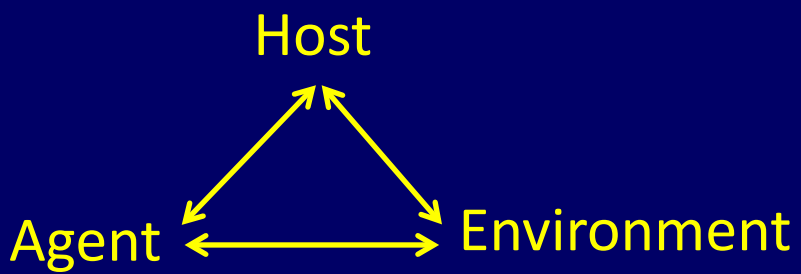
Introduction of Management Discussion

Disease Management

- Complex situation with multiple factors to be considered and that influence
- 3 basic forms of management exist:
  - Prevention of introduction of disease,
  - Control of existing disease, or
  - Eradication
- Let disease run its course
- Management may be directed at the disease agent, host, or environment

Disease Management Strategies for Wildlife Wobeser 2002

Disease Causation



Agent

Strain
Dose
Route of exposure
Duration of exposure

Host

Species
Genotype
Age
Sex
Nutritional status
Reproductive status
Past exposure
Concurrent disease
Immunity
Food habits
Behavior

Environment

Climate
Weather
Altitude
Other species
Population density
Air and water quality
Soil
Human activity

Disease in Wild Animals Wobeser 2007

Disease Management

- Reactive disease strategies: applied when disease is already present, can be aimed directly at the agent or at reducing transmission
  - Treatment of individuals
  - Mass medication
  - Disinfection/sanitation
  - Habitat modification
  - Vector control

Disease Management

- Proactive disease strategies: intended to prevent introduction of a disease agent to new areas or new hosts
  - Protect/supplement existing natural barriers
  - Immunization

Disease Management

- Population density management for disease
  - Alteration of animal distribution
  - Selective removal of diseased animals from the population
  - General reduction in population density
  - Elimination of the total exposed population
    - Large scale mandatory well-organized efforts in Australia and New Zealand have failed to eradicate sheep foot rot

Disease Management Strategies for Wildlife Wobeser 2002

Disease Management

- To consider:
  - Biology of disease agent and species affected
  - Objective of management program
  - Advantages/disadvantages of potential techniques
  - Required and available resources
  - Monitoring program

How is Infectious Hoof Disease Managed in Domestic Animals?

- Maintain clean dry environment
- Quarantine new animals before introducing to the rest of the herd
- Trim feet 2X/year; disinfect instruments between animals
- Foot baths 2X/week
- Injectable and/or topical antibiotics
- Vaccination
  - Only in sheep and only certain strains
- Good nutrition (including trace minerals)
  - To improve general health, immunity, and hoof structure
- Cull individuals that are severely affected or fail to respond to treatment
  - Hoof disease is the 3rd most common reason for culling dairy cattle

Extremely challenging to consider these options in wild populations

Examples of Management Options

Examples of Management Options

Reduce elk density

- Reduce transmission and advancement
- Increase nutrient level of remaining animals
- Removal of elk:
  - Targeted removal and/or increase recreational permits
  - Remove animals in “newer areas”
  - Local/small areas; not landscape level

Questions/Concerns:

- How effective if pathogen (bacteria) is in soil
- Immunity in some animals/areas
- Access, public willingness

Examples of Management Options

Treatment

- Treat elk - increase elk immunity and nutritious status
  - Test on captive elk
- Treat soil

Questions/Concerns:

- Challenge of achieving treatment on a landscape level
  - Difficult to treat animals
  - Difficult to treat soil on landscape level
  - Bacteria can develop resistance
- Life cycle of bacteria
  - In different conditions (dry/wet, elevation, etc.)
  - Difference of hoof disease between wet and dry land
- Permanence/prevalence of bacteria in environment & elk
  - Different elevations have different prevalence rate
  - Soil composition/Density in soil

Examples of Management Options

Let disease run its course

Questions/Concerns:

- How to determine if effective
- Public concern
- Sustainable overall population health

Examples of Management Options

Containment areas

- Keep elk off/out of core area
- Fencing of affected areas
- Removal of animals

Questions/Concerns:

- Feasibility
- Private property
- Maintenance
- Wildlife corridors

Examples of Management Options

Before consideration, need to evaluate if any of these examples of management options are likely to be effective

- Affect on population
- Cost
- Feasibility
- Sustainability

Need to be thorough and thoughtful in how we proceed

Additional Information

- Nutrition
- University of Alberta study: effects of herbicides and herbivory on elk forage abundance
  - Herbicide/Herbivory interaction
- NCASI Research: Relations among habitat characteristics, plant succession, and nutrition of foraging elk during summer and autumn in temperate Pacific Northwest forests
- WDFW Black Tailed deer study: effects of forest management on BT deer ecology
- Timber practices have changed over the past 30 years
  - Open landscape, increased canopy cover, burning, clear cuts (private), reduced timber harvest (federal), etc.

Radio-collared Elk in the MSH herd

Collared	Condition	Fate
Feb-09	Moderate hoof disease	Hunter-kill fall 2009
Feb-09	Moderate hoof disease	Survived winter 09-10; dead by spring 2011
Feb-09	Scissor hooves	Survived until winter 12-13
Feb-09	Scissor hooves	Contact lost winter 11-12; alive until then
Feb-09	Scissor hooves	Still alive as of spring 2013
Feb-09	Scissor hooves	Hunter-kill fall 2009
Feb-09	Scissor hoof	Hunter-kill fall 2009
Feb-09	Clubbed hoof	Hunter-kill fall 2009
Feb-09	Scissor hoof	Hunter-kill fall 2010
Feb-11	Moderate hoof disease	Alive at GPS collar drop May 2012
Feb-11	Moderate hoof disease	Alive at GPS collar drop May 2012
Feb-11	Moderate hoof disease	Alive at GPS collar drop May 2012
Feb-12	Severe hoof disease	Still alive as of spring 2013
Feb-12	Moderate hoof disease	Still alive as of spring 2013
Feb-12	Moderate hoof disease	Still alive as of spring 2013
Feb-12	Severe hoof disease	Survived winter; missing by spring 2013

Management Questions

Management Questions

- What is the prevalence of hoof disease in elk?
  - Observable, subclinical
- Is there a genetic link:
  - Propensity?
  - Resistance?
- How often do elk die with hoof disease?
- What is the affect of hoof disease on productivity?
  - Does hoof disease reduce breeding or likelihood to carry a calf to term?
- What is the affect of hoof disease on population?
  - Monitor population growth/decline, survival
- How will/can diagnosis help to be preventative in the future?

Management Questions

- Technical Team reviewed results to date:
  - Appears consistent with an infectious pathogen
    - Questions:
      - Is it environmental, parasitic, etc.?
        - Oregon has similar habitat and forest practices, but does not appear to be present in elk
      - Genetic factor?
      - Once HD in herd – stays – how to respond?
      - Are the elk & pathogen obligate to each other?
        - Deer do not seem to exhibit, use same area
        - Elk are robust and generalists/long-lived & social
      - Additional collections to further understand?

Next Steps

- Specialized microbiology analyses results ongoing
- Explore management/research options with Technical and Public working groups

- WDFW - work through Technical Advisory Group and Public Working Group input
- Sequence additional meeting schedule for Working Group

HD Public Working Group

- Explore management/research options with public working group
  - Prioritize management questions/options to be addressed
  - Resources

HD Public Working Group

- Reduce Elk density
  - Concern about shooting healthy elk (left with diseased animals e.g., Wakh Co)
  - Alter hunting season structure – to allow for resting period
  - Cull diseased animals – as soon as reported, destroy
    - Work with landowners
    - Can do this despite if know the cause of HD
    - May help with understanding genetics?
    - Premature to cull until know cause
    - Consider alternatives such as treatment on “terminally ill” elk
    - Balance of letting survive or culling

HD Public Working Group

- Reality – HD is in SW WA and will likely stay in herds – can't eliminate – but can control
- Prolonged sustained effort that needs to be feasible
- Find cause and effect - manage - be limited in the herd should be long term goal
- Containing the disease should be first priority if we can before it spreads more to other areas of NW
  - While still figuring out the cause – not wait to know the cause
- Find out the prevalence
- Test on captive elk
  - E.g., pregnant female and watch

HD Public Working Group

- Define perimeter to contain HD
  - Develop criteria and policy to implement
  - Can that be established
  - Sustain hunting removal
  - Elk that slip by?
  - How to achieve?
  - Public acceptance of a “no elk zone”
  - Urgency depends on the cause
    - Infectious and non-infectious have very different management approaches
    - Need to find early lesions…..finish this investigation to get there
    - Between 3-9 months of age – evaluate
    - Prevalence and range – Q if still expanding? (as we look harder we will find more)
      - If not changing – might not have the urgency
  - Mgmnt Interventions might interfere with understanding prevalence and range
  - Difficult to reproduce DD in cattle
  - Captive scenario might be difficult to reproduce as well

HD Public Working Group

- Affect of Selenium and Copper on foot/hoof growth/health
  - Immunity and keratin
- Mineral blocks?
  - Let people try and watch
- Elk on Eco park – study?
- Dual strategy
  - Mgmnt
  - Analyses
- Legislative – funding request
  - Develop as we move forward
  - W Governor Assoc
- Watch Pacific County – not seeing HD right now
- What can be done at the same time while waiting?
  - Other/additional testing
- Is HD natural, normal baseline occurrence?
- Link to something that came into situation/environment that is contagious?
  - E.g., fungal?
- “Disaster Recovery Plan” on how to proceed
- Ask public for cooperation in Counties that don't see HD to report elk with deformities
- Sample 3-9 month old calves
- Include DNR

HD Public Working Group

HD Public Working Group


Thank you
….any questions….