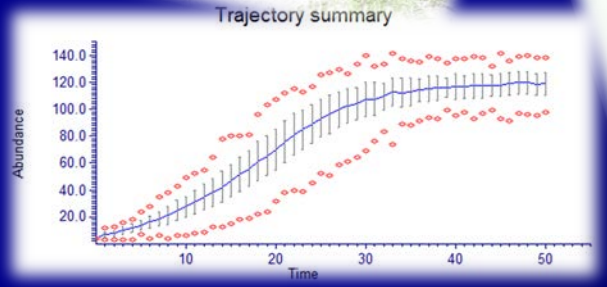
A spatially explicit meta-population model to predict recolonization and recovery of wolves in Washington



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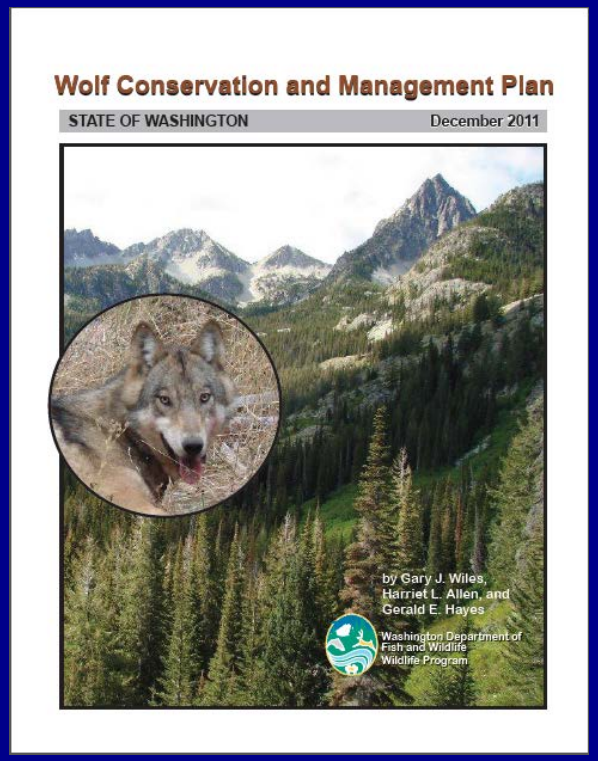
Wolf Conservation and Management Plan 2011



- Reviewed Wolf Ecology
- Set guidelines for recovery
- Identify potential habitat
- Understanding of social tolerance
- Protocol for conflict with livestock

The tough questions…

Where will they end up?

How long will it take?

What if livestock are threatened…will removals jeopardize recovery?

How many wolves will there be?

How many should there be to ensure a sustainable population into the foreseeable future?

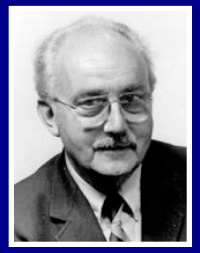
…Where do you start?

Is 15 Breeding Pairs a Scientifically Credible Delisting Goal?

- Peer Review / Public Comments
- Too low
- Conduct Population Viability Analysis

Wolf Population Persistence Model

"Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful."



George E.P. Box, 1919-2013
Professor of Statistics,
University of Wisconsin

Modeling Approach

- Use most relevant (ID, MT) empirical data to estimate population model parameters:

  Precautionary principle: higher mortality, larger territories, lower reproduction

- Use Oakleaf habitat model applied in WA:

  Forest Cover, Human density, elk density, sheep density

- Use RAMAS, PVA software, Metapopulation Module, Hypothetical Pack Territories Defined Population Units

- Parameterized RAMAS model, tested against Idaho and Montana observed wolf population growth rates (Appendix G)

Model Framework

Model assumptions

- Habitat Selection (NW MT, ID)
- Dispersal ability (NW MT, ID)
- Territory size (ID)
- Spatial Organization (NW MT, ID)
- Pack size (NW MT, ID)
- Survival rates, Fecundity rates (NW MT)

Ecologically based, versatile and easily adapted as data from Washington wolves is collected

Habitat

Research Article

Habitat Selection by Recolonizing Wolves in the Northern Rocky Mountains of the United States

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Model Parameters:	Wolf Response
Percent Forest Cover	Positive
Elk Density	Positive
Human Density	Negative
Domestic Sheep Density	Negative

ranging wolves was documented in northwestern Montana in 1986 (Ream et al. 1989), and soon thereafter a small population was established in the area (Ream et al. 1991).

Lethal control of wolves that killed livestock, as well as dispersal of animals to Canada, quelled the growth rate of the establishing population in Montana (Bangs et al. 1998). However, 66 wolves were released to Yellowstone National Park and central Idaho during 1995–96, and populations in those areas have increased rapidly (Fritts et al. 1997, Bangs et al. 1998, Fritts et al. 2001). The recovery objective, establishing a minimum of 30 breeding pairs of wolves evenly distributed among the 3 recovery areas (central Id., the Greater Yellowstone Area, and northwestern

soon will be subject to changes in protection status, little effort has been made to determine the amount of available wolf habitat, potential wolf population limits, or the availability of wolf dispersal corridors in the northern Rocky Mountains of the United States.

Previous investigations of wolf habitat selection in the northern Rocky Mountains could lead to a liberal assessment of wolf habitat availability because of the inclusion of location data obtained during exploratory wolf movements (e.g., Brehme 1997, Kelley 2000). Other efforts have described wolf home ranges in the western United States through georeferencing (a process that uses known locations [e.g., cities] in a paper map to reference the location of wolf home ranges in that map) based on either published (Kelley 2000) or gray literature (Houts 2000). Yet, this approach has limited resolution for assessing wolf habitat requirements due to potential spatial biases (e.g., the type of home range analysis performed, the number of locations used to generate the home range, or clear understanding of the purpose of

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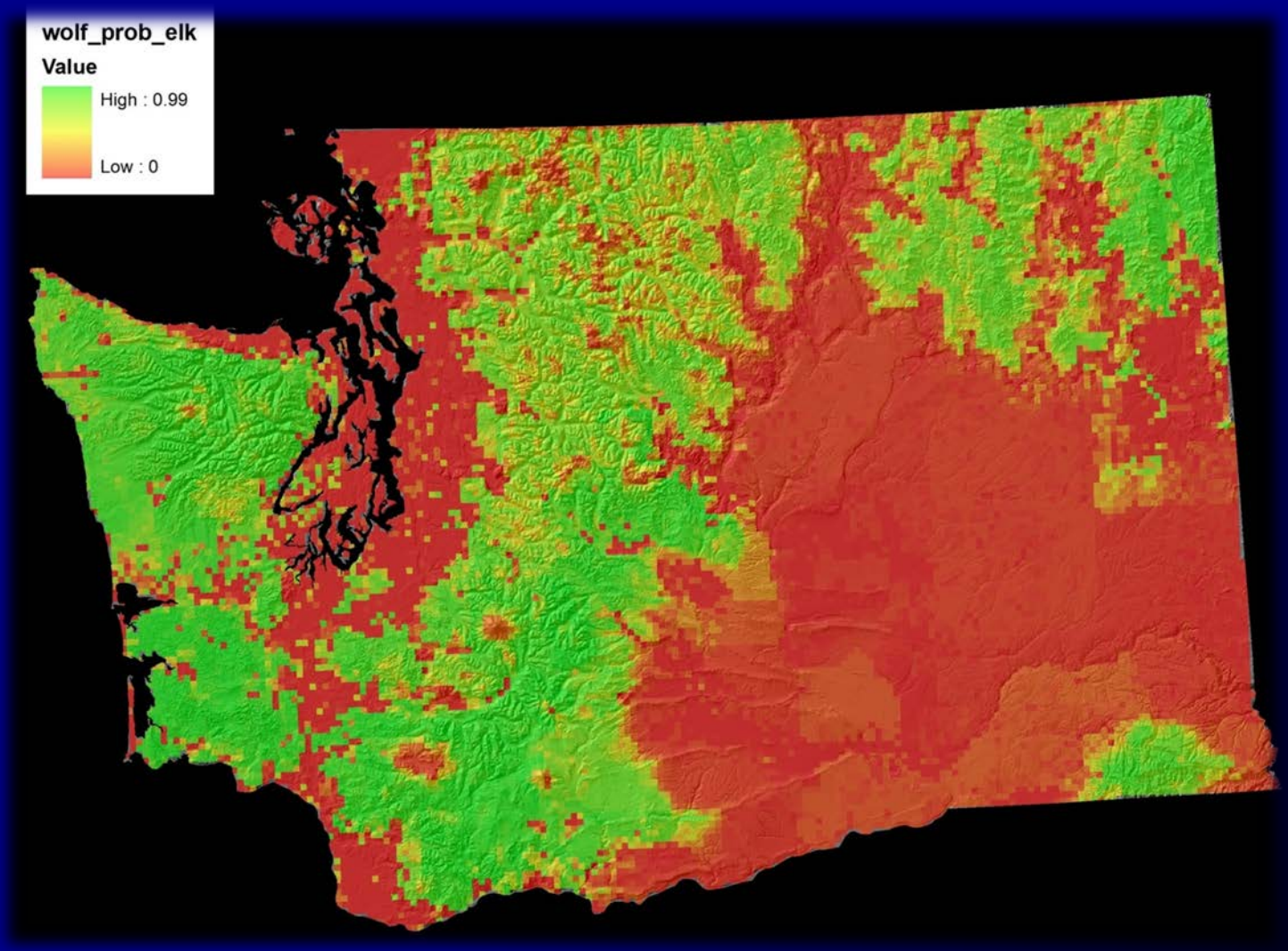
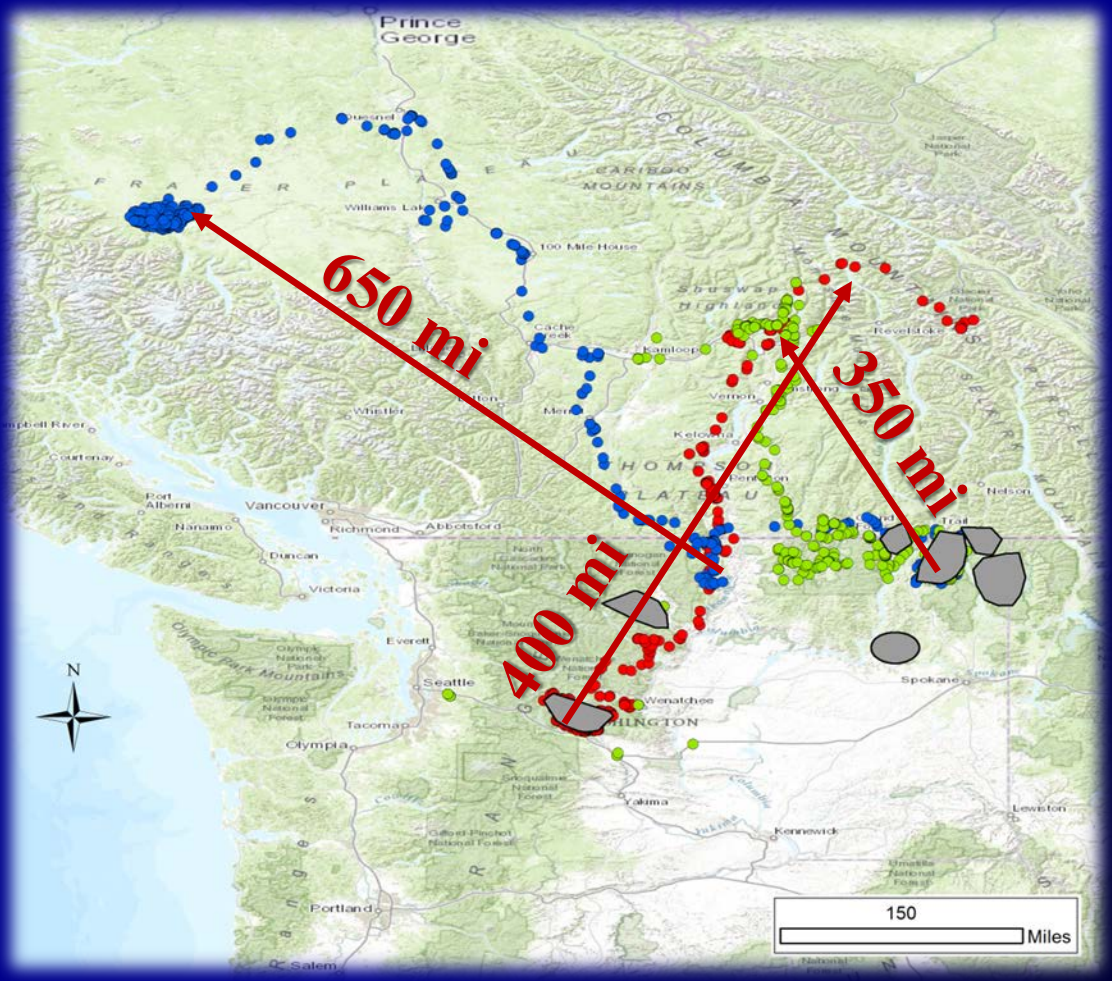
Oakleaf et al. 2006

Habitat (Where might they end up?)

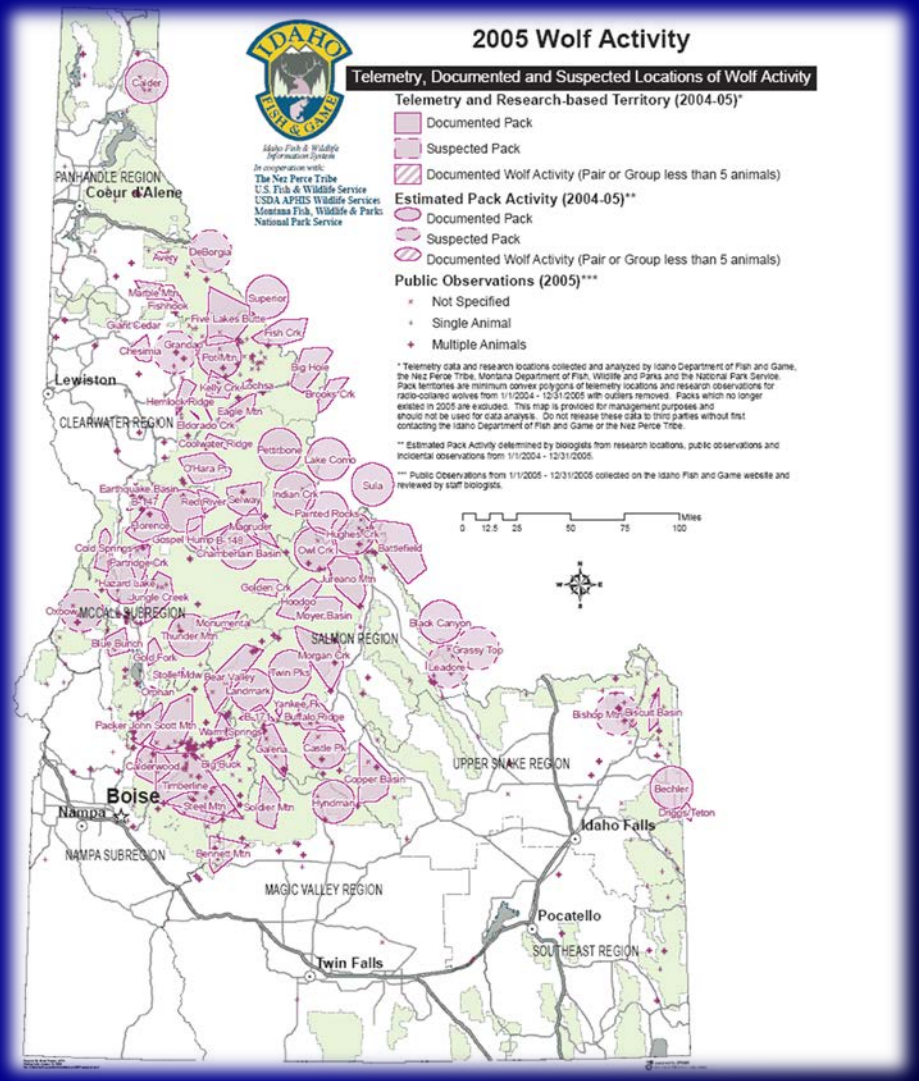
Probability of recolonization for Wolves in Washington



Dispersal Ability



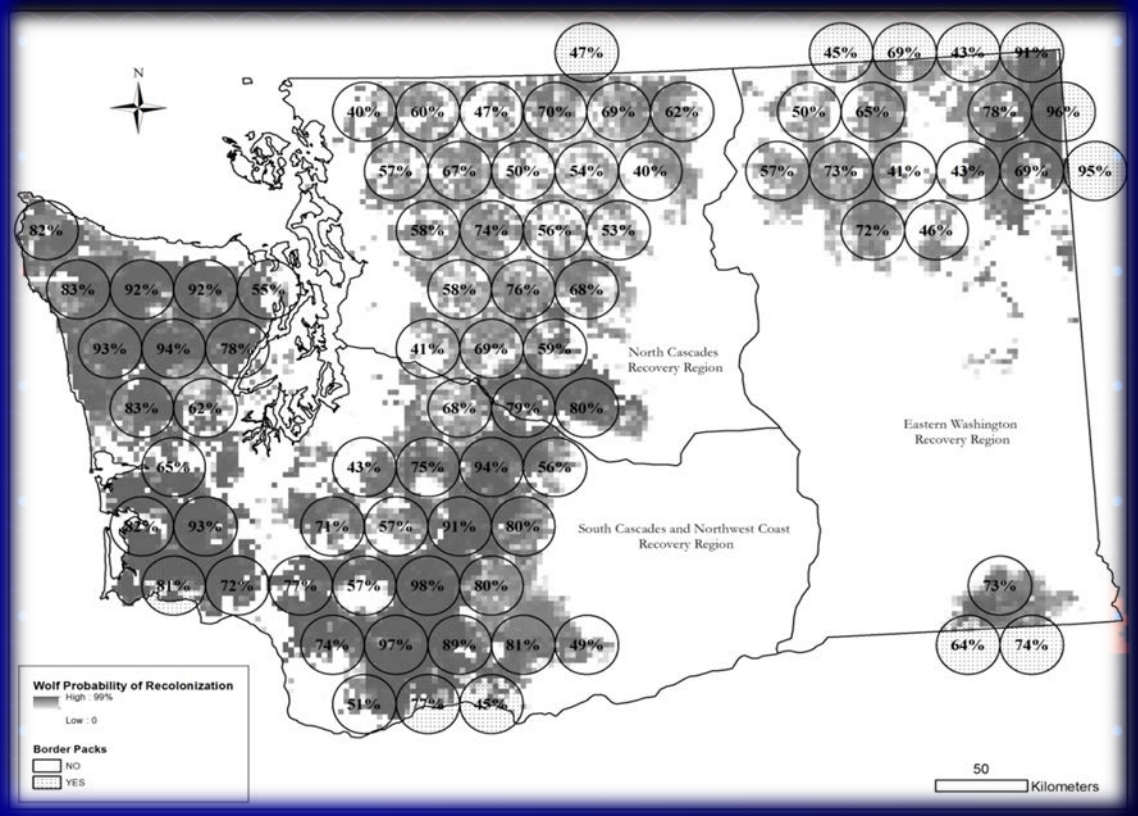
Spatial Organization



Territoriality (defending space against other packs)

Spatial Organization

- 933 km^2 (360 mi^2) in central ID (USFWS 1999, WDFW 2011)
- Spatially referenced to calculated dispersal distances between packs
- Simulated Packs with > 40 % Probability of Recolonization



Wolf Vital Rates Used in Persistence Models, Appendices G,H

Population Parameter	Estimated Rate	Source
Adult Survival	0.72	Smith et al. 2010
Pup Survival	0.81	adj. Smith et al. 2010
Litter Size	4 pups	Idaho Progress reports 2006-2010
Pack size	8 adults, subadults, Juveniles	Boyd and Fletcher 1999, USFWS 1999, Mitchell et al. 2008

~ Mortality factors during recolonization included.

~ Model growth rates were similar to actual observed in NW MT

Model Scenarios

1. With and without Immigration
2. With and without post-delisting removals (30% every 4 years)
3. Implement additional removals in Eastern WA Recovery Zone before statewide recovery goals met

Model Scenario Evaluation Criteria

1. Population Extinction Risk low
2. Occupied Territories Goals Met
3. Probability of falling below delisting threshold low

Mangement Scenarios

1. Statewide population Goals met – delisting management activities impacts on maintaining statewide delisting goals
2. Eastern WA Recovery Zone Goals met – delisting management activities impacts on maintaining statewide delisting goals
3. Eastern WA Recovery Zone Goals met – delisting management activities impacts on maintaining recovery zone delisting goals; with and without immigration

Model Results

Scenario	Results
Statewide - with and without immigration, allow population to fill suitable habitat	Little to no likelihood of population ending below delisting goal 50 years ; ~56-58 occupied territories.
Statewide - Limit population to 15 breeding pairs, with and without immigration	High probability (0.93-1.0) of population ending below recovery goals at end 50 year period
Statewide - Eastside Recovery Zone recovered, statewide below recovery, with and without immigration , with additional removal	Additional removals (at level modeled) did not have significant effect on probability of falling below statewide delisting goals
Recovery Zone Goal- Eastside Recovery Zone recovered, statewide below recovery, with and without immigration , with additional removal	Additional removals (at level modeled) did not have significant effect on probability of falling below recovery zone delisting goals assuming immigration, quasi-extinction probability increased significantly if no immigration is assumed.

Quasi Extinction = probability falling below delisting goal

Is 15 Breeding Pairs a Scientifically Credible Delisting Goal?

Yes - Under Assumptions of Model

1. Populations respond similarly to ID and MT
2. Habitat suitability is adequate
3. 15 is not a Cap, and population is allowed to fill unoccupied habitat
4. Actual lethal removals are similar to simulated levels

Where do we go from here?

<u>Future Metrics once data from Washington is available</u>

- Carrying capacity
- Minimum viable population
- Management scenarios

Questions?

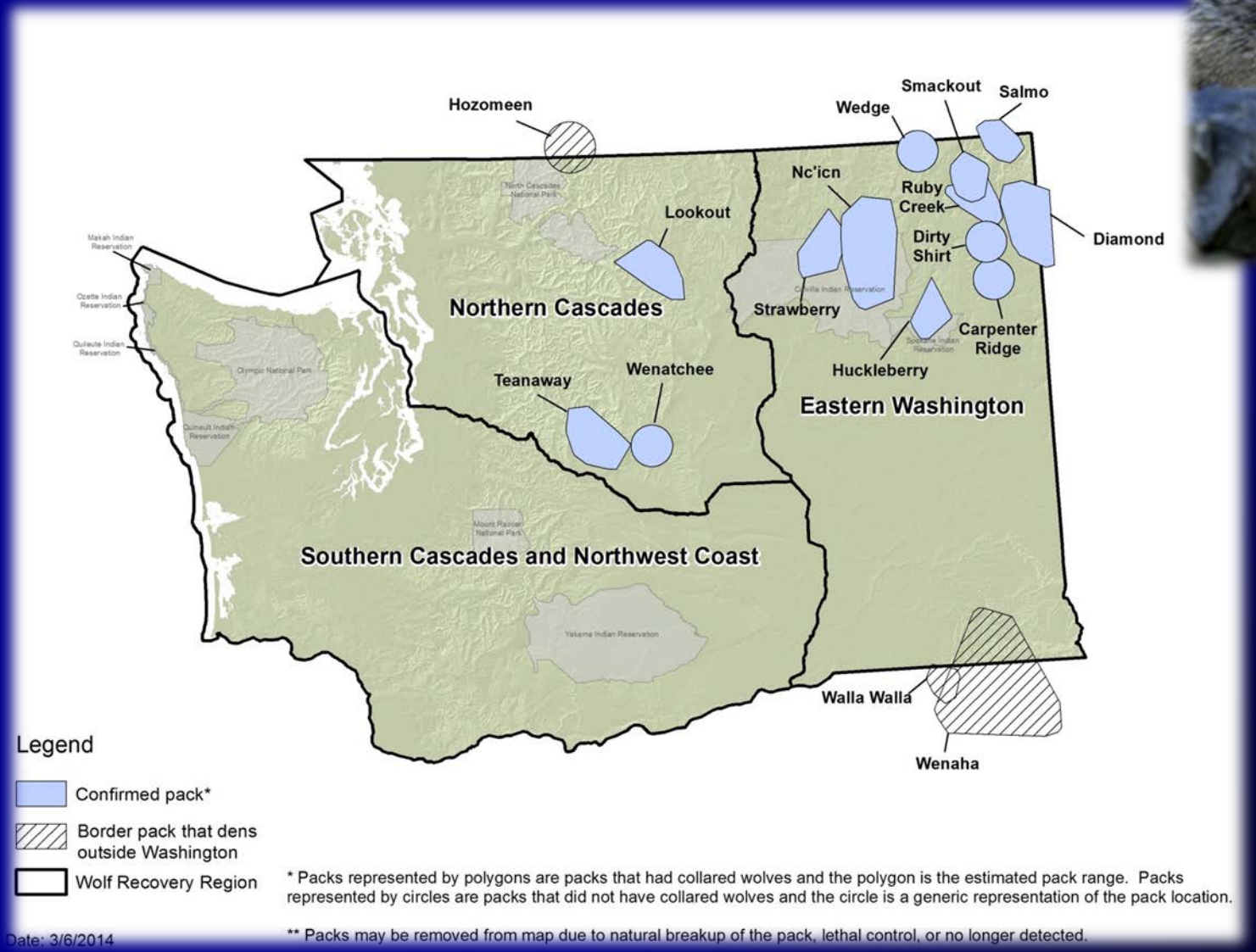



Photo by Gary Kramer