

Colockum Background Management Issues

- **Historically... increasing issues with elk damage to private property**
- **...earlier migration from the WD winter range**
- **...elk herd below population objective**
- **...variable herd productivity (calf:cow ratios)**
- **...chronically low estimates of bull:cow ratios**

Actions to Reduce Elk Damage

- **Established BGMR to improve WDFW / community communication on elk issues**
- **Liberal *damage-oriented* hunts**
- **Established a full-time *Wildlife Conflict Damage Specialist* position in Ellensburg**
- **Active herding & hazing elk from conflict areas as needed**

Actions to Improve Winter Range

- **Purchased Skookumchuck Ranch (17,500 acres)**
- **Obtained Conservation Easement for PSE Wild Horse Wind Farm**
- **Coordinated Resource Management Grazing on the Skookumchuck**
- **Implemented WD Winter Range Closure**
- **Supported Implementation of Colockum Elk Study to better understand elk movements**

The Colockum Elk Study II: 2008-2012



January 2013

Washington Department of Fish and Wildlife

Acknowledgments

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Primary Objectives

- Quantify space-use and movements of Colockum cow elk
- Assess distributional relationship (*i.e.*, connectivity) between core area and Parke Creek elk sub-herds
- Explore effects of disturbance, weather, and habitat features on Colockum elk movements and distribution
- Estimate survival, productivity, and condition of cow elk
- Evaluate whether the ***Whiskey Dick winter access closure*** has potential management value



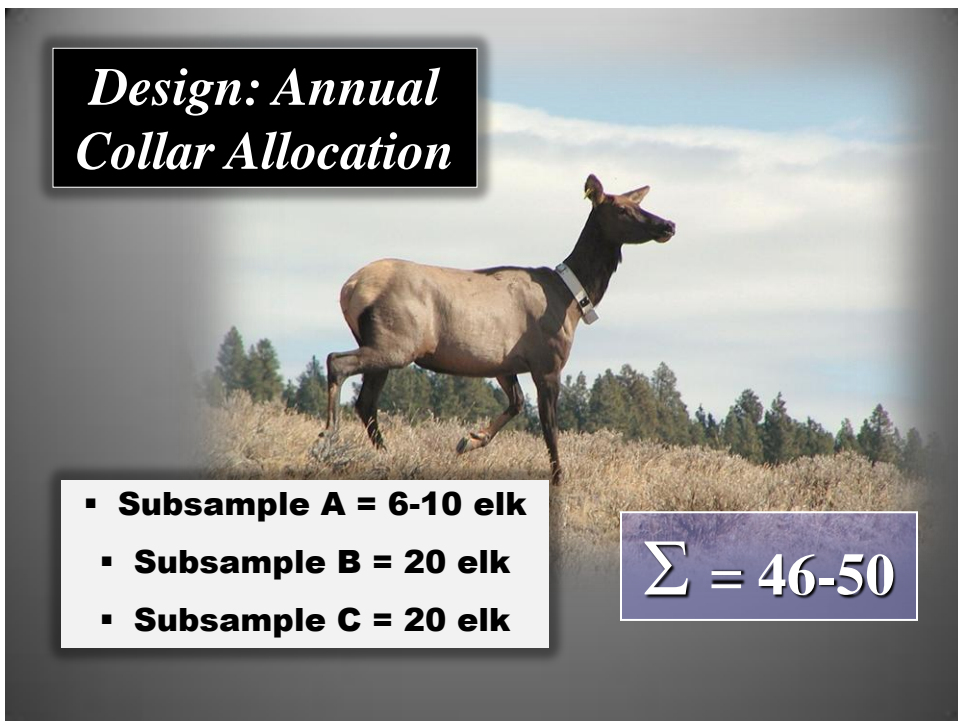
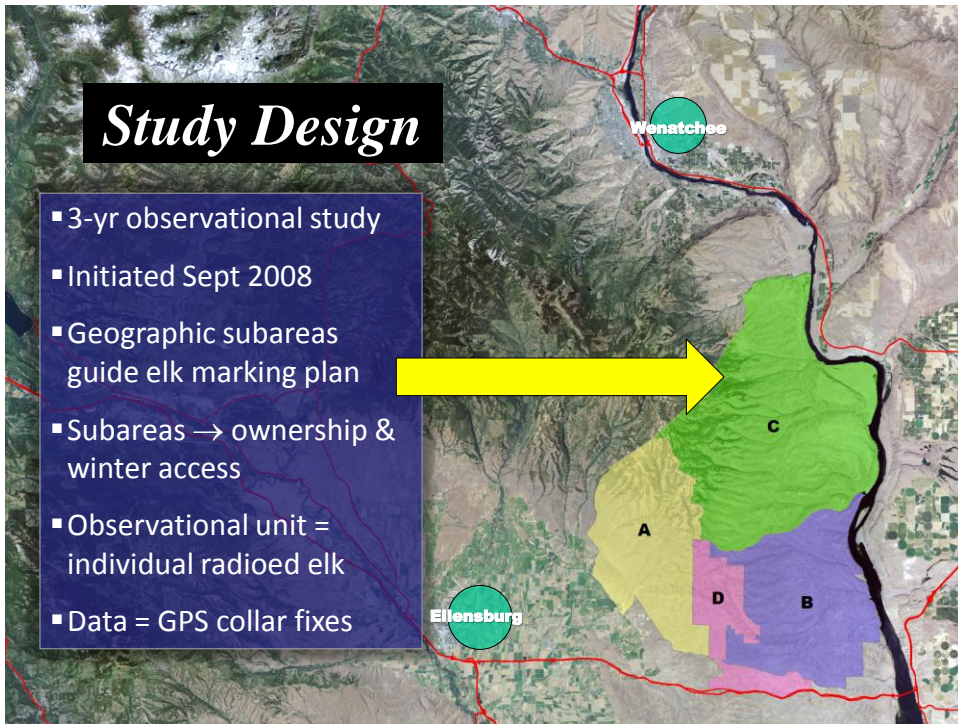
Elk and Private Land

- Colockum elk have unrestrained access to private land and agricultural areas
- Complaints have been chronic, but variable
- Elk damage is a source of conflict and consumes resources (time, \$, elk)
- Divergent opinions on contributing factors

Mobile Site Ready FOR SALE
6 ACRES
 253-279-9198

Disturbance as a Contributing Factor?

One thought is that disturbance on public land (especially winter and transition range) motivates elk to seek refuge on private land



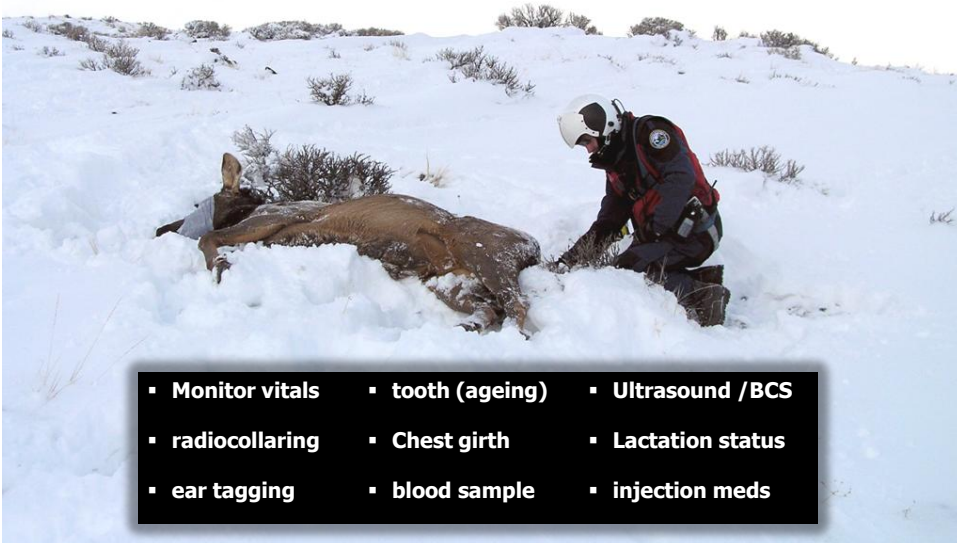
GPS Collar Attributes

- High level of accuracy (2-10 m error typical)
- Eliminates intra-animal sample size limitations
- Eliminates diurnal and weather fix biases
- Discriminates between **patterns** and **novel** behavior
- Allows assigning precise dates to events
- Allows meaningful estimation of movement **rates, distances**

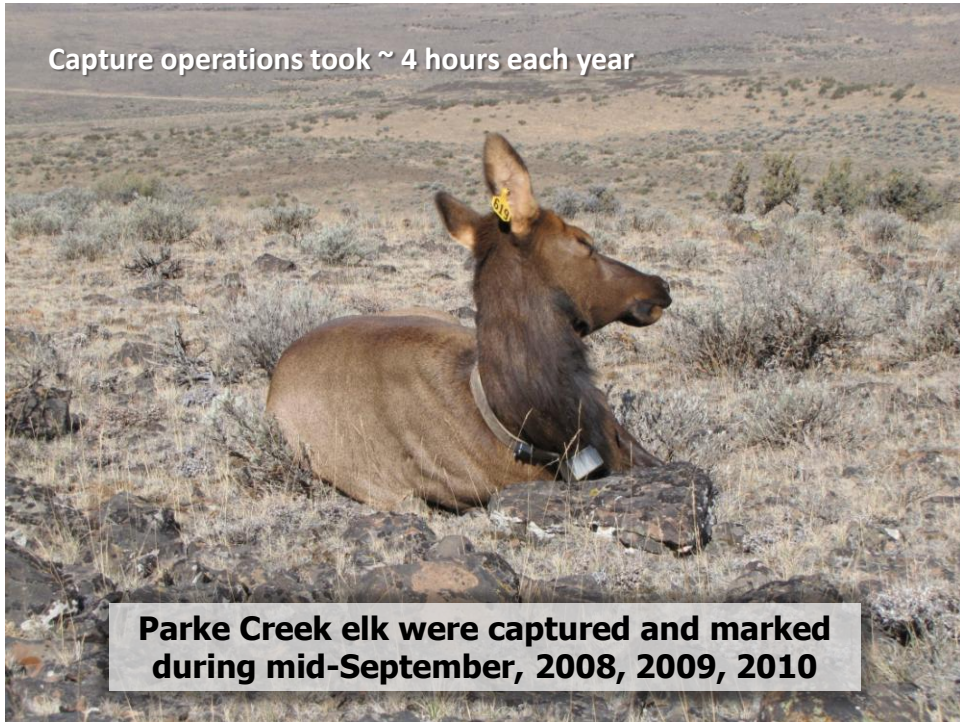


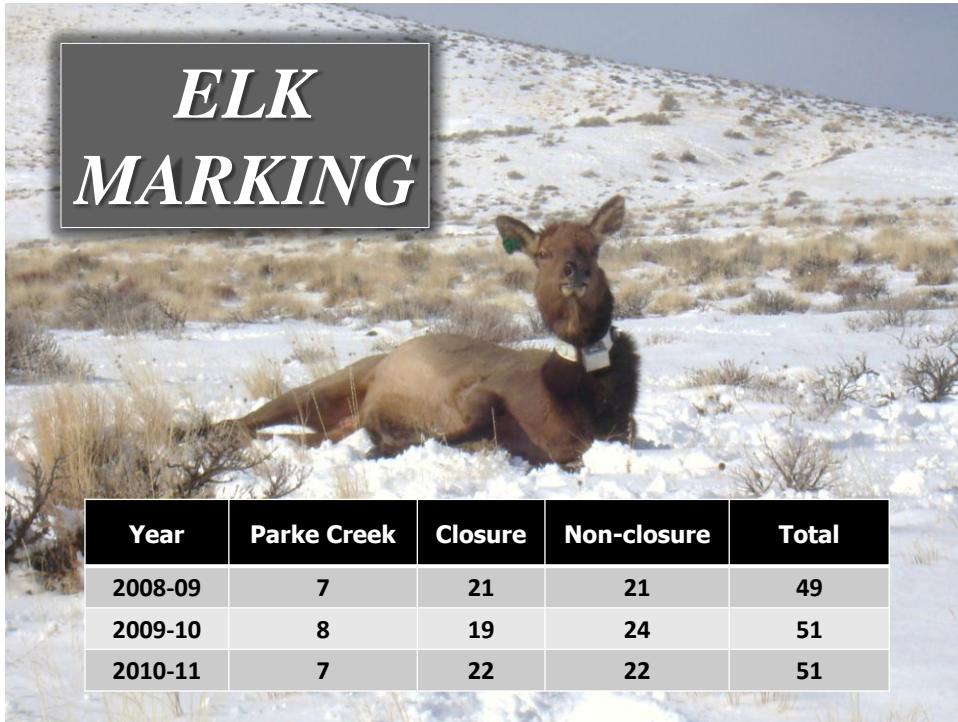


Handling Procedures ...



- Monitor vitals
- radiocollaring
- ear tagging
- tooth (ageing)
- Chest girth
- blood sample
- Ultrasound /BCS
- Lactation status
- injection meds





So, this elk goes into a bar...



GPS Collar Parameters

- Seasonal adjustments to schedule
- 8 fixes per day (3-hr interval)
- ≈2,900 fixes possible per elk per year
- Partial collar rotation to increase sample of elk
- Collar retrieval via both drop-off technology and recaptures

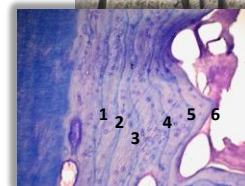
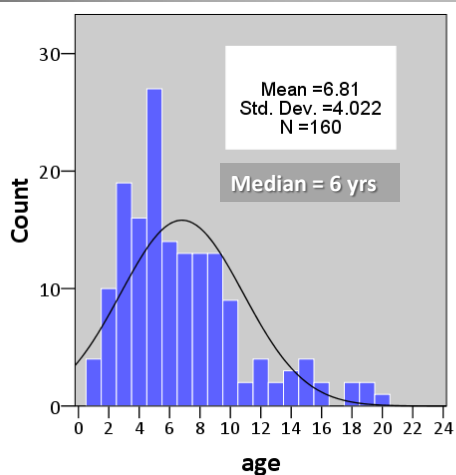


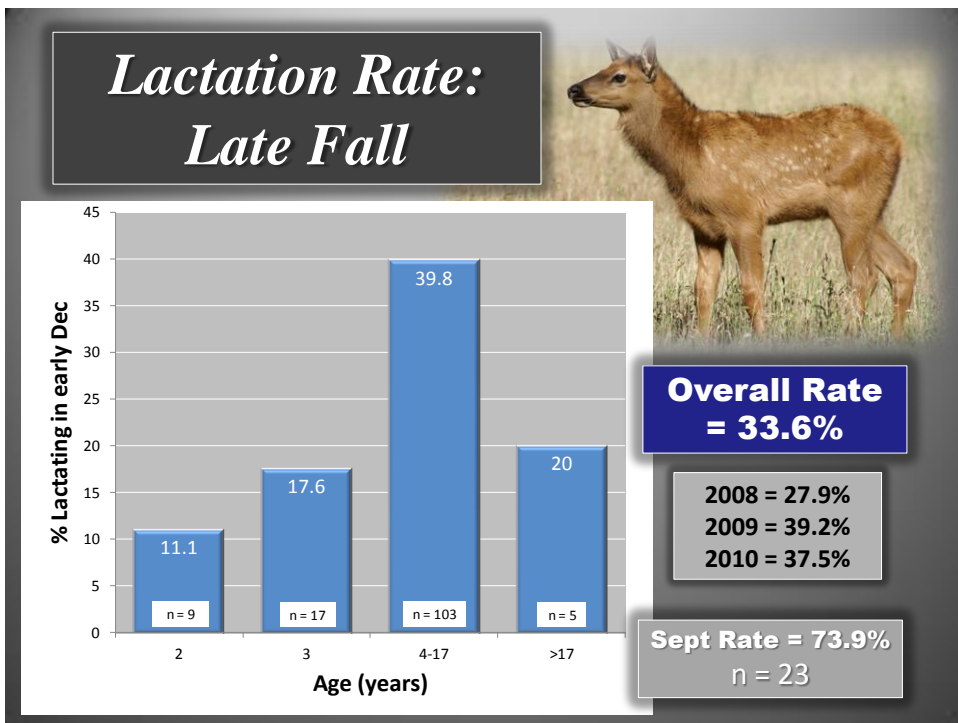
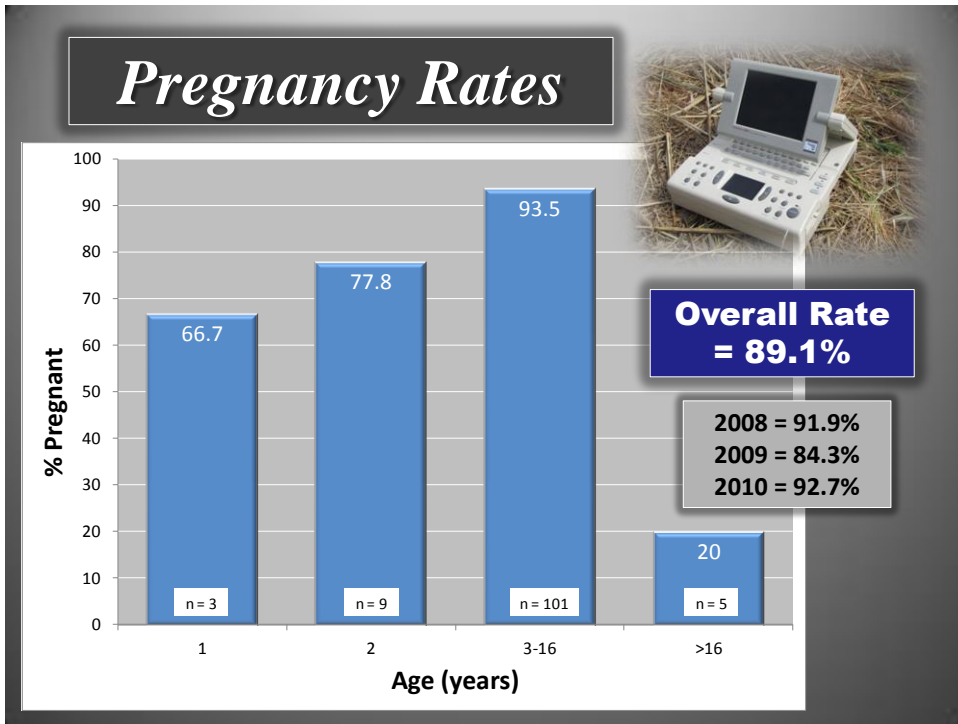
Collar Performance

- 90/95 (95%) collar drops possible acquired as scheduled
 - 2/95 (2%) collar drops early
 - 1/95 failed to drop; 2 contact lost
-
- Across months and years, mean GPS fix acquisition success was 97.6%
 - Across years, mean GPS fix success ranged from 99.0% (Feb) to 95.8% (Aug)



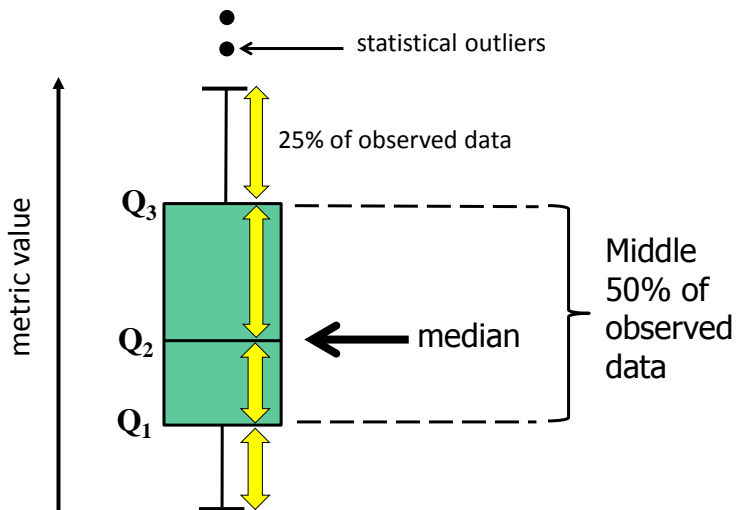
Ages of Study Elk



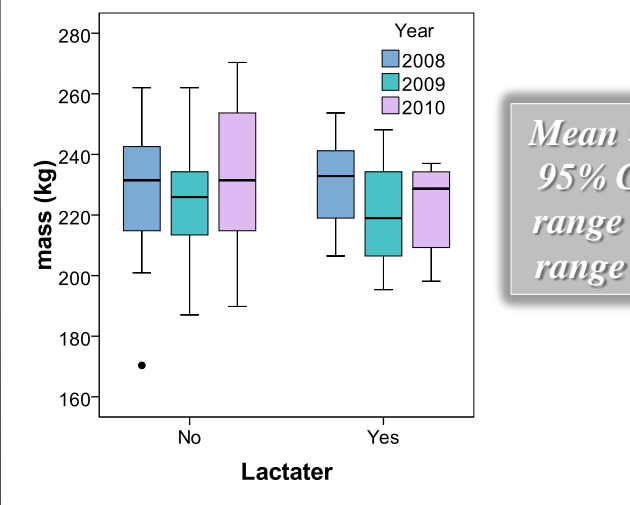




Boxplots...



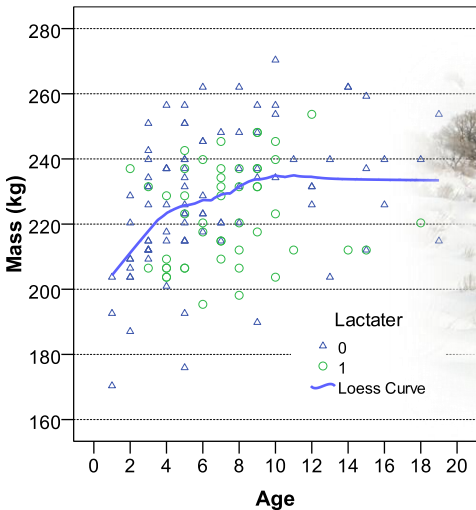
Late Fall Body Mass



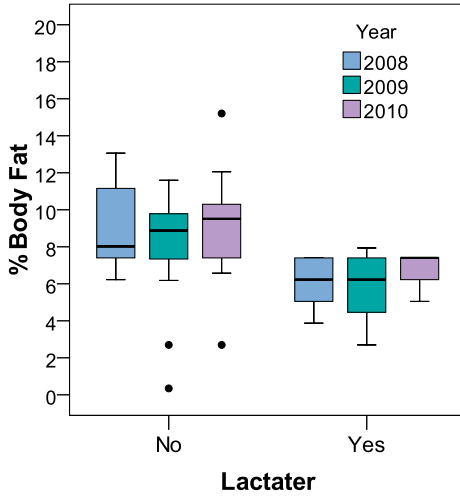
Mean = 226.1 (498.6 lbs)
95% CI = 208.5 – 223.9
range = 170.4 – 270.4 kg
range = 375.7 – 596.2 lb



Mass by Age



Late Fall Body Condition



Marginal Means

Lactater

No = $8.34 \pm 0.41\%$

Yes = $6.03 \pm 0.47\%$

Pregnant

No = $6.09 \pm 0.61\%$

Yes = $8.28 \pm 0.31\%$



Body Condition

~17% IFBF



~6% IFBF



~1% IFBF



~20%



~10%



~4%

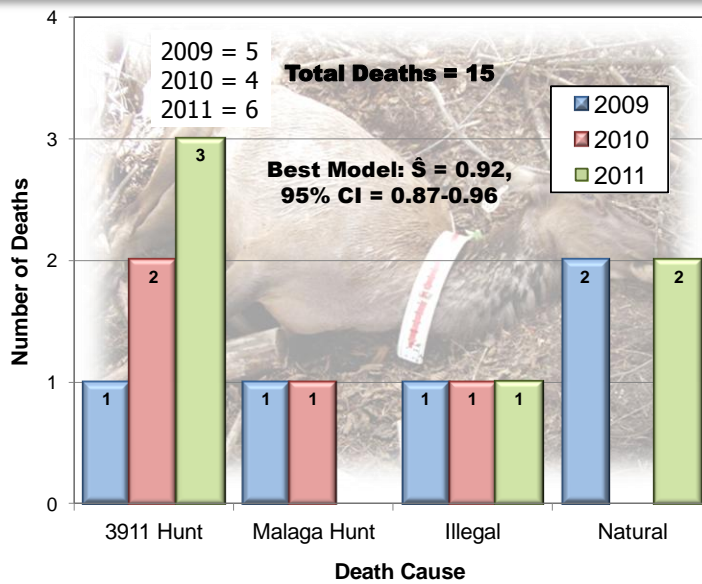


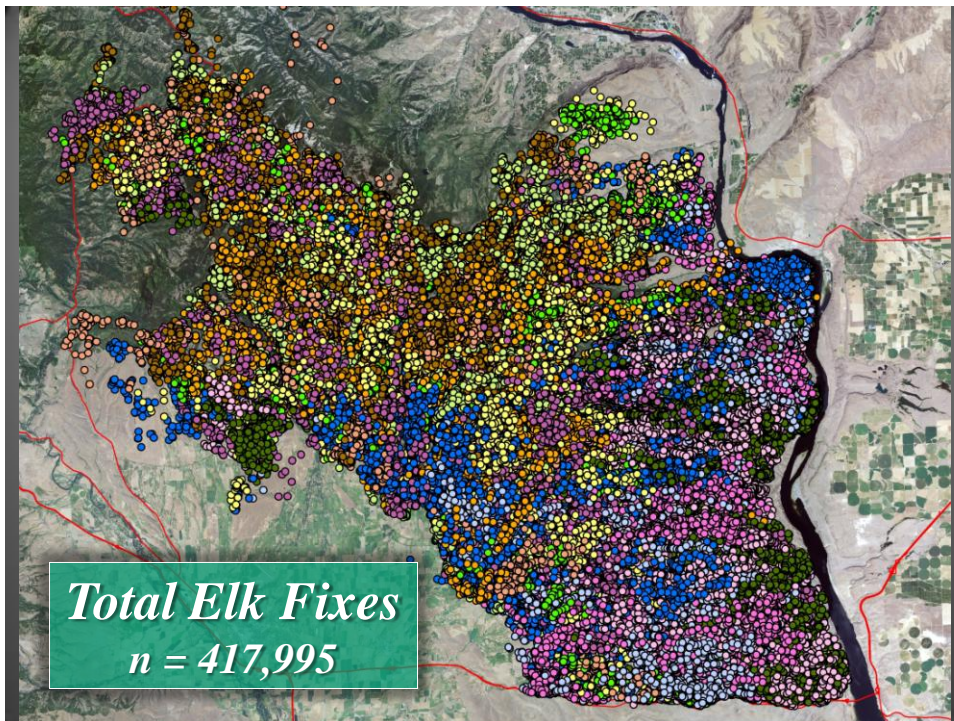
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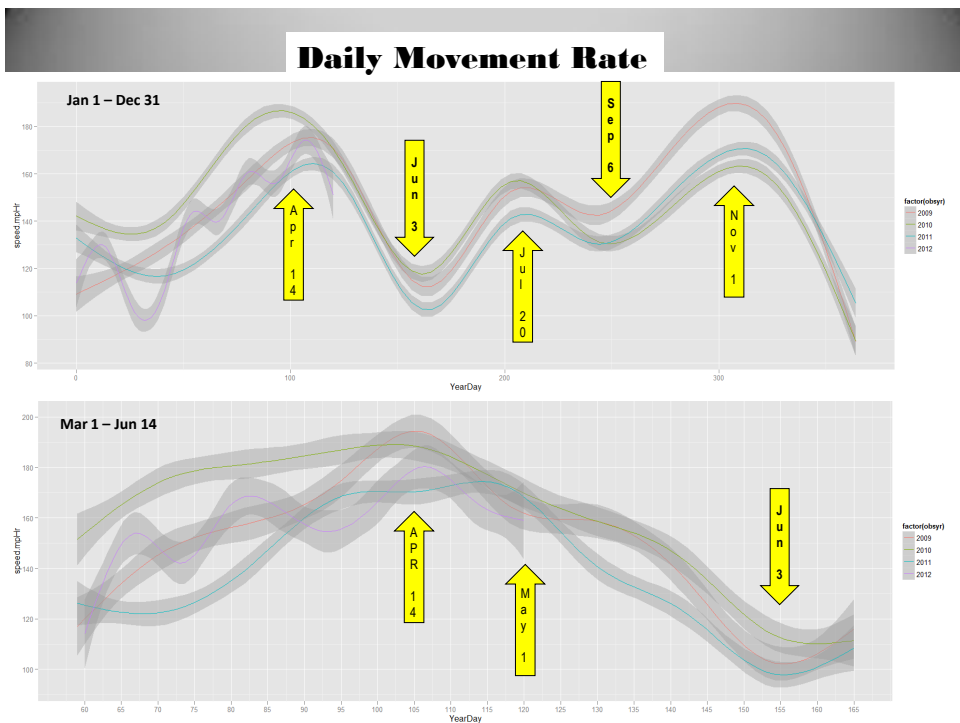
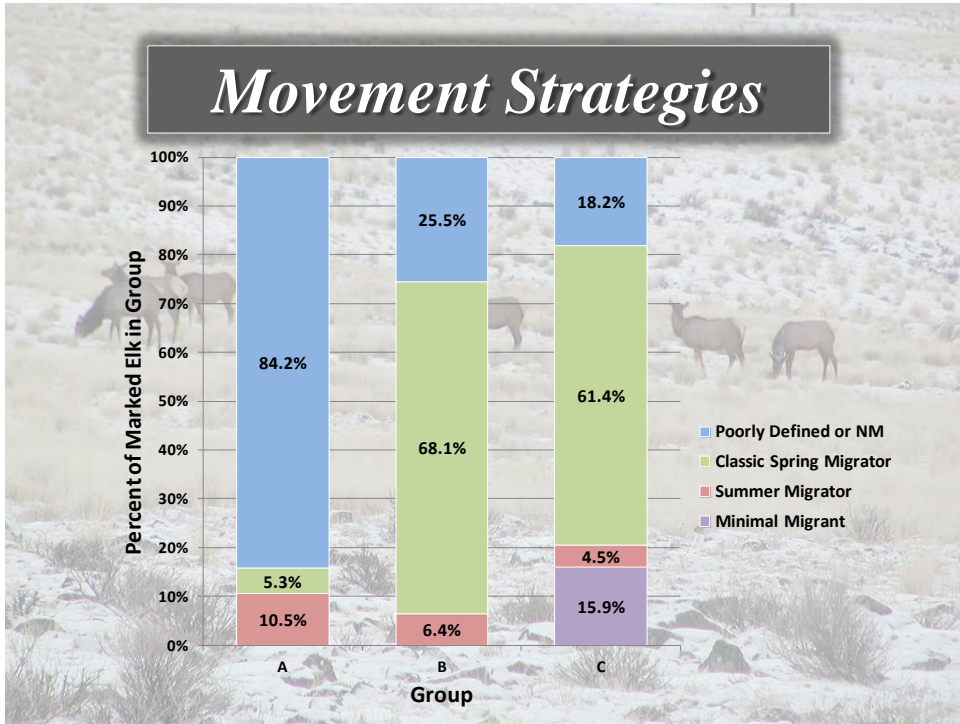


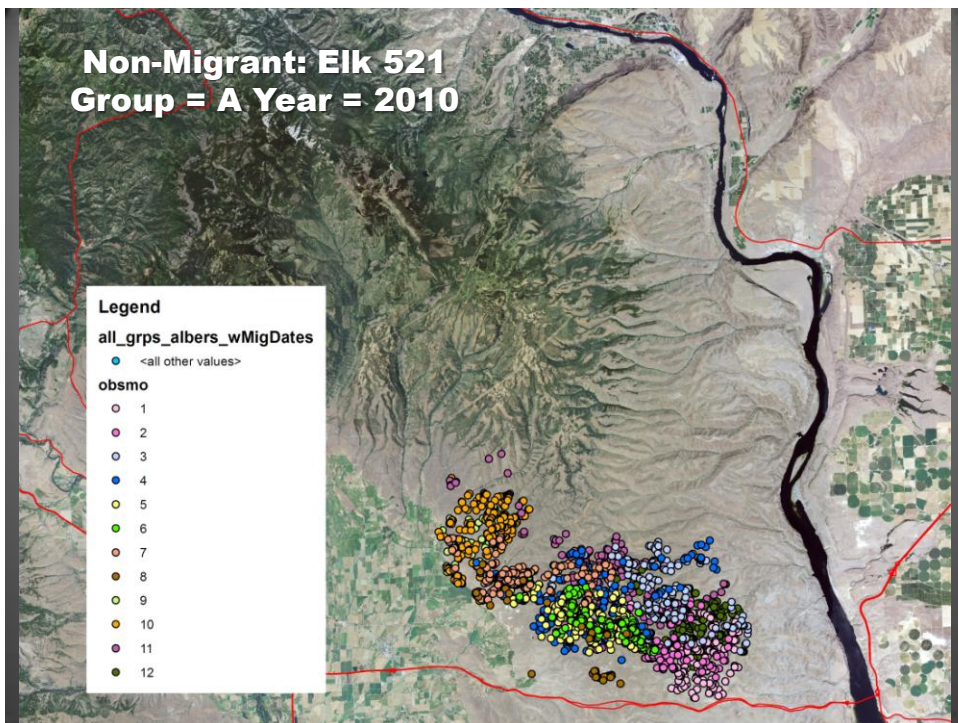
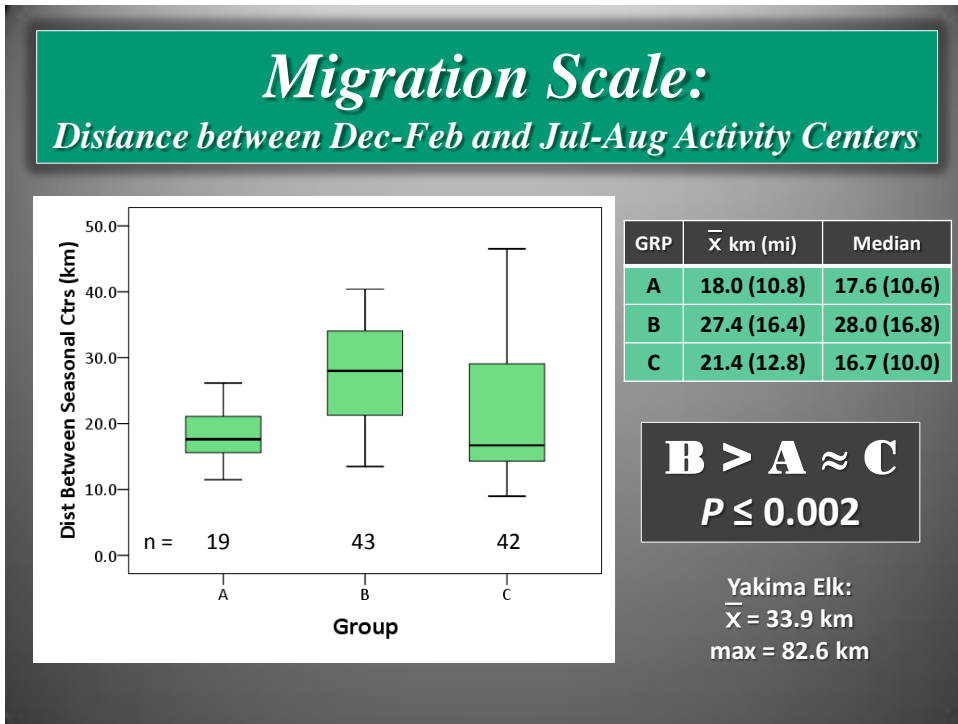
Survival and Mortality

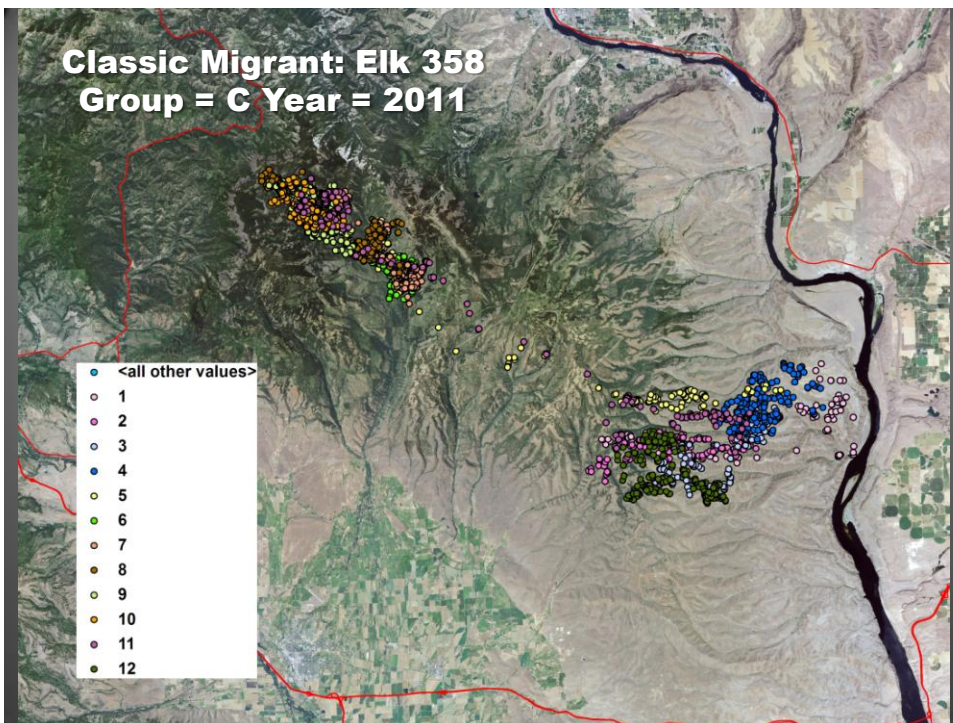
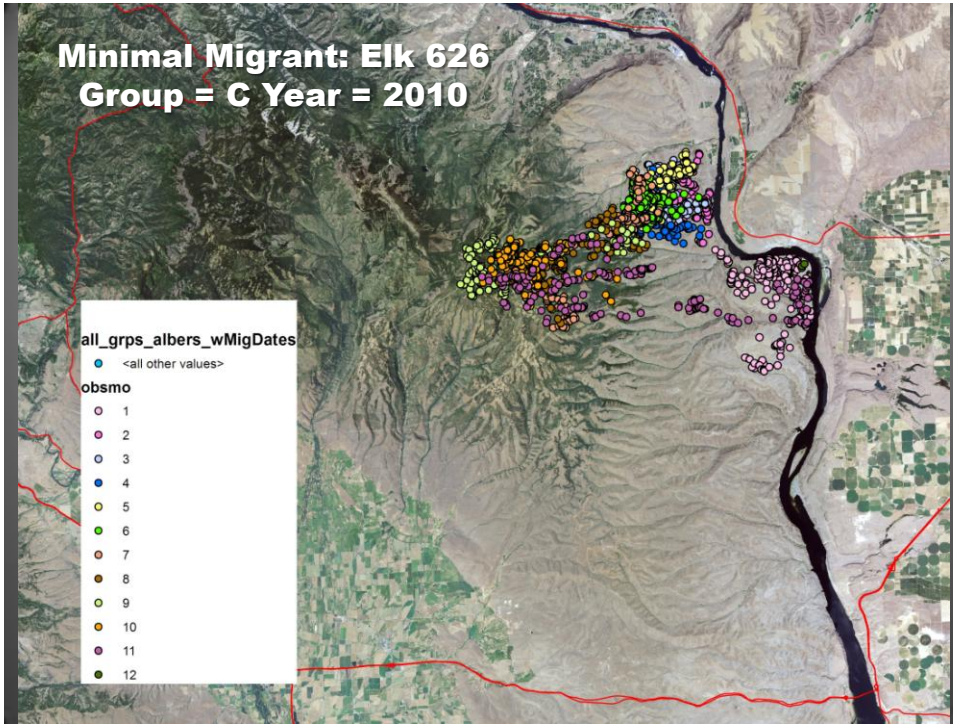
Radiomarked Elk Mortalities

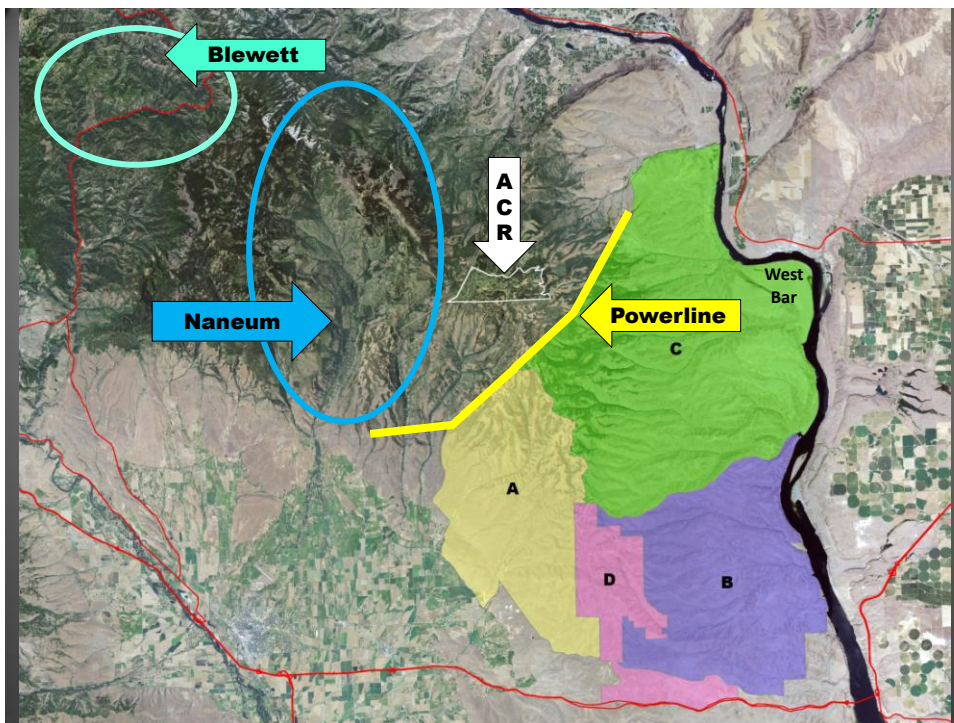
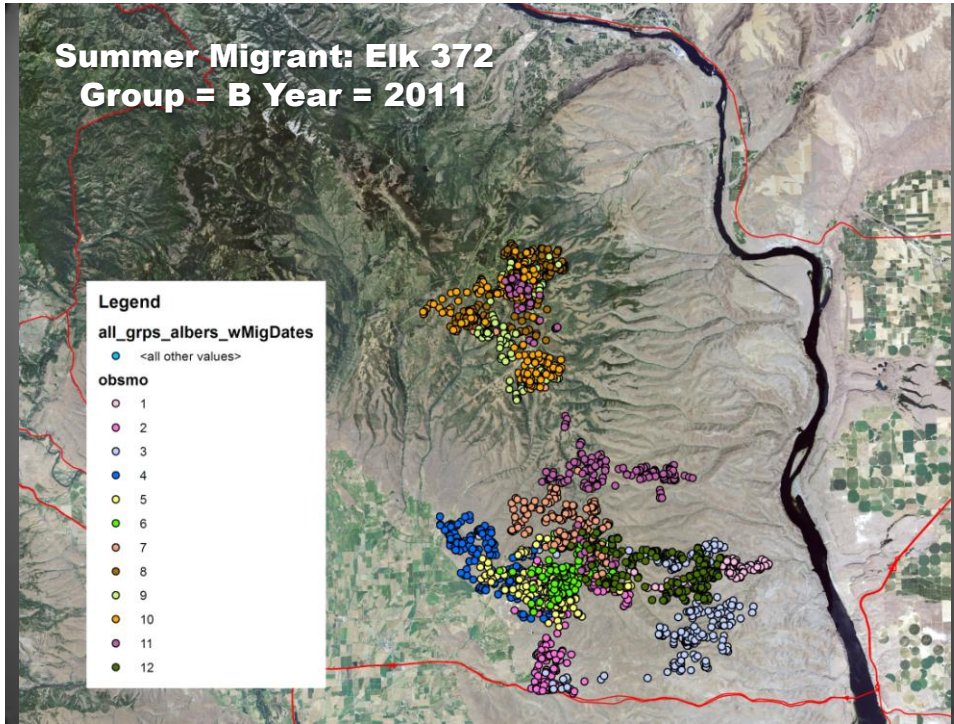


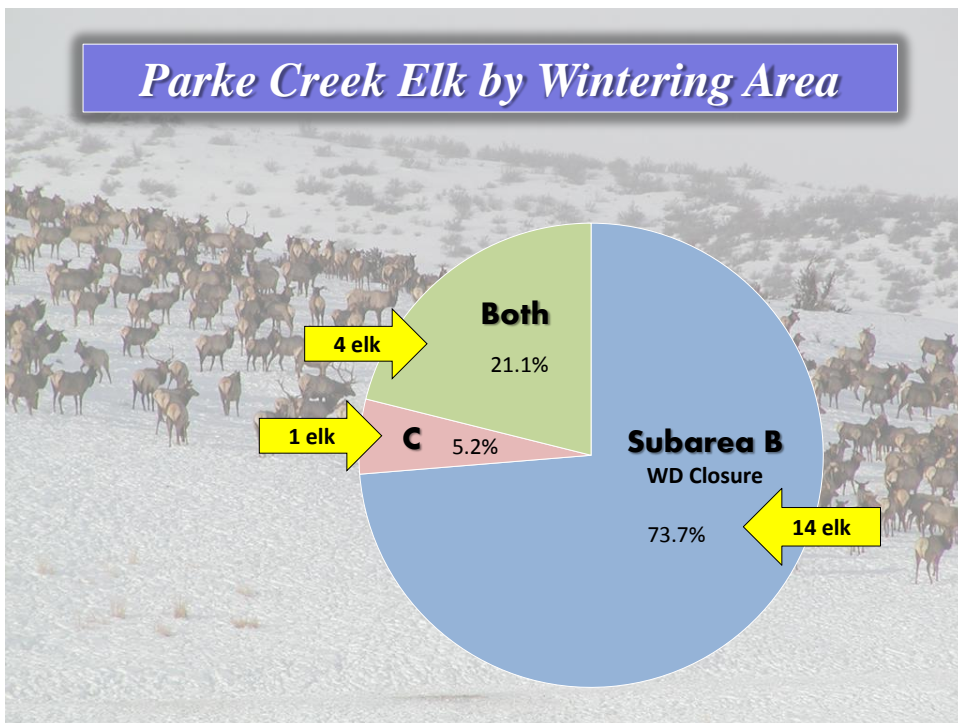
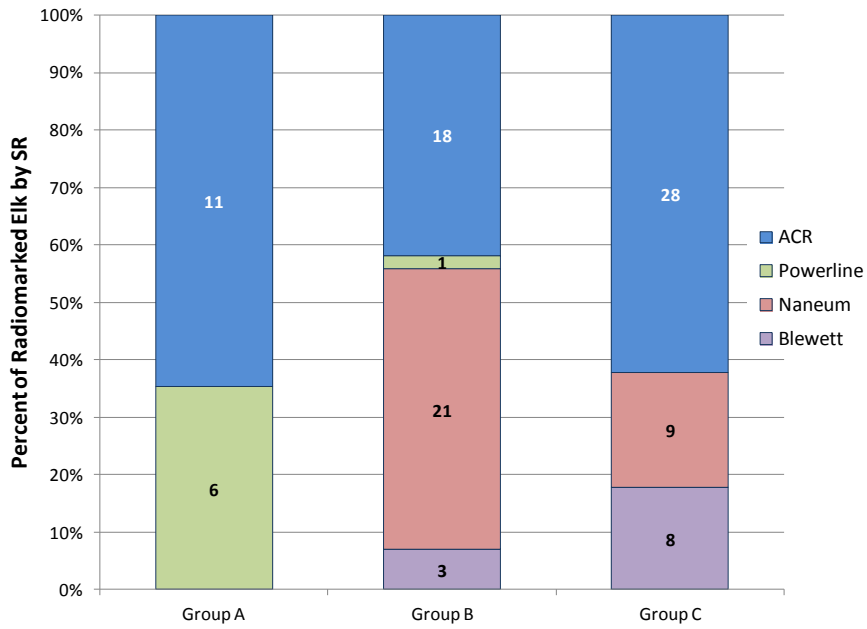


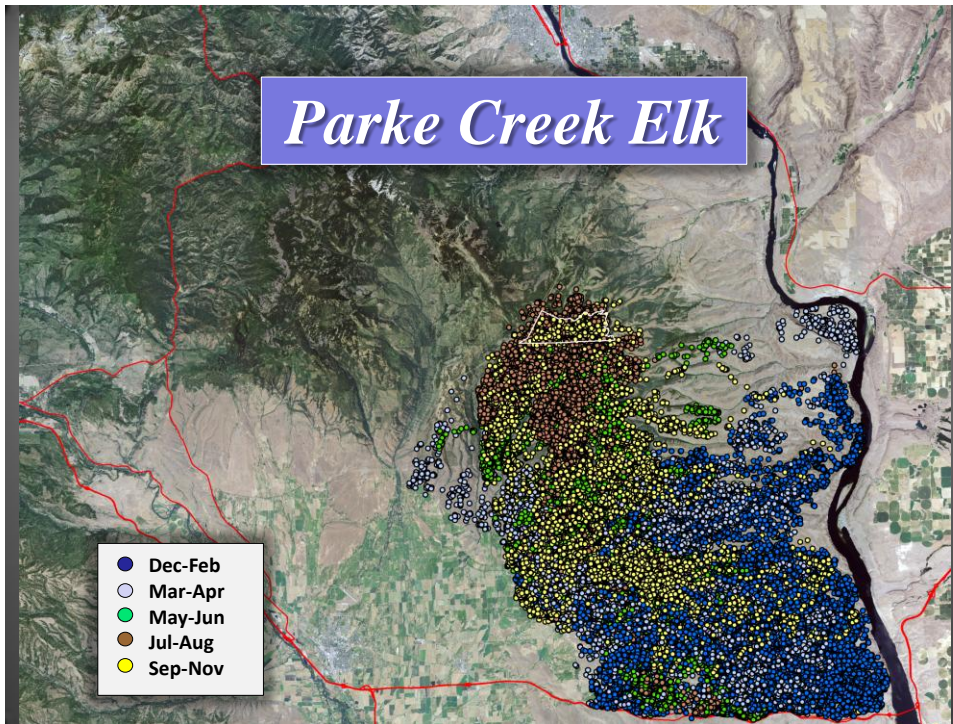












Elk and Roads

- Perhaps the most studied landscape effect on elk distribution and habitat use
- In general, results on landscapes where elk are hunted have been very consistent... when possible, elk will select areas away from open roads
- Elk are predictably “refuge-seekers” when faced with high levels of disturbance/harassment
- This does not mean elk will never be near a road

The slide features a photograph of an elk standing on a paved road with a yellow double line, set against a backdrop of a mountainous landscape with trees and a clear sky. The title "Elk and Roads" is displayed in a green box with white text on the left side of the image.

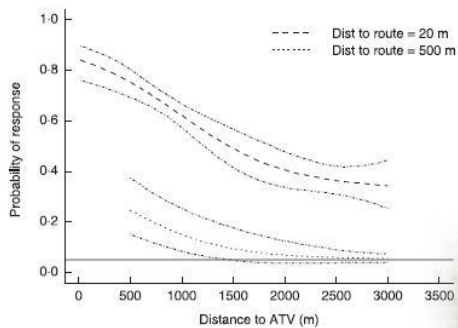


Fig. 6. Estimated probabilities of flight response by elk as a function of distance to ATV and distance to closest ATV route (Dist to route). The bounds around the estimated probabilities are approximate point-wise 95% limits. The horizontal line at 5% response is the level below which responses are similar to those on control days. When elk are close to routes (20 m) the probability of flight is higher, even when the ATV is far away (e.g. 1000 m). The response appears to drop dramatically when there are no routes closer than 500 m.

Elk Flight Response



From: Preisler et al. 2006. Statistical methods for analysing responses of wildlife to human disturbance. *J. Applied Ecology* 43:164-172.

Elk Stress Response

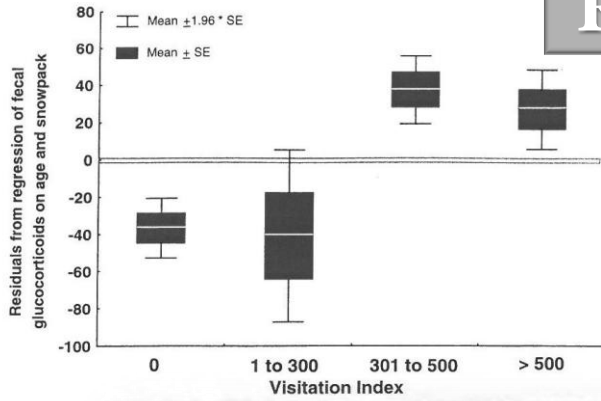
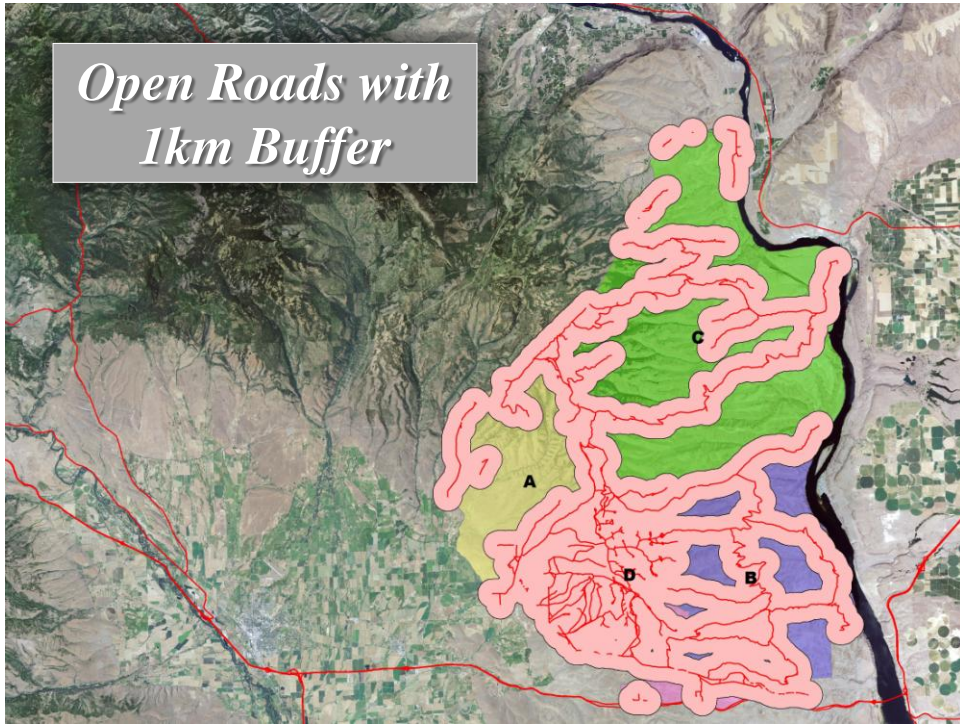
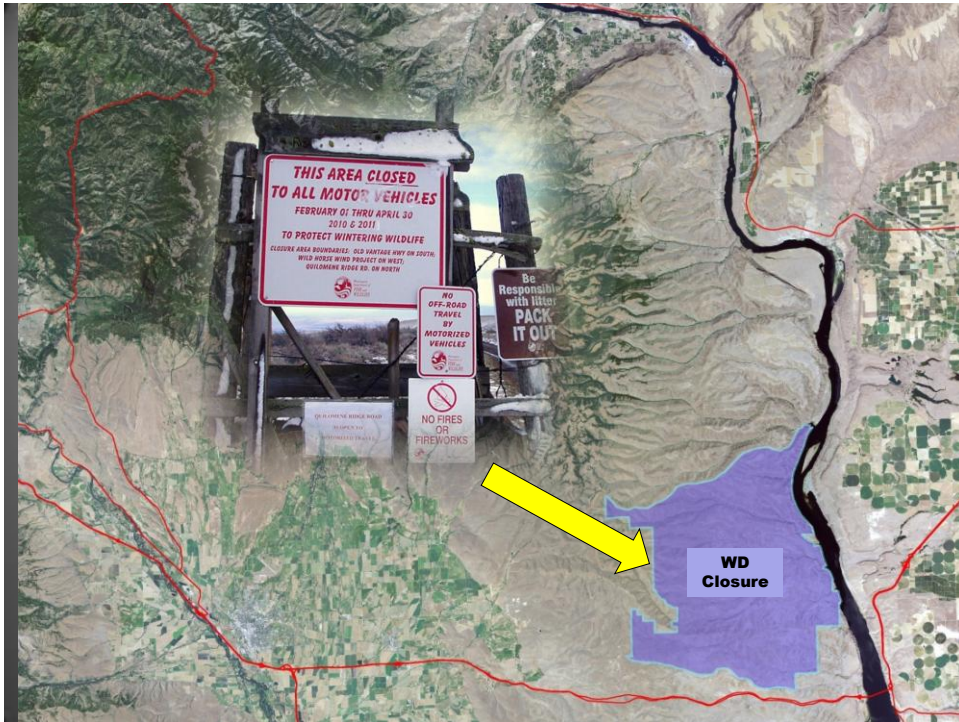


Figure 1. Fecal glucocorticoid (GC) concentrations of adult female elk in the Madison-Firehole-Gibbon region of Yellowstone National Park as a function of the daily number of snowmobiles entering the area. Because age and snow pack affected GC concentrations, the ordinate shows residuals from the regression of GC on age and snow-water equivalents. Visitation index gives the number of snowmobiles entering the area via West Yellowstone (see methods).



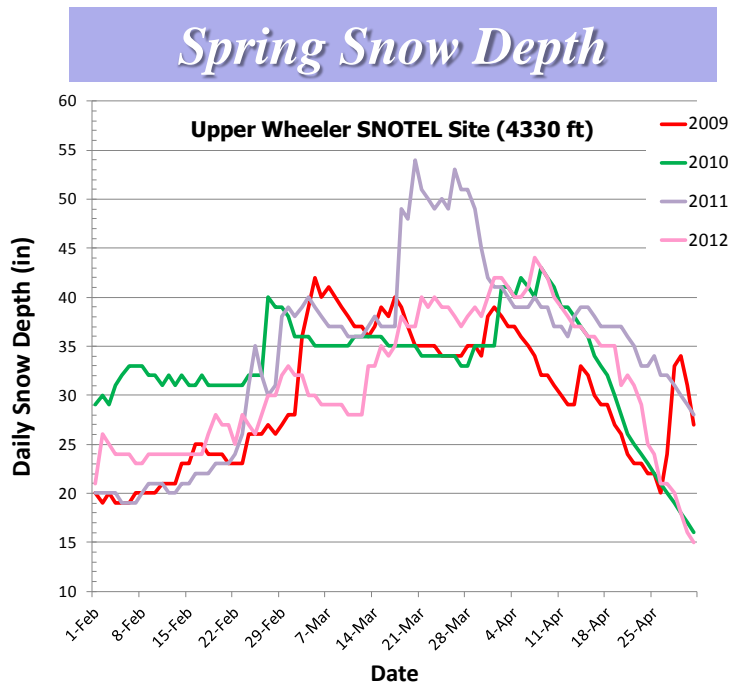
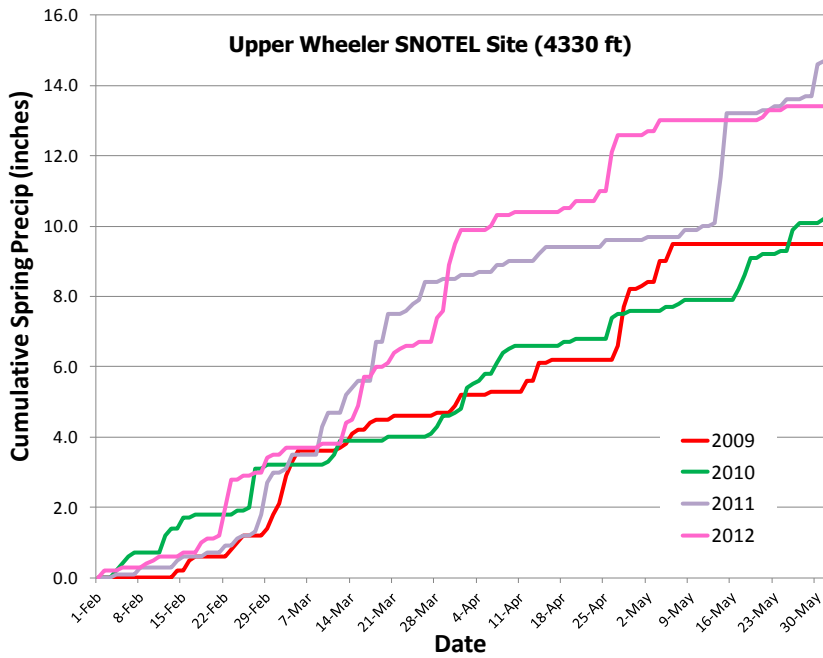


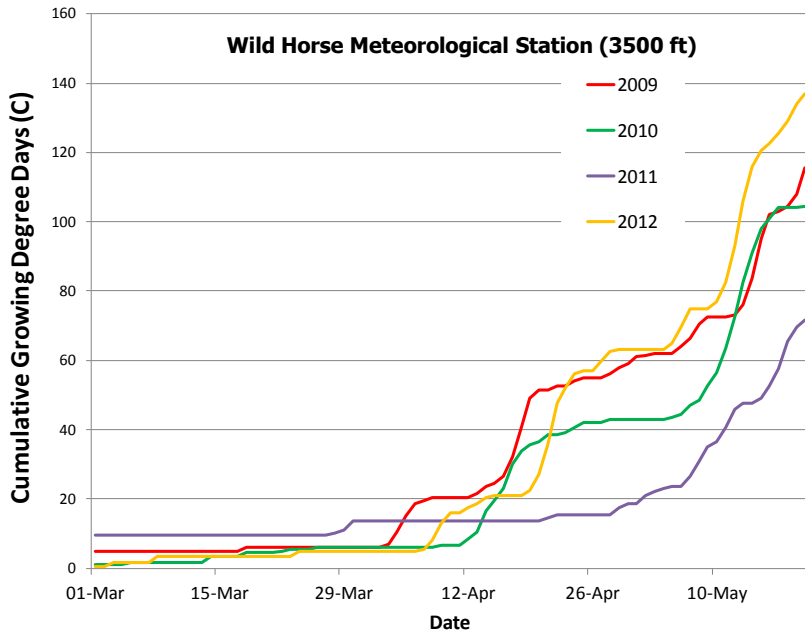


Spring Movement Prompts?



- Fixed by individual
- Photoperiod (daylength)
- Disturbance
- Weather (warming?)
- Snowline or snowpack
- Plant phenology (greenup)
- Cumulative days on WR
- Physical condition / hormone





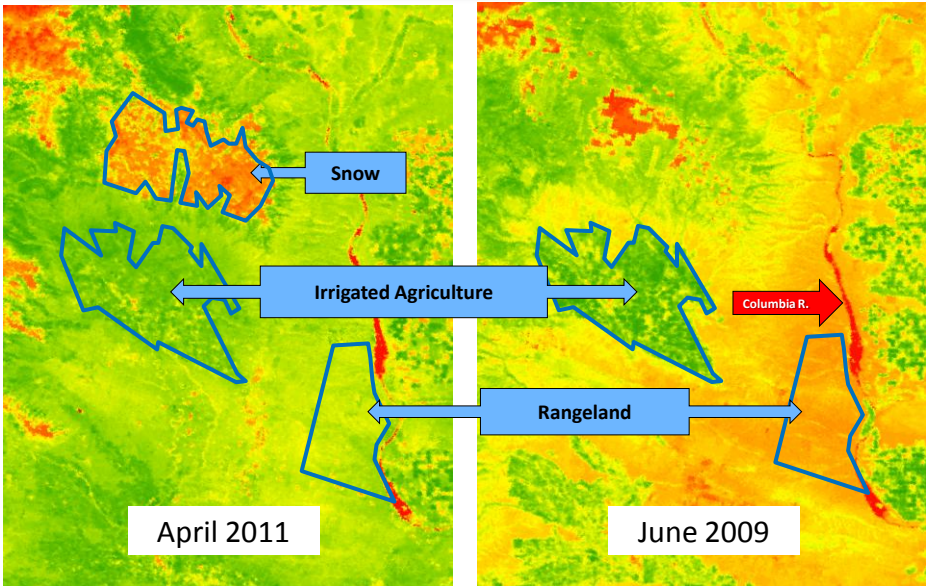
Normalized Difference Vegetation Index

Heathy Vegetation Reflectance
50% NIR, 8% Red
NDVI = 0.72

Stressed Vegetation Reflectance
40% NIR, 30% Red
NDVI = 0.14

NDVI = $\frac{NIR - Red}{NIR + Red}$

Normalized Difference Vegetation Index



Elevation classes

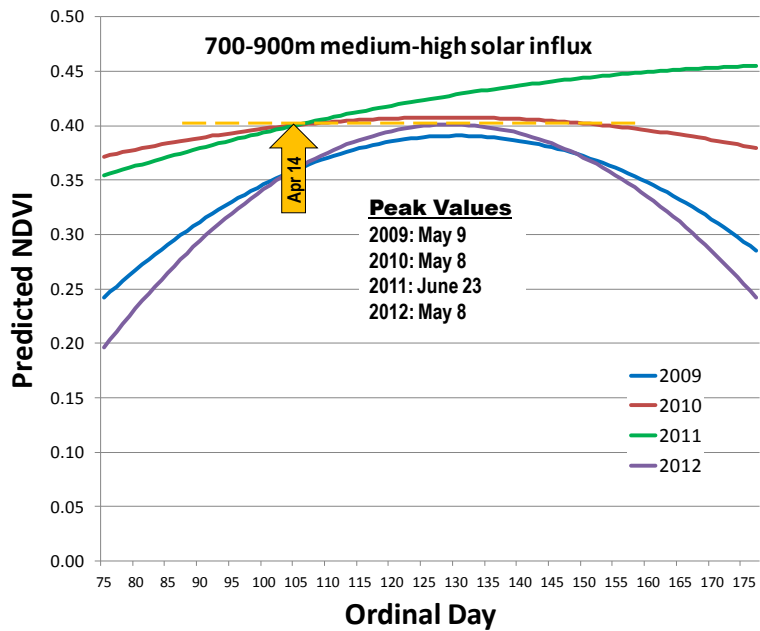
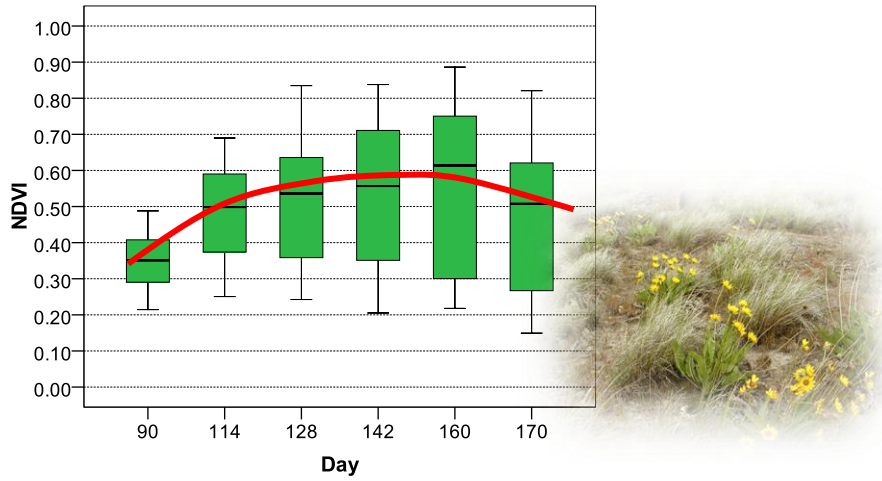
Random Sampling

**NDVI:
Sampling
Strategy**

- 16 combined classes
- 28 scenes (6-8 per year)
- ~ 2 week intervals, late-Feb to mid-June
- 38,585 sampled NDVI values

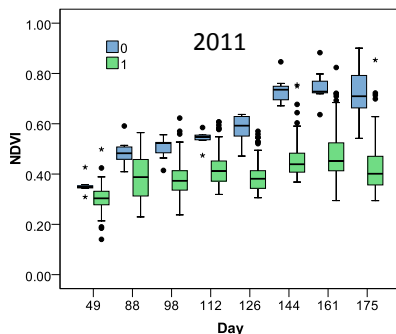
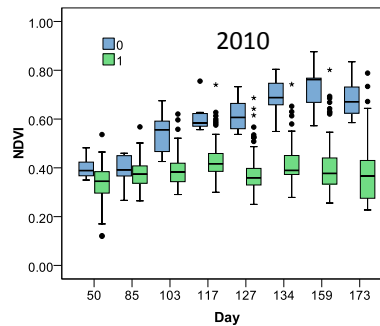
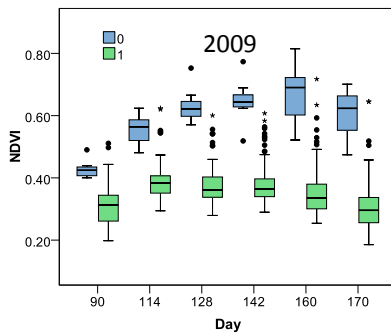
Solar Radiation classes

NDVI: Example
 Year = 2009
 Class = 500-700 m, medium-high solar



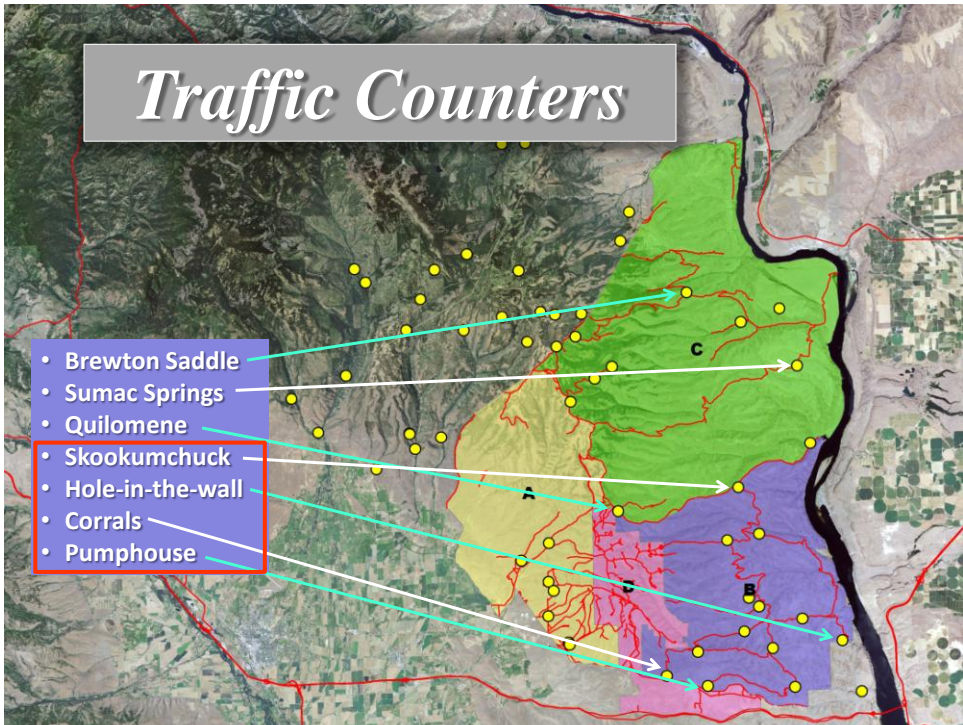
Environmental Summary

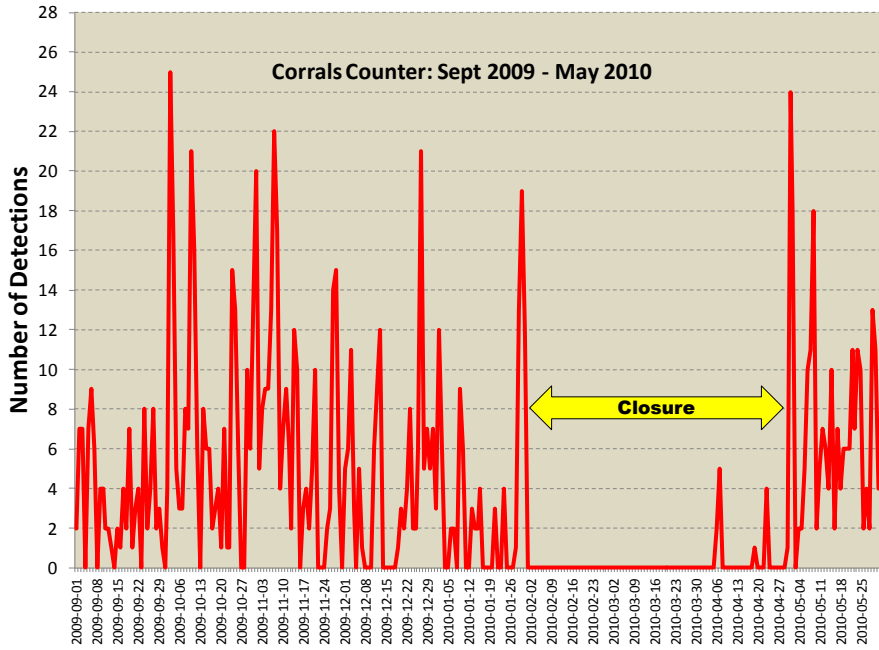
- mid-elev Feb 15 snowpack: **2010 > 2009=2011=2012**
- mid-elev Apr 15 snowpack: **2010=2011=2012 > 2009**
- mid-elev May 1 snowpack: **2009=2011 > 2010=2012**
- spring precipitation: **2011=2012 > 2009=2010**
- spring warmth (May 1): **2009=2012 > 2010 > 2011**
- spring warmth (rate): **2009=2010=2012 > 2011**
- NDVI (Apr 15): **2010=2011 > 2009=2012**
- NDVI (May 15): **2011 > 2010=2012 > 2009**
- NDVI (daily Δ): **2009=2012 > 2010=2011**



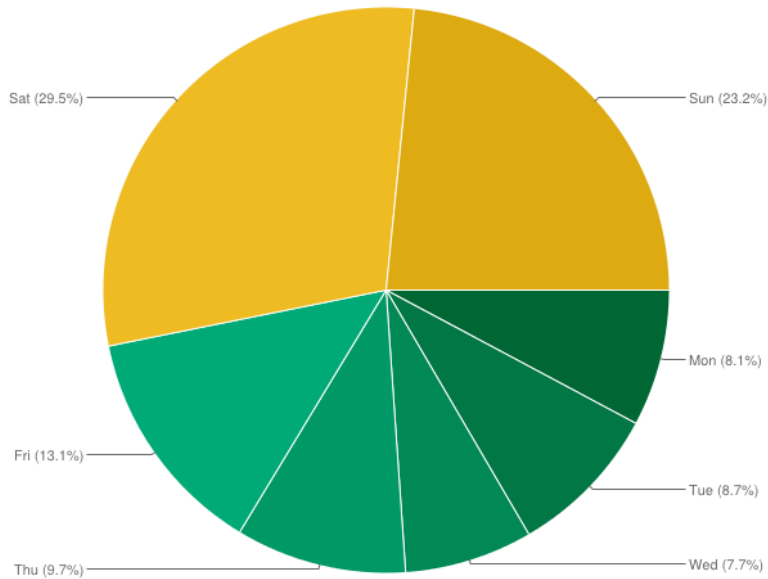
***NDVI: rangeland
vs. agricultural***

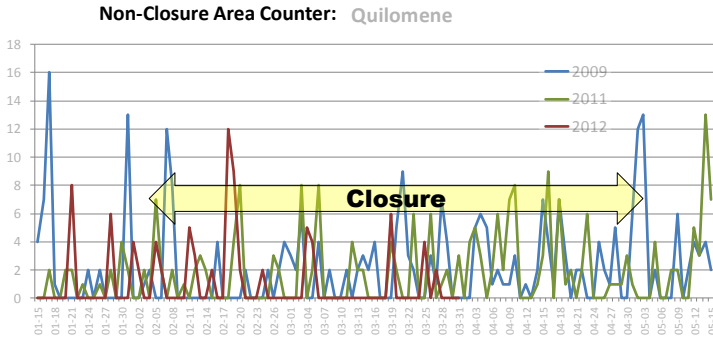
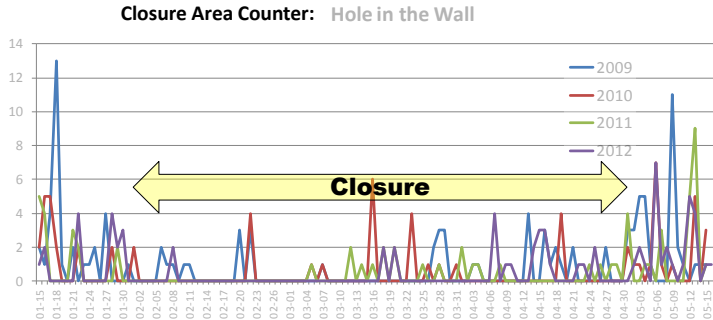
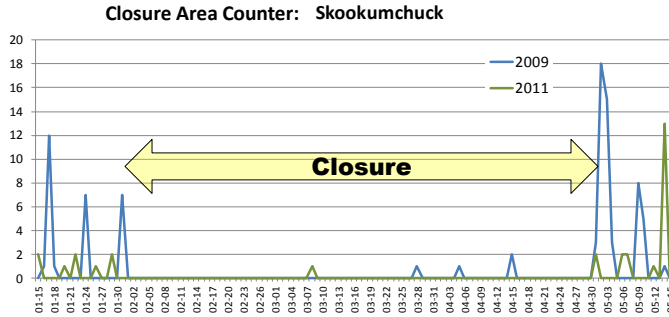
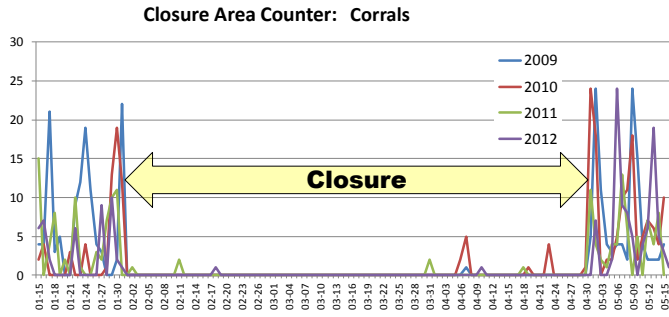
700-900 meters, medium-high solar influx

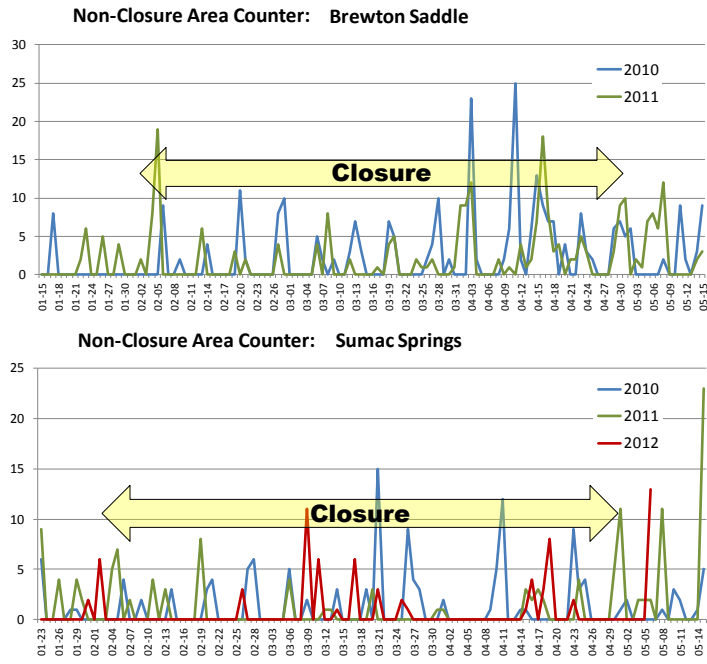




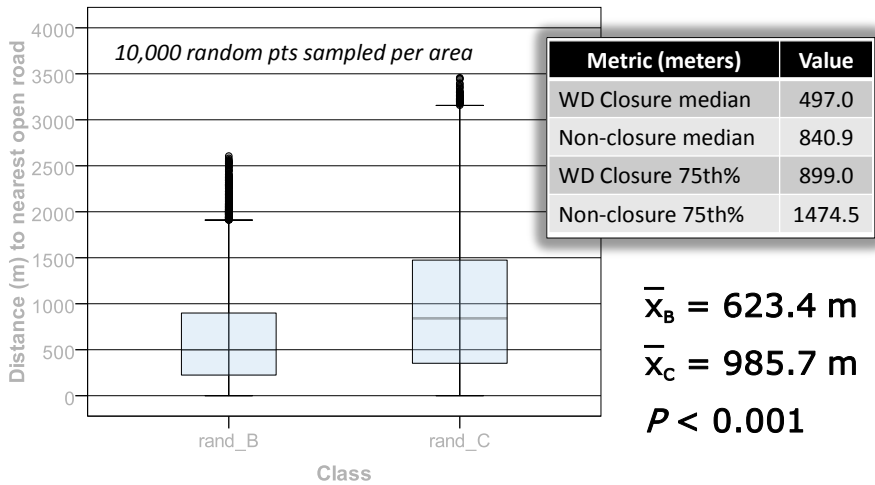
Corrals Counter: Jan 1 – Jun 30, 2010



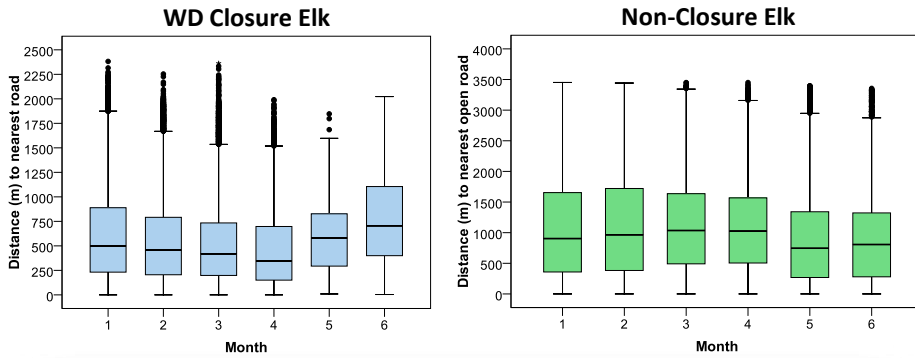




*Distance to Open Roads:
Winter Landscape Availability*



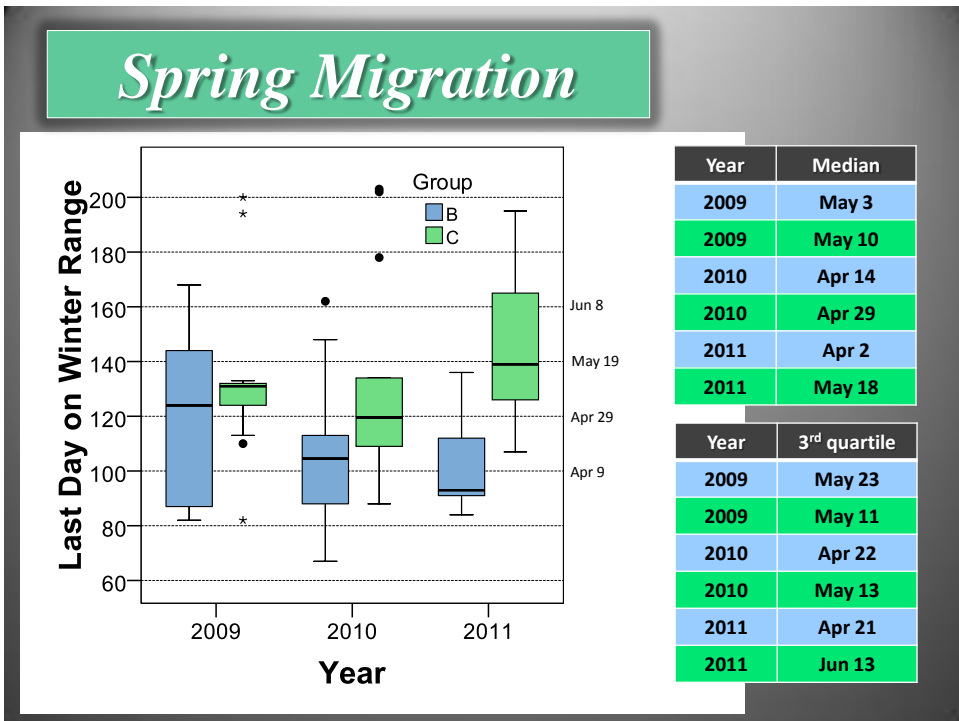
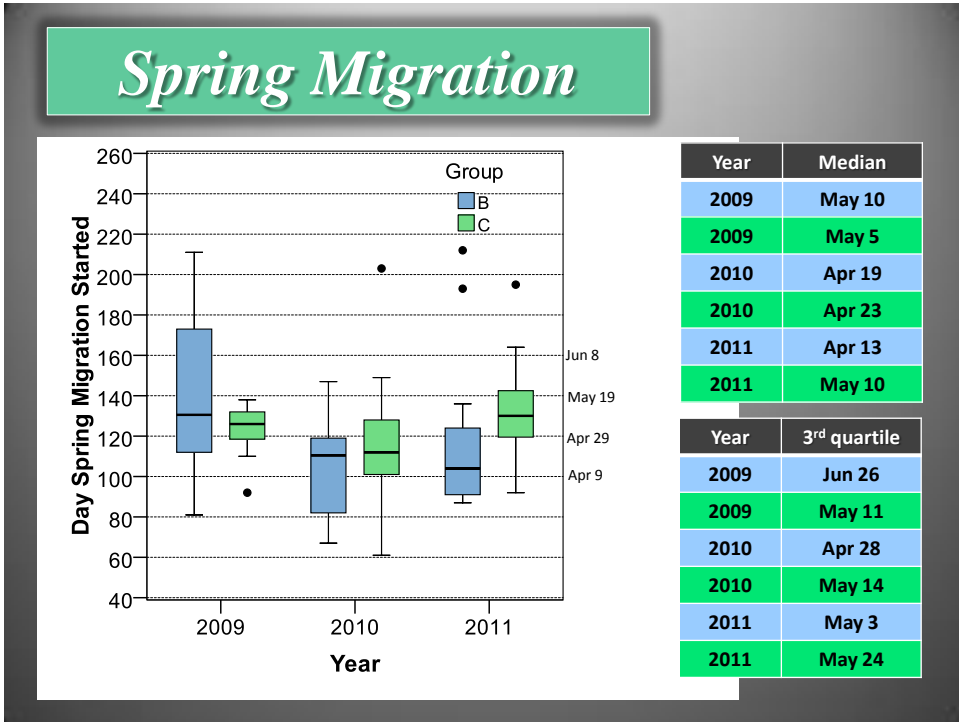
Elk Use Relative to Distance-to-Roads



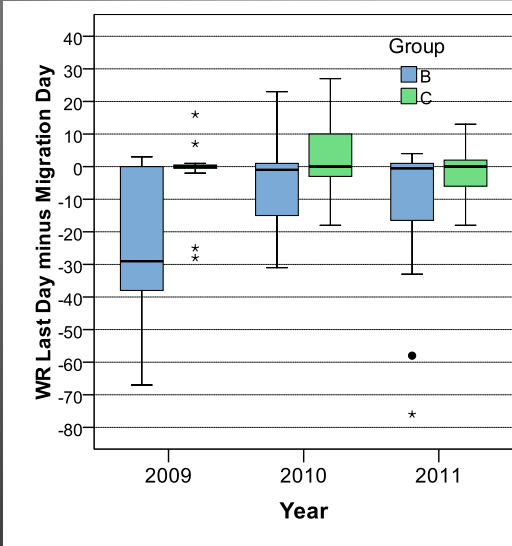
Seasonal Migration

Elk No. 163

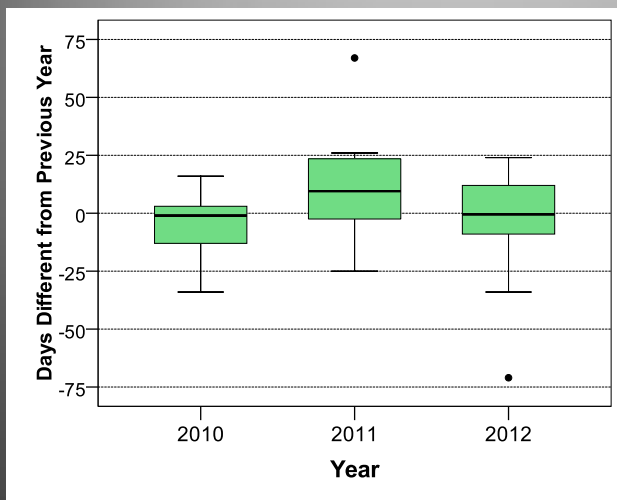
“ Distinct directional movement connecting an individual’s winter home range with their summer-fall home range... continuing until cessation of consistent directional movement”



Spring Migration



Spring Migration: Intra-elk, Inter-year



Last Day on WR

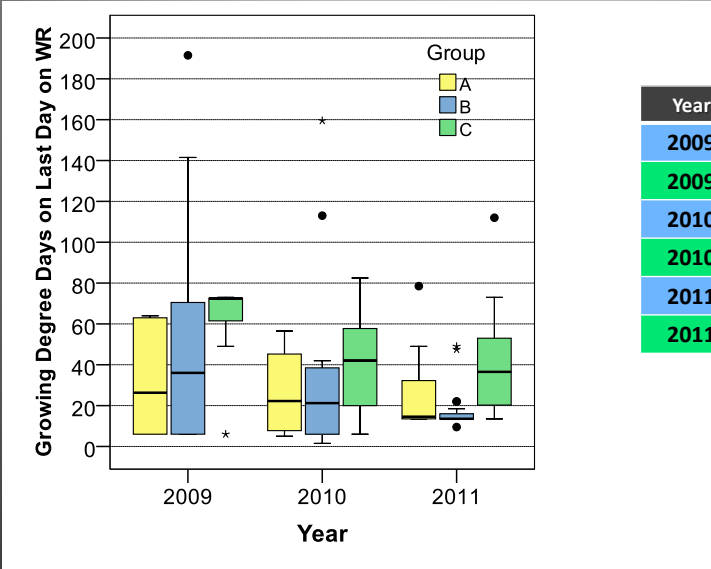
Inter-quartile Range

2009→2010: -13.0 – +3.0
 2010→2011: -2.5 – +23.5
 2011→2012: -9.0 – +12.0

Observed Range

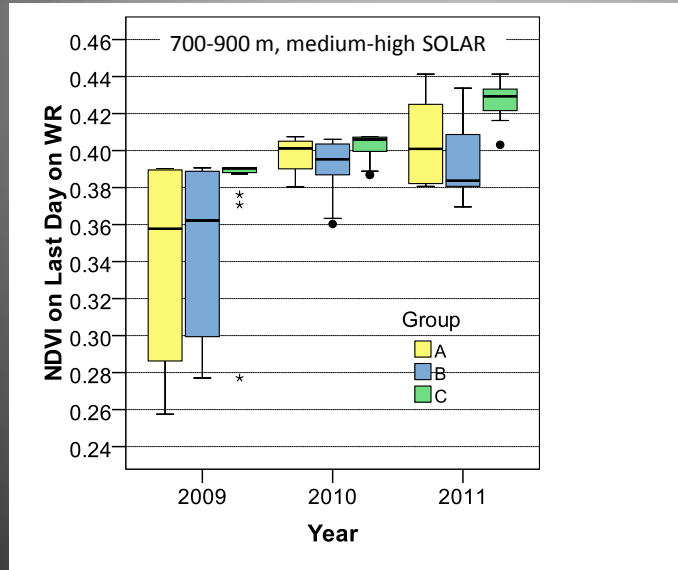
2009→2010: -34 – +16
 2010→2011: -25 – +67
 2011→2012: -71 – +24

Spring Migration: GDD



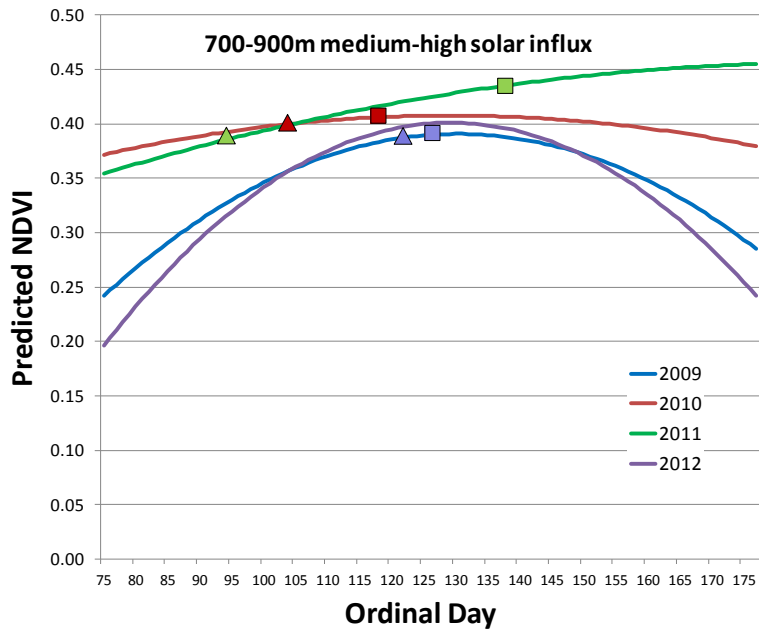
Year	Median
2009	36.0
2009	72.5
2010	21.3
2010	42.0
2011	13.5
2011	36.5

Spring Migration: NDVI

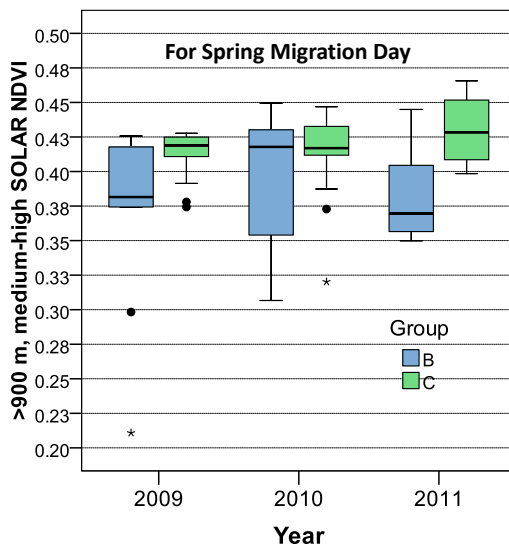


Year	Median
2009	0.362
2009	0.390
2010	0.395
2010	0.406
2011	0.384
2011	0.429

Year	3 rd quartile
2009	0.389
2009	0.391
2010	0.404
2010	0.407
2011	0.409
2011	0.433



Spring Migration: NDVI

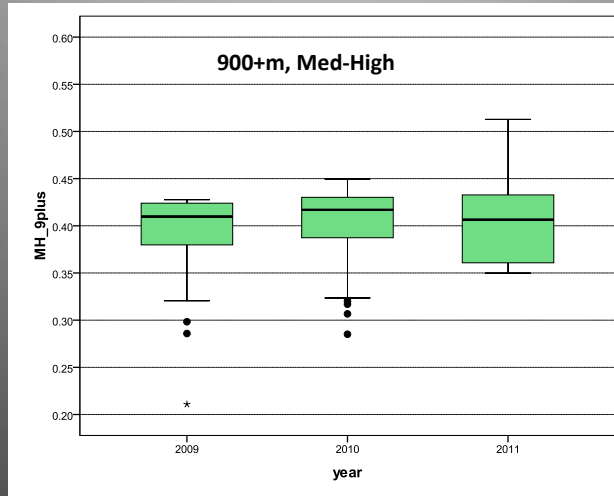


Year	Median
2009	0.382
2009	0.419
2010	0.418
2010	0.417
2011	0.370
2011	0.428

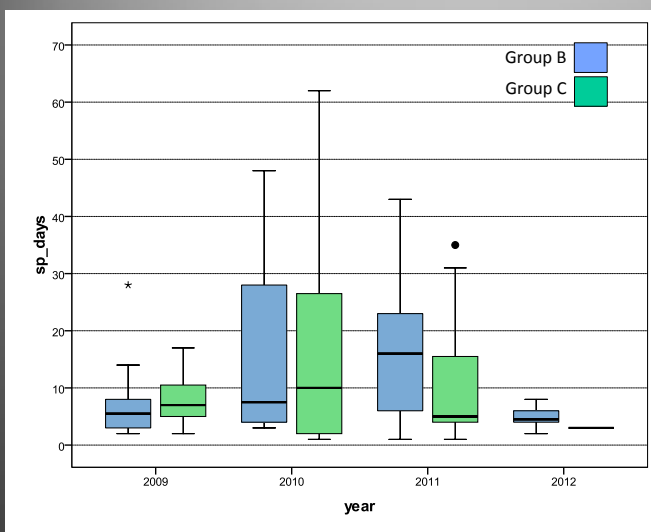
Year	3 rd quartile
2009	0.418
2009	0.425
2010	0.430
2010	0.433
2011	0.405
2011	0.452

Spring Migration

Closure and Non-closure Wintering Elk Pooled

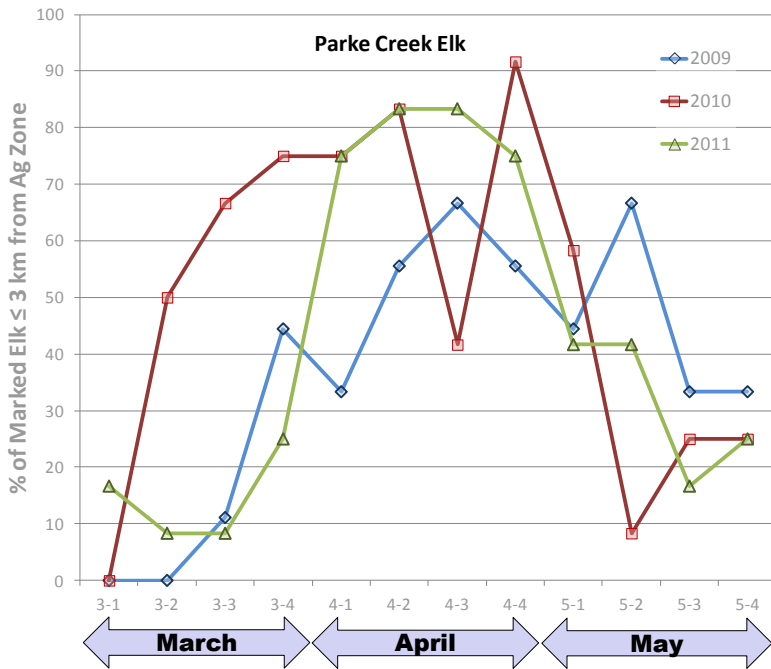
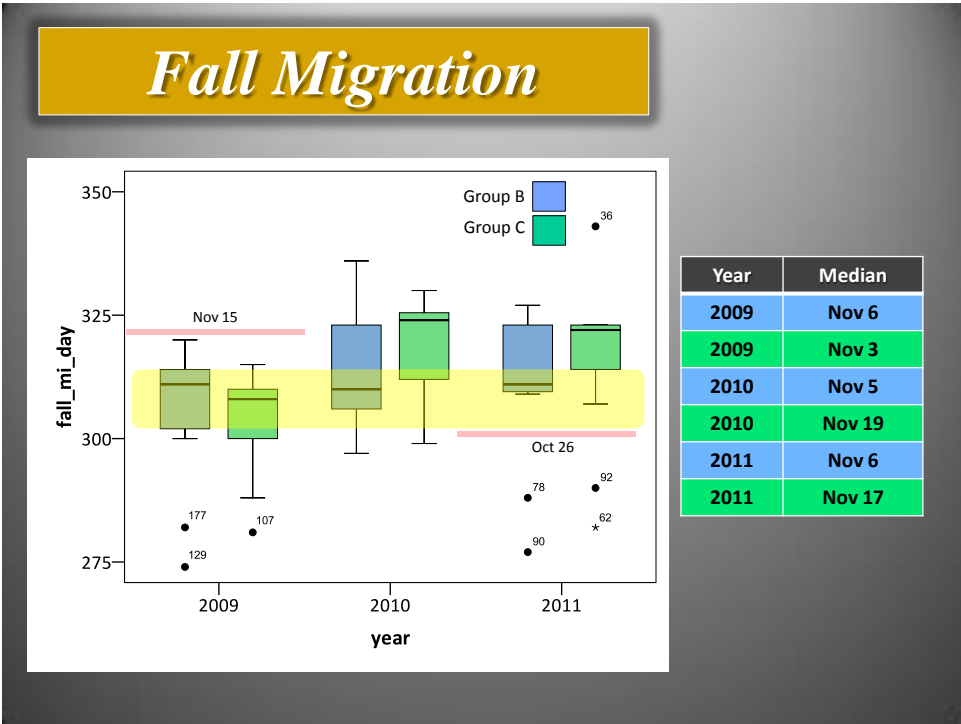


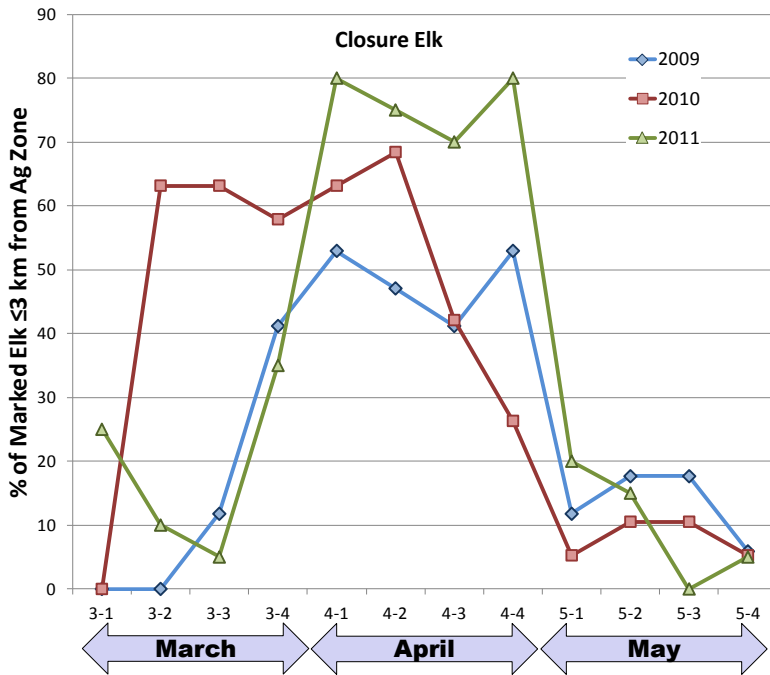
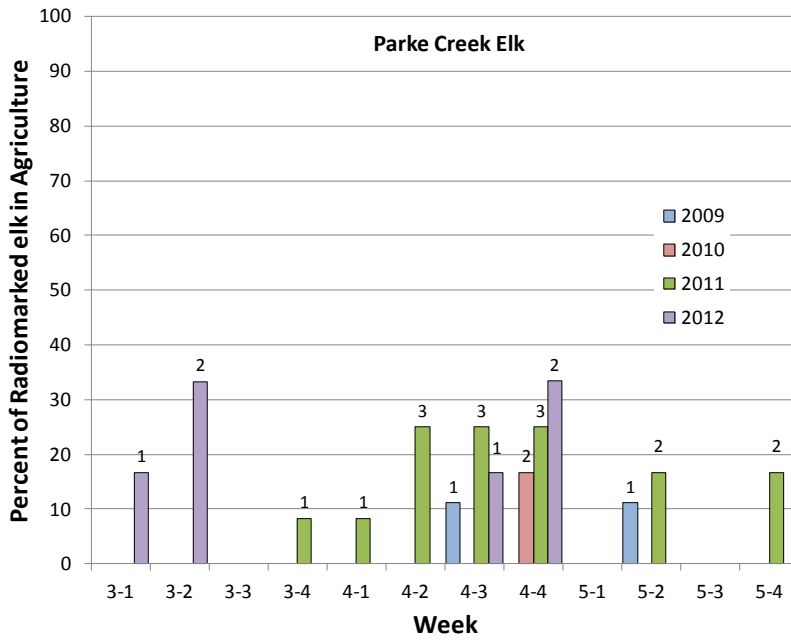
Spring Migration

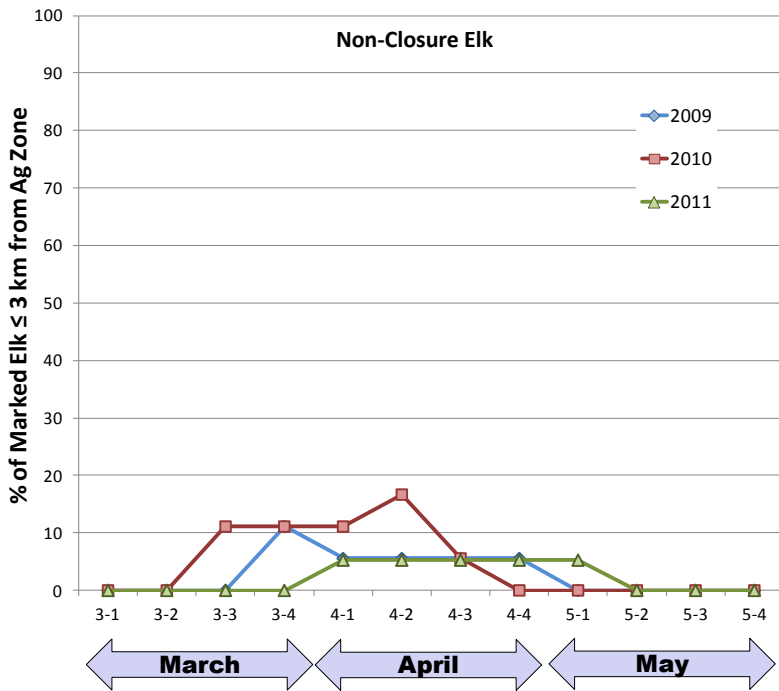
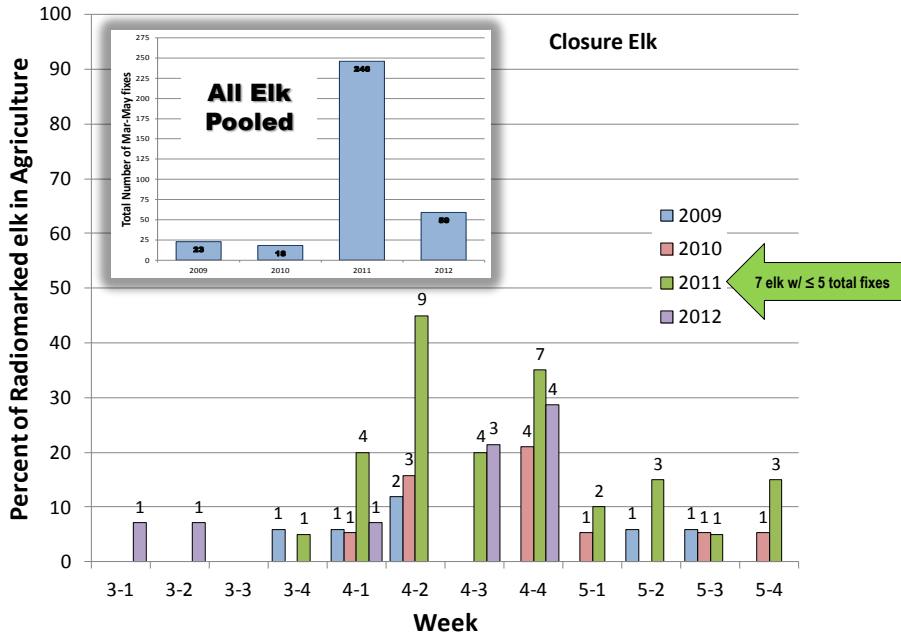


Year	Median
2009	6 days
2009	7 days
2010	8 days
2010	10 days
2011	16 days
2011	5 days

Year	3 rd quartile
2009	9 days
2009	11 days
2010	28 days
2010	27 days
2011	23 days
2011	16 days







Conclusions...

- Most Colockum cow elk were in modest to marginal physical condition entering winter
- Parke Creek elk were spatially and socially integrated with core herd elk but were behaviorally distinctive (temporal movements)
- Most Non-Parke Creek elk were migratory, but scale was typically modest (Closure wintering elk migrated the furthest)
- Parke Creek elk almost exclusively wintered in the WD closure, but tended to leave slightly earlier in spring than other closure-wintering elk
- Closure-wintering elk use was closer to roads than use for non-closure elk, reflecting the availability of habitat distant from roads



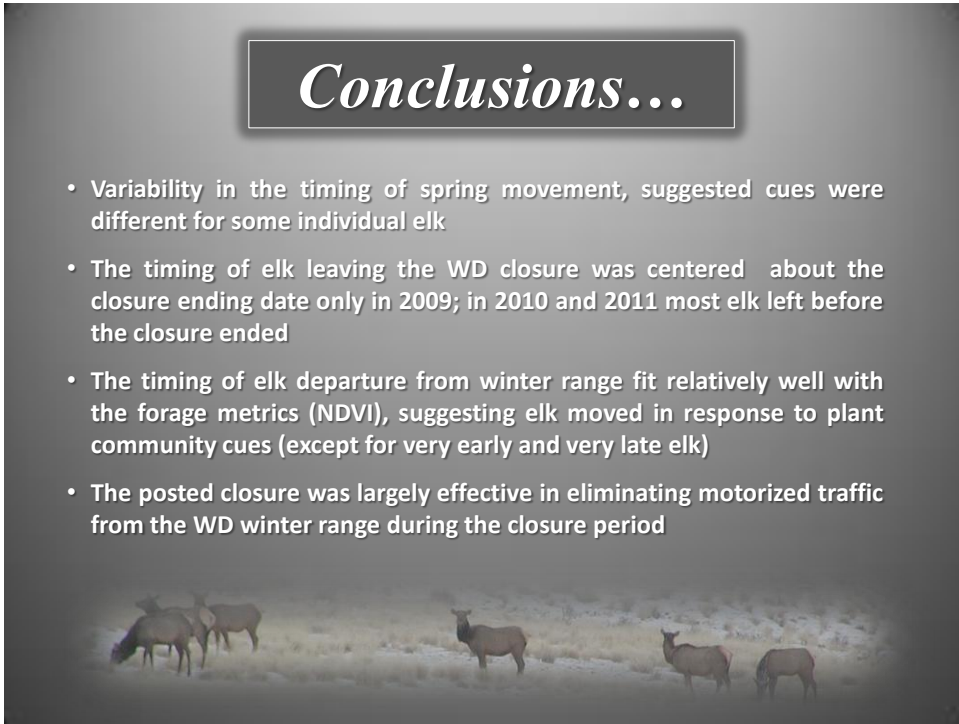
Conclusions...

- Closure-wintering elk appeared to become less sensitive to road effects during the closure period; not so for non-closure wintering elk
- The timing of spring movement was highly variable across elk and years
- Spring movement rate of elk peaked in April during most years
- Closure wintering elk typically left WR before non-closure elk
- Parke Creek elk and other Closure-wintering elk often used a transition range between SR and WR; non-closure elk typically left WR about the same time they began movement to SR
- Most Closure-wintering elk transitioning near Parke Creek did not use agricultural fields or pastures (but, higher [~20-40%] in 2011)



Conclusions...

- Variability in the timing of spring movement, suggested cues were different for some individual elk
- The timing of elk leaving the WD closure was centered about the closure ending date only in 2009; in 2010 and 2011 most elk left before the closure ended
- The timing of elk departure from winter range fit relatively well with the forage metrics (NDVI), suggesting elk moved in response to plant community cues (except for very early and very late elk)
- The posted closure was largely effective in eliminating motorized traffic from the WD winter range during the closure period



Summary Thoughts

- Virtually all western states employ temporary winter access closures (e.g., Sun River Game Range in MT; Pinedale, WY, BLM closures) to reduce disturbance to winter concentrations of elk and deer on key ranges (most are 30-60 days longer than the Whiskey Dick closure).
- RMEF (among others) has historically been supportive of temporary winter range access closures to reduce disturbance of winter concentrations of elk.
- Data for Colockum elk (and Yakima elk) clearly demonstrate that wintering elk in this region are in marginal physical condition during the mid-to-late winter period (energy stores are low).
- Although the Whiskey Dick closure did not appear to substantially delay collared elk from moving westward from the core winter range, few of these elk were detected on developed agriculture; concurrently spring damage complaints have been reduced.