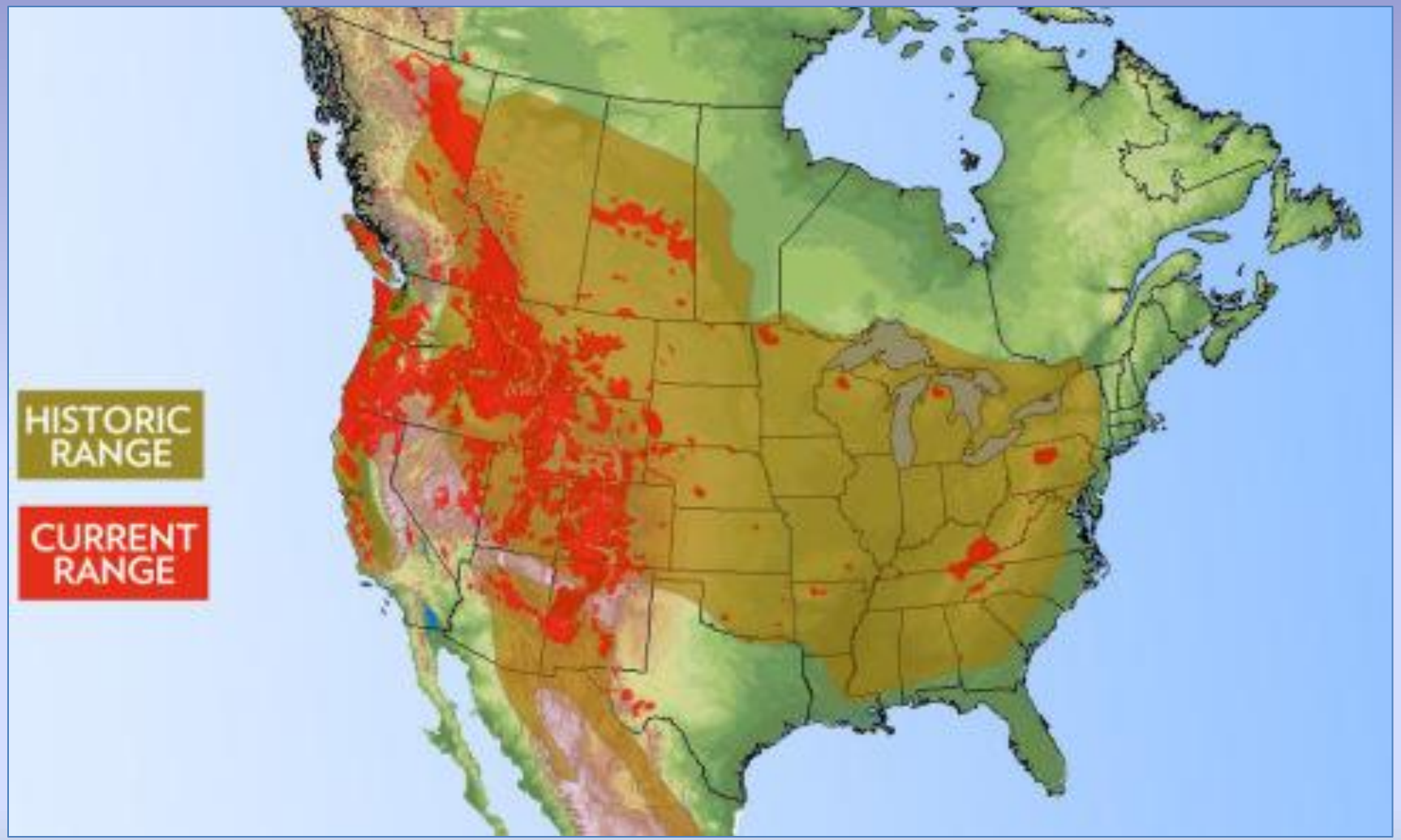
Elk Population Dynamics and the Primary Factors That Drive Them

By: Ken Robins BSCI 462

Goals For Presentation

- Briefly discuss biology/ecology of elk
- Highlight factors that effect population dynamics
- Review studies that offer explanations or support of these factors
- Form conclusions for management implications

Elk (*Cervus elaphus*) North American Range



Biology

- Elk are ungulates belonging to the deer family
- Antler size indicates dominance, nutritional state and genetic fitness of males
- Breeding period occurs from early September to mid-October
- Adult males weigh about 700 pounds, adult females weigh about 500 pounds
- Gestation period is 8-1/2 months
- Usually one calf is born; twins are very rare
- Average life span is 13 to 18 years
- K-selected species

Limiting Factors

- Predation
- Climate
- Habitat
- Population Density
- Inbreeding
- Disease

Predation

Predated by:

- wolves
- grizzly bears
- black bears
- cougars
- coyotes
- people

- Recent re-introduction of gray wolves believed by some to be the cause of declining populations because they target calves

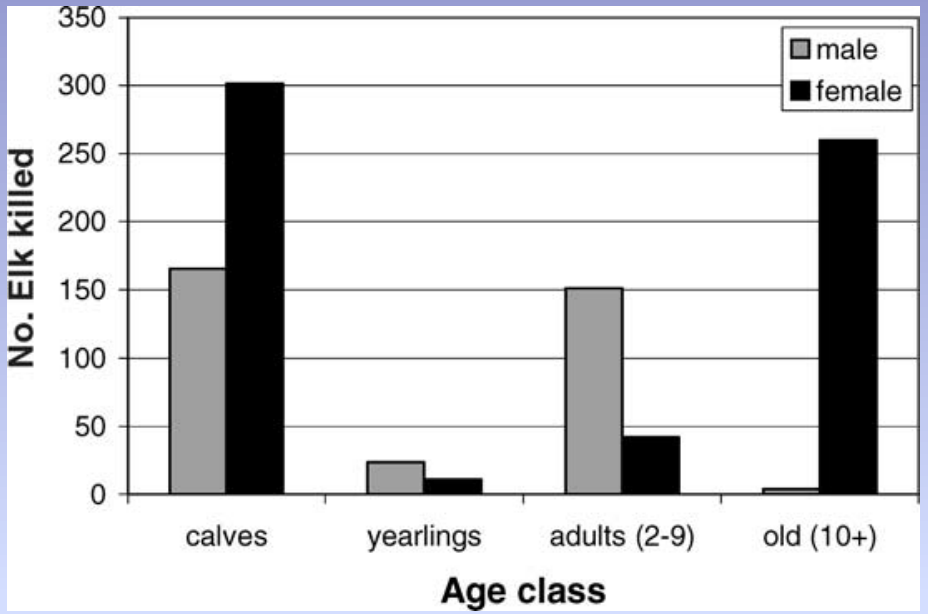
- Wolves generally cull the most vulnerable (e.g., young, old, weak, or diseased)

Human Predation

- Without the presence of additional predators, which in many states is the case, regulated harvest takes the place of predation by animals
- Shown to strongly affect the population characteristics of hunted populations

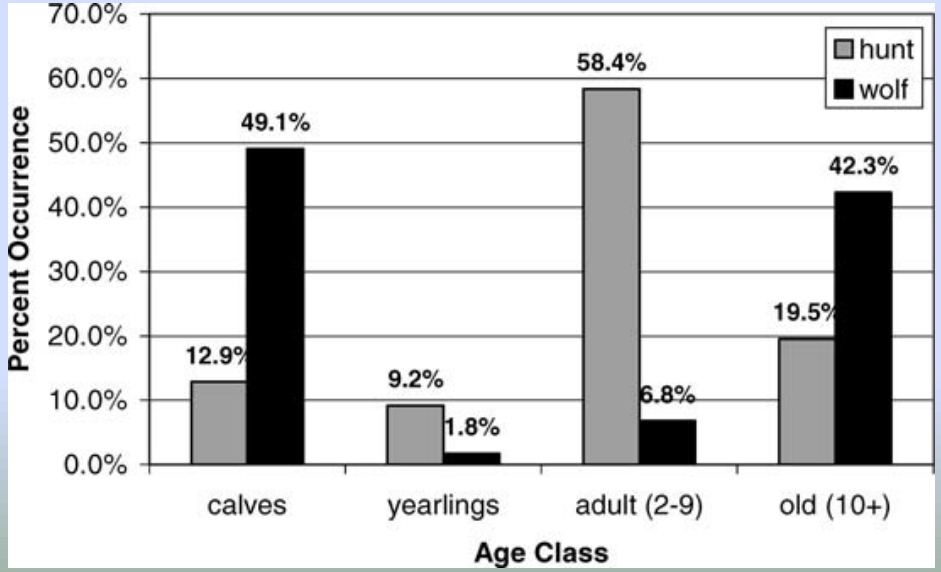
- The combination of human hunting and wolf predation, or predation from multiple large predators may offset or exceed recruitment, leading to a decline in the prey population

Northern Yellowstone study 1995-2001

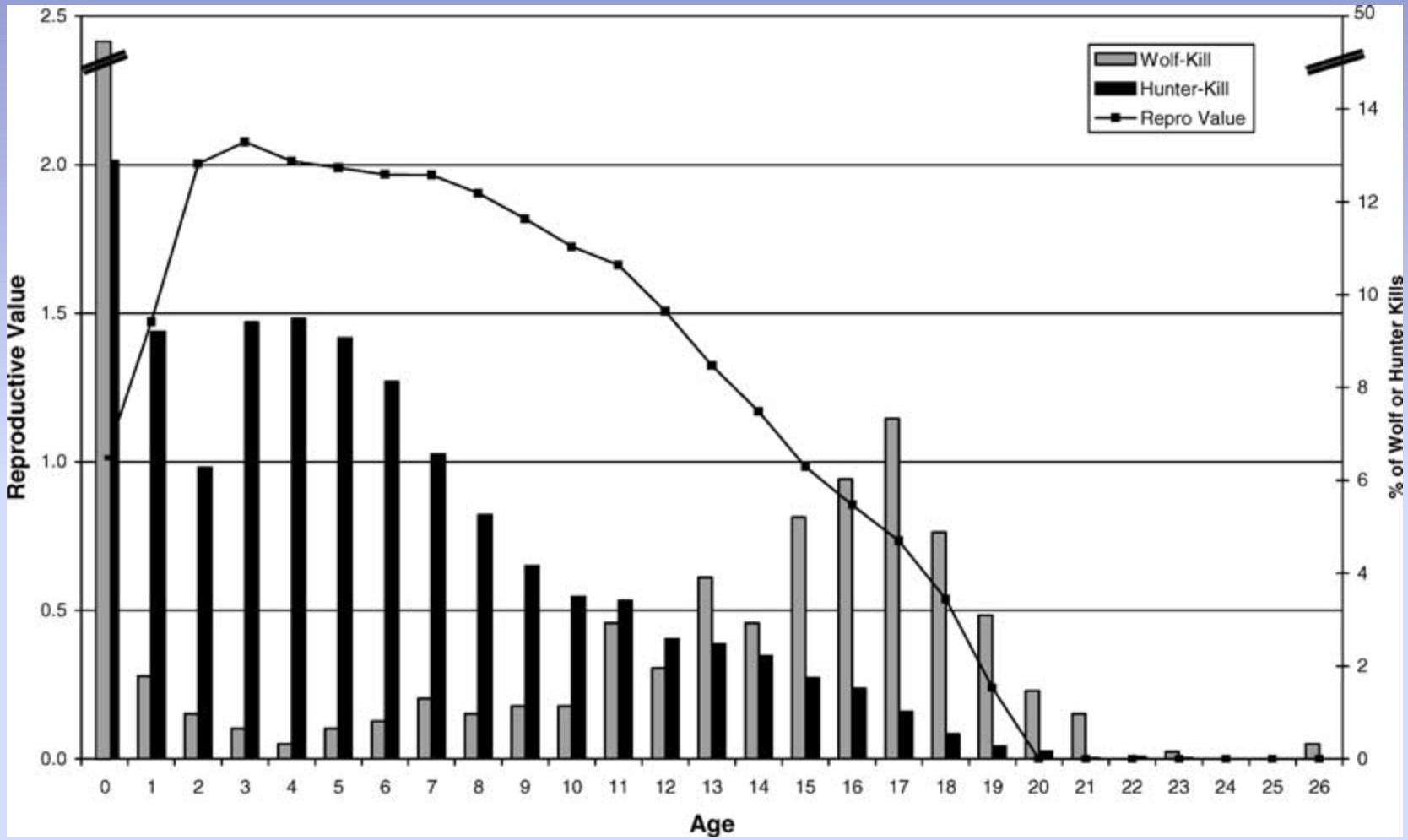


- Wolves tend to select female elk under the age of 1, or 10 years and older

- Humans tend to harvest primarily females between the ages of 2-9, the most productive age range



Effects of Wolf and Human Predation

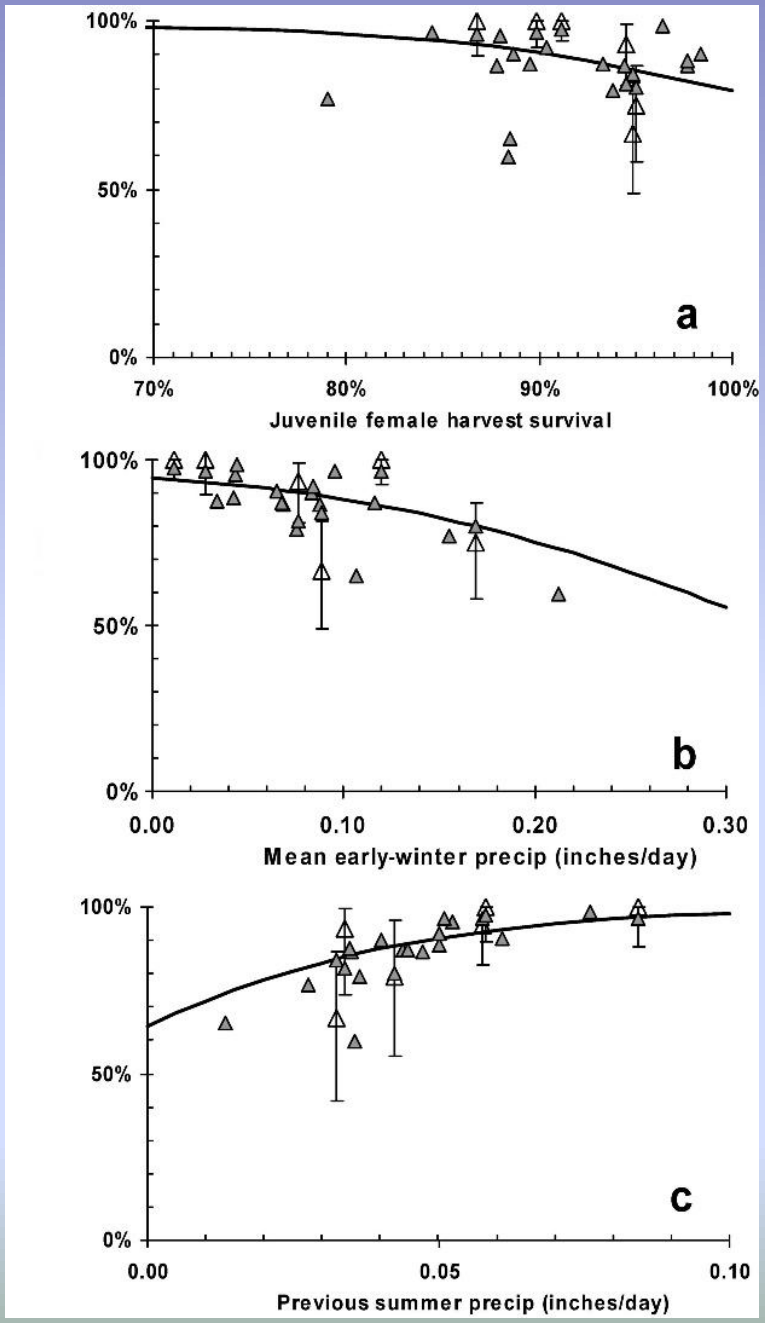


- Humans remove the most productive elk, while wolves remove the least productive and those most likely to die off in the winter

Population Density

2005 study in northeastern Oregon and southeastern Washington

- Study shows that both female fecundity and body condition were significantly higher in low population density
- Density-dependent factors overrode the effects of density-independent factors
- Disease more abundant in high-density populations
- High-density populations bad!



Climate

a) Negative autocorrelation between survival of harvest and winter survival. Elk not harvested more likely to survive winter

b) Higher early-winter precipitation correlates with lower juvenile survival

c) Higher summer precipitation correlated with higher juvenile survival

- Historically, precipitation levels and winter severity have had the greatest impact on northern herd abundance through large reductions from winter-kill.

- If climate change produces increasingly mild winters, populations have the potential to increase at rates as high as 28% until resources are stripped (particularly aspen) and the population crashes

Disease

- Brucellosis - contagious bacterial disease that originated in livestock and often causes infected cows to abort their first calves. Average of 30% elk on feedgrounds have tested positive for exposure

- Chronic Wasting Disease - No vaccination or treatment. Spreads easily in high density populations

- Disease generally only accounts for about 3% of mortality

Future Management Implications

- Re-introduced predators will need to be closely monitored to determine the most beneficial density
- Chronic Wasting Disease needs to be closely monitored and infected culled from herd
- Climate change may lead to severe changes in habitat and thus changes in population density. Harvest should be quickly adjusted accordingly
- Human harvest needs to be directed toward less productive life stages of the elk to continue culling weakest from the herd but allowing high productivity while populations are low
- Once populations are at a higher level, harvest can be redirected to the proper life stages to continue healthy population levels

Literature Cited

Coughenour, M. B., & Singer, F. J. (January 01, 1996). Elk population processes in yellowstone national park under the policy of natural regulation. *Ecological Applications*, 6, 2, 573-593.

Eberhardt, L. E., Eberhardt, L. L., Tiller, B. L., & Cadwell, L. L. (1996). Growth of an isolated elk population. *Journal of Wildlife Management*, 60, 2, 369-372.

Hebblewhite, M., Pletscher, D. H., & Paquet, P. C. (2002). Elk population dynamics in areas with and without predation by recolonizing wolves in banff national park, alberta. *Canadian Journal of Zoology*, 80, 5, 789.

Hebblewhite, Mark, Merril, Evelyn H., Morgantini, Luigi, White, Clifford A., Allen, James R., Bruns, Eldon, Thurston, Linda, Whittaker, Hurdtomase (2006). Is the migratory behavior of montane elk herds in peril? The case of alberta's ya ha tinda elk herd. *Wildlife Society Bulletin*, 34, 5, 1280-1294.

Hundertmark, K. J., & Daele, L. J. (January 01, 2010). Founder effect and bottleneck signatures in an introduced, insular population of elk. *Conservation Genetics*, 11, 1, 139-147.

Larin, J. L., Maehr, D. S., Cox, J. J., Bolin, D. C., & Wichrowski, M. W. (2003). Demographic characteristics of a reintroduced elk population in kentucky. *The Journal of Wildlife Management*, 67, 3, 467.

Larkin, J. L., Maehr, D. S., Cox, J. J., Wichrowski, M. W., & Crank, R. D. (2002). Factors affecting reproduction and population growth in a restored elk cervus elaphus nelsoni population. *Wildlife Biology*, 8, 49-54.

Lubow, Bruce C., & McCorquodale, Smith, Bruce L. (2004). Population dynamics of the Jackson elk herd. *Journal of Wildlife Management*, 68, 4, 810-829.

Murrow, J. L., Clark, J. D., & Delozier, E. K. (2009). Demographics of an experimentally released population of elk in great smoky mountains national park. *Journal of Wildlife Management*, 73, 8, 1261-1268.

Raithel, Jarod D., Kauffman, Matthew J., & Pletscher, Daniel H. (2007). Impact of spatial and temporal variation in calf survival on the growth of elk populations. *Journal of Wildlife Management*, 71, 3, 795-803.

Sargeant, G. A., Weber, D. C., & Roddy, D. E. (2011). Implications of chronic wasting disease, cougar predation, and reduced recruitment for elk management. *Journal of Wildlife Management*, 75, 1, 171-177.

Sargeant, Glena, & Oehler, Michael W. (2007). Dynamics of newly established elk populations. *Journal of Wildlife Management*, 71, 4, 1141-1148.

Stewart, K. M., Bowyer, R. T., Dick, B. L., Johnson, B. K., & Kie, J. G. (2005). Density-dependent effects on physical condition and reproduction in north american elk: an experimental test. *Oecologia*, 143, 1, 85-93.

Wang, G., Thompson, H. N., Singer, F. J., Ojima, D. S., & Lubow, B. C. (2002). Impacts of climate changes on elk population dynamics in rocky mountain national park, colorado, U.S.A. *Climatic Change*, 54, 205-223.

Weisberg, P. J., & Coughenour, M. B. (2003). Model-based assessment of aspen responses to elk herbivory in rocky mountain national park, USA. *Environmental Management*, 32, 1, 152-69.

White, P. J., & Garrott, R. A. (2005). Northern yellowstone elk after wolf restoration. *Wildlife Society Bulletin*, 33, 3, 942-955.

Wright, Gregory J., Peterson, Rolfo, Smith, Douglas W., & Lemke, Thomas O. (2006). Selection of northern yellowstone elk by gray wolves and hunters. *Journal of Wildlife Management*, 70, 4, 1070-1078.