California Wolf Center

Conservation, Education, Research

Gray Wolf Habitat Suitability Analysis for Northern California

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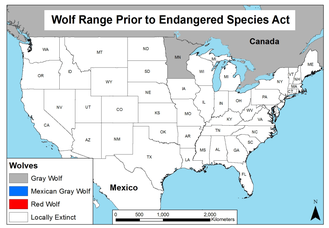
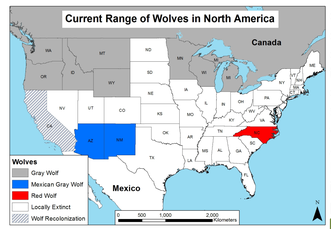
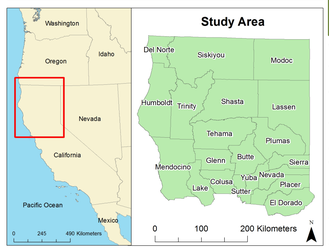
Introduction





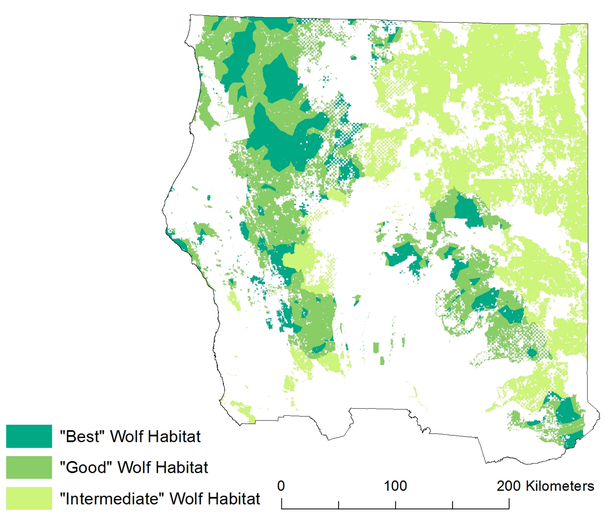
The gray wolf (*Canis lupus*) historically used to be **native to all of North America**.[1] By 1960, wolves had been **extirpated from the conterminous U.S.** with the exception of a small population in Minnesota.[1] Since gaining protection under the **Endangered Species Act**, wolf populations have slowly recovered and begun to **recolonize parts of their former range**.[1] An increase in wolf populations in the Pacific Northwest has resulted in a few **wolves dispersing into Northern California to seek out new habitat**. These dispersing wolves have generated a high level of public interest.[2] The California Department of Fish & Wildlife has begun a planning process for gray wolf management to address concerns that arrive with the presence of wolves, such as **wolf-livestock conflicts**, maintenance of prey sources and conserving a sustainable population.[2] Another concern is that **wolves are returning to a different landscape here in California today after almost 100 years of absence**. Much of the habitat once occupied by wolves has been developed or converted to agriculture. Road densities have increased substantially, and the population of California has grown to over 38 million people.[2] The objective of this study was to **explore the prospects for wolf recovery in Northern California**. ArcMap (ESRI, Redlands,CA), a Geospatial Information System (GIS), was used to identify suitable habitat for gray wolves and potential wolf-livestock conflict areas.

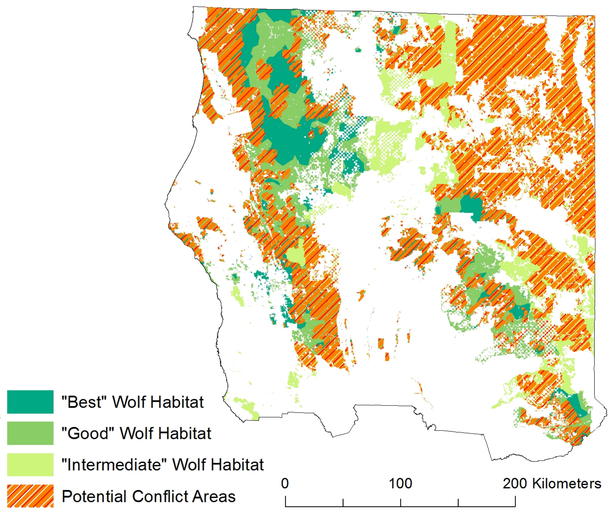
Gray Wolf Habitat



Wolves are **habitat generalists** and, therefore, can live in most places in North America that have a sufficient prey base (primarily large ungulates).[1] Conflicts typically occur, however, when they occupy areas close to humans.[3] The **majority of wolf mortality** in the wild **is human-caused**.[3] Identifying favorable wolf habitat thus becomes a process of locating areas that contain sufficient prey and provide security from humans to lessen conflict.[4]

Potential Gray Wolf Habitat & Wolf-Livestock Conflict Areas



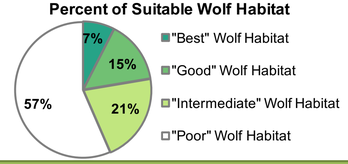


In August of 2015, a **trail camera** captured photos of five wolf pups and two adults in Siskiyou County. They were named the **"Shasta pack."**

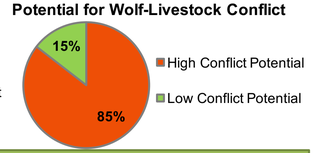
Results & Conclusion

The results indicate that Northern California has **substantial amount of suitable wolf habitat**, with most of the highest quality habitat located in the **Klamath Mountains** in Northwestern California. Large areas of public land and forest cover combined with low road and human population densities all favor wolf recolonization. However, the **small elk population** and **depressed deer populations are problematic**, especially in the northeastern portion of California. (Elk density was not included in this study, because elk populations are patchy and the vast majority of prey biomass for wolves in this region will consist of deer.) Moreover, while sheep densities are low, **high cattle densities** generate high potential for wolf-livestock conflicts. Significant funding and effort will be necessary to **implement nonlethal livestock protection methods** to minimize predation on livestock. Low prey density and high potential for conflict indicate that the region can only support a relatively small wolf population. Wolf densities can vary tremendously, ranging from less than 5 wolves per 1,000 km^2 near the arctic circle to over 50 wolves per 1,000 km^2 in prey-rich areas. Applying an equation that relates wolf density to prey abundance, wolf habitat identified in the study area can support an average of **12 wolves per 1,000 km^2**.[1] The **total potential habitat is 54,048 km^2**, meaning that Northern California would be able to **support 649 wolves**. However, this does not account for habitat fragmentation, edge effects and the need for core areas. The reality is that the biological carrying capacity hinges on the political will of the people, regulatory decisions of government agencies and the willingness of humans to share the landscape with this apex predator.

Percent of Suitable Wolf Habitat



Percent Wolf Habitat Area with Potential for Wolf-Livestock Conflict



Methods

To determine suitable habitat for wolves in Northern California, **five variables** were examined: **prey density** (primarily deer in this region), **public land** ownership, **forest cover**, **road density** and human **population density**. To identify potential wolf-livestock conflict areas, **sheep density**, **cattle density** and **land use** (agricultural and rangeland) data was also taken into account. Data was acquired from the California Department of Fish & Wildlife, California Department of Forestry & Fire Protection, California Department of Transportation, U.S. Bureau of Land Management, U.S. Census Bureau, U.S. Forest Service, U.S. Geological Survey and the U.S. Department of Agriculture. The data was converted into GIS layers through **table joins** between excel datasheets and shapefiles containing administrative boundaries, using the spatial unit name as the join key. **Density tools** and several **geoprocessing functions** (clip, dissolve, merge, etc.) were performed to pretreat the layers for further spatial analysis. **Thresholds** were determined for each variable based on previous research to **reclassify attributes** into favorable and unfavorable conditions for wolves.[3,4,5,6,7] The **intersect tool** was then used to identify areas in which favorable wolf habitat attributes overlapped. **Areas of overlap** were then classified into "best," "good" and "intermediate" wolf habitat based on how many favorable attribute values intersected in a given area. Similarly, to identify potential conflict zones, the intersect tool was used to overlay livestock data with predicted wolf habitat.

Acknowledgements & References

I thank the staff from the **California Wolf Center**, especially **Erin Hunt**, **John Murtaugh** and **Heidi Pankratz**, for being such supportive mentors and providing me with a positive and meaningful internship experience during the summer of 2015. I also thank **Dr. Suzanne Walther** from the University of San Diego for being a passionate and caring GIS instructor during the previous semesters.

[1] Mech, D.L., and L. Boitani. 2003. Wolves: Behavior, Ecology, and Conservation. University of Chicago Press. 448 pp.
[2] California Department of Fish and Wildlife. 2015. Draft Conservation Plan for Gray Wolves in California Part 1. 23 pp.
[3] Mech, L.D. 1989. Wolf population survival in an area of high road density. American Midland Naturalist 121:387-389.
[4] Mladenoff, D.J., T.A. Sickley, R.G. Haight, and A.P. Wydeven. 1995. A regional landscape analysis and prediction of favorable gray wolf habitat in northern Great Lakes region. Conservation Biology 9:279-294.
[5] Thiel, R.P. 1985. Relationship between road densities and wolf habitat suitability in Wisconsin. *American Midland Naturalist* 113:404-407.
[6] Oakleaf, J.K., Murray, D.L., Oakleaf, J.R., Bangs, E.E., Mack, C.M., Smith, D.W., Fontaine, J.A., Jimenez, M.D., Meier, T.J. and C.C. Niemeyer. 2006. Habitat Selection by Recolonizing Wolves in the Northern Rocky Mountains of the United States. Journal of Wildlife Management 70:554–563.
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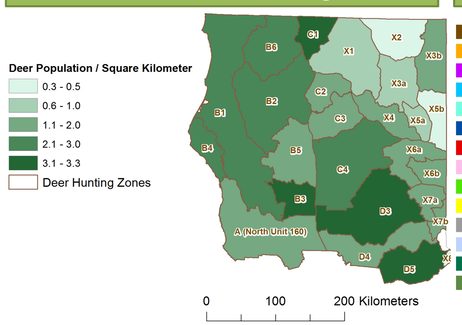
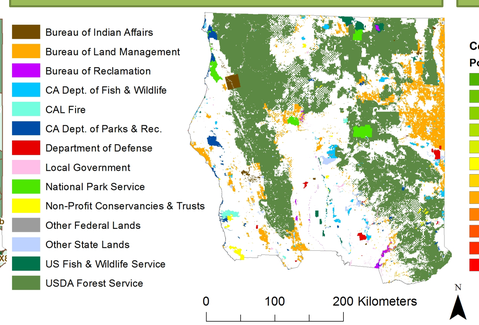
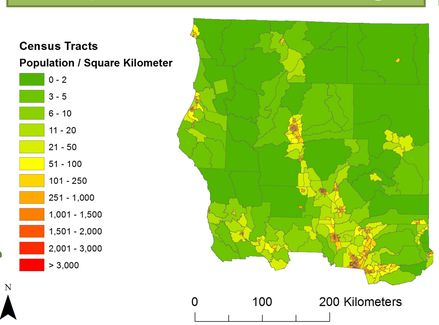
Deer Density



Public Land



Population Density



Road Density

Cattle Density

Sheep Density