

# American Pika (*Ochotona princeps*) habitat assessment for Boulder county, Colorado

GEOG5080: Intro to GIS, Final Project

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## 1. Abstract

The purpose of this geodatabase is to provide a variety of layers and datasets that can be used to assess the spatial distribution of American pika habitat and what areas are already being protected within Boulder County, Colorado. All feature classes and feature datasets have been projected in “NAD 1983 StatePlane Colorado North FIPS 0501 (Meters)”. This coordinate system uses a Lambert Conformal Conic projection because the zones in Colorado run east-west. This coordinate system was chosen because it’s the most tailored to this part of the state, and the entirety of Boulder County lies within the CO North State Plane. This geodatabase includes four feature datasets (Admin, Recreation, Transportation, and Water) and 5 pairs of rasters depicting pika habitat requirements (aspect, elevation, and landcover), ranked pika habitat, and Boolean pika habitat.

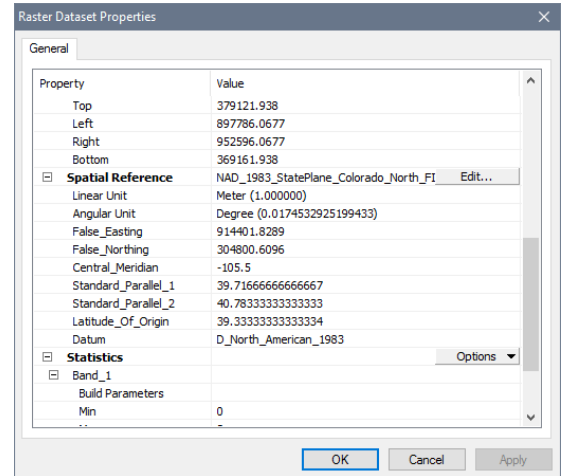
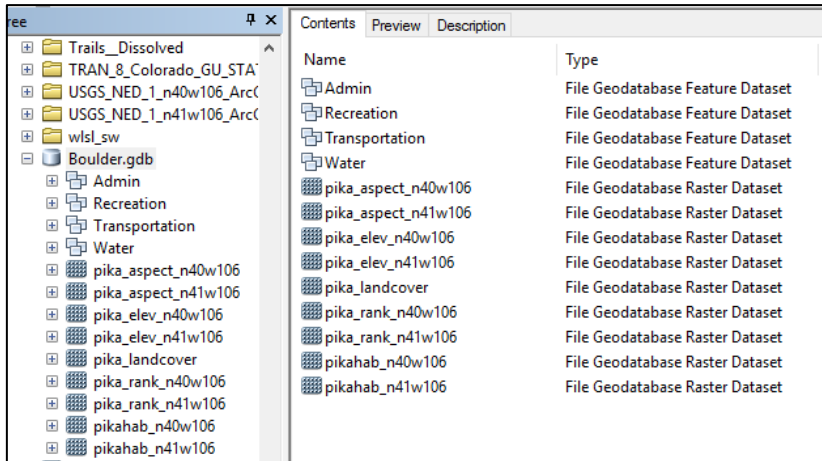
## 2. Introduction

The American pika (*Ochotona princeps*), a relative of the rabbit, makes its home in rocky talus fields at or above tree line. It is one of the only mammals that spends its entire adult life in the alpine zone and has a thick fur coat to keep warm during the harsh winter. Pikas spend their summer days foraging for herbaceous alpine plants and must take refuge from the heat of the sun to cool down. As a temperature-sensitive species, they are considered indicator species for climate change impacts in the alpine zone.

The rapid increase in air temperature puts the American pika at great risk of extinction. Already, approximately one-third of pika populations have been extirpated from their habitat in the Great Basin of the western United States (Beever, et al., 2003). Pika deaths have been primarily attributed to elevated temperatures and reduced winter snowpack, which helps insulate their dens during the winter. Although they are not listed as endangered or threatened, monitoring their populations and is critical to mitigating their continued extirpation and potential extinction.

Boulder County, Colorado, encompasses a large diversity of habitat, from grassland plains to alpine tundra and talus fields. A population of pika inhabit the highest elevations in the westernmost part of the County, and the pika is included on the Boulder County Wildlife Species of Special Concern list. Specifically, pika are listed as “dependent on isolated or restricted habitat for at least a portion of their life cycle,” and as a “species whose populations in the County may be currently secure, but are vulnerable to imminent threats affecting their populations either directly or indirectly” (Boulder County, 2013).

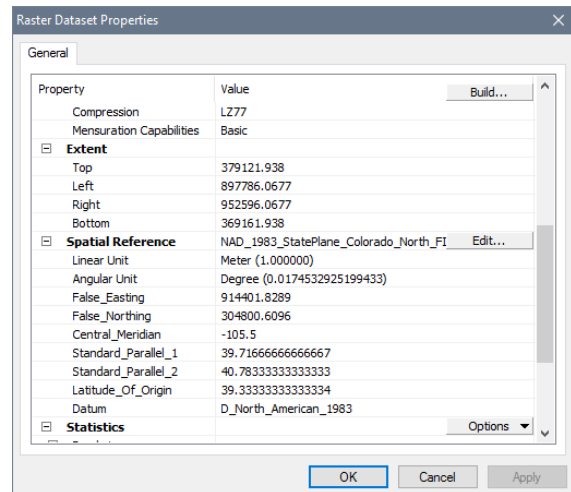
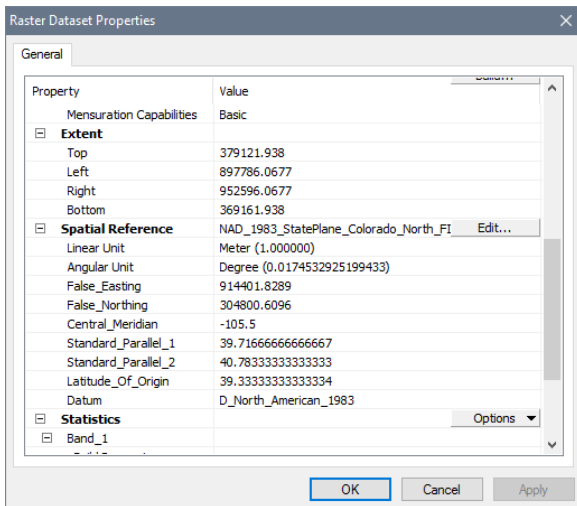
3. **Geodatabase** (summarize your geodatabase and the work you did to create it using tables and screen shots)
  - a. Specify file naming conventions & connect to a Web Map Service that serves any kind of data for your study area and use at least one data layer from that source.



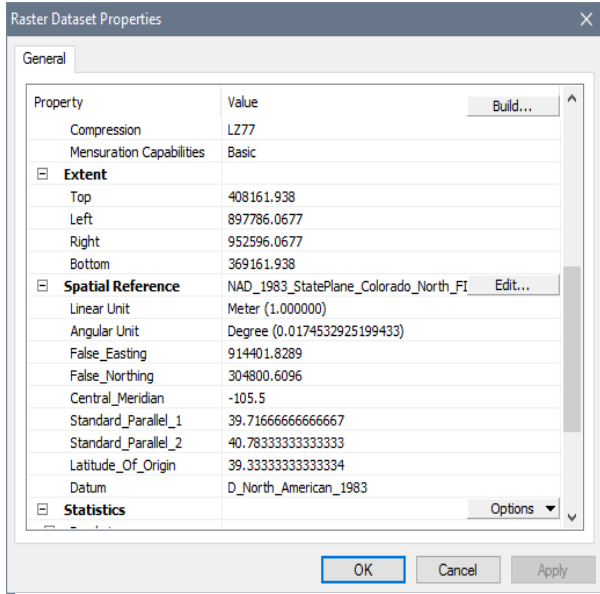
Boulder geodatabase

Pika\_rank raster

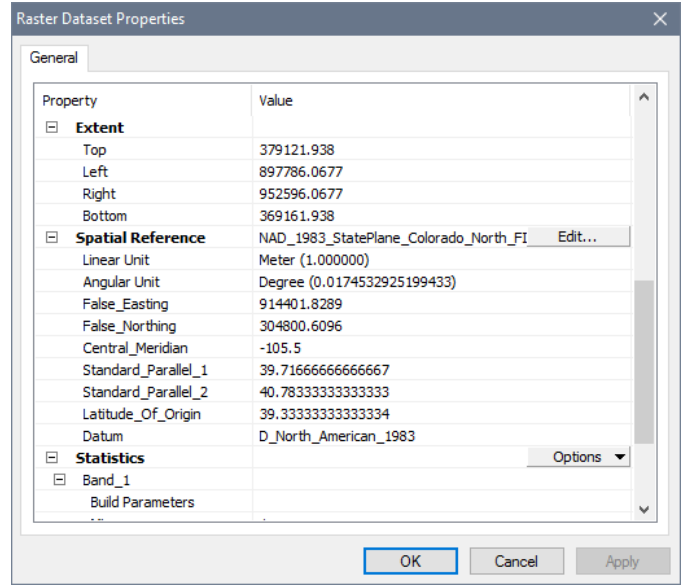
Pika aspect



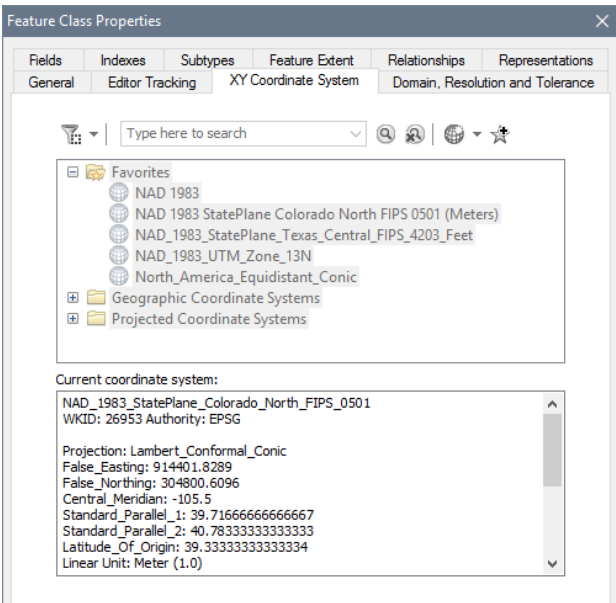
Pika elevation raster



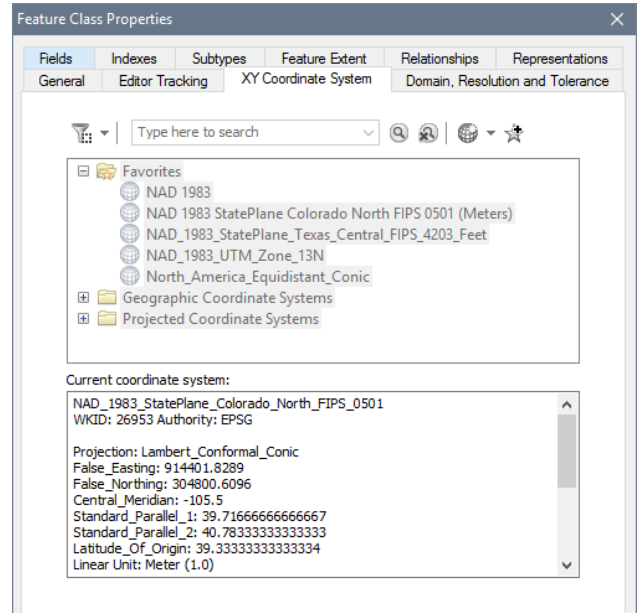
Pika landcover raster



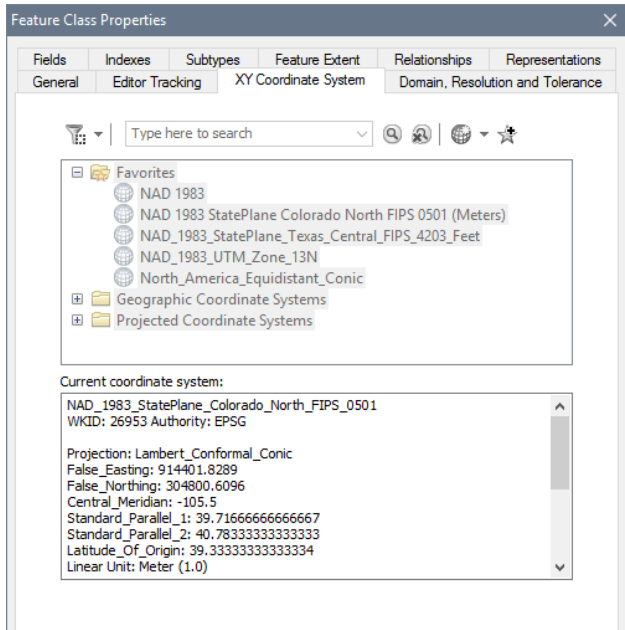
Pika habitat raster



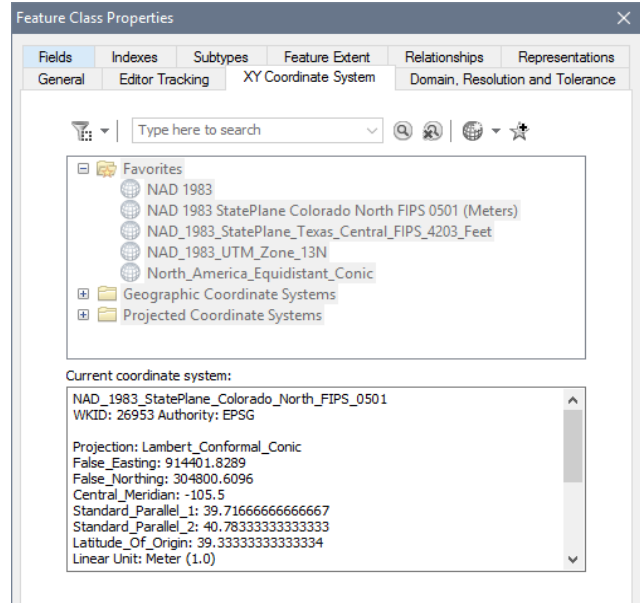
Cities\_points feature class



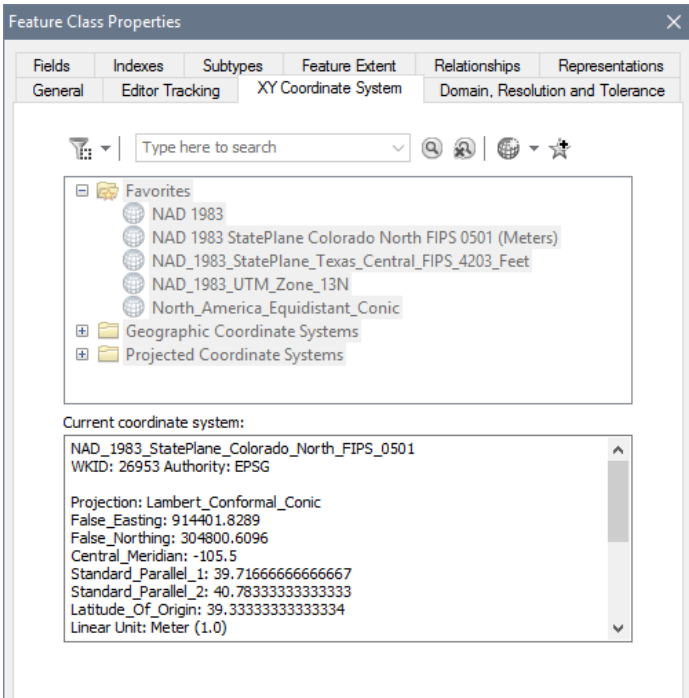
Cities\_polygons feature class



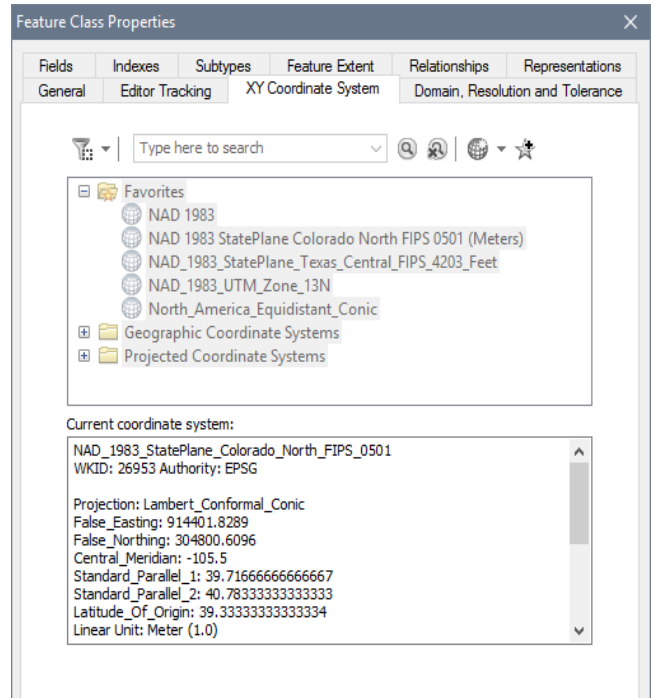
County\_boundary feature class



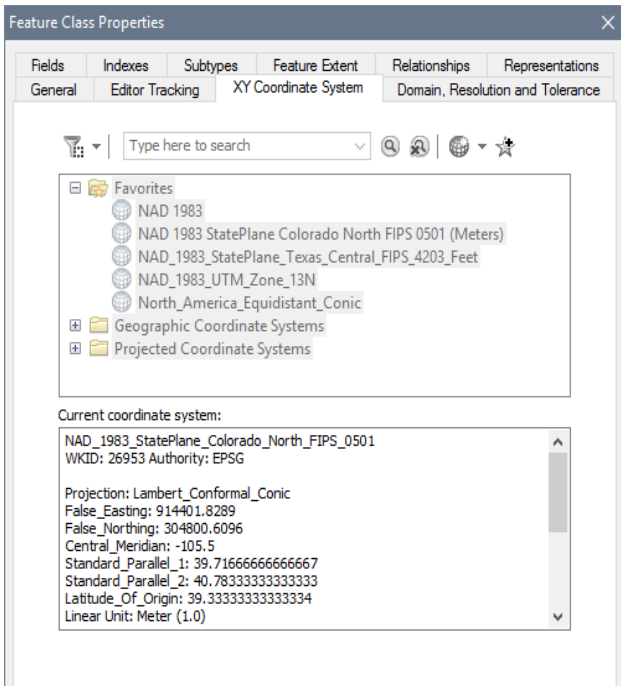
Critical Wildlife Habitats feature class



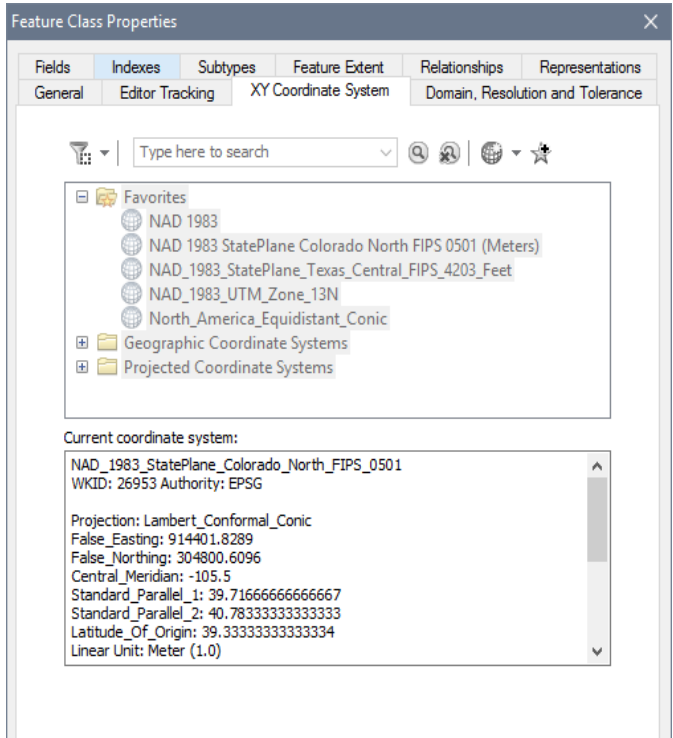
Trailheads feature class



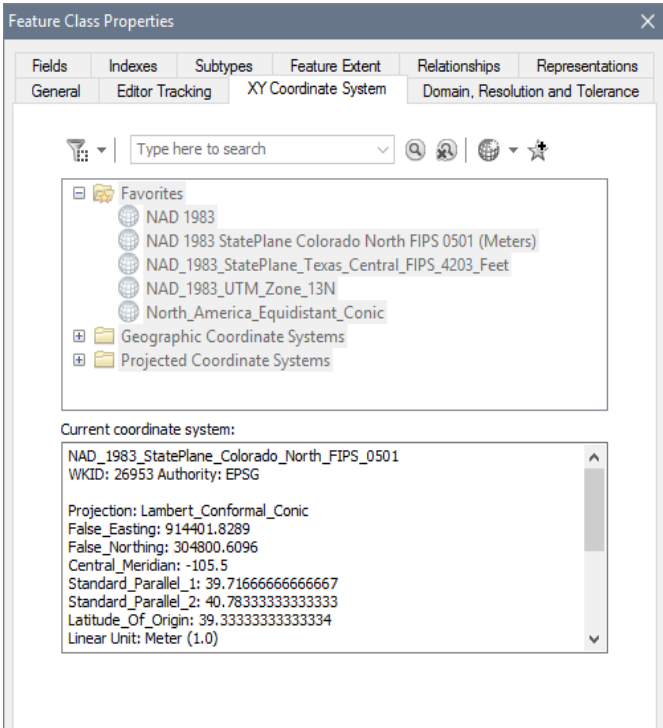
Trails feature class



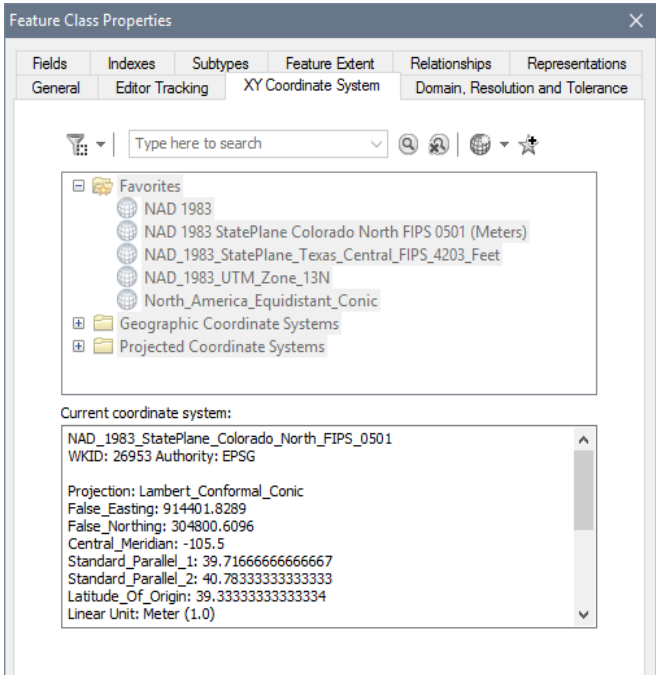
Roads feature class



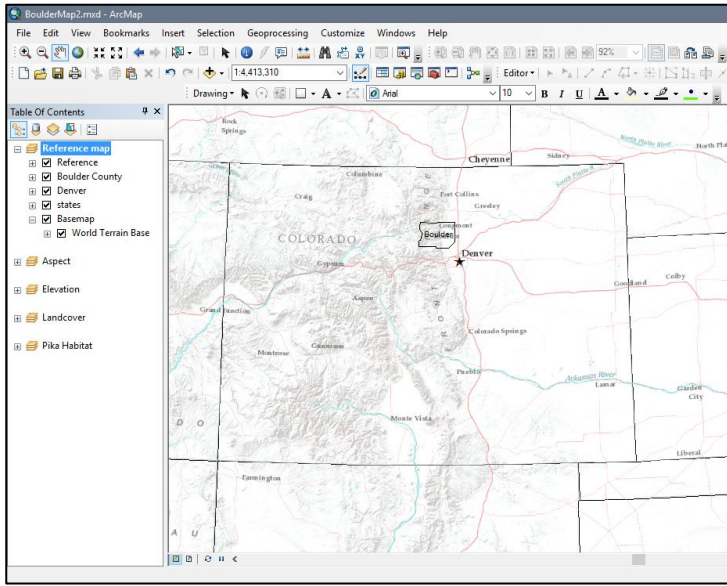
Lakes feature class



Rivers feature class



Watersheds feature class



Web map service: World Terrain Base

Used in reference map in Map #2

Table 1: Vector data		
Feature dataset	Feature class	Source
Admin	cities_points	ESRI
	Cities_polygons	ESRI
	County_Boundary	Boulder County
	Critical_Wildlife_Habitats	Boulder County
	High_Biodiversity_Areas	Boulder County
Recreation	Environmental_Conservation_Areas	Boulder County
	Trails	Boulder County
Transportation	Trailheads	Boulder County
	Roads	Boulder County
Water	Lakes	Boulder County
	Streams	Boulder County
	Watersheds	USGS National Gap Analysis Program (GAP)

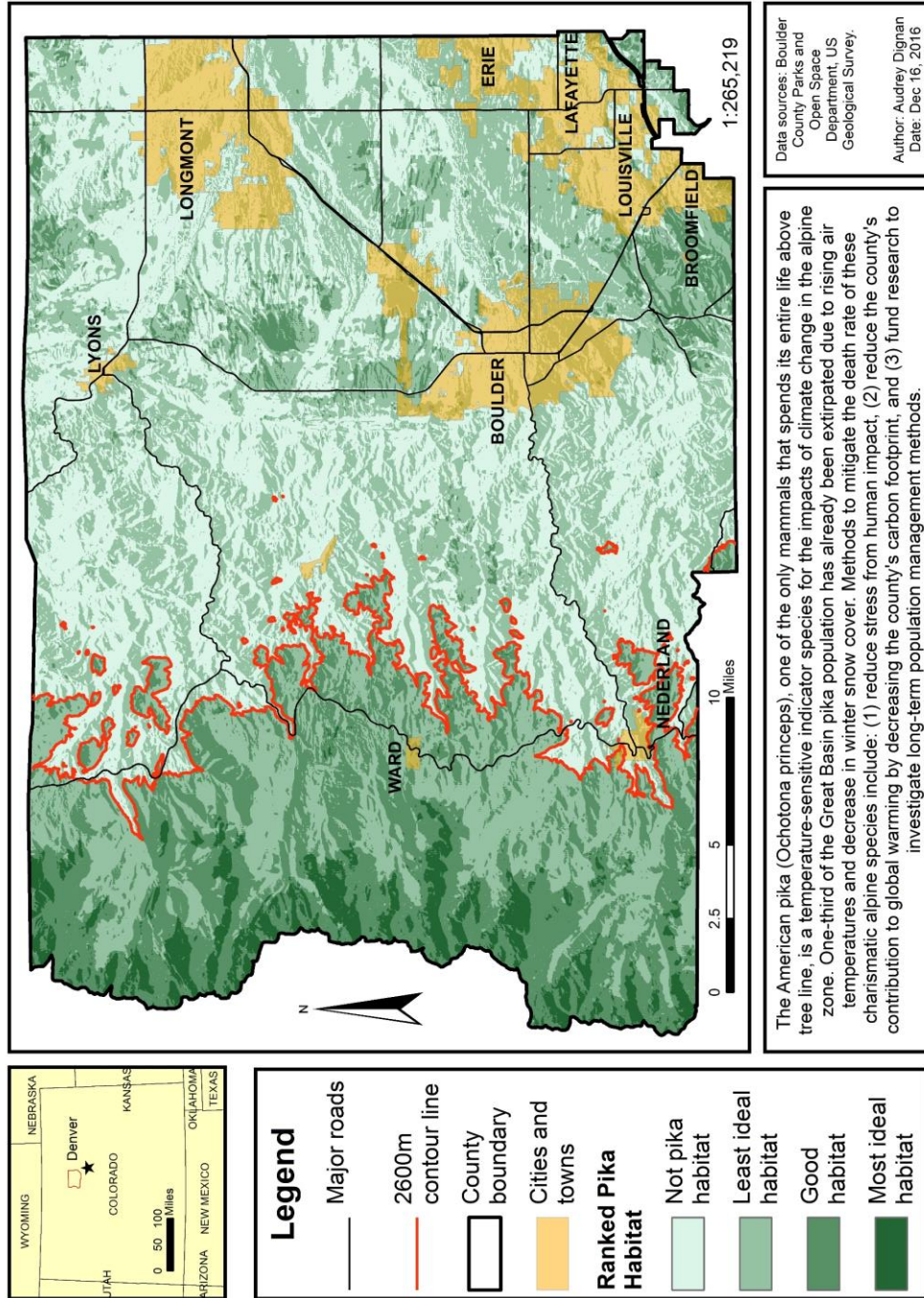
<b>Table 2: Raster data</b>			
<b>Name</b>	<b>Description</b>	<b>Resolution</b>	<b>Source</b>
Pika_aspect_n40w106 Pika_aspect_n41w106	Aspect facing north, northeast, or northwest (aspect values = 0-67.5 and 292.5-360 degrees)	1 arc-second (approx. 30 meters)	US Geological Survey National Elevation Dataset (NED) DEMs for n40w106 & n41w106
Pika_elev_n40w106 Pika_elev_n41w106	Elevation above 2600 meters	1 arc-second (approx. 30 meters)	US Geological Survey National Elevation Dataset (NED) DEM for n40w106 & n41w106
Pika_landcover	Landcover type including "Barren Land", "Perennial Snow/Ice", and "Herbaceous" classifications	30 meters (Landsat)	US Geological Survey National Land Cover Dataset (NLCD)
Pikahab_n40w106 Pikahab_n41w106	Pika species distribution model created using the Raster Calculator tool and the following expression: "pika_aspect * pika_elev * pika_landcover"	30 meters	USGS NED & NLCD
Pika_rank_n40w106 Pika_rank_n41w106	Ranked pika habitat model created using the Raster Calculator tool and the following expression: "pika_aspect + pika_elev + pika_landcover"	30 meters	USGS NED & NLCD



4. Information products:

- a. Map #1: "Ranked pika habitat in Boulder County, Colorado"
  - i. *Audience*: This map was created for land use planners and natural resource managers in the Boulder County Parks and Open Space Department.
  - ii. *Purpose*: To identify areas of greatest importance for pika conservation and to support the implementation of wildlife protection measures.
  - iii. *Decision-making environment*: Local government land-use decisions regarding methods of protecting pika habitat.

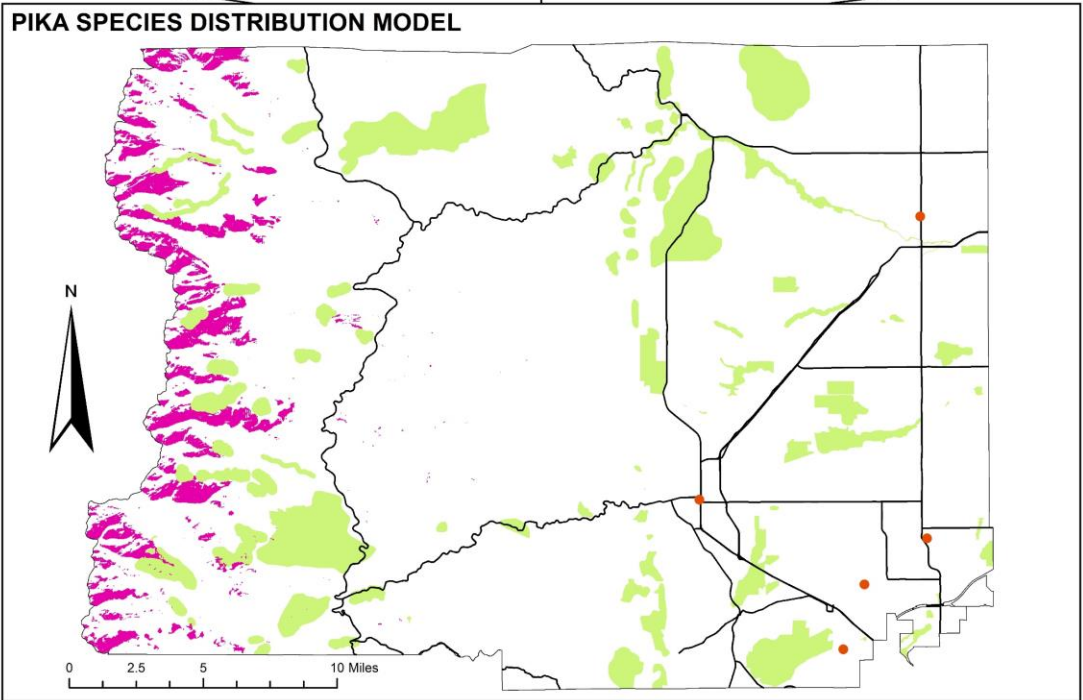
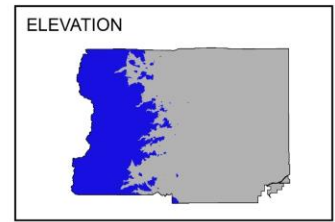
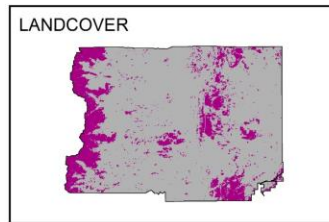
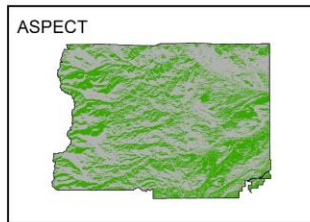
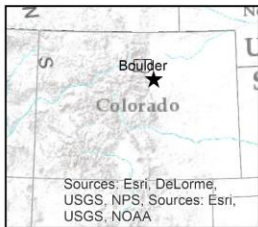
# Ranked pika habitat in Boulder County, Colorado





- b. Map #2: "Modeling Pika Habitat in Boulder County, Colorado"
- i. *Audience*: Students in Introduction to GIS and other geospatial analysis courses.
  - ii. *Purpose*: To demonstrate an application for the Raster Calculator tool and to illustrate one method of creating a species distribution model.
  - iii. *Decision-making environment*: Educational environment

## Modeling pika habitat in Boulder County, Colorado



## 5. Lessons learned

It was difficult to find data without a clear objective in mind from the beginning. My project idea didn't really start to develop once I had downloaded an excessive amount of data and started manipulating it. From this challenge, I learned the importance of developing a clear project objective with target data in mind prior to beginning. At the same time, a certain degree of flexibility has to be incorporated into the project, in order to accommodate the data that is available for the given budget. In this case, there was zero budget, so I had to be flexible according to the data that I could find for free online.

Another difficulty was interpreting attribute fields from downloaded data. A significant amount of time went into working out what different field categories meant by clicking on individual features and comparing them to other features in the feature class as well as to an image basemap. The lessons learned here were to incorporate the extra time needed for this task into any project timeline. Also, I realized the importance of creating clear attribute fields and metadata for any data that might be published online.

Finally, there were inherent creative challenges in this project regarding making decisions about what I wanted to show on the maps and how I wanted to display it. Unexpectedly, an equally difficult challenge was deciding what I needed to omit.

I find Geographic Information Science and Technology to be fascinating and a vital component to almost every discipline and industry. I plan to complete my GIS Certificate during my time at UC Denver, and I hope to enter a career where I can apply my GIS skills in an environmental science setting.

## 6. References

Beever, E., Brussard, P., & Berger, J. (2003). Patterns of Apparent Extirpation among Isolated Populations of Pikas (*Ochotona princeps*) in the Great Basin. *Journal of Mammalogy*, 84(1), 37-54. Retrieved from <http://0-www.istore.org.skyline.ucdenver.edu/stable/1383633>.

Boulder County (2013). Boulder County Wildlife Species of Special Concern. Retrieved from <http://www.bouldercounty.org/doc/landuse/bccp-wssc.pdf>.

U.S. Geological Survey. *USGS NED 1 arc-second n41w106 1 x 1 degree ArcGrid 2015*. U.S. Geological Survey, 17 July 2015. Retrieved 6 December 2016 from <https://www.sciencebase.gov/catalog/item/581d260ce4b08da350d5b7ab>.

U.S. Geological Survey. *USGS NED 1 arc-second n40w106 1 x 1 degree ArcGrid 2015*. U.S. Geological Survey, 17 July 2015. Retrieved 6 December 2016 from <https://www.sciencebase.gov/catalog/item/581d2608e4b08da350d5b769>.

U.S. Geological Survey. *NLCD 2011 Land Cover (2011 Edition, amended 2014), 3 x 3 Degree: NLCD2011\_LC\_N39W105*. U.S. Geological Survey, 10 October 2014. Retrieved 6 December 2016 from <https://www.sciencebase.gov/catalog/item/581d5a0de4b0dee4cc8e50ae>.

Boulder County. *boco.HYDRO.LAKES\_RES*. Boulder County Parks and Open Space, updated 6 December 2016. Retrieved 6 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/e0759cd6dc8f4990a04b77a29c988b55\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/e0759cd6dc8f4990a04b77a29c988b55_0).

Boulder County. *boco.HYDRO.STREAMS\_DITCHES*. Boulder County Parks and Open Space, 13 June 2013. Retrieved 6 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/d52c150f5f2e48aebd8ef74b34a0dc14\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/d52c150f5f2e48aebd8ef74b34a0dc14_0).

Boulder County. *BOCO.POLITICAL.COUNTY*. Boulder County Parks and Open Space, updated 6 December 2016. Retrieved 6 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/964b8f3b3dbe401bb28d49ac93d29dc4\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/964b8f3b3dbe401bb28d49ac93d29dc4_0).

Boulder County. *BOCO.TRANSPORTATION.STREETS*. Boulder County Transportation, updated 6 December 2016. Retrieved 6 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/f8292cbf379e4df7b9b8f62e21120ea7\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/f8292cbf379e4df7b9b8f62e21120ea7_0).

Boulder County. *ParksOpenSpace.POS.BCCP\_2013\_CriticalWildlifeHabitats*. Boulder County Parks and Open Space, updated 6 December 2016. Retrieved 12 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/353950217aaa455fbb2b0442764cfa47\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/353950217aaa455fbb2b0442764cfa47_0).

Boulder County. *boco.PARKSOPENSOURCE.OP\_BCPOS\_TRAILS DISSOLVE*. Boulder County Parks and Open Space, 6 December 2016. Retrieved 13 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/1a98f0f0d126403c93c1c6a76a9bccdc\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/1a98f0f0d126403c93c1c6a76a9bccdc_0).

Boulder County. *ParksOpenSpace.POS.OP\_BCPOS\_TRAILHEADS*. Boulder County Parks and Open Space, 6 December 2016. Retrieved 13 December 2016 from

[http://gis.bouldercounty.opendata.arcgis.com/datasets/5ade4ef915c54430a32026bcb03fe1d7\\_0](http://gis.bouldercounty.opendata.arcgis.com/datasets/5ade4ef915c54430a32026bcb03fe1d7_0).

ESRI. *USA Major Cities*. Layer Package. ArcGIS Online, 2 November 2010. Retrieved 12 December 2016 from <http://www.arcgis.com/home/item.html?id=4e02a13f5ec6412bb56bd8d3dadd59dd>.

U.S. Geological Survey. *USGS National Gap Analysis Program Additional Data – Hydrologic Unit Codes [HUCs]*. U.S. Geological Survey Gap Analysis Program, 22 February 2011. Retrieved 13 December 2016 from <https://www.sciencebase.gov/catalog/item/56d496eee4b015c306f17a42>.