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EES 391 – Report 2 – 2/21/19

Tasks: Readings of "Summer Temperature / Pika extirpations in California" paper, *Python Scripting* Chapter 3 (with exercise), and *Saving a Million Species* chapter 3 & 4

READINGS AND EXERCISES

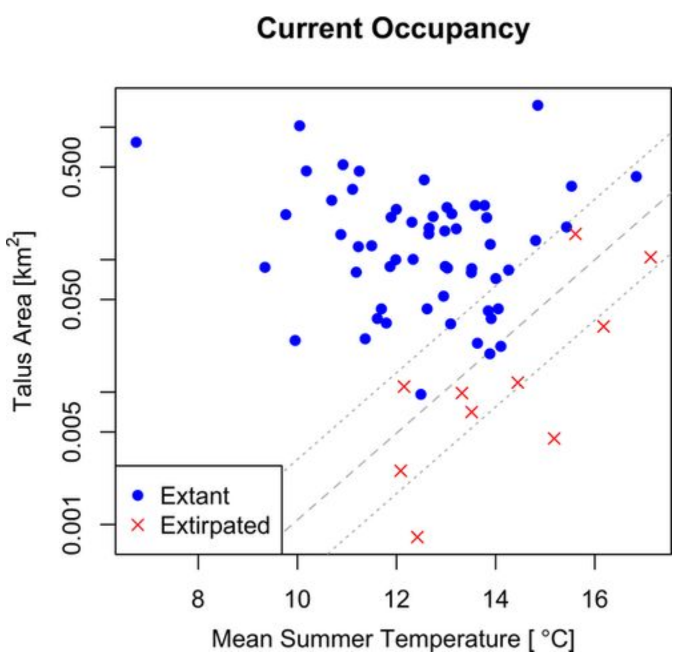
Summer Temperature / Pika extirpations in California – Perrine et al 2015 - https://onlinelibrary.wiley.com/doi/full/10.1111/jbi.1246

Description of text:

This study focused on determining the climate envelope of pika habitat in California for the purpose of explaining recent pika extirpations as well as predicting where extirpations will occur in the future. After a multi-year long survey of pika distribution, the team compared the data to historical distributions, and found 15% loss to historical pika range. The team found that summer temperature was the main limiting factor to pika distribution, as it leads to behavioral limitations due to the pika's temperature sensitivity.

Pikas are well adapted to living in freezing, snowy alpine conditions, and are vulnerable to hyperthermia in the summer as a result. Pikas avoid hyperthermia by resting in cool and shaded talus piles, which protect them from heat, but limit how much they can forage for food. Since pikas don't hibernate, instead feeding on their hay stocks during the winter, ample foraging is vital for pika survival. For this reason, summer temperatures are the limiting factor in pika distribution.

The team collected pika distribution data manually over a 12 year period. This data is highly accurate due to pikas being very loud and easy to find by using specific calls. Pika persistence was modeled extensively using 16 variables, with the best performing model being talus area with mean summer temperature. Below it can be clearly seen how these factors impact occupancy. The average elevation of current pika habitat was found to be around 2800m – this is very close to my California pika habitat elevation results from last week's report (~2700m) which is a good sign for the legitimacy of my data. Depending on the emissions scenario, the study concluded that pika extirpation in California by 2070 would range from 51 – 75% for GCM values of RCP4.5 and RCP8.5 respectively.



Applications for study:

Knowing the limiting factors of pika distribution (talus area and mean summer temperature) is great for any GIS projects I do into the future regarding the pika. I was able to find a good set of mean summer temperature rasters this week, which I am in the process of converting into a useable format (from float to int).

Saving a Million Species Chapter 3 & 4

Chapter 3:

This chapter detailed global public policy in regards to climate change and extinction. Internationally, the UNFCCC environmental treaty is the foremost global policy dedicated to slowing climate change. It remains non-binding but has influenced countries to implement greener policies. The IUCN is an important global advocate for species extinction, and maintains the "Red List," an expansive inventory of the conservation status of species from around the world. At the base level, many countries have policy that protects "endangered" species, but current policy will have to take climate change into account to be effective. For species whose sole threat is a changing climate, protective policy will have to focus on things like lowering emissions.

Chapter 4:

This chapter goes into climate modeling. SDMs (Species distribution models) are routinely used in species-climate studies, and are built using climate models (such as Global Climate Models), which are built using various emissions scenarios and a lot of math. SDMs often focus on the two extremes of species migration – zero dispersal, where the species can't migrate, and unlimited dispersal, where the species can migrate anywhere. Using these two scenarios makes modeling easier since "dispersal modeling" isn't required. One of the few certainties in species climate modeling is that area loss is tied to extinction risk. For this reason, the species distribution model is a popular tool in studies (it was used in the study that resulted in this book).

Python Scripting Chapter 3 / Pika Data Collection

- This chapter introduced python syntax and got a bit deeper into using the python command line in ArcGIS.
- It went over basic material that I already knew, but did introduce some arcpy commands that I found useful for this week.
- One major problem that I faced this week was float-value rasters. Basically, these rasters are useless as far as geoprocessing goes and need to be converted. The tools to convert float rasters, however, are locked behind Esri's "Spatial Analyst License"
- Based on this week's material, I found some great raster data on mean summer temperatures, ranging all the way to 2100. Since the rasters were float-value, I struggled to find a way to convert them but eventually came up with a very simple method in arcpy, as follows:

```
myRaster = RasterToNumPyArray("rasterfilename")

myRaster.astype(int)

NumPyArrayToRaster(myRaster, Point corner, sizex, sizey)
```

- Thanks to the RasterToNumPyArray and NumPyArrayToRaster functions, it was very easy to finally convert the rasters into a usable format. It simply puts the raster data in a 2D array, converts the cell values to integers, and complies the 2D array back into a raster grid. For next week, I'll get into using my pika habitat shapefiles to isolate and analyze this future temperature data for the different climate scenarios given. I'll likely continue to focus on the California pika population.