Biodiversity

Introduction to Data Analysis
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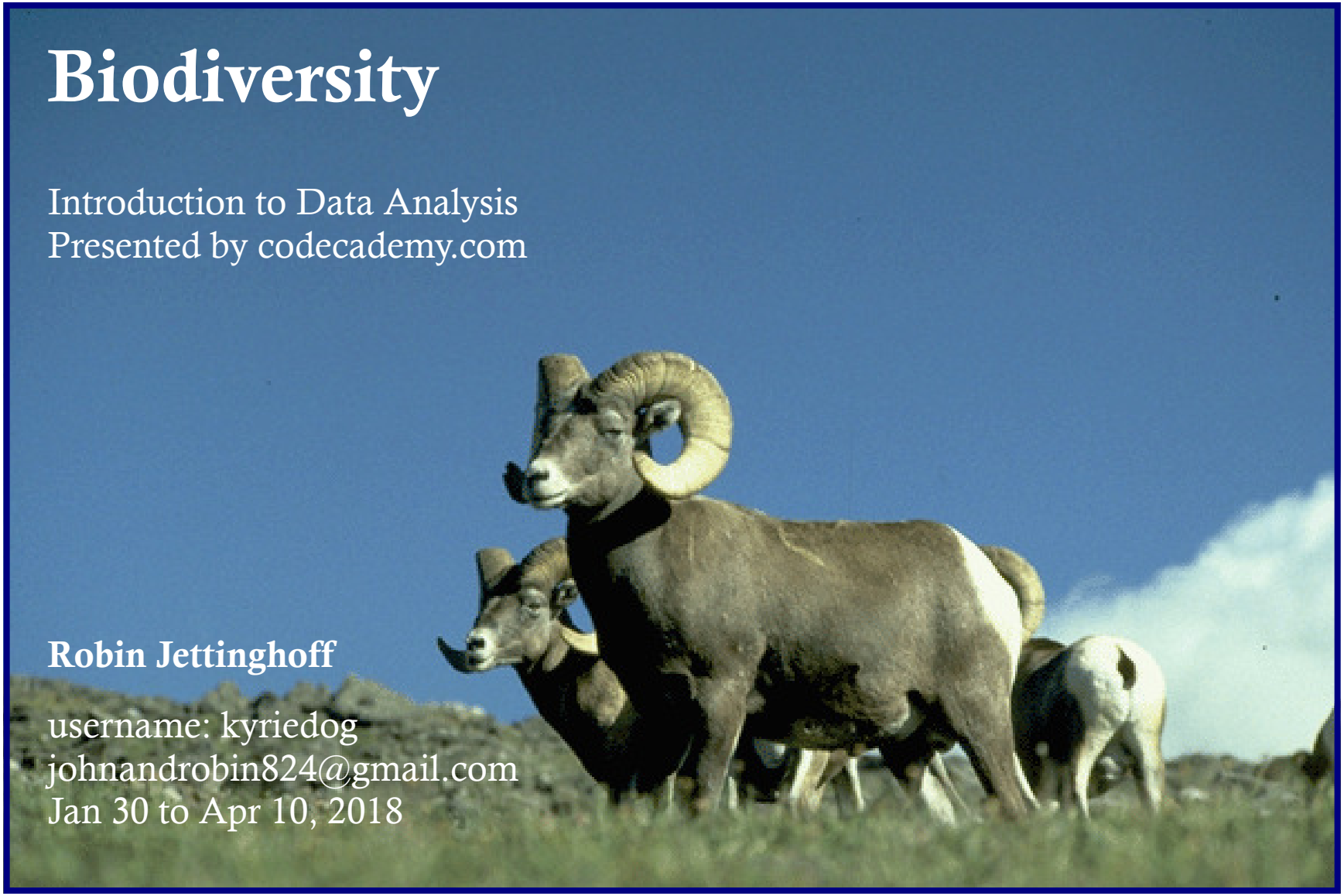

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Jan 30 to Apr 10, 2018

Objective: Conservation Status Analysis

•Reviewed **species_info.csv** holding data on 5541 species observed by NPS.

•The 1021 animals are in 5 categories:
- —214 **mammals**
- —521 **birds**
- —127 **fish**
- —79 **reptiles**
- —80 **amphibians**

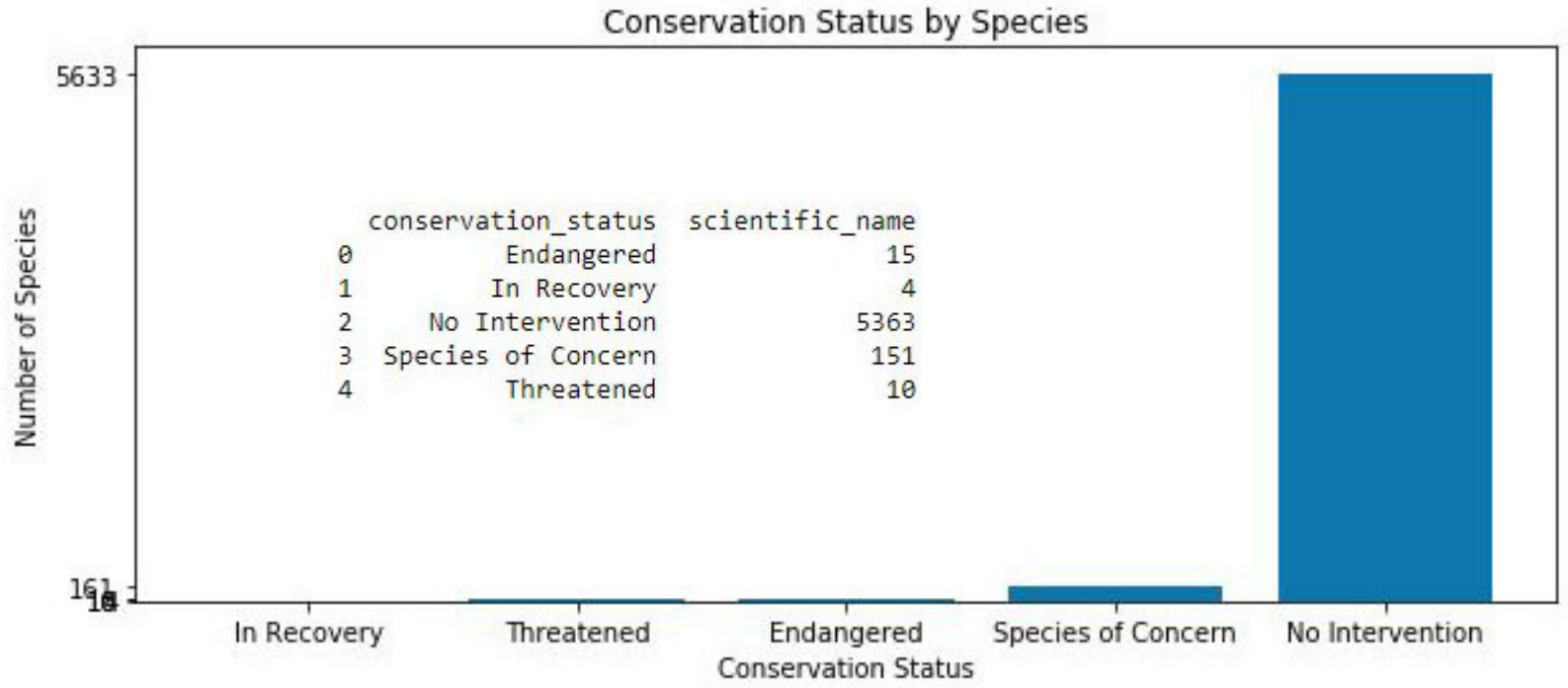
•The 4520 plants are in 2 categories:
- —4187 **vascular plants**
- —333 **non-vascular plants**

•**Conservation Status** has 4 levels:
- —**Species of Concern:** a declining population has been noted.
- —**Threatened:** population indicates imminent vulnerability to endangerment.
- —**Endangered:** seriously at risk of extinction.
- —**In Recovery:** formerly Endangered, but populations increases noted in most or all of its habitable range.

•Are there patterns or themes that can help us identify which types of species become endangered?

Results from Data: How many species are in trouble?

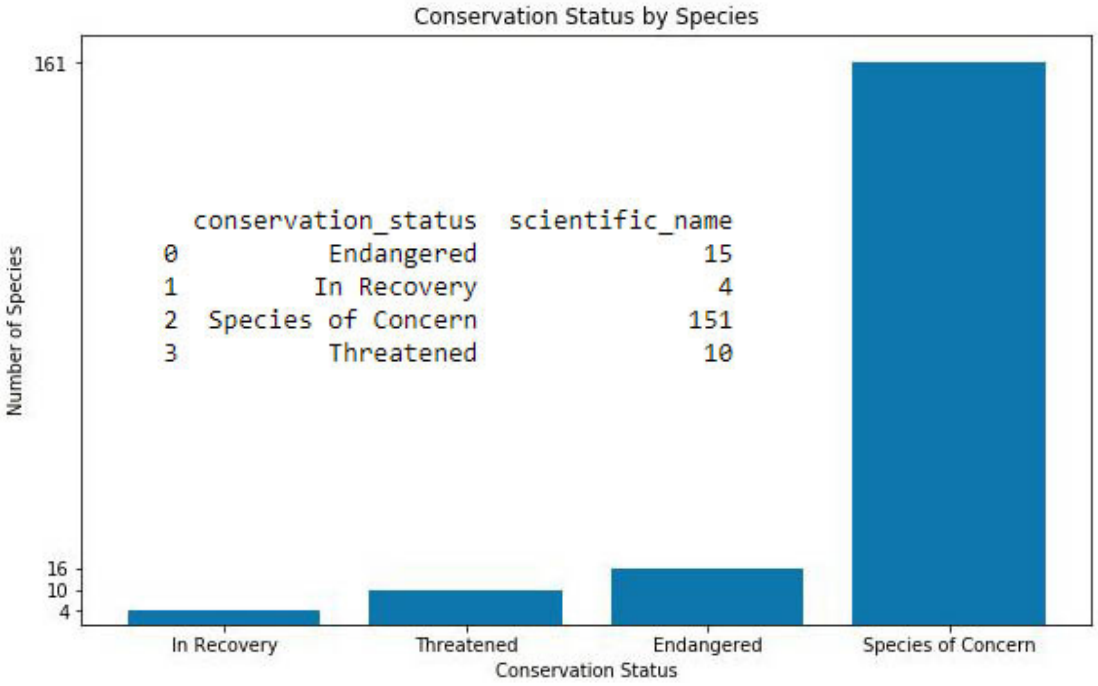
- Of the 5541 species, 5361 do not meet guidelines requiring Conservation Status
  - This indicates that 96.8% of these species are not in danger of extinction.
  - The remaining 180 species constitute just 3.2% of the total.
- On the graph below, the animals in trouble are barely visible.



	conservation_status	scientific_name
0	Endangered	15
1	In Recovery	4
2	No Intervention	5363
3	Species of Concern	151
4	Threatened	10

Results from Data: Levels of Needed Conservation

- **180 species do have a level of Conservation Status:**
  - **Species of Concern:** 151 species (84%) are showing declining populations.
  - **Threatened:** Only 10 (5.5%) are approaching endangerment.
  - **Endangered:** Just 15 (8.3%) are nearing extinction.
  - **In Recovery:** Only 4 species (2.2%) have shown improvement, indicating some past work by the NPS may have been effective.



Likelihood of Endangerment by Species Type

- **Are certain types of species more likely to become endangered?**

	category	not_protected	protected	percent_protected
0	Amphibian	73	7	0.087500
1	Bird	442	79	0.151631
2	Fish	116	11	0.086614
3	Mammal	176	38	0.177570
4	Nonvascular Plant	328	5	0.015015
5	Reptile	74	5	0.063291
6	Vascular Plant	4424	46	0.010291

- In the above chart, **Mammals** and **Birds** show the **highest percent of protected species**. Are Mammals significantly more likely to become endangered than Birds? The **null hypothesis** (considered false if pval < 0.05) is that this difference is **due to chance.**
- Running a **chi-square test for Mammals and Birds**, the resulting pval is 0.6875948. This indicates a **non-significant difference**.
- The **results of other chi-square tests** are below.
  - **Mammal** and **Reptile**, pval = 0.0383555, **significant difference**. **Mammals** are more likely to be listed with a conservation status than **Reptiles** are.
  - **Reptile** and **Bird**, pval = 0.0531354, **non-significant difference**.
  - **Bird** and **Fish**, pval = 0.07668199, **non-significant difference**.

Recommendations: Conservation Status Analysis

- **Action taken on any of the data presented here would be premature.**

- **Though the analysis indicates that a significantly higher proportion of mammals have a Conservation Status than reptiles do, one should consider other possible factors:**

  - **Because of overlapping habitats, humans are more likely to encounter and IMPACT mammals than reptiles, fish, or amphibians. Birds are a slightly different case.**

  - **Thus, because humans observe mammals more frequently, they have better baselines and better understandings of their life cycles and food chains. Consequently a decrease in population is more likely to be seen than with the other classes of vertebrates.**

  - **The factors above also support the similarity in ratios of protected species between birds and mammals. Humans, including many amateur ornithologists, spend a lot of time observing, counting, and tracking birds. Though our habitats differs, it is easier for people to watch birds without disturbing them, than any other vertebrate class.**

- **In conclusion, despite my analysis, I believe the main reason mammals are more likely to become endangered than other vertebrates, is our greater impact on them and their habitats. I would like to pursue this question further.**

Reduction of Foot-and-Mouth Disease in NPS Sheep

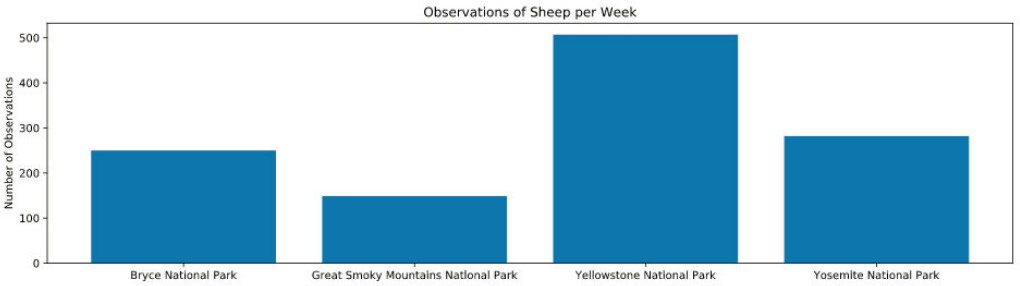
- **What percentage of NPS sheep have foot-and-mouth disease?**

	category	scientific_name	common_names	conservation_status	is_protected	is_sheep
3	Mammal	Ovis aries	Domestic Sheep, Mouflon, Red Sheep, Sheep (Feral)	No Intervention	False	True
3014	Mammal	Ovis canadensis	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
4446	Mammal	Ovis canadensis sierrae	Sierra Nevada Bighorn Sheep	Endangered	True	True

- The dataset **observations.csv** includes sightings of various animals and plants by park personnel at four national parks: **Bryce**, **Great Smoky Mountains**, **Yellowstone**, and **Yosemite**. The above chart identifies the three sheep species observed at those four parks over the last seven days.

- The chart and graph below show the number of sheep-sightings at each park over this period.

	park_name	observations
0	Bryce National Park	250
1	Great Smoky Mountains National Pa	149
2	Yellowstone National Park	507
3	Yosemite National Park	282



Reduction of Foot-and-Mouth Disease in NPS Sheep

•How effective is the foot-and-mouth reduction program at Yellowstone NP?

•The rangers consider a reduction of the disease by at least 5 percentage points as effective. (**a**)
•Rangers at Bryce NP recorded foot-and-mouth in 15% of the sheep they observed. (**b**)
•YPS rangers will use this amount as their baseline.
•Sample size determined below. (**c**)
•Recorded observations are at right. (**d**)
•Level of significance = 90%. (**e**)

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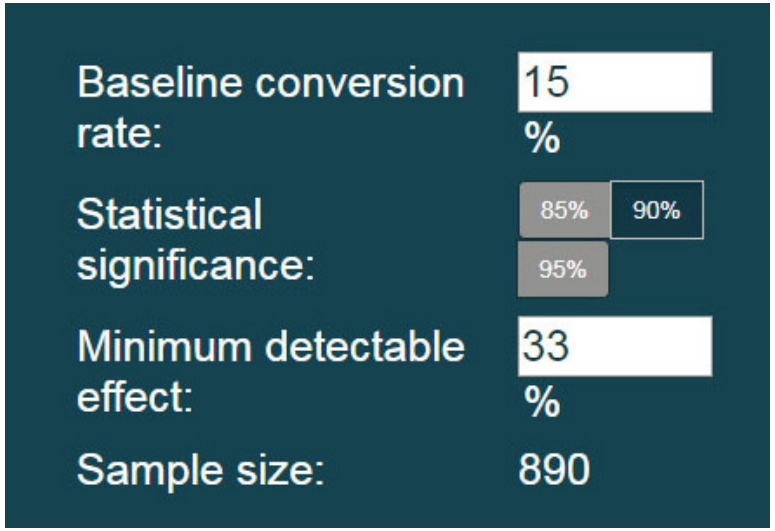
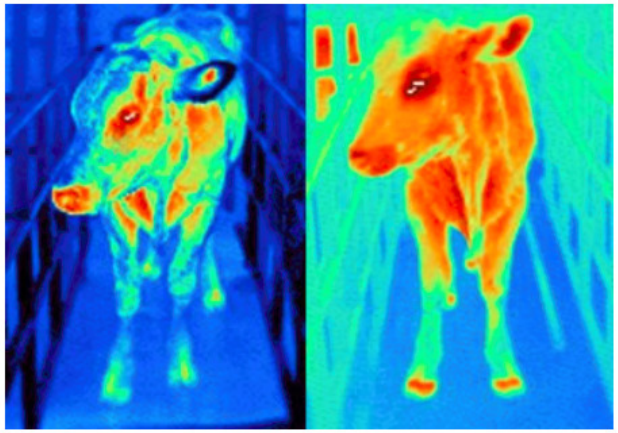


•Measure of effectiveness = 5%. (**a**)
•**Baseline = 15%** (**b**)
•Sample Size per Variant = 890.0 (**c**)
•Number of sheep observed at Bryce = 250 (**d1**)
•Number of sheep observed at Yellowstone = 507 (**d3**)

•**Minimum detectable effect** =
(100 * **a**) / **b** = (100 * 0.05) / 15 = 33
•Weeks needed for **full observation at Yellowstone** =
c /**d3** = 890.0 / 507 = **1.75 weeks or 12 days**
•Weeks needed for **full observation at Bryce** =
c /**d1** = 890.0 / 250 = **3.56 weeks or 25 days**

Recommendations: Reduction of Foot-and-Mouth

- Data presented here is just the first step of population analysis to measure the effectiveness of the NPS program.
  - The determination of 5 percentage points as a minimal indication of effectiveness does not answer the question of what other factors may contribute to that number.
  - Once it has been determined that the NPS program is the primary factor in this level of improvement, the next question is whether this amount is the maximum level of its effectiveness, minimum level, or something in between.
  - Nor does this include a measure of time. Is this reduction supposed to take place over a several days, or several months? What is the rate of increase of the disease over time? Does that 5% take this number into account.



The left is a cow not infected with FMD; on the right is a cow infected with FMD. Note that the hooves are red in the infected cow, which indicates heat.

Photo courtesy of USDA.

- In conclusion, along with the proscribed observations, more analysis is necessary.

Images above from www.nps.gov/orgs/1103/footmouth.htm

To the National Park Service:

- Thank you for hiring Kyriedog Data for all your research needs. We look forward to working with you again soon.

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To Codecademy:

- Thank you for this class in Data Analysis. I look forward to learning more of the same, and eventually to a career change to this field. Thank you also for your ever patient advisors. I never had to wait more than a few minutes for very efficient help.

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