Biodiversity for the National Parks

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Species Data

- Several animal categories were documented: mammals, amphibians, birds, fish, non vascular plants, vascular plants, and reptiles
- Columns included their scientific names, common names, and conversation status
- Highest documented species: Vascular plants
- Highest tier of conservation status: Species of Concern
- Highest category with need for protection %: Mammals
  - However, raw data within pivot table suggests Birds also have the highest need
- Highest non-protected species: Vascular Plants
- Conservation Status Species Data:
  - 15 Endangered
  - 4 Recovery
  - 151 Species of Concern
  - 10 Threatened

Species Dataframe

	category	scientific_name	common_names	conservation_status
0	Mammal	Clethrionomys gapperi gapperi	Gapper's Red-Backed Vole	nan
1	Mammal	Bos bison	American Bison, Bison	nan
2	Mammal	Bos taurus	Aurochs, Aurochs, Domestic Cattle (Feral), Domesticated Cattle	nan
3	Mammal	Ovis aries	Domestic Sheep, Mouflon, Red Sheep, Sheep (Feral)	nan
4	Mammal	Cervus elaphus	Wapiti Or Elk	nan

Species Data (cont)

- Species documentation by category, scientific name and conservation status

	category	scientific_name	common_names	conservation_status
0	Mammal	Clethrionomys gapperi gapperi	Gapper's Red-Backed Vole	NaN
1	Mammal	Bos bison	American Bison, Bison	NaN
2	Mammal	Bos taurus	Aurochs, Aurochs, Domestic Cattle (Feral), Dom...	NaN
3	Mammal	Ovis aries	Domestic Sheep, Mouflon, Red Sheep, Sheep (Feral)	NaN
4	Mammal	Cervus elaphus	Wapiti Or Elk	NaN

	conservation_status	scientific_name
0	Endangered	15
1	In Recovery	4
2	Species of Concern	151
3	Threatened	10

Species Data (cont)

- Pre-pivot Species Data by category and protection status

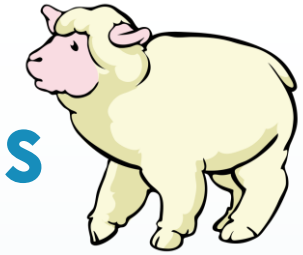
	category	is_protected	scientific_name
0	Amphibian	False	72
1	Amphibian	True	7
2	Bird	False	413
3	Bird	True	75
4	Fish	False	115

- Pivoted Species Data

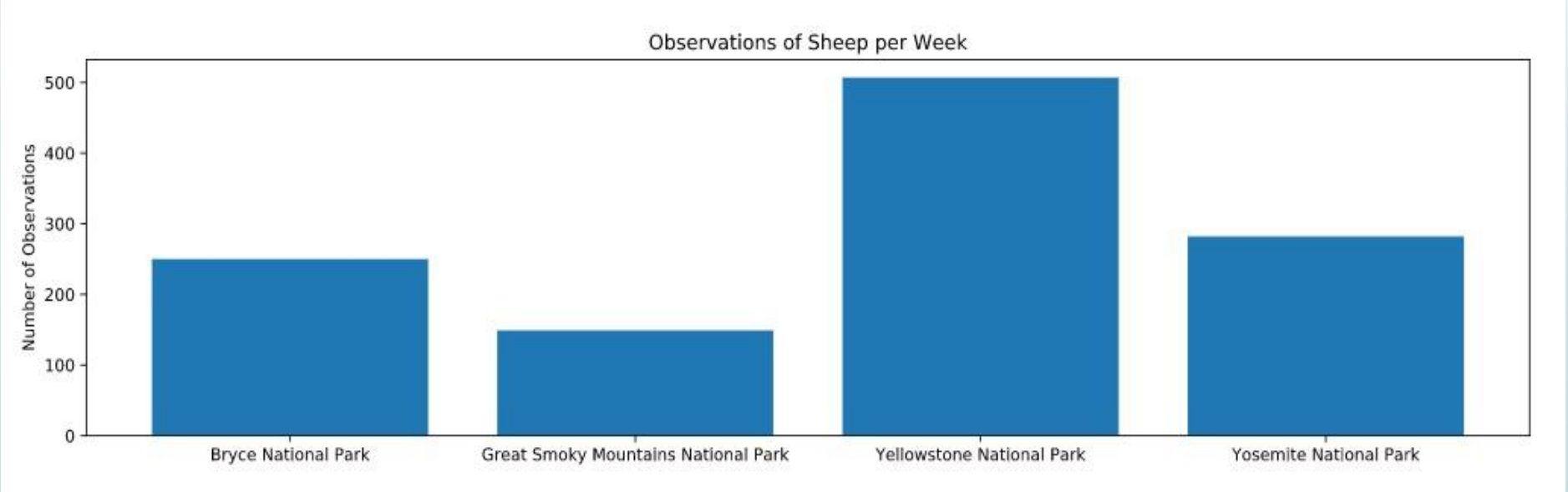
	category	is_protected	scientific_name
0	Amphibian	False	72
1	Amphibian	True	7
2	Bird	False	413
3	Bird	True	75
4	Fish	False	115

is_protected	category	False	True
0	Amphibian	72	7
1	Bird	413	75
2	Fish	115	11
3	Mammal	146	30
4	Nonvascular Plant	328	5

Sheep Observations



- Sheep were also observed over a 7 day timeline in several parks, documenting both protected /non-protected species, conservation status, and park locations
- Highest park sightings: Yellowstone National Park
- In addition to general observation data, rangers at Yellowstone National Park ran a program to reduce the rate of foot and mouth disease (1 week)



Sheep Observation Data

- Dataframe with Sheep species and locations (7 days)

	scientific_name	park_name	observations
0	Vicia benghalensis	Great Smoky Mountains National Park	68
1	Neovison vison	Great Smoky Mountains National Park	77
2	Prunus subcordata	Yosemite National Park	138
3	Abutilon theophrasti	Bryce National Park	84
4	Githopsis specularioides	Great Smoky Mountains National Park	85

Sheep Observation Data (cont)

- Sheep species and conservation status

	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
1139	Vascular Plant	Rumex acetosella	Sheep Sorrel, Sheep Sorrell	No Intervention	False	True
2233	Vascular Plant	Festuca filiformis	Fineleaf Sheep Fescue	No Intervention	False	True
3014	Mammal	Ovis canadensis	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
3758	Vascular Plant	Rumex acetosella	Common Sheep Sorrel, Field Sorrel, Red Sorrel, Sheep Sorrel	No Intervention	False	True
3761	Vascular Plant	Rumex paucifolius	Alpine Sheep Sorrel, Fewleaved Dock, Meadow Dock	No Intervention	False	True

2233	Vascular Plant	Festuca filiformis	Fineleaf Sheep Fescue	No Intervention	False	True
3014	Mammal	Ovis canadensis	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
3758	Vascular Plant	Rumex acetosella	Common Sheep Sorrel, Field Sorrel, Red Sorrel, Sheep Sorrel	No Intervention	False	True
3761	Vascular Plant	Rumex paucifolius	Alpine Sheep Sorrel, Fewleaved Dock, Meadow Dock	No Intervention	False	True
4091	Vascular Plant	Carex illota	Sheep Sedge, Smallhead Sedge	No Intervention	False	True
4383	Vascular Plant	Potentilla ovina var. ovina	Sheep Cinquefoil	No Intervention	False	True
4446	Mammal	Ovis canadensis sierrae	Sierra Nevada Bighorn Sheep	Endangered	True	True

Sheep Observation Data (cont)

- Sheep species, Protected/Not Protected, Conservation Status and Location

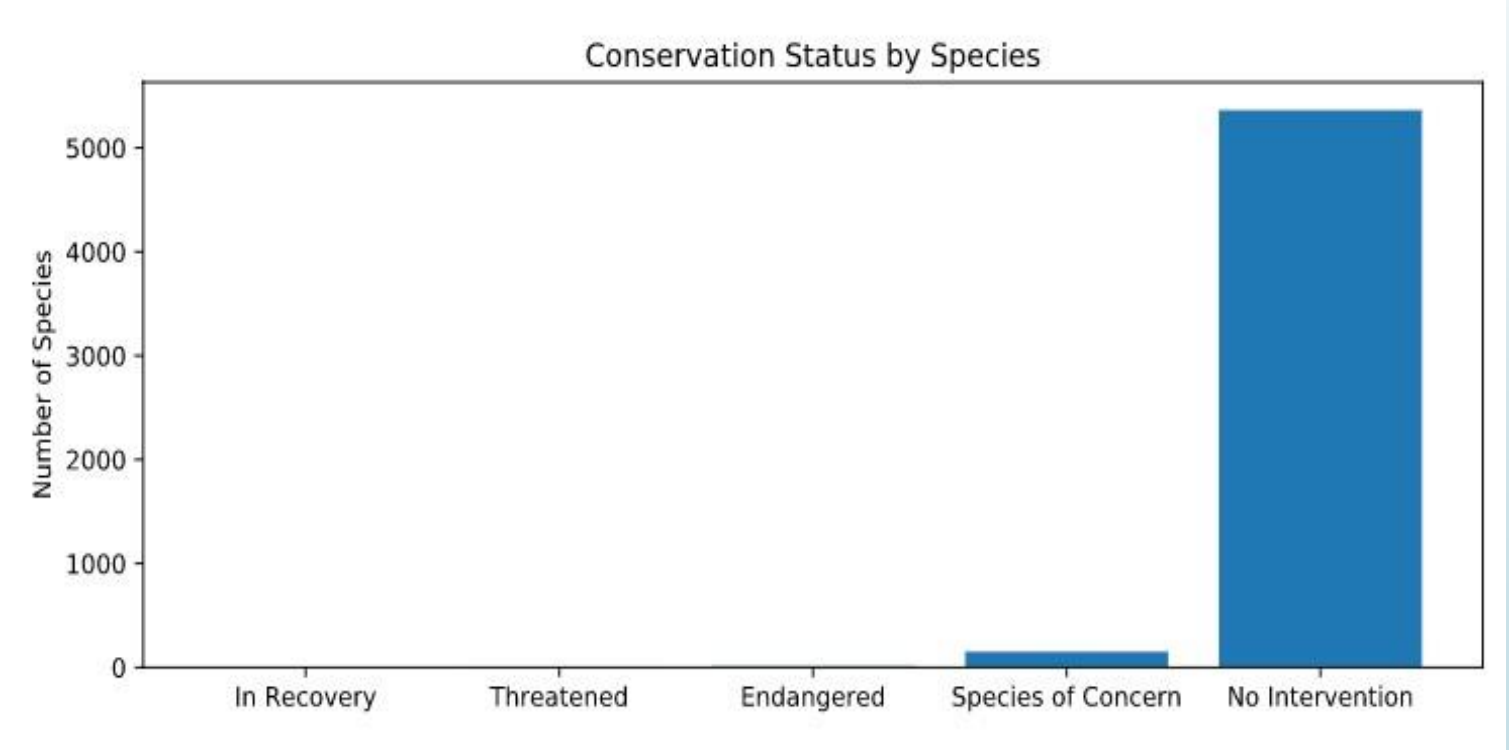
	category	scientific_name	common_names	conservation_status	is_protected	is_sheep
3	Mammal	Ovis aries	Domestic Sheep, Mouflon, Red Sheep, Sheep (Feral)	No Intervention	False	True
3014	Mammal	Ovis canadensis	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
4446	Mammal	Ovis canadensis sierrae	Sierra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

	scientific_name	park_name	observations	category	common_names	conservation_status	is_protected	is_sheep
0	Ovis canadensis	Yellowstone National Park	219	Mammal	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
1	Ovis canadensis	Bryce National Park	109	Mammal	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
2	Ovis canadensis	Yosemite National Park	117	Mammal	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
3	Ovis canadensis	Great Smoky Mountains National Park	48	Mammal	Bighorn Sheep, Bighorn Sheep	Species of Concern	True	True
4	Ovis canadensis sierrae	Yellowstone National Park	67	Mammal	Sierra Nevada Bighorn Sheep	Endangered	True	True

	park_name	observations	is_protected	is_sheep
0	Bryce National Park	250	2.0	3.0
1	Great Smoky Mountains National Park	149	2.0	3.0
2	Yellowstone National Park	507	2.0	3.0
3	Yosemite National Park	282	2.0	3.0

Chi Squared Analysis

- Data shows that the majority of the observed species across categories did not require human intervention, but there were still some species that needed assistance.



Chi Squared Analysis (cont)

- Species and Status Based on Protected vs Non-Protected

	category	not_protected	protected	percent_protected
0	Amphibian	72	7	0.088608
1	Bird	413	75	0.153689
2	Fish	115	11	0.087302
3	Mammal	146	30	0.170455
4	Nonvascular Plant	328	5	0.015015

- With this knowledge, we calculate the "protected" percentages

	category	is_protected	scientific_name
0	Amphibian	False	72
1	Amphibian	True	7
2	Bird	False	413
3	Bird	True	75
4	Fish	False	115

is_protected	category	False	True
0	Amphibian	72	7
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	category	not_protected	protected	percent_protected
0	Amphibian	72	7	0.088608
1	Bird	413	75	0.153689
2	Fish	115	11	0.087302
3	Mammal	146	30	0.170455
4	Nonvascular Plant	328	5	0.015015
5	Reptile	73	5	0.064103
6	Vascular Plant	4216	46	0.010793

Chi Squared Analysis (cont)

- The chi square test doesn't show significance between mammal and bird, but shows significance between reptile and mammal (calculated below). Based on the p-values, the statistical significance is < 0.05

```
contingency = [[30, 146],
               [75, 413]]
from scipy.stats import chi2_contingency
chi2, pval, dof, expected = chi2_contingency(contingency)
print(pval)
#pval=0.687594809666 (P value = ~.69; no significance)

contingency2 = [[5, 73],
                [30,146]]
chi2, pval_reptile_mammal, dof, expected = chi2_contingency(contingency2)
print(pval_reptile_mammal)
#pval=0.0383555902297 (P value = ~.031; significance)
```

Conservation Recommendation

- Mammals and birds show the highest need for protection, both percentage and raw-data wise. The chi squared test also confirms little significance/differences between their data sets, grouping them in a similar level of need

Sample Size Determination

Foot and Mouth Reduction Efforts

- Baseline Conversion Rate: 15%
- Minimum Detectable Effect: 33.3%
- Statistical Significance: 90%
- Sample size: 870