ENDANGERED SPECIES ANALYSIS

COMMISSIONED BY THE NATIONAL PARK SERVICE

PREPARED BY: JULIE J. MURPHY

AUGUST 18, 2018

TABLE OF CONTENTS

DATA OVERVIEW

- The following information is known about each species catalogued by the National Park Service:
  - Category
    - 5 Animal Categories: Amphibian, Bird, Fish, Mammal, Reptile
    - 2 Plant Categories: Nonvascular Plant, Vascular Plant
  - Scientific Name
  - Common Names
  - Conservation Status:
    - Species of Concern: declining or appear to be in need of conservation
    - Threatened: vulnerable to endangerment in the near future
    - Endangered: seriously at risk of extinction
    - In Recovery: formerly Endangered, but currently neither in danger of extinction throughout all or a significant portion of its range

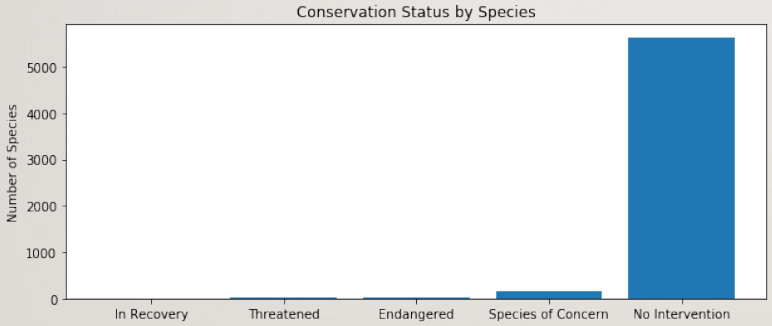
DATA OVERVIEW

5,541 species have been catalogued by the National Park Service across 7 categories

Category	Number of Species
Animal Species:	
Amphibian	79
Bird	488
Fish	125
Mammal	176
Reptile	78
Total Animal Species	**946**
Plant Species:	
Nonvascular Plant	333
Vascular Plant	4,262
Total Plant Species	**4,595**
Total Species	**5,541**

SPECIES CATEGORY ANALYSIS FOR CONSERVATION

96.7% of known species require
"No Intervention" for conservation measures.



Category	Not Protected	Protected	% Protected
Animal Species:			
Amphibian	72	7	8.8%
Bird	413	75	15.4%
Fish	115	11	8.7%
Mammal	146	30	17.0%
Reptile	73	5	6.4%
Total Animal Species	**819**	**118**	**12.6%**
Plant Species:			
Nonvascular Plant	328	5	1.5%
Vascular Plant	4,216	46	1.1%
Total Plant Species	**4,544**	**51**	**1.1%**
Total	**5,363**	**169**	**3.3%**

Are certain types of species more likely to be endangered?

SPECIES CATEGORY ANALYSIS FOR CONSERVATION

Species v. Species Test Results

Test 1: Mammal (17.0%) vs. Bird (15.4%)

- **NO** - There is not a significant difference between the number of protected species categorized as Mammal vs. those categorized as Bird
  Chi square test pvalue = 0.6875948096661336

Test 2: Mammal (17.0%) vs. Reptile (6.4%)

- **YES** - There is a significant difference between the number of protected species categorized as Mammal vs. those categorized as Reptile
  Chi square test, the pvalue = 0.038355590229698 98

ENDANGERED SPECIES RECOMMENDATIONS

- 3.3% of known species require conservation measures.
  - 13.7% Animal species require conservation measures
  - 1.1% Plant species require conservation measures
- Recommendations based upon species categories determined to be most at risk:
  - Equal conservation measures should be taken for Mammals and Birds.
  - Conservation measures should first be applied to Mammals before Reptiles.

DISEASE STUDY SAMPLE SIZE

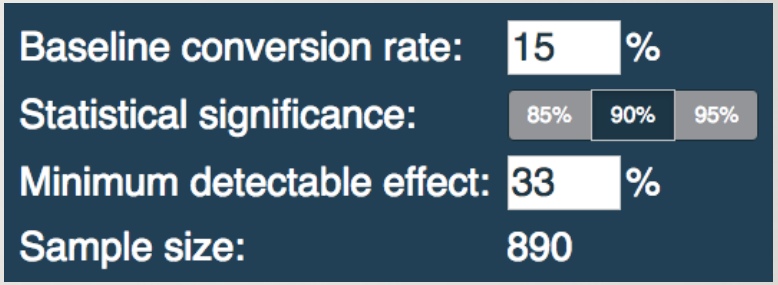
- Certain conservation efforts for Mammals focus on disease control.
- 3 Mammal species are "Sheep", and 2 of the 3 species are classified as Protected.
- Scientist have determined 15% of sheep at Bryce National Park have foot and mouth disease.
- Park rangers at Yellowstone National Park have been running a program to reduce the rate of foot and mouth disease at that park.

Is the Foot and Mouth Disease Program working?

Category	Scientific Name	Common Names	Conservation Status
Mammal	Ovis aries	Domestic Sheep, Mouflon, Red Sheep, Sheep (Feral)	No Intervention
Mammal	**Ovis canadensis**	**Bighorn Sheep, Bighorn Sheep**	**Species of Concern**
Mammal	**Ovis canadensis sierrae**	**Sierra Nevada Bighorn Sheep**	**Endangered**

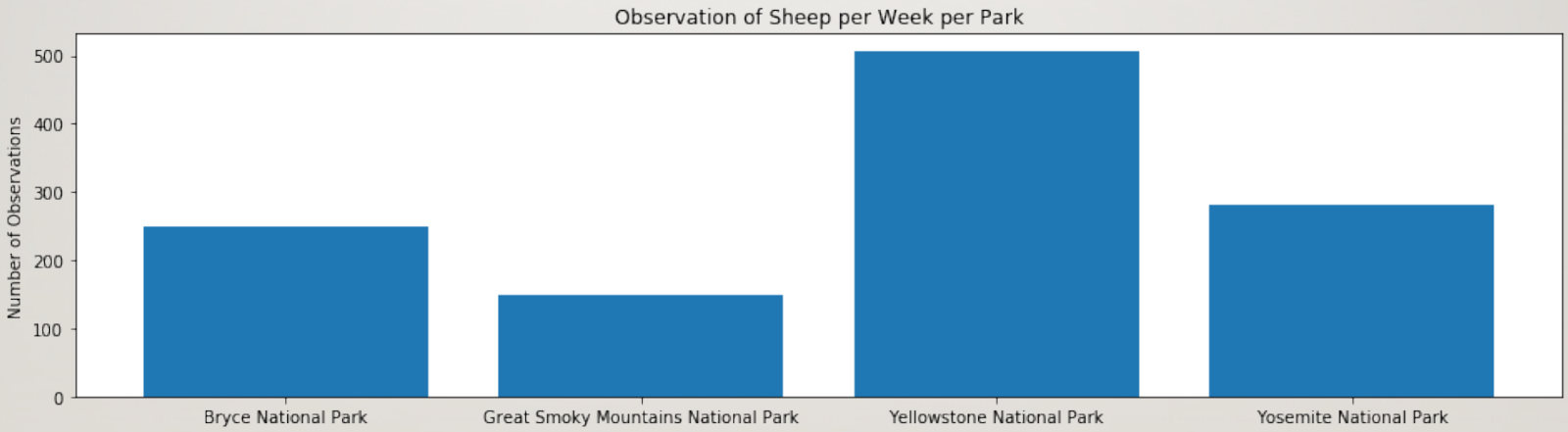
DISEASE STUDY SAMPLE SIZE

How many sheep need to be observed to determine with 90% confidence that 5% change in sheep with the disease has occurred?



Sample Size = 890 sheep

DISEASE STUDY SAMPLE SIZE



DISEASE STUDY SAMPLE SIZE

Park Name	# of Observations		Park Name	# of Observations
Bryce National Park			Yellowstone National Park	
Sheep/Week	250		Sheep/Week	507
Weeks to Observe	**3.56**		**Weeks to Observe**	**1.76**

Based upon sheep observed in the respective Parks, to observe 890 sheep:

- In Bryce National Park, sheep need to be observed for 25 days (3 weeks, 4 days).
- In Yellowstone National Park, sheep need to be observed for 13 days (1 week, 6 days).