National Park Service


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## Codecademy Capstone Project

# Biodiversity in our National Parks

**Julian Underdown, May 2019**


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# Outline

Our national parks are teeming with flora and fauna. It is our duty to safeguard this part of our heritage for current and future generations. This report covers the following:

**Part One: Biodiversity and conservation**
Overview of key park data

**Part Two: Conservation resource allocation**
Deepdive into a criterion for decision making

**Part Three: Sheep conservation programs**
Status update on a key park project

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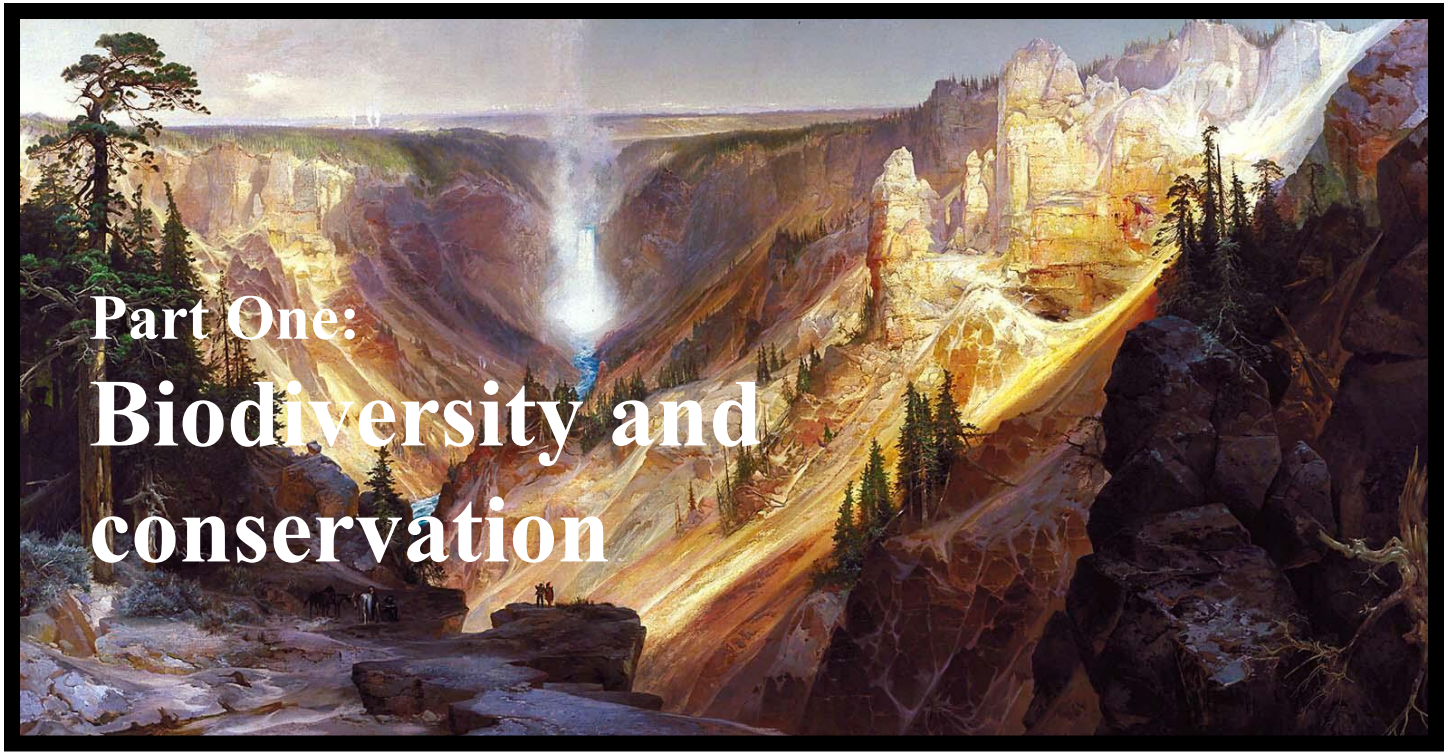


Yellowstone National Park, established in 1872

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# More than 5.5k species make our parks biodiverse

4,262 Vascular Plant

488 Bird

333 Nonvascular Plant

176 Mammal

125 Fish

79 Amphibian

78 Reptile

At risk species (from top left to bottom right): Small Whorled Pogonia, Golden Eagle, Bazzania, Red Wolf, Duskytail Darter, California Red-Legged Frog, Ring-Necked Snake

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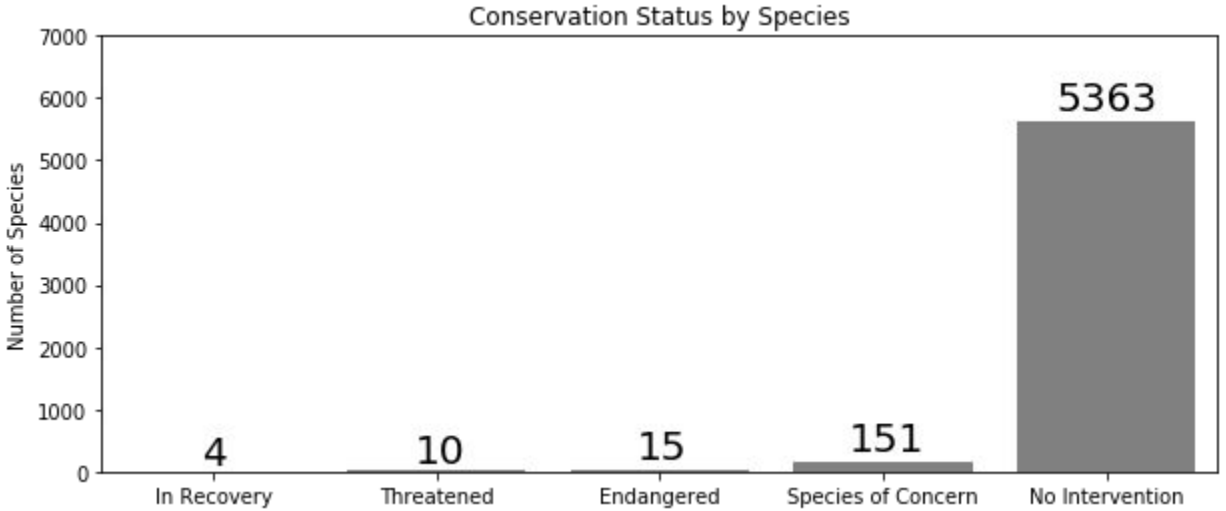
# There's more conservation work to be done in our parks: 180 species remain at risk.




**Conservation statuses:**

No Intervention: population healthy

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

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Bryce National Park, established in 1928

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# Mammals and birds comprise the majority of at-risk species

| category | not_protected | protected | percent_protected | |
|---|---|---|---|---|
| Mammal | 146 | 30 | 0.170455 | Most risk |
| Bird | 413 | 75 | 0.153689 | |
| Amphibian | 72 | 7 | 0.088608 | |
| Fish | 115 | 11 | 0.087302 | |
| Reptile | 73 | 5 | 0.064103 | |
| Nonvascular Plant | 328 | 5 | 0.015015 | |
| Vascular Plant | 4216 | 46 | 0.010793 | Least risk |

Assumption: percent_protected is a proxy for risk level

**Risk level is one criterion for decisions of conservation resource allocation**

We use percent_protected as a proxy for risk levels in species categories. Please note, it is important to test for significant differences between species categories when allocating conservation resources.

# Chi-squared test for significant differences guide resource allocation decisions

Using a contingency table and the Chi-squared test, we test the null hypothesis that there's no significant difference between the datasets.

Contingency table

| | protected | not_protected |
|---|---|---|
| Category 1 | $x_1$ | $y_1$ |
| Category 2 | $x_2$ | $y_2$ |

$\chi^2$ test → *p-value*

if:

*p-value < 0.05, we reject the null hypothesis.*
*p-value > 0.05, we accept the null hypothesis.*




# The difference between mammal and bird risk levels is not significant

Therefore, we might allocate similar levels of conservation resources between mammal and bird species. Note: we also must consider that the absolute number of bird species at risk is over double that of mammal species.

Contingency table

| | protected | not_protected |
|---|---|---|
| Mammal | 30 | 146 |
| Bird | 75 | 413 |

$\chi^2$ test → *p-value:* 0.69

As, *p-value > 0.05, we accept the null hypothesis.*

# The difference between mammal and reptile risk levels is significant

Therefore, we might allocate more resources developing conservation programs for mammal species.

Contingency table

| | protected | not_protected |
|---|---|---|
| Mammal | 30 | 146 |
| Reptile | 5 | 73 |

$\chi^2$ test

*p-value:* 0.04

As, *p-value < 0.05, we reject the null hypothesis.*

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Bighorn Sheep, *Ovis canadensis*

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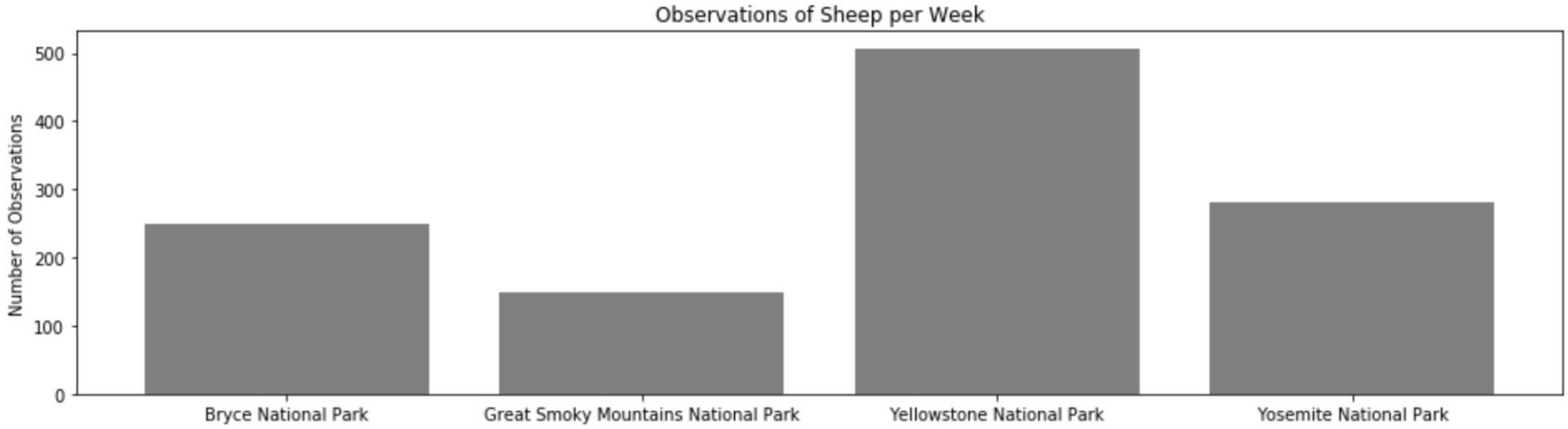
# Sheep conservation programs record hundreds of observations per week across four national parks.



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# Program: testing for foot and mouth disease in sheep populations

## Current Status

Our scientists know that 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.

## Next Steps

The scientists want to test whether or not this program is working. They want to be able to detect reductions of at least 5 percentage points. For instance, if 10% of sheep in Yellowstone have foot and mouth disease, they'd like to be able to know this, with confidence.

# Determining relevant sample sizes

Calculated using Codecademy's sample size calculator and 90% confidence level:

Minimum detectable effect = 100 * 0.05 / 0.15

Baseline = 15

Sample size  = 870

Bryce = 870 / 250

Bryce = 3.48

Yellowstone = 870 / 507

Yellowstone = 1.72

Therefore, it will take approximately 3.5 weeks at Bryce and 1.7 weeks at Yellowstone to collect enough observations for relevant sample sizes.

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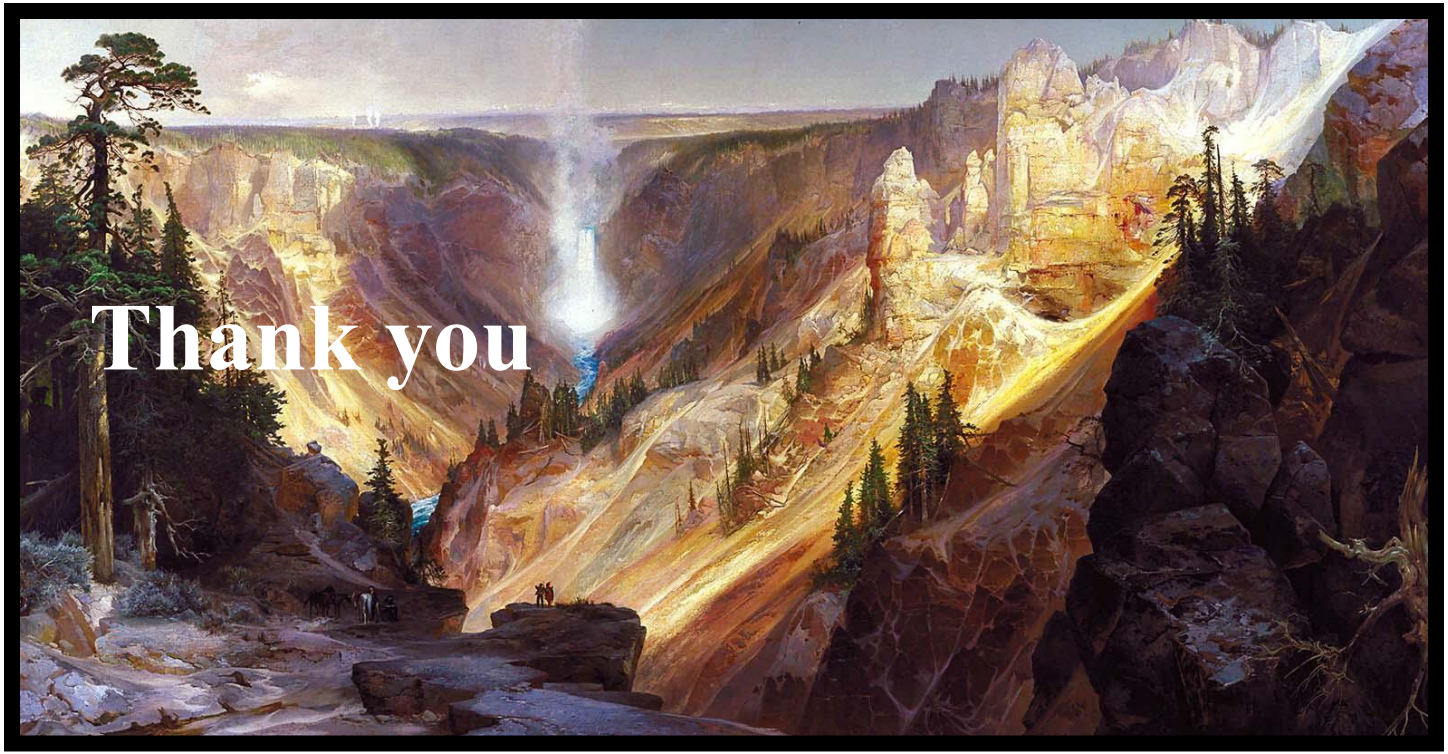


Yellowstone National Park, established in 1872