

Wildlife Resource Management



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Overview

Responsible wildlife management is crucial to maintaining a healthy and sustainable environment for all species. Because of the fragile nature of many local ecologies, detailed organizing systems are needed in order to establish effective resource management policies. In this sense, animals are physical resources that are organized by the U.S. Fish and Wildlife Service (FWS) and state-level fish and wildlife agencies. Information about wildlife is used to make a variety of decisions, from land development and funds allocation to issuing hunting and fishing licenses, so an accurate and comprehensive organizing system is essential.

What is being organized?

Animals are the primary resources being organized in wildlife management systems. The U.S. Fish and Wildlife Service maintains a national organizing system and uses it to shape policy related to wildlife resources at a federal level. Within this broadly-scoped system, each individual state is responsible for managing its own state-wide wildlife resource organizing system.¹

Accurate information about individual animals and collections of animals is important for keeping wildlife populations healthy. In addition to the physical animals, wildlife organizing systems track description resources about the animals. Metadata about individual properties such as an animal's age, sex, and number of offspring is tracked, while data about population size and male-to-female ratio are useful for collections like flocks and herds. In some cases, animals are monitored with RFID tags and GPS transponders to provide detailed information such as location.²

Organizing wildlife resources is difficult because focusing on a single resource or collection is insufficient. Because wildlife resources are animals, they interact with one another and with environmental factors. Mismanagement can have negative consequences (keeping wolves and deer in the same location will likely lead to a reduction in the deer population). Additionally, animal populations are constantly changing, so wildlife organizing systems must be able to manage continual additions and removals of resources.

Why is it being organized?

Though they may appear hearty, ecosystems can be quite fragile. Seemingly insignificant changes like the extinction of a species or construction of oil pipelines can cause far-reaching consequences that cascade throughout an ecosystem and lead to widespread disease and destruction.³ Thorough organization allows scientists and regulators to assess and improve the health of wildlife populations.

In addition to protecting wildlife resources, these organizing systems also support other interactions. Each state is responsible for issuing hunting and fishing licenses within its borders. In order to know

1 U.S. Fish and Wildlife Service. "About the U.S. Fish and Wildlife Service." https://www.fws.gov/help/about_us.html. Retrieved November 2016.

2 Wikipedia. "Microchip implant (animal)." [https://en.wikipedia.org/wiki/Microchip_implant_\(animal\)](https://en.wikipedia.org/wiki/Microchip_implant_(animal)). Retrieved November 2016.

3 University of Michigan. "Ecological Communities: Networks of Interacting Species" (course lecture, *Global Change – The Science of Sustainability*, 14 October 2016). http://www.globalchange.umich.edu/globalchange1/current/lectures/ecol_com/ecol_com.html. Retrieved November 2016.

how many licenses to issue each year, states must carefully track animal populations.⁴ States carefully control hunting permits to ensure that wildlife populations are kept at sustainable levels. Other users of wildlife organizing systems include conservation nonprofit and advocacy groups, Native American tribes, and managers of national and state parks and preserves.

How much is it being organized?

The granularity with which wildlife resources are organized depends on the species of animal and whether its population is endangered. Wildlife organizers around the world use a standardized categorization system developed by the International Union for the Conservation of Nature (IUCN) to organize animals by conservation status, which ranges from “extinct” for species that no longer exist to “least concern” for species that have healthy populations (Figure 1). Species that are classified as “least concern” are typically widespread and have large populations. A “least concern” species like mule deer is usually organized as a collection—these animals are generally tracked by herds and large geographic areas.

As species become more threatened, they are classified into categories like “vulnerable” and “endangered.” Animals that are classified into these threatened categories are organized with much greater granularity than non-threatened animals. Instead of tracking them only as collections of animals, endangered animals are often tracked individually. They are given unique resource identifiers that allow wildlife managers to continuously monitor individual properties like age and location. This additional metadata about threatened animals is used to shape federal and state policy and conservation efforts. For example, it is illegal in the United States to hunt, import, export, or sell most endangered species.

When is it being organized?

Organization initially happens “on the way in” in a literal sense for threatened species when new animals are born. Births of threatened animals are tracked quite closely. For example, endangered giant panda cub births often garner significant media attention around the world.⁵ Not only are these resources immediately classified as threatened, but metadata about the entire process is carefully recorded and later used to curate or maintain that species. For non-threatened species, newborn animals join the collection of their herd.

Population numbers, whether detailed individual statistics on threatened species or herd estimates of robust species, are used to curate the organizing system. Reclassification can happen whenever a species population dips under or rises above specified thresholds. As a recent example, the gray wolf (*Canis lupus*) was first classified as endangered across the United States in 1978. In 2011, the gray wolf was reclassified as non-threatened after populations recovered and reached healthy numbers in Region 6 (the Mountain-Prairie Region consisting of Montana, Idaho, eastern Washington, eastern Oregon, and north-central Utah).⁶

4 Edson, Jacob. “Counting White-tailed Deer Kill Totals.” *Deer and Deer Hunting*. 13 September 2012. <http://www.deeranddeerhunting.com/blogs/counting-white-tailed-deer-kill-totals>. Retrieved December 2016.

5 Associated Press. “Surprise! Giant panda produces twins at Vienna Zoo.” 16 August 2016. <http://bigstory.ap.org/article/1a090c07da6c49ce84f4f8c0cc011775/surprise-giant-panda-produces-twins-vienna-zoo>. Retrieved November 2016.

6 Environmental Conservation Online System. “Gray wolf (*Canis lupus*).” <https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A00D>. Retrieved December 2016.

State-level organizers also perform curation and organization tasks annually using resource population data. Methods of population control such as hunting are used to remove resources from the organizing system. Curation is essential to maintaining healthy ecosystems, as overpopulation can lead to habitat destruction, extinction of other native species, animal starvation, and the spread of disease.⁷ Different species have different seasons in which they can be legally hunted, so curation takes place during specific times throughout the year. State and federal fish and wildlife services have legal governance over the curation process, as mandated by law.

How and by whom is it being organized?

Wildlife resource organization is officially performed by wildlife and conservation biologists and scientists. As experts in the field, their organization and categorization systems carry scientific warrant and are embodied in local and federal laws. The IUCN has created a standardized categorization system used throughout the world.⁸ The FWS follows this international standard to classify wildlife resources in the United States and establishes other federal policy around the use of wildlife resources. State fish and wildlife service agencies perform similar organization tasks at state and local levels.

These professional organizers are also among the most active users of the organization system. However, other groups and individuals regularly interact with resources in the system. Hunters and fishers, environmental advocacy groups, and national parks all interact with wildlife resources in accordance with the rules set by the state and federal agencies.

Where is it being organized?

In this organizing system, resources are organized by geographic area. The FWS divides the United States into eight regions (Figure 2). Each state also further subdivides itself into regions; for example, California has seven state regions (Figure 3). These areas are more administrative than natural boundaries—the resources themselves are not aware that they may be crossing state or FWS region boundaries. States must therefore coordinate policies around issues like hunting and resource use, as animals that may be legal to hunt in one state could be illegal to hunt in a neighboring state.

This continual resource movement makes organizing wildlife difficult. In addition to short-range movement, resource location can depend on time of year, as some animals migrate seasonally to different regions or even outside the United States. These large-scale migrations put the resources outside the scope and legal jurisdiction of the FWS, which has led the FWS to share conservation and legal duties with neighboring countries.

Other considerations?

Though the Fish and Wildlife Service is the official wildlife management organization in the United States, there are other groups that contest its institutional authority. The use of animals in religious

7 Rawiniski, Thomas J. "Impacts of White-tailed Deer Overabundance in Forest Ecosystems: An Overview." Forest Service, U.S. Department of Agriculture. June 2008. USADA: Newton Square, PA. https://www.na.fs.fed.us/fhp/special_interests/white_tailed_deer.pdf.

8 International Union for Conservation of Nature. "The 2001 IUCN Red List Categories and Criteria Version 3.1, Second Edition." 2012. IUCN: Gland, Switzerland and Cambridge, UK.

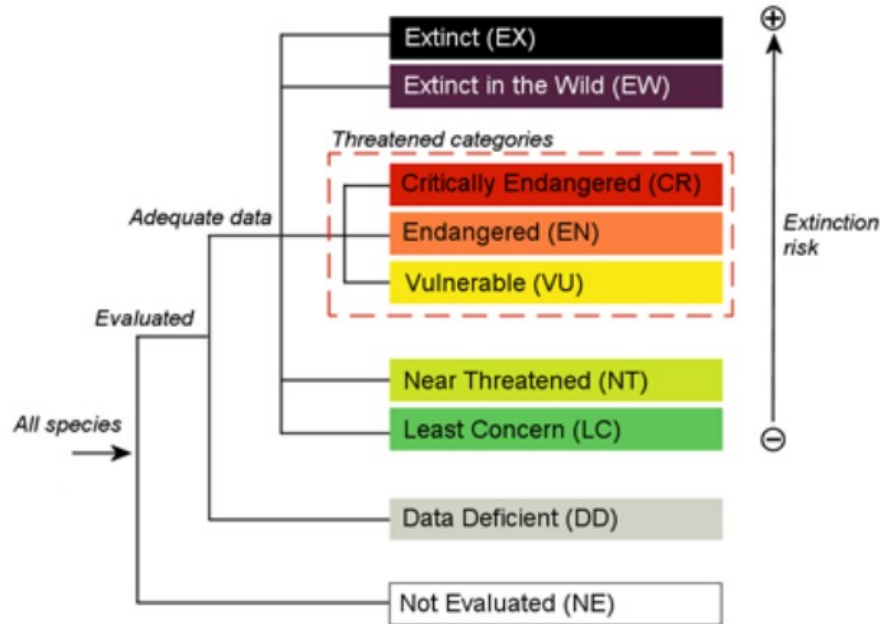
ceremonies is culturally important for many Native American groups. These groups have successfully worked with the U.S. Fish and Wildlife Service to preserve their right to interact with endangered resources in ways that are otherwise illegal for those who do not have a permit. A primary example is with the use of bald eagle feathers. It is illegal to sell or trade eagles and eagle parts, including feathers, as the bald eagle is classified as an endangered species.⁹ Native American tribes are allowed to legally receive exceptions to these laws. Additionally, the FWS has established a specific Native American Program and now includes tribal experts and conservationists in decisions that affect wildlife resource organization.¹⁰

9 U.S. Fish and Wildlife Service. "How Can I Obtain Eagle Feathers or Parts?" <https://www.fws.gov/faq/featherfaq.html>. Retrieved December 2016.

10 U.S. Fish and Wildlife Service. "Native American Program." <https://www.fws.gov/nativeamerican>. Retrieved December 2016.

RESOURCES

Figure 1: IUCN Wildlife Conservation



Source: IUCN Red List Categories and Criteria, Version 3.1 (2001)

Extinct (EX)	No known individuals remaining.
Extinct in the wild (EW)	Known only to survive in captivity, or as a naturalized population outside its historic range.
Critically endangered (CR)	Extremely high risk of extinction in the wild.
Endangered (EN)	High risk of extinction in the wild.
Vulnerable (VU)	High risk of endangerment in the wild.
Near threatened (NT)	Likely to become endangered in the near future.
Least concern (LC)	Lowest risk; does not qualify for a higher risk category. Widespread and abundant taxa are included in this category.
Data deficient (DD)	Not enough data to make an assessment of its risk of extinction.
Not evaluated (NE)	Has not yet been evaluated against the criteria.

Source: https://en.wikipedia.org/wiki/Conservation_status

Figure 2: National Fish and Wildlife Regions



Image source: U.S. Fish and Wildlife Service (<https://www.fws.gov/ecological-services/about/contacts-new.html>)

Region 1 - Pacific

Region 2 - Southwest

Region 3 - Midwest

Region 4 - Southeast

Region 5 - Northeast

Region 6 - Mountain Prairie

Region 7 - Alaska

Region 8 - Pacific Southwest

Figure 3: California Fish and Wildlife Regions



Image source: California Department of Fish and Wildlife (<https://www.wildlife.ca.gov/regions>)

Region 1 - Northern

Region 2 - North Central

Region 3 - Bay Delta

Region 4 - Central

Region 5 - South Coast

Region 6 - Inland Deserts

Region 7 - Marine

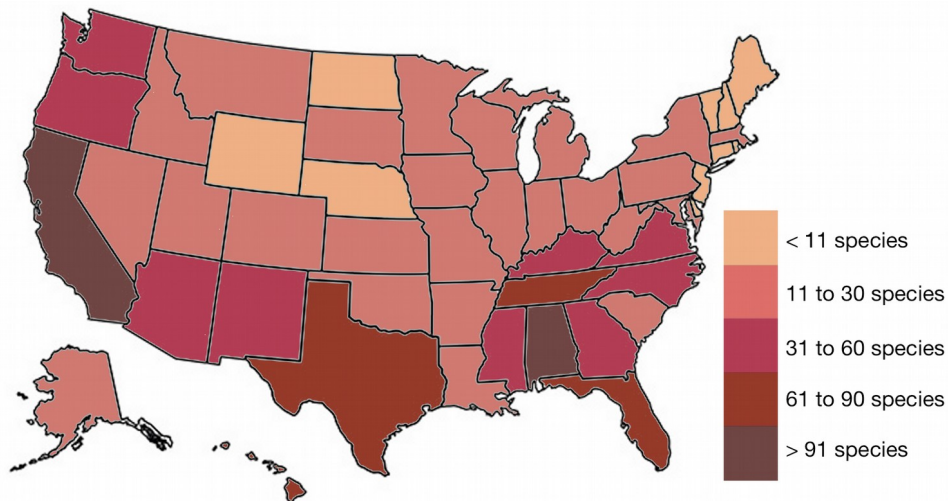
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Case Study Artifact: Wildlife Resource Management

The U.S. Fish and Wildlife Service (FWS) maintains a thorough organizing system of wildlife resources in the United States. However, much of the information the FWS collects is not easy to find or interpret. Furthermore, there are many interesting comparisons, analyses, and learning opportunities that could be made if the data were more accessible. To address these issues, I have prototyped an interactive map application that combines the FWS data with other sources to allow users to explore wildlife resources in greater detail.

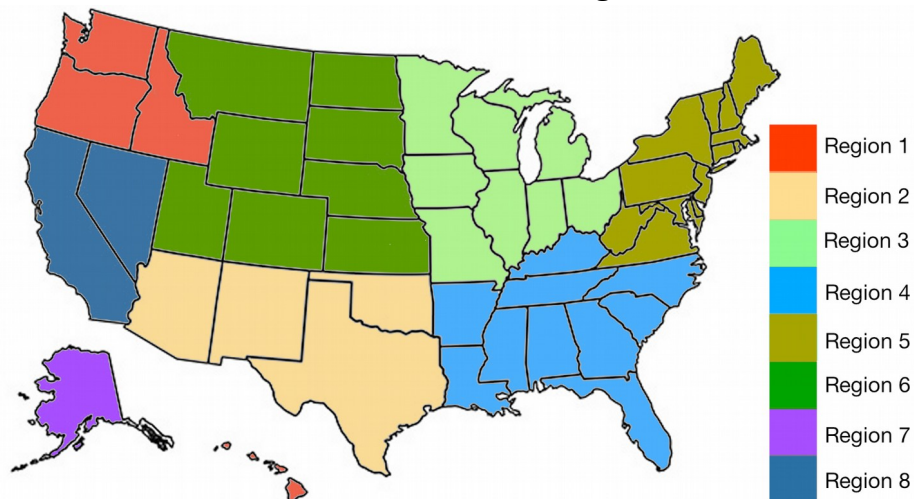
The application combines maps with informational overlays. Users can first select a map that interests them. These could include heat maps of endangered and threatened species, election results, total population, GDP per capita, and more. A few examples are presented below:

Number of Endangered Species, by State



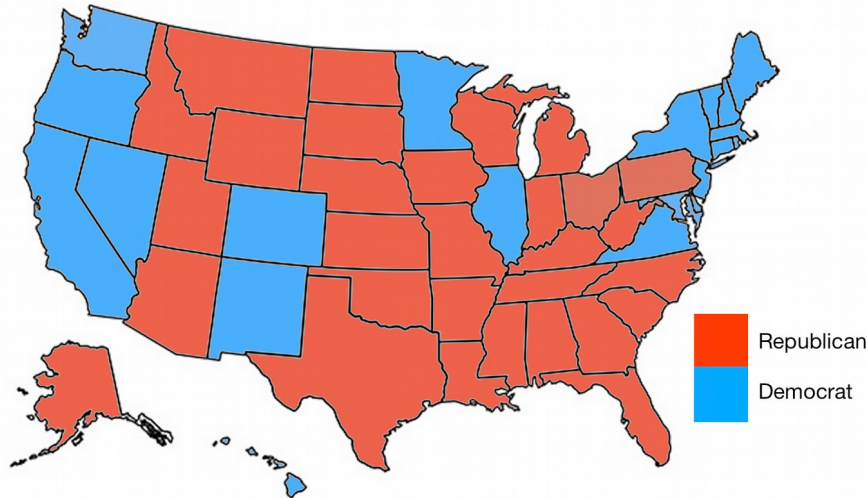
Data source: U.S. Fish and Wildlife Service (<https://www.fws.gov/endangered/map>)

U.S. Fish and Wildlife Regions



Data source: U.S. Fish and Wildlife Service (<https://www.fws.gov/ecological-services/about/contacts-new.html>)

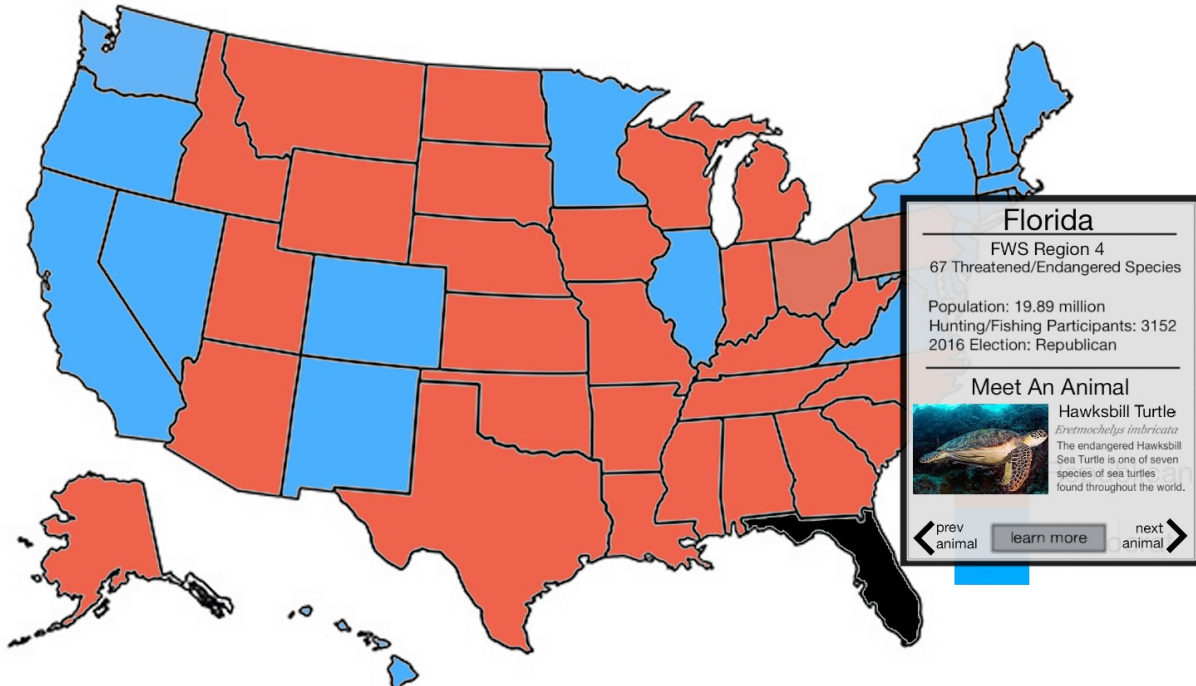
2016 Presidential Election Results



Data source: New York Times (<http://www.nytimes.com/elections/results/president>)

After selecting a base layer map, users can explore the map by clicking on different states. Clicking on a state brings up an info box with data about the state, its placement in the broader organizing system, and the endangered and threatened animals in the state. It also contains a “Meet an Animal” feature that displays photos and facts about the wildlife resources in the state.

Info Box: Selecting Florida in the Election Results Map



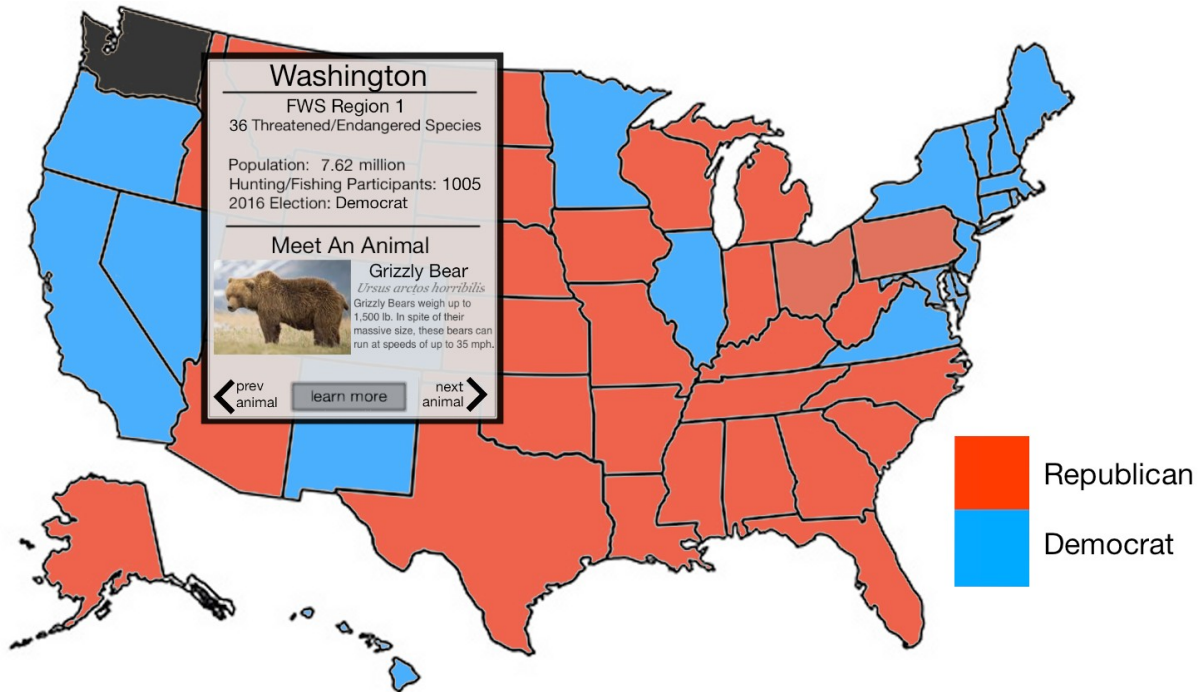
Data source: New York Times (<http://www.nytimes.com/elections/results/president>)

Photo source: Henry Jager, YourShot, National Geographic
(<http://animals.nationalgeographic.com/animals/reptiles/hawksbill-turtle>)

Text source: U.S. Fish and Wildlife Service (<http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=C00E>)

Clicking on a different state opens that state's info box:

Info Box: Selecting Washington in the Election Results Map



Data source: New York Times (<http://www.nytimes.com/elections/results/president>)

Photo source: Fernando O'Farrill, YourShot, National Geographic
(<http://animals.nationalgeographic.com/animals/mammals/grizzly-bear>)

Text source: U.S. Fish and Wildlife Service (<http://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A001>)

This interactive map application relies on the underlying structure of the wildlife resource organizing system that is maintained by the FWS. The FWS divides the United States into eight regions that it uses to organize wildlife resources and set policy. However, each individual state is also responsible for maintaining its own wildlife organizing systems. This application is designed to bridge those two organizing systems, sharing data and information aggregated from the national level (the federal FWS) and state level (each state's FWS). Allowing users to change the map underneath the wildlife resource data allows for further insights, as users can make connections between the institutional data and information about cultural, social, and economic factors.