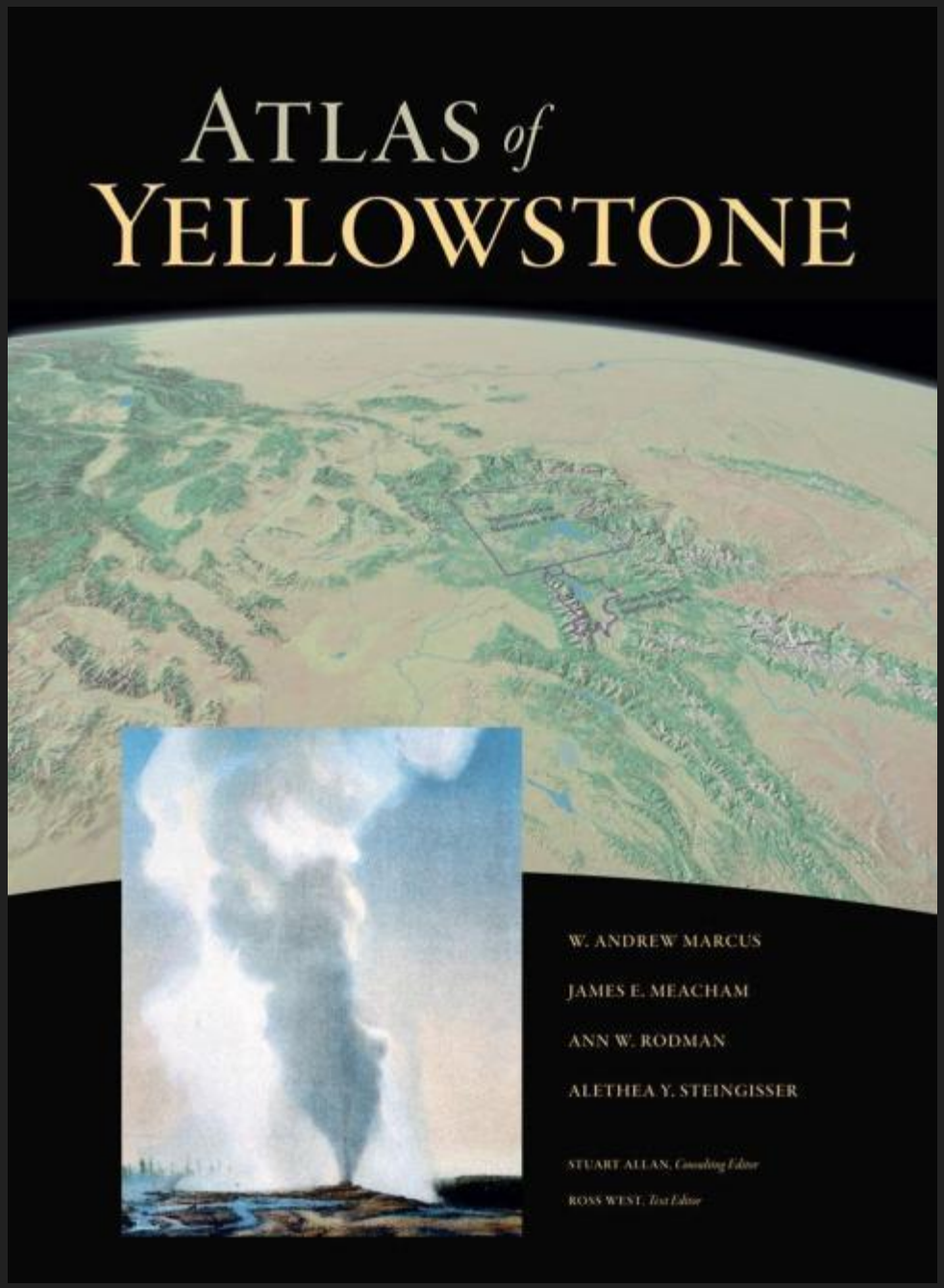

9th ICA Mountain Cartography Workshop - 2014 Banff

Thematic Map Design and the Atlas of Yellowstone

James E. Meacham
InfoGraphics Lab
Department of Geography
University of Oregon
jmeacham@uoregon.edu

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Acknowledgments - Atlas

Editorial team:

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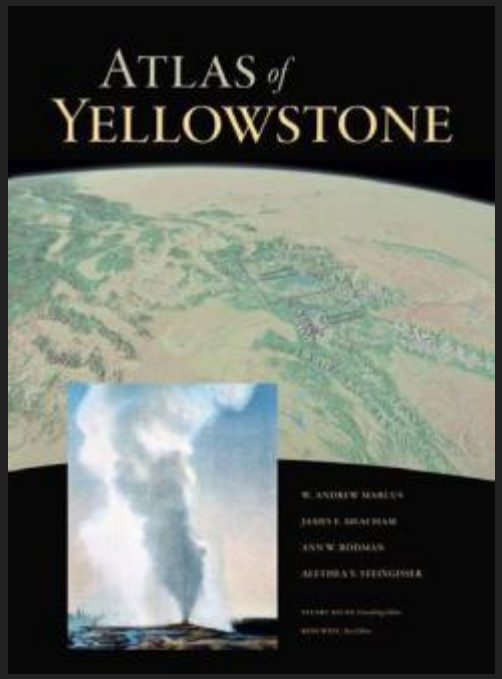
Alethea Steingisser, Production Manager
and
Stuart Allan, Consulting Editor
Ross West, Text Editor

Contributions by: 100+ topic experts and 30+ cartographic/GIS staff and students

Funding provided by: Yellowstone Park Foundation, Canon USA, University of Oregon, Montana State University, University of Wyoming, and individual donors

Publisher: University of California Press



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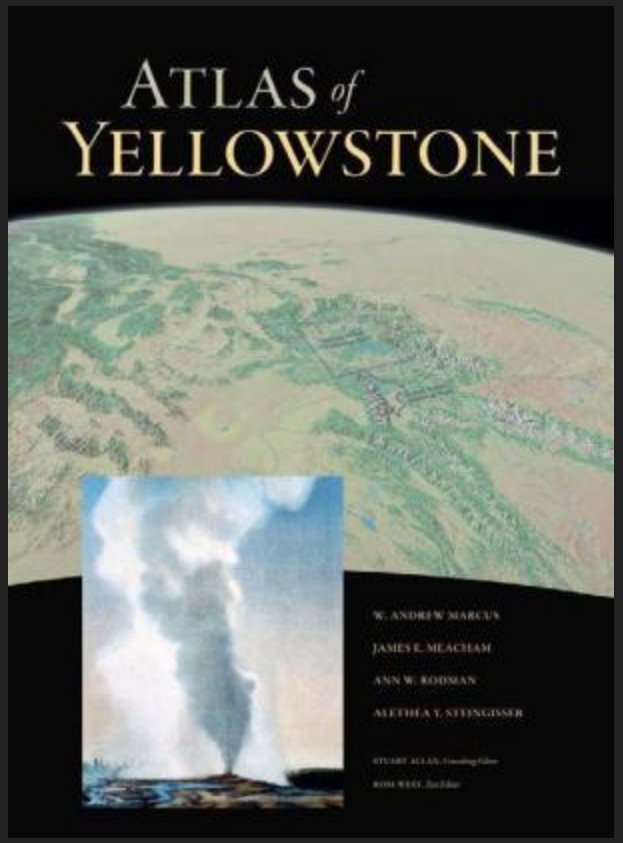
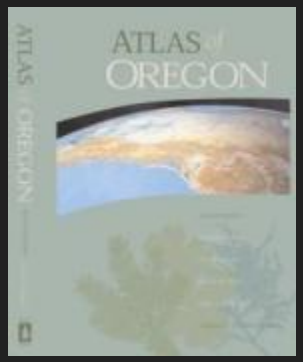


The Atlas of Yellowstone is an authoritative reference.

296 pages - 9.5” by 13.5”

- topics – ranging from archaeology, history, art, to geology, geysers, bears, bison, wolves, and waterfalls
- New topographic reference maps of the region and parks
- gazetteer and index



Modeled after the Atlas of Oregon

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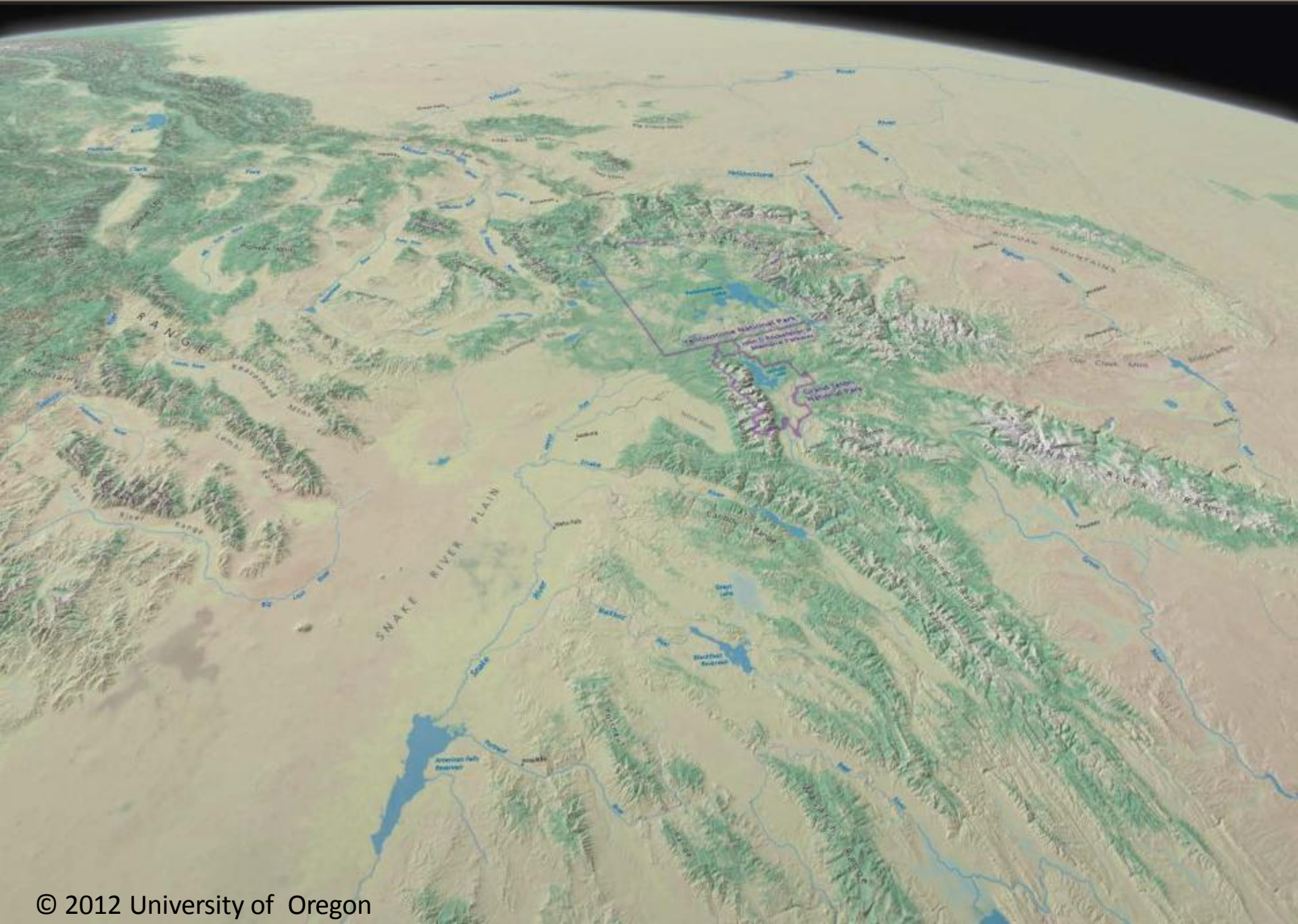
Greater Yellowstone Area



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Geographic Themes

The Atlas is organized around four interconnected geographic themes:

- ***Importance of Yellowstone***
- ***Interaction of Humans and Nature***
- ***Yellowstone is Connected***
- ***Yellowstone is Dynamic***

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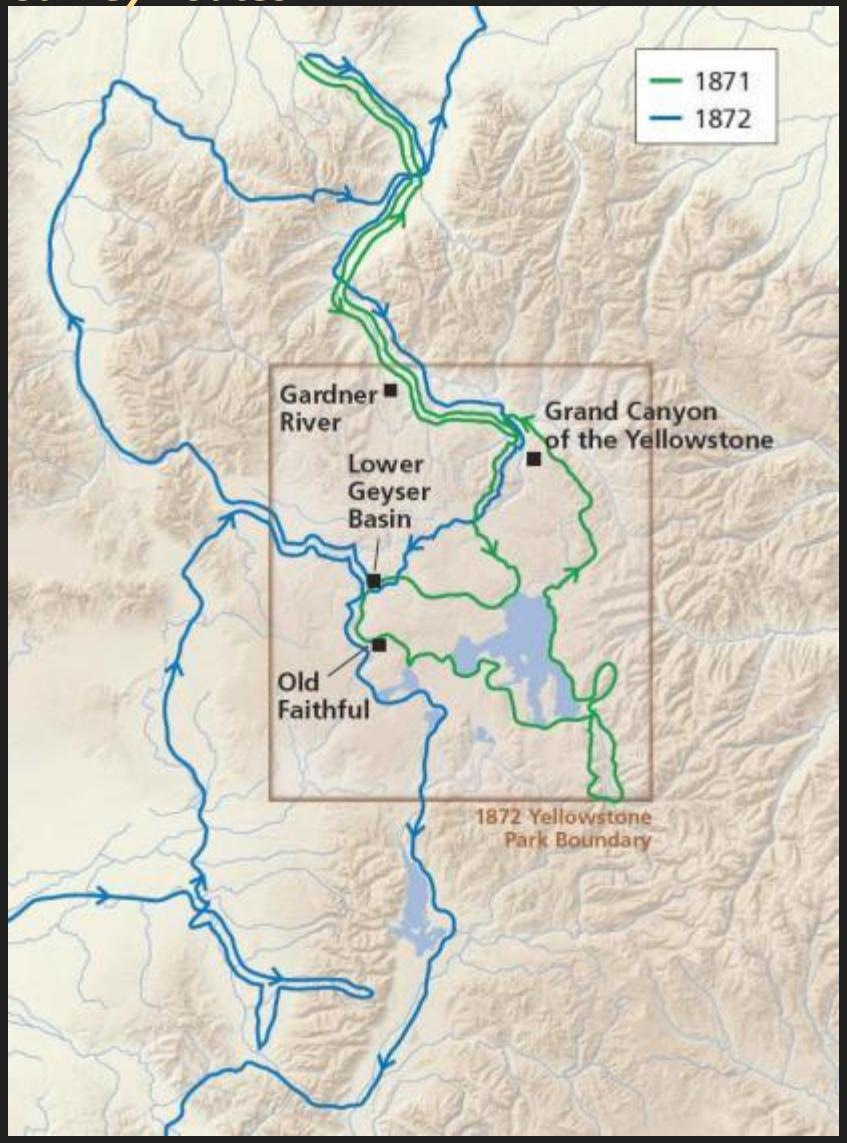
The Hayden Survey

Survey Routes



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The Hayden Survey

Thomas Moran - Paintings

Grand Canyon of the Yellowstone, 1871, Smithsonian

The Hayden Survey

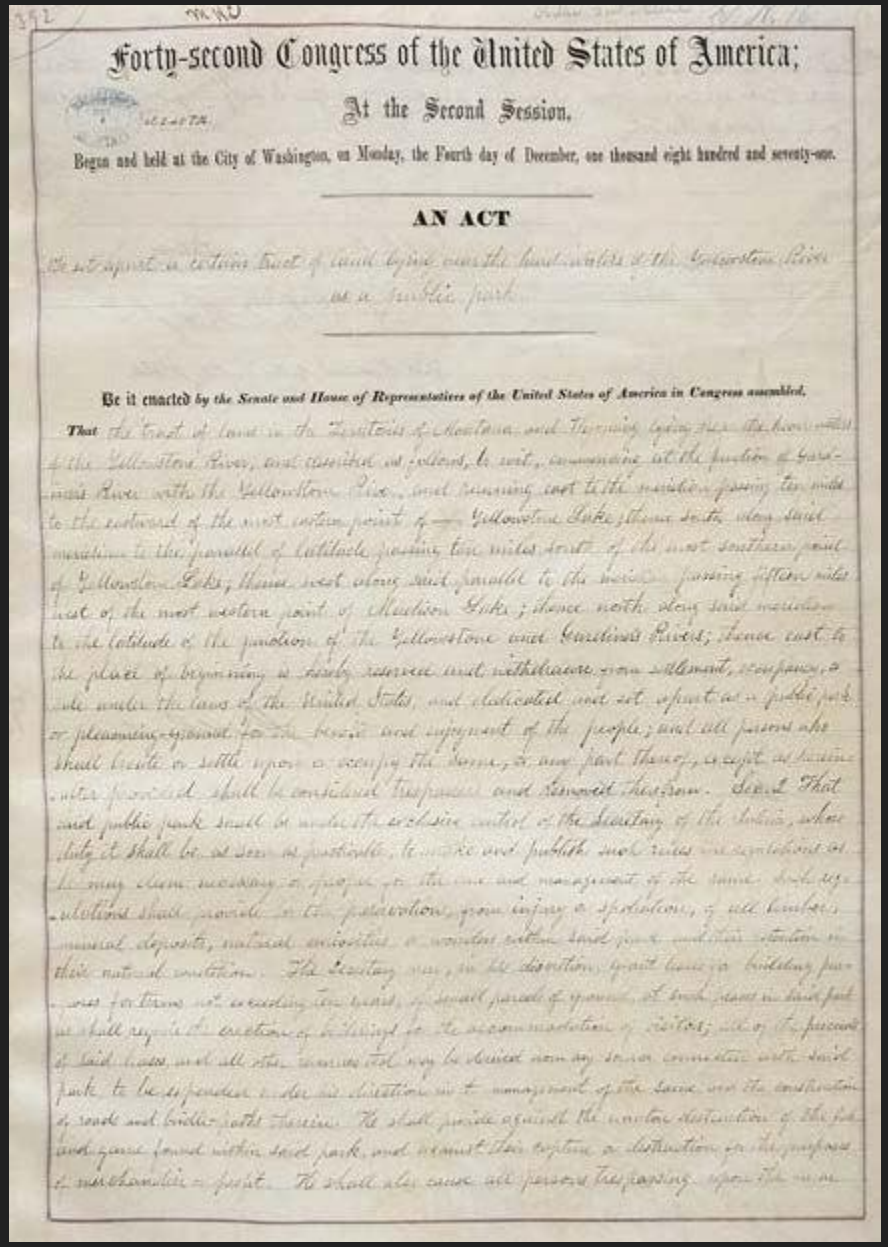
William Henry Jackson - Photography

Crater of Old Faithful, 1871

Teton Range from the West, 1872

Congressional Establishment of Yellowstone, 1872

"the tract of land
…set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people…"



Forty-second Congress of the United States of America;

At the Second Session,

Begun and held at the City of Washington, on Monday, the Fourth day of December, one thousand eight hundred and seventy-one.

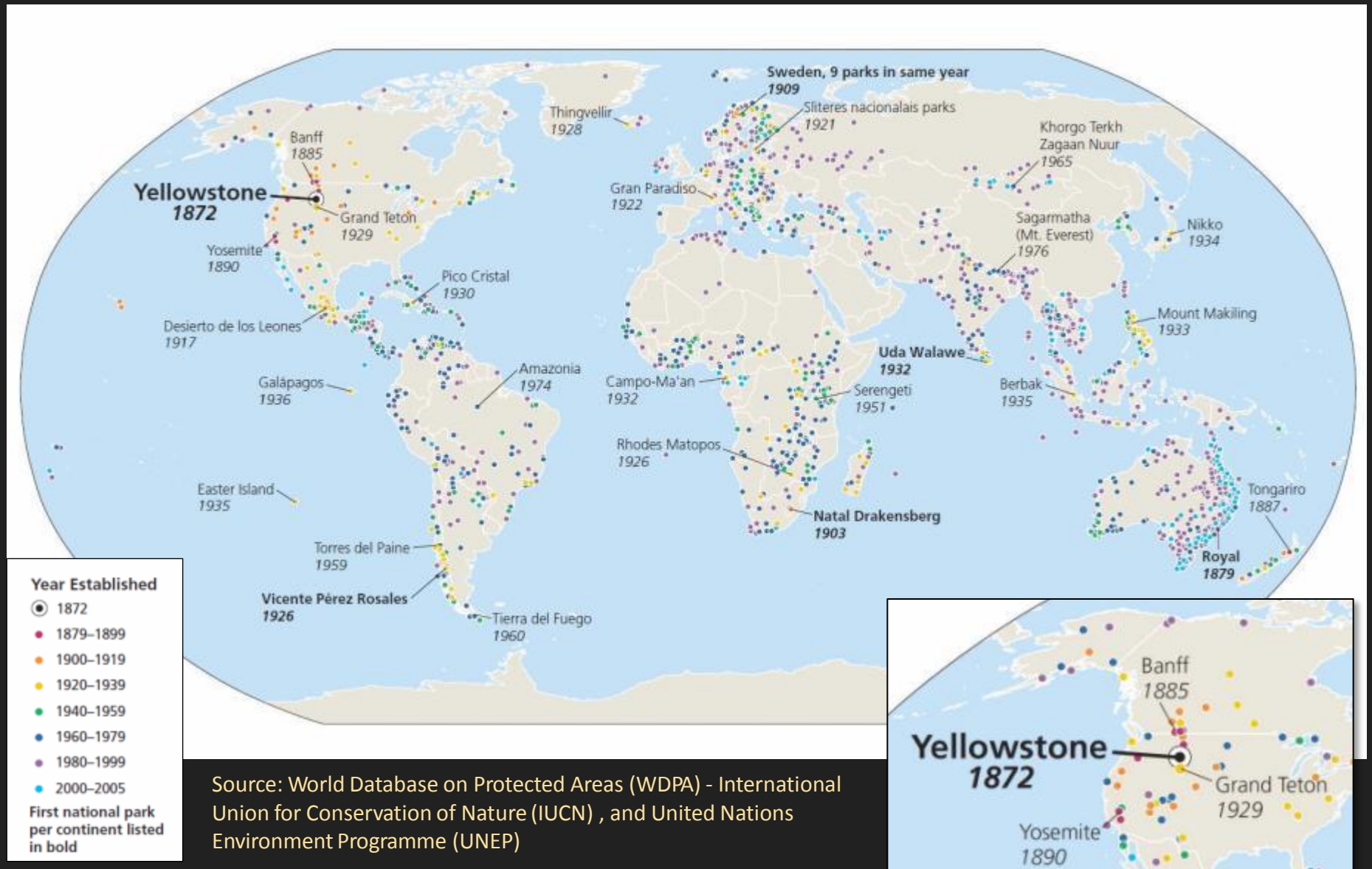
AN ACT

To set apart a certain tract of land lying near the head waters of the Yellowstone River as a public park.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That the tract of land in the Territories of Montana and Wyoming lying near the headwaters of the Yellowstone River, and described as follows, to wit, commencing at the junction of Gardiner's River with the Yellowstone River, and running east to the meridian passing ten miles to the eastward of the most eastern point of Yellowstone Lake; thence south along said meridian to the parallel of latitude passing ten miles south of the most southern point of Yellowstone Lake; thence west along said parallel to the meridian passing fifteen miles west of the most western point of Madison Lake; thence north along said meridian to the latitude of the junction of the Yellowstone and Gardiner's Rivers; thence east to the place of beginning is hereby reserved and withdrawn from settlement, occupancy, or sale under the laws of the United States, and dedicated and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people; and all persons who shall locate or settle upon or occupy the same, or any part thereof, except as hereinafter provided shall be considered trespassers and removed therefrom. Second That said public park shall be under the exclusive control of the Secretary of the Interior, whose duty it shall be, as soon as practicable, to make and publish such rules and regulations as he may deem necessary or proper for the care and management of the same. Such regulations shall provide for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities or wonders within said park, and their retention in their natural condition. The Secretary may, in his discretion, grant leases for building purposes for terms not exceeding ten years, of small parcels of ground, at such places in said park as shall require the erection of buildings for the accommodation of visitors; all of the proceeds of said leases, and all other revenues that may be derived from any source connected with said park, to be expended under his direction in the management of the same and the construction of roads and bridges therein. He shall provide against the wanton destruction of the fish and game found within said park, and against their capture or distribution for the purpose of merchandise or profit. He shall also cause all persons trespassing upon the said

The World's First National Park



Source: World Database on Protected Areas (WDPA) - International Union for Conservation of Nature (IUCN) , and United Nations Environment Programme (UNEP)

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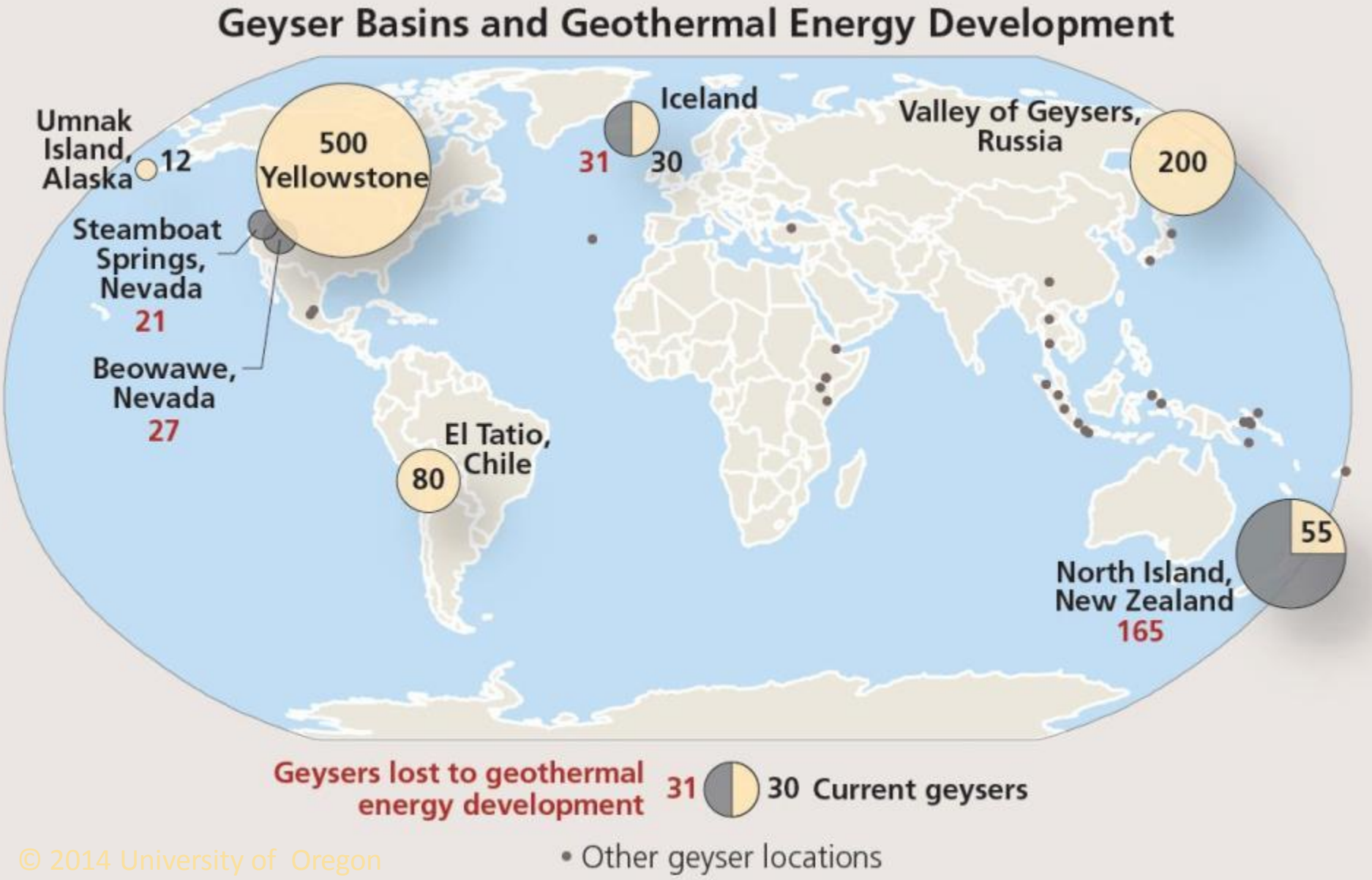
The Largest Concentration of Geysers



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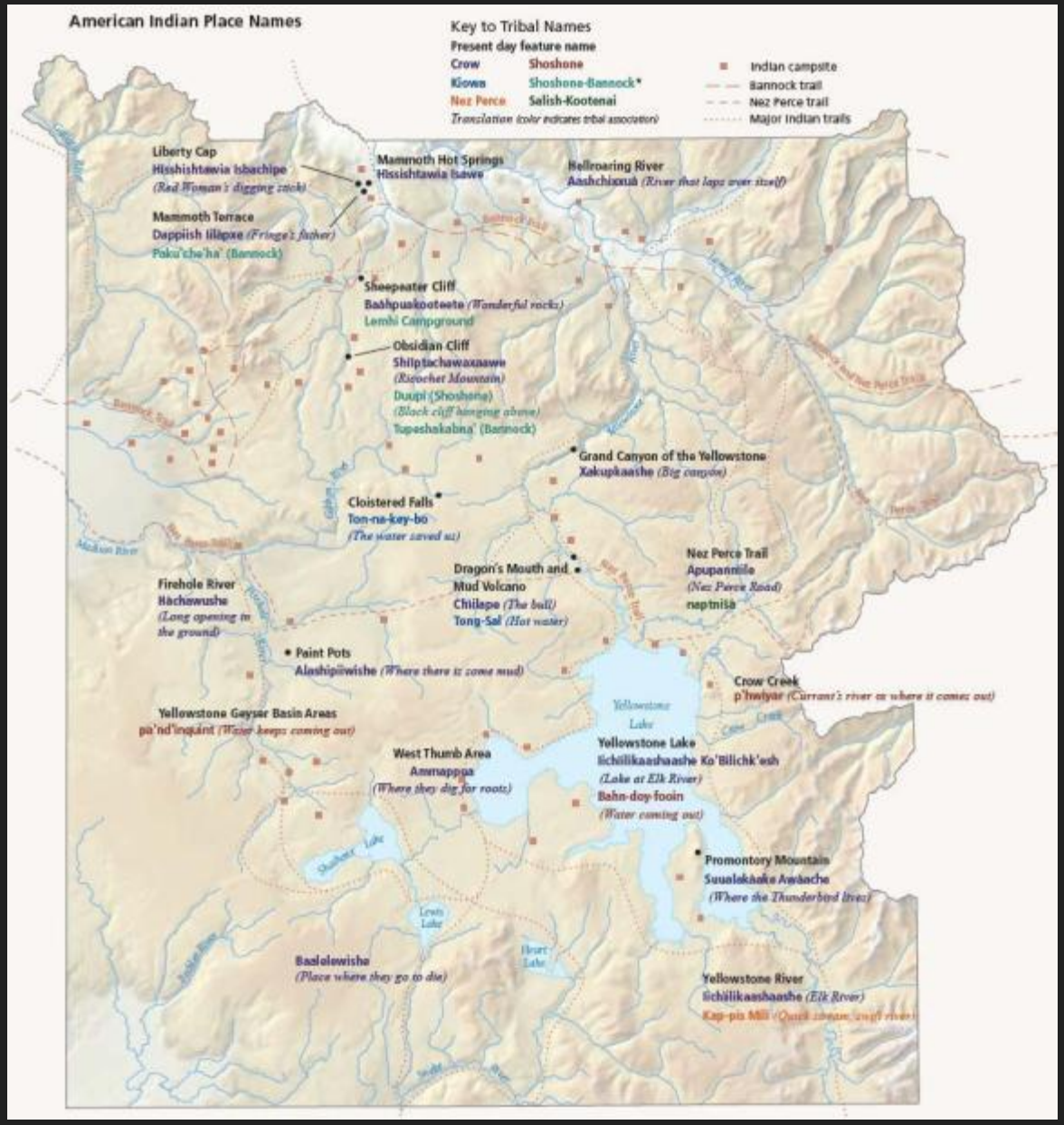
American Indians Place Names



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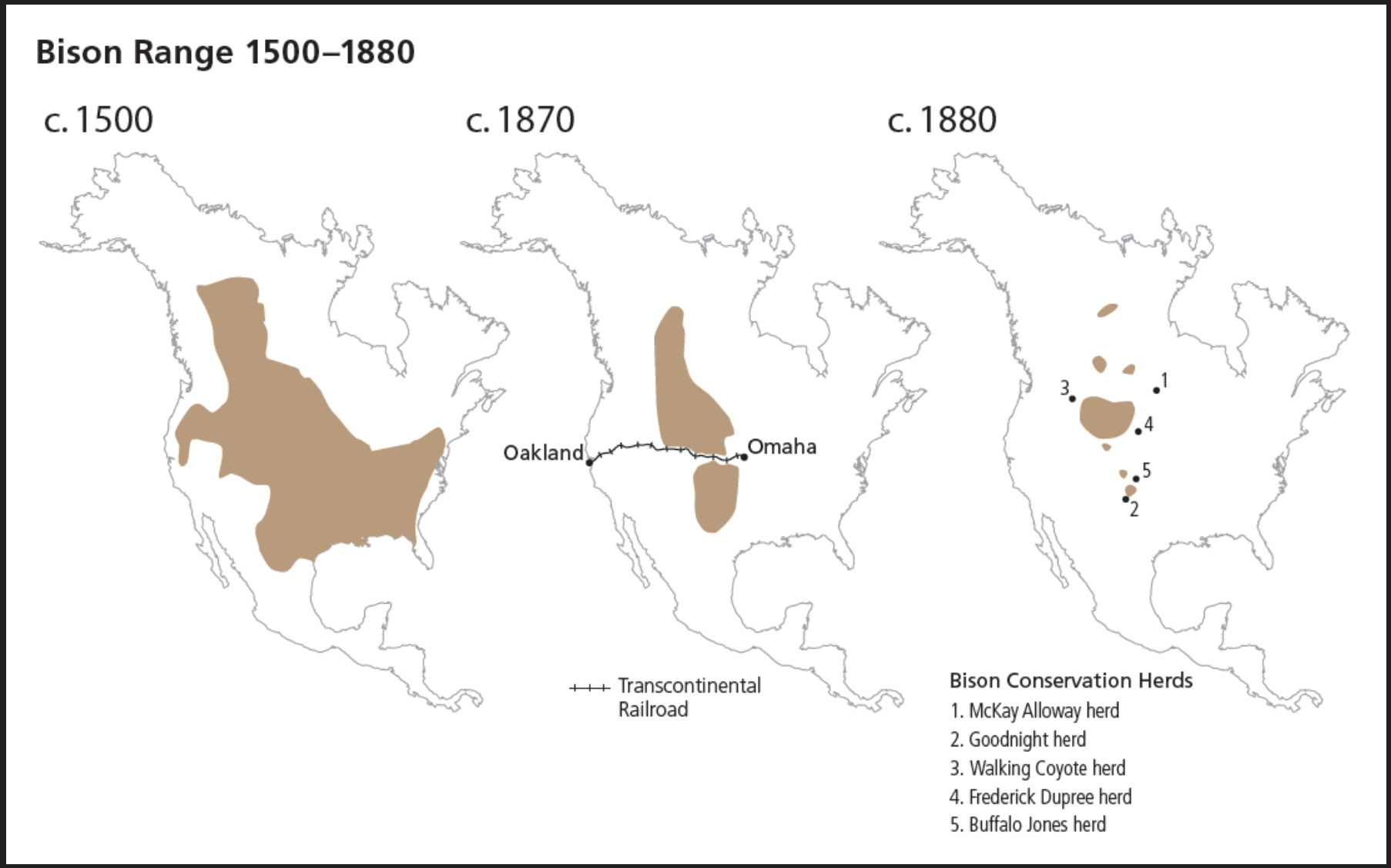
Bison Decline



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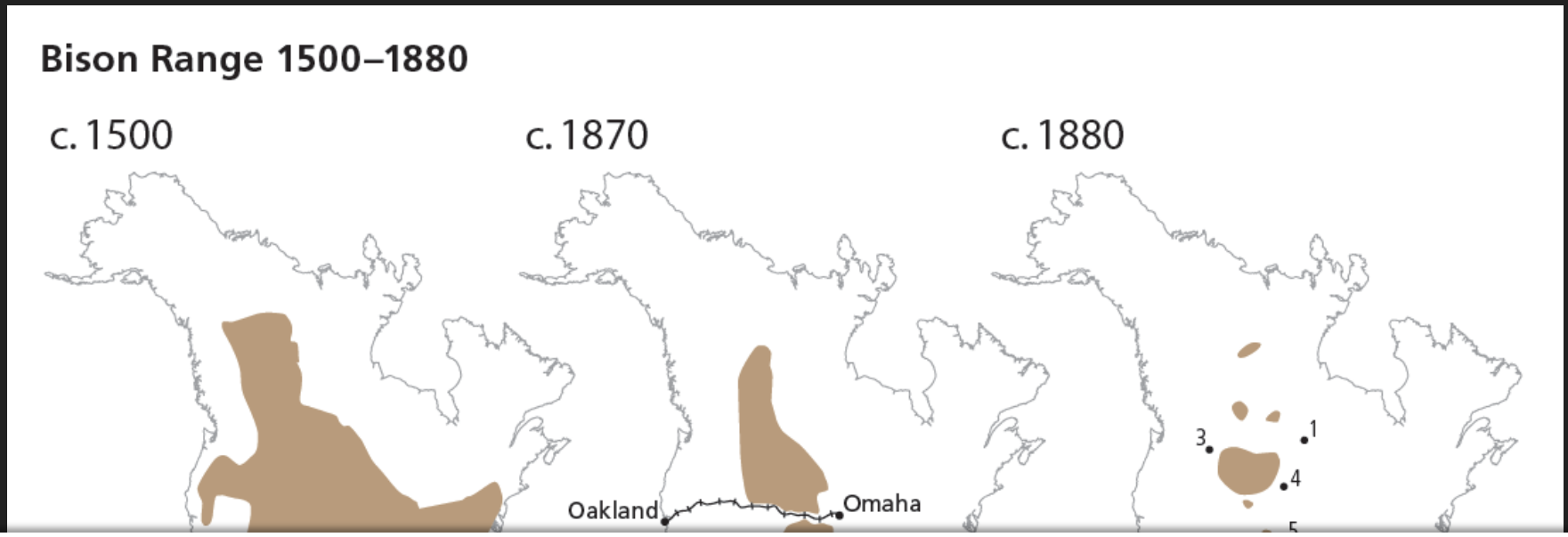
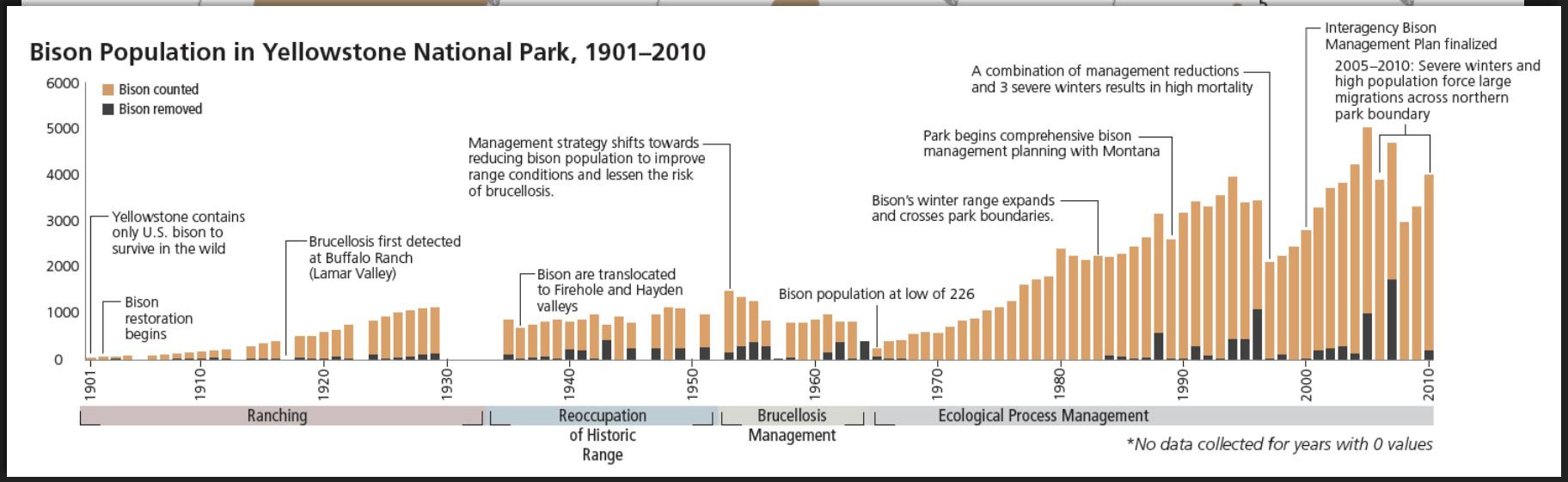
Bison Restoration





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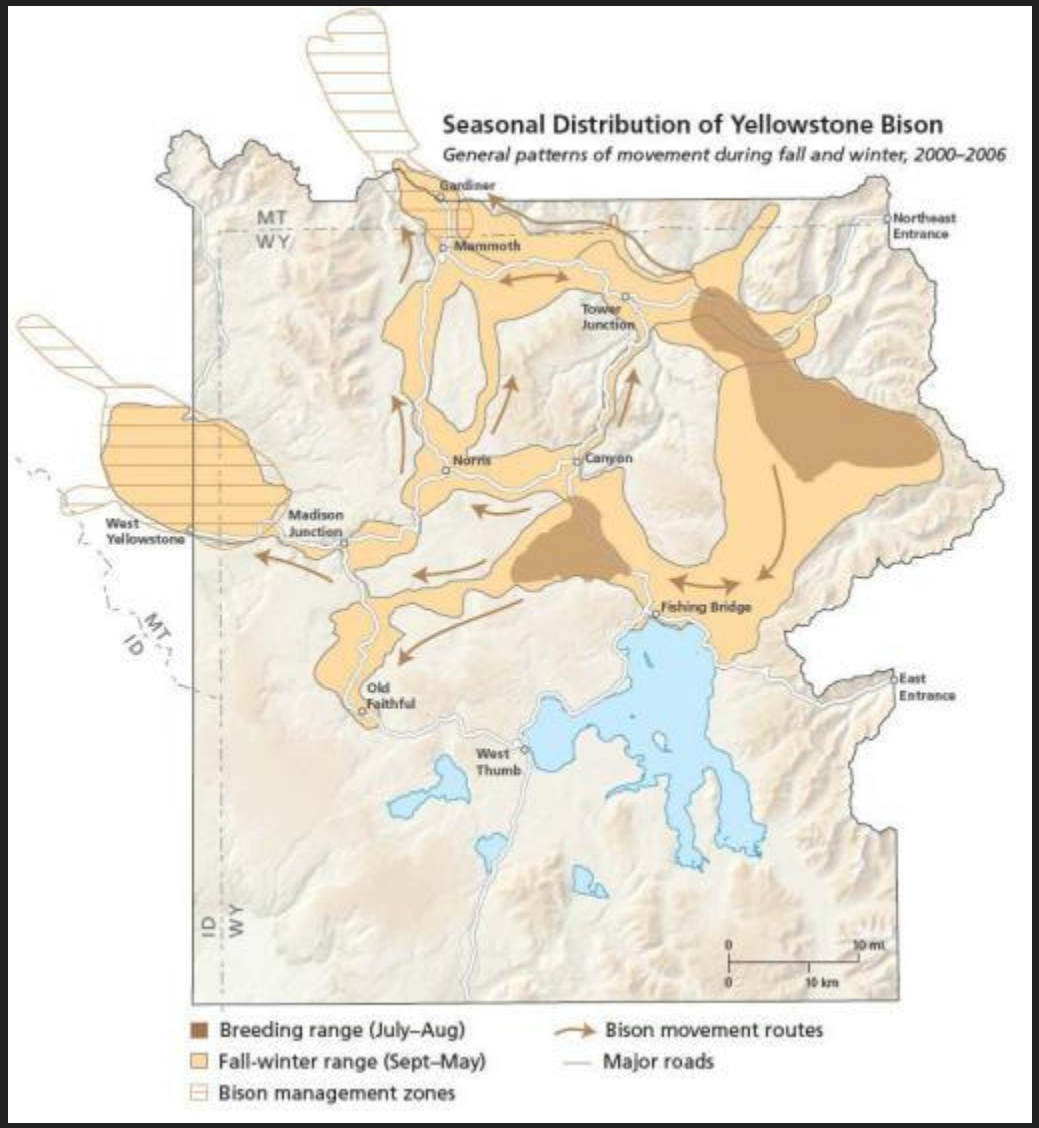
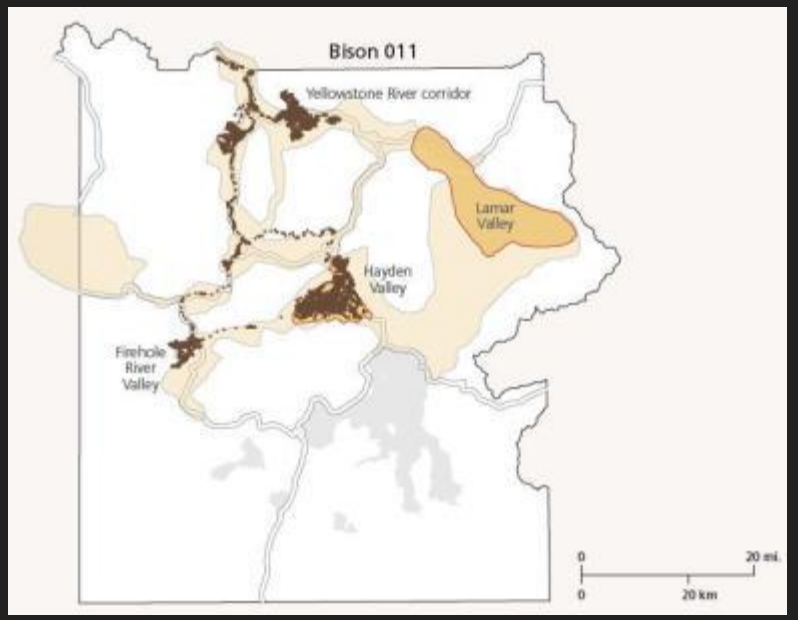
Bison Movement and Management





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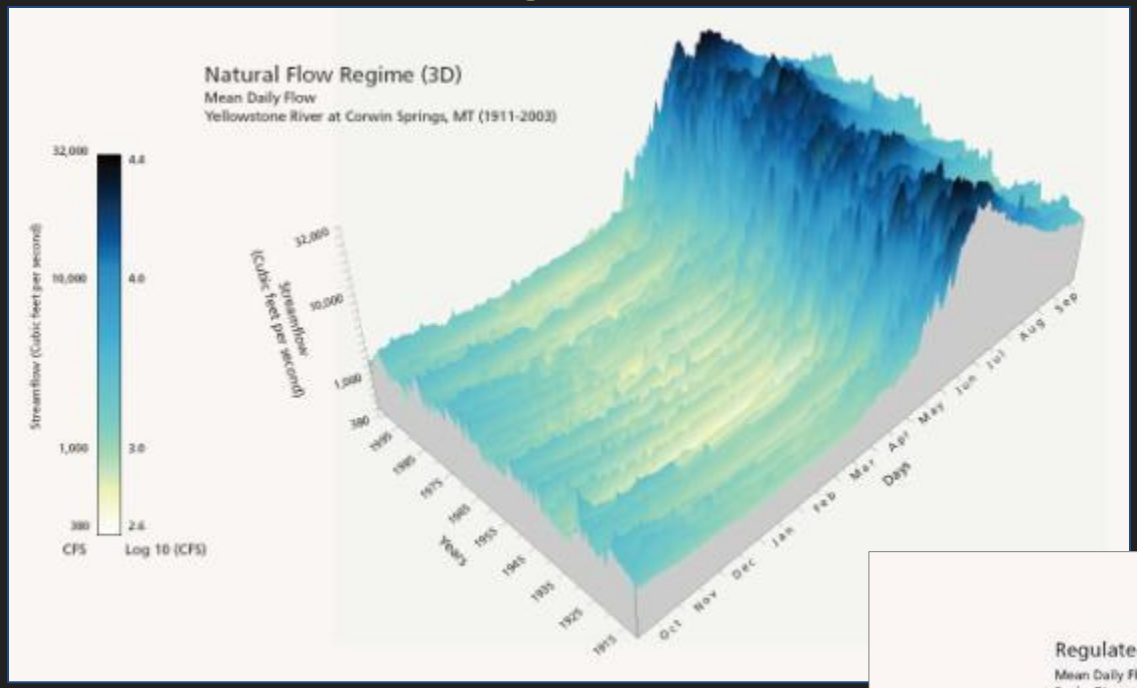
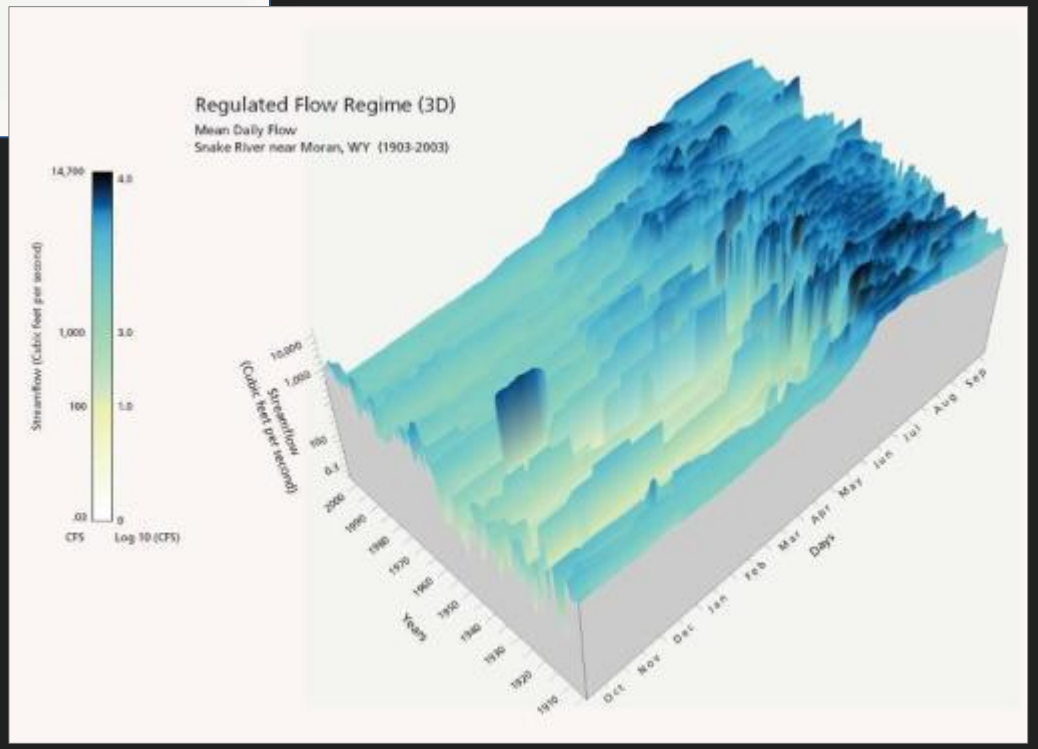
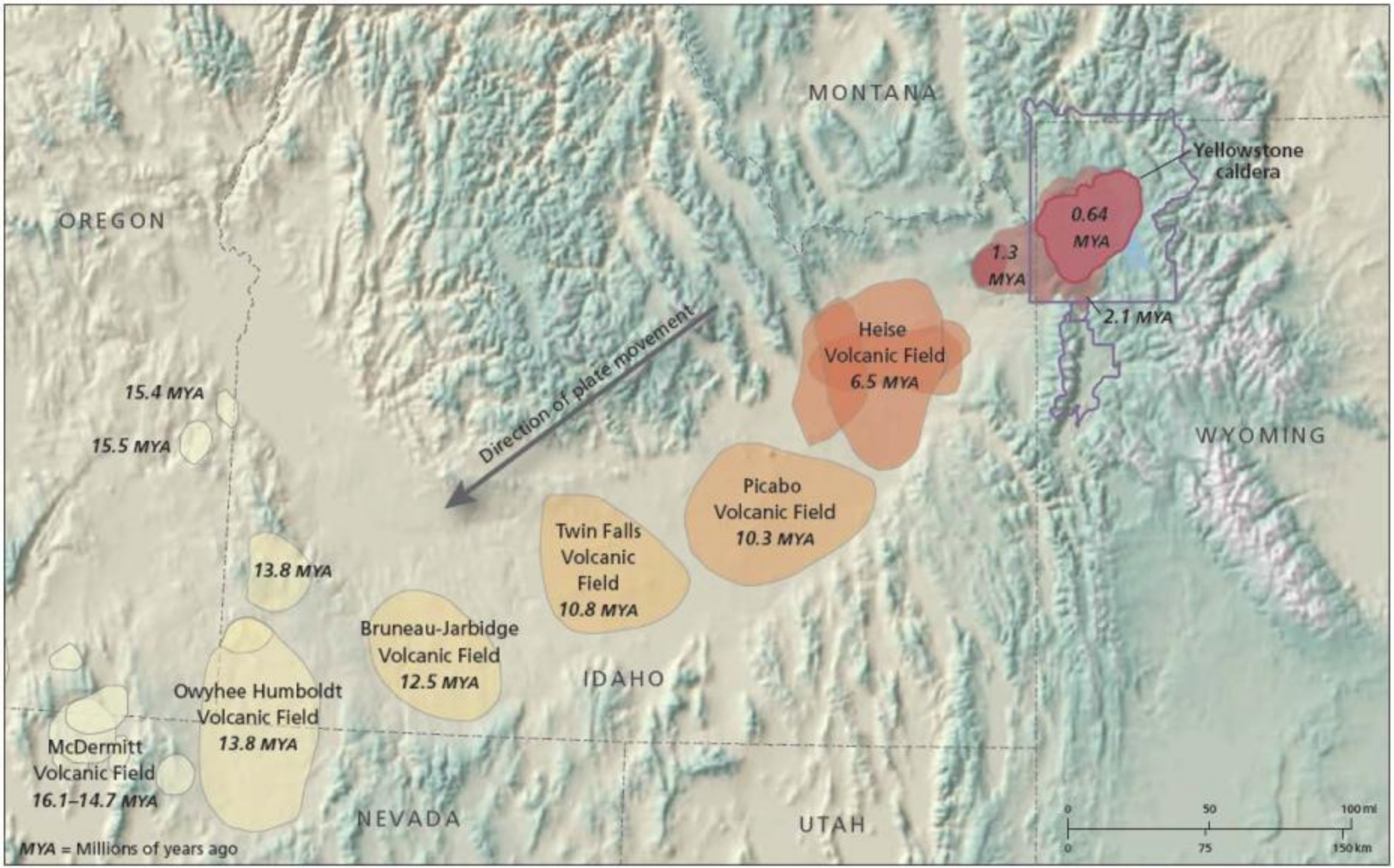
Headwaters of the Nation: Rivers

Rivers – Erik Strandhagen MA Research

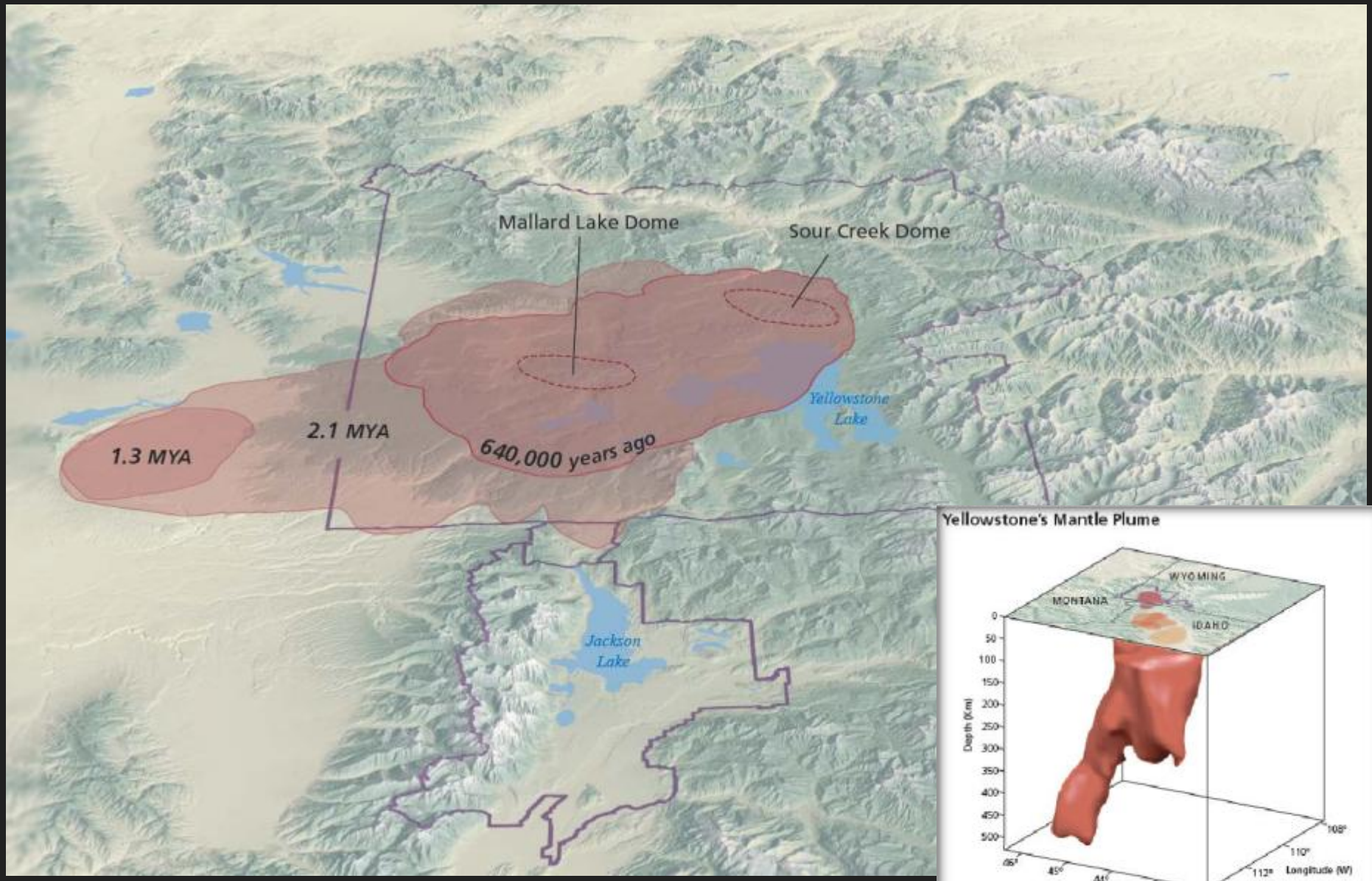




The Yellowstone Hot Spot



The Yellowstone Caldera



Making the Atlas

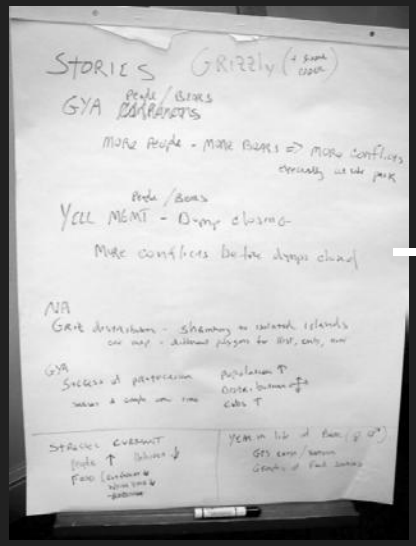
Working with Topic Experts-Contributors

Yellowstone National Park
Grand Teton National Park
Montana State University
University of Wyoming
Buffalo Bill Historical Center
Head Waters Economics
Allan Cartography
Yellowstone Ecological Research Center
University of Oregon

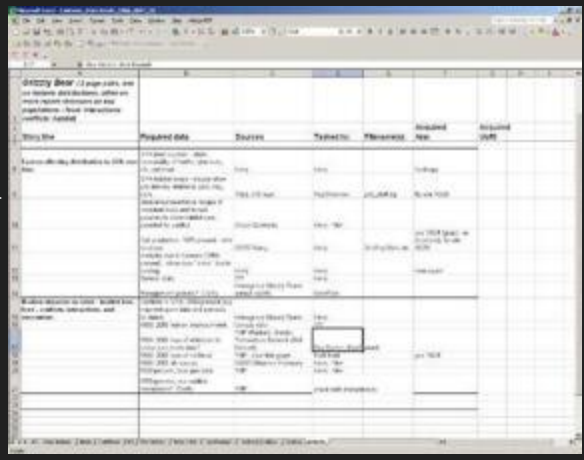
Working with the Experts to Capture the Stories

- What are the big stories?
- Data sources/availability
- Data experts
- Initial map/graphic ideas - layouts

Mockup Pages



Flip Chart – Stories list

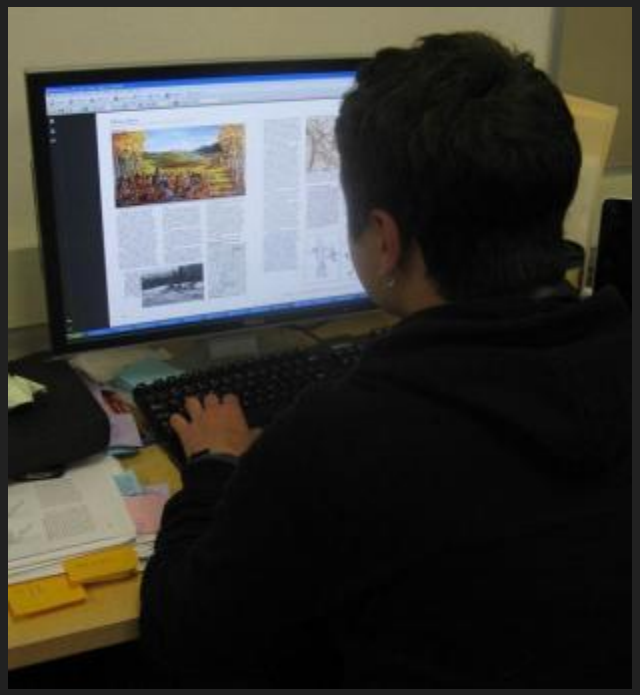


Tracking Sheet

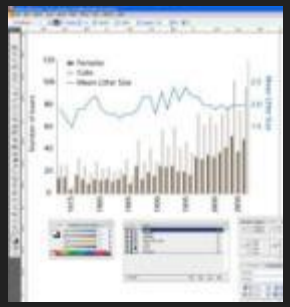
Production – Work Flow

Published or Online

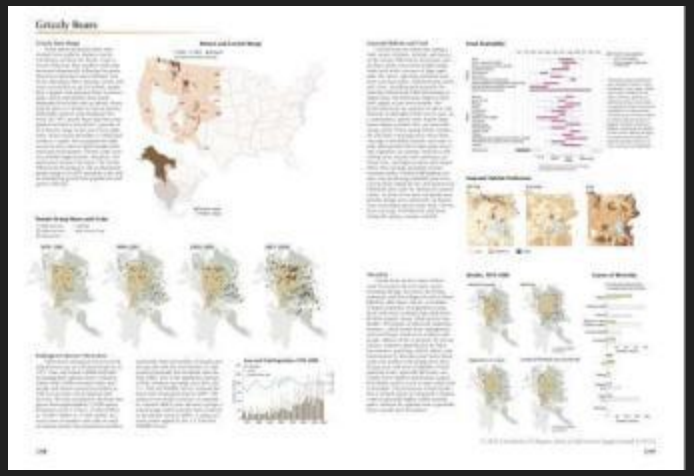
Map Design:
Adobe Illustrator and Photoshop



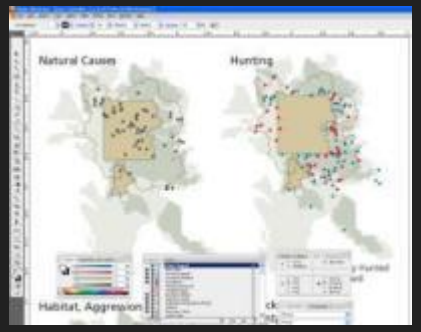
Tabular - Excel



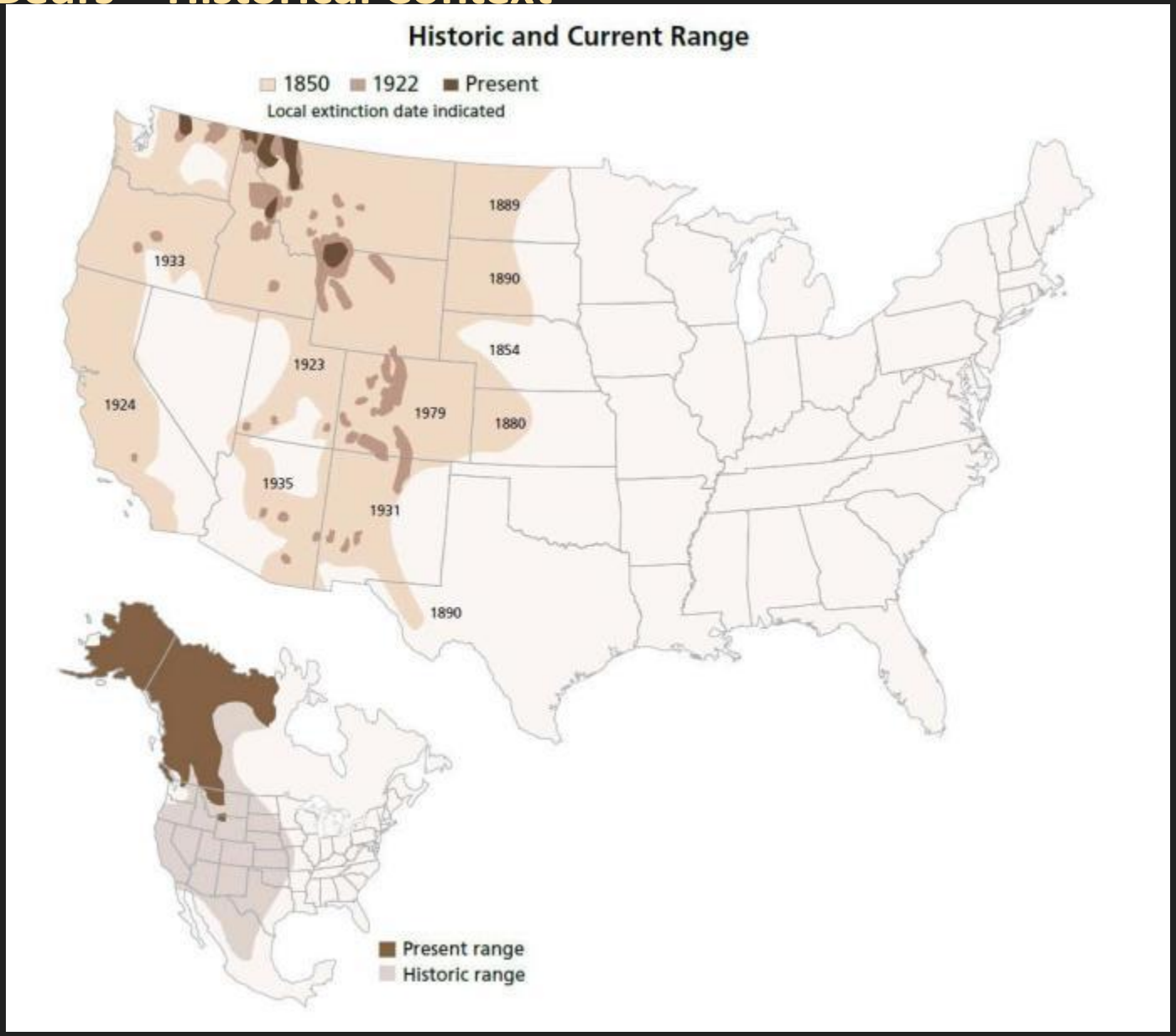
Page Layout: Adobe InDesign



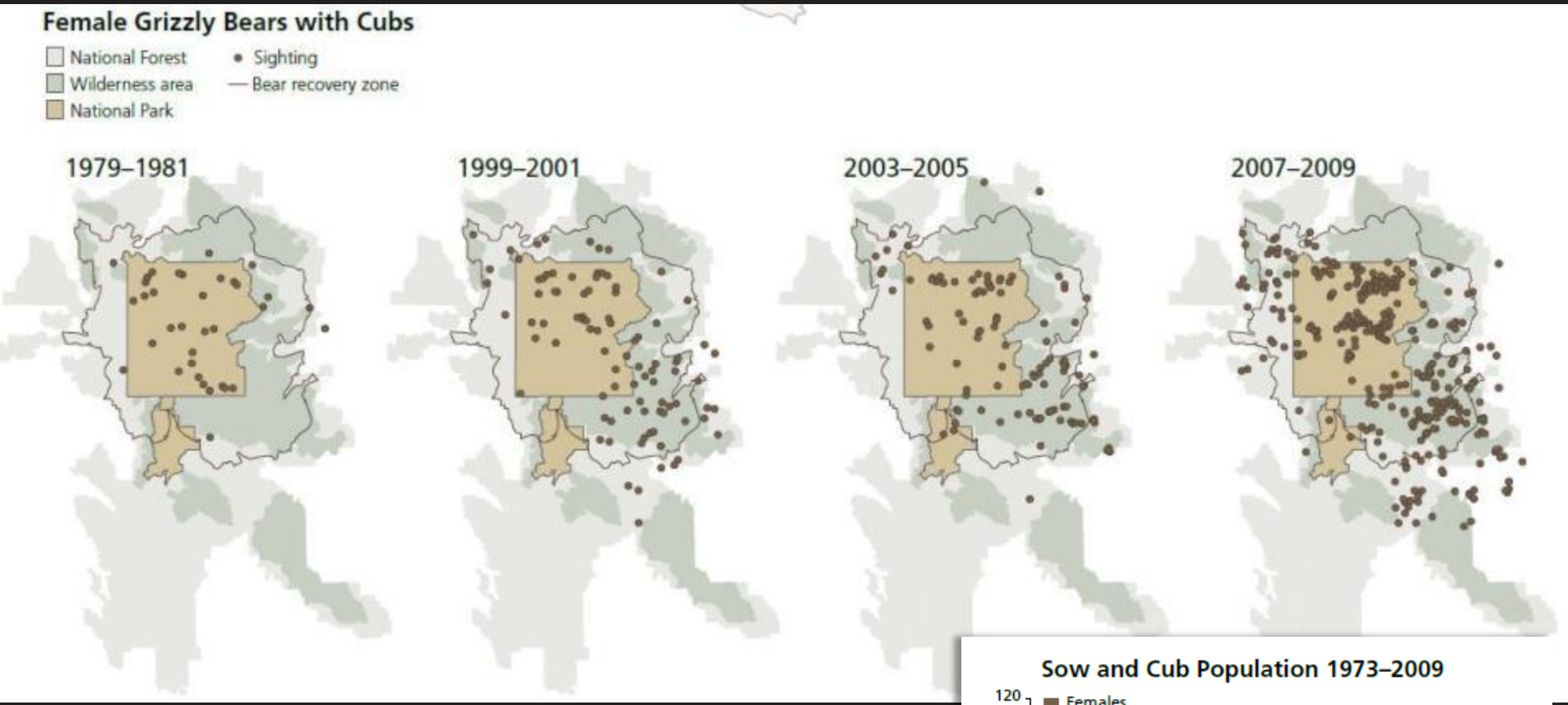
Map Data - GIS

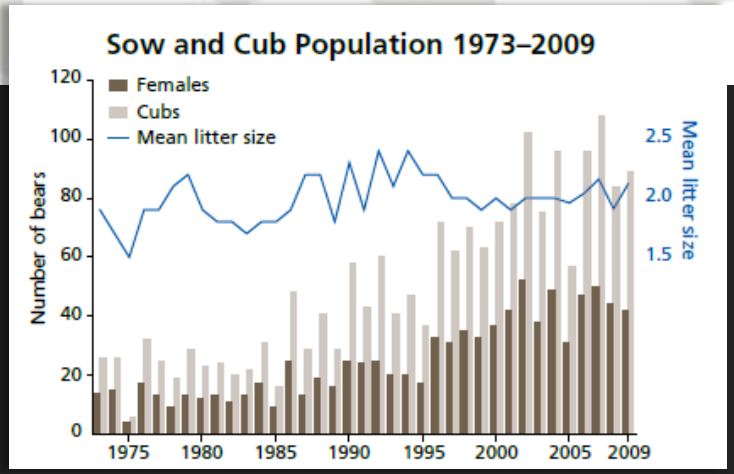


Grizzly Bears – Historical Context



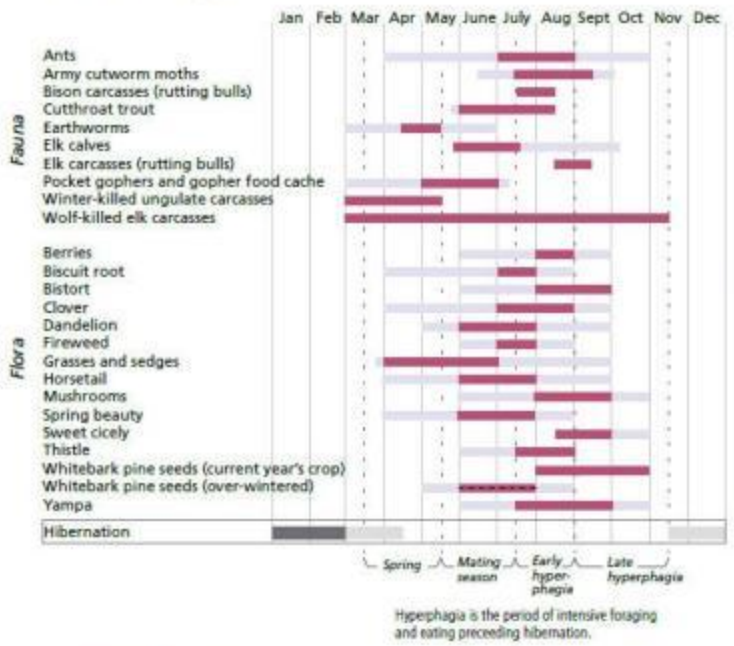
Grizzly Bears – Birth





Grizzly Bears – Life

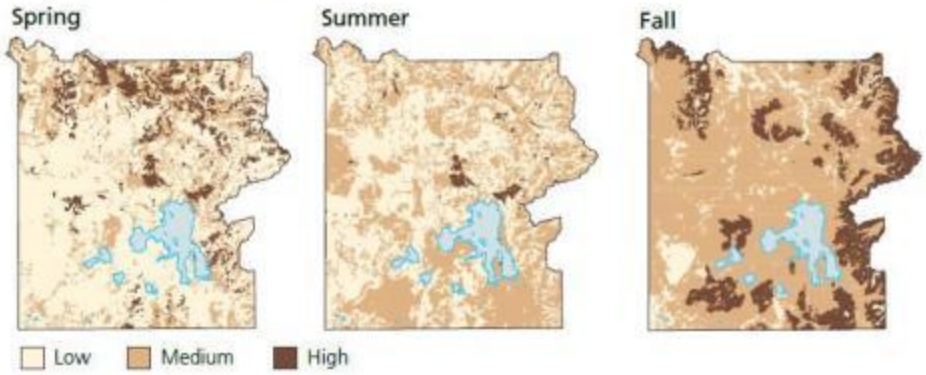
Food Availability



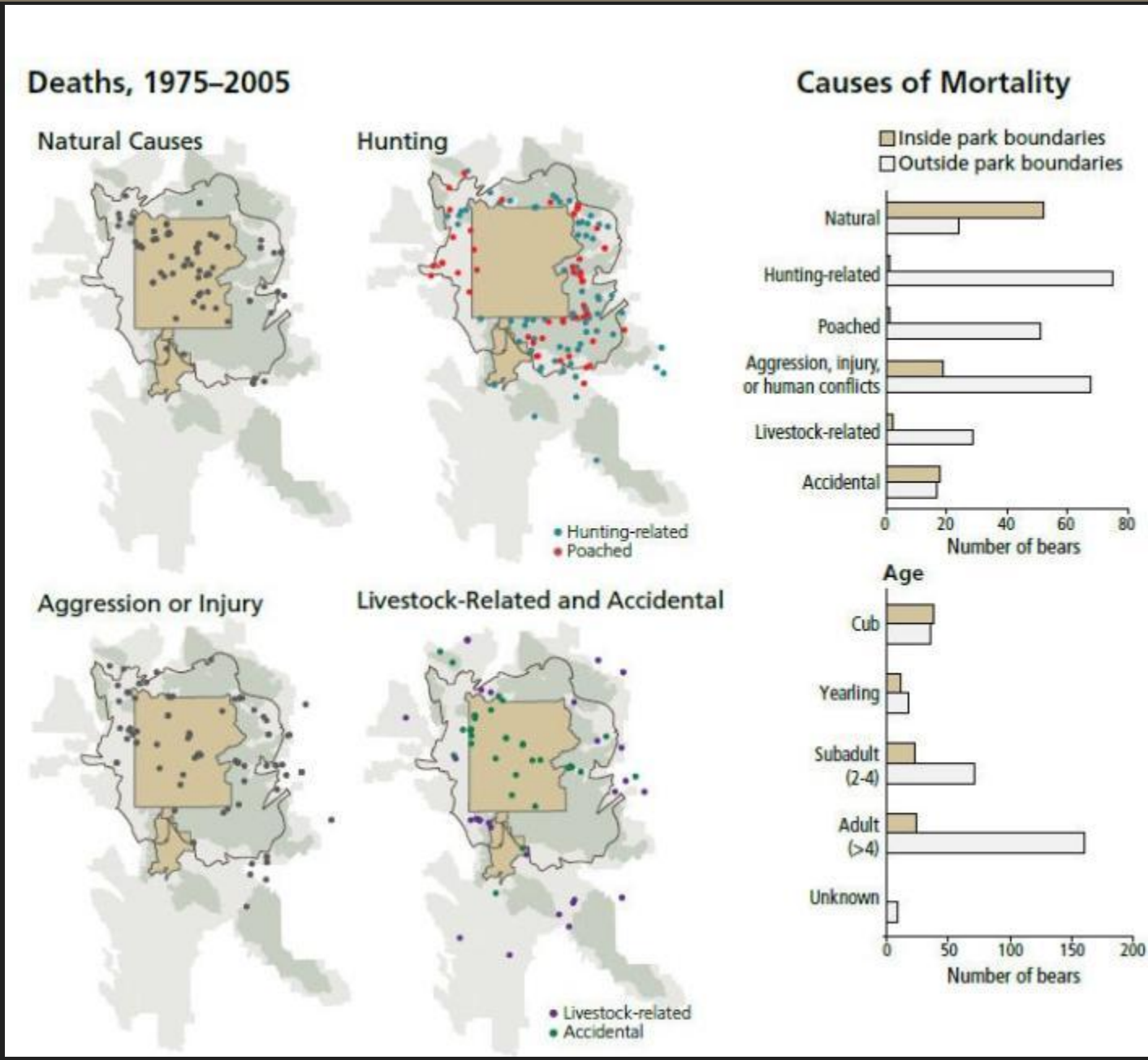
Hyperphagia is the period of intensive foraging and eating preceding hibernation.

Yellowstone area grizzly bears eat a breadth of foods: insects, vertebrates, fungi, seeds. Unlike many other members of the order Carnivora, bears eat a significant amount and variety of vegetation. Bears have several adaptations for eating plants, including large chewing surfaces on molars and long claws for digging. Grizzlies are shrewd feeders, maximizing the quality of their food intake by foraging for many kinds of plants and seeking each plant when it is most nutritious and digestible.

Seasonal Habitat Preference



Grizzly Bears – Death



Final Page Pair: Grizzly Bears

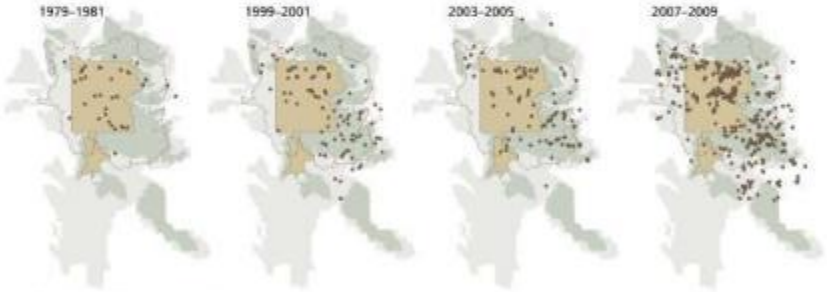
Grizzly Bears

Grizzly Bear Range

North American grizzly bears once roamed from northern Alaska to northern Mexico and from the Pacific Coast to western Missouri. Bear numbers and range decreased dramatically following European American exploration and settlement west of the Mississippi River. Ranches, farms, and cities encroached on grizzly habitat; people shot, trapped, and poisoned bears to protect cattle, sheep, and poultry from attack. Important bear foods such as salmon, bison, and elk grew ever harder to find as humans built dams, hunted, and introduced livestock. By 1975, grizzly bears had been extirpated from Mexico and all but 2 percent of their historic range in the lower forty-eight states. Bears remain abundant in Alaska and northern Canada, their populations stable except in a few areas of rapid human settlement and development. Farther south, however, habitat fragmentation, alteration, and destruction threaten the bears. The Greater Yellowstone Ecosystem is the southernmost grizzly range as of 2007 and plays a key role in maintaining grizzly bear populations and genetic diversity.

Historic and Current Range

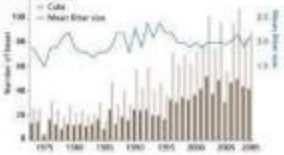
Female Grizzly Bears with Cubs



Endangered Species Protection

Yellowstone area grizzly bears received federal protection as a threatened species in 1975. State and federal wildlife and habitat management agencies have worked to reduce both conflicts between bears and people and human-caused bear deaths as well as to increase cub production and survival. The area occupied by the bears has grown from approximately 15,000 square kilometers in the 1970s to 17,000 (1980s) to 34,000 (1990s) to 37,000 (2003). Annual counts of females with cubs are used to estimate grizzly bear population numbers and trends. Both the number of females producing cubs and the total number of cubs produced annually has increased since the mid-1980s. Due to the significant increase in bear numbers and range since then, the U.S. Fish and Wildlife Service removed the bears from threatened status in 2007. The matter is not settled, however; in response to a lawsuit filed by bear advocacy groups, a federal judge ordered grizzly bears returned to threatened status in 2009—a ruling currently under appeal by the U.S. Fish and Wildlife Service.

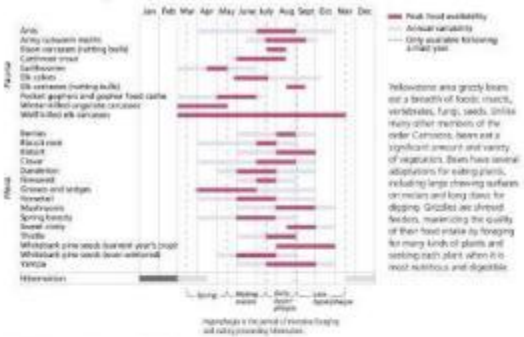
Sow and Cub Population 1973–2009



Seasonal Habitat and Food

Grizzly bears are omnivores, eating a wide variety of plants, animals, and insects. In the Greater Yellowstone Ecosystem, grizzly bears prefer concentrated high-energy foods such as the carcasses of large mammals, elk calves, spawning cutthroat trout, army cutworm moths, whitebark pine seeds, and clover. Spending approximately five months without food while hibernating in winter dens, the bears must ingest a year's food supply in just seven months. Preferred bear foods are seasonal in nature and fluctuate in abundance from year to year. As a consequence, grizzly bears require large home ranges to ensure they can meet their energy needs. Prime spring habitat includes elk and bison wintering areas where bears scavenge winterkilled animals, and areas of early plant growth where bears graze succulent vegetation. In summer, bears favor elk calving areas, streams with spawning cutthroat trout, and high elevation talus slopes where they eat large quantities of army cutworm moths. Preferred fall habitat contains cone-producing whitebark pine trees. Grizzly bears obtain the fat- and protein-rich whitebark pine seeds by raiding red squirrel caches. In years of low pine nut production, grizzlies forage more extensively on biscuit roots and yampa and eat more meat. Grizzly bears scavenge wolf-killed elk and bison during the spring, summer, and fall.

Food Availability



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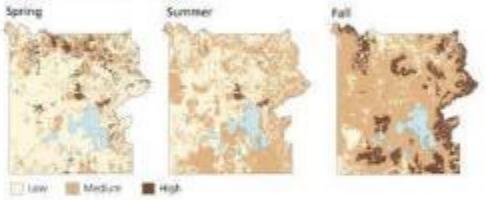
Seasonal Habitat Preference

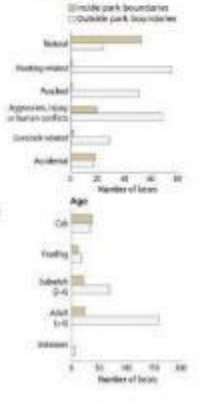


Mortality

Grizzly bears in the Greater Yellowstone Ecosystem die from many causes including old age, starvation, drowning, avalanche, and den collapse as well as when killed by other bears, wolves, or humans. A larger proportion of dependent young bears (cubs and yearlings) than adult bears die from natural causes. Adult grizzly bear deaths—85 percent of which are caused by humans—result mostly from management removal of bears involved in conflicts with people, defense of life or property by private citizens, mistaken identification by black bear hunters, poaching, vehicle strikes, and electrocution by downed power lines. Bears come into conflict with people more often during years with poor availability of their preferred foods, especially fall foods; conversely, fewer conflicts and human-caused bear deaths tend to occur in years when food is abundant. The proportion of bear deaths due to natural causes as compared to human causes is generally higher within national parks, whereas the opposite ratio is generally found outside park boundaries.

Deaths, 1975–2005

Causes of Mortality



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Review Session

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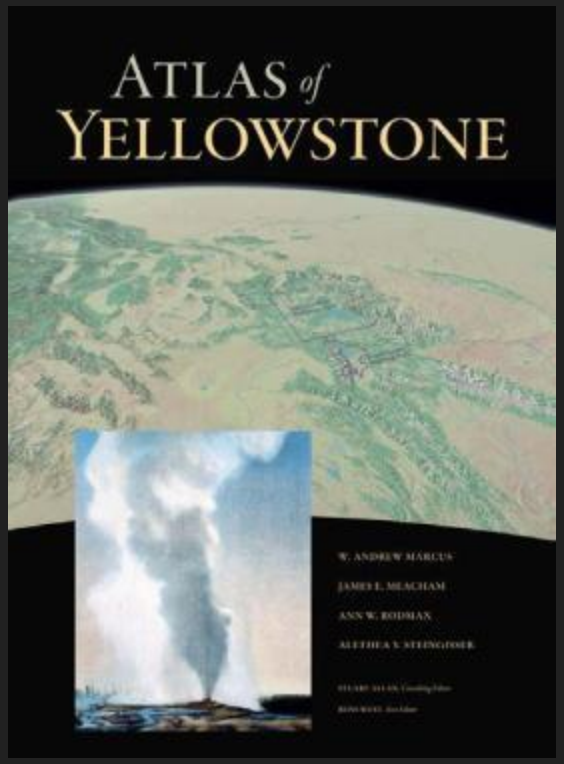
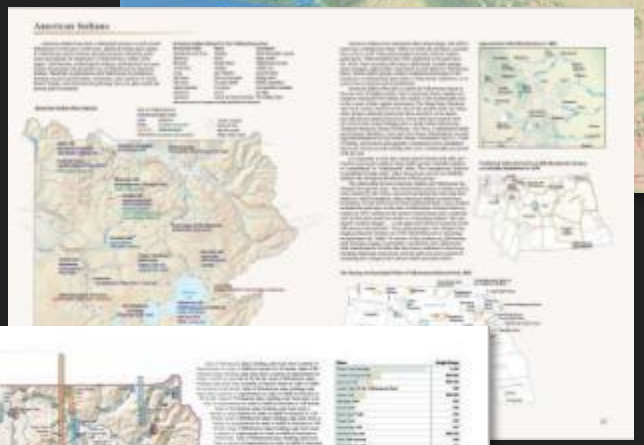
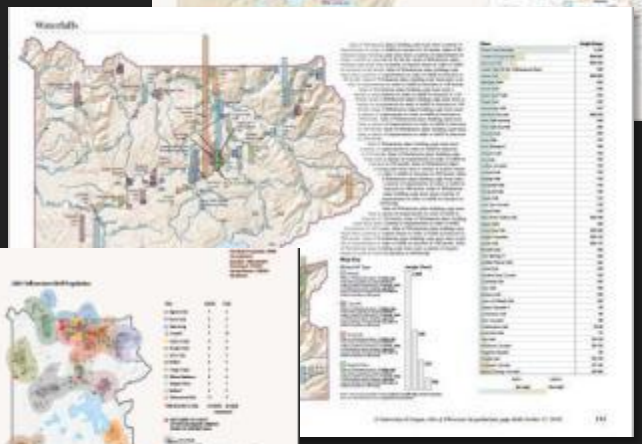
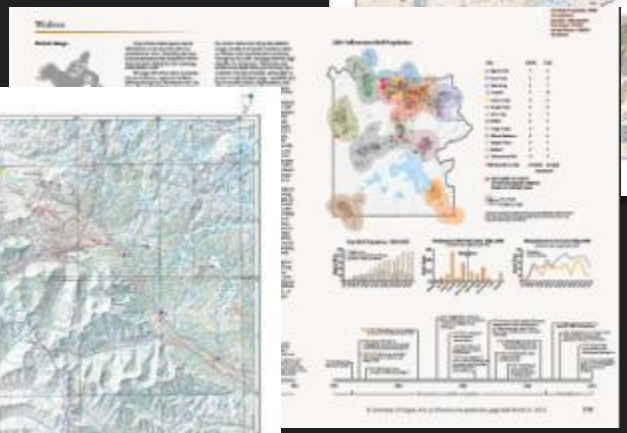


Geographic Setting
Human Geography
Physical Geography
Wildlife
Reference







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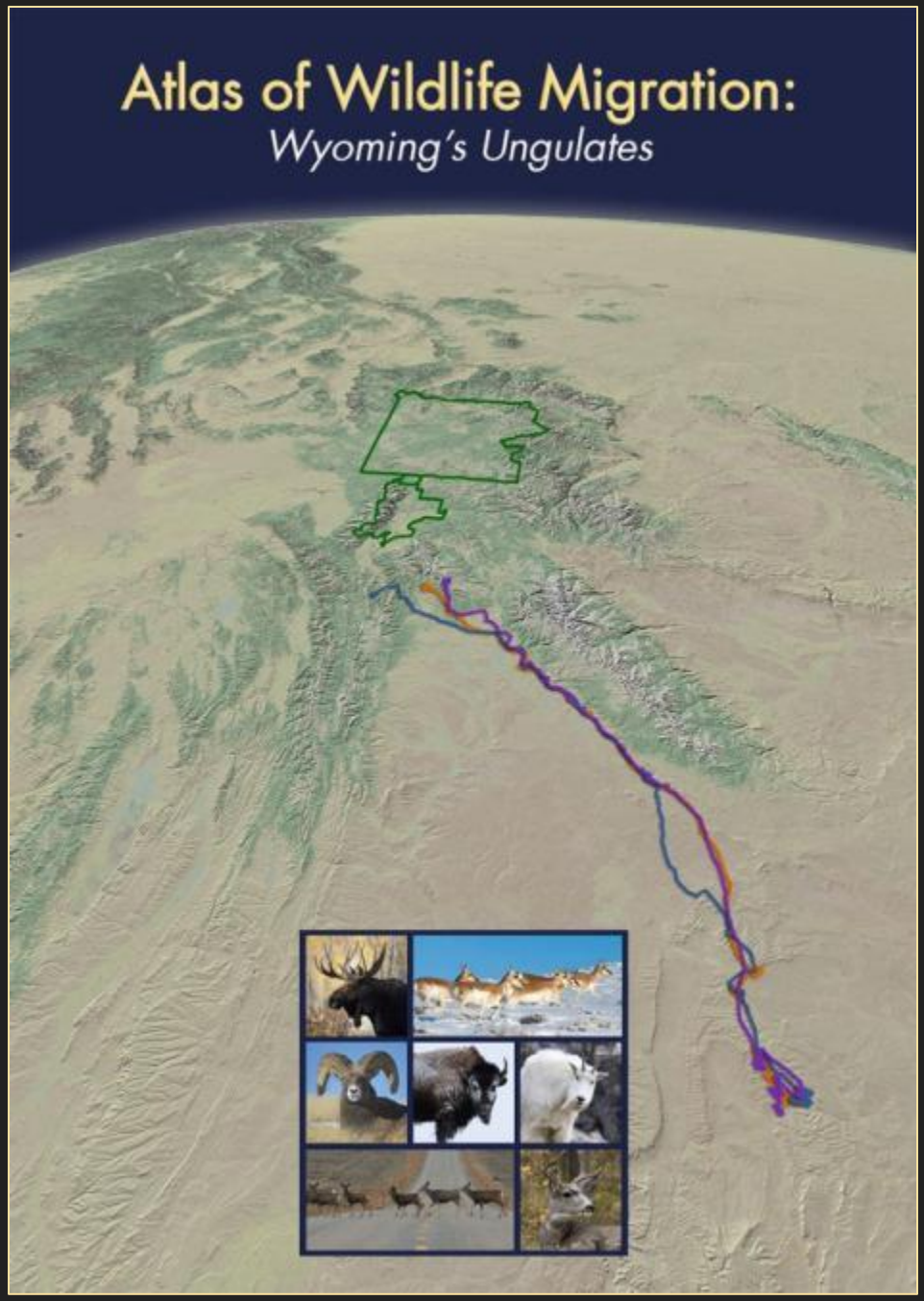

Telling the Wyoming Migration Story

The Salt Lake Tribune

U.S.'s longest mule deer migration discovered in Wyoming

By Gregory Nickerson | WyoFile
First Published Apr 24 2014 07:23 am • Updated 7 hours ago

WYOMING MIGRATION INITIATIVE
Understanding & Conserving Ungulate Migration

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Migration Impacts

Impacts of Energy Development

Researchers have developed solid understanding of how energy development impacts ungulates on winter ranges, but relatively little is known about how it affects migration. One recent study compared mule deer migration patterns before and after coal-bed methane (CBM) well development in Wyoming's relatively pristine Atlantic Rim Project Area.

In 2006, the Bureau of Land Management approved 2,000 CBM wells in eight development areas between the winter and summer ranges of two migratory mule deer populations near Atlantic Rim. Prior to development, researchers put GPS collars on 47 mule deer and collected 116,000 locations. Results showed that two of the eight proposed development areas, Dry Cow Creek and Wild Horse Basin, overlapped deer migration routes. The 13-square-mile Dry Cow Creek area was slated for heavy development with 7.3 well pads per square mile. Wild Horse Basin was smaller, 6 square miles, and would be less heavily developed with 4.8 well pads per square mile.

As wells were developed from 2008 to 2010, the researchers collected 191,000 GPS locations from 50 collared mule deer. They found the deer continued to migrate through moderate development in Wild Horse Basin as they had before. However, in Dry Cow Creek where development was more intensive, deer often detoured from established routes. Additionally, deer moved more quickly through the developed areas than surrounding areas.

The researchers also compared how and where the deer stopped to rest and forage before and after development. During the weeks or months it takes to migrate, a typical deer spends 95% of its time in stopover areas where forage is best (see page xx [Stopovers]), and the other 5% of the time moving between stopovers. Following intensive development in the Dry Cow Creek area, migrating deer quit using about half of the stopover sites they had used before, stopping only in the perimeter of the development area. To benefit from migration, deer need to graze and browse specific areas at specific times, especially in spring when new plant growth is most nutritious.

Impermeable barriers such as fences or urban areas can block migration routes and cut off access to necessary ranges. For example, fences separating livestock from disease-carrying ungulates in Botswana and Kenya killed tens of thousands of wildebeest, zebras, hartebeest, and other species trying to migrate to forage during the dry season.

In contrast to impermeable barriers, semi-permeable development, such as in the Atlantic Rim area, does allow migrating deer to move through. However, as this study shows, if migrating deer hurry past prime stopover locations, they lose access to the best forage, and thus lose the benefit of the migration. This imbalance makes the migration less and less worthwhile for the ungulates. At some threshold the animals may stop using the migration corridor and the summer range it accesses.

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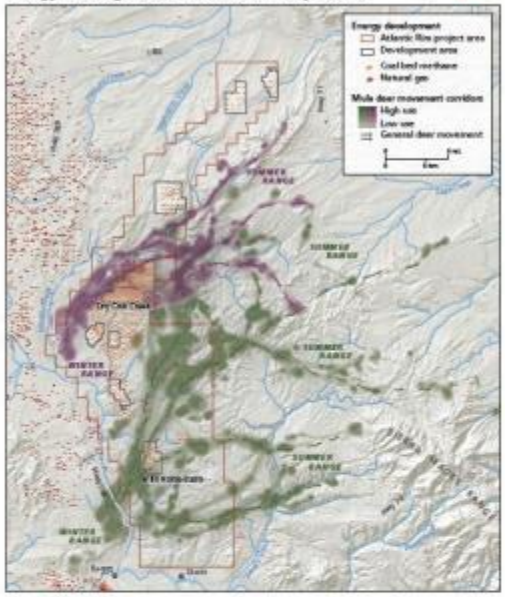

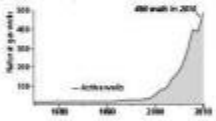

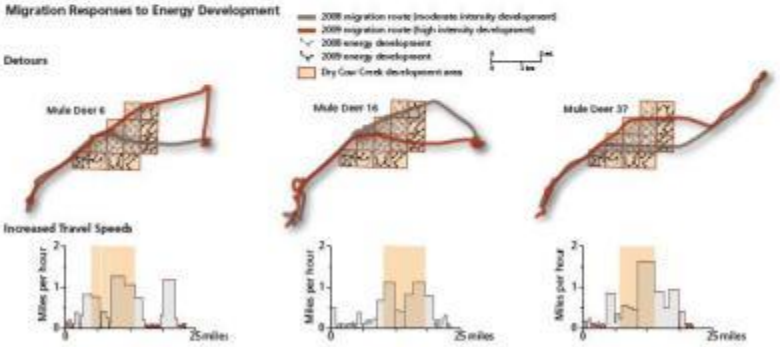

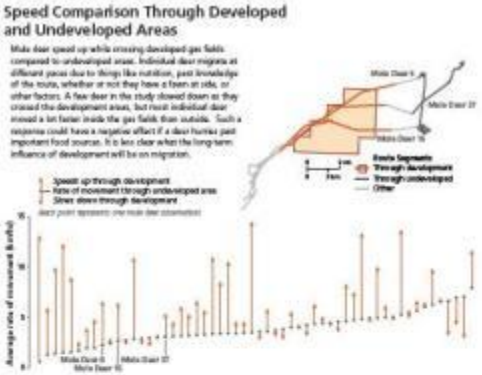

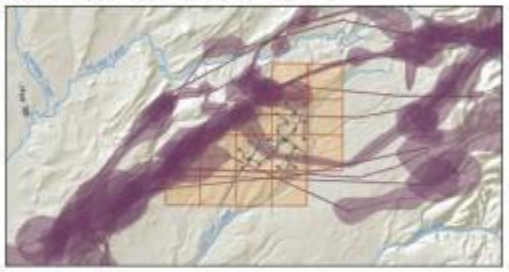

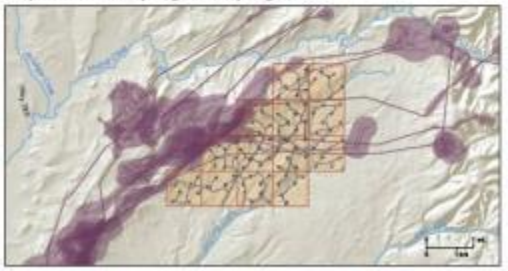

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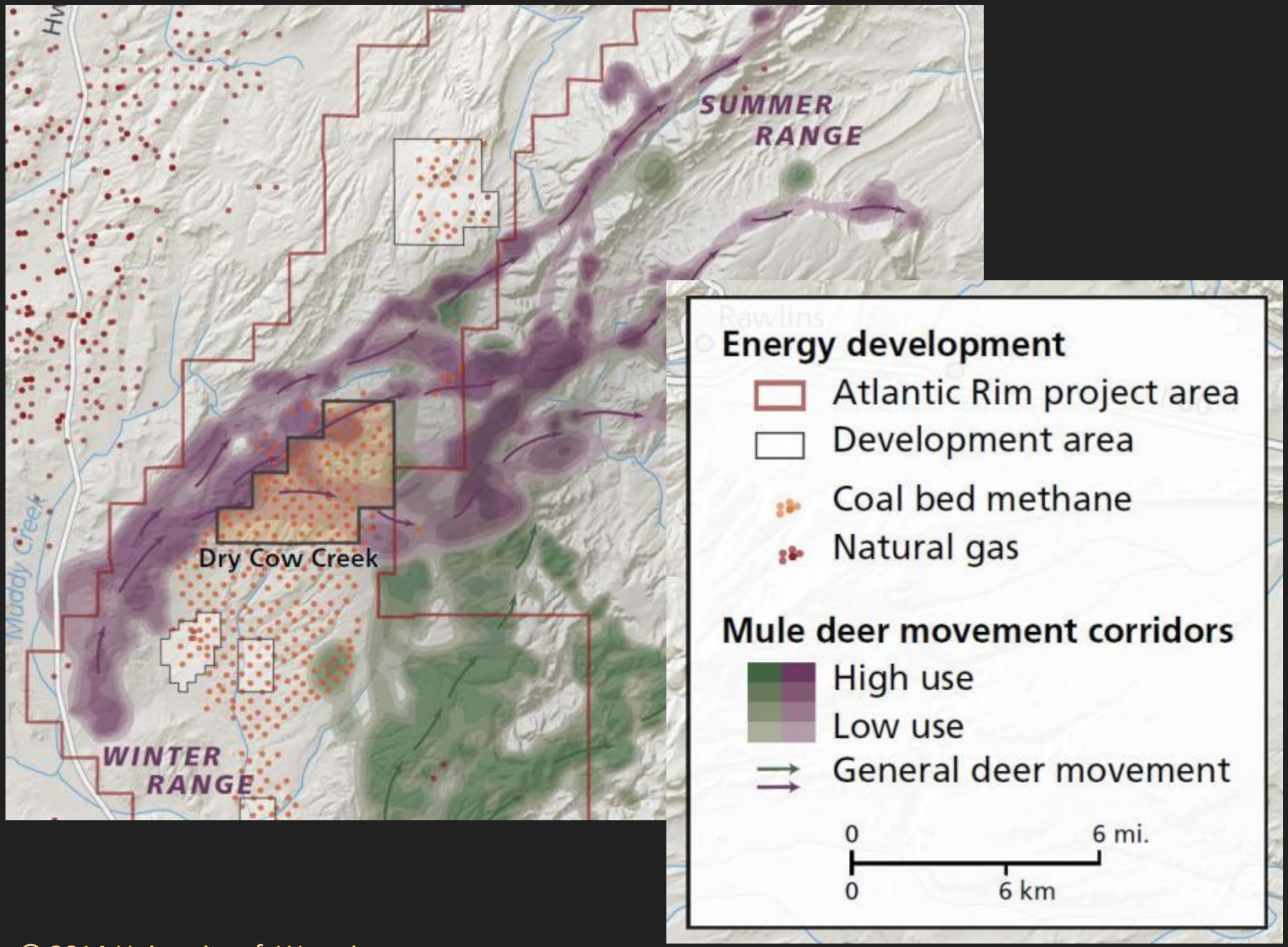

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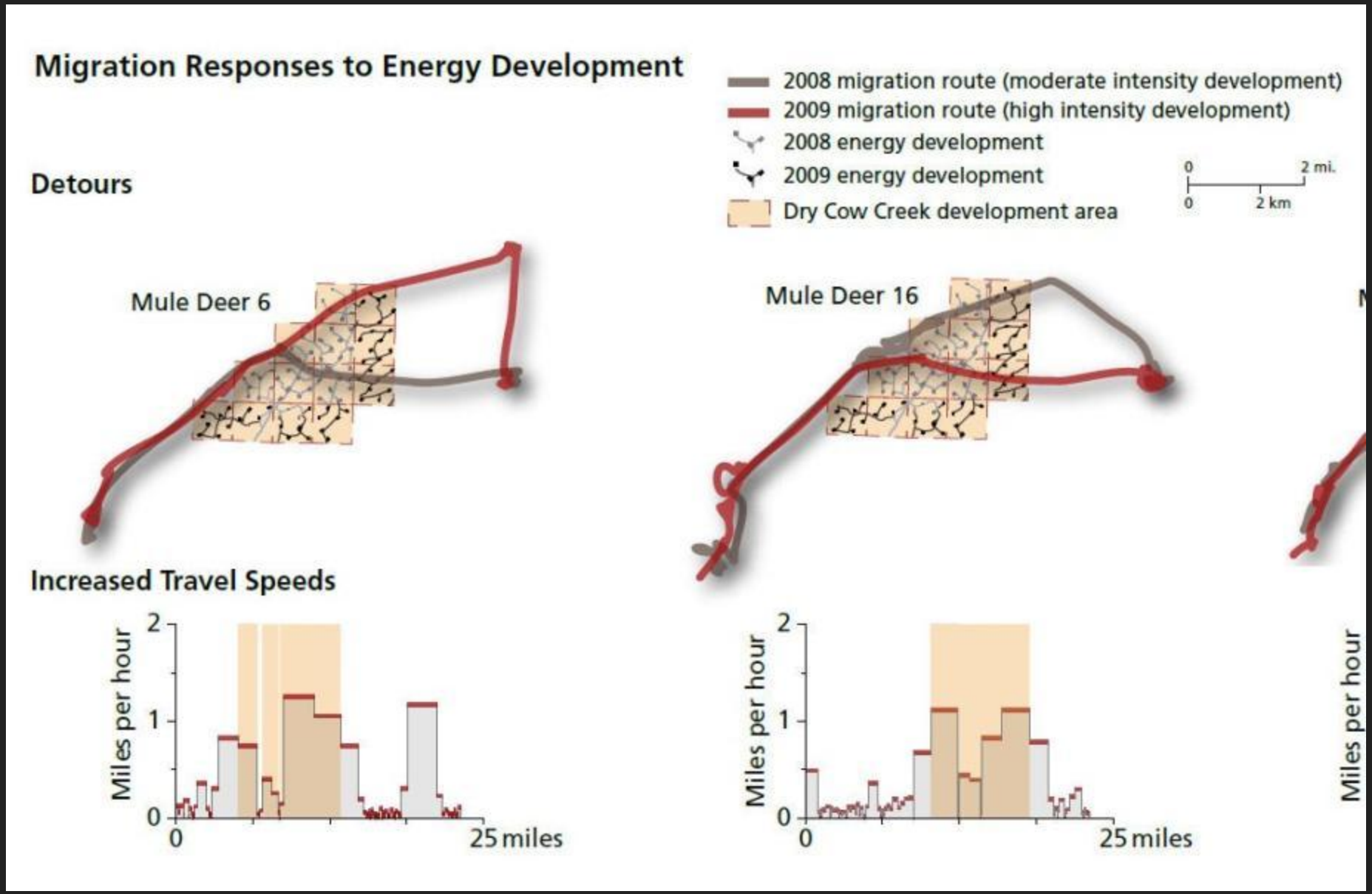

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