



Greater Yellowstone Ecosystem

The **Greater Yellowstone Ecosystem (GYE)** is one of the last remaining large, nearly intact ecosystems in the northern temperate zone of Earth.^[1] It is located within the northern Rocky Mountains, in areas of northwestern Wyoming, southwestern Montana, and eastern Idaho, and is about 22 million acres (89,000 km²).^[2] Yellowstone National Park and the Yellowstone Caldera 'hotspot' are within it.^[1]

The area is a flagship site among conservation groups that promote ecosystem management. It is one of the world's foremost natural laboratories in landscape ecology and Holocene geology, and is a world-renowned recreational destination. It is also home to the diverse native plants and animals of Yellowstone.



Bison grazing near Gibbon River at Madison in Yellowstone National Park.

History

Yellowstone National Park boundaries were drawn in 1872 with the intent to include all the known geothermal basins in the region.^[3] As landscape ecology considerations were not incorporated into original boundary, revisions were suggested to conform more closely to natural topographic features, such as the ridgeline of the Absaroka Range along the east boundary. In 1929, President Hoover signed the first bill changing the park's boundaries: The northwest corner now included a significant area of petrified trees; the northeast corner was defined by the watershed of Pebble Creek; the eastern boundary included the headwaters of the Lamar River and part of the watershed of the Yellowstone River. In 1932, President Hoover issued an executive order that added more than 7,000 acres (2,800 ha) between the north boundary and the Yellowstone River, west of Gardiner. These lands provided winter range for elk and other ungulates.^[4] By the 1970s, the grizzly bear's (*Ursus arctos*) range in and near the park became the first informal minimum boundary of a theoretical "Greater Yellowstone Ecosystem" that included at least 4,000,000 acres (16,000 km²). Since then, definitions of the greater ecosystem's size have steadily grown larger. A 1994 study listed the size as 19,000,000 acres (76,890 km²), while a 1994 speech by a Greater Yellowstone Coalition leader enlarged that to 20,000,000 acres (80,000 km²).



Grizzly bear range expansion in Greater Yellowstone Ecosystem 1990–2018

In 1985 the United States House of Representatives Subcommittees on Public Lands and National Parks and Recreation held a joint subcommittee hearing on Greater Yellowstone, resulting in a 1986 report by the Congressional Research Service outlining shortcomings in inter-agency coordination and concluding that the area's essential values were at risk.

Protected areas

Federally managed areas within the GYE include:

- United States National Park Service (NPS) — Yellowstone National Park, Grand Teton National Park, and John D. Rockefeller, Jr. Memorial Parkway.
- United States National Forest Service (USFS) — Gallatin, Custer, Beaverhead-Deerlodge, Caribou-Targhee, Bridger-Teton, and Shoshone National Forests
- United States Fish and Wildlife Service (USFWS) — National Elk Refuge, Red Rock Lakes and Grays Lake National Wildlife Refuges

Ten distinct National Wilderness Areas have been established within the GYE's National Forests since 1966, mandating a higher level of habitat protection than the USFS otherwise uses.

The GYE also encompasses some privately held and state lands surrounding those managed by the U.S. Government.

The Trust for Public Land has protected 67,000 acres (27,000 ha) over about 40 projects in the Greater Yellowstone Ecosystem.^[2]

Animals and plant diversity

Large mammals

The GYE is home to some of North America's most iconic wildlife.^[5] The ecosystem supports the largest free-roaming herds of American bison (Bison bison) on public land,^[6] a species central to the region's ecological balance. Grizzly bears (Ursus arctos horribilis) and gray wolves (Canis lupus) are apex predators^[7] that play crucial roles in regulating prey populations.^[8]

Elk (Cervus canadensis) are abundant and form a key component of the ecosystem, providing sustenance for predators.^[9] Other significant ungulate species include moose (Alces alces),^[10] pronghorn (Antilocapra americana),^[11] bighorn sheep (Ovis canadensis),^[12] and mountain goats (Oreamnos americanus).^[13]

Birds

The GYE is home to a variety of birds, including iconic species like Bald Eagles,^[14] Golden Eagles^[15] and Peregrine Falcons.^[16] Osprey populations around Yellowstone Lake, have experienced declines, linked to the decrease in Cutthroat Trout.^[17] Several bird species act as keystone species within the GYE. For example, the Clark's Nutcracker plays a crucial role in the dispersal of the all-important^[18] Whitebark Pine seeds.^[19]

Management by species

Ecological management has been most often advanced through concerns over individual species rather than over broader ecological principles. Though 20 or 30 or even 50 years of information on a population may be considered long-term by some, one of the important lessons of Greater Yellowstone management is that even half a century is not long enough to give a full idea of how a species may vary in its occupation of a wild ecosystem.

The Yellowstone hot springs are important for their diversity of thermophilic bacteria. These bacteria have been useful in studies of the evolution of photosynthesis and as sources of thermostable enzymes for molecular biology. Although the smell of sulfur is common and there are some sulfur fixing cyanobacteria, it has been found that hydrogen is being used as an energy source by extremophile microbes.

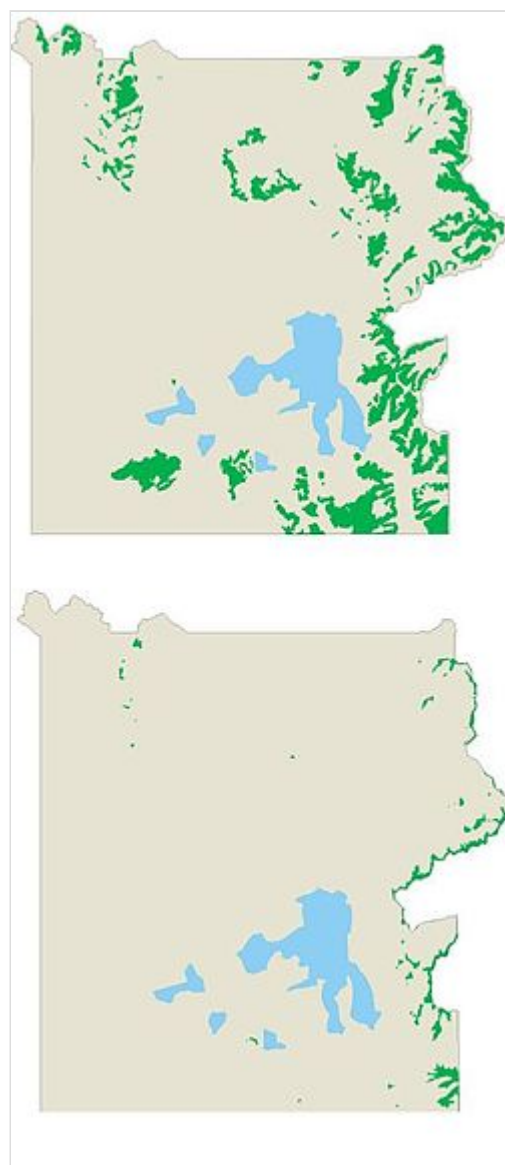
Flora

Among native plants of the GYE, whitebark pine (*Pinus albicaulis*) is a species of special interest, in large part because of its seasonal importance to grizzly bears,^[20] but also because its distribution could be dramatically reduced by relatively minor global warming. In this case, researchers do not have a good long-term data set on the species, but they understand its ecology well enough to project declining future conservation status. A more immediate and serious threat to whitebark pines is an introduced fungal rust disease, White Pine Blister Rust (*Cronartium ribicola*), which is causing heavy mortality in the species. Occasional resistant individuals occur, but in the short to medium term, a severe population decline is expected.

Estimates of the decline of quaking aspen (*Populus tremuloides*) on the park's northern range since 1872 range from 50% to 95%. The decline has been linked to multiple stressors, such as defoliation by the forest tent caterpillar (*Malacosoma disstria*), aspen bark beetles (*Trypophloeus populi* and *Procryphalus mucronatus*), wood-boring beetles such as the poplar borer (*Saperda calcarata*) and the bronze poplar borer (*Agrilus liragus*), fungal disturbances such as those by the Cytospora canker (*Valsa sordida*), and Climate change related stressors.^{[21] [22] [23]}

Fauna

Anecdotal information on grizzly bear abundance dates to the mid-19th century, and administrators have made informal population estimates for more than 70 years. From these



Current (top) and projected (bottom) distribution of whitebark pine (*Pinus albicaulis*) in Yellowstone National Park.

sources, ecologists know the species was common in Greater Yellowstone when Europeans arrived and that the population was not isolated before the 1930s, but is now. Researchers do not know if bears were more or less common than now.

A 1959-1970 bear study suggested a grizzly bear population size of about 176, later revised to about 229.^[1] Later estimates have ranged as low as 136 and as high as 540; the most recent is a minimum estimate of 236,^[1] but biologists think there may be as many as 1,000 bears in the ecosystem.^[24] Although the Greater Yellowstone population is relatively close to recovery goals, the plan's definition of recovery is controversial. Thus, even though the population may be stable or possibly increasing in the short term, in the longer term, continued habitat loss, climate change, and increasing human activities may well reverse the trend.

Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) have suffered considerable declines since European settlement, but recently began flourishing in some areas. Especially in Yellowstone Lake itself, long-term records indicate an almost remarkable restoration of robust populations from only three decades ago when the numbers of this fish were depleted because of excessive harvest. Its current recovery, though a significant management achievement, does not begin to restore the species' historical abundance. Also, they declined because of invasive lake trout. An aggressive lake trout removal program has caused the cutthroats to rebound.

Early accounts of pronghorn (*Antilocapra americana*) in Greater Yellowstone described herds of hundreds seen ranging through most major river valleys. These populations were decimated by 1900, and declines continued among remaining herds. On the park's northern range, pronghorn declined from 500 to 700 in the 1930s to about 122 in 1968. By 1992 the herd had increased to 536.

Gray Wolf reintroduction

The park is a commonly cited example of apex predators affecting an ecosystem through a trophic cascade.^[25] After the reintroduction of the gray wolf in 1995, researchers noticed drastic changes occurring. Elk, the primary prey of the gray wolf, became less abundant and changed their behavior, freeing riparian zones from constant grazing. The respite allowed willows and aspens to grow, creating habitat for beaver,^[26] moose, and scores of other species. In addition to the effects on prey species, the gray wolf's presence also affected the park's grizzly bear population. The bears, emerging from hibernation, chose to scavenge off wolf kills to gain needed energy and fatten up after fasting for months. Dozens of other species have been documented scavenging from wolf kills.^[27]

See also

- Ecology of the Rocky Mountains
- Ecology of the Rocky Mountains topics

References

1. This article incorporates public domain material (<https://www.usgs.gov/information-policies-and-instructions/copyrights-and-credits>) from Schullery, Paul (1995). "The Greater Yellowstone Ecosystem" (<https://web.archive.org/web/20060927172031/http://biology.usgs.g>

- ov/s%2Bt/noframe/r114.htm). *Our Living Resources*. U.S. Geological Survey. Archived from the original (<https://biology.usgs.gov/s+t/noframe/r114.htm>) on September 27, 2006.
2. "Greater Yellowstone Ecosystem" (<https://www.tpl.org/our-work/greater-yellowstone-ecosystem#sm.000001tw1n9rvrfo8u6y3v8zmk5xa>). *The Trust for Public Land*. Retrieved August 8, 2018.
 3. "Greater Yellowstone Ecosystem" (<https://www.nps.gov/yell/learn/nature/greater-yellowstone-ecosystem.htm>). *U.S. National Park Service*. August 21, 2020. Retrieved January 31, 2024.
 4. This article incorporates public domain material (<https://www.nps.gov/aboutus/disclaimer.htm>) from *Yellowstone National Park - Birth of a National Park - Boundary Adjustments* (<https://www.nps.gov/yell/learn/historyculture/yellowstoneestablishment.htm>). U.S. National Park Service. Retrieved June 24, 2022.
 5. "15 Facts About Our National Mammal: The American Bison | U.S. Department of the Interior" (<https://www.doi.gov/blog/15-facts-about-our-national-mammal-american-bison>). *www.doi.gov*. November 3, 2022. Retrieved July 24, 2024.
 6. "Yellowstone Bison - Yellowstone National Park (U.S. National Park Service)" (<https://www.nps.gov/yell/learn/nature/bison.htm>). *www.nps.gov*. Retrieved July 24, 2024.
 7. Tallian, Aimee; Ordiz, Andrés; Metz, Matthew C.; Milleret, Cyril; Wikenros, Camilla; Smith, Douglas W.; Stahler, Daniel R.; Kindberg, Jonas; MacNulty, Daniel R.; Wabakken, Petter; Swenson, Jon E.; Sand, Håkan (February 8, 2017). "Competition between apex predators? Brown bears decrease wolf kill rate on two continents" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5310606>). *Proceedings of the Royal Society B: Biological Sciences*. **284** (1848): 20162368. doi:10.1098/rspb.2016.2368 (<https://doi.org/10.1098%2Frspb.2016.2368>). ISSN 0962-8452 (<https://search.worldcat.org/issn/0962-8452>). PMC 5310606 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5310606>). PMID 28179516 (<https://pubmed.ncbi.nlm.nih.gov/28179516>).
 8. Berger, Joel; Stacey, Peter B.; Bellis, Lori; Johnson, Matthew P. (August 2001). "A Mammalian Predator-Prey Imbalance: Grizzly Bear and Wolf Extinction Affect Avian Neotropical Migrants" ([http://doi.wiley.com/10.1890/1051-0761\(2001\)011%5b0947:AMPPIG%5d2.0.CO;2](http://doi.wiley.com/10.1890/1051-0761(2001)011%5b0947:AMPPIG%5d2.0.CO;2)). *Ecological Applications*. **11** (4): 947–960. doi:10.1890/1051-0761(2001)011[0947:AMPPIG]2.0.CO;2 (<https://doi.org/10.1890%2F1051-0761%282001%29011%5B0947%3AAMPPIG%5D2.0.CO%3B2>). ISSN 1051-0761 (<https://search.worldcat.org/issn/1051-0761>).
 9. French, Steven P.; French, Marilyn G. (1990). "Predatory Behavior of Grizzly Bears Feeding on Elk Calves in Yellowstone National Park, 1986-88" (<https://www.jstor.org/stable/3872937>). *Bears: Their Biology and Management*. **8**: 335–341. doi:10.2307/3872937 (<https://doi.org/10.2307%2F3872937>). ISSN 1936-0614 (<https://search.worldcat.org/issn/1936-0614>). JSTOR 3872937 (<https://www.jstor.org/stable/3872937>). "We also observed black bears (*Ursus americanus*), coyotes (*Canis latrans*), and golden eagles (*Aquila chrysaetos*) prey on elk calves during this study."
 10. Tyers, Daniel B. (January 1, 2006). "MOOSE POPULATION HISTORY ON THE NORTHERN YELLOWSTONE WINTER RANGE" (<https://www.alcesjournal.org/index.php/alces/article/view/397>). *Alces: A Journal Devoted to the Biology and Management of Moose*. **42**: 133–149. ISSN 2293-6629 (<https://search.worldcat.org/issn/2293-6629>).
 11. White, P.J.; Davis, Troy L.; Barnowe-Meyer, Kerey K.; Crabtree, Robert L.; Garrott, Robert A. (April 2007). "Partial migration and philopatry of Yellowstone pronghorn" (<https://doi.org/10.1016/j.biocon.2006.10.041>). *Biological Conservation*. **135** (4): 502–510. Bibcode:2007BCons.135..502W (<https://ui.adsabs.harvard.edu/abs/2007BCons.135..502W>). doi:10.1016/j.biocon.2006.10.041 (<https://doi.org/10.1016%2Fj.biocon.2006.10.041>). ISSN 0006-3207 (<https://search.worldcat.org/issn/0006-3207>).

12. White, Patrick J; Lemke, Thomas O; Tyers, Daniel B; Fuller, Julie A (2008). "Initial effects of reintroduced wolves *Canis lupus* on bighorn sheep *Ovis canadensis* dynamics in Yellowstone National Park" (<https://nsojournals.onlinelibrary.wiley.com/doi/full/10.2981/0909-6396%282008%2914%5B138%3AIEORWC%5D2.0.CO%3B2>). *Wildlife Biology*. **14** (1): 138–146. doi:10.2981/0909-6396(2008)14[138:IEORWC]2.0.CO;2 (<https://doi.org/10.2981%2F0909-6396%282008%2914%5B138%3AIEORWC%5D2.0.CO%3B2>).
13. Lemke, Thomas O. (June 2004). "Origin, expansion, and status of mountain goats in Yellowstone National Park" (<http://www.bioone.org/doi/abs/10.2193/0091-7648%282004%2932%5B532%3AOEASOM%5D2.0.CO%3B2>). *Wildlife Society Bulletin*. **32** (2): 532–541. doi:10.2193/0091-7648(2004)32[532:OEASOM]2.0.CO;2 (<https://doi.org/10.2193%2F0091-7648%282004%2932%5B532%3AOEASOM%5D2.0.CO%3B2>). ISSN 0091-7648 (<https://search.worldcat.org/issn/0091-7648>).
14. "Bald Eagle - Yellowstone National Park (U.S. National Park Service)" (<https://www.nps.gov/yell/learn/nature/bald-eagle.htm>). *www.nps.gov*. Retrieved July 27, 2024.
15. Park, Mailing Address: PO Box 168 Yellowstone National; Us, WY 82190-0168 Phone: 307-344-7381 Contact. "Golden Eagle - Yellowstone National Park (U.S. National Park Service)" (<https://www.nps.gov/yell/learn/nature/golden-eagle.htm>). *www.nps.gov*. Retrieved July 27, 2024.
16. "Peregrine Falcon - Yellowstone National Park (U.S. National Park Service)" (<https://www.nps.gov/yell/learn/nature/peregrine.htm>). *www.nps.gov*. Retrieved July 27, 2024.
17. Baril, Lisa M.; Smith, Douglas W.; Drummer, Thomas; Koel, Todd M. (September 2013). "Implications of Cutthroat Trout Declines for Breeding Ospreys and Bald Eagles at Yellowstone Lake" (<http://www.bioone.org/doi/abs/10.3356/JRR-11-93.1>). *Journal of Raptor Research*. **47** (3): 234–245. doi:10.3356/JRR-11-93.1 (<https://doi.org/10.3356%2FJRR-11-93.1>). ISSN 0892-1016 (<https://search.worldcat.org/issn/0892-1016>).
18. Buermeyer, Karl; Reinhart, Daniel; Legg, Kristin (2016), Hansen, Andrew J.; Monahan, William B.; Olliff, S. Thomas; Theobald, David M. (eds.), "Case Study: Whitebark Pine in the Greater Yellowstone Ecosystem" (https://doi.org/10.5822/978-1-61091-713-1_15), *Climate Change in Wildlands: Pioneering Approaches to Science and Management*, Washington, DC: Island Press/Center for Resource Economics, pp. 304–326, doi:10.5822/978-1-61091-713-1_15 (https://doi.org/10.5822%2F978-1-61091-713-1_15), ISBN 978-1-61091-713-1, retrieved July 27, 2024
19. Hutchins, H. E.; Lanner, R. M. (November 1, 1982). "The central role of Clark's nutcracker in the dispersal and establishment of whitebark pine" (<https://doi.org/10.1007/BF00384487>). *Oecologia*. **55** (2): 192–201. Bibcode:1982Oecol..55..192H (<https://ui.adsabs.harvard.edu/abs/1982Oecol..55..192H>). doi:10.1007/BF00384487 (<https://doi.org/10.1007%2FBF00384487>). ISSN 1432-1939 (<https://search.worldcat.org/issn/1432-1939>). PMID 28311233 (<https://pubmed.ncbi.nlm.nih.gov/28311233>).
20. Mattson, David; Reinhart, Daniel (January 1994). "Bear Use of Whitebark Pine Seeds in North America" (<https://www.researchgate.net/publication/344047290>). *Conference: Proceedings-International Workshop on Subalpine Stone Pines and Their Environment: The Status of Our Knowledge*.
21. Hogg, E H; Brandt, James P; Kochtubajda, B (May 1, 2002). "Growth and dieback of aspen forests in northwestern Alberta, Canada, in relation to climate and insects" (<http://www.nrcresearchpress.com/doi/10.1139/x01-152>). *Canadian Journal of Forest Research*. **32** (5): 823–832. doi:10.1139/x01-152 (<https://doi.org/10.1139%2F01-152>). ISSN 0045-5067 (<https://search.worldcat.org/issn/0045-5067>).

22. Worrall, James J.; Egeland, Leanne; Eager, Thomas; Mask, Roy A.; Johnson, Erik W.; Kemp, Philip A.; Shepperd, Wayne D. (March 2008). "Rapid mortality of *Populus tremuloides* in southwestern Colorado, USA" (<https://doi.org/10.1016/j.foreco.2007.09.071>). *Forest Ecology and Management*. **255** (3–4): 686–696. Bibcode:2008ForEM.255..686W (<https://ui.adsabs.harvard.edu/abs/2008ForEM.255..686W>). doi:10.1016/j.foreco.2007.09.071 (<https://doi.org/10.1016%2Fj.foreco.2007.09.071>). ISSN 0378-1127 (<https://search.worldcat.org/issn/0378-1127>).
23. Worrall, James J.; Rehfeldt, Gerald E.; Hamann, Andreas; Hogg, Edward H.; Marchetti, Suzanne B.; Michaelian, Michael; Gray, Laura K. (July 2013). "Recent declines of *Populus tremuloides* in North America linked to climate" (<https://doi.org/10.1016/j.foreco.2012.12.033>). *Forest Ecology and Management*. **299**: 35–51. Bibcode:2013ForEM.299...35W (<https://ui.adsabs.harvard.edu/abs/2013ForEM.299...35W>). doi:10.1016/j.foreco.2012.12.033 (<https://doi.org/10.1016%2Fj.foreco.2012.12.033>). ISSN 0378-1127 (<https://search.worldcat.org/issn/0378-1127>).
24. Koshmrl, Mike (January 6, 2024). "Montana to start trucking grizzlies into Yellowstone region to improve delisting prospects" (<https://dailymontanain.com/2024/01/06/montana-to-start-trucking-grizzlies-into-yellowstone-region-to-improve-delisting-prospects/>). *Daily Montanan*. Retrieved January 31, 2024.
25. Weston, Phoebe (June 23, 2022). "'People may be overselling the myth': should we bring back the wolf?" (<https://www.theguardian.com/environment/2022/jun/23/rebalancing-act-bringing-back-wolf-fix-broken-ecosystem-aoe>). *The Guardian*. Retrieved June 24, 2022.
26. "Beyond the Headlines" (<http://loe.org/shows/segments.html?programID=15-P13-00012&segmentID=5>). *Living on Earth*. March 20, 2015. Retrieved March 22, 2015.
27. Smith, Douglas W.; Peterson, Rolf O.; Houston, Douglas B. (April 1, 2003). "Yellowstone after Wolves" ([https://doi.org/10.1641/0006-3568\(2003\)053%5b0330:YAW%5d2.0.CO;2](https://doi.org/10.1641/0006-3568(2003)053%5b0330:YAW%5d2.0.CO;2)). *BioScience*. **53** (4): 330–340. doi:10.1641/0006-3568(2003)053[0330:YAW]2.0.CO;2 (<https://doi.org/10.1641%2F0006-3568%282003%29053%5B0330%3AYAW%5D2.0.CO%3B2>). ISSN 0006-3568 (<https://search.worldcat.org/issn/0006-3568>). S2CID 56277360 (<https://api.semanticscholar.org/CorpusID:56277360>).

Further reading

- Turner, Jack (2008). *Travels in Greater Yellowstone* (<https://archive.org/details/travelsingreat00turn>). New York: St. Martin's Press. ISBN 978-0-312-26672-1.

External links

- Greater Yellowstone Coalition: The Greater Yellowstone Ecosystem website (<https://web.archive.org/web/20070217232330/http://www.greateryellowstone.org/ecosystem/>)
 - USGS Rocky Mountain Mapping Center: Greater Yellowstone Ecosystem (<https://web.archive.org/web/20040223212234/http://rockyweb.cr.usgs.gov/html/gye/>)
 - Yellowstone-Teton Clean Energy Coalition (<http://www.ytcleanenergy.org>)
 - The Trust for Public Land - Greater Yellowstone Ecosystem Program (https://web.archive.org/web/20040313183254/http://www.tpl.org/tier3_cd.cfm?content_item_id=5263&folder_id=678)
-

Retrieved from "https://en.wikipedia.org/w/index.php?title=Greater_Yellowstone_Ecosystem&oldid=1287308541"