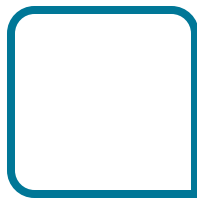




It's Getting
Hot Out There:

Top 10 Places
to Save for
Endangered Species
in a Warming World





Acknowledgements

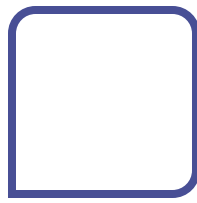
This year's report came about because of the tremendous efforts of our member organizations. Our member groups submitted nominations for ecosystems to be considered for inclusion in the report and photos for the ecosystem profiles. We would like to thank each of these individuals for their submissions. Many thanks go to Nicole Cordan and Gilly Lyons from Save Our Wild Salmon, Mike Daulton from Audubon, Ellycia Harrould-Kolieb from Oceana, Sylvia Fallon and Whitney Leonard from NRDC, Laurie Macdonald and Caitlin Leutwiler from Defenders of Wildlife, Josh Pollock from Center for Native Ecosystems, Mark Rockwell from N. California Federation of Fly Fishers, Nicole Rosmarino & Mark Salvo from WildEarth Guardians, Jym St. Pierre from Restore the North Woods, Shaye Wolf, Julie Miller and Anna Mirocha from Center for Biological Diversity, Liana Vitali from ARKive and Marjorie Ziegler from the Conservation Council for Hawaii.

We were incredibly fortunate to have our board member, Jan Randall, Professor Emeritus of Biology at San Francisco State University, leading this effort. Jan created the Endangered Species Coalition's first Scientific Advisory Committee. The Scientific Advisory Committee played a large role in shaping the report—articulating the need to highlight those ecosystems for which we can significantly improve resiliency, selecting the criteria by which the nominated ecosystems would be judged, crafting the first draft of our nomination form, suggesting key ecosystems that should be nominated for the report, and providing crucial supplemental information for the ecosystem's profiles.

In addition to Jan, our Scientific Advisory Committee includes: Jean Brennan, Ph.D., Appalachian LCC Coordinator, U.S. Fish & Wildlife Service, Richard Buchholz, Ph.D., Associate Professor of Biology, University of Mississippi, Gregory S. Butcher, Ph.D., Director of Bird Conservation for the National Audubon Society, Sylvia Fallon, Ph.D., Staff Scientist, Natural Resources Defense Council, Francesca Grifo, Ph.D., Senior Scientist and Director, Scientific Integrity Program, Union of Concerned Scientists, David Inouye, Ph.D., Professor and Director, CONS program, Department of Biology, University of Maryland, Gary Mef- fe, Ph.D., former Editor of the scientific journal Conservation Biology and Professor, Department of Wildlife Ecology and Conservation, University of Florida, Camille Parmesan, Ph.D., Associate Professor of Integrative Biology, University of Texas and a lead author, on the Third Assessment Report of the Intergovernmental Panel on Climate Change, United Nations, and Peter H. Raven, Ph.D., Director of the Missouri Botanic Garden.

Staff members Derek Goldman, Greg Kuether, Mitch Merry, Mark Rockwell and Tara Thornton put an incredible amount of work into getting this report off the ground and completed.

Finally, we are able to share this report with you, because our designer, Steven Skurski turned around a beautiful and well-organized layout for us in record time!



Introduction

If your house were on fire, what would you save? Would it be the precious items passed down in your family from generation to generation? Or would you choose the irreplaceable photos that would disappear forever? Where do you even start?

What if it wasn't just your house, but your whole planet that was on fire?

That is the scenario we face today. Climate change has arrived. No longer clouds gathering in the distance, the storm is here now—melting our titanic glaciers, drying our mighty rivers and setting our deserts ablaze.

What do we save? For the Endangered Species Coalition, the answer is easy: we start with our endangered species. They are already on the brink of extinction, so vulnerable that a stressor such as climate change acts as a bulldozer, steaming full force ahead with the potential to shove them right over the edge of extinction.

And where do we begin? We asked our member groups and our scientists, “If we want to save endangered species from climate change, what habitats do we need to protect?” Together, they identified ten ecosystems that are critical to conserve if we are to protect our nation's endangered species from the ravages of climate change.

This report highlights ecosystems that are hotspots for threatened and endangered species, many of which are highly vulnerable to climate change now. Each was chosen because we have an opportunity to increase its resiliency, or the resiliency of their species, to climate change if we immediately implement needed conservation measures.

Of course, aggressively reducing greenhouse gas pollution is the most important step to guard against climate change. And we must take that action. But the impacts of climate change are already being felt across the country, and these ecosystems highlight the need to exponentially increase additional conservation measures now. Assisting species adaptation to the rapidly changing world will be essential to ensuring their survival.

Many of the conservation measures that we must take are ones that we've already implemented on smaller scales, such as eradicating invasive species, setting aside open space, creating wildlife corridors, and restoring wild lands. Others require that we head in new directions, such as preventing offshore oil and gas drilling in the Arctic and transforming how we manage the water that flows through California. Whether drawing upon new or standard practice in our conservation toolkit, the urgency for all of these measures is higher than it has ever been. We must invest significantly more in funding, political solutions and hands-on conservation in a massive effort to help ecosystems and species adapt.

Fortunately, one of the world's most effective wildlife laws—the U.S. Endangered Species Act—has powerful tools to protect species and their habitats from climate change that can be implemented today. We cannot let climate change defeat us or defeat the Endangered Species Act. Under the Act's umbrella, we can protect critical habitats and habitat connectivity, reduce threats, and put in motion on-the-ground recovery plans with concrete actions needed to help species better survive climate change. In doing so, we will pass on not only the incredible success of our endangered species program, but also the very existence of our endangered species to the next generation.

We still have time to save many of our ecosystems and endangered species. The American spirit is surely up to the task. The following pages outline where we can start. Please join us in this call to action.

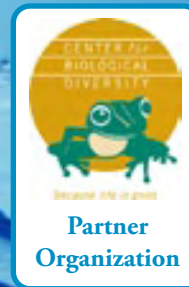


Photo Credit: NOAA

Arctic Sea Ice

Needed Conservation Measures

Reducing greenhouse gas is the most important step to slow and reverse the sea ice melt. To avoid the most severe impacts to the planet, the Intergovernmental Panel on Climate Change (IPCC) states a need to reduce emissions from 1990 levels 25 to 40 percent by 2020. Other recommendations go further and state that we should stabilize global CO₂ levels to 350 ppm, below our present level of 389. To restore Arctic sea ice, the well-known leading climate scientists including James Hansen estimate that we'll need to lower CO₂ levels to 300-325 ppm. We must also increase habitat and species resilience by ending Arctic oil and gas development, prohibiting increased shipping as melting ice opens new routes, stopping overhunting and trade in imperiled wildlife, and reducing toxic contaminants. The United States must proactively protect the Arctic through multi-agency collaboration, domestic environmental law enforcement, and international mechanisms including the International Agreement for the Conservation of Polar Bears, the Arctic Council, the United Nations Convention on the Law of the Sea, and the United Nations Framework Convention on Climate Change.



Photo Credit: USGS

The Arctic's icy beauty sustains charismatic species from the much-loved polar bear to the mythical narwhal. Here, sea ice floats on the ocean's surface. It changes size seasonally, keeps the Arctic cool and moderates global climate. It is the platform where many species give birth, raise young, hunt, hide from predators and move long distances. Sea ice sustains a remote web of life: it supports marine algae at the base of the food web, and its spring melt drives phytoplankton blooms that enrich the marine ecosystem. The Bering Sea's sea-ice bloom sustains a rich benthic community, providing food for walrus, bearded seals, and seabirds. It is one of the world's most endangered habitats due to climate change. Climate scientists have projected that summer sea ice will disappear in the 2030s. Winter sea ice will also continue to decline.

A Home for Threatened and Endangered Species

Sea-ice provides critical habitat for imperiled species. The polar bear relies on sea ice to hunt, seek mates, move long distances and build dens to rear cubs. Polar bears hunt seals at ice openings and by breaking into seal snow caves. Other imperiled species that depend on sea ice for rearing young, resting, and/or molting include the ringed, bearded, spotted, ribbon, harp, and hooded seals, Pacific walrus, and spectacled eider.

Climate Change Threats

The Arctic has warmed at twice the rate of the rest of the planet, causing sea ice to rapidly decline. In 2007, summer sea ice plummeted to a record low: ~1 million square miles below the 1979-2000 average—a level that most climate models projected would not be reached until 2050. The ice is also half as thin as it was a few decades ago, and it is melting earlier in spring and forming later in autumn.

As sea ice hunting grounds shrink and break up early, polar bears in some regions are starving, drowning and resorting to cannibalism. If current emission trends continue, scientists predict two-thirds of the world's polar bears will be lost by 2050. As temperatures rise, the ringed seals' snow dens are collapsing and killing their pups. The loss of sea ice over the Pacific walrus' foraging grounds is forcing walrus to come ashore to rest—where vulnerable calves are trampled to death in stampedes. The spectacled eider faces shrinking sea ice over its winter feeding-grounds, which reduces its prey and eliminates its resting areas. The bowhead, beluga, and gray whale are threatened by the expansion of oil drilling and shipping traffic as sea ice melts.



Shallow Water Coral Reefs

Photo Credit: US FWS

Shallow water coral reefs are found throughout the tropics in waters generally shallower than 70 m depth. The Department of Interior has jurisdiction over 24 different coral areas, including coral reefs found off the coasts of Florida, the U.S. Virgin Islands, and Hawaii. Over 800 species of reef-building coral are known to exist worldwide and are often described as the rainforests of the sea because they harbor such a great quantity of biodiversity. Reefs provide homes, nurseries, feeding grounds and spawning sites to more than a quarter of life in the ocean—a diversity of life that is virtually unparalleled in the world. More than 100 million people depend economically on corals reefs, and many more rely on reefs for protection from storm surges, tsunamis and coastal erosion. Resources such as food and recreation provide \$30 to \$172 billion annually to the global economy. Unfortunately, due to climate change, coral reef communities will become much less common.

A Home for Threatened & Endangered Species

Coral reefs are living habitats, and many species of coral are threatened by extinction. Elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) are both critically endangered. Dozens more corals have been petitioned for listing as endangered by the US Fish and Wildlife Service. Coral reefs also provide important habitat for many endangered marine species, including sea turtles and fish and food for marine mammals.

Climate Change Threats

Coral reefs are vulnerable to ocean acidification and rising sea surface temperatures. As absorbed CO₂ increases the acidity of the oceans, coral reefs find it more difficult to secrete their calcium carbonate skeletons. The slowed growth rates coupled with warming temperatures, which causes tropical corals to bleach, can result in death. Coral reefs are predicted to become functionally extinct if CO₂ levels continue to rise: at CO₂ levels of 450 ppm in the atmosphere calcareous corals will decline; above 500 ppm coral reefs are likely to be crumbling habitats; at 560 ppm (expected to be reached by the middle of the century) reefs will likely be eroding globally. These impacts may be especially severe for elkhorn and staghorn corals that are already critically endangered.

Endangered fish may already be negatively affected by rising temperatures and acidifying waters. In the future the fish may have to spend more energy on respiration versus growth or reproduction. These vulnerable fish will also lose the structural complexity of the reef that they use to hide, find food and raise young. Endangered reef fish include giant sea bass, totoaba, plain goby, Warsaw grouper, and strawberry grouper. Top predators capture prey from the reef. Species that rely on food from reefs include the Caribbean monk seal, Hawaiian monk seal, Borneo Shark, Pondicherry Shark, whitefin topeshark, Maltese skate or ray, giant devilray, Caribbean electric ray, Queensland sawfish, common guitarfish, scalloped hammerhead, and sawback angelshark.

Needed Conservation Measures

Coral reefs are not only threatened by ocean acidification and climate change, but also from a number of local and regional threats that are rapidly decreasing coral cover. These include destructive fishing practices such as bottom trawling and dynamite fishing, coastal development, depletion of grazers, and run-off pollution. Mitigation of these threats would boost the resiliency of coral reefs in the face of rising acidity and temperature. However, the removal of these threats will only begin to solve the problem of reef destruction and death. We must stabilize atmospheric CO₂ if we want healthy coral reefs and the animals that depend on them for future generations. (See the Arctic profile for more on stabilizing CO₂ levels.)



Photo Credit: NOAA



The Hawaiian Islands

Photo Credit:
Randolph Femmer

Needed Conservation Measures

The Hawaiian Island ecosystem is a popular visitor destination. The uniqueness of its species makes Hawai'i a desired destination for birders and ecotourists. If species decline or become extinct, the influx of capital to the region will decline with it. Habitat protection, species recovery, and programs to help species adapt to climate change are essential to continued environmental, cultural, and economic prosperity of the Hawaiian Islands.

The Northwestern Hawaiian Islands are part of National Wildlife Refuge System, the Papahānaumokuākea National Marine Monument (a UNESCO World Heritage Site), and the Hawaiian Humpback Whale National Marine Sanctuary. These are among the most protected marine areas in the nation. Yet, increased conservation activities are greatly needed. These include habitat management for native species, captive breeding and release of birds, intensive monk seal management—especially of pups—careful management of appropriate public access areas, fishing, and gathering, the elimination of toxic pollution, and eradication of invasive species.

The main Hawaii islands also face invasive species problems that must be managed such as mosquitoes and glory bush. These islands have important habitat that has been ceded land primarily within the State's Conservation District. While uses of the land are managed in varying degrees, stronger policies and increased funding are needed to better protect native forests, watersheds, coastal lands, and nearshore waters for wildlife in a time of climate change.

The Hawaiian Islands are an extensive ecosystem with a broad range of habitats from coastal beaches, atolls, and low-elevation areas to native forests on volcanic mountainsides to alpine summit peaks. The ecosystem spans the northwestern boundary of the Papahānaumokuākea National Marine Monument to the southernmost Big Island of Hawai'i. Thousands of rare and endemic species are found on the islands. The ecosystem provides habitat for millions of nesting seabirds. Hawaiian birds are particularly vulnerable to the cascading impacts of climate change, but if the ecosystem is conserved, this paradise can be an important refuge for unique species.

A Home for Threatened & Endangered Species

Hawai'i has the greatest number of threatened and endangered species in the United States. Of the more than 100 birds unique to the Hawaiian Islands, it is likely that more than 70 have become extinct since the arrival of humans. Today, the islands provide habitat for a few dozen remaining species of endemic landbirds, primarily honeycreepers, but due to continuing habitat changes, at least six of these species are probably extinct. Millions of nesting seabirds are found in the Northwestern Hawaiian Islands, including the black-footed and Laysan albatrosses. These islands have the largest breeding population of Laysan albatrosses in the world. Hawai'i has 319 threatened and endangered plant species. Imperiled species in coastal areas include the threatened green sea turtle and endangered hawksbill sea turtle. The critically endangered Hawaiian monk seal and imperiled coral reefs are also found in the coastal waters.

Climate Change Threats

Warming temperatures from global climate change assault the ecosystem on multiple fronts. First, as the sea levels rise with the increased melting of the arctic, low-elevation atolls will be inundated. Second, as oceans become more acidic, corals will bleach and die off more quickly, which will reduce sand production for coastal beach ecosystems and healthy reef ecosystems essential for fish and seabirds. Third, as temperatures rise, introduced mosquitoes carrying avian malaria and avian pox will breed at higher elevations, putting bird populations at increased risk of extinction. Because mosquitoes survive at specific temperature ranges, the cooler temperatures of the higher elevations have thus far protected some bird populations from the mosquitoes.



Photo Credit: Jack Jeffrey

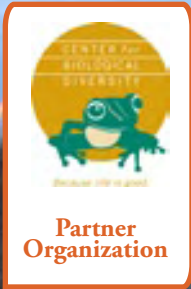


Photo Credit: USFWS

Southwest Deserts

Although the Southwest Deserts are characterized by severe conditions of low rainfall, periodic drought, high winds and daily fluctuations of extreme cold and heat, they also contain rich biodiversity and species uniquely adapted to deserts. Four unique desert communities—the Sonoran, Mojave, Chihuahuan, and Great Basin deserts—span Nevada, Arizona, New Mexico and southern California. The Sonoran Desert alone contains approximately 5,000 plant species, 600 species of vertebrates and thousands of invertebrates, including 1000 native bee species. More than 500 of the world's 1,500 cacti species are in the Chihuahuan desert. In North America, the region's threat from global warming is second only to the Arctic, and the ecosystem's fast growing urban areas and increased use of severely limited water are forcing many species to the brink of extinction.

A Home for Threatened and Endangered Species

The Southwest deserts are a hotspot for endemism (species found nowhere else) and are home to an incredible diversity of threatened and endangered plants and animals—23 species in just one Sonoran desert county alone. Because many species are adapted to very specialized niches, their survival is fragile. The Desert tortoise and Sonoran pronghorn antelope depend on this ecosystem. Declines in endangered long-nosed and long-tongued bats, essential for pollination of the agaves, may put the long-term survival of the agaves at risk. Arid-adapted rodents, kangaroo rats, kangaroo mice and pocket mice, found in all four deserts, are threatened or endangered. One endangered plant, six threatened plants, four species of endangered pupfish and one threatened aquatic beetle live in the Great Basin desert's Ash Meadows National Wildlife Refuge.

Aquatic species inhabit marshes and pools, fed by rainfall and springs, that dot the landscape. Forty-two imperiled freshwater mollusks called springsnails, which are key to food production, water chemistry, and nutrient cycling, live in the Great Basin and Mojave deserts. If these small species were to disappear, the effect would be catastrophic for the food chain.

Climate Change Threats

The temperature increase and precipitation changes in Southwest deserts is the most severe in the United States. The increase in duration and severity of droughts threaten to make the Dustbowl and 1950's drought climates the new norm, threatening both terrestrial and aquatic species. For instance, the Quitobaquito pupfish, found only in a 1/2-acre Arizona pond, could see its home heat up or dry up. Desert pupfish can survive in 110-degree, saline water, but their eggs may not survive the increased temperatures. Desert tortoises already face numerous threats, and they cannot tolerate the additional stressors of droughts, heat waves and changing vegetation brought about by climate change. With a wild population that has fluctuated around 100 in Arizona, the Sonoran pronghorn antelope is threatened by the increased droughts, which limit surface water and eliminate food resources.

Needed Conservation Measures

The Desert National Wildlife Refuge Complex—including four wildlife refuges in southern Nevada—is part of the U.S. Fish and Wildlife Service's new Landscape Cooperative Conservation initiative. (The initiative forms management-science partnerships to inform resource management for climate change and other stressors.) However, existing refuges are inadequate for this ecosystem. Ongoing threats come from urban sprawl, cattle grazing, mining, dam building, and off-road vehicles. And climate change is worsening invasive species impacts. Highly combustible invasive plants in the drier conditions are leading to greater fire frequency and severity, which harm the ecosystem and its species, such as fire-intolerant native cacti. Furthermore, unsustainable water use from explosive population growth combined with the increasing drought severity threatens to leave desert ecosystems without enough water, making water conservation measures an urgent need. To withstand the effects of climate change, these additional threats must be greatly minimized and refuges established to protect unique, but threatened species throughout the desert regions.



Photo Credit: USGS



The Bay-Delta

Photo Credit: Dan Blanton

Needed Conservation Measures

This ecosystem's endangered species won't survive climate change without a shift in California's water management. Currently, massive dams, canals and pumps move water north to south for California's exploding population—expected to exceed 50 million by 2050. Unrealistic human demands on water must be addressed. Water management must focus on efficiency, conservation, run-off recovery, ground water management, storage and other innovative strategies. Conservation easements, land acquisitions and corridor protections for streams are also key strategies. The current Sierra Mountain meadow restoration is one example—improving water storage in upper elevations to increase flows later in the season. (To learn more about upstream conservation measures that influence Bay Delta health, see the Sierra Nevada profile.) Without substantive change, species already endangered are likely to go extinct, and many, which are now safe, will not be in the future.



Photo Credit: NOAA

San Francisco's iconic Golden Gate Bridge overlooks the ocean edge of the Bay-Delta Ecosystem—a complex system of rivers, riparian habitats (where land and rivers meet) and inland and coastal estuaries. It is the heart of California's water system. The area encompasses the west slope of the Sierra Nevada Mountains, south slope of the Siskiyou Mountains, east slope of the Northern Coastal Range, and the San Francisco Bay-Delta. The Delta provides habitat for hundreds of species of fish, birds and other wildlife and protects one of nature's most miraculous migrations—the run of Pacific salmon from spawning grounds in the upper reaches of cold-water rivers to the saline oceans and back again. Climate change is significantly shifting the hydrology of this region, tremendously impacting both humans and wildlife.

A Home for Threatened & Endangered Species

Pacific salmon migrate between fresh and salt water every season. Fish that migrate together—based on latitude and genetic characteristics—are called runs and often behave differently. The threatened spring-run and endangered winter-run Chinook salmon primarily exist in only two locations. The "species of concern" fall-run Chinook are found in multiple rivers.

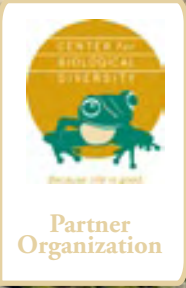
Twelve of the original 29 indigenous Delta fish species are either extinct or endangered. The Delta smelt, once an extremely abundant species, is now endangered. Its decline is viewed as an indicator of the deteriorating condition of the region.

All ten California Wild and Heritage trout are in the territory. The threatened Central Valley steelhead is a unique rainbow trout that migrates to the ocean. The threatened green sturgeon forages along estuaries and bays and returns to freshwater pools to spawn. Additional threatened and endangered species that use this habitat include Swainson's Hawk, California least tern, California black rail and clapper rail, Smith's blue butterfly, salt marsh harvest mouse, northwestern pond turtle, tiger salamander, tidewater goby, California freshwater shrimp, and imperiled vernal pool species.

Climate Change Threats

In the past, a heavy winter snowpack in the mountains slowly melted through the spring and was coupled with healthy spring rain to ensure that a steady supply of fresh cold water coursed through the ecosystem. Today with climate change, there is less snow and more rain in the winter, and less rainfall later in the season, when it is needed most. This changed precipitation pattern, combined with more droughts, creates dry, low-flow, and warmer conditions in California's rivers. Without healthy, cold-water rivers, habitat that is critical for the survival of the Central Valley Steelhead, spring-run and winter-run salmon has greatly declined.

In addition, climate change has impacted the political climate in the region. Reduced water availability due to climate change has been misleadingly blamed on water restrictions for Endangered Species Act protections. Scientific studies have exposed the truth, but the media and common knowledge remain mired in myth rather than science.



California Sierra Nevada Mountains

Famously hiked by John Muir and a favorite place of Teddy Roosevelt, the Sierra Nevada mountain range is a birthplace of America's modern conservation movement. Sculpted by glaciers, the California Sierra Nevada Mountains' topography (from upper montane to alpine forests), climatic zones, geology and soils are highly variable. It is also an area where frequent wildfires are natural. This variability has led to many endemic species (found nowhere else) and a great diversity of plants and thousands of mountain meadows that support a rich diversity of birds and amphibians. The ecosystem's high-mountain snow pack melt regulates the region's water cycle. But higher temperatures are reducing snowpack and shifting snowmelt earlier, putting species at risk in this global biodiversity hotspot.

A Home for Threatened and Endangered Species

California's Sierra Nevada Ecosystem is home to 570 vertebrate wildlife species: 290 birds, 135 mammals, 46 reptiles, 37 amphibians, and 60 fish. Of these, 80 birds, 40 mammals, 10 reptiles, 20 amphibians, and 30 fish are on California's Special Animals List. Twenty-six are endemic to the Sierra Nevada. Sierra Nevada mid and high elevations provide the only habitat for the Sierra Nevada mountain yellow-legged frog, the Yosemite toad, and the Sierra Nevada bighorn sheep. The headwaters of the rivers that start in the Sierra Nevada sustain threatened and endangered fish.

Climate Change Threats

The ecosystem is rapidly warming, having more winter rains instead of snow and experiencing an earlier snowmelt with less snowpack. This is disastrous for amphibians—more than half of Sierra Nevada's 30 native species have declined. Yellow-legged frogs (reduced to 7 percent of their range), which are tadpoles for 3-4 years, require the snowpack to provide enough water to keep ponds from drying in summer or freezing in winter. Yosemite toads—with crashing populations even in Yosemite National Park—rely on spring snowmelts for pools to lay eggs and for survival.

The Sierra Nevada bighorn sheep is losing mountain meadows where it browses as tree lines move higher and seasonal droughts increase. The American pika, adapted to cold alpine conditions, is intolerant of high temperatures and is disappearing from lower elevation sites in the eastern Sierra Nevada. Climate change exposes pikas to heat stress in the summer as they try to forage and disperse, and to cold stress in winter as they lose the insulating snowpack that protects them from cold snaps. As temperatures warm, pikas will be pushed further upslope until they have nowhere left to go. The reduced snowpack impacts threatened and endangered fish that rely on downstream cold-water flow. (See California Bay Delta profile.)

Needed Conservation Measures

This ecosystem is heavily impacted by climate change, but also population growth, recreation, and changing land use. Most of its mountain meadows—the keystones of the ecosystem—have been altered by grazing, mining, logging, fire suppression, water uses (e.g. dams) and invasive species. Reducing these impacts is essential to build ecosystem resiliency. An under-utilized conservation measure, restoration of mountain meadows, will help species adapt and will provide Californians with water when they need it most. Scientists and nonprofits are exploring comprehensive mountain meadow restoration, reducing pollutants, and increasing forest cover to help combat climate change.

In addition to landscape efforts, there are important opportunities to minimize threats to individual species, for example, the removal of nonnative trout from high Sierra lakes and reduction of transmission of chytrid fungus to protect the yellow-legged frog, limitation of introduced fish, pesticides and cattle grazing to protect the Yosemite toad, and reduction of the threat of disease transmission from domestic sheep to protect the Sierra Nevada bighorn sheep.



Photo Credit: Adam Backlin, USGS



Photo Credit:
SOS/Neil Osborne/ILCP

The Snake-River Basin

Needed Conservation Measures

The potential for the Snake River Basin ecosystem to serve as a climate change haven highlights the need to remove four federal dams on the lower Snake River to ensure the survival of the basin's imperiled salmon and steelhead. Removal of these dams would restore more than 140 miles of free-flowing habitat that are spawning grounds for threatened Snake River fall Chinook salmon and would open up the remaining 70% of potential habitat that scientists describe as a "Noah's Ark" for salmon. Fishermen, outdoor retailers, scientists, conservationists, clean energy advocates, taxpayer groups, eastern Washington farmers, the State of Oregon, Members of Congress, and Native American Indian tribes support the protection and restoration of the Snake River Basin habitat. Restoring access to this habitat would also create jobs and economic prosperity. Moreover, it would leverage existing federal resources for already protected areas that are in generally excellent condition. Therefore, after the initial investment to remove the dams, the fish will return to habitats that require little investment in restoration.



Photo Credit:
SOS/Neil Osborne/ILCP

The mighty Snake River flows through diverse habitats in Wyoming, Central Idaho, Southeast Washington, and Northeast Oregon. Powerful forces of nature—volcanoes, flooding episodes and glaciers—shaped the basin. The Snake River has over twenty major tributaries, most of them in mountains of the basin. Its best-known feature is Hells Canyon—North America's deepest river gorge. Its iconic species is the salmon. Key portions of the basin provide the largest, highest, and most intact salmon habitat of the lower 48 states, and it also supports other imperiled species. If conservation measures are implemented, this ecosystem could be an important refuge for endangered species in a time of climate change.

A Home for Threatened & Endangered Species

The Snake River is home to four imperiled runs of anadromous fish—steelhead, spring/summer Chinook, fall Chinook, and sockeye salmon (the most endangered salmon on earth). Snake River salmon and steelhead climb 7,000 feet and swim almost 1,000 miles from the Pacific Ocean to their natal streams. (No other salmon or steelhead goes as high and as far, making them truly unique in the world.) The threatened bull trout overwinters in the Snake River, while native and resident fish species of concern also live in the Snake and its tributaries. The river is also home to dozens of rare and endemic mollusks, with at least 21 snail and clam species of special concern.

Snake River salmon also carry nutrients from the oceans to inland rivers, forests and other species. They and their Columbia River cousins are the primary food source for the endangered and distinct Southern resident killer whales. Some of America's great carnivores—the grizzly bear, gray wolf, wolverine, and Canada lynx—rely on this ecosystem and its salmon. The basin's salmon-enriched habitat is home to more than 200 bird species, including whooping cranes, bald eagles, peregrine falcons, greater sage-grouse, and yellow-billed cuckoos.

Climate Change Threats

Recent analyses indicate that rivers are warming faster than surrounding air temperatures. These warmer waters, as well as the scouring of salmon nests and other changes in habitat, are putting threatened and endangered fish on the front lines of climate change, particularly in the Pacific Northwest. Since salmon and steelhead require clear, cold water, ensuring that salmon can migrate to the coolest tributaries in the basin is vital to their survival and reproduction. Fortunately, the mountainous areas of the Snake River Basin are projected to remain fairly cool in a warming world, so they could be refuges for salmon and steelhead in the whole Columbia River Basin. Since their survival is vital to the ecosystem and its species, the basin could also be a highly valued refuge for dozens of other threatened and endangered species.

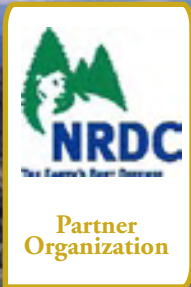


Photo Credit: Macfarlane, et al.

Greater Yellowstone

The Yellowstone ecosystem is home to the iconic and historical Yellowstone National Park, the first U.S. national park created in 1872. Its high-elevation mountains of alpine and sub-alpine forests, are a UNESCO World Heritage site, spanning the rugged region where Idaho, Wyoming and Montana meet. Whitebark pine is the ecosystem's foundation tree, living in the highest and harshest parts of the region, where few other trees survive. Moreover, whitebark forests stabilize and shade the snowpack, reducing avalanches and extending precious snowmelt flows into the summer months. The slow melt keeps rivers cool for trout and other wildlife and helps maintain water resources for people in the arid American West. But warming temperatures are threatening these majestic pines by allowing the mountain pine beetle to move into higher elevations, where it is decimating the defenseless whitebark forests on an unprecedented scale.

A Home for Threatened and Endangered Species

The whitebark pine is an imperiled foundation species of the Yellowstone ecosystem that provides critical food and essential habitat to many species at higher elevations. Elk use these forests as shelter. Small mammals and birds, such as the red squirrel, chipmunk and Clark's nutcracker, rely on whitebark pine seeds as a primary food. Perhaps most importantly, pine seeds play a key role in the survival of Yellowstone's threatened grizzly bears. The pine seeds are a high-calorie, high-fat food source that the grizzly eats to build fat stores essential for surviving winter hibernation. Whitebark pine is the engine that drives the health of the Yellowstone grizzly bear population: because of its remoteness, whitebark pine helps keep grizzly bears up high and out of harm's way during their fall feeding frenzy. Moreover, when whitebark pine seeds are abundant, more cubs are produced, whereas when whitebark pine food crops are poor, bear reproduction suffers.

Climate Change Threats

As global warming progresses, increased temperatures at higher elevations allow the mountain pine beetle—once confined by cooler temperatures to lower elevations—to move up the mountains. Whitebark pines have no significant defenses, causing yearly die-offs. As the beetles attack the adult tree, an invasive pathogen called blister rust is attacking the smaller trees, creating a perfect storm where whitebark pines are being wiped out. A recent study by the NRDC and the U.S. Forest Service revealed that 82 percent of the whitebark pine forests in the Yellowstone ecosystem showed either high or medium mortality; only 18 percent of the ecosystem's whitebark pine forests are healthy. Based on this study and current changes, experts predict that whitebark pine will be functionally extinct in the ecosystem—failing to provide food, shelter and hydrological functions—in five to seven years.

If the grizzlies do not have pine seeds, they migrate to lower elevations searching for other food, where conflicts with humans occur. Over the past few years, bears have wandered farther from high-altitude havens where they would normally be feasting on whitebark pine seeds, resulting in more conflicts with hunters, campers, and residents and often the bears' lethal removal.

Needed Conservation Measures

Nonprofits, federal and state agencies are exploring future forest management options. The Greater Yellowstone Coordinating Committee's whitebark pine subcommittee has mapped the priority whitebark pine conservation and restoration areas for the Yellowstone ecosystem. Continued monitoring and efforts to search for beetle-resistant whitebark pine trees will be critical. The U.S. Forest Service and other agencies are already collecting blister-rust-resistant seeds and raising seedlings for replanting. While still small in scale compared with the extent of beetle-impacted whitebark, restoration projects have the potential to expand and target critical habitat areas throughout the tree's range. At the same time, adaptation programs and strong protections for grizzly bears can be part of a program to respond to the effects of declining whitebark in Greater Yellowstone.



Photo Credit: Erwin and Peggy Bauer



Photo Credit: USFWS

The Gulf Coast Flatlands & Wetlands

Needed Conservation Measures

The region has had ongoing efforts to prevent nitrification (dead zones), restoration of endangered species, restoration of marsh buffers, and protection of sea turtles from fisheries. Expanding these types of conservation measures, creating a comprehensive plan to protect the region's biodiversity and ecosystem services (particularly mitigating climate change threats such as sea rise), and addressing non-climate change threats to specific species (such as closing sections of beaches with the highest concentrations of nesting plovers to development and recreational use) would build the region's resiliency. The former U.S. Fish & Wildlife Service Director called for the BP liability funds to be spent on acquiring lands and expanding the wildlife refuge system on the Gulf. Money for these activities will likely become available when BP pays its federal penalties from the Deepwater Horizon catastrophe.



Photo Credit: NOAA

From southern Texas to the Florida panhandle, this ecosystem's coastal marshes, beaches, barrier islands, inland streams, rich deltas, interior coastal wet prairies, longleaf pine savannahs and grasslands function as a diverse ecosystem. The area is a center of plant endemism in the Southeast, and abounds with threatened animals and plants. Migratory birds use it to refuel before flying non-stop over the Gulf to Central America. The wetlands provide breeding sites and nursery areas for commercially fished species, serve as nesting sites for sea turtles and protect coastal communities from storm surge. Unfortunately intense development—agricultural and industrial production, casinos, marine recreation, shipbuilding, international shipping, and oil exploration—have damaged and fragmented the region. With the public attention brought by Hurricane Katrina and the Deep Horizon catastrophe, the time is ripe to restore and protect the ecosystem, for man and nature, particularly in light of forecasted climate change conditions.

A Home for Threatened & Endangered Species

The threatened Piping plover winters in the Gulf beaches and the Snowy plover nests here. The only remaining historical flock of the critically endangered Whooping Crane overwinters in coastal Texas' Aransas National Wildlife Refuge. Reintroduction of a flock on Louisiana marshes planned. The remnant prairies are the only habitat of the endangered Mississippi sandhill crane. Texas coastal grasslands are managed to expand the endangered Attwater's prairie chicken populations. The northern Aplomado Falcon has been restored to coastal flatlands and barrier islands. The Gulf's five endangered whales and manatee rely on wetlands and marshes to protect water quality. The endangered Mississippi Gopher frog relies on the Gulf's upland and seasonally flooded lowlands. Endangered and threatened sea turtles—the Green, Hawksbill, Kemp's ridley, Leatherback and Loggerhead—feed and/or breed here. Coastal Mississippi streams are occupied by the endangered Alabama Red-bellied Turtle. Coastal longleaf pine savannahs have snakes and lizards that take advantage of the burrowing habits of the threatened Gopher tortoise. Gulf Sturgeon move from marine waters into freshwater to spawn.

Climate Change Threats

In the near future, the region is predicted to see increases in the number and intensity of storms, including Category 5 hurricanes. Greater storm damage to offshore drilling platforms is likely to occur, raising the possibility of more oil spills. The storms will erode the coasts—by destroying marshes and sinking barrier islands—causing even small sea level rise to amplify storm surge and habitat destruction. If sea levels rise 1 meter, as predicted by some models, inland habitats will be threatened by storm damage, inundation, salinization, and destruction by humans as we move back from the flooding land areas nearest the Gulf of Mexico.

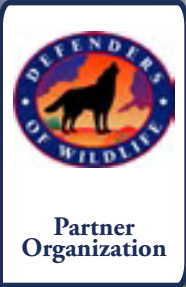


Photo Credit: USGS

The Greater Everglades

America's Greater Everglades Ecosystem is a beautifully rich mosaic of habitats, from sawgrass prairies and freshwater marshes to upland pinelands and cypress forests. It is an International Biosphere Reserve and a World Heritage Site in Danger. A peninsula surrounded by three seas (Atlantic, Gulf and Caribbean), the region is a key area for wildlife, providing stopover sites for neotropical migrants, hawks, hummingbirds and monarch butterflies. Unfortunately, this ecosystem is also on the front lines of climate change and considered one of the most vulnerable regions of the world to sea level rise.

A Home for Threatened and Endangered Species

The Greater Everglades contains 67 federally listed threatened or endangered species—8 mammals, 12 birds, 10 reptiles, 2 invertebrates and 35 plants. These include: the Everglades snail kite, red cockaded woodpecker, manatee, American crocodile, Schaus swallowtail butterfly, and fragrant prickly apple. It provides globally significant nesting sites for five endangered and threatened sea turtles and is the only place in the world where both alligators and crocodiles reside. Over 600 species are considered rare or imperiled in south Florida, including state listed species, such as the Florida black bear, Everglades mink, gopher tortoise and numerous orchids. Of all the imperiled species in the Greater Everglades Ecosystem, none is more iconic than the critically endangered Florida panther. The only breeding population of this wide-ranging, top-of-the-food-chain carnivore is found here.

Climate Change Threats

With projected rises in sea level of three feet or more over the next century, much of the low-lying Everglades ecosystem is at risk of being submerged under water. Climate change will very likely bring stronger storms, higher water temperatures, saltwater intrusion, beach erosion, changing species ranges, and new invasive species. As a result, species with very specific niches, including the Cape Sable seaside sparrow, will be particularly vulnerable. The Florida panther and black bear are likely to lose habitat from sea level rise within the next half-century. Saltwater intrusion may change the ecosystem's plantlife, with secondary impacts such as a diminishing prey base for panthers (deer). Endangered species in the southernmost reaches are at high risk of habitat inundation: Key deer, Key Largo cotton mouse and woodrat, and the Lower Keys marsh rabbit.



Photo Credit: NPS

Needed Conservation Measures

Much has been invested in the conservation of this ecosystem, perhaps more than any other restoration effort in the world. However, continued development coupled with climate change requires that these efforts be expanded to buffer the ecosystem and its species.

A landmark visionary program for South Florida ecosystem recovery is CERP, the Comprehensive Everglades Restoration Plan. Several additional landscape initiatives are now underway including the U.S. Fish & Wildlife Service's Peninsular Florida Landscape Cooperative Conservation plan, the Florida Fish and Wildlife Conservation Commission State Wildlife Action Plan Cooperative Conservation Blueprint pilot project, the Babcock Ranch Wildlife Corridor, the Northern Everglades National Wildlife Refuge proposal and expansion of the Florida Panther National Wildlife Refuge. These will help to guide conservation measures, such as preserving landscape corridors and core habitat, and coordination of state-of-the-art natural resource identification.

Key strategies must include traditional approaches such as land acquisition and easements, Farm bill and other innovative conservation incentive programs and pioneering credit transfer programs for development, agriculture and conservation. This ecosystem is particularly vulnerable to invasive species from plants to pythons that must be controlled. Furthermore, continued effective transportation planning is necessary to avoid habitat fragmentation and ensure safe wildlife passage.



Additional Ecosystems

Not all of the ecosystems nominated are in the final selection, yet they are nonetheless important (the scores were close) and are included below. As science and conservation focus on ecosystem protection in a time of climate change these will undoubtedly receive attention and concern.

Glacier National Park: Scientists predict that Glacier National Park will lose all of its glaciers by 2030. This ecosystem provides a home for the mist forestfly, bull trout, and grizzly bear. Though it is unlikely that the mist forestfly will survive, conservation measures to protect the forestfly, bull trout, and grizzly bear must be undertaken. (WildEarth Guardians)

Jemez Mountains: Mixed conifer forests and riparian areas in New Mexico's Jemez Mountains are affected by climate change: warmer temperatures, less precipitation, susceptibility to forest fires, and insect outbreaks. The Jemez Mountains salamander and the New Mexico meadow jumping mouse are imperiled in part due to climate change. Other ESA-listed species that will suffer from climate change include the Canada lynx and Mexican spotted owl. River and stream restoration and beaver reintroduction can increase this ecosystem's resilience. (WildEarth Guardians)

Sagebrush steppe: The sagebrush steppe covers more than 100 million acres in the West, but less than 5% receives federal protection. It is among the most imperiled landscapes in North America facing numerous threats that will be exacerbated by climate change. Greater sage-grouse are an umbrella species for scores of sensitive sagebrush flora and fauna and will experience severe negative impacts from climate change. The government agencies should designate additional sagebrush reserves to protect important habitat cores and corridors for sage-grouse and other species. (WildEarth Guardians)

U.S. Western Coast: The entire population of the Western Snowy Plover winters from Southern Washington to the Mexican border. The main climate change threat to beaches

and their wildlife is sea level rise. Beaches see heavy human use; and as their total area decreases with climate change, recreational and commercial use will encroach upon animal habitat. (Audubon)

The Maine Woods: The Maine Woods encompass an undeveloped expanse of forestland of more than 17 million acres stretching from the New Hampshire border on the west to the New Brunswick border on the east and north to Quebec. This is the last U.S. stronghold of native brook trout, a primary breeding area for neotropical migratory songbirds, and home to several endangered and threatened species, including Canada lynx, Atlantic salmon, wood turtle, Bicknell's thrush, yellow lampmussel, and Tomah mayfly. If permanently protected, it could provide habitat for species adaptation and carbon storage in a naturally reproducing forest. (RESTORE: The North Woods)

Grasslands: National Grasslands comprise 4 million acres of large, rolling terrains of grasses, flowers and herbs that extend down the midsection of the continental United States. They are home to a variety of threatened and/or endangered species including a number of prairie wildfowl, the black-footed ferret, and the Wyoming Toad. Grasslands in the Great Plains are predicted to get warmer, while Southwestern grasslands are expected to become drier. Grassland restoration, invasive species eradication and other conservation measures can protect this ecosystem. (ARKive)

Southern Rockies: Canada lynx and wolverines use this mountainous ecosystem because of its prey base, persistent snow coverage, and cold temperatures. Given its higher elevation habitat, the Southern Rockies could provide an important refuge for endangered species pressured by climate change. This ecosystem and wildlife corridors connecting its core habitats can be preserved for wide-ranging species through protections such as wilderness designation and by limiting the number of roads and developments within important wildlife areas in the Southern Rockies. (Center for Native Ecosystems)

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