NATIONAL WILDLIFE FEDERATION®

FUELING THE FIRE

Global Warming, Fossil Fuels and the Fish and Wildlife of the American West

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NATIONAL WILDLIFE FEDERATION™

Fueling the Fire: Global Warming, Fossil Fuels and the Fish and Wildlife of the American West

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Cover Photo: An elk in a burned out area of forest in Yellowstone National Park, 1988. (National Park Service)

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

INTRODUCTION 1

GLOBAL WARMING: A DIRE THREAT TO THE WEST'S WILDLIFE LEGACY 3

Impacts of Global Warming on Western Wildlife and Habitats 4

Declining Water Resources 4

More Extreme Heat Waves 5

Pervasive Drought 6

Expansion of Invasive Species, Pests and Diseases 7

More Catastrophic Wildfires 8

Loss of Sagebrush Habitat 9

Loss of Habitat for Trout, Salmon and Other Cold-Water Fish 9

Loss of Wetland Habitat and Waterfowl 10

Loss of Alpine Tundra and Other Mountain Habitats 11

Increased Risk of Species Extinctions 11

EXPANSION OF OIL AND GAS DEVELOPMENT: DRILLING THE LAST BEST PLACES.. 12

CHANGING THE FORECAST FOR FISH AND WILDLIFE IN THE WEST: A PLAN OF ACTION 14

CONCLUSION 19

ENDNOTES 21

EXECUTIVE SUMMARY

For millions of people, hunting, fishing and other outdoor traditions are an important part of life in the American West. But America's addiction to fossil fuels is coming at an enormous price, one that threatens not only people but the fish, wildlife and ecosystems that are so fundamental to the region's— and nation's—economy, culture and values.

Hunting, fishing and other outdoor traditions are an important part of life in the American West. (Natural Resources Conservation Service)

GLOBAL WARMING– A DIRE THREAT TO THE WEST'S WILDLIFE LEGACY

Above all, burning coal, oil and gas is the driving force behind global warming, which will dramatically alter the western landscape if left unchecked. Indeed, the growing body of evidence that global warming is already having an impact on natural systems is a strong warning: without meaningful action to reduce now emissions of carbon dioxide and other heat trapping gases responsible for the problem, the western U.S. faces greater risks ahead. For example:

- **Global warming will cause a dramatic reduction in snowpack** in some areas, placing considerable strain on the region's water supply. Mountains in the Pacific Northwest are projected to lose as much as 88 percent of average snowpack by 2090; the Central Rocky Mountains could lose up to 75 percent; and parts of the Southern Rockies and the Sierra Nevada range could lose 98-100 percent.

- **The past nine years (1997-2005) were the warmest years on record**, and scientists project that heat waves will become more intense, more frequent and longer lasting during this century if global warming continues unabated.

- **Drought conditions are expected to become more extreme** in some areas as higher average temperatures contribute to increased evaporation rates. The current drought plaguing the West is the worst in 500 years and has drastically reduced available water resources for people and wildlife alike.

- Warmer average winter temperatures and less frost are expected to increase the rate, intensity and extent of **invasive species, pest and disease outbreaks** throughout the region. If warming trends continue as projected, forest die-offs due to pine bark beetles and other pests are expected to become even worse than the recent devastating epidemics.

- Warmer, drier conditions due to global warming have caused a four-fold **increase in the number of major wildfires** in western forests and a six-fold increase in the area of forest burned since the mid-1980s. Scientists predict that the overall area of acreage burned by wildfires will double in size across 11 western states between 2070-2100. States hit particularly hard include Montana, Wyoming, Utah and New Mexico.

- Big **sagebrush habitats throughout the western U.S. could decline by 59 percent** before the end of this century, which would have devastating consequences for sage grouse, mule deer, pronghorn and other species that depend on them.

- A continuing trend toward **higher stream temperatures would significantly reduce viable habitat for trout, salmon and other cold-water fish** across the West. The Rocky Mountain region alone could see the area of suitable habitat for cold-water fish decline by 50 percent if average July temperatures rise 5.4 degrees Fahrenheit.

- Global warming poses a significant **threat to the region's diverse wetlands**, including areas that provide critical breeding and wintering habitat for waterfowl. The Prairie Pothole Region could see as much as a 91-percent reduction in prairie pothole wetlands by the 2080s, resulting in up to 69-percent reduction in the abundance of ducks breeding there.

- **High-elevation species are particularly vulnerable to global warming** given the fact that they have limited space available to find new habitats as higher average temperatures push them farther up in the mountains. Wildlife species at risk include mountain goats, bighorn sheep and ptarmigan.

- There is growing concern that **the accelerating pace of change will put alarming numbers of species on the path to extinction**. Global warming is projected to reduce boreal habitat in all of the mountain ranges of the Great Basin region, contributing to a 44-percent loss of mammal species, a 23-percent loss of butterfly species, a 30-percent loss of perennial grasses and forbs and a 17-percent loss of shrub species.

Making matters worse is the fact that many continuing problems in the American West, including habitat fragmentation, invasive species and growing demands for water resources, have degraded wildlife habitat and reduced the resiliency of wildlife species to cope with the impacts of global warming that are already underway. Ultimately, it is the combination of global warming and these other human-induced problems that will fundamentally change the West's unique and diverse natural systems unless the region and nation takes a much more concerted effort to implement solutions.

EXPANSION OF OIL AND GAS DEVELOPMENT—DRILLING THE LAST BEST PLACES

Over-dependence on fossil fuels has also had a direct impact on the western landscape through extensive oil and gas development, destroying unique and important habitats for fish and wildlife. There are currently more than 850,000 oil and gas wells strewn across the 33 states, mostly in the West (including Alaska), with proposals to drill countless more waiting in the wings.

Within the past decade, energy companies have proposed and begun projects to drill on millions of additional acres in the West that provide essential habitat for fish and wildlife, facilitated in part by recent federal government efforts to reduce important environmental protections.

The total number of permits approved by the Bureau of Land Management for drilling on public lands tripled (from 1,803-6,399) between fiscal years 1999-2004, with the most activity occurring in Colorado, Montana, New Mexico, Utah and Wyoming. A recent General Accounting Office analysis found that this dramatic increase significantly lessened the Bureau's ability to meet its environmental protection responsibilities. In many cases, these projects pose a serious threat to some of the region's most popular game species, including sage grouse, mule deer, pronghorn antelope and elk.

CHANGING THE FORECAST FOR FISH AND WILDLIFE IN THE WEST—A PLAN OF ACTION

Fortunately, solutions are at hand. Effective and affordable technologies are available that can significantly improve the energy efficiency of buildings, appliances, cars and trucks. In addition, clean, renewable energy sources such as the sun, wind and biofuels are becoming increasingly affordable and have tremendous potential to diversify the region's and nation's energy portfolio. It is time to re-tap the pioneering spirit that built America and forge a new energy frontier for generations to come. A meaningful strategy should include the following actions:

1. ***Place significant, mandatory limits on U.S. global warming pollution.***
2. ***Reduce the nation's overall dependence on fossil fuels through greater investments in energy efficiency and renewable energy technologies.***
3. ***Implement strategies to help wildlife survive the effects of global warming that are already underway.***
4. ***Promote strong wildlife stewardship as an important part of a new energy future.***

This community in Rancho Cordova, California, is comprised of "Zero Energy Homes," which have both solar generation technology and improved energy efficiency capabilities. (Sacramento Municipal Utility District)

With a resounding voice and determination, people can change the forecast for fish and wildlife in the West and ensure that their children and grandchildren will have the same opportunities to fish, hunt, and enjoy the natural world they know and love. By acting now to reduce dependence on fossil fuels and invest in cleaner, more sustainable energy resources, the United States will take the single most important conservation action of the 21st century.

INTRODUCTION

Hunting, fishing and other outdoor traditions are an important part of life in the American West. Twenty-five percent of people who live in the region are sportsmen and women. According to the U.S. Fish and Wildlife Service, in 2001 hunters and anglers spent more than $17 billion on their recreational pursuits in the western United States, contributing greatly to the region's economy.[1]

For generations, sportsmen have been true champions for conservation, recognizing the importance of fish, wildlife and their habitats to the region's and nation's culture and values. Despite many important conservation successes, however, the American West faces serious and growing problems that have yet to be solved.

A significant decline in the West's remaining sagebrush habitats due to global warming would have devastating consequences for pronghorn antelope. (U.S. Fish & Wildlife Service)

Now, there are growing signs that the nation's over-dependence on fossil fuels is coming at an enormous price, not only for people, but for the fish, wildlife and ecosystems that sustain them. If the recent headlines are any indication, hunters and anglers are rightly concerned about the critical problems facing the region, from mounting pressure to drill for oil and gas in sensitive areas to the devastating consequences of global warming.

In the News....

"**Yes, the planet is heating up. Hottest year on record; more to come,"** by Jane Kay, *San Francisco Chronicle*, July 30, 2006

"**Heat halts fishing on Little Blackfoot, most of Clark Fork**," by Perry Backus, *The Missoulian*, July 26, 2006

"**Western parks hit hard by the heat**," by Michael Jamison, *The Missoulian*, July 26, 2006.

"**Scientists see link in warmer climate, more fires**," by Charles J. Hanley (AP), *Salt Lake Tribune*, July 26, 2006.

"**Study: Gas drilling hurting sage grouse**," by Becky Bohrer (AP), *Fort Wayne Journal Gazette*, June 16, 2006

"**Deer population facing drought-linked decline**," by Tony Davis, *Arizona Daily Star*, March 20, 2006

As President Bush acknowledged in the 2006 State of the Union address, "America is addicted to oil." In fact, the U.S. population, about 5 percent of the world population, consumes nearly 25 percent of the world's annual energy supply. And U.S. oil use has increased dramatically over the past decade. Oil accounts for virtually all of the energy used for transportation in America, and the transportation sector has become the largest and fastest-growing contributor to the nation's global warming pollution.[2] In addition, the vast majority of the nation's electricity continues to be produced with highly polluting coal and increasingly expensive natural gas.

Rising demand for domestically produced oil and gas has led to the expansion of energy development into pristine public lands throughout the Rocky Mountain region, which is having a significant impact on unique and important habitats for big game species and upland birds. Currently more than 850,000 oil and

gas wells are strewn across 33 states, mostly in the West (including Alaska), with proposals to drill countless more waiting in the wings.[3]

Furthermore, the same addiction to fossil fuels is the driving force behind global warming, which is already contributing to catastrophic wildfires, the expansion of invasive species and more pervasive drought across the western United States, thereby threatening cold-water fish, waterfowl and other wildlife. Without dramatic reductions in emissions of carbon dioxide and other heat trapping gases responsible for the problem, global warming will fundamentally alter the western landscape.

As described in this report, the impacts of global warming on the American West include:

- ***Declining water resources***
- ***More extreme heat waves***
- ***Pervasive Drought***
- ***Expansion of invasive species, pests and diseases***
- ***More catastrophic wildfires***
- ***Loss of sagebrush habitat***
- ***Loss of habitat for trout, salmon and other cold-water fish***
- ***Loss of wetland habitat and waterfowl***
- ***Loss of alpine tundra and other mountain habitats, and***
- ***Increased risk of species extinctions***

Of particular concern is the fact that these impacts will fall on top of the many other serious problems plaguing the region, from urban development and agriculture to industrial activities and poor forest management. Ultimately, it is the combination of global warming and these other human-induced problems that will fundamentally change the West's unique and diverse natural systems unless the region and nation takes a much more concerted effort to implement solutions.

Habitat loss due to urban sprawl and other problems will exacerbate the impacts of global warming on wildlife. (Natural Resources Conservation Service)

The bottom line is, there is no substitute for the great sagebrush steppe habitats of eastern Montana and western Wyoming, which support some of the largest remaining populations of sage grouse. Nothing can replace cold, clear rivers such as the Clearwater River in Idaho and the Gunnison River in Colorado, which are true paradise for trout anglers. If the storied mule deer and pronghorn home ranges in Arizona's Mogollon Rim are destroyed, people will never again be able to share with their children the same hunting traditions as their parents and grandparents.

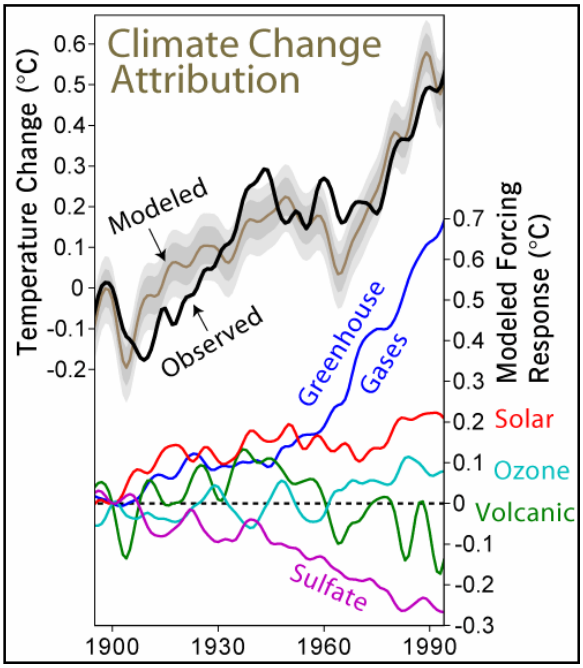
Fortunately, however, there *are* substitutes for fossil fuels. Effective and affordable technologies are available today that can significantly improve the energy efficiency of buildings, appliances, cars and trucks. In addition, clean, renewable energy sources such as the sun, wind and biofuels are becoming

increasingly affordable and have tremendous potential to diversify the region's and nation's energy portfolio. Hunters and anglers not only have a role to help build a new energy future with cleaner alternatives but also to help ensure alternative energy sources are pursued using wildlife-friendly siting and agricultural practices.

It is time to re-tap the pioneering spirit that built America and forge a new energy frontier for generations to come. By acting now to reduce dependence on fossil fuels, the United States will take what will likely go down as the single most important conservation action of the 21st century.

GLOBAL WARMING – A DIRE THREAT TO THE WEST'S WILDLIFE LEGACY

Global warming and associated loss of habitat loom as the most significant and dire threats to the West's fish and wildlife and the invaluable benefits they provide for people. Scientists have widely and conclusively determined that global warming is happening and that burning fossil fuels is in large part to blame. The Bush administration stated in its 2002 *U.S. Climate Action Report*: "Greenhouse gases are accumulating in the Earth's atmosphere as a result of human activities, causing global mean surface temperature and subsurface ocean temperature to rise."[4]



As this graphic shows, scientists have determined that most of the observed global warming during the latter part of the 20th century is attributed to man-made greenhouse gas emissions, as opposed to natural factors such as solar and volcanic activity. (Global Warming Art)

Indeed, the evidence that human activities are causing global warming is stronger than ever. Science has shown a direct relationship between the amount of carbon dioxide and other heat-trapping gases being released into the air due to the burning of fossil fuels and the increase in average surface temperatures around the world. Since the start of the Industrial Revolution, the amount of heat-trapping carbon pollution in the Earth's atmosphere has risen to a level greater than any other time in at least the past 650,000 years, and perhaps the past 20 million years.[5]

Consequently, in less than one century, the Earth's average temperature has risen more than one degree Fahrenheit, and it is expected to rise by another 2.5-10 degrees Fahrenheit by 2100 if global warming pollution remains unchecked.[6] While this change may not seem like much, consider that the average global temperature difference between the peak of the last ice age more than 20,000 years ago and today's climate is only nine degrees Fahrenheit. With global warming, the planet faces a similar amount of change, but this time in a matter of decades, not thousands of years.

Global warming means far more than hotter weather. As the planet's temperature rises, local climate systems are being disrupted in ways that directly affect the region's forests, lakes, prairies, rivers, wetlands and other habitats as well as the fish and wildlife that depend on them. Water temperatures are becoming warmer, precipitation patterns are changing, and extreme weather emergencies such as droughts and floods are becoming more frequent and severe. In addition, thermal expansion of the oceans combined with melting glaciers and polar ice caps are causing global sea levels to rise at an unprecedented pace.

Making matters worse is the fact that many continuing problems in the American West have reduced the resiliency of wildlife species to cope with the impacts of global warming that are already underway. For example, habitat fragmentation due to oil and gas drilling, urban development, agriculture and other factors makes it much more difficult, if not impossible, for wildlife species to migrate to find more-favorable conditions. Harmful invasive species have progressively out-competed many native plants and animals across the region over the past century, and global warming is also likely to further shift the balance in their favor. In addition, pressures for scarce water resources have long plagued the West, often generating conflicts between meeting the needs of people and those of fish and wildlife. With global warming expected to contribute to even greater reductions in available water supplies across the region, competition among users will likely escalate.

Impacts of Global Warming on Western Wildlife and Habitats

The consequences of global warming for people and wildlife are serious without immediate and meaningful action to reduce the pollution causing it.

Declining Water Resources

One of the greatest concerns about global warming in the West is the impact on the region's water resources. Winter snowpack accounts for 75 percent of the water supply in the West and is the primary source of water in many areas in dry summer months as the snow melts in high altitude mountains. Global warming is expected to contribute to a considerable reduction in average snowpack across the region, as well as more rapid earlier spring snowmelt. This will place enormous strain on water supply, particularly during periods when the demand for water is greatest.

Winter snowpack accounts for 75 percent of the water supply in the west and is the primary source of water in many areas in summer. (National Park Service)

Warmer temperatures and more winter precipitation falling as rain than snow have already been causing a substantial decline in snow accumulation across the western United States in recent decades, contributing to a shift toward earlier peak river runoff and lower average summer and fall streamflows, when this water is most needed.[7] Recent studies have found that the average amount of April 1 snow-water equivalent (the amount of moisture contained in snowpack) declined significantly in many parts of the region, including a 15-30-percent decline in the northern Rocky Mountain region and more than 50-percent decline in parts of the Cascades, since 1950.[8] In addition, the

average onset of spring snowmelt and snowmelt-fed streamflow shifted 10-30 days earlier between 1948-2002, corresponding with a general increase in winter and spring temperatures of about 1.8-5.4 degrees Fahrenheit over the same period.[9]

According to research by a team of scientists with the U.S. Department of Energy, global warming could lead to more than 50-percent reduction in snowpack along coastal mountains between 2040-2060, along with increased likelihood of wintertime flooding and decreased summertime water supply in major river basins.[10] If global warming continues unabated, models project even greater declines in snowpack (compared to the average conditions for the period 1961-1990) by the end of the century.

Projected Changes in Average Snowpack in the West Due to Global Warming

	2025-2034	2090-2099
Pacific Northwest	-44%	-88%
Central Rocky Mountains	-27%	-75%
Sierra Nevada	-74%	-100%
Southern Rocky Mountains	-51%	-98%

Source: G.J. McCabe and D.M. Wolock, "General Circulation Model Simulations of Future Snowpack in the Western United States," *Journal of the American Water Resources Association*, Vol. 35, No. 6, December 1999: 1473

More Extreme Heat Waves

The record heat and drought that have plagued much of the nation in 2006 illustrate just how devastating weather extremes can be for people and wildlife alike. The average temperature for the continental United States from January through June 2006 was the warmest first half of any year since records began in 1895, and the trend continued into the summer months. May-July temperatures were above to much-above average for all of the contiguous United States west of the Mississippi River, and July 2006 was the warmest July on record for Wyoming and the second warmest on record for North Dakota, Montana, Idaho and Nevada.[11] In California, more than 160 people died as a result of triple-digit heat wave in July.[12] And farmers and ranchers throughout the West faced considerable losses as crops and livestock perished in many areas.[13]

Extreme heat can cause considerable stress for wildlife . This photo shows a herd of elk cooling off in a stream. (iStock)

The extreme heat has had serious consequences for fish and wildlife, as well. For example, the Montana Department of Fish, Wildlife and Parks was forced to close some of the state's top trout streams to anglers during peak periods of the day to reduce stress on trout fisheries due to higher-than-normal water temperatures. The closures affected rivers or parts of rivers across Montana, including the Lower Bitterroot, the Lower Gallatin, the East Gallatin, the Lower Madison, the Sun, the Dearborn, the Smith, the Yellowstone, the Clark Fork and the Little Blackfoot rivers.

Bobwhite quail also are vulnerable to extreme heat and can die if conditions remain unfavorable for too long.[14] A study of quail in Oklahoma shows that bobwhite population abundance is highly sensitive to long term climate trends, particularly when associated weather conditions deviate significantly from the

normal conditions to which they have become adapted. In particular, the researchers found that when August temperatures are greater than average, bobwhite abundance decreases. As a result, they conclude that the region's bobwhite quail populations could decline if average temperatures over the long-term become significantly greater than the historic average, as some models project.[15]

According to the World Meteorological Society, the past nine years (1997-2005) were the warmest years on record, a trend that is expected to continue.[16] Scientists project that heat waves in many parts of the United States are likely to become more intense, more frequent and longer lasting during this century if little is done to mitigate greenhouse gas emissions.[17]

Pervasive Drought

Worsening drought conditions throughout much of the West also have had a significant impact on wildlife. According to the U.S. Geological Survey, the persistent drought that has been plaguing the interior West over the past few years is the worst in 500 years, particularly in the Colorado River Basin.[18]

The persistent drought that has been plaguing much of the West is the worst in 500 years. Since the drought began in 1999, water in Lake Powell has declined by 51 percent. (iStock)

Wildlife officials in Arizona blame extreme dry weather for declines in the state's deer and elk populations, whose natural water sources have all but disappeared in some areas.[19] In fact, conditions near the Grand Canyon are so bad that wildlife species have become dependent on man-made water catching devises as their only source of water. Drought is also affecting big game species in the northern Rocky Mountain region. Reduced forage in some areas has forced many deer, antelope, moose and elk to seek runoff-enhanced vegetation along roadsides, which has made the animals increasingly vulnerable to vehicle collisions.[20] And in Texas, landowners depending on income from hunting are concerned that the extreme drought conditions and high temperatures have affected quail populations and reduced forage availability for deer.[21]

Wildlife populations can typically bounce back after weather extremes such as heat waves and droughts when conditions return to normal, but severe and long term events can be devastating for some populations. Moreover, there is evidence that the hot, dry conditions in 2006 are not just an anomaly. The persistence and broad geographical extent of the trend toward warmer temperatures over the past few decades are projected to continue, due primarily to global warming.

Expansion of Invasive Species, Pests and Diseases

Global warming will increase the rate, intensity and extent of invasive species, pest and disease outbreaks throughout the West, as warmer average winter temperatures and less frost enable species normally limited by harsh winter conditions to survive in greater numbers or expand their ranges northward and to higher elevations. Furthermore, by their very nature, many invasive and pest species are able to take advantage of habitats or hosts weakened by factors such as drought and wildfires. A National Wildlife Federation-sponsored review of published studies shows that global warming is expected to contribute to range increases for at least 37 harmful species in the United States, including fish, amphibians, plants, insects and diseases.[22]

Global warming will contribute to the expansion of invasive species such as Tamarisk, shown here in the Grand Staircase Escalante National Monument in Utah. (National Aeronautics and Space Administration)

One such species is the Tamarix shrub, a plant that was introduced in the 16th century as an ornamental shrub and windbreak and has since spread rapidly into perennial riparian drainages throughout arid and semi-arid regions in the West. Tamarix consumes a lot of water, and can reduce water availability and dry out ponds and streams in the riparian regions it invades. It also does not provide good habitat for many native wildlife species because it lacks palatable seeds, harbors few insects, and forms dense stands which destroy native habitats. Projected increases in average temperatures and a decline in annual precipitation in the region are expected to allow Tamarix to spread to areas currently too moist for it to invade, including parts of California, Oregon, eastern Texas, Oklahoma, Kansas, Nebraska and South Dakota.[23]

Similarly, warmer average temperatures and drier conditions are projected to exacerbate outbreaks of harmful forest pests, including the mountain bark beetle and spruce budworm, which have already plagued many parts of western North America in recent years. For example, scientists have identified warming-enhanced drought in the southwestern United States as a major factor in extensive forest die-off by making piñon pine trees more susceptible to bark beetle infestations.[24] In some high elevation areas (including Mesita del Buey in New Mexico, Mesa Verde in Colorado and near Flagstaff, Arizona) more than 90 percent of the trees have died, which has significantly altered the regional landscape.[25] If warming trends continue as projected, forest die-offs due to insect infestations will be more severe and extensive in the future.[26]

While a number of factors, including habitat fragmentation, globalization of agriculture and commerce, human travel and animal transport, have contributed to the emergence and expansion of infectious diseases in wildlife, domestic animals and people, scientists are finding evidence that in some

cases global warming and associated climate change is a factor as well.[27] Studies show that global warming will alter the incidence and geographic range of vector-borne diseases, which are often highly sensitive to temperature and humidity.[28] A number of vector-borne diseases of humans (e.g., Lyme disease, tick-borne encephalitis, malaria, and dengue fever) and livestock (e.g., African horse sickness and blue tongue viruses) have recently expanded into regions of higher latitude and altitude, as warmer average temperatures have enabled the vectors to expand and thrive in areas that had previously been too cold. In addition, there is evidence that warmer average temperatures have contributed to the expansion of the newly-introduced West Nile virus across North America, killing birds, horses and people in its wake.[29] The disease has also been detected in several game species, including mountain goats, mule deer and white tailed deer.[30]

More Catastrophic Wildfires

Another serious consequence of global warming in the West is an increase in the incidence and severity of wildfires, a problem made even worse by decades of fire suppression, extensive grazing and other factors. Although moderate fire is natural and helpful to some ecosystems, catastrophic, drought-fueled wildfires can destroy vast expanses of wildlife habitat and cause extensive damage to homes and property.[31] In Nevada, for example, wildlife officials were forced to call for an emergency antelope hunt and relocation effort northwest of Elko as major wildfires destroyed more than half of the area's critical antelope winter range.[32]

Global warming has contributed to a four-fold increase in the number of major fires and a six-fold increase in the area of forest burned in the West since 1986 compared to the period between 1970-1986. The region can expect even more catastrophic fires in the coming decades if global warming pollution is left unchecked. (Federal Emergency Management Agency)

Alarming new research reveals that wildfires in western forests have become much more frequent and larger since the mid-1980s, a trend that corresponds with warmer springs and an expansion of summer dry periods.[33] Across the region, there has been a four-fold increase in the number of major fires each year and a six-fold increase in the area of forest burned since 1986 compared to the period between 1970-1986. These recent trends have occurred during a period when land use practices have not changed significantly from the period prior to the shift, which underscores the role that climate-related variables are playing in wildfire activity in the region. This trend will continue if global warming continues unabated, with devastating consequences for people and wildlife alike. One study, for example, projects that the overall area of acreage burned will double in size across 11 western states if the average summertime temperature increases 2.9 degrees Fahrenheit between 2070-2100.[34] States hit particularly hard include Montana, Wyoming, New Mexico and Utah, which could see between a four- and five-fold increase in the

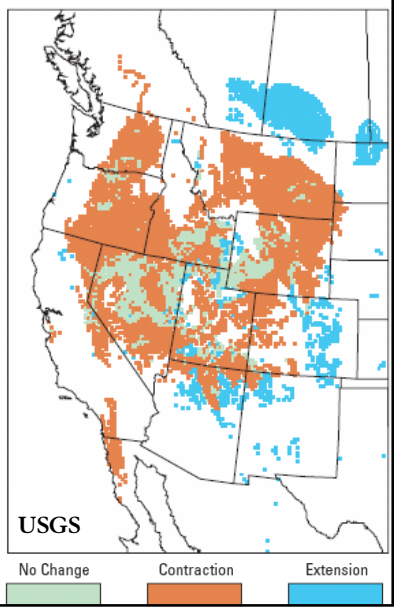
area burned each summer before the end of this century. Although moderate fires are natural and beneficial in many of these areas, the increased intensity and frequency are changing these habitats. What's more, catastrophic wildfires can release tremendous amounts of carbon into the atmosphere, further enhancing global warming.

Loss of Sagebrush Habitat

Scientists predict that vast areas of sagebrush habitat across the West will be reduced to a fraction of their current size due to warmer temperatures and more frequent major wildfires.[35] A recent study of global warming impacts in the Great Basin projects up to an 80-percent reduction in the area of sagebrush ecosystems across the region, replaced by woody vegetation and invasive grasses such as cheatgrass.[36]

Similarly, research by the U.S. Geological Survey shows a 59-percent decline in big sagebrush habitat throughout the western U.S. with a doubling of carbon dioxide concentrations in the atmosphere from pre-industrial levels, which is likely to occur well before the end of this century if emissions continue to increase under business as usual.[37] On the whole, any significant decline in the West's remaining native sagebrush habitats would have devastating consequences for sage grouse, mule deer, pronghorn and other species that depend on them.

Projected Changes in the Distribution of Big Sagebrush Habitat Under 2 x CO_2



Loss of Habitat for Trout, Salmon and other Cold-water Fish

Water temperatures in lakes and streams across the western United States have been on the rise in recent decades, corresponding with a rise in air temperatures. For example, according to the National Academy of Sciences, average water temperatures in the Columbia River Basin rose about 3.4 degrees Fahrenheit during the latter half of the 20th century. While problems associated with hydroelectric dams, water withdrawals and loss of riparian vegetation are responsible for some of the increase, data shows that higher regional temperatures due to global warming also are a major factor.[38]

Left unchecked, global warming will contribute to a dramatic decline in habitat for trout, salmon and other cold-water fish throughout the West. (National Park Service)

A continuing trend toward higher average temperatures would have a devastating impact on cold-water fish across the region, from the prized cutthroat and rainbow trout of the Rocky Mountains to the iconic steelhead and salmon of the Pacific Northwest. Scientists at the University of Wyoming estimate that a 5.4 degree Fahrenheit increase in average July air temperatures could eliminate 50 percent of currently viable trout stream habitat in the Rocky Mountain Region.[39] A temperature change of this magnitude is well within the range climate

models project within this century. A similar study by the U.S. Environmental Protection Agency projects a dramatic reduction in cold-water fish habitat in a number of western states with a 4.5 degree Fahrenheit increase in average stream temperatures, including a loss of up to 49 percent of viable habitat for cutthroat trout in Oregon, Montana, Utah, Wyoming and Colorado and 50-99 percent of cutthroat habitat in Washington, Idaho, California and New Mexico.[40] In addition, research published by Defenders of Wildlife and the Natural Resources Defense Council projects that an increase in average summer water temperatures of 4.5-11 degrees Fahrenheit would eliminate 21-42 percent of stream habitat for a number of the nation's trout and salmon species.[41]

On the other hand, some warm-water fish species may be able to expand their ranges in the region under a warmer climate. For example, species native to warmer regions, such as largemouth bass, green sunfish, and bluegill, may become more dominant in western watersheds where they have been introduced for sportfishing.[42] On the whole, if left unchecked, global warming will forever change the legacy and traditions of sportfishing in the West.

Loss of Wetland Habitat and Waterfowl

Global warming also poses a significant threat to the region's diverse wetlands, including areas that provide critical breeding and wintering habitat for waterfowl and other wildlife. The Prairie Pothole Region of south-central Canada and the north-central United States (including much of North Dakota, South Dakota and parts of Montana), so-called for its multiple, often ephemeral pothole-like wetlands, is the single most important waterfowl breeding ground for North America's migratory ducks and other waterfowl. Often called North America's "duck factory," the Prairie Pothole Region is the primary source for waterfowl harvested in the United States and Canada.

Higher regional temperatures and drier conditions are projected to lead to as much as a 91-percent reduction in Prairie Pothole wetlands by the 2080s, resulting in up to a 69-percent reduction in the abundance of ducks breeding in the region. (Natural Resources Conservation Service)

Global warming is projected to increase the likelihood of severe drought across central North America, including the Prairie Pothole Region. Mean annual March to May temperatures in the region already have increased in the latter half of the 20th century, and continued warming is expected to raise evaporation rates and reduce soil moisture by 25 percent by the middle to the end of this century, particularly in summer months.[43] Continuing trends of higher regional temperatures and drier conditions are projected to lead to as much as a 91-percent reduction in Prairie Pothole wetlands by the 2080s, resulting in up to a 69-percent reduction in the abundance of ducks breeding in the region.[44]

Critical stopover and wintering habitats in the West may also be affected by global warming-induced changes in river flows, lake levels, and the quantity and quality of wetlands. For example, models project that global warming will cause a significant decrease in runoff and an associated decline in wetland

habitat in the Central Valley of California.[45] With 90 percent of California's wetlands having already been destroyed by agricultural development, urban sprawl, water diversions and pollution, the remaining wetlands of Central Valley provide some of the most important wintering habitat for waterfowl in the Pacific Flyway. In fact, Ducks Unlimited has ranked the Central Valley at "Number Two" in its list of the 25 most important and threatened waterfowl habitats in North America.[46] Continued loss of these habitats due to global warming will have a devastating impact on waterfowl populations and hunting opportunities in the region.

Loss of Alpine Tundra and other Mountain Habitats

Global warming is likely to alter some of the most unique and important habitats of the Intermountain West. A number of studies show that global warming is already causing many lower-elevation species, such as western Douglas fir, to expand into higher altitude zones, encroaching on existing alpine habitats.[47]

Global warming will significantly alter alpine habitats throughout the Intermountain West, which are home to many wildlife species, including mountain goats, bighorn sheep, elk and ptarmigan. (Natural Resources Conservation Service)

High-elevation species are particularly vulnerable to global warming given the fact that they have limited space available to find new habitats as higher temperatures push them farther up in the mountains. In some places, further warming could squeeze out some species and habitats altogether. For example, according to a new report by the Rocky Mountain Climate Organization and Natural Resources Defense Council, a 5.4 degree Fahrenheit rise in average temperature could eliminate half of the tundra in Colorado's Rocky Mountain National Park, which provides habitat for mountain goats, bighorn sheep, elk and ptarmigan.[48]

In addition, scientists studying the effects of global warming on habitats in Glacier National Park in Montana suggest that the park could ultimately become more like forests of the Pacific Northwest by as soon as 2050 as higher temperatures and increased precipitation contribute to the expansion of cedar hemlock forests.[49]

Increased Risk of Species Extinctions

There is growing concern that the accelerating pace of change will put alarming numbers of species on the path to extinction.[50] For example, research points to global warming as a major factor in the decline of desert bighorn sheep in the Southwest. Scientists have found that an increase in average regional temperatures of about 1.8 degrees Fahrenheit from 1901-1987 coupled with a 20-percent decrease in

Populations of desert bighorn sheep are among the wildlife species that could face extinction if global warming continues unabated. (U.S. Fish & Wildlife Service)

average precipitation in southeastern California over the period contributed to a significant reduction in forage, particularly in the lower, drier mountain ranges.[51] Consequently, of the 80 known populations of desert bighorn sheep in the region, 30 populations became extinct over the period. The study projects that a 3.6 degree Fahrenheit increase in average temperatures and a 12-percent decrease in precipitation due to global warming will significantly increase the probability of extinction in the next 60 years.

In addition, a study of global warming and biological diversity in the western United States projects that a regional warming of 5.4 degrees Fahrenheit will reduce boreal habitat in all of the mountain ranges in the Great Basin Region. As a result, significant numbers of extinctions are predicted, including a 44-percent loss of mammal species, a 23-percent loss of butterfly species, a 30-percent loss of perennial grasses and forbs and a 17-percent loss of shrub species.[52]

EXPANSION OF OIL AND GAS DEVELOPMENT — DRILLING THE LAST BEST PLACES

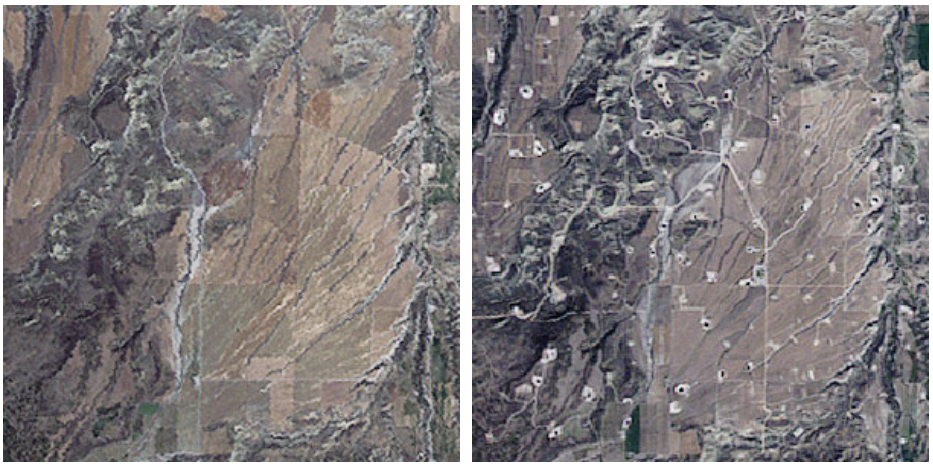
In addition to being the driving force behind global warming, over-dependence on fossil fuels has had a direct impact on the western landscape through extensive oil and gas development. Escalating concerns about national security and rising global energy prices have generated new pressure to drill for oil and gas domestically, including in sensitive areas such as the Powder River Basin and Upper Green River Valley in Wyoming, San Juan National Forest in Colorado and New Mexico's Otero Mesa and Valle Vidal.[53]

Extensive oil and gas drilling has been identified as a major factor in the decline of sage grouse populations in parts of the West. (National Park Service)

Within the past decade, energy companies have proposed and begun projects to drill on millions of additional acres in the West that provide essential habitat for fish and wildlife, facilitated in part by recent federal government efforts to reduce important environmental protections. According to the U.S. General Accounting Office, the total number of permits approved by the Bureau of Land Management for drilling on public lands tripled (from 1,803 to 6,399) between fiscal years 1999-2004, with the most activity occurring in Colorado, Montana, New Mexico, Utah and Wyoming.[54] The GAO

found that this dramatic increase significantly lessened BLM's ability to meet its environmental protection responsibilities. In many cases, these projects pose a serious threat to some of the region's most popular game species, including sage grouse, mule deer, pronghorn and elk.

A recent study from the University of Wyoming has identified gas drilling as likely factor in the decline in sage grouse populations in parts of the region.[55] The study looked at sage grouse populations in the Pinedale Anticline and Jonah gas fields in Wyoming's upper Green River Valley and found that the number of breeding males on important sage grouse mating sites (called leks) declined by an average of 51 percent from the year prior to development, compared to a three-percent decline at undisturbed leks. In addition, females nesting in developed areas had significantly lower survival rate than those in undeveloped areas. The study concludes that if the current rate of population decline continues, sage grouse would likely be gone from these areas entirely within 19 years.



Satellite images showing the sage/grasslands of Jonah Natural Gas Field in the Upper Green River valley of Wyoming before development in 1986 (left) and after development in 2005 (right). (SkyTruth)

Similarly, research on the effects of natural gas development on mule deer in western Wyoming found that the animals tend to avoid areas in close proximity to well pads. As a result, the placement of wells in areas of preferred habitat has forced mule deer to crowd into smaller areas and, in some cases, has pushed them into areas outside of their normal winter range, even when the habitat conditions in the developed sites were otherwise favorable.[56] The quality of forage is a critical factor in maintaining the health of mule deer in their winter range, and scientists fear that the dislocation of the animals to areas with less suitable habitat could ultimately affect their survivability and reproduction.

Oil and gas drilling also have a major impact on the region's water resources. Coal bed methane development, in particular, entails pumping tremendous amounts of water from coal aquifers to the surface. In addition to reducing fresh water availability in springs, streams and shallow aquifers, this pumped water can often be highly saline and sodic, making it unsuitable for irrigation and other agricultural uses and damaging to fisheries and regional ecosystems.[57]

According to a report by Trout Unlimited, tens of millions of acres of habitat for important fish and game species in Montana, Wyoming, Utah, Colorado and New Mexico are in areas of recoverable oil and gas where development could occur.[58] For example, more than 33.5 million acres of Wyoming (54

percent of the state's land) falls within areas of recoverable gas and oil, which includes 55.9 percent of mule deer habitat, 59.7 percent of pronghorn habitat, 66.7 percent of sage grouse habitat, and 52 percent of elk habitat. In Colorado, 18 million acres could potentially be developed for oil and gas, including 29 percent of mule deer habitat, 30 percent of pronghorn habitat, 28.1 percent of sage grouse habitat, and 29 percent of elk habitat. In addition, more than 15 percent of all trout habitat throughout the region occur in areas with oil and gas reserves, including 50 percent of Yellowstone cutthroat habitat, 40 percent of fine spotted and Bonneville cutthroat habitat and 20 percent of Colorado River cutthroat habitat.

Efforts are currently underway to halt some of the most egregious projects before they irreparably damage critical habitats, but the pressures to accelerate and expand oil and gas projects in the West will continue without an overarching strategy that fundamentally shifts the nation's demand for energy toward cleaner alternatives. Drilling for more oil is not the solution. As outdoor writer Hal Herring wrote for *Field and Stream*, "We cannot sacrifice the wildlife and wild country of this planet while doing nothing to develop alternative fuels and improving the fuel efficiency of our cars, factories, and homes."[59]

CHANGING THE FORECAST FOR FISH AND WILDLIFE IN THE WEST— A PLAN OF ACTION

Fortunately, Americans can take action now to change the forecast for fish and wildlife in the West and ensure that the economic opportunities, ecological benefits and outdoor traditions they support will endure for generations to come.

More and more, these are the types of headlines that can prevail:

"**Arizona unveils climate strategy**," Environment News Service, www.ens-newswire.com, September 11, 2006.

"**Colorado joins effort to fight global warming**," by Daniel Chacon, *Rocky Mountain News*, August 25, 2006.

"**Utah House sets example on how to increase energy efficiency**," by Diane Sagers, *Tooele Transcript Bulletin*, August 1, 2006.

"**World's biggest solar farm planned for New Mexico**," www.planetark.com, April 27, 2006.

The region and nation have yet to fully tap the enormous potential that energy efficiency and renewable sources of energy can offer, but growing public demand for a safe, secure and healthy energy future is creating the political will to turn the corner. Sportsmen have long been one of the nation's strongest voices for conservation. The opportunity is now for hunters and anglers to help move America forward by urging their elected officials to implement a strong plan of action against the ravages of fossil fuels, from the destruction to habitat caused by oil and gas development to the devastating impacts of global warming. Together, the following measures will be the key to success.

1. Place significant, mandatory limits on U.S. global warming pollution.

First and foremost, the best way to channel the ingenuity of America's industry in confronting global warming is to establish specific national limits on the nation's global warming pollution.

Scientists are optimistic that the impacts of global warming can be lessened if meaningful action is taken during the next few decades to reduce the emissions of carbon dioxide and other greenhouse gases and stabilize their concentrations in the Earth's atmosphere.[60] But it is important to take meaningful steps to reduce global warming pollution as soon as possible. Once released, carbon dioxide can stay in the atmosphere for 100 years, and the more that its concentration builds up, the more global warming will occur. There is growing concern among scientists that the planet may well be nearing a tipping point in terms of the levels of greenhouse gases in the atmosphere, which will lead to extensive and irreparable changes to the planet's climate system. Many suggest that the worst-case scenario can only be avoided if the growth in global greenhouse gas emissions is halted within the next ten years and overall emissions are cut in half within the next 50 years.[61]

Placing mandatory limits on carbon dioxide emissions from coal-fired power plants and other major sources is the best way to channel the ingenuity of America's industry to confront global warming. (Wikimedia Commons)

To meet that deadline, America must show leadership and take decisive action right away. The United States is historically and currently the single greatest contributor to global warming, and U.S. emissions alone are expected to grow 13 percent over the next decade if the nation fails to curb its pollution. Furthermore, U.S. industry is planning massive investments during the next five years that will determine America's pollution levels for decades to come. Two-thirds of the growth in U.S. emissions is expected to come from spikes in energy demand from two sources: oil for transportation and coal for electricity. For example, electric utility companies have proposed building 129 large coal-fired power plants throughout the country. Built to last more than 50 years, these plants will emit 35 billion tons of heat-trapping carbon dioxide in the atmosphere over their lifetimes.

To transform fully the energy investments being made across the nation in all sectors — from electric power plants to cars and trucks — an effective federal plan of action is needed that fundamentally shifts the nation's energy priorities and that rewards investments in energy efficiency and cleaner, renewable energy technologies. The centerpiece of such a plan would be an emissions trading program, modeled after the successful Clean Air Act program for acid rain, that allows industry, investors and consumers to develop the best means possible for meeting pollution-reduction targets set by lawmakers. America has a real opportunity to meet its growing energy needs in a way that not only reduces the nation's contribution to global warming, but protects air and water quality, reduces pressure to drill for oil and gas, saves consumers money and positions the nation to capitalize on emerging markets for cleaner energy

solutions.

2. *Reduce the nation's overall dependence on fossil fuels through greater investments in energy efficiency and renewable energy technologies.*

There are a number of actions that the region and nation can undertake to help improve energy efficiency and the use of clean, renewable energy resources. Measures such as implementing stronger efficiency standards for air conditioners, appliances and motor vehicles and offering incentives for the purchase of energy efficient technologies would not only reduce global warming pollution and lessen pressure to drill for oil and gas, but they would also provide significant economic savings for households and businesses.

There is tremendous potential for clean, renewable energy sources such as the wind to diversify the West's energy portfolio, creating economic opportunities in the process. (Photodisc)

Abundant, clean and reliable energy sources such as the sun and wind also have tremendous potential to significantly reduce the nation's use of fossil fuels. Thanks in part to federal research programs and state clean energy standards, the cost of renewable energy has fallen dramatically, and the use of these technologies continues to grow. With policies such as production tax credits, net metering to allow homeowners to sell solar electricity to the local utility company and state and national renewable energy portfolio standards, the United States could achieve a goal of producing 25 percent of its electricity from renewable energy sources by 2025, creating hundreds of thousands of jobs in the process.[62]

In addition, communities can decrease reliance on individual automobiles by reining in suburban sprawl, reducing the distances between where people work, shop and live. Curbing sprawl will not only save energy, but it will help save green space and habitat for fish and wildlife. According to the National Governors' Association, local and state governments can use a variety of strategies, such as creating incentives to increase public transit use, promoting bicycle- and pedestrian-friendly options, and linking transportation funding to effective growth-management strategies.[63]

Some of the most significant action to date is occurring at the state and local levels. For example, the Western Governors' Association recently adopted a policy resolution that incorporates a number of strategies to promote clean energy in the region, including implementing measures to reduce energy use by 20 percent from projected levels by 2020 through increased energy efficiency and conservation.[64] In addition, dozens of cities across the West have stepped up to the plate by endorsing the U.S. Mayors

Climate Protection Agreement, an initiative begun in 2005 to engage cities in solutions to global warming. In doing so, they have pledged their own commitment to reduce fossil fuel by promoting energy efficiency, renewable energy and other actions. They are also sending a strong message to state and federal governments to enact meaningful policies and programs to curb global warming pollution on a broader scale.

3. *Implement strategies to help wildlife survive the effects of global warming that are already underway.*

While the most important action the nation can take to prevent overwhelming loss of wildlife and habitat due to global warming is to reduce greenhouse gas emissions, it is also necessary to develop strategies to help species and ecosystems cope with some changes that are inevitable, as well as build in the flexibility to deal with those impacts that may be unforeseen. In many cases, continuing to focus attention on reducing non-climate stressors such as habitat fragmentation, pollution and invasive species will also help fish and wildlife become more resilient to the effects of global warming. However, failure to take the known and potential impacts of global warming into consideration in fish and wildlife management plans and other relevant resource management activities will make it much more difficult, if not impossible, to meet important conservation goals.

Maintaining connected habitats and providing migratory corridors will help make wildlife more resilient to changes in their environment. (Federal Highway Administration)

The recent advances in scientific understanding of the regional and localized consequences of global warming, as well as the vulnerability of species and ecosystems, will go far in helping resource managers and other relevant decision makers develop and promote appropriate solutions. The likelihood of drier conditions in areas like the Central Valley of California and the Prairie Pothole Region in the north-central Great Plains, for example, should persuade resource managers, conservation organizations and other stakeholders in the region to develop contingency plans such as promoting development of less water-intensive agriculture or securing long-term rights for water use to ensure its availability for streams and wetlands when water resources are scarce, and to implement watershed-based land-use planning.[65] Wildlife managers should also identify and protect key migratory corridors, restore interconnected habitats, and create buffers around protected areas to facilitate the ability of big game species and other wildlife to find suitable habitat when localized conditions become unfavorable.[66]

By its very nature, however, there will always be a degree of uncertainty about how, when and where global warming will affect natural systems. Increased monitoring and research on known and potential impacts of global warming on species and habitats will help close the gap in knowledge, but that

does not mean that we should wait until we can predict exactly when and where we will experience impacts in all cases before we act. Rather, the very fact that there *is* uncertainty — and the potential for global warming to lead to irreversible damages, such as the extinction of species — necessitates precautionary action.[67] Conservationists must develop strategies to better deal with uncertainty in long-term species-protection plans to ensure that resources will be available if and when extreme events occur.[68]

4. *Promote strong wildlife stewardship as an important part of a new energy future.*

Finally, fish and wildlife managers, conservationists and other stakeholders must play an active role in ensuring that all energy development and global warming mitigation projects are managed in a way that prevents or minimizes harmful impacts on wildlife and habitats.

Restoring native forests and other habitats can benefit wildlife and help reduce global warming by storing carbon. (Natural Resources Conservation Service)

Alternative energy sources such as wind energy and biofuels, for example, have enormous potential to help reduce global warming pollution and lower the nation's reliance on damaging fossil fuels to meet its growing energy needs, and they should therefore be an important part of a cleaner, safer, more-diversified energy future. In addition, strategies to protect and enhance the ability of natural systems to absorb and store carbon from the air (called carbon sequestration) can play a role in slowing the buildup of heat-trapping carbon dioxide in the atmosphere.

However, if carelessly developed and poorly managed, even new sources of energy and carbon sequestration projects could have adverse effects on fish and wildlife. For example, several studies have shown that wind energy turbines can cause localized mortality among birds and bats if they are sited near important nesting areas or migratory routes.[69] There is also concern that the development of large-scale wind farms can cause damage to fragile habitats. The cultivation of land for biomass energy could be harmful to fish and wildlife if it replaces native habitats or uses feedstocks that require large amounts of water in areas where water is scarce. Likewise, some carbon storage activities can be harmful to local conservation concerns if they are not carefully designed.

Accordingly, policy makers must work with scientists, wildlife officials, conservation organizations and other relevant stakeholders to identify and develop a strong set of criteria by which to evaluate the potential negative impacts of new energy projects and carbon storage projects and develop and implement measures to minimize them.

On the other hand, some of these activities may actually provide multiple benefits for people and wildlife alike by reducing the threat of global warming over the longer term and enhancing on-the-ground

conservation efforts in the short term. For example, well-designed carbon storage projects, such as preventing wetland loss, improving agricultural practices or planting new trees and grasslands, can provide habitat for wildlife, economic opportunities for landowners and recreational opportunities for wildlife enthusiasts.

CONCLUSION

The wildlife and wild places of the American West are truly a national treasure. The value they bring to millions of people is a legacy worth protecting. As this report has shown, however, the nation's continued dependence on fossil fuels to meet its energy needs places at great risk the West's diverse habitats and the fish and wildlife they support. Above all, burning fossil fuels is the driving force behind global warming, which will dramatically alter the western landscape if left unchecked.

But it is not too late to act. It will take some foresight, the right investments and determination to reduce the risk rather than wait for its consequences. By taking action now, people can change the forecast for fish and wildlife in the American West and ensure that the economic opportunities, ecological benefits and outdoor traditions they provide will endure for generations to come.

U.S. Fish & Wildlife Service

U.S. Sportsmen Call for Action on Global Warming

A national poll of hunters and anglers shows that the majority of America's sportsmen believe global warming is an urgent problem that needs immediate action, and they want clean energy solutions that create jobs and cut pollution from burning fossil fuels. According to the survey, more than three-quarters of America's hunters and anglers said they have observed changes in climate conditions where they live, such as warmer, shorter winters, hotter summers, earlier spring and less snow. More than half (54 percent) said they believe these changes are related to global warming. Nearly three-quarters (73 percent) believe it either is currently impacting or will impact hunting and fishing conditions. The survey also reveals that sportsmen are deeply dissatisfied with the nation's current energy policy and support a major shift to depend less on fossil fuels that produce global warming pollution while developing a new generation of alternative and renewable energy sources. An overwhelming majority (78 percent) say conserving more, developing fuel efficient vehicles and expanding the use of renewable sources are the best way to address America's energy needs, rather than drilling for more oil and gas within the United States

THINGS *YOU CAN DO* TO LESSEN ENERGY DEMAND AND COMBAT GLOBAL WARMING AT HOME AND IN YOUR COMMUNITY

√ Reduce gasoline consumption and save money at the pump.

√ Use compact fluorescent light bulbs throughout your home and workplace.

√ When shopping for home appliances or vehicles, choose the most energy- or fuel-efficient model.

√ Recycle.

√ Persuade your workplace to improve the energy efficiency of its buildings and office machinery and support transportation alternatives such as carpooling and teleworking.

√ Urge your local electric utilities to offer "green" electricity programs, which enable customers to purchase electricity produced from clean, renewable energy sources like the sun and wind.

√ Encourage your mayor to sign on to the U.S. Mayors Climate Protection Agreement (www.ci.seattle.wa.us/mayor/climate).

√ Visit www.targetglobalwarming.org and sign onto the petition to the Congressional Sportsmen's Caucus, which asks caucus members to enact meaningful policies to reduce global warming pollution.

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