

## Summary

Jeremy Symons, National Wildlife Federation

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The National Wildlife Federation would like to thank Senator Bingaman and Senator Domenici for inviting comments on the design of federal legislation to curb greenhouse gas emissions. The National Wildlife Federation has worked to advance non-partisan solutions to protect America's wildlife for 70 years. Founded as a federation of state affiliates that includes hunters and anglers, wildlife managers and farmers, gardeners and other nature enthusiasts, the National Wildlife Federation today has 47 state and territorial affiliates devoted to conservation and more than four million members and supporters.

The National Wildlife Federation has identified global warming as the single most urgent challenge to protecting wildlife for our children's future. For the first time in human history, we are nearing the tipping point in an ecological crisis that could see wholesale loss of wildlife populations and profound changes in our outdoor way of life. Congress can take the first steps toward achieving the necessary reductions in emissions by enacting a market-based system with clear, mandatory safeguards to limit greenhouse gas emissions. While the first-and-foremost priority for a meaningful national policy to address global warming should be to reduce emissions and minimize the threat altogether, NWF also believes that a comprehensive policy should include financial resources for adaptation measures, including assistance for wildlife conservation.

**Summary of Response to Question One:** The National Wildlife Federation urges Congress to establish a clear and aggressive national goal for reducing U.S. greenhouse gas emissions, with mandatory safeguards to limit emissions from all major sources. The need for a nationwide goal for curbing U.S. greenhouse gas emissions is driven by: (1) the urgency of stopping and reversing the growth of emissions of carbon dioxide and other greenhouse gases within a decade; (2) alarming new forecasts of steady increases in U.S. greenhouse gas emissions if Congress fails to act soon to enact emission limits; and (3) the tremendous opportunities to make immediate progress in curbing emissions and encouraging innovation in all sectors.

**Summary of Response to Question Two:** Wildlife are already being impacted by changing climate, and climate change is adding new wildlife management burdens on states. The best way to help fish and wildlife survive those impacts of global warming that may be unavoidable is to provide a dedicated, stable source of funding to state wildlife agencies, which will allow states to prepare locally for the impacts of a changing climate. In particular, the National Wildlife Federation and 332 sportsmen groups, state fish and wildlife agencies, conservation groups and scientific societies have requested in the attached letter that climate legislation include dedicated funding for the Wildlife Conservation and Restoration account of the Pittman-Robertson Act, which funds the State Wildlife Grant Program. Healthier, more robust habitats will be better able to adapt to climate change as an additional stress. State fish and wildlife agencies, funded through the State Wildlife Grants program, will be able to consider the impacts of climate change locally and to work through cooperative partnerships to strengthen wildlife populations and ecosystems.

## Question 1. Point of Regulation Jeremy Symons, National Wildlife Federation

### *Who is regulated and where?*

The National Wildlife Federation has identified global warming as the single most urgent challenge to protecting wildlife for our children's future. The National Wildlife Federation has worked to advance non-partisan solutions to protect America's wildlife for 70 years. Founded as a federation of state affiliates that includes hunters and anglers, wildlife managers and farmers, gardeners and other nature enthusiasts, the National Wildlife Federation today has 47 state and territorial affiliates devoted to conservation. Collectively, the National Wildlife Federation and our affiliates have more than four million members and supporters, representing a cross-section of America that spans the nation's political spectrum.

The National Wildlife Federation urges Congress to establish a clear and aggressive national goal for reducing U.S. greenhouse gas emissions, with mandatory safeguards to limit emissions from all major sources. In order to make sufficient progress to protect wildlife, public health, our economy and our security, such a program should not be restricted to a few sectors of polluting sources.

The need for a nationwide goal for curbing U.S. greenhouse gas emissions is driven by: (1) the urgency of stopping and reversing the growth of emissions of carbon dioxide and other greenhouse gases within a decade; (2) alarming new forecasts of steady increases in U.S. greenhouse gas emissions if Congress fails to act soon to enact emission limits; and (3) the tremendous opportunities to make immediate progress in curbing pollution and encouraging innovation in all sectors. Consider two of the latest pronouncements from the scientific and energy fields:

“How long have we got? We have to stabilize emissions of carbon dioxide within a decade, or temperatures will warm by more than one degree. That will be warmer than it has been for half a million years, and many things could become unstoppable.... We don't have much time left.”

—*Dr. James Hansen, Director of NASA's Goddard Institute for Space Studies (2006)*

United States emissions of carbon dioxide are forecasted to increase 13 percent over the next decade, based on current energy and global warming policies.

—*Energy forecast from the U.S. Energy Information Administration (Annual Energy Outlook 2006), which accounts for the impacts of the 2005 Energy Policy Act*

With the leadership of Senators Bingaman and Domenici, 54 members of the United States Senate last year made a promise to the American public. Acknowledging the “substantial risk” posed by the buildup of greenhouse gases in the atmosphere, the Senators promised to take concrete steps to slow, stop and reverse greenhouse gas emissions in the United States. We applaud all 54 Senators for their promise. From the perspective of the National Wildlife

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Federation, delay has been the operative stance of Congress for years, and further delays without timetables for Congressional action would constitute a broken promise to the American public.

### Global Warming and Wildlife

For the first time in history, we are nearing the tipping point in an ecological crisis that could see wholesale loss of wildlife populations and profound changes in our outdoor way of life. Severe climatic disruptions that have long been the subject of scientific speculation are now striking with a speed and intensity that are shocking climate scientists. For example, new studies have documented a 50 percent increase in the power of hurricanes as ocean temperatures have warmed during the past three decades, an impact all too apparent in the record-breaking Atlantic hurricane seasons of the past two years.

According to a 2004 study by the National Center for Atmospheric Research in Colorado, the percentage of Earth's land area stricken by serious drought more than doubled from the 1970s to the early 2000s, due largely to rising temperatures. The U.S. Geological Survey determined in 2004 that the drought in the Western U.S. could be the worst in up to 500 years, surpassing the Dust Bowl years. Drought conditions in the Western United States have fueled extensive wild fires in recent years.

Wildlife species are ill-prepared to meet the threat of global warming's rapid and disruptive climate changes. Independent studies by teams of scientists have concluded that within the next 50 years as many as a third of the species in studied regions could be headed for extinction from global warming and from the continued disruption of habitat. Species that survive may see large reductions in populations. For example, global warming-induced drought conditions in the Prairie Pothole Region could lead to as much as a two-thirds decline in the abundance of ducks breeding in the region, affecting populations of mallards, gadwall, blue-winged teal, northern pintails, canvasbacks, redheads and ruddy ducks throughout North America's flyways.

The rapid pace of climate change is already unraveling the threads of many ecosystems that nurture wildlife. In Alaska, Canada and parts of the continental U.S., millions of acres of forestlands have been wiped out in recent years by beetle outbreaks brought about by warmer winters. In recent decades, parts of the Caribbean have lost as much as 80 percent of their coral reefs to warming seas.

### An Urgent Need for a National Plan of Action

The science of global warming penalizes procrastination. Much of the carbon dioxide we pumped into the atmosphere a century ago is still trapping heat, and the pollution we have released since then and that we will release in the next few years will almost irreversibly affect the lives of our children and our children's children.

The environmental and financial price of delay is compounded by industry investment cycles. For example, electric utility companies have proposed building 129 large coal-fired power plants throughout the nation. Built to last more than 50 years, these plants will emit 35 billion tons of heat-trapping carbon dioxide to the atmosphere over their lifetimes if Congress

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fails to act soon to adequately encourage the latest pollution-reducing technologies and alternatives. If these plants are built without thought to global warming, then either we will miss the goals that scientists are urging, or we will impose significant added cost on industry as investment is stranded and opportunities for incremental investments are lost.

Analysis by Lawrence Berkeley National Laboratory and the Environmental Protection Agency suggests that between 60 and 80 percent of energy sector greenhouse gas emissions in the year 2025 will derive from energy technologies purchased over the next 20 years. U.S. investments in new capital stock over this time could be more than \$60 trillion (in 2000 dollars), regardless of any new energy or economic policies that might be implemented. Because of the long lives of many technologies and the importance of allowing for efficient replacement of capital stock, it is economically and environmentally prudent to take every opportunity in the coming years to install cleaner, more efficient technologies possible in all sectors of the economy. Taking action now with a clear market signal such as a cap and trade program will in the long run lead to better investments and save money.

Scientists are warning that we must act prudently to stop and reverse our growing pollution levels within the next decade or risk passing ‘points of no return’ or ‘tipping points’ that trigger runaway global warming scenarios. Legislation must be responsive to the call from scientists for urgent near-term action from all major pollution sources, while also setting a longer term course for the 60-80% reductions in global emissions that are needed by mid-century.

Knowing what we know today, that greenhouse gases are building an irreversible environmental debt to our children, any plan that allows pollution levels to increase indefinitely fails to meet the most basic test of responsible action. Congress should not put off to future Congresses – and to our children – the leadership that is needed now to stop and reverse the growth of greenhouse gas emissions within the next decade.

### Focusing on Outcomes with Clear, Transparent Goals

It is important that Congress consider any global warming legislation in terms of its actual impact on greenhouse gas emission levels. Measures such as ‘greenhouse gas intensity’ targets can serve to cloud the actual impact of legislation. ‘Greenhouse gas intensity’ is an abstract construct that exists only in speeches and on spreadsheets. What really matters scientifically is the amount of pollution coming out of smokestacks and tailpipes and building up in the atmosphere. Similarly, loopholes that encourage polluters to violate a nationwide global warming emissions goal by purchasing unlimited pollution permits (sometimes referred to as ‘cost caps’ or ‘safety valves’) can be constructed in ways that turn emission reduction targets into little more than an illusion.

### Opportunities for Immediate Action to Reduce Emissions

By applying the same leadership to global warming today that Congress applied to other air and water pollution threats in the past, Congress can secure our environmental and economic future. Since the Clean Air Act was enacted in 1970, America has cut in half the emissions of the six common air pollutants for which air quality standards have been set. What has been good for

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our environment has been good for our economy, which more than doubled over that time, increasing by 167 percent. It created new opportunities for entrepreneurs and engineers. America's environmental technology sector today generates more than \$220 billion annually and supports 1.6 million jobs in more than 50,000 firms.

We ask Congress today to have the same determination to get the job done when it comes to reducing greenhouse gas emissions. If Congress sets clear goals and safeguards to curb pollution, American industry will become the driving force behind solving global warming, instead of being the leading contributor to an escalating environmental disaster.

Technologies exist today to significantly reduce emissions. Time and time again, companies that have set goals for reducing emissions have been able to achieve those goals ahead of schedule and at a corporate profit. For example, BP met its internal greenhouse gas reduction target in 2001, nine years ahead of schedule, reducing emissions by 18 percent and saving \$650 million over three years from an estimated outlay of \$20 million.

As documented in a report by The Climate Group, dozens of companies and governments have had similar success in reducing emissions. According to their 2004 report, Carbon Down, Profits Up, five global companies (DuPont, Alcan, British Telecom, IBM and NorskeCanada) have achieved greenhouse gas reductions of 60 percent or more with combined savings of over \$5.5 billion resulting from improved energy efficiency, fuel switching, and reduced waste.

In 2000, an exhaustive technology assessment was conducted by five Department of Energy laboratories. They concluded that technologies exist that can reduce U.S. greenhouse gas emissions to below 1997 levels by the year 2020 while reducing oil imports by 2 million barrels per day and enhancing national security. The report noted that technology opportunities "are so abundant that they compete with each other to reduce carbon emissions." The report also concluded that aggressive deployment of these technologies will require a market-based signal such as an emissions trading program to boost investment in advanced technology across the economy.

A 2003 analysis by Argonne National Laboratory and the Environmental Protection Agency found that the strategies identified by the Department of Energy's national laboratories would significantly boost economic output while reducing natural gas wellhead prices by up to 20 percent and cutting global oil prices by more than 5 percent.

A 2005 report by Redefining Progress and the Tellus Institute concluded that one market-based global warming plan being considered in Congress (the Climate Stewardship Act) would lead to new investments in efficient and renewable technologies, spurring an increase net U.S. employment by 600,000 jobs by the year 2020 as money is redirected from wasteful energy expenditures (such as money sent overseas for oil) toward more productive investments in technology throughout the nation.

According to a 2003 economic analysis by the highly respected independent modeling forum at the Massachusetts Institute of Technology, that same legislation would have no net employment loss and would cost the economy less than \$20 annually per household by 2010.

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The plan would also lower natural gas demand and decrease natural gas prices by encouraging conservation and more efficient technology. Similarly, the plan would reduce America's dependency on foreign oil and reduce world oil prices.

The U.S. Energy Information Administration (EIA) has consistently in our view provided "worst case" assessments of the economic impact of global warming legislation, because EIA fails to account for the positive economic impacts of investments in advanced technologies, innovation and energy bill savings to consumers. Nevertheless, EIA found that economic growth (U.S. GDP) would be relatively unchanged under two plans considered by Congress – the proposal by the National Commission on Energy Policy as well as the Climate Stewardship Act. According to EIA, the economy would grow by 78 percent between 2000 and 2020 regardless of whether the Climate Stewardship Act is enacted or not.

The Environmental Protection Agency also conducted an analysis of global warming legislation, although the Bush Administration has withheld the analysis from Congress. A copy of the EPA analysis was obtained by National Wildlife Federation and reported in the New York Times. Unlike EIA, EPA accounts for the positive economic impacts of investments in advanced technologies, innovation, and energy bill savings to consumers. EPA found that the bill would deliver positive economic benefits to consumers and reduce natural gas prices by up to 20 percent.

Other nations are moving ahead with the Kyoto Protocol, taking action and providing market-based incentives to their industry. According to the Pew Center on Climate Change, the European Union's emissions trading system, launched in January, has created a market worth up to \$37 billion for climate friendly technology. Even those opposed to the Kyoto Protocol itself should recognize that the U.S. should not be waiting around as other nations work to outpace America as global leaders in advanced energy technology. The global energy technology marketplace accounts for as much as a trillion dollars of sales annually. By combining clear environmental goals and safeguards with a flexible emissions trading system, a new federal plan of action on global warming would encourage American industry to retain our global technology leadership and expand high-paying technology jobs in the United States.

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*Should the costs of regulation be mitigated for any sector of the economy, through the allocation of allowances without cost? Or, should allowances be distributed by means of an auction? If allowances are allocated, what is the criteria for and method of such allocation?*

Allocating allowances for free to industry will not reduce the overall cost of the program. Further, it is widely recognized that the emissions limits Congress is considering are only a first step for dealing with global warming, and will not themselves deliver the 60-80 percent emission reductions needed by mid-century. Therefore, the National Wildlife Federation recommends that Congress recognize that the revenues that can be raised by fairly distributing allowances through an auction should be a principle part of any global warming plan. Allowances of an emissions trading program should be auctioned, and the revenues raised primarily used to: (1) provide financial resources to support adaptation strategies, including assistance to states; (2) maximize investments in clean energy technologies, including transformational expansion of federal research and development for renewable energy and energy efficiency; and (3) promote wildlife-friendly land use practices that remove carbon from the atmosphere and draw down the buildup of greenhouse gases in the atmosphere.

The National Wildlife Federation also supports the targeted use of emission allowances to assist workers and consumers, especially if climate policy has a regressive impact on low-income households or a disproportionate impact on specific job sectors.

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**Clarifying Questions 2b:**

*Adaptation Assistance*

- What portion of the overall allowance pool should be dedicated to adaptation research or adaptation-related activities?
- How should these allowances or funds be administered?
- What is the appropriate division between federal vs. regional, state, and local initiatives?

National Wildlife Federation agrees with the following statement from the design paper presented by Senators Domenici and Bingaman:

“Even very aggressive emission reduction policies undertaken today are unlikely to fully mitigate the impacts of future warming, some of which is almost certain to occur given historic and current levels of global greenhouse gas emissions. Actions to moderate the consequences of climate change — which may include rising sea levels, melting permafrost, altered precipitation patterns, more intense and frequent extreme weather events, and changes to the geographic distribution of important disease vectors — must therefore complement actions aimed at mitigating its causes. Adaptation measures can substantially reduce the potential for damage by improving the ability of human and natural systems to respond to the consequences of climate change.”

The best way to help fish and wildlife survive those impacts of global warming that may be unavoidable is to provide a dedicated, stable source of funding to state wildlife agencies, which will allow states to prepare locally for the impacts of a changing climate. In particular, the National Wildlife Federation and 332 sportsmen groups, state fish and wildlife agencies, conservation groups, and scientific societies have requested in the attached letter that climate legislation include dedicated funding for the Wildlife Conservation and Restoration Account of the Pittman-Robertson Act, which funds the State Wildlife Grant Program.

The National Wildlife Federation believes that at least two percent of the total number of emission allowances should be auctioned and the proceeds deposited in the Wildlife Conservation and Restoration Account established under section 3 of the Pittman-Robertson Wildlife Restoration Act (16 U.S.C. 669b) to fund efforts to strengthen and restore habitat that improves the ability of fish and wildlife to adapt successfully to climate change. The amounts deposited in the sub-account should be available without further appropriation for obligation and expenditure. The National Wildlife Federation supports alternate constructs of this funding, including the funding for wildlife adaptation and conservation included in Senator Bingaman’s Climate and Economy Insurance Act of 2005, S. Amdt. 866.

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### FUNDING FOR STATE FISH AND WILDLIFE AGENCIES

The state fish and wildlife agencies work to strengthen ecosystems to prevent species from becoming endangered and are at the forefront of the conservation, protection and restoration of fish and wildlife. They are best positioned to work through cooperative partnerships to assist fish and wildlife in adapting to the changes caused by global warming. Wildlife managers can ensure widespread habitat availability and manage for self-sustaining populations.

Climate change is already adding new wildlife management burdens on states and magnifies the agencies' need for funding. The FY05 federal appropriation of \$61 million to the states through the State Wildlife Grants program is far short of what states need to conserve our rich fish and wildlife heritage. State agencies need a guaranteed source of annual funding for climate adaptation that supplements the annual congressional appropriation for State Wildlife Grants. State Wildlife Grants are guided by very detailed and measurable action plans developed by each state.

Global warming legislative proposals can raise new revenues to meet the needs of fish and wildlife as they are impacted by global warming. By using the well-established structure of the Wildlife Conservation and Restoration Account of the Pittman-Robertson Act, one of America's landmark conservation laws, funds derived from a market-based regulatory system would be efficiently and fairly distributed to the states. Adequate and consistent funding for the Wildlife Conservation and Restoration Account of the Pittman-Robertson Act is essential to fulfill the responsibility federal and state governments share for conserving our nation's fish and wildlife.

The National Wildlife Federation would like to thank Senator Bingaman for including funding for wildlife adaptation and conservation in his draft legislation (Climate and Economy Insurance Act of 2005, S. Amdt. 866). We urge that any climate change legislation include substantial funding for the Wildlife Conservation and Restoration Account of the Pittman-Robertson Act, to facilitate the adaptation of fish and wildlife to the impacts of climate change.

### ECONOMIC SIGNIFICANCE OF WILDLIFE

Fish and wildlife play an integral role in the economy of the United States (Table 1). In 2001 more than 82 million adults participated in hunting, fishing, and wildlife watching, spending more than \$108 billion and supporting more than 2.6 million jobs across the nation (U.S. FWS, 2001). With these numbers, hunting, fishing and wildlife watching together are comparable to being the 7<sup>th</sup> largest corporation in America, with nearly as many employees as the U.S. computer industry (NWF & IAFWA, 2005). Declines in wildlife populations due to global warming could significantly reduce the opportunities for people to engage in these activities in the future.

More than 34 million anglers fish the rivers, lakes, and oceans of the United States (U.S. FWS, 2001). The enthusiasm for angling in America generated over \$41 billion in fishing

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related expenditures in 2001 (American Sport Fishing Association, 2002). New Mexico received more than \$235 million, with \$3.3 million going to state income taxes (American Sport Fishing Association, 2002). Recreational fishing in Florida is one of the highest grossing economic activities in the state, second only to tourism. As temperatures rise throughout the U.S., and fish stocks begin decreasing due to their sensitivity to warmer waters, we could see a decline in the robustness of the fishing industry.

### GLOBAL WARMING AND AMERICA'S WILDLIFE

Scientists have been pointing to the mounting impacts of climate change on wildlife for years. As conveyed by the Bush administration to Congress in 2004, "Analyses based on a large number of studies of plants and animals across a wide range of natural systems worldwide have found that many species have shifted their own geographic ranges or changed temperature-sensitive behavior – such as migration, flowering, or egg-laying, in ways consistent with reacting to global warming." (U.S. Climate Change Science Program, 2004)

A report by The Wildlife Society, "Global Climate Change and Wildlife in North America" (Inkley et al., 2004), provides a comprehensive assessment of global warming's likely consequences for North American wildlife and concludes that "the effects of climate change and variability on wildlife simply cannot be ignored."

Scientists fear that, without a concerted strategy to confront global warming, wildlife will face a mounting threat as the pace of climate change continues to accelerate in the coming decades. A study in the journal *Nature* concluded that, within the next 50 years, as many as one-third of wildlife species in studied regions could be headed for extinction due to global warming (Thomas et al., 2004).

The threat to some wildlife populations in the United States is particularly acute due to the limited ability to adapt as suitable habitat dwindles in the face of development, invasive species and other threats. The Wildlife Society report states that "wildlife is likely to depend upon factors such as the availability of migration corridors and suitable habitats" to escape the pressures of global warming. However, landscape changes associated with human development and invasive species competition will "present significant barriers" to species' ability to respond to such pressures.

The Wildlife Society report stresses the importance of improving the resiliency of wildlife to respond to climate change by improving wildlife habitat and maintaining healthy, connected, genetically diverse populations. According to the report, "healthier or more robust species and habitats should be better able to adapt to climate change as an additional stress."

The Wildlife Society (Inkley et al., 2004) identified many actions wildlife managers should be implementing now to ameliorate the effects of climate change on wildlife. These management actions include protecting coastal wetlands to allow for sea level rise, reducing the risks to wildlife from potential catastrophic events, adjusting yield and harvest models,

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accounting for known climatic variations, and taking climate change into consideration when selecting the location and other characteristics of conservation areas. Wildlife managers also need to expect the unexpected and reduce non-climate stressors on ecosystems. Overall, wildlife managers can minimize negative impacts to wildlife and take advantage of positive aspects by planning ahead and employing adaptive management (for a complete listing of recommendations please see Appendix C). Absent funding to implement these recommendations now, fish and wildlife resources will be less able to endure the challenges of climate change.

Although the earth's climate, as well as the wildlife communities, has always been changing, the current global warming caused by the burning of fossil fuels is uniquely different by changing climate at an unprecedented rate, with subsequent impacts on the fish and wildlife resources with which we are so richly endowed. Rapid climate change also is occurring at a time when wildlife habitat has been fractured and lost to development and other pressures, limiting the ability of wildlife to adapt. Disruption of habitat due to climate change is also opening the door to the latest invasive species that threaten America's wildlife. The link between wildlife and climate is highlighted below for several types of wildlife:

### Waterfowl

North America's wetlands support a rich abundance and diversity of waterfowl and other wildlife that have many important economic, ecological, recreational, and aesthetic values. But changes in wetland ecosystems may profoundly affect future waterfowl populations and other wetland-dependent species. In the Prairie Pothole Region, the single most important breeding ground for North American migratory waterfowl, the effects of global warming on their abundance could be drastic, reducing migratory waterfowl populations throughout North America. The Wildlife Society's report entitled "Global Climate Change and Wildlife in North America" (Inkley et al., 2004) states:

"All global climate change models for [the Prairie Pothole Region] predict substantial warming under a doubling of atmospheric CO<sub>2</sub>, but precipitation changes for this region are less certain (slight decreases to slight increases). Mean annual and March–May temperatures have increased in this region over the past 50 years (L. G. Sorenson, R. Goldberg, T. L. Root, & M. G. Anderson, unpublished data). Because of temperature-sensitive evapotranspiration, however, nearly all future scenarios predict decreases in soil moisture, which is highly correlated with the abundance of small wetlands (Clair et al. 1998, Sorenson et al. 1998). For many waterfowl species, decreased wetland abundance or shortened hydroperiods have been linked to decreased reproductive effort, reduced clutch sizes, lower re-nesting propensity, lower nesting success, lower brood survival, and reduced recruitment probability for the subsequent year (Dzus & Clark 1998; Anderson, Lindberg, & Emery, 2001).

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“Sorenson et al. (1998) used model projections of future drought conditions in the Prairie Pothole Region to project trends in wetland and duck abundance during the 21<sup>st</sup> century. Most scenarios and models projected significant declines in wetlands (no change to -91%), and thus declines in the abundance of breeding ducks (-9% to -69%) in this region by the 2080s.”

Restoration of destroyed wetlands, rehabilitation of degraded wetlands, and protection of existing wetlands will reduce the impacts of climate change on wetlands acreage in this region, and thus help minimize reductions in waterfowl populations resulting from climate change. Already, states have been working to conserve wetlands through various Farm Bill programs, Clean Water Act protections, the North American Wetlands Conservation Act and other programs. Enhancement of these efforts will increase the ability of states to slow and reverse wetlands loss as the climate changes.

### Salmonids (Trout, Salmon and Steelhead)

As global warming increases the average temperature of our atmosphere, there is an associated increase in the temperatures of rivers, streams, and other bodies of water. This is based on evidence that air and water temperatures are correlated, particularly when the air temperature remains at a certain level over time periods of a week or longer (Rahel, Keleher, Anderson, 1996). Water temperatures are among the most important factors affecting the health and distribution of trout, salmon, and steelhead, – collectively called salmonids (McCullough, 1999).

Temperatures above optimal conditions can influence cold-water fish in each of their life stages (Kyle & Brabets, 2001). Even a small increase in temperature (just a few degrees) above their optimum range can affect salmonids in a number of ways, including changing migration timing, reducing growth rates, reducing available oxygen in the water, and increasing susceptibility to toxins, parasites, and disease (Poole et al., 2001).

Because salmonids seek stream habitat in their preferred temperature range, their geographic distribution tends to match rivers that are within those optimum temperatures (Dunham et al., 2001). In general, salmonids will not be found where river temperatures are outside of the optimum range for an extended period of time (Figure 1). The “thermal limit” for most adult salmon, steelhead, and trout species occurs where the average daily air temperature in the warmest summer months exceeds 69.8° F (21° C) (McCullough, 1999). Salmonids exposed to water temperatures at or above 71.6° F (22° C) over several days are impaired or will die (Ministry of Water, Land, and Air Protection, 2004).

The U.S. Environmental Protection Agency projects a 50 to 100 percent reduction in cold-water fish habitat in many New England, Great Lakes, and western states if there is a 4.5° F (2.5° C) increase in average stream temperatures (U.S. EPA, 1995; Figure 1). Research by Defenders of Wildlife and the Natural Resources Defense Council estimates that an increase in average summer water temperatures of 4.5 to 11° F (2.5 to 6° C) could eliminate 21 to 42 percent of stream habitat for the nation’s trout and salmon species (O’Neil, 2002).

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Temperature increases of these magnitudes are well within the ranges of climate warming projected for this century (IPCC, 2001).

Tens of thousands of stream miles used by salmonids in the U.S. are degraded from pollution, dewatering, loss of shade cover, siltation and other factors. State fish and wildlife agencies have successfully restored salmonid populations in many streams through proper management. With funding, state fish and wildlife agencies can reduce pollution, purchase in-stream flow rights, restore shade cover, and reduce sedimentation. These improvements will reduce impacts on climate change on streams. Especially the restoration of shade cover can minimize increases in water temperatures, thereby maintaining many streams within the suitable thermal range for salmonids.

### Neotropical Migrants and Other Birds

While birds may appear to be particularly suited for adapting to climate change because of their ability to migrate, they may not be well adapted to the new prey, predators, competitors, and habitat conditions which changing climate could force them into (Price & Glick, 2002). Their “optimal” habitats will no longer exist, at least in the short term (Price & Root, 2001). The number of neotropical migrant bird species are expected to decrease throughout the contiguous United States as bird ranges shift in response to climate change. For example, the potential loss of current neotropical migrant bird species from the Southwest region of the U.S. could be 29% (Price & Root, 2001). American goldfinches may no longer breed in much of the United States (Figures 2 and 3). Savannah sparrows, sage thrashers, and other birds that keep outbreaks of rangeland grasshoppers in check (Price & Glick, 2002) may disappear from Arizona, Nevada, and New Mexico.

In addition to altered species' ranges directly through climate effects, the abundance of the birds' key food sources may shift, decreasing the availability of seeds, insects, and other foods, affecting birds' health for migration and breeding (Price & Glick, 2002). As sea levels rise, populations of shorebirds and other birds that rely on coastal marshes could be reduced (Erwin, 2001). Van Riper et al. (1997) found that the endangered Southwestern Willow Flycatcher has seen its numbers plummet during the last 100 years due to the loss of its narrow, dense riparian habitat along rivers, streams, or other wetlands in southern California, Arizona, New Mexico, and parts of Nevada, Utah, Colorado, and Texas. Global warming could exacerbate the habitat loss by restricting water flow even further, hurting fish and wildlife as well as songbirds.

It will be essential for state fish and wildlife agencies to monitor and assess the status and trends of neotropical migrant birds. Through monitoring, agencies can identify changes in populations and ranges, and the necessary management actions needed to help maintain population levels.

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### Coastal Habitats

A significant increase in the rate of sea-level rise due to melting glaciers and ice caps and the thermal expansion of the oceans is one of the most direct consequences of global warming, and many of the nation's low-lying coastal areas are at considerable risk. Average global sea levels rose 4-8 inches over the 20<sup>th</sup> century, and studies project that sea levels will rise an additional 4-35 inches by 2100 (IPCC, 2001).

Sea-level rise is expected to contribute to significant coastal erosion as well as inundation of coastal wetlands, marshes and other habitat important to numerous fish and wildlife species. These problems will likely be exacerbated by other human-induced stressors, such as groundwater withdrawal, wetland drainage and levee construction. In Louisiana, for example, a combination of sea-level rise and these other factors have already contributed to a loss of close to one million acres of coastal wetland since 1900 (USGCRP, 2000). With the rate of sea-level rise projected to accelerate as much as five-fold over the next century, the losses in this and other regions are likely to be catastrophic – particularly in areas where dikes, levees and other developments hinder the ability of wetlands to migrate inland (Glick, Inkley and Tufts, 2001).

Moreover, scientists are becoming increasingly concerned that the rate of sea-level rise in the future could be even greater than currently projected, as several new studies have determined that the ice sheets of Greenland and Antarctica are melting much more rapidly than previously thought (Rignot & Kanagaratnam, 2006; Velicogna & Wahr, 2006).

Global warming is having a significant impact on ocean temperatures as well. On average, the temperature of the upper 300 meters of the world's oceans has risen about 0.5 degrees F since the 1950s, a trend that scientists have determined is a direct result of human activities (Barnett, Pierce and Schnur, 2005). In the Tropical Atlantic, average sea surface temperatures have warmed 1 degree Fahrenheit over the past three decades. These higher sea surface temperatures are damaging coral reefs, enhancing marine diseases and harmful algal blooms and making hurricanes more intense and destructive. For example, two recent studies have offered compelling evidence that hurricanes around the world have become increasingly intense over the past 35 years, a trend that they attribute to warmer ocean temperatures fueled by global warming (Emanuel, 2005; Webster, et al., 2005). The rise in severity of storms not only affects vulnerable human populations, but wildlife and their habitats as well. Increased storm surge and mean tide levels could alter disturbance regimes in shallow coastal waters, thereby influencing the composition and productivity of sea grasses and benthic fauna that are vulnerable to changes in sedimentation patterns, current velocity, and turbidity (Inkley et al., 2004).

Even without global warming, there will no doubt be increasing demands for the nation's coastal resources in the coming decades. The added pressures associated with sea-level rise, more-intense storms and other global warming impacts will make managing those resources to meet the needs of fish, wildlife and people all the more challenging. As the demand for coastal resources increases a well funded fish and wildlife management plan will help alleviate the cumulative threats to fish and wildlife habitat.

## Question 2. Allocation

Jeremy Symons, National Wildlife Federation

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APPENDIX

A. Figures and Tables

Figure 1

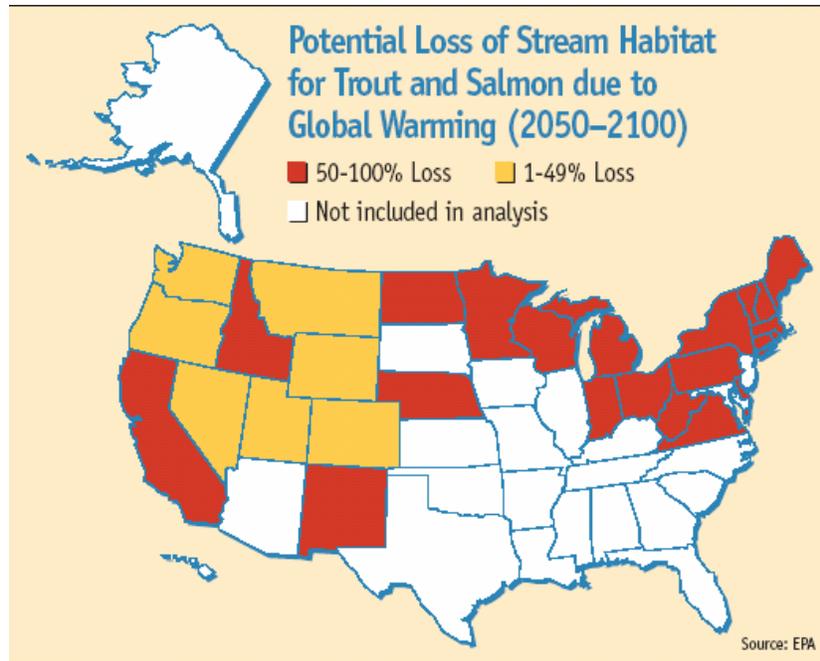


Figure 2

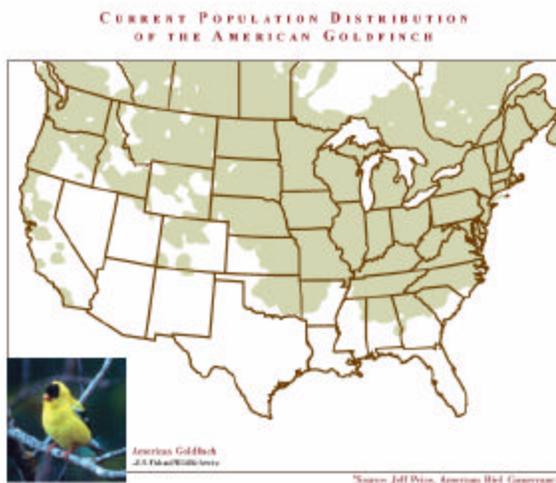
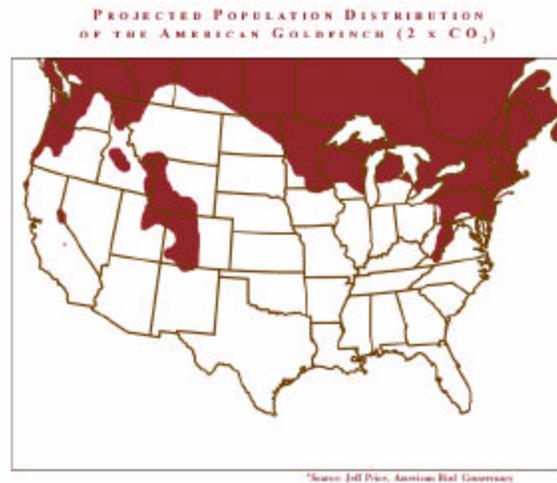


Figure 3



Question 2. Allocation  
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**Table 1 – Jobs Created by Wildlife Recreation, Current Wildlife Funding and Potential Funding from Global Warming Policy**

	Jobs created by wildlife recreation	FY05 State Wildlife Grants (millions)	Potential Annual Funding from Global Warming Policy* (millions)
Alabama	53,817	\$0.90	\$7.50
Alaska	28,583	\$3.10	\$24.20
Arizona	31,654	\$1.40	\$11.50
Arkansas	25,609	\$0.70	\$5.70
California	113,422	\$3.10	\$24.20
Colorado	41,109	\$1.30	\$10.10
Connecticut	7,983	\$0.60	\$4.80
Delaware	2,255	\$0.60	\$4.80
Florida	122,518	\$2.60	\$20.50
Georgia	33,458	\$1.50	\$12.00
Hawaii	4,873	\$0.60	\$4.80
Idaho	19,908	\$0.70	\$5.70
Illinois	34,492	\$2.10	\$16.50
Indiana	37,839	\$1.10	\$8.50
Iowa	16,782	\$0.80	\$6.10
Kansas	13,559	\$0.90	\$7.10
Kentucky	40,285	\$0.80	\$6.50
Louisiana	29,306	\$0.90	\$7.40
Maine	23,390	\$0.60	\$4.80
Maryland	38,304	\$0.80	\$6.30
Massachusetts	19,134	\$0.90	\$7.40
Michigan	50,795	\$1.80	\$13.90
Minnesota	53,570	\$1.20	\$9.70
Mississippi	18,732	\$0.70	\$5.60
Missouri	34,261	\$1.20	\$9.70
Montana	22,923	\$1.10	\$8.50
Nebraska	12,051	\$0.70	\$5.90
Nevada	9,415	\$1.00	\$7.90
New Hampshire	12,791	\$0.60	\$4.80
New Jersey	35,305	\$1.20	\$9.60
New Mexico	23,052	\$1.00	\$8.20
New York	60,505	\$2.90	\$23.30
North Carolina	55,500	\$1.50	\$11.50
North Dakota	6,158	\$0.60	\$4.80
Ohio	48,730	\$1.80	\$14.60
Oklahoma	24,299	\$0.90	\$7.40
Oregon	42,590	\$1.10	\$8.70
Pennsylvania	56,113	\$2.00	\$15.80
Rhode Island	4,809	\$0.60	\$4.80
South Carolina	27,613	\$0.80	\$6.00
South Dakota	12,716	\$0.60	\$4.80

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Tennessee	35,875	\$1.10	\$8.40
Texas	101,401	\$3.10	\$24.20
Utah	33,805	\$0.90	\$6.80
Vermont	9,833	\$0.60	\$4.80
Virginia	43,014	\$1.20	\$9.90
Washington	45,205	\$1.30	\$10.00
West Virginia	9,802	\$0.60	\$4.80
Wisconsin	79,450	\$1.10	\$8.80
Wyoming	13,064	\$0.60	\$4.80
<b>United States</b>	<b>1,721,657</b>	<b>\$61.00</b>	<b>\$500.00</b>

\* Climate and Economy Insurance Act (expected revenue \$600 million per year), and Climate Stewardship Act (expected revenue \$500 million – \$1.8 billion per year)

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**B. Sign on letter to Senators Bingaman and Domenici**

March 1, 2006

The Honorable Pete V. Domenici  
Chairman  
Committee on Energy and Natural Resources  
United States Senate  
364 Dirksen Senate Office Building  
Washington, D.C. 20510

The Honorable Jeff Bingaman  
Ranking Member  
Committee on Energy and Natural Resources  
United States Senate  
364 Senate Dirksen Office Building  
Washington, D.C. 20510

Dear Senators Domenici and Bingaman:

We are writing to urge you to include in any climate change legislation dedicated funding for fish and wildlife conservation and restoration through the Wildlife Conservation and Restoration account of the Pittman-Robertson Wildlife Restoration Act.

Adequate and consistent funding for the Wildlife Conservation and Restoration account of the Act is essential to fulfilling the responsibility federal and state governments share for conserving our nation's fish and wildlife. Current federal efforts to proactively conserve fish and wildlife through annual appropriations for State Wildlife Grants are having dramatic results, but they still fall far short of what is needed. At the same time, changing climate conditions are placing even greater burdens on fish and wildlife and fish and wildlife management agencies. As a result, we ask you to use the well-established structure of the Pittman-Robertson Act, one of America's landmark conservation laws, to address this issue. Climate change legislative proposals that raise new federal revenues can meet the needs of fish and wildlife without raising the federal deficit.

America's fish and wildlife are highly-valued public trust resources and must be conserved. The most recent national survey shows that in 2001, some 82 million adults participated in hunting, fishing, and wildlife watching. In pursuit of these activities, participants spent more than \$180 billion in our communities, which in turn generated more than 2.6 million jobs across the nation.

Changing climate conditions will place enormous strain on the nation's fish and wildlife and other natural resources. At the same time, our response to this challenge offers us an opportunity to make a long-overdue investment in fish and wildlife conservation. As Congress considers options to respond to climate change, we ask that you champion the need

## Question 2. Allocation

Jeremy Symons, National Wildlife Federation

to take immediate action to assist the states in securing the nation's fish and wildlife heritage for our children and for our economic and environmental future.

Sincerely,

### **NATIONAL ORGANIZATIONS**

Ghassan Rassam  
Executive Director  
American Fisheries Society

Steve Olson  
Director of Government Affairs  
The American Zoo and Aquarium  
Association

John Baughman  
Executive Vice President  
International Association of Fish and  
Wildlife Agencies

Tom Franklin  
Conservation Director  
Izaak Walton League of America

Larry Schweiger  
President & CEO  
National Wildlife Federation

Matt Connolly  
President  
Theodore Roosevelt Conservation  
Partnership

John F. Calvelli  
Senior Vice President of Public Affairs  
Wildlife Conservation Society

Steven A. Williams  
President  
The Wildlife Management Institute

Michael Hutchins  
Executive Director  
The Wildlife Society

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**STATE ORGANIZATIONS**

**New Mexico**

Oscar Simpson, President  
New Mexico Wildlife Federation

Gene Tatum, President  
Albuquerque Wildlife Federation

Mike Maurer, President  
New Mexico Trout

William Schudlich, Chairman  
New Mexico Council of Trout Unlimited

Robert O'Connor, President  
Truchas Chapter of Trout Unlimited

Ken Whiton, President  
Republicans For Environmental  
Protection, NM Chapter

Charlie Sanchez, Chairman  
Valencia Soil and Water Conservation  
District.

Tom Wobbe, President  
Mesilla Fly Fishers, Las Cruces, NM

Julie Basile, President  
Back Country Horsemen, Lower Rio  
Grande Chapter, Las Cruces, NM

Jesse Berryhill, President  
New Mexico State University Student  
Chapter of the Wildlife Society

Dr. Sanford Schemnitz, President  
Southwest Consolidated Sportsmen, Las  
Cruces, NM, Represents 15  
organizations in the Las Cruces Area:

1. Brittany Club
2. Dona Ana County  
Associated Sportsmen

3. Ducks Unlimited
4. Fisheries Society
5. German Shorthair  
Club
6. Las Cruces Chapter –  
Turkey Federation
7. Mesilla Valley Fly  
Fishers
8. Mule Deer  
Foundation
9. New Mexico  
Shooting Sports  
Association
10. Organ Mountain  
Bowmen
11. Picacho Gun Club
12. Southwestern New  
Mexico, Quail  
Unlimited
13. Rocky Mountain Elk  
Foundation
14. Wildlife Society
15. Wild Turkey  
Sportsmen  
Association

Rick Simpson,  
S – S Outfitters, Glencoe, NM

Gary Fonay, Manager  
Fonay Oil and Gas, Hobbs, NM

Cheryl Nigg,  
3 Paws Wilderness Services, Tijeras,  
NM

Tina Buchen  
Tina's Range Gear, Santa Fe, NM

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Pete David, President  
New Mexico Chapter of the Wildlife Society

**Arkansas**

David Carruth, Board Chair  
Arkansas Wildlife Federation

**Arizona**

Mary Jo Miller, President  
Arizona Wildlife Federation

**California**

Gary A. Patton, Executive Director  
Planning and Conservation League

**Colorado**

Michelle Cowardin, President  
Colorado Chapter of The Wildlife Society

**Connecticut**

Adam Moore, Executive Director  
Connecticut Forest and Park Association

**Delaware**

Richard Bradley, Associate Professor, EEO Biology  
Delaware County Bird Club

**Florida**

Manley Fuller, Executive Director  
Florida Wildlife Federation

Franklin Adams, Board Member  
Naples Fishing Club

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David Tetzloff, President  
Traditional Bowhunters Of Florida

Jody Millar  
Tampa Bay Wildlife Federation

Scott Paterno, Executive Director  
Big Bend Saltwater Classic

Rosalee Schaeffer  
Panhandle Citizen's Coalition

Scott Paterno, Chairman of the Board  
Organization For Artificial Reefs

Lou Dombrova, Founder and Executive  
Director  
Snook Foundation

Save The St. John's River

Jack Leppert, Waterkeeper  
Wakulla/Aucilla Waterkeeper

Matt Draper, Owner/Editor  
Gaff (Gulf Atlantic Florida Fishing)  
Magazine

Ernie Rivers, President  
Bream Fisherman's Association

Scott Matamoros, Chairman of the  
Board  
South Dade Anglers

Dan Kipnis, Chairman of the Board  
Miami Beach Rod and Reel Club

South Florida Sportfisher's  
Islemorada Fishing Club

Captain Pat Kelley, Chairman of the  
Board  
Islemorada Guides Association

Captain Pat Kelley, Chairman of the  
Board  
Florida Guides Association

Danny Brantley, Chairman of the Board  
Kissimmee River Sportsman's  
Association

### Bait And Tackle Shops (FL)

John Dewing, Owner  
Dewing's Fly And Gun Shop

Scott Paterno, Owner  
Jerry's Bait And Tackle

Dave Navarro, Owner  
World Class Angler

Annie's Bait And Tackle  
Jigs Landing  
Rod And Reel Fishing Pier  
Captain Mikes Bait And Tackle Center  
New Pass Bait Shop  
Oneco Bait And Tackle  
Ruskin Bait And Tackle  
Lake Manatee Fish Camp  
Maugherman's Johns Lucky Strikes  
Perico Harbor Bait And Tackle  
Southern Angler- Light Tackle Outfitter  
Reel Waters Outdoors  
The Tackle Box  
Big Time Discount Bait And Tackle  
Jack's Bait And Tackle  
The Saltwater Angler  
Key West Bait And Tackle  
Island Angler Outfitters  
Sea Boots Outfitters  
Kendal Bait And Tackle  
Biscayne Bay Fly Shop  
Big Pine Fish Camp  
Andes Outfitters  
The Wildness Way  
Circle J's Bait And Tackle  
The Canoe Shop  
T'n't Hideaway Canoe/Kayak Rental

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Conchy Joe's Marine And Tackle

Captain Danny Mora, Owner  
Cortez Fishing Center

#### Charter Guides (FL)

Pete Kelley, Owner  
Pete Kelley Guide Service

Captain Conch, Owner  
Captain Conch Charters

Captain Frank Adams, Owner  
Captain Frank Adams Guide Service

Captain Tim Jenson, Owner  
Sea Dog Charters

Roy Salgado, Owner  
Grand Slam Charters

Steve Salgado, Owner  
Compleat Angler

Cuda Charters  
Neva-Miss Charters  
Johnnie Walker's Fishing Place  
Miss Inclined Charters  
Key Limey Charters  
Sea Boots Charters  
Knee Deep Charters  
Outer Limits Sportfishing  
Almost There Charters  
Rusty Fly Charters  
Boo-Ya Custom Charters  
Sivler Fox  
Barefoot Charters  
Reef Reacher Charters  
Snooky Bear Inshore Charters  
Flying Fish Fleet  
Walking Small Fishing Charters  
Reel Fast Charters  
Thunderbird Offshore Fishing  
Angling Adventure  
Captain Action Charters

## **Georgia**

Jerry L. McCollum, President and CEO  
Georgia Wildlife Federation

## **Hawaii**

Marjorie Ziegler, Executive Director  
Conservation Council of Hawaii

## **Idaho**

Ken Marlor, President  
Idaho Wildlife Federation

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**Illinois**

Aaron Yetter, President  
Illinois Chapter of The Wildlife Society

**Iowa**

Joe Wilkinson, President  
Iowa Wildlife Federation

**Indiana**

Charlie O'Niel, President  
Indiana Wildlife Federation

**Kansas**

Steven Sorensen, President  
Kansas Wildlife Federation

Don Kaufman, President  
Kansas Chapter of The Wildlife Society

**Kentucky**

Ronnie Well, President  
League of Kentucky Sportsmen

**Louisiana**

Randy P. Lanctot, Executive Director  
Louisiana Wildlife Federation

**Maine**

Brownie Carson, Executive Director  
Natural Resources Council of Maine

**Massachusetts**

Jim Gomes, President  
Environmental League of Massachusetts

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**Minnesota**

Doug Wells, President  
Minnesota Chapter, TWS

Gordon Meyer, President  
Minnesota Conservation Federation

**Missouri**

Dave Murphy, Executive Director  
Conservation Federation of Missouri

**Michigan**

Sam Washington, President  
Michigan United Conservation Clubs

**Montana**

Craig Sharpe, Executive Director  
Montana Wildlife Federation

Mike Phillips, Executive Director  
Turner Endangered Species Fund,  
Montana

**Nevada**

Kevin Cabble, President  
Nevada Wildlife Federation

**New Hampshire**

Lee E. Perry, Executive Director  
New Hampshire Fish and Game

**New Jersey**

Janet L. Bucknall  
NJ Chapter of The Wildlife Society

Brian Maloney, President  
English Setter Club of America,  
Medford, NJ

Janet Bucknall, President  
NJ Chapter of the Wildlife Society

George P. Howard, Conservation  
Director  
NJ State Federation of Sportsmens Clubs

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Ross Kushner, Executive Director  
Requannock River Coalition, New  
Foundland, NJ

Margaret O'Gorman, Executive Director  
Conserve Wildlife Foundation of New  
Jersey

Tom Gilmore  
NJ Audobon Society

Tom Fote  
Jersey Coast Anglers Association

Andrea M. Bonette, President  
Sourland Planning Council

### **New York**

Robert J. Moore, Executive Director  
Environmental Advocates of NY

David Miller, Executive Director  
Audubon Society, New York

### **North Carolina**

Camilla M. Herlevich, Executive  
Director  
North Carolina Coastal Land Trust

Larry Thompson, Executive Director  
North Carolina Wildlife Federation

### **Ohio**

John Hoopingarner, Executive Director  
Muskingum Watershed Conservancy  
District (OH)

Sam Speck, Director  
Ohio Department of Natural Resources

Steven A. Gray, Chief  
Ohio Division of Wildlife

Lynn E. Elfner, CEO  
The Ohio Academy of Science

Lisa Brohl, Chair  
Lake Erie Islands Chapter  
Black Swamp Conservancy, Ohio

Larry Mitchell, President  
League of Ohio Sportsmen

Damon M. Greer, President  
Ohio Chapter of The Wildlife Society

Mark Young  
Federal Public Policy Chair  
Ohio Parks and Recreation Association

Dr. Richard Bradley, Faculty Advisor  
Marion Environment Group (OH)

Eugene C. Braig IV, President  
Ohio Chapter of the American Fisheries  
Society

Jen Sauter, Executive Secretary  
Ohio Ornithological Society

David Kohler, President  
Ohio Fish and Wildlife Management  
Association

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Gerald W. Borin, CEO  
Columbus Zoo and Aquarium

Damon M. Greer, President  
Ohio Chapter of The Wildlife Society

**Oklahoma**

Andy McDaniels, Executive Director  
Oklahoma Wildlife Federation

**Pennsylvania**

Melody Zullinger, Executive Director  
Pennsylvania Federation of Sportsmen's Clubs

**Puerto Rico**

Joel Franqui, President of the Board  
Ornithological Society of Puerto Rico

**Rhode Island**

Sheila Dormody, President  
Environment Council of Rhode Island

**South Carolina**

Angela Viney, President/CEO  
South Carolina Wildlife Federation

**South Dakota**

Chris Hesla, Executive Director  
South Dakota Wildlife Federation

**Tennessee**

Gary T. Myers, Executive Director  
Tennessee Wildlife Resources Agency

Cynthia Rohrbach, Board President  
Swan Conservation Trust (TN)

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**Texas**

Bob Warneke, Jr., Chairman of the Board  
Texas Committee on Natural Resources

**Vermont**

Elizabeth Courtney, Executive Director  
Vermont Natural Resources Council

**Virginia**

Manuel Barrera, President  
Virginia Audubon Council

Carey Whitehead, Executive Director  
Virginia Conservation Network

Christopher G. Miller, President  
Piedmont Environmental Council

**Washington**

John McGlenn, President  
Washington Wildlife Federation

**West Virginia**

Joe Calvert, Director Region IV  
West Virginia Wildlife Federation

**Wisconsin**

George Meyer, Executive Director  
Wisconsin Wildlife Federation

Almond Rod & Gun Club  
Am. Wild Turkey Hunting Dog Assoc.  
Berlin Conservation Club  
Breed Sportsman's Club  
Butte des Morts Conservation Club  
Cambria Conservation Club  
Cascade Sportsmen's Club

Cassville Conservation Club  
Challenge the Outdoors, Inc.- Kaukauna  
Challenge the Outdoors, Inc.- Shiocton  
Chippewa Rod & Gun  
Citizens Nat. Resources Assoc. of WI  
Clarks Mills Sportsmen's Club  
Cleveland Fish & Game  
Columbia County Sporting Alliance  
Columbus Sportsman's Assoc.  
Community Conservation

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Jeremy Symons, National Wildlife Federation

Daniel Boone Conservation League	MPO Conservation & Sports Club
De Pere Sportsman's Club	Neosho Sportsman's Club
Denmark FFA	North Fond du Lac Rod & Gun Club
Discovery Center Bird Club	Outdoors, Inc.
Dousman Gun Club	Paynes Point Hook & Spear Club
Ducks Unlimited – Wisconsin	Pewaukee Lake Sports Club
Dunbar Sportsman's Club	Pheasants Forever – Columbia Co.
East Central Hunter Safety Instructors	Pheasants Forever – Sugar River
Eau Claire Rod & Gun Club	Pheasants Forever – Wisconsin
Exeland Rod & Gun Club	Pike Lake Sportsman's Club
Farmers & Sportsmen's Con. Club	Plover River Alliance
Feather & Fin Club	Porterfield Sportsmen's Club
Fox Valley Area Wild Ones	Prairie Rod & Gun Club
Friends of Cedarburg Bog	Pumkin Center Sportsman's Club
Friends of the Hickory Ridge Trail	Quack Club of WI
Friends of the Upper Miss. Fishery	Ozaukee Co. Fish & Game Assoc.
Gathering Waters Conservancy	Racine County Line Rifle Club
Gods Country Muskies	River Alliance of Wisconsin
Great Lakes Sport Fish.Club, Ozaukee	River edge Bird Club
Green Bay Duck Hunters Association	Riverside Hunting & Fishing Club
Green Bay Great Lakes Sport Fishermen	Rock County Parks
Greenwood Rod & Gun	Ruffed Grouse Society - Kettle Moraine
Hancock Sportsmen Club	Sally's Marsh Hunting Club
Happy Hookers Fishing Club	Sayner – St. Germaine Wildlife Club
Ice Age Park & Trail Found.-Chippewa	Shadows on the Wolf
Indianhead Rifle & Pistol Club	Shawano Gun Club
Iowa C. Rec. and Prairie Restoration	Sheboygan Area Great Lakes Fish
Izaak Walton League – Watertown	Sheboygan County Conservation Assoc.
Izaak Walton League – WI	Shoto Conservation Club of WI
Jefferson Sportsmen's Club	Slinger Sportsman Club
Johnsonville Rod & Gun Club'	Smerkes Sportsman's Club
Kenosha Sport Fishing	Solberg Lake Association
Kettle Moraine Bass Anglers	South Clark Co. Sportsmen's Club
Kiel Fish & Game	Southwest WI Longbeards
Lake Poygan Sportsmen's Club	Spooner Muskie Club
Lakeshore Fisherman's Sports Club	St. Anna Sportsman's Club
Lauderdale Lakes Assoc. Fish Comm.	Stan Plis Sportsman's League
LEAF Program	Star Prairie Fish & Game
Long Lake Fishing Club	Star Prairie Land Trust
Madison Audubon Society	Sturgeon For Tomorrow – No.Chapt.
Mammals of WI	Suring Sportsman's Club
Manitowoc Unit of Fish & Game	The Nature Conservancy
Marshfield Coon Hunters Club	The Prairie Enthusiasts – Empire Sauk
Milwaukee Casting Club	The Prairie Enthusiasts – Prairie Bluff
Mishicot Sportsman's Club	The Prairie Enthusiasts - Wisconsin
Monches Fish & Game Club	The Wildlife Society – WI Chapt.

## Question 2. Allocation

Jeremy Symons, National Wildlife Federation

Trees For Tomorrow  
Trempealeau Sportsmen's Club  
Triangle Sportsman's Club  
Trout Unlimited, Aldo Leopold  
Trout Unlimited, Green Bay  
Twin City Rod & Gun Club  
Union Rod & Gun Club  
UWEC Outdoor Rec. Program  
Watershed Watchers  
Watertown Conservation Club  
Waukesha Co. Conservation Alliance  
Waukesha Co. Environ. Action League  
Waunakee Bow Hunters  
Waupaca Conservation League  
West Bend Barton Sportsman's Club  
Westgate Sportsman's Club  
White Snake Preservation Club  
WI Assoc. for Environmental Edu.  
WI Assoc. of Beagle Clubs  
WI Assoc. of Field Trial Clubs  
WI Audubon Council  
WI Conservation Congress  
WI Hunter Ed. Instructors Assoc.  
WI Sharp-Tailed Grouse Society  
Wilderness Sportsman's Club  
Wings Over WI – Beaver Dam  
Wings Over WI – Green Bay  
Wings Over WI – SW Chapter  
Wings Over Wisconsin – State Chapt.  
Wisconsin Bass Fisherman's Assoc.  
Wisconsin Carpenter's Union  
Wisconsin Deer Hunters Association  
Wisconsin Dept. of Natural Resources  
Wisconsin Muzzleloader Assoc.  
Wisconsin Outdoor Alliance  
Wisconsin Society for Ornithology  
Woods & Waters Sportsman's Club

## **Wyoming**

Mark Winland, President of the Board  
Wyoming Wildlife Federation

*C. The following is excerpted from The Wildlife Society's report Global Climate Change and Wildlife in North America, Inkley et al., 2004*

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## RECOMMENDATIONS

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The pervasiveness, magnitude, and complexity of global climate change and variability are so daunting that taking advantage of positive effects and preventing or minimizing negative effects may initially appear futile. Further, given the difficulties of simply predicting the scale of broad climate changes underway and projected for the decades ahead, climate change may seem totally irrelevant in our daily lives or even in our lifetimes. Nothing could be further from the truth.

The adverse effects of climate change on wildlife and their habitats may be minimized or prevented in some cases through management actions initiated today. Likewise, positive or desirable effects that occur may be enhanced if anticipated. Herein we present a set of recommendations or actions to assist wildlife biologists in coping with the challenges of global climate change to help ensure a brighter future for wildlife.

To plan and respond effectively, managers must first understand the nature of climatic and ecological changes that are likely to occur in their regions. Numerous adaptations and combinations of approaches should emerge as experienced resource managers gain a better understanding of the changes that are likely to occur to habitats and species. The following 18 recommendations should assist managers in meeting the challenges of climate change when working to conserve our wildlife resources.

### **1) Recognize global climate change as a factor in wildlife conservation**

Adaptation starts with recognition that climate change is occurring. Planners and managers should become better informed about the consequences of climate change and variability on the resources they work with. This technical review provides an introduction of the basics and should act as a springboard for learning more. Although further research is needed, some data on changes in regional climates, biomes, individual species, and potential faunal changes are available.

### **2) Manage for diverse conditions**

Given the uncertainties inherent in projecting the extent and rate of climate change, one management approach is to develop what are known as “no regrets” management strategies. These are sound wildlife management strategies under current conditions, yet remain viable as the climate warms. Restated, the better you can manage under unusual weather conditions today (e.g., drought and flood), the better prepared you may be for future climate change and variability.

### **3) Do not rely solely on historical weather and species data for future projections without taking into account climate change**

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Managers must be aware that historical climate, habitat and wildlife conditions are less reliable predictors as climate changes. For example, some migratory birds are returning as much as 3 weeks earlier than previously observed (Root et al. 2003). If bird population surveys continue to be conducted the same week each year based on historic observations, they could be significantly biased. The problem is considerably more complex for surveys such as the national Breeding Bird Survey that survey many avian species, some of which may change migration timing and some of which may not. Similarly, conducting hunting seasons in the same time period each year may mean that harvest levels are either over- or underachieved if the timing and/or pattern of seasonal movements changes.

#### **4) Expect surprises, including extreme events**

Surprises in climate change and the wildlife and habitat responses to it could occur. For example, “100-year” floods may become much more frequent because the precipitation cycle changes. Another surprise may be an insect pest suddenly switching from one generation per year to two generations per year—with increased habitat damage as a result. Flexibility in natural resource budget processes will give managers better capability of dealing with surprises as they occur.

#### **5) Reduce nonclimate stressors on ecosystems**

The reduction of stressors caused by human activities may increase the resiliency of habitats and species to the effects of climate change and variability. In essence, this situation is what good management already seeks to accomplish. However, a changing climate amplifies the need for managers to minimize effects these stressors have on wildlife populations.

#### **6) Maintain healthy, connected, genetically diverse populations**

Small populations and/or more isolated populations are more prone to local extirpations than larger, more widespread populations. Healthier or more robust species and habitats should be better able to adapt to climate change as an additional stress. Although these are goals managers already strive to accomplish, climate change increases their importance.

In addition to government resource agencies, various entities focusing on conservation of specific taxa must include global climate change in their thinking and planning. For example, these groups should include the North American Bird Conservation Initiative, Partners in Flight, North American Wetlands Management Plan, Partners in Reptile and Amphibian Conservation, North American Shorebird Plan, and Western Hemisphere Shorebird Reserve Network.

#### **7) Translocate individuals**

In some cases, it may be necessary to physically move wildlife from one area to another to maintain species viability. However, translocation is not only expensive but it introduces its own potential problems (e.g., disease transmission) to wildlife management. Introduction of exotic species can have devastating effects on host ecosystems, including the extinction of native fauna (McKnight 1993). The unpredictable consequences of species introductions mean that translocation should be severely limited as a conservation strategy to deal with climate change.

#### **8) Protect coastal wetlands and accommodate sea level rise**

Impacts of sea level rise can be ameliorated with conservation easements and acquisition of inland buffer zones to provide an opportunity for habitats and wildlife to migrate inland. Setback

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lines for coastal development can be effective at establishing zones for natural coastal migration based on projected sea level rise and subsidence projections that include local land movements. Storm surge should be considered in establishing buffer zones and setback boundaries. In other cases, restoration of natural hydrology could facilitate sediment accretion and building of deltaic coastal wetlands.

#### **9) Reduce the risk of catastrophic fires**

Fire is a natural part of many ecosystems; however, climate change could lead to more frequent fires and/or a greater probability of catastrophic fires. For instance, in areas that experience lower precipitation from climate change, reductions in soil moisture can increase drought stress on plants, making them more vulnerable to disease and pest outbreaks, thereby increasing mortality. This factor, in turn, could lead to more frequent fires or a greater probability of catastrophic fires. Managers can use prescribed fires and other techniques to reduce fuel load and the potential for catastrophic fires.

#### **10) Reduce likelihood of catastrophic events affecting populations**

Increased intensity of severe weather places wildlife at risk. Although it is not possible to avoid the disturbance itself, it may be possible to minimize the effect of the event. For example, securing water rights to maintain water levels through a drought or having an infrastructure capable of surviving floods should minimize impacts. Maintaining widely dispersed and viable populations of individual species also minimizes the probability that localized catastrophic events will cause significant negative effects. Having multiple, widely spaced populations may offset some of the population losses attributable to widespread events such as hurricanes.

#### **11) Prevent and control invasive species**

Rapidly changing climates and habitats may increase opportunities for invasive species to spread because of their adaptability to disturbance. Already a very significant problem (McNight 1993) for native plants and wildlife, invasive species control efforts will be essential, including extensive monitoring and spot control to preclude larger impacts. Existing invasive species in southern regions should be monitored and aggressively controlled to preclude northward movements as climates warm.

#### **12) Adjust yield and harvest models**

As fish and wildlife populations respond both directly to climate and indirectly to climate through changes in habitats, their productivity and sustainability may increase or decrease. Drought may require increased harvest to reduce the impact of the species on its habitat. Alternatively, stressed populations may need to be protected from harvest so that the population remains large enough to recover once the stress has been removed. Managers may need to adapt yield and harvest regulations, perhaps well beyond historic parameters, in response to climate variability and change. This could be aided greatly by a better understanding of sources of variation in vital rates, especially for exploited populations, coupled with monitoring programs to detect trends in those vital rates most influential in population change.

#### **13) Account for known climatic oscillations**

Short-term periodic weather phenomena, such as El Niño, should be closely monitored and predictable. By understanding effects of periodic oscillations on habitats and wildlife,

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management options can be fine-tuned. For example, restoration of native plants during the wet phase of oscillations could make the difference between success and failure.

#### **14) Conduct medium- and long-range planning**

Climate change and variability should be considerations in all medium- and long-range planning exercises. Plans longer than 10 years should take into account potential climate change and variability as part of the planning process. This planning should also apply to National Environmental Policy Act–mandated Environmental Impact Statements, especially for any area potentially affected by sea level rise. If climate change and variability are not proactively taken into account, the potential for conservation plans to succeed will likely be much reduced.

#### **15) Select and manage conservation areas appropriately**

As wildlife and habitats have declined across North America, the establishment of refuges, parks, and reserves has been used as conservation strategy. However, placement of conservation areas has rarely taken into account potential climate change and variability, even though the problems of climate change and conservation area placement were pointed out in the mid-1980s (Peters and Darling 1985). In highly fragmented habitats, the placement of conservation areas on a north–south axis may enhance movements of habitats and wildlife by in essence providing northward migration corridors. Efforts to conserve habitats for single, or small numbers of species, should be concentrated in northern portions of their range(s), where suitable climate is more likely to be sustained.

Managers of existing conservation areas should consider climate change and variability in developing future management plans (Solomon 1994, Halpin 1997). Specifically, this planning should include assessing the vulnerability of key taxa in the preserve (Herman and Scott 1994) and monitoring potential effects related to climate change (Solomon 1994). Reintroductions of native species should be more likely to succeed in more northerly areas within a species historic range.

#### **16) Ensure ecosystem processes**

Ultimately, managers may need to enhance or replace diminished or lost ecosystem processes. This could mean manual seed dispersal or reintroducing pollinators for some plant species. In the case of pest outbreaks, increased pesticide use with accompanying potential health risks (human and wildlife) and economic costs (Colborn et al. 1996, Kirk et al. 1996, Herremans 1998) may be required. Enhancing or replacing other services, such as contributions to nutrient cycling, ecosystem stability, and ecosystem biodiversity are much harder to imagine. The loss or reduced capacity of ecosystem services may be one of the major sources of surprise from climate change and variability.

#### **17) Look for new opportunities**

Managers must be continually alert to anticipate and take advantage of new opportunities that arise. For example, if climatic conditions render existing agricultural areas unusable for agriculture, they could become important wildlife conservation areas with appropriate management. As a means of mitigating global climate change, some industries are investing in carbon sequestration programs by planting trees. In some regions, grassland and wetland conservation may benefit similarly, but more research is needed on carbon cycling in these

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systems. Collaborating with industry to invest in restoration of habitats has significant potential to offset impacts from global climate change.

### **18) Employ monitoring and adaptive management**

Uncertainty concerning climate change means we should monitor climate and its effects on wildlife and their habitats. Wildlife managers must try to anticipate impacts to wildlife and use monitoring data to quickly adjust management techniques and strategies. Relying on traditional, long-practiced methods and strategies will most likely be less effective as environmental conditions change. In a given area, adaptive management could be as diverse as adjusting regulations, being more proactive in habitat management, and/or changing management objectives altogether.

Source: Inkley, D.B., Anderson, M.G, Blaustein, A.R., V.R. Burkett, Felzer, B., Griffith, B., Price, J., and Root, T.L. Global climate change and wildlife in North America. Wildlife Society Technical Review 04-02. The Wildlife Society: Bethesda, MD.

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