EARTHJUSTICE
Because the earth needs a good lawyer

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# Global Warming - Now is the Time

## PREAMBLE

–U.S. Fish and Wildlife Service

Global warming and its impacts on wildlife and habitat will become the leading new cause of species extinction over the next several decades.[1] The effects are already being felt. A recent survey involving nearly 1,600 species in the United States shows that approximately half these plants and animals already are showing significant impacts from global warming.[2] Another analysis of 143 studies finds effects in a broad range of species, "from mollusks to mammals and from grasses to trees."[3] While this information is sobering, it also provides an opportunity to act before it is too late.

Now is the time to recognize that it is imperative that we help species that are in trouble due to global warming: species like polar bears experiencing disappearing sea ice, Pacific salmon impacted by warmer sea temperatures and lower stream flows, amphibians facing new diseases spurred by global warming, grizzly bears with diminishing food sources in part because of beetle infestations hastened by warmer temperatures, and cold-dependent New England sugar maples. Now also is the time to remember that helping such species protects resources and ecosystems crucial for our own survival and quality of life.

Stemming global warming is an indispensable response to looming biodiversity loss. But along with addressing global warming overall, new initiatives are needed to help specific species, especially those already recognized as endangered or threatened. Now is the time to determine which species and habitats are most at risk from global warming -- and to pinpoint actions necessary to ensure they are not lost forever.

## INTRODUCTION

The earth's climate system has demonstrably changed in both global and regional scales since the pre-industrial era. The atmospheric concentrations of key greenhouse gases (GHG)[4] reached their highest recorded levels in the 1990s, primarily due to the combustion of fossil fuels, agriculture, and land-use changes.[5]

Global mean surface temperatures have warmed between about 0.7 and 1.5° F during the 20th century.[6] Climate change simulations for the period of 1990 to 2100 predict that average surface temperatures will increase between 2.5 and 10.4° F relative to 1990.[7] Global warming is doing more than raising the earth's temperature. Secondary effects of the disruptions to the planet's climate system from GHG build up include alterations to regional temperatures, a rise in sea level, and shifting rain and snowfall patterns around the world.

So what does this mean for wildlife? And of particular importance, what does this mean for species that are already at risk and the habitat they need for survival? Climate change over the past 30 years has produced numerous shifts in the distribution and abundances of species and has been implicated in one species-level extinction.[8] It is anticipated that changes in natural systems will continue and become even more apparent in the future, resulting in the degradation and loss of U.S. biodiversity.[9] With continued and more severe changes in the climate, the ability of U.S. wildlife to adapt through migration and physiological change will be increasingly limited.[10]

Regional impacts of global warming are already evident. In the arctic, for example, "average temperature has risen at almost twice the rate as the rest of the world in the past few decades. Widespread melting of glaciers and sea ice and rising permafrost temperatures present additional evidence of strong arctic warming."[11] Similarly, the temperature in the Pacific Northwest has increased 1.5° F on average during the 20th century causing changes in precipitation levels, peak snow accumulation and snowmelt-derived streamflows.[12]

The bottom line: the time to act is now. We cannot afford to wait any longer to protect species and the places they call home.

## HOW WILL CLIMATE CHANGE IMPACT WILDLIFE?

The global, regional and local shifts in climate caused by global warming have already had significant effects on wildlife. At least one species of amphibian—the golden toad in Costa Rica's cloud forests—is thought to have been pushed into extinction by climate change as the humidity level the frog required to survive dropped in response to warming temperatures. Researchers are studying the impacts of mid-range climate scenarios on species extinctions and the projections are alarming - 15 to 37 percent of the world's species would be "committed to extinction" by 2050.[13] Temperature change at the higher end of the range of possibilities, as well as eliminating assumptions like the ability of species to move to alternative habitat, yielded much higher extinction rates. A recently released report from the United Nation's Intergovernmental Panel on Climate Change (IPCC) approximates that 20-30% of animal and plant species could be at an increased risk of extinction if increases in global average temperatures exceed 1.5 to 1.5 degrees Celsius; with up to 60% species loss in some areas if global warming continues unabated. The report also discusses other serious effects global warming could have, such as fishery collapses, widespread coral mortality, and extensive loss of biodiversity.[14]

While many species might be able to accommodate to these changes in a pristine environment, the earth's habitats are so heavily developed that there is often no place left to go when habitat no longer supports a species. The situation is even more dire for endangered and threatened species. Endangered and threatened species already exist in a tenuous state, and it will not take much to push them to extinction.

There are a number of pathways which climate change has and will harm at risk species, reflecting the enormous complexity of biodiversity that has evolved in a relatively stable climate system. Several of them are discussed below.

### SEASONAL ACTIVITIES AND BEHAVIORS

–U.S. Fish and Wildlife Service
**Tree Swallow**

Global warming is impacting seasonal activities and behaviors of different species. One study found that in each of the last five decades, spring events in temperate zones took place an average of five days earlier than the decade before it.[15] Examples of spring events with altered timing include earlier arrival and breeding of birds, earlier appearance of butterflies, earlier breeding behavior in amphibians, and earlier sprouting and flowering of plants.[16] Global warming is attributed to be the cause of this shift.[17]

These shifts can have significant impacts on wildlife because not all species respond the same way. For example, data shows that the caterpillar of the winter moth, which relies exclusively on young oak leaves for food, now hatches earlier in response to warming trends. However, the oak leaves have not responded in kind and there is an inadequate leaf supply available when the caterpillars hatch, resulting in declines in the moth population. This then triggers changes through the ecosystem as the caterpillar and moth become unavailable as food sources for birds.

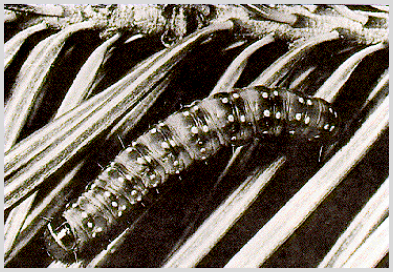
## SHIFTS IN RANGE

- U.S. National Park Service
**Edith's Checkerspot Butterfly**

The geographic ranges of numerous wildlife species around the world are shifting. In one statistical review of historical observations of 1,700 species, the research shows that climate change is causing significant range shifts either toward the poles or up mountain slopes in response to warming trends.[18]

However, because most habitat is so heavily fragmented, species are losing habitat without gaining access to new alternative habitats nearer the poles or at higher elevations.[19,20] This habitat loss increases the likelihood of extinction, and for species already at risk it makes the future even more uncertain.

## INVASIVE SPECIES AND PESTS



- U.S. National Park Service
**Spruce Budworm**

Effects of climate change on invasive species are expected to be important determinants of future ecosystem structure and productivity.[21] However, studies of invasion biology have rarely considered climate change, and *vice versa*.[22] Such research is important and essential in the discussion of protecting imperiled species because biological invasions can have strong effects on the structure and function of ecosystems that are responding to a changing climate and on the services provided by those ecosystems.[23,24]

The effect of invasive species on native biodiversity can be severe. A study by Cornell University says that 42 percent of the species on the threatened or endangered species lists are at risk primarily because of non-indigenous species.[25] The National Invasive Species Council attributes invasive species to be the second leading cause, after habitat loss, of species being listed as imperiled.[26]

Climate change has also been linked to the spread of diseases that have played a major role in bringing one-third of all amphibian species to the brink of extinction.

## CHANGES TO AQUATIC HABITAT

- U.S. Geological Survey
**Pacific Salmon**

Climate change has already altered patterns of rain and snowfall accumulation from which the characteristics of many aquatic habitats are derived. In the Pacific Northwest, for example, warming temperatures have shifted the timing of peak snow accumulation and snowmelt-derived runoff, decreased the total snowpack, and melted glaciers.[27] This means significant changes in the timing and level of stream flows, water temperatures and water quality.

For example, with less snowpack to provide water for summer flows, already high temperatures and low flow levels will make it harder for salmon to migrate, rear, and spawn. As different species and stocks have developed over time, the migratory and spawning behavior that corresponds with variations in streamflows may not be able to adapt to such rapid changes to the habitat they need for survival. Similarly, excessive spring and winter flow events can scour riverbeds needed for spawning and wash away salmon eggs.[28]

## SEA LEVEL RISE & COASTAL ECOSYSTEMS

- Massachusetts State Government
**Piping Plover**

Accelerated sea level rise is regarded as one of the most certain consequences of increasing global temperature.[29] Average global sea level rose 10-25 cm during the past 100 years, and is projected to increase 2- to 4- fold in the next 100 years.[30] Significant melting of either the Antarctic or Greenland ice covers could raise sea levels even higher, significantly altering the earth's landscape.

The projected impacts of sea level rise on habitat include inundation of inland areas, loss of current coastal habitats, increased tidal flushing in estuaries, altered productivity in marsh areas and changes in salinity levels in estuaries and adjacent habitats. Sea level rise also poses threats to wildlife that need these areas for survival, such as shorebirds that use sand dunes, tidal marshes, and coastal wetlands for breeding.[31]

Impacts would be particularly high for the imperiled Piping Plover. Plovers need inter-tidal mud flats and tidal rivers for feeding, dune grass for resting and hiding, and intact dune systems with frontal dunes and sandy spits for nesting. Only a few such places are left along Maine's coast. Sea level rise means loss of habitat for this species. Coastal ecosystems are among the planet's most biologically productive, however these areas are increasingly under threat from climate change. For example, sea level rise poses a major threat to mangrove ecosystems through sediment erosion, inundation stress and increased salinity.[32] Mangroves provide important services for adjacent ecosystems such as nursery habitat and sediment trapping for water quality. Inundation of mangrove habitat and loss of this important ecosystem will impact coastal species diversity.

## DISRUPTION TO OCEAN ECOSYSTEMS

- National Oceanic and Atmospheric Administration
**Bleached Elkhorn Coral**
(St. Croix, U.S. Virgin Islands)

Some of the more frightening potential consequences of climate change are occurring in the world's oceans. Climate change has resulted in warmer water and increasing acidification caused by the absorption of $CO_2$. Warming water has contributed to the bleaching of coral reefs and their inability to provide habitat for countless ocean species. Scientists project that a majority of the world's reefs will face extensive bleaching in the next 20 to 40 years.[33] Higher temperatures and increasing acidification can cause dramatic changes to the marine food web from plankton to marine mammals and seabirds. Acidification also prevents marine organisms from absorbing minerals like calcium that make their skeletal structures. In recent decades, plankton levels have declined sharply along the Pacific Coast, and reports of ever growing "dead zones"—not attributed to pollution—have sparked concern.

Similarly, the dramatic warming trends in the artic regions have resulted in sharp reductions in the amount of sea ice available. Countless artic species rely on sea ice, including polar bears, seals, walrus and various birds.

## WHAT DOES THIS MEAN FOR ENDANGERED AND THREATENED SPECIES?

Today, right now, we are experiencing the impacts of climate change. However, the global community is taking measures to curb emissions and the U.S. is exploring new technologies, innovations and steps that we can take as a nation to reduce our carbon output. However, if all sources of GHG emissions were eliminated tomorrow, the ongoing presence of current levels of GHG's in the atmosphere will continue to impact earth's climate, effecting our natural systems. So, we must act now.

It is imperative that in the meantime, we take measures to protect already at-risk species. From the perspective of imperiled species, our policies must help species cope with these inevitable changes to their habitat that have already begun. For some species, that means creating habitat corridors or other options for facilitating migration to a more suitable habitat. For others, we can reduce the other pressures on their existence that leave them less resilient to the new challenges of climate change. We need information and action that focus on adaptive strategies to help as many at-risk species as possible – and influence on-the-ground management decisions in time to save species.

## WHAT WE CAN DO - "ARK"

Now is the time for in-depth understanding of the link between global warming and extinction – an understanding that leads to solutions to safeguard the diversity of life. To achieve this depth, and since action to aide specific species often is local, now is the time to work together at the regional, national, and continent-wide levels.

We urge our leaders to consider policies that encourage information sharing, discussion and action at all levels—regional, national and throughout North America. What we can do:

- **A**gency requirements: Require that *federal agencies now begin identifying ways to contribute to the survival and recovery of species impacted by global warming*. Federal agencies manage a great deal of land in the U.S., and many existing federal agency plans and activities provide an opportunity for consistent consideration of both global warming and ways to mitigate its impacts
- **R**egional and North American *scientific symposiums* to save the species: regional and North American scientific symposiums are needed to address these issues at a regional scale and continent-wide scale; allowing for extensive discussion and information exchange.
- **K**nowledge: Published items, including a National Academy of Sciences report on the Impact of Biodiversity from Climate Change, with an emphasis on endangered species and ecosystems.

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