

## The Effects of Climate Change on Animals

A key point about climate change is this: animals of almost all species will suffer along with -- but much more (in terms of numbers) -- from climate change than human beings will. Yet the devastation of animal life from climate change is seldom mentioned in any of the hundreds of reports from myriad government and professional agencies. The closest they come to describing the effect on the animal kingdom is to mention that extinctions will increase dramatically. But the reports seldom if ever get around to mentioning that heat waves, droughts, floods, wildfires, increasing diseases, sea level rise, and more intense hurricanes and other extreme weather will harm far more animals than people.

Many of the people who are the most innocent of causing climate change will suffer the most compared to the major players that are responsible for the problem and its continuation. How much more innocent are all the non-human living beings that will lose food, shelter, habitat, and in many cases, their lives!

In addition, some animals face climate change threats that humans don't, such as increasing ocean acidification along with higher ocean temperatures that destroy corals, shellfish, and the plankton that many marine animals depend on to survive. Disappearing sea ice may be beneficial to shipping interests, but leads to starvation and death for polar bears. In Australia, wildfires endanger the survival of the iconic koala population. Humans can escape wildfires; koalas can't.

This report will outline the many ways that climate change is damaging to wildlife and domestic animals along with human beings. It starts with a review of some of the evidence that climate change is happening and is almost entirely man-made.

\*\*\*\*\*

### *Is climate change real?*

Evidence comes forth nearly every day to show that climate change is real.

A) 18 of the 19 warmest years in recorded history have occurred in the 21<sup>st</sup> century. In 2016 the temperature exceeded historical values by almost 1.8<sup>o</sup>F. These temperatures would have been even higher except that the oceans absorb 90% of the excess heat. However, the excess heat stored in the vast oceans will eventually be released into the atmosphere.

B) The oceans have risen more than a foot since the late 1800's, and the rise is accelerating. Both thermal expansion as the ocean temperature rises and melting of ice sheets and glaciers contribute to sea level increase. Greenland alone has lost 280 billion tons of ice *per year* since



2002, while Antarctica has lost nearly 250 billion tons per year. Island nations are losing land area as the oceans rise. Some will soon be lost (under water) completely.

C) In 2018, 49 inches (4 feet!) of rain fell in 24 hours in Kauai, Hawaii. Extreme rainfall, 10 – 20 inches in short time periods, occurred in multiple states in the US. Flash floods took place in many locations, causing widespread destruction and loss of life. More flooding comes from ocean surges that inundate coastal towns and cities along the US East Coast. Hurricanes have increased in intensity and duration as more moisture and more heat energy transfer into the



atmosphere. Thousands of glaciers world-wide have been lost.

D) In some cases, the very ground that buildings, cities, and roads are built on is collapsing. The permafrost is a mix of vegetation and ice mixed with soil that makes up the land in high latitudes like Alaska, Siberia, and the Arctic. The permafrost is melting, causing houses to collapse and roads to buckle. The cause of this is the abnormally-high temperatures in these regions, as much as 15<sup>o</sup>F above normal. When the permafrost melts, it can release both CO<sub>2</sub> and methane, (CH<sub>4</sub>), potent greenhouse gases, causing a positive feedback that further accelerates the melting.



E) Wildfires have increased in number and intensity all over the world as warming dries out the forests and ground vegetation becomes more combustible. Numerous forest fires in California and the Southwest, Alaska, Australia, Spain, and Indonesia are related to these more flammable conditions exacerbated by climate change. Droughts also increase the conditions conducive to wildfires. While floods due to extreme precipitation and sea level rise devastate some regions of the globe, droughts with the damage to vegetation, water supplies, and wildlife plague other regions. Droughts have become more common due to climate change.



F) The average temperature of the planet may be a few degrees higher than past values, but even more significantly, periodic heat waves that can have temperatures 10°F higher than normal are becoming more common and more widespread. High temperature records are being set in countries all over the world. Heat waves across the globe are becoming more frequent, last longer, and have higher temperatures. Heat-related deaths are increasing, and the numbers are expected to continue to climb. A heat wave in Europe in 2003 killed an estimated 35,000 to 70,000 people. Heat waves occur in the oceans also, where a few degrees increase has brought disaster to marine ecosystems, already damaging coral reefs worldwide and driving down fish populations in normal fishing areas when fish migrate to cooler waters.

Some recent heat wave temperature extremes in the last several years:

Los Angeles	- 108°F
Paris	- 110°F
Australia	- 114°F
France, Europe	- 115°F
India	- 118°F
Arizona	- 119°F
Pakistan	- 122°F
Northwest India	- 123°F
Algeria	- 124°F
Turbat, Pakistan	- 129°F
Kuwait	- 129°F

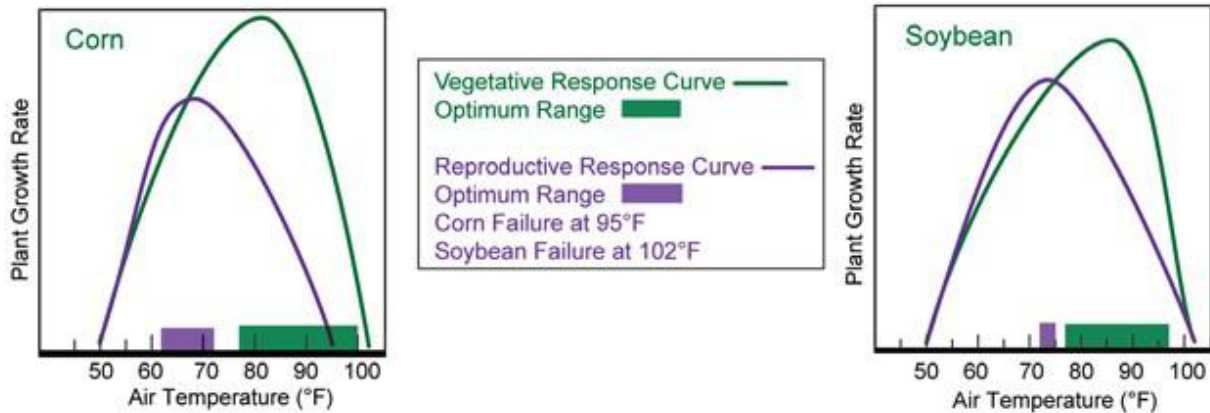


An even more important measure of discomfort and danger is the “heat index,” which combines temperature and humidity and is the temperature that living beings supposedly “feel.” As global temperatures rise, leading to more water evaporation, the heat index rises even more. Iran has already experienced a heat index of 163<sup>o</sup>F, at which no living being can survive for long. To add to the problem, nighttime temperatures, which used to bring relief by cooling things down, have begun to remain high in many parts of the globe, especially in cities.



G) Diseases are on the rise due to climate change. In Russia, melting permafrost uncovered reindeer that had died from Anthrax centuries ago, causing the spread of Anthrax today for animals and people. Mosquito populations are increasing and extending both their geographic range and active period, resulting in the spread of Zika, dengue, and chikungunya viruses, which are often extremely painful and can be fatal. Malaria, Lyme disease, and livestock diseases are also increasing their ranges. Warmer temperatures increase the host populations (ticks, mosquitoes) and the rate at which the pathogens themselves reproduce and mature. Yellow fever, once rare, has seen outbreaks in South America. Smoke from wildfires in Asia and smog from industrial or coal-fired power plants are causing increases in respiratory diseases as winds that would normally disperse the pollution become stagnant due to global warming’s effect on wind patterns. Both floods and droughts have worsened the spread of infectious diseases.

H) “The Food Supply Is At Dire Risk, U.N. Experts Say.” This was on the front page of newspapers in August 2019. Floods, droughts, storms, even heat waves threaten the global food supply. Higher concentrations of CO<sub>2</sub> in the atmosphere can make plants grow faster, but the nutritional value of those crops decreases. Growing seasons have become shorter in some locations due to adverse climate conditions. Both floods and droughts can destroy crops before they can be harvested. Temperature increase also represents a danger. Crop yields peak around 90 to 95<sup>o</sup>F and drop rapidly at higher temperatures which are expected to occur or are already occurring in many present agricultural zones, causing some growing zones to decrease in size and others to migrate to higher latitudes. Precious topsoil is also being lost from floods, erosion, and desertification made worse by climate change. Farm animals like cattle contribute inadvertently to the climate change problem due to their methane emission and because forests are being destroyed to raise cattle. The Earth needs trees to be preserved and planted, not cut down to produce more farm land.



I) Endangerment and extinction of species has greatly accelerated, so much so that ecologists are calling this period the “6<sup>th</sup> mass extinction.” As habitat is lost to drought and floods, as sea levels rise and inundate islands, as wildfires increase and burn forest dwellers to death, as diseases spread in intensity and range, endangered animals pay the price. Estimates are that in this period of climate change, the rate of extinction has increased 100 to 1000 times the natural extinction rates throughout history.

\*\*\*\*\*

***Is it natural or man-made?***

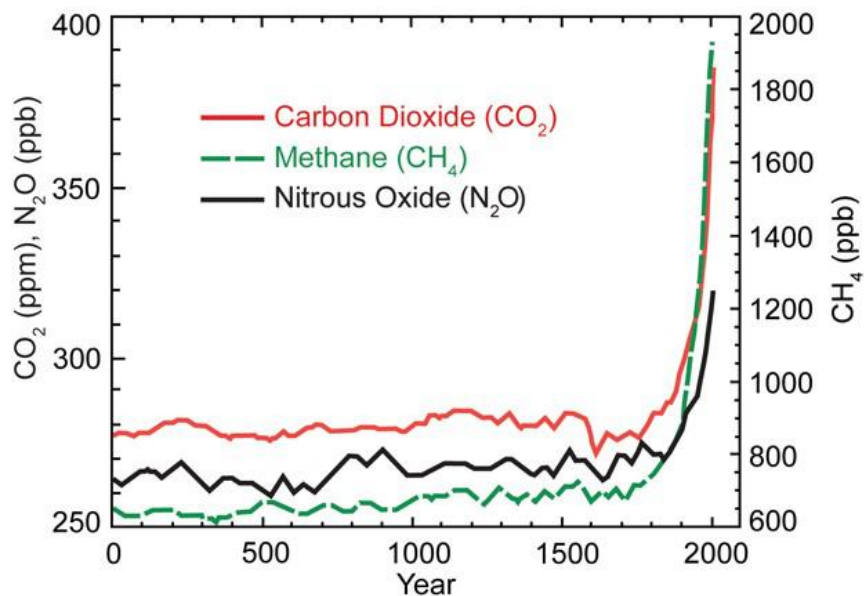
Since it is established that climate change is happening, one question is whether it is the result of natural causes or whether humans have contributed to it (or caused it. If it’s natural, then we supposedly couldn’t do much about it). There have been many ice ages and warming periods over the last millions of years, roughly every 80 - 90,000 years, so perhaps the change going on today is just more of the same, so the argument would go. The evidence that global warming is occurring is abundant: ice cores, tree rings, ocean and fresh water sediments, geological formations, coral reefs, and other evidence can be used to put the story together. Ice cores in particular give data going back millions of years.

The Earth, its oceans, mountains, land areas, represents a huge “thermal mass.” It takes enormous amounts of energy to make significant changes in the average temperature. Even a 1<sup>o</sup>C temperature rise takes gigantic amounts of energy and takes place by natural occurrence over a *minimum* of 1,000 – 2,000 years. In the last 50 – 100 years, the temperature has risen 1<sup>o</sup>C, a rate *at least* 10 times what could be explained by natural causes. Over the next century, if emissions remain on their present course, the expected temperature increase could be 2 to 6<sup>o</sup>C, at a rate not seen in the last 55 million years and a rate 50 - 100 times what could be explained naturally. Most of this warming has occurred in the last 35 years. The hottest summer of the last 20 years, when heat waves killed thousands of people, could become the new average. In the past, a 2 to 5<sup>o</sup>C temperature rise did indeed take place naturally, several times in fact, but it took 20,000 years for that change to occur. Now it’s happening in a few decades.

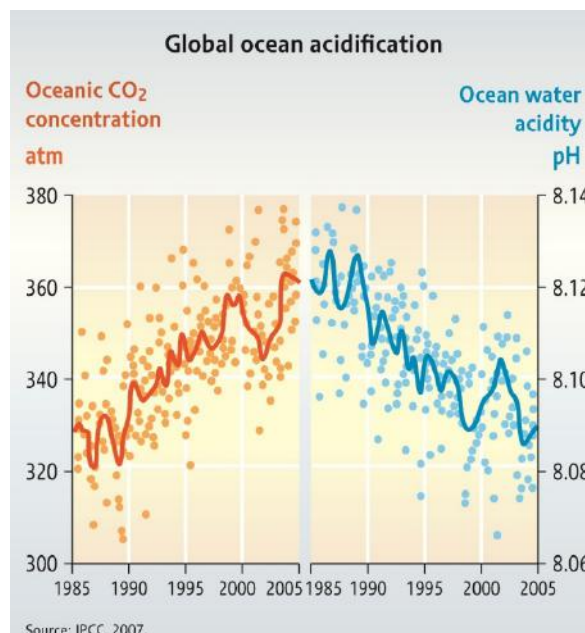
What about greenhouse gases? Ice core data shows that CO<sub>2</sub> in the atmosphere has fluctuated between 180 and 280 parts per million (ppm) over the last 800,000 years and has hovered between 270 and 280 ppm for the last 2,000 years. The global temperature historically correlated very closely with the CO<sub>2</sub> concentration, rising and falling in tandem. In the last 100 years, the CO<sub>2</sub> concentration

has shot up to 410 ppm, and is on a steep incline, expected to rise to 500 ppm by 2100 as the temperature climbs 2-5°C. This is a rate 100 to 1000 times higher than has occurred naturally. CO<sub>2</sub> concentrations are now higher than they have been in the last 30 million years.

A similar abrupt increase in methane has taken place in recent years at a rate tens to hundreds of times faster than in the last million years. Methane increases can come from decomposing vegetation, cattle, deforestation, melting permafrost, and gas leaks at gas wells. In the last few decades, methane concentrations in the atmosphere have increased nearly 4-fold compared to the average of the last 800,000 years.



At the same time that the earth's temperature has risen, the solar intensity has fluctuated by less than 0.08% and is actually less now than when the global temperature began to increase. Solar activity, if anything, has decreased its influence on climate change in the last 60 years. Finally, the oceans have been absorbing much of the excess CO<sub>2</sub> emissions from the atmosphere, making them more acidic compared to the historical average and together with higher ocean temperatures is killing coral reefs that have flourished for millions of years. The oceans have become 30% more acidic over the past century and the rate of acidification is accelerating, conditions not seen for 300 million years.



Bottom line – climate change can happen naturally but at a rate at least 100 times slower than is happening now. Only human influence can cause this degree of change in such a short time, and the rate of change is accelerating, to the great peril of humans and animals alike.

\*\*\*\*\*

### ***Consequences to people and animals***

Biologically, animals and people, including all the life in the oceans, have adapted well to the climate that has existed for thousands of years. As changes occurred slowly, species including humans evolved and, it can be said, thrived. However, sudden changes in the environment that occur over a few decades, or even hundreds of years, bring new difficulties for both to adapt to a new ecological reality. Compounding the problem, in climate dynamics there can be a considerable delay between cause and effect. It takes decades for glaciers to melt, decades for permafrost to melt, decades for atmospheric temperatures to rise, and most importantly, most of the extra heat endangering the earth is absorbed in the vast oceans (out of sight, out of mind?) which will delay the truly serious effects for a number of years. This delay causes confusion. People are more used to thinking in time scales of years rather than decades or generations. It is our children and grandchildren who will bear the brunt of the problem.

Scientists talk about answers to climate change in terms of mitigation and adaptation. Mitigation is the attempt to halt or at least slow down the march of global warming and climate change. Adaptation is the means of adapting to all the problems that might occur.

Mitigation doesn't seem to be going too well, especially when climate change deniers are in power. Adaptation has a better chance, at least in the short run. People can escape heat waves by staying indoors with air conditioners or jumping into swimming pools. They can escape floods and sea level rise by moving to higher ground, assuming the present occupants will accept them. They can escape wildfires by building their homes away from fire zones and if caught in the wrong place during a wildfire, at least they have a chance of escape by driving away as fast as cars and roads will allow. If they catch a disease or become injured, trillion-dollar medical establishments exist to save them. If crop growing conditions become difficult or prohibitive in one place, they can establish new farms in more favorable locations, and if the smoke and smog from fires and coal-fired power plants threatens them with respiratory diseases, they can move indoors where the air can be filtered.

Animals don't have these luxuries. They don't have indoor places or air conditioners to cool them off from heat waves, and there aren't enough lakes and ponds to go around. Floods and sea level rise can destroy the habitat they need to find food and shelter to survive. Birds may be able to fly away from wildfires, as long as they don't mind leaving their nests and young behind, but many forest creatures aren't fast enough to escape fast-moving fires, or they mistakenly climb trees to escape the flames on the ground, only to have the tree burn beneath them. Wildlife can't escape the dangerous smoke and consequent respiratory problems it brings. If they contract one or more of the many diseases becoming worse from climate change, there are few hospitals for wildlife available to help cure them or treat them from injuries caused by hurricanes, tornadoes, thunderstorms, blizzards, and other extreme weather events made worse by climate change. If the food supply dwindles with the habitat loss, the search for food becomes more difficult and starvation may be their lot.

And farm animals on factory farms, like pigs trapped in gestation cages or chickens crammed into tiny cages where they can't even turn around, can't escape the rising water from floods, when extreme precipitation dumps oceans of water onto the saturated land and rivers overflow their banks, causing mass drowning of countless farm animals. Factory farms are designed to make money for the owners at the expense of enormous suffering for the farm animals. They aren't set up to rescue the farm animals when disaster hits.



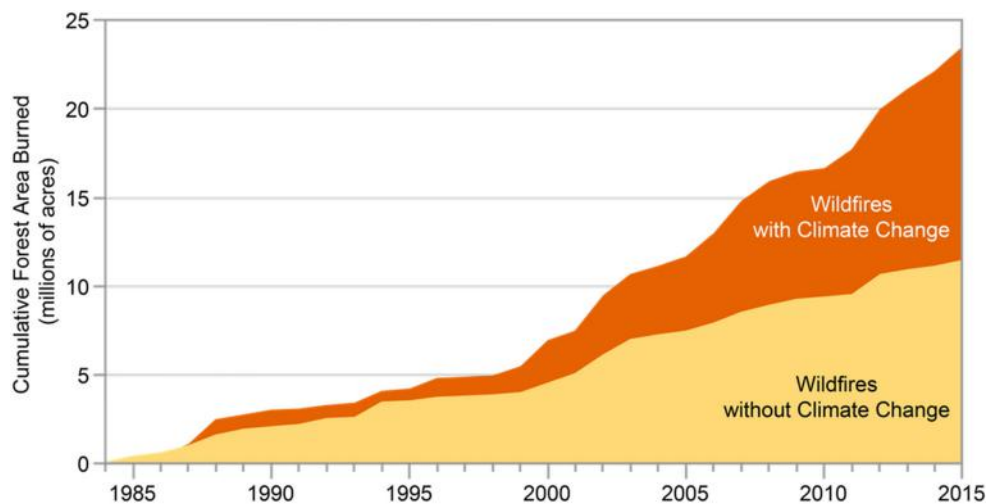
**Wildfires** are deadly to wildlife. High winds can cause wildfires to travel as fast as an Olympic runner. Large mammals like elk and deer may be able to escape but many small animal species are unable and perish. Young animals and small animals are most at risk from fires and even fish and amphibians are at risk as ponds and streams become too warm and polluted with debris. Vast



numbers of invertebrates that can only crawl out of harm's way will almost surely perish.

When wildlife habitat is destroyed by fire, finding food, water, and shelter becomes difficult. Unburned habitat has been shrinking in area and less available due to the sheer number and magnitude of wildfires that destroy millions of acres of habitat each year, creating great hardship for animals trying to survive. New habitat is also likely to be occupied already, creating competition for available resources and possibly exceeding the carrying capacity of the remaining habitat, leading to possible starvation.

Estimates are that climate change increases the number of wildfires that would otherwise occur by 50%. In 2015 there were 68,000 wildfires in the United States that burned 10.1 million acres of forest. There is no doubt that millions, certainly many millions, of wildlife die in these fires, and



the smoke inhalation suffered by humans and animals alike debilitate and kill many more indirectly. Wildfire smoke is linked to hundreds of thousands of human deaths each year across the planet. There



would be many fewer deaths, both human and animal, if the number of wildfires multiplied by climate change didn't take place.

In California and other Western states during the wildfires in recent years, many horses, dogs and cats, and farm animals burned to death or died from heat or smoke inhalation. At the same time millions of wild animals died, and many survivors will suffer from small particle smoke inhalation. Estimates of how many animals died are difficult to establish, but researchers in Bolivia concluded that 18 million animals in that country perished from wildfires in a burned area of 4.45 million acres. In 2019, estimates from Australia were that almost 500 million animals died from wildfires totaling 9.88 million acres, and in 2020 estimates were updated that as many as a billion animals may have died as 15 million acres have burned in total so far. Several unique species in Australia are believed to be nearly extinct from the fires.

In the United States, 8.8 million acres have been lost *on average* to wildfires per year. Using the data from Bolivia and Australia, a crude estimate of wildlife deaths in the US ranges from 36 million to *at least* several hundred million per year: deer, elk, rabbits, lizards, opossums, coyotes, black bears, raccoons, chipmunks, squirrels, birds, mice, badgers, and countless invertebrates. Just from wildfires. And to repeat the main point, climate change makes wildfires more frequent and more intense.

The Amazon rain forest is said to be the “lungs of the earth” because of the enormous amount of forest area with oxygen-generating and carbon-sequestering plant life. It covers 2.3 million square miles and holds several million plant and animal species, many as yet uncatalogued by science. The Amazon is being systematically deforested for logging and for raising cattle for the world's meat supply, adding billions of tons of carbon dioxide to the atmosphere and destroying countless numbers (certainly many millions) of animals. Fires in the Amazon and other rainforests, some caused by nature but many more set deliberately, contribute not only to climate change but to the death of countless animals that can't escape the blazes or the smoke.

***Heat waves*** are just one of the natural disasters that both humans and animals face. According to the NRDC (Natural Resources Defense Council), “in the United States, hundreds of heat-related deaths occur each year due to direct impacts and the indirect effects of heat-exacerbated, life-threatening illnesses, such as heat exhaustion, heatstroke, and cardiovascular and kidney diseases. Indeed, extreme heat kills more Americans each year on average than hurricanes, tornadoes, floods, and lightning combined.” In Europe in 2003, at least 35,000 people died during a heat wave, while in Russia, more than 50,000 people died during another heat wave in 2010. Such numbers can only become worse as global warming and climate change make extreme weather events more frequent and more intense.

Many more animals die from extreme weather events like heat waves than humans do, from the inability to escape the severe conditions. Millions of animals of many species die unseen and unheard in the forests, deserts, and mountains. Animals with fur can't shed their “clothes” to feel cooler; many can't sweat as humans do in the human body's natural cooling mechanism. Birds can only cool off by panting with their beaks wide open, and many die from dehydration as they lose moisture, and many mass die-offs of birds have occurred. Habitats may become uninhabitable as temperatures rise, causing those species and individuals that can't migrate northward or to higher elevations. This potential future isn't just true for animals; it is said that parts of the planet may become uninhabitable for people as well, causing the conflicts, refugee crises, and human migration that have been mentioned before.



It is much more difficult to estimate the number of animals that die from heat waves (and droughts, floods, and storms) in the wild because humans don't usually come into contact with injured and dead wildlife from these causes as they do when fighting wildfires. However, some estimates become available from the farm animal population. In 1995 in the central US, an unknown but significant number of people died from heat waves along with thousands of cattle and 1.8 million laying hens. In July 1999, 3,000 cattle died in Nebraska and in the year 2000, in Australia, 24 people, 2,000 cattle, and an undisclosed number of dogs, horses, and wildlife perished. When 35,000 people died from the heat wave in Europe in 2003, hundreds of thousands of animals of many species also died. In the California heat wave in 2006, 225 people died along with 25,000 cattle and 700,000 chickens and turkeys. In Europe that same year, more than 2,000 people died and untold numbers of animals. In parts of Asia, heat waves and human and animal deaths have become routine; India experiences thousands of people and animals dying from heat extremes nearly every year.

**Droughts** destroy habitats and can cause life-threatening problems for wildlife such as starvation and habitat destruction. The high temperatures dry out the land, cause poor growth of vegetation and crops, and cause water shortages. Many wildlife mass deaths are related to these food and water shortages, which can also lead to the deaths of many farm animals. In 2019, it was reported that 50 elephants starved to death during a drought in Africa. In some cases, entire lakes have dried up, leading to major water crises. Some animals are able to migrate during droughts and heat waves, finding more suitable and hospitable habitat. Birds may be better able to acclimate by flying to better areas, but many animal species can't adapt or move as easily and are more likely to perish.

**Floods** can result from storm surges or torrential downpours or may come from high volumes of water accompanying hurricanes. Human deaths may come from physical injury such as building collapse or from drowning, while wildlife and livestock deaths are most often caused by drowning. Wildlife is also destroyed in the aftermath by loss of livable habitat as flood waters and storms destroy many square miles of land area. Extreme rainfall is becoming more frequent and intense due to climate change, causing rivers to overflow, drowning countless animals directly or destroying their

food sources and their habitat. Rising sea levels are contributing directly to floods, and sea level rise is accelerating.

Thousands of people have lost their lives in storms, hurricanes, and the associated floods. Hurricane Mitch in 1998 killed at least 9,000 people with another 9,000 missing. Hurricane Jeanne in 2004 killed 3,000, and Katrina in 2005 killed at least 1,800. Hurricane Matthew in 2016 killed 46 in the US, and killed at least 1,000 people in the Caribbean and sparked fears of a cholera epidemic from contaminated water.

While these thousands of people died from these killer storms, literally millions of animals were killed at the same time. Some wildlife may be able to escape, fly away from the storm, climb trees, find refuge on floating debris, but others drown en masse, like ground-nesting birds and small animals, invertebrates, the young and newly hatched. Others perish from polluted rivers, streams, ponds, and lakes that receive the runoff from surging and receding waters.

Reliable estimates of wildlife casualties from extreme weather are difficult to obtain since they are scattered over large areas, but the death toll of domesticated animals, primarily livestock, is relatively better known. Hurricane Floyd in 1999 drowned at least 10,000 pigs. Hurricane Matthew and its associated floods is estimated to have killed 5 million chickens and turkeys along with countless pigs in North Carolina alone. The Fort Bend flood in 2016 killed “countless numbers” of cattle, horses, goats, sheep, chickens, and dogs.



Factory farming conditions with livestock confined in large warehouse-like buildings and most often confined in cages as mentioned earlier make it impossible for animals to escape when flood waters inundate these buildings. To make matters worse, flood waters swamp the manure lagoons that accompany pig farms and overflow into rivers and streams, placing wildlife at risk that depend on these waters and possibly contaminating water that humans depend on also. Family pets are at risk also, left behind to drown or starve when people are rescued. During hurricane Katrina, an estimated 600,000 companion animals drowned or starved when they were denied access to shelters along with their human families.

Thousands of people and millions of animals have perished and will perish from storms and floods and heat waves that wouldn't have taken place without climate change.

**Extinction** of the planet's precious wildlife has accelerated at a high rate, largely due to all the consequences of climate change. It is said that the Earth is in the midst of the 6<sup>th</sup> mass extinction, the first since the dinosaurs succumbed 65 million years ago, brought about by the combined effects of pollution, habitat loss, poaching, and climate change. The planet is losing species at the rate of dozens per day, estimated to be 100 - 1,000 or more times the natural extinction rate.

Some species will be able to migrate to alternate habitats, usually farther north or higher elevations, preventing their extinction, but the rapid pace of climate change is likely to exceed the ability of many species to either migrate or adapt. One example is the iconic polar bear, dependent on the disappearing sea ice for food and for survival. Many polar bears are starving and drowning due to their inability to adapt quickly enough as the sea ice disappears and could become extinct in 100 years or less. Adelie penguins, amphibians, reptiles, many species of invertebrates, sea turtles and whales, and some bird and fish species are also seriously endangered due to climate change.



Corals are another example of a species unable to migrate, expand their range, or adapt to climate change. All over the Earth coral reefs are dying due to human influence, from chemical pollution, coastal sediment and agricultural runoff, and also due to rising water temperatures and acidity brought on by climate change as mentioned earlier. A great deal of marine life depends on healthy reef ecosystems to breed, feed, and survive. The Australian Great Barrier Reef, 1400 miles long and visible from space, is in serious trouble, with mass bleaching that has already killed off half of the reef. Around the world, half of the coral reefs have died and 90% are expected to die by 2050 at the present rate of climate change. The accelerating loss of coral reefs around the world is a serious danger to many species of marine life, including the corals themselves.

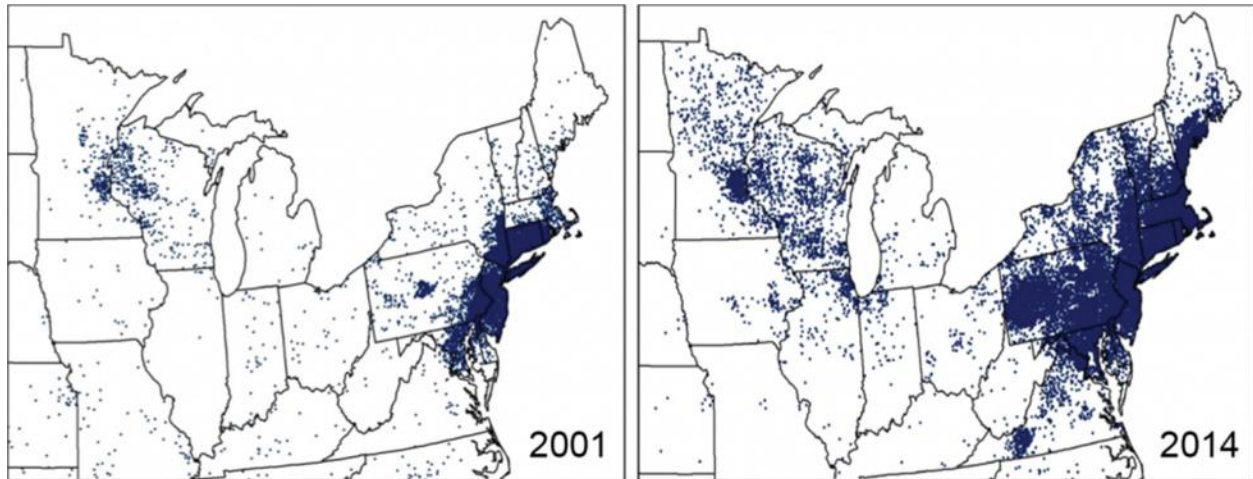




**Diseases.** There are many diseases and pathogens that attack both animals and humans alike, and the list is quite long: rabies, ebola, polio, malaria, cholera, plague, Lyme disease, West Nile virus, influenza, encephalitis, SIV, tuberculosis, staphylococcus aureus, salmonellosis, Giardia parasites, brucellosis, ehrlichiosis, hantavirus, measles, Zika, Marburg, and small pox, to name a few. The great apes die from ebola just as humans do, and the animal form of HIV, known as SIV, affects monkeys and apes, sheep, goats, horses, cattle, and cats. West Nile virus is deadly to many bird species as well as horses, cats, dogs, squirrels, rabbits, and alligators, and is responsible for 1,000 human fatalities and millions of animal fatalities each year. Cholera, bubonic plague, and tuberculosis jointly infect and kill thousands of people and millions of animals each year.

Many of these diseases are transmitted by vectors: mosquitoes, fleas, ticks, black flies, and all of these are strongly affected by climate conditions. The pathogens themselves that cause the diseases, the viruses, bacteria, and parasites, are also strongly affected by climate conditions. Climate-sensitive diseases are said to be among the planet's largest killers, causing millions of human deaths each year as well as millions of animal deaths. As the planet warms, the populations of both the vectors and pathogens can increase and their geographic ranges widen, often moving into territories where they were previously absent. Cold winters, which used to control some vector populations such as ticks, have been getting warmer and losing their effect.

Mosquitoes, which spread many, perhaps most, of these diseases are augmented by the warmer and wetter conditions that accompany climate change. Floods can also augment mosquito populations and spread bacteria such as cholera by inundating sanitary facilities and spread chemical pollution as well. Prolonged droughts, paradoxically, when interrupted by heavy rains, can also increase mosquito-borne disease problems as well as populations of rodents that are the disease reservoirs. Floods and droughts are both increased in frequency and severity by climate change.



*Lyme Disease Spread from 2001 to 2014.*

Climate change, by its exacerbating effects on hosts, vectors, and pathogens, can make all of the diseases more severe, more frequent, or more wide-spread, over and above the naturally-occurring rate that would exist without it. Many excess human and animal lives will be lost to these ever-worsening effects, unless we human beings modify our current path.

**Agriculture.** Just as climate change affects agriculture through floods and droughts, violent storms, rising temperatures and heat waves, agriculture in turn contributes to climate change. Early estimates have suggested that at least 18% of global greenhouse gas emissions are caused by agriculture, more than the entire transportation sector (cars, trucks, railroads, airplanes). However, this estimate didn't take into account the large contribution coming from cutting down forests to create pasture land for grazing and raising feedcrops for livestock. The majority of the crops that are grown are used to feed livestock, not people. Adding respiration from livestock (who exhale CO<sub>2</sub>), methane from manure and livestock flatulence, fertilizer production, fish aquaculture, and all the energy needed to carry out these activities, as much as 35% of all global greenhouse gases may very well come from agriculture, much of it from all the processes that go into meat production.

Changing dietary habits therefore can represent a significant way to reduce global warming and climate change. World-wide, 70 billion animals are raised for food production every year, and hundreds of billions of marine species (mostly fish, also lobsters, crabs, etc.) are killed for food. Reducing this animal holocaust would go a long way to mitigating climate change. Animal agriculture is also one of the top contributors to environmental degradation, including deforestation, desertification, pollution, water usage and contamination, and energy usage.

An animal-heavy diet is also known to contribute to many human diseases including heart disease, diabetes, prostate and colon cancers, and others. Reducing meat consumption, especially in a world with a rising human population with its consequent increasing demand for food, could save literally billions of animals with all the accompanying suffering as well as being a powerful way to impact the climate change crisis. Climate change, animal agriculture, and saving the planet are closely tied together.

**Conclusion.** So many human lives and animal lives would be saved by fighting climate change! So much suffering would be avoided! From heat waves and droughts, floods, violent storms, wildfires, food shortages, water shortages, habitat damage, increasing wars over resources, refugee crises, expanding diseases, species extinction, all life would benefit from stopping this runaway train that threatens us now but threatens future generations far more. Drive smaller cars and drive less miles, car pool, use energy efficient lights and appliances, plant more trees, eat less meat, promote renewable energy, recycle, preserve rainforests and other forests, pressure the politicians, educate our children and others about climate change, use less plastics, – these are things we can do collectively and as individuals instead of relying solely on government officials to solve the problem for us. (How's that going?) This is a global problem, and humans have to join together across the globe to solve it. It's not an exaggeration to say that the future of the planet *as we know it* is at stake, and we owe it to the future generations of human and animal life to leave them a viable planet to live and thrive on.

{This article was adapted from Helping Animals Means Helping People, Outskirts Press, 2017 by Harold Hovel}