Long- & Short-Term Effects of Global Warming

Education | **Science**
By **Meg Michelle**

Global warming -- and climate change -- have long-term and short-term impacts on our environment. Caused by air pollutants such as carbon dioxide and methane, global warming is the gradual increase of air temperature across the globe. The rise in air temperatures can lead to higher extinction rates, increased risk of disease and political repurcussions, such as wars over available resources. Understanding the possible short-term and long-term effects can help humans better prepare for the consequences of global warming.

Extinction of Important Species

Global warming endangers animals and plants all over the world. The biggest risk comes from habitat change. For example, polar bears rely on cold, snowy regions. As the planet warms and these regions shrink, polar bears will no longer have a place to live. The long-term impact is not only on large animals, but also on smaller animals such as insects, frogs and fish. Extinction affects the food chain and puts stress on the surviving animals to find adequate food. The extinction of animals and plants eventually affects human choices for food as well.

Health Issues

As temperatures rise, so do heat-related illnesses such as heatstroke. Increased air pollution correlates with the number of lung-related illnesses, such as asthma and lung cancer. Rising temperatures and unstable climates can also lead to rapid spread of disease. For example, infectious diseases, such as malaria and West Nile virus, will likely infect more people in a warmer climate. In addition, many medicines are derived from plant-based sources, and the long-term extinction of those source plants may limit access to the medications.

Political Conflict

As sea levels and temperatures rise, access to resources such as clean water and land decreases. This could raise the threat of political conflicts. For example, the civil war in Darfur is thought to be the first conflict that can be partially attributed to climate change. The conflict began in 2003 in a country that was already politically unstable. The extreme drought in that year caused fights to break out over the limited resources of water and food. When the lack of resources was added to the instability of the region, war broke out. Although global warming may have not been the only cause, political scientists speculate that global warming added to an already volatile situation.

Environmental Dangers in the Tundra

By **Amy Harris**

The tundra is a region characterized by extremely cold temperatures, snow cover during the much of the year, permafrost, absence of trees and a low diversity of plant and animal species. Most of the world's tundra lies in the far north, above the Arctic Circle, although the tundra environment can also be found above the treeline on high mountain peaks at any latitude, where it is known as alpine tundra. Overall, tundra covers approximately 10 percent of the Earth's landmass. Certain environmental features pose specific dangers to humans traveling in or inhabiting the tundra, and humans pose dangers to the tundra environment as well.

Extreme Cold

The tundra climate is among the harshest on Earth. The average winter temperatures are around -34 degrees Celsius (-29 F) and can sometimes dip much lower. Winds can also be extreme, particularly in the alpine tundra, where they often blow at speeds above 120 kilometers per hour (75 miles per hour). This results in wind chills that make the bitterly cold temperatures feel even colder to the human body. Any exposed skin is at risk for frostbite, which can happen in mere minutes; prolonged exposure to the elements can cause hypothermia.

Poor Visibility

It is quite easy for even experienced outdoorsmen to become lost in the tundra. Whiteouts -- blinding blizzards -- can obscure the landscape, reducing visibilities to less than 9 meters (30 feet). During the winter months, the Arctic tundra experiences very little daylight, spending most of the day engulfed in darkness. Even with favorable lighting and weather conditions, the tundra remains challenging to navigate. Many tundra landscapes are relatively uniform, consisting of seemingly unending flat plains with few landmarks. In the high latitudes of the Arctic tundra, light refracts in a way that distorts the perception of distance -- for instance, a rocky outcropping that appears quite close may actually be several kilometers (or miles) away.

Predatory Animals

Carnivorous mammals, such as wolves and polar bears, as well as omnivorous grizzly bears inhabit the Arctic tundra. Tundra grizzlies are considerably smaller than their southern counterparts. Eking out a marginal existence near ocean shores, they keenly devour almost anything they can. Although attacks on humans are rare, loss of sea ice due to climate change is bringing some species into closer contact with people, leading scientists to step up warnings about the risk of human-polar bear conflicts, according to a November 2013 in The Guardian. As polar bears, in particular, lose access to their food sources in the sea, they venture into villages and camps to search for alternate sources of food, occasionally hurting humans in the process. This pattern will continue if the Arctic continues to warm.

Dangers Posed by Humans

Not only does the tundra environment pose dangers to humans, humans pose dangers to it. Considerable pollution exists near sites of human habitation, as waste management practices -- such as sewage treatment -- prove extremely difficult to implement in the tundra, according to Marietta College. The extraction of oil and natural gas has caused environmental damage; serious oil spills maim or kill hundreds of thousands of birds, fish and other animals. Further, climate change has broad implications for the tundra, which extends beyond the destruction of polar bears' habitat. With the warming temperatures, boreal forests migrate to higher latitudes and altitudes, encroaching on tundra ecosystems and reducing their overall geographic extent. The increased vegetation due to warming temperatures increases the likelihood of large tundra fires, posing a widespread threat to flora and fauna.

Crucial Environmental Problems Affecting the Ocean

By **Barbara Cozzens**

Oceans represent the largest ecosystem on Earth, covering more than 70 percent of the planet's surface and supporting nearly 200,000 identified species and the more than 3 billion people who depend on them for their livelihoods. Yet according to a panel of the world's leading experts on oceans, ocean health is declining, and people have only themselves to blame. Without an immediate change in this trajectory, the oceans' ability to support life, including human life, will be compromised.

State of the Seas

In a 2011 report to United Nations member states, an international panel of scientists concluded that the magnitude of negative impacts to the oceans has been underestimated, and the speed of ocean degradation is now happening at a rate far greater than predicted. The cumulative impacts of warming and acidification, coupled with stressors from other human activities, including overfishing and pollution, have resulted in a dramatic decline in the health of the world's oceans. Perhaps most sobering, the panel warned that current conditions mirror those of every previous major extinction of species, a signal that marine life could be headed to a new mass extinction event, unprecedented in human history.

Getting Warmer

Atmospheric concentrations of carbon dioxide – the bulk generated by humans – are higher than at any point in the past 800,000 years. The reasons may be fodder for debate, but the result is indisputably real: global climate change. As a heat sink for rising temperatures, the oceans will continue to get warmer. The annual National Climate Assessment report warns rising ocean temperatures will affect not only climate, but also ocean circulation, chemistry and ecosystems. Of particular concern are impacts to the world's coral reefs. Higher ocean temperatures lead corals to expel the symbiotic algae that provide them with nourishment and color, leaving "bleached" corals stressed and vulnerable to disease. If greenhouse gas emissions continue at the current rate, scientists predict only 5 percent of the world’s reefs will remain unaffected by 2050.

The "Equally Evil Twin"

The oceans absorb more than a quarter of the carbon dioxide humans pump into the air, helping to buffer the impacts of global warming. But as society burns more and more fossil fuels, the seas are absorbing more carbon dioxide, reducing oceanic pH and depleting carbonate ions needed by reef and shell-building organisms like corals and shellfish. Jane Lubchenco, former head of the National Oceanic and Atmospheric Administration, refers to ocean acidification as the "equally evil twin" of climate change. Since the industrial revolution, ocean pH has fallen from 8.2 to 8.1, an acidification rate at least 10 times faster than during the Paleocene-Eocene Thermal Maximum, a period 56 million years ago of rapid global warming and significant marine extinctions.

Dirty Business

Globally, approximately 80 percent of marine pollution originates from land-based sources such as agricultural runoff, untreated sewage and plastics. Ocean dead zones – areas of low oxygen levels where most marine life cannot survive – have been attributed to agricultural runoff and appear to be growing in size. Excessive nutrients from fertilizers have also been linked to harmful algal blooms that contaminate seafood and kill fish. Pollutants, including flame-retardant chemicals, have even been traced to the polar seas. Much of the 220 million tons of plastics produced each year finds its way to the oceans, clogging habitats and killing more than a million sea birds and 100,000 marine mammals every year.

Loving to Death

More than 2.6 billion people depend on the oceans as their primary protein source. The growing world population and unsustainable fishing practices have led to overharvesting of marine resources. Under the Magnuson-Stevens Fisheries Management Act, NOAA is mandated to end overfishing in the United States. But globally, high demand coupled with subsidies for fishing are contributing to depletion of many species. Illegal, unreported and unregulated fishing – also known as pirate fishing – further undermines fisheries at home and abroad by damaging marine ecosystems and undermining international conservation and management agreements.

Ecological Concerns That Affect the Tundra

By **Andrea Becker**

Tundra is a biome typified by permafrost, permanently frozen ground, that is found in polar regions and isolated patches at the tops of mountains. It is an environment that is harsh, yet surprisingly delicate and easily disturbed. Historically, tundra hasn't been able to support much human life, and has remained relatively free of human disturbance, but humans are increasingly impacting this biome both directly and indirectly.

Climate Change

The overarching concern facing tundra ecosystems is global climate change. Arctic temperatures have risen three to five degrees over the past 50 years and models forecast that this may double in the future. Warming temperatures thaw the permafrost, allowing non-tundra plants to invade. Thawed permafrost no longer holds the soil in place, so erosion also becomes a problem. Climate change has led to larger and more frequent wildfires, such as the largest tundra fire in recorded history in Alaska in 2007. It is very difficult to quantify how much change has already happened and even more difficult to model the future.

Air Pollution

Industrial air pollutants, such as organochlorines and heavy metals, are carried to the arctic on air currents from populated areas. Lichens are a dominant life form on the tundra, and they are particularly vulnerable to air pollution because they lack roots and get the majority of their resources from the air. Because of this, lichens have historically been used as air pollution indicators. Air pollution has also led to a persistent 'arctic haze' that contributes to acid rain and settles on the ground, hastening snowmelt. Finally ozone holes over the poles have led to increased radiation damage. The impacts of air pollution are intertwined with other effects and are difficult to quantify.

Human Development

Large reserves of oil, natural gas, diamonds and other minerals have been found beneath the tundra, leading to the construction of roads, mines and drilling operations. The land where development takes place is obviously affected, but indirect effects include disrupted migration routes, road dust that chokes plants and lichens, and the potential for oil spills. All of this adds up and we now impact much more of the tundra biome than we did in the past.

Ecological Imablances

In addition to global concerns, ecosystem imbalances can have profound regional impacts. For example, the snow geese nesting on Canadian tundra have increased by 5 to 7 percent annually since 1965, from around 500 thousand to estimates of around 5 million. This is likely because of increased agricultural production in their wintering areas. Geese need to eat, and the limited nesting areas become denuded of vegetation as the geese eat themselves out of house and home. Hunting has been used with limited success to reduce the population.

Drawbacks of Poor Forest Management on Land Ecology

By **Terri Schab**

Forests contain important resources and managing those resources has not always been done properly, which can affect forest ecosystems in a dramatic way. In the American West and other forests, the suppression of naturally occurring wildfires, timber harvesting, and livestock grazing have dramatically changed these systems. Poor forest management can have damaging impacts on species, water quality, and even local residents.

Fire as a Natural Disturbance Regime

The ecology of the Pacific Northwest forests is now being studied by scientists with a new outlook on management practices. Forest ecologists are studying the natural disturbance regimes of these ecosystems. Decades before eastern colonizers arrived in the west, the forests had a natural cycle of disturbance that was played a critical role in the development of the plant communities and species that occupy these areas. In the eastern Cascade mountains a common disturbance was low intensity fires.

Fire Regimes: Natural Regulators of Ecosystems

In the eastern Cascades of Washington and Oregon, low intensity fires often swept through the ecosystem. These fires left the area with a park like appearance with little dead wood on the forest floor. When fire suppression management was employed, fuels were allowed to build up on the forest floor. It is thought that these low intensity fires served to clear out damaging mistletoe infestations, decrease the density of stands, which increases the forest's ability to fight pests and diseases, and keep forest fuel levels low. Fire suppression has caused a shifts in species dominance, weakened overcrowded stands allowing for pest and disease outbreaks, and changed the historical fire regime. The current situation is critical, as now fires build to large intensity and several hundred acres and properties are damaged.

Effects of Timber Harvest

Timber harvest has negatively affected forest ecosystems worldwide. In the American West, clear cut timber harvests have devastating effects on the entire ecosystem. Such effects include increased sediment runoff into streams which affects fish reproduction and development, entire stands are replaced with monocultures of replanted trees which decrease wildlife habitat and can make stands more susceptible to disease and insects, and increased stream flows and flooding due to loss of trees which uptake large amounts of water. Logging operations themselves can have many devastating effects such mass soil erosion caused by poor road placement.

Livestock Grazing

For decades, ranchers have been sold grazing rights to graze their cattle and sheep on public lands. The impacts from grazing can be regulated, however when overgrazing occurs damage can result. Over grazed stream banks eliminate the shading necessary for certain fish species to reproduce and survive. Over grazing also weakens banks, causing bank failure and stream bank overflow. This can drastically change these critical ecosystems and their inhabitants. In addition, fecal matter from grazing animals can contaminant water supplies and lead to increased pathogens loads. Forest management that critically manages these impacts is essential in order to maintain health forest ecosystems.

What Ecological Problems and Hazards Face the Desert?

By **Milton Kazmeyer**

Deserts may seem harsh and inhospitable, but in reality, they contain a fragile ecosystem of plants and animals specially adapted to thrive under these conditions. In some cases, the balance of life is so fragile that one unusually dry or wet season can lead to massive changes. This environmental sensitivity means that deserts face many threats, both from human activity as well as from natural climate cycles.

Climate Patterns

Natural weather variability can drastically alter the temperatures and amount of rainfall of any given region. For example, an El Nino pattern in the Pacific can lead to wet winters, bringing lots of rainfall to the deserts of the South American continent. La Nina, on the other hand, tends to bring drought during the same period. As these patterns become extreme or repeat themselves multiple years in a row, the changes to normal rainfall patterns can cause a disruption in the ecosystem of the desert, reducing the number of plants and animals able to thrive away from permanent water sources.

Climate Change

Climate change affects the desert just as it affects every other biome. Deserts around the world have been warming at a rate of 0.2-0.8 degrees Celsius every decade, compared to an average global increase of 0.45 degrees Celsius during the same period. A rise in desert temperatures can dry out plants, making them more vulnerable to wildfires, or they might simply die due to a lack of moisture. Likewise, the animals that make the desert their home may not be able to cope with the increased temperatures, limiting their range or forcing them to migrate to cooler regions. During the 20th century, much of the Sahel region adjacent to the Sahara desert suffered desertification, greatly changing the makeup of plant and animal life in the area.

Environmental Degradation

Deserts can also suffer from land degradation from a variety of sources. Temperature or rainfall changes that cause vegetation to die out can increase erosion as the roots that hold soil together crumble away. Agriculture using artificial fertilizers in and near the desert can increase the minerals in the soil or change soil chemistry, making it more difficult for plants and animals to thrive in affected regions. Over time, these effects can render near-desert regions into high desert and make the driest areas all but inhospitable to any kind of life. During the 1930s, the great plains of the United States suffered desertification, creating the "Dust Bowl," as a result of years of drought and poor agricultural techniques.

Human Development

Human habitats represent another major threat to desert areas. Expansion of cities and towns into desert regions can displace animals and destroy plants, especially since these developments tend to focus around sources of water where other living things would naturally thrive. Since human settlements require large amounts of water to thrive, this reduces the amount available to other living things, and it may drive species away or cause local extinctions due to a lack of resources. For instance, Pima County, Arizona is home to 23 threatened or endangered species, and many are at risk due to the destruction or depletion of their natural habitats.

What Factors Influence the Biodiversity of an Ecosystem?

By **Kari Norborg Carter**

Biodiversity, the rich variety of living things that have evolved over millions of years to live in particular habitats, contributes to the beauty of natural ecosystems as well as to their resilience and stability. But certain stressors, most of them human-caused or human-influenced, threaten or reduce biodiversity. Because the creatures and plants in ecosystems are interdependent, the loss of even one species can have profound effects on the entire ecosystem, can affect other ecosystems and can endanger people as well. As biologist Edward O. Wilson said, "It is reckless to suppose that biodiversity can be diminished indefinitely without threatening humanity itself."

Overexploitation

Overexploitation means harvesting species more rapidly than populations ca
unsustainable levels. All over the world, people collect or hunt wild plants, birds, mammals, amphibians, fish, reptiles and other animals or their eggs for purposes as varied as commercial fishing; fur, skin or feathers for fashion; meat; lumber; sport; scientific research; superstitious beliefs; medicine; the pet trade and zoos. Hunting threatens about one-third of threatened mammals and birds in the world and poses the most immediate threat to large animals that reproduce slowly, including elephants, antelopes, rhinoceroses, jaguars and primates. Animals that humans hunted or harvested to extinction include the passenger pigeon, great auk, dodo, Zanzibar leopard, Pyrenean ibex, Javan tiger, Falkland Island wolf, Caribbean monk seal, Tasmanian tiger, Carolina parakeet, Stellar's sea cow, West African black rhinoceros and sea mink.

Habitat Loss

Habitat loss and fragmentation due to development, ranching, agriculture and pollution has a huge impact on biodiversity as human populations continue to grow. Deforestation of tropical rainforests has had perhaps the most dramatic effect on biodiversity, both directly in the loss of species in these incredibly diverse ecosystems and indirectly through the increased threat of global warming. Tropical rainforests hold at least 50 percent of the world's species, and they are also known as the "lungs of the earth" for their role in producing oxygen and absorbing carbon dioxide. Today, less than half of the world's tropical rainforests remain from what existed a few thousand years ago, and that destruction continues at a rate of about 80,000 acres per day. More than 85 percent of all natural habitat in Europe has disappeared since the mid-Holocene, and more than 96 percent of native tallgrass prairie and 50 percent of wetlands in the United States have been destroyed since the arrival of Europeans. In addition, habitat fragmentation, the division of ecosystems and populations of species into smaller, isolated, sometimes unsustainable parcels, often causes loss of biodiversity by increasing vulnerability of some populations to disease and other stressors, leaving habitats too small for some species to survive. Pollutants such as acid rain, air pollution, fertilizers, herbicides and pesticides alter and destroy habitats and their species in numerous ways as well.

Invasive Species

Non-native, introduced, alien or invasive species are plants, animals, diseases or other organisms transferred unnaturally from one ecosystem to another, either intentionally or unintentionally. They can pose a threat to biodiversity when they possess adaptations that help them out-compete, prey upon or interbreed with native species in their new ecosystem, especially in isolated ecosystems such as islands or freshwater habitats. For example, humans introduced the Nile Perch for sports and subsistence fishing to Lake Victoria in Africa, where it has eaten many of the native species and very well might lead to their extinction. In North America, an exotic beetle carrying Dutch elm disease has destroyed most large elm trees, the exotic emerald ash borer has killed hundreds of millions of ash trees and purple loosestrife has choked out much native vegetation in wetlands, devastating the wetland ecosystems. Scientists estimate that introduced species have contributed to at least half of the species extinctions that have occurred since 1600.

Climate Change

Climate change is generally more gradual than habitat destruction, but it thre
climate strongly influences the kinds of organisms that have adapted to each
temperatures are predicted to rise by up to 4°C by 2100, and most scientists argue that the increase in atmospheric

Deforestation Impact on Australia's Ecosystems

By **Marie-Luise Blue**

The impact of deforestation on the environment and ecosystems includes loss of biodiversity, climate change and decline in soil fertility. Australia has lost almost 40 percent of its forests and some of the remaining forests are fragmented. Most of Australia's forests are in the coastal regions with much of the rest of the continent covered by deserts and dry land. The Australian coastal regions are the most fertile, and since colonial times, the coastal forests were cleared mostly for agricultural use. Australia is a forest-poor country and extensive efforts are required to stop the ecological impact of deforestation.

Biodiversity

Deforestation and forest fragmentation have an adverse effect on the biodiversity of animals and plants. Loss of biodiversity in Australia is of catastrophic proportions. Many bird species have been lost in Victoria, Queensland, New South Wales, Western Australia and the Mount Lofty Ranges in South Australia. In forest-fragmented regions of Queensland, reptiles have declined. The decline of native plant diversity is increased by the introduction of invasive non-native grasses and the invasion by weeds. In the Mount Lofty Ranges of South Australia, at least 132 species of animals and plants have become extinct.

Climate Change

Clearing of forests affects local temperature and precipitation patterns; it increases temperatures and reduces rainfall. Cutting down trees disrupts the natural water cycle, during which trees maintain soil moisture and release water vapor back into the atmosphere. Over the last century, Australia has warmed about 1.0 degree Centigrade (1.8 degrees Fahrenheit). The physical process of cutting down forests affects climate by releasing large amounts of the greenhouse gas carbon dioxide into the air. Trees take up atmospheric carbon dioxide and convert it to energy and oxygen. Deforestation causes the loss of tree-mediated carbon dioxide uptake and increases heat-retaining carbon dioxide concentrations in the atmosphere. Recently, the Australian legislature has implemented anti-clearing strategies, decreasing carbon dioxide emissions.

Soil Salinity

Clearing forests can increase the salinity of the soil. About 7 percent of western agricultural regions in Australia suffer from increased salinity due to deforestation, according to the World Wildlife Fund. Water can drain from the deforested land to affect downstream and down-slope areas, impacting water quality and plant life.

Soil Fertility

Deforestation causes a decline in soil fertility. The main losses are in organic carbon, nitrogen, phosphorus and sulfur. Removal of trees causes increased decomposition of soil nutrients and topsoil erosion. The removal of trees decreases biomass above and below the ground. Deforestation allows the soil to heat up and dry out due to lack of shade, thereby increasing decomposition of nutrients. Water flux in deforested areas is also increased, leaching out nutrients to streams or groundwater.

Forest Fragmentation and Replanting

Forest fragmentation, the leaving of small patches of forest, and replanting of trees cannot undo many of the adverse effects of cutting down large areas of forests. Forest fragmentation is proven to decrease biodiversity. Replanting deforested land with forest or plantation trees usually results in monocultures, or single tree species. Understory vegetation and previous animal diversity does not fully return to these areas.

What Are the Dangers of Deforestation to the Environment & to Human Life?

By **Kori Morgan**

It's hard to believe that much of the earth was once covered in forests, including half the U.S., three-quarters of Canada and the majority of Europe. Today, though, the University of Michigan's Global Change curriculum reports that only 22 percent of the world's forests remain. This dramatic decrease is due to deforestation, the process of clearing forests for agriculture, urban development and other purposes. While deforestation has paved the way for many positive uses of land, it carries many dangers to the environment and humans as well.

Habitat Loss

Tropical rainforests are home to 65 percent of the world's endangered species, according to a 2000 research publication by Sumit Chakravarty, forestry professor at North Bengal Agricultural University. Today, the University of Michigan School of Natural Resources and Environment reports that habitat loss due to deforestation is the leading cause of extinctions. With the invasion of human development into their natural habitats, species have a harder time meeting their basic needs, such as shelter, places to raise their offspring and sources of food and water. A reduced ability to survive and even mass extinction are often the consequences.

Climate Change

Deforestation also bears significant links to climate change. Under normal circumstances, forests help stabilize the climate by removing carbon dioxide from the atmosphere. Trees require carbon dioxide to manufacture carbohydrates, which feed the trees and contribute to tree structure, and, indirectly, to produce oxygen. Without trees to take up excess carbon dioxide, it builds up in the atmosphere and traps solar radiation, leading to an overall warming of the planet and extreme temperature and weather shifts. The changes in weather and climate can lead to natural disasters such as droughts, crop failures, melting of ice caps, flooding and desertification. These phenomena can not only significantly disrupt the natural environments of the earth, but affect human activities such as agriculture.

Poor Air Quality

Altered weather patterns aren't the only effect of increased carbon dioxide from deforestation. A 2008 Stanford University study linked high levels of the gas in the atmosphere to increased deaths and respiratory illnesses like asthma. Mark Jacobson, the scientist behind the study, states that for every one-degree Celsius temperature increase caused by carbon dioxide pollution, a thousand deaths will occur. According to Jacobson, the findings are particularly relevant for California, which is home to 12 percent of the U.S. population and six of the 10 most polluted U.S. cities, at the time of the study.

Altered Water Cycle

Deforestation also impacts humans by disrupting the natural water cycle. Trees draw water from rainfall up from the ground through their roots; without trees, the ground can't absorb as much water and becomes drier. Instead, any rainfall runs off the land, often leading to floods and soil erosion. Rather than being drawn into the ground through soil that is loosened by tree roots, the water is instead lost. Fewer trees also means reduced transpiration, or evaporation of water through leaf pores into the atmosphere, which reduces local rainfall and can result in drought. This disruption in the water cycle can significantly disrupt human life by affecting the quantity and quality of drinking water, impairing irrigation systems and inhibiting the productivity of fisheries.

What Type of Effect Does Global Warming Have on Temperate Forests?

By **Christopher Cascio**

Global warming and climate shift can potentially have both positive and negative effects on temperate forests, according to research conducted at The University of Minnesota. Warmer temperatures and increased greenhouse gases can actually inspire growth in plant life, provided those particular species are tolerant climate shifts. Global warming brings other dangers, however. Climate change can alter habitats dramatically, and cause shifts and disturbances which make forest environments unlivable for the native plants and animals.

Effect of Higher Temperatures

Species that live in temperate forests thrive in temperate climates -- that is, climates not generally subject to sustained extremes in temperature. When the climate changes, species will either have to adapt, migrate to areas that still maintain ideal conditions or die off completely in the region. For example, The University of Minnesota found that deciduous trees in these forests responded positively or neutrally to the warmer temperatures: Growth sped up or remained the same. Conifers, however, suffered. Additionally, The U.S. Forest Service conducted a 13-year study in southern Alaska, and noted similar findings: while red cedar tree growth increased by four percent, shore pine decreased by nearly five percent.

Effect of Carbon Dioxide Surplus

Increased carbon dioxide levels in the atmosphere are driving global warming, and the greater availability of carbon dioxide could prove beneficial to trees because trees consume carbon dioxide and convert it into carbohydrates, which feed and become part of the trees. The United States Environmental Protection Agency, EPA, acknowledges that increased atmospheric carbon dioxide could support increased growth in areas with fertile soil and sufficient water supplies. For trees that live in the western U.S or the South, however, the added carbon dioxide might be useless because water isn't sufficiently available. Furthermore, CNN reports research conducted by the Intergovernmental Panel on Climate Change, which states that when trees are dying they emit more carbon than they absorb. This carbon emission from dying trees could counter the amount absorbed by surrounding trees, depending on the forest's population dynamic and death rate.

Effect of Precipitation Shifts

The EPA also states that global warming will likely bring precipitation shifts that could destroy forest habitats. These shifts could bring severe rain and flooding to some areas and drought to others. Flooding can rinse the soil of nutrients or potentially add nutrient overloads or pollutants, depending on the water's source. Droughts can also have multiple negative effects. Droughts hinder trees' ability to produce sap, which helps safeguard them against harmful insects. Dry conditions also increase the risk of forest wildfires, conditions which will be compounded when combined with higher temperatures.

Effect of Forest Disturbances

With all of the direct effects of global warming on temperate forests, some serious indirect effects exist as well. Just as certain species will be forced to emigrate because of the new conditions, invasive tree and animal species will have to immigrate to the temperate forests from their own origins. Some of these invasive species can wreak havoc on temperate trees, such as the mountain pine beetle, which can infest entire regions of forest land in the American Southwest. Furthermore, as some species die off or emigrate, and new species take up residence, the biological dynamic of the forests could transform entirely.

How Does Climate Change Affect the Temperature in a Deciduous Forest?

By **Amy Harris**

The term “climate change” generally refers to anthropogenic temperature increases and the corresponding impacts of these increases on global precipitation patterns, wind and other meteorological atmospheric phenomena. Human-fueled climate change is affecting temperatures in all types of environments worldwide, including deciduous forests, and is projected to continue to do so in the foreseeable future -- by how much depends on whether we significantly modify our emissions of greenhouse gases into the atmosphere. Although the Earth has experienced natural cycles of temperature changes throughout its long history, average temperatures in the modern era may eventually surpass previous norms, ultimately resulting in major widespread alterations to deciduous forest ecosystems.

Types and Distribution

Deciduous forests are those dominated by tree species which shed and regrow their leaves each year. There are two main types of deciduous forests: temperate and tropical. Temperate deciduous forests lie in the middle latitudes, in regions possessing distinct, well-defined seasons, and experience a relatively wide range of temperatures. These forests cover much of eastern North America, western and central Europe, and northeastern Asia. Tropical deciduous forests, also sometimes known as dry or monsoon forests, are warmer year-round than their temperate cousins. Also, unlike temperate deciduous forests, they have a dry season which extends for several months; it is during this time they lose their leaves. Tropical deciduous forests are found in patches of South America, Mexico, the Caribbean, India, Australia, southern Africa and elsewhere.

Geographic Differences in Seasonality

Climate change impacts the temperatures in certain deciduous forests differently than in others, according to a European Commission fact sheet. For instance, in Eastern Europe, models predict that warming will be more noticeable in winter, while in southern and western Europe, temperature increases will be more pronounced in summer. In Northern Europe, the warmth will be relatively evenly distributed throughout all seasons. It is worthy to note that temperate deciduous forests experiencing milder winters may suffer from an increase in tree-killing pests and pathogens.

Relationship to Precipitation

Coupled with these seasonal discrepancies in warmer temperatures are changes in precipitation distribution. Due to the higher temperatures, deciduous forests in some areas are receiving more rainfall than they used to and others are receiving less. On the whole, climate change is causing dry regions to get drier and wet areas to turn wetter. Also, precipitation is tending to fall in heavier bursts -- that is, gaps between periods of measurable precipitation may be lengthier, but when it rains, it pours. This is especially significant for temperate deciduous forests, as many lie in areas prone to severe winter weather. Increased frequency and intensity of ice storms are of particular concern, as ice accumulation harbors the potential to exert irreparable damage on hardwoods.

High Temperatures and Drought

On the other end of the spectrum, some deciduous forests are beginning to experience an uptick in sustained droughts due to climate change, which adversely affects the health of many species, such as birch and beech, according to the Forest Ecology Network. Deciduous forests in the western United States, southern Europe, the Mediterranean, and northern China are especially vulnerable to increased droughts; these droughts can also spark fires that quickly destroy large swaths of forest. Drought aside, high temperatures may harm some deciduous forests -- such as those of the Mediterranean -- outright, as trees cannot photosynthesize effectively in extreme heat. In cooler regions, however, the warmer temperatures may enhance tree growth, so long as rainfall remains sufficient.

Range Fluctuations

On the whole, these temperature-related climate changes affect the global distribution of deciduous forests, cause them to recede from their existing locations and migrate to new areas. For instance, in already arid regions which are becoming even drier, deciduous forests are starting to slowly vanish, turning to savanna. On the other hand, deciduous species are invading high northern latitudes once covered by coniferous boreal forests. Along with the shifting deciduous forests, the animals and forest floor plants which inhabit them also shift.

Examples of Indicator Species

By **Carolyn Csanyi**

Valuable as an early warning system for environmental problems, indicator species are chosen for their sensitivity to environmental conditions. If the chosen indicator species declines in numbers or health, it is a sign to look for detrimental influences such as soil contamination, air or water pollution, habitat fragmentation or climate change. Besides being sensitive to change, indicator species need to be representative of the other organisms in the ecosystem, easily observable and able to be sampled, and they should react consistently to environmental changes. Indicator species are sometimes called proxy or surrogate species.

Plants, algae, and fungi

In Vancouver, Canada, the environmental health of estuaries is monitored by the indicator species of eel grass. In open water ecosystems, yellow water lily is the indicator species. A University of Michigan study of the North American Great Lakes recommended blue-joint grass, wire-grass, purple loosestrife and wild rice as among the indicator plants used as lake-level indicator species. Lichens, which are a combination of an alga and a fungus growing together, are indicators of air pollution, especially sulfur dioxide, a waste product of burning sulfur-containing fossil fuels. In Great Britain, bushy lichens grow only in clean air. Leafy lichens tolerate some air pollution and crusty lichens can survive with higher levels of pollutants. If no lichens are present, it usually indicates heavy air pollution.

Amphibians

Adult frogs and toads live on land and in water and are good indicator species since the skin of the adults is moist and permeable, allowing numerous pollutants entry into their bodies. Tadpoles live in water and indicate water quality issues. Of the nearly 100 species that live in the United States, about 30 percent are in trouble. On a world-wide scale, a 2007 study by Malcolm McCallum of Texas A&M University-Texarkana suggests that current estimates of amphibians in danger of imminent extinction approach 211 times the background amphibian extinction rate estimated from the fossil record.

Fish

Salmon are an indicator species for wetland ecosystems of Greater Vancouver as well as over the greater Pacific Rim. The National Wildlife Federation lists them as species at risk due to pollution, river channelization, dams, deforestation and urban sprawl. Commercial farmed salmon increase the chance that accidental interbreeding occurs and that diseases could spread into wild populations. The Environmental Protection Agency uses fish species in the Chesapeake Bay as indicator species. The health of the fish helps evaluate ecosystem water quality.

Mammals

Indicator species for American grassland ecosystems, the five species of prairie dogs now occupy only about 2 percent of their historical range. Non-Alaskan grizzly bears are indicator species for mountain ecosystems, measuring the health and diversity of the ecosystem. "When grizzly bears are thriving, we can feel confident that the life requirements of many other mountain species are being met," says Canada's Dominion Parks Service. In the United States, grizzly bears have been nearly hunted to extinction in the lower 48 states.

Effect of Human Activities on the Environment

By **Jonas Martonas**

Humans impact the environment in several ways. Common effects include decreased water quality, increased pollution and greenhouse gas emissions, depletion of natural resources and contribution to global climate change. Some of these are the direct result of human activities, whereas others are secondary effects that are part of a series of actions and reactions.

Water Pollution

One of the biggest impacts humans have on aquatic systems is excess nutrient inputs. Nutrients, like nitrogen and phosphorus, are essential to the health and survival of aquatic plants and animals. However, humans introduce large quantities of nutrients, primarily through overuse of fertilizers. Too many nutrients can rapidly reduce water quality by causing overgrowth of certain bacteria and algae that use the oxygen necessary for other species to survive. Even more problematic is that these nutrients can be transported downstream to other streams, rivers and bays. Therefore, nutrients can reduce water quality in places far removed from where they were first introduced.

Air Pollution

The majority of air pollution is the result of human activities. For example, increased fossil fuel combustion from motor vehicles, industrial factories and power plants all pump large quantities of air pollutants, such as carbon monoxide, ozone and nitrous oxides, into the atmosphere. Other air pollutants, such as lead-based compounds, can lead to serious health effects like cancer, or other types of reproductive effects and birth defects.

Climate Change

According to the U.S. Environmental Protection Agency, human activities are largely responsible for an increase in temperature around the globe, primarily due to carbon dioxide and other greenhouse gas emissions. This increase in temperature is leading to changes in where crops can grow and where certain fish or animals can be found, all vital for feeding an increasing human population. The rise in global temperatures is also causing glaciers to melt, releasing water that causes sea levels to rise and threaten coastal communities and economies that rely on coastal resources.

Solutions

There are several simple things that people can do on a daily basis to minimize their impact on the environment. For example, taking public transportation, biking or walking instead of driving will reduce carbon dioxide emissions. Reducing the amount of fertilizer applied to lawns, gardens and vegetables will lessen the likelihood of water pollution nearby, which is also beneficial for drinking water and human health. Using less energy in the home can lessen the amount of pollution put into the air by coal burning power plants. Any activity which reduces water and energy consumption can lead to positive impacts on our environment.

Do Blizzards Affect the Environment?

By **Maria Magher**

Blizzards aren't just heavy snow storms. The U.S. Search and Rescue Task Force says that they are classified by large amounts of snow, winds 35 mph or higher and visibility of less than 1/4 mile. These conditions must also be present for three hours or more, but they can go on for weeks. Blizzards don't just pose a danger to the health of people, they also threaten the environment, including the health of local plants and animals.

The Local Ecosystem

Temperatures quickly drop below zero during a blizzard, especially with the wind chill. Ice and winds cause trees to fall and plants to die. The Environmental Protection Agency says that such storms have the potential to cause significant damage to entire forests, which then release carbon during decay. The excess carbon causes an imbalance in the local ecosystem, which impacts other plants and wildlife. When other plants and flora are killed during a blizzard, their lack of availability also impacts the food supply for local animals and wildlife.

Mold and Fungus Damage

Blizzards create wet or damp conditions for extended periods, both while there is snow on the ground and while it is melting. The ongoing wet and damp conditions encourage the spread of mold and fungi. Some mold and fungi are beneficial for the environment because they help break down decaying matter, like fallen trees. However, some mold and fungi damage the environment by destroying plants and trees that provide food sources and are important to sustaining the local ecosystem.

Risk of Flooding

All the snow that blizzards usher in has to go somewhere. When the temperatures start to rise, the snow melts too quickly and abundantly for it to be absorbed, which increases the risk of flooding, especially in coastal areas. Blizzards also cause sea levels to rise, which can lead to flooding. Floods devastate the plant and animal population, shifting the local ecosystem and potentially impacting the food supply. The National Oceanic and Atmospheric Administration says that floods can also spread pollution from oil dropped on parking lots to plastic bags left out on the street; pesticides; fertilizers and detergents. All of these impact the water supply and further poison the plant and animal population.

The Water Cycle

Whether blizzards result in flooding, they blanket the land with heavy precipitation that is drawn up into the atmosphere as a result of evaporation. Whether it is the snow from the blizzard or the water from the resulting flood, blizzards can contribute to heavy accumulation of water vapor in the atmosphere. That can lead to greater rainfall throughout the rest of the year, including heavy storms. Those storms can raise water levels and impact plant and animal populations, depending on their severity.

Why Is Biodiversity High in Some Places But Low in Others?

By **Kevin Wandrei**

Biodiversity refers to the number of biological species that exist in a given region. High biodiversity means that a region supports a wide variety of species, while low biodiversity implies that an area supports only a few. The reasons for variances in biodiversity are complex, but they include both natural and man-made causes.

Unique Climates and Conditions

One of the most significant and naturally occurring causes of differences in biodiversity across the world is differences in climate. Mountain tops and deserts are naturally low in biodiversity, for the simple reason that their unique climates are not suitable to many types of life. Plants and animals have as much difficulty surviving in the thin atmosphere on freezing mountain tops as they do living in hot, waterless deserts. As such, these climates support very low biodiversity. On the other extreme, moist, tropical zones like the Amazon rainforest support some of the highest levels of biodiversity in the world. Numerous varieties of plants and animals can thrive in these environments.

Pollution and Environmental Destruction

Humans also impact biodiversity through their actions, especially those that cause pollution. Even in the most biodiverse regions of the world, like rainforests, human pollution can reduce biodiversity. This is because pollution does not uniformly affect all species. Some species, for example, might be more resistant to the impact of a toxic oil in a water supply, while another species might be killed almost to extinction because of the pollutant. The loss of a single species can throw off a food web, and lead organisms that relied heavily on that species as a source of food to also die. In the process, numerous species may die or even go extinct, which reduces biodiversity considerably.

Invasive Species

Invasive species are another type of environmental factor that can vastly reduce biodiversity. While invasive species are frequently introduced by humans, they sometimes occur naturally. Introducing a new species to an new environment can often lead to a disruptive change in food webs, which can reverberate throughout a region and cause numerous other species to go extinct. In the 1950's, for example, British colonists introduce a species of perch into Africa's Lake Victoria, and the perch killed off numerous other species in the lake. The fish that the perch killed, in turn, no longer ate the algae that grew in the lake, so the algae population bloomed and then decayed, resulting in decreasing oxygen levels in the lake, which then became inhospitable to many forms of life. This is an example of how one small invasive species can turn a high biodiversity region into a low one.

Overhunting or Overuse

Overhunting or overuse of a species can have the same adverse impact on biodiversity as an invasive species or pollution. Overusing or overhunting just one species in an ecosystem can disrupt food chains and impact the ability of numerous other species to survive. But sometimes the threat is not due to food web disruption. In the Amazon rainforest, for example, the spider monkey plays an important role in helping the the tree species Inga ingoides survive by distributing its seeds manually and through feces. As the spider monkey has been hunted almost to extinction, the Inga ingoides have largely failed to reproduce, and thus have also declined in population. The overhunting of just one species can thus rapidly reduce the entire biodiversity of a region.

Environmental Problems in Temperate Deciduous Forests

By **Kevin Lee**

People often marvel at the radiant beauty of deciduous trees that glow with vibrant fall colors. Deciduous forests in temperate climates consist of maples, elms oaks, and other trees that lose their leaves when seasons change. Temperate climates have cold winters, hot summers and average temperatures of 10 Celsius (50 Fahrenheit). These forests can feel the impact of natural forces and human activity that influenc

The Cost of Acquiring Lumber

If you cut down trees for a living, you may create conditions that have mild to devastating effects on life in an ecosystem. As NASA reports, "In addition to the species lost when an area is totally deforested, the plants and animals in the fragments of forest that remain also become increasingly vulnerable, sometimes even committed, to extinction." The U.S. Environmental Protection Agency's (EPA's) Western Ecology Division in Corvallis Oregon reports that slowing deforestation can also help sequester or conserve large amounts of carbon that can lead to environmental warming.

Fire and Pathogen Threats

Parasites and pathogens can have large scale effects on life forms of all types including deciduous forests. For example, the EPA reports that a chestnut blight once "completely restructured North American temperate deciduous forests." Pathogens may also cause the loss of some or all members in a native species. Wildlife recreation and other human activities near forests may lead to fire which could cause pathogen levels in forests to increase.

Climate Change Changes Things

Thirty three percent of the country's land consists of forests. Climate change affects the growth of those forests and can impact their productivity. Warming from higher atmospheric carbon dioxide levels can make growing seasons longer and cause some areas to experience more droughts. Warmer weather may also change the rate at which insect infestations, and cause destructive storms occur. While some forests may recover from these types of problems others may not. Wild fires resulting from warmer weather are also a threat, especially during drought.

Deciduous Forest Facts

In addition to deforestation and overgrazing, agricultural practices have deciduous forests exist around the world. They were also some of the first forests that people converted to agricultural use. Broad leaves on trees in temperate deciduous forests help provide shade for shrubs and other plants on the ground. While a wide variety of animals and birds found homes in these forests, their populations dwindle as humans continue to remove the trees and use the land for other purposes.

Ecological Succession in the Desert

By Andrea Becker

Desert biomes, defined by low annual precipitation, cover one-fifth of the planet. Under the umbrella term desert are some of the hottest and coldest places on Earth. Precipitation can vary among deserts as well, from arid climates with no precipitation, to those with an annual wet season, to semi-arid ecosystems that receive slightly more precipitation. Deserts may represent a wide range of conditions, but some aspects of desert succession can be seen across the planet.

Describing Succession

Succession can be thought of as ecosystem aging, but unlike human aging, it does not always move forward in an orderly fashion. During succession, species become established and are then supplanted when conditions become more favorable for another species. Succession usually follows a progression from colonizers through a series of intermediate stages until it reaches a climax community. Climax communities represent species assemblages that are relatively stable, unless the ecosystem is perturbed. Succession can be primary, where life starts out on completely new territory, or secondary, where succession is set back by a disturbance.

Primary Desert Succession

In deserts, primary succession could occur on a sand dune or a fresh lava flow. Bacteria or seeds of colonizing species find a foothold where a microclimate offers a pocket of increased moisture and protection. These original colonizers form biofilms and put down roots that stabilize the upper layer of soil and break down rocks. The improved soil can hold more moisture and support other plants, which crowd out the original colonizers. Eventually the ecosystem may be able to support grasses and finally woody shrubs, if there is enough water.

Secondary Desert Succession

Desert ecosystems can be disturbed by fire, flash flood scouring or land clearing. After disturbance, succession is set back, but the soil has already been developed. Secondary succession in deserts is relatively quick compared to primary succession, but it takes much longer to establish a desert community than it does in less arid regions. For example, in the southwestern deserts of North America, it can take 76 years to establish perennial plant cover and 215 years for full ecosystem recovery. If the disturbance is great enough, secondary succession may produce an entirely different climax ecosystem.

Changing Desert Disturbance Regimes and Succession

Climate change and other factors have led to increased fire frequency in many desert areas. Burned areas can be more susceptible to invasive species such as cheat grass, which, in turn, are more prone to fire. The changes in fire frequency and the resulting changes in succession have led to the loss of desert habitat types in some areas. Resistance to invasion and resilience in the face of fire depend on water and resource availability and the speed with which native communities become