Climate Change in National Parks

National Park Service
U.S. Department of the Interior

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level."

- Intergovernmental Panel on Climate Change, 2007

Change has always been a powerful force of nature. National parks and the stories they represent help us understand and appreciate how much our lives are influenced by change. They show us how interconnected we are with our environment whenever change occurs.

Today, we hear more and more about the effects of "climate change." Scientists tell us there is little doubt that human activities are having a major impact on the atmosphere and ecosystems of our planet.

Glaciers and snow packs are melting, stream and lake temperatures are going up, coastal erosion is increasing, and changes in weather patterns are leading to heat waves and drought, both locally and regionally. According to researchers, the magnitude and pace of these changes, as well as additional ones that climatologists believe probable, are unprecedented in human history. Many of the impacts have consequences that will affect resources and influence the experiences for which the national parks were established.

Regardless of their causes, we must do what we can to manage these impacts and adapt to the new circumstances they bring. Perhaps the same wisdom that has preserved our heritage in the past can guide us in making choices for the future.

Local "weather" is often confused with global "climate." Specific park records may reflect periods of warming or cooling depending on regional circumstances. Global mean temperature, on the other hand, is based on surface and atmospheric temperatures from thousands of locations, and from satellites worldwide. Global mean temperature has risen 0.8 degrees C, since 1880.

Nutrient-rich whitebark pine seeds are a critical food source for the grizzly bears of Yellowstone National Park. Warmer winters have enabled bark beetles to significantly increase mortality of whitebark pines over their entire American range with little sign of relief. Not only does this lower the grizzlies' survival rates, they are now more likely to experience human conflicts in their search for alternate foods.

Climate Change is Happening

Warmer winters and longer, more intense melt seasons have increased the rate of glacial retreat in Alaska's Glacier Bay and Kenai Fjords National Parks. It is estimated by USGS scientists that by 2030, many of the glaciers in Montana's Glacier National Park will be completely gone.

Muir Glacier, 1941 (left) and 2004 (right)
Glacier Bay National Park and Preserve

Changes have Consequences

Many climate change consequences make it difficult for park managers to preserve the resources unimpaired. Higher temperatures in spring and summer and earlier melting of the snow pack in recent years have contributed to an increase in the frequency and duration of wildland fires. Fire suppression costs may continue to increase, with decreasing effectiveness under extreme fire weather and fuel conditions. The 2006 wildfire season set a 45-year record in the number of acres burned. Particularly at risk are plant and animal species that are more restricted in their needs for habitat, have limited ability to relocate, or have surrounding development that leaves them few options.

In Yosemite, the pika population is in danger of becoming extinct as warming temperatures occur higher and higher on the mountainsides. With each season, the cool habitat in which they make their homes shifts further upslope. Eventually, if this continues, they may have nowhere higher to go.

At parks like Bandelier National Monument, higher temperatures and drought have brought high mortality to the pinon pines as infestations of bark beetles have expanded to higher elevations and new ranges. At Everglades National Park, increasing sea level may overwhelm mangrove communities that filter out saltwater and maintain the freshwater wetlands. At Canyon de Chelly National Monument, Mesa Verde and Rocky Mountain National Parks, floods and fires have damaged historic structures and are threatening the loss of archeological sites.

A dilemma for managers is already occurring at Joshua Tree National Park. Joshua trees require cool winters and freezing temperatures in order to flower and set their seeds. Researchers have documented substantial mortality of Joshua trees and predict that because of climate warming, the trees will be unable to persist much longer within the park. Soon, Joshua trees may no longer be found in the park bearing their name.

Arrange for Change

We Must Do What We Can

While many changes to park resources are inevitable, they can still influence the ways in which visitors use and enjoy the parks. Reduced winter snow pack and, in some cases, more rain, have changed the timing of surface runoff each year which often makes spring and summer water activities difficult or impossible. Salmon and trout populations, popular for fishing, are showing high mortality rates due to warming water and flooding. Indigenous users of these fisheries, especially in Alaska, are at risk to lose not only a food source, but a way of life. Winter seasons are opening later and closing earlier. Although this extends the season for activities like hiking and camping, it reduces the opportunities for recreational skiing and other winter sports due to inadequate snow cover. Many of these impacts have economic implications.

Scientists who study climate change agree that human activities are a big part of the current warming trend. As stated in the 2007 report of the Intergovernmental Panel on Climate Change, "Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* (90% certainty) due to the observed increase in anthropogenic greenhouse gas concentations."At Mauna Loa in Hawaii and around the world, specific evidence has been gathered of an increase in greenhouse gases in the atmosphere, predominantly carbon dioxide, which are contributing to the warming of the planet. Carbon dioxide levels in the atmosphere today are higher than they've been in over 650,000 years.

For our national parks to thrive and for us to continue enjoying them, it seems appropriate now to do what we can to reduce climate change impacts and adapt to their consequences. Fortunately, we now have the tools, knowledge, and ingenuity to better understand these changes and make informed choices for coping with them. Prominent scientists are saying that our own survival may be at stake.

How will you arrange for change...?

"What is the use of a house, if you haven't got a tolerable planet to put it on?"

- Henry David Thoreau

Parks and Scientists Provide Hope for the Future

National parks are helping us figure out how to respond to these changes. Parks across the nation are conducting "Climate Friendly Parks" workshops, co-sponsored by the Environmental Protection Agency, to evaluate energy usage and identify efficiencies that improve park operations. Many are developing alternate energy strategies to reduce their emissions of greenhouse gases. Use of solar and wind energy, fuel cells, electric and hybrid cars, and public mass transportation where high visitation exists, are being developed. Vulnerable resources are being monitored in most parks, and several have researchers who specifically address climate change impacts. Rangers in many parks are being trained and provided the latest reports from climate scientists to enable them to respond to questions and help visitors understand climate change and its implications.

Many times during our nation's history, citizens have confronted difficult circumstances and found creative solutions. Our parks tell compelling stories about the American Revolution, the abolition of slavery, the fight for civil rights, and about countless inspirational personalities who have made a difference for our nation. Many parks convey stories about people's responses over thousands of years to shifting climate patterns. These stories now form a call to action in the stewardship of our resources for future generations. It is important that all of us participate in answering that call.

Scientists tell us we already possess all the technologies needed to reduce carbon dioxide in our atmosphere. They have identified strategies to do so within 50 years. Many of these actions involve choices that individuals can make to conserve and reduce energy use. One of the best suggestions for coping with climate change on a personal level is to become "carbon neutral." Because we exhale carbon dioxide and need energy for our daily activities, we are unlikely to eliminate all impacts. However, if we reduce our energy use to a basic level, and offset the emissions we do generate by recycling, and investing in clean alternative energies, we may achieve balance and not further compromise global resources. Changing to more energy efficient light bulbs and appliances, unplugging computers and electronic devices when they are not in use, and using public transportation whenever and as often as we can, are good examples of conservation practices. There are many more.

To find out more about becoming carbon neutral and to become better informed about climate science, here are some helpful references:

The Intergovernmental Panel on Climate Change
http://www.ipcc.ch/

The Arctic Climate Impact Assessment
http://amap.no/acia/ACIAContent.html

Understanding and Responding to Climate Change
http://dels.nas.edu/basc/Climate-HIGH.pdf

EPA's Global Warming – Actions
http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsIndividualMakeaDifference.html

NPS/NASA Earth-to-Sky Interpretive Training tool
http://www.earthtosky.org

Regardless of the causes, taking action to manage the impacts of changing climate will have positive benefits for our resources. In the future, national parks will tell the story of our collective success in dealing with climate change, about creating a way of life in harmony with the natural processes that operate on our planet. After all, Earth is the only planet we call home.

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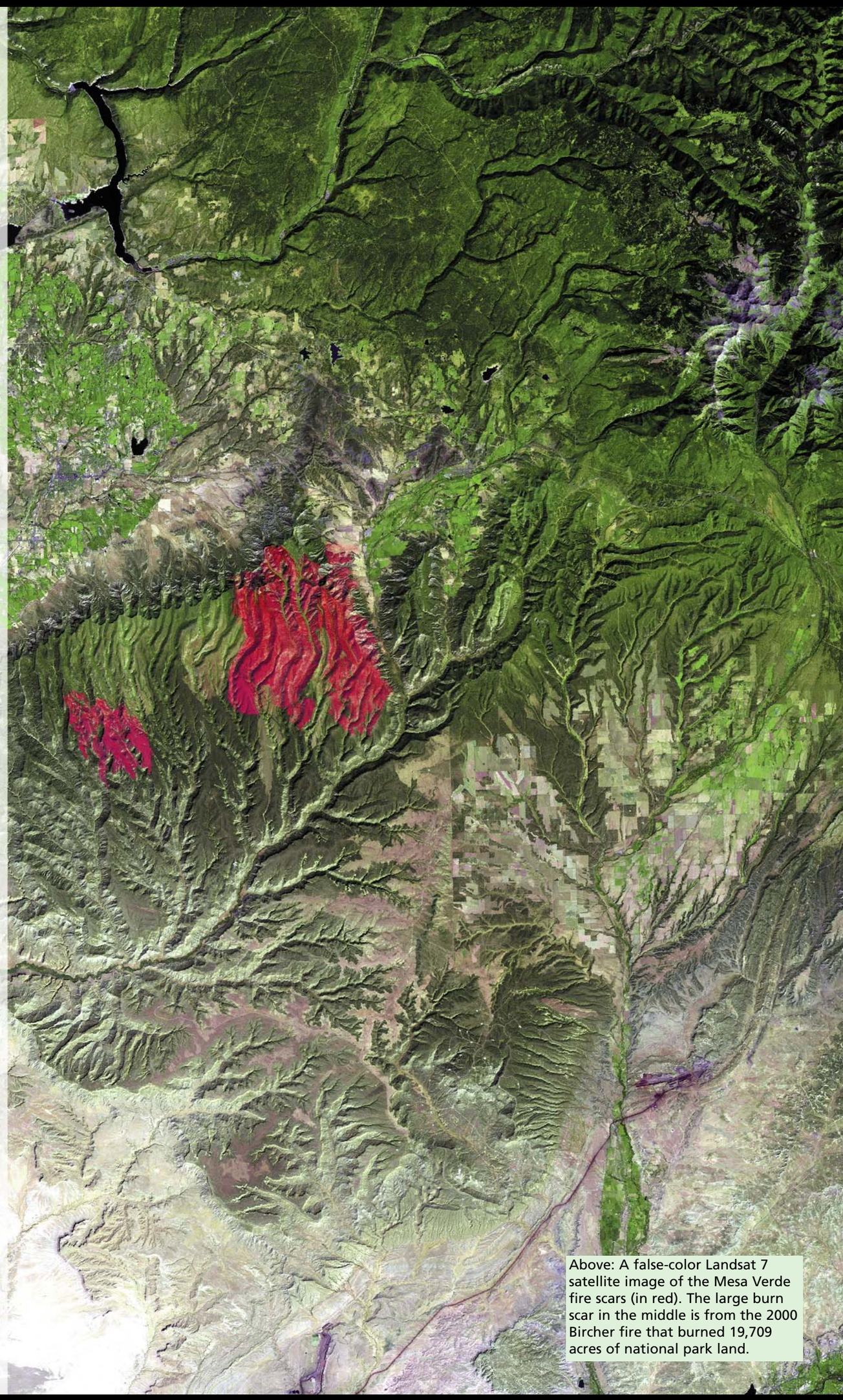

Above: A false-color Landsat 7 satellite image of the Mesa Verde fire scars (in red). The large burn scar in the middle is from the 2000 Bircher fire that burned 19,709 acres of national park land.