

Narrative for Federal Employee Climate Change PowerPoint

1. The topics of “climate change” and “global warming” are all over the news these days. Federal land managers in the Greater Yellowstone Ecosystem (the GYE) developed this presentation to send three messages to all employees:

climate change is real,
it has already affected the resources in our local area, and
we are adapting our management to respond to it.

This presentation describes the basic science behind climate change and shows resource impacts we are seeing and responding to today. As you watch this, please consider two questions – “how does climate change affect your work?” and “how can the choices you make at work affect the rate of future climate change?”

2. Climate change response in the Department of Interior is guided by Secretarial Order No. 3289. It establishes a coordinated strategy to address renewable energy efforts and increase scientific understanding of and development of effective adaptive management tools to address the impacts of climate change on natural and cultural resources. This strategy applies to all Department of Interior agencies, including the National Park Service, the Bureau of Land Management, and the US Fish and Wildlife Service.

The National Park Service has also developed agency specific guidance in their *Climate Change Response Strategy* on how the agency can respond through science, adaptation, mitigation and communication.

3. Similarly, the Forest Service developed a *National Roadmap for Responding to Climate Change*, and the 2012 planning rule mandates that all national forests take climate change into consideration during their planning process. Forest Supervisors must annually report accomplishments integrating climate change into land management in the Climate Change Scorecard.

4. Let’s start by describing the difference between climate and weather. Weather is the day-to-day variations in temperature, wind and precipitation. An unusual cold spell in July is attributed to weather. Climate, on the other hand, is the long-term pattern seen in temperature and precipitation. An example of a climate pattern is that Wyoming is cold in the winter and warm in the summer, while Hawaii is relatively warm all year round. You can think of it like this: If you decide to wear shorts vs. pants on any given day, you’re talking about weather. How many shorts-vs.-how many pants you have in your wardrobe is related to the climate.

5. Climate change is not new to the GYE. This area was covered by a large glacial complex during the last ice age about 20,000 years ago. The ice age ended about 16,000 years ago, and glaciers rapidly melted and receded to high elevations. Lakes, soil and forest developed in the de-glaciated region, creating suitable conditions for animals and early humans. The early period was followed by one of warmer drier conditions and high fire activity between 11,000 and 7000 years ago. The present-day vegetation and fire conditions of the GYE were formed about 5000 years ago when the modern climate was established.

6. Did you know our current climate is related to the amount of gas in the atmosphere? As sunlight passes through the atmosphere, it warms the earth’s surface. This heat is radiated back toward space. Some of the outgoing heat is absorbed by atmospheric gas molecules and re-emitted in all directions, warming the surface of the earth and lower atmosphere. Certain gases, especially CO₂, trap heat in the atmosphere. This “Greenhouse Gas Effect” causes the planet to warm and this warmth allows life on

earth to thrive. Because of greenhouse gases, the average temperature on earth is 57.5 degrees Fahrenheit, otherwise it would be below zero and too cold to sustain most life.

7. Before human influence, changes in climate resulted entirely from causes such as changes in Earth's orbit and solar activity, ocean and atmospheric circulation patterns, changes in the amount of greenhouse gases, and or volcanic eruptions. Scientists have been able to analyze gases trapped in ice sheets to recreate a lengthy history of atmospheric CO₂ concentrations. They have determined that for the past 850,000 to one million years the level of CO₂ varied between 180 and 300 parts per million. Since the industrial era, CO₂ has risen at an unprecedented rate to 398 parts per million, nearly 50% above the previous high.

8. Worldwide, 2001-2010 was the warmest decade on record since thermometer-based observations began (over 100 years ago). Temperatures in the latter half of the century have been ½ to 1 degree Fahrenheit warmer than the long term average, as shown in this graph by the orange bars above the baseline beginning in the 1940's.

9. Because climate change can shift the wind patterns and ocean currents that drive the world's climate system, some areas have experienced more warming than others, while others have actually cooled. The dark red blocks on this map indicate areas where the largest average annual temperature increases have occurred in the past century while blue blocks show areas where temperatures decreased. In the Greater Yellowstone Ecosystem we have experienced an increase of 1 to 2°F in the average annual temperature between 1901 and today.

10. Have you heard that climate scientists disagree about future temperature predictions? It is true that some scientists support a conservative estimate based on low carbon emission models. These models lead to a predicted increase of one and one half degrees Centigrade in global mean temperature by the year 2100 (shown by the blue line on the left side graph). Other scientists using a model based on continuation of the current rate of increased emissions predict a change of over 4 and one half degrees (shown by the orange line). Whether using conservative models or models that continue the current rate of increasing emissions, scientists agree that they expect the global mean temperature to increase. The first two bars on the graph on the right displays the level of risk to unique and threatened systems and risk of extreme weather events. Even under the conservative prediction of a one and one half degree increase, a high risk to unique and threatened plant and animal systems is expected.

11. The change in wind patterns and ocean currents related to climate change has influenced precipitation. The dark green areas have seen increased rates of precipitation in the past century while the brown areas have seen less precipitation. As average temperatures at the Earth's surface rose, more evaporation occurred, which, in general, increased overall precipitation. Records in the GYE show a 10 to 20% increase since 1901. Notice the decreases displayed in Montana, northeastern Wyoming, Florida, Hawaii, and the southwestern US. Drought can be caused by decreasing precipitation, increasing temperatures, or both.

12. This map shows trends in April snowpack in the western US in the past 60 years. April snowpack has decreased in the GYE as shown by the medium and large sized orange circles while it has increased in the southwestern mountainous areas. With continued warming in the winter months, more precipitation is predicted to fall as rain rather than snow.

13. This map of snow survey sites in Yellowstone National Park and the surrounding area shows all sites that have over 30 years of data. A significant decrease in the amount of snowpack on April 1 has been documented at the sites shown in red. Snowpack is also decreasing over time at the sites shown in blue, however the trend is not statistically significant over the period of record.

14. Look at temperature records from the past 30 years at the Lick Creek thermometer station in Yellowstone National Park. This graph shows the decrease in the number of days where the temperature dropped below 32 degrees Fahrenheit. In 2012 there were 90 fewer days below freezing than in 1983.

15. Scientists are documenting how the changing climate is affecting our resources. Glaciers cool local environments and act as reservoirs that release water during summer and early fall when it's most needed. Researchers measured the changes in glacial mass within the Beartooth Mountains on the Custer National Forest. In the top photos, the 1952 perimeter is overlaid on the 2003 perimeter. The bottom three photos show the reduction in ice from 1952 to 1987 to 2003.

16. To assess the dynamics of glaciers and their response to climate change, Grand Teton National Park is testing a monitoring program that combines QuickBird imagery interpretation with ground-based measurements and photo-points.

17. Melting ice patches have resulted in irreparable losses of resources and are of great concern to resource managers. Numerous artifacts and paleo-biological specimens, including animal bones, tree stumps and stone tools that have been encased in ice for thousands of years, are emerging as ice melts. A complete dart fore-shaft dated over 10,000 years old was recovered in the GYE. We are obliged to recover information and material from the melting ice patches before it vanishes, and, as part of that preservation effort, new questions about human use of high altitude areas are arising.

18. Warmer temperatures have created earlier and higher peak flows during spring run-off, damaging bridges, culverts, and roads. On the Caribou-Targhee National Forest in 2011, this bridge and the 3-ft-diameter culvert were overwhelmed. The road acted as a dam. The force of the flooding water eroded the road surface and down-cut the ditch line by nearly 2 feet.

High waters aren't bad news for everyone though. As precipitation increases and snow melts earlier, the whitewater rafting season will start earlier and may last longer. Changes in commercial raft permits may be needed.

19. Changes in winter snowpack and increasing temperatures has reduced wolverine habitat. Snow cover during their denning period is essential for successful reproduction. Yellowstone National Park in collaboration with the Wildlife Conservation Society mapped wolverine tracks to determine their extent in the GYE. Wolverine may be sensitive to winter backcountry recreation use, which can be managed to protect key denning sites.

20. Warmer temperatures enable grizzly bears to delay hibernation in the fall and emerge from their dens earlier in the spring. Changes have been made in bear closure orders in the GYE to minimize the interactions between newly emerged bears and visitors.

21. Native cutthroat trout spawn as the peak of spring runoff begins to recede. Non-native rainbow trout--which can hybridize with native cutthroat trout and erode their genetic integrity--spawn earlier, as high water is building. Spring runoff patterns are changing, with smaller high and low flows throughout the spring. The spawning period for both fish may lengthen and allow their spawning periods to overlap, which may prompt managers to design regulations or install barriers to minimize the mixing of fish

species. Also, GYE managers have temporarily closed fishing areas in response to high summer temperatures.

22. Land managers want to ensure that streams, riparian areas, and wetlands are in their best possible condition. Forest, park, refuge and BLM employees are assessing watershed conditions, identifying potential improvements and implementing them to make watersheds more resilient to climate change.

23. On lower-elevation shrub- and grasslands, increases in temperature and changes in seasonal moisture availability are allowing invasive species such as cheatgrass to spread. Cheatgrass--a highly flammable invasive--currently covers 158 million acres of public lands, and can out-compete native grasses for the limited moisture that is available in much of the GYE. . By mapping and monitoring cheatgrass spread, managers can identify areas most vulnerable to future invasions, treat infestations, and identify sites for restoration of native shrubs and grasses.

24. Climate change has affected how native mountain pine beetles influence Greater Yellowstone's forests. Warmer temperatures have accelerated beetle life cycles. Severe winter temperatures, which limit the cyclic beetle outbreaks, are occurring less frequently. Recent pine beetle epidemics have killed large areas of forests in the West, such as these trees on the border between Yellowstone National Park and the Shoshone National Forest. Fortunately, the beetle epidemic appears to have peaked in the GYE.

25. Whitebark pine are in decline in the GYE, due to pine beetles and an introduced fungus called white pine blister rust. Federal land managers are working with researchers to predict suitable whitebark pine habitat in a warmer climate and have developed a strategy to try to slow the loss of whitebark pine forests in the ecosystem and restore them where appropriate.

26. Researchers have documented an increase in duration and intensity of fire seasons, presenting a growing challenge to managers, fire fighters, and residents who live in and near western forests.

27. While the GYE is a fire-adapted ecosystem, in which some species need fire to survive, increased fire frequency and severity may lead to large shifts in vegetation composition. Many prescribed fire projects aim to restore historical fire regimes by reducing fuel load, building resilience to climate change, and limiting the damage to structures and human communities.

28. Change is to be expected - ecosystems have always been dynamic. Federal employees from the forests, parks, refuges and BLM are all planning for a future affected by climate change. Through monitoring, vulnerability assessments, and scientific studies, we are learning more about the ecological responses that are occurring. Specialists are beginning to incorporate climate information into project planning, design and prioritization. Through increased education and communication, we are sharing this information across agency boundaries and with others to engage the public and partners to assist in efforts to prepare for future changes.

29. One way we are influencing the rate of climate change is by reducing the human imprint on our environment. *The Greater Yellowstone Area Climate Action Plan* outlines ways we can reduce greenhouse gas emissions at work. Many federal buildings in the GYE are now using renewable energy sources such as solar panels and new buildings are being constructed with energy efficiency in mind.

30. We have recycled more than 3.5 tons of plastic since 2009 and reduced water consumption at administrative and recreation sites by millions of gallons per year. Using sustainable practices not only saves energy, it saves money that our agencies can better use for resource management in the Greater Yellowstone Ecosystem. Using video conferencing instead of traveling to meetings, managing the office thermostats, eco-driving, reducing idling, carpooling, the increased use of low-emission vehicles, turning

off your computer and office lights, reducing your use of bottled beverages, and using public transportation are all ways you can make a difference.

31. We hope this presentation has helped you understand the basic science behind climate change. We've shown examples of resources that have already been affected and you have seen what employees are doing to measure and respond to past and present climate related effects. It is time for every federal employee to engage in climate change adaptation. You can learn more about it at the website listed on this screen.

32. Thanks for your attention today! This presentation was developed by Jessica Haas in the Rocky Mountain Research Lab and the Climate Change Sub-committee of the Greater Yellowstone Coordinating Committee.