Temperature Indicators Figure Set Descriptions

**Figure 1 — Damage caused by Wildfires in the United States:** This figure shows the damage from wildfires by acreage across the United States. The severity of each fire is measured by comparing the “greenness” of satellite images taken before and after a fire. Burn severity provides an indication of the damage done and can help scientists predict how long it will take for the location to recover. Climate change can impact wildfires because with warmer temperatures, forests become more vulnerable to fires. This is due to drought and higher temperatures.

**Figure 2 — Average Global Sea Surface Temperature:** This figure shows how the average surface temperature of the world’s oceans has changed since 1880. The shaded regions show the amount of uncertainty. Notice how those bands of shaded regions decrease dramatically around 1950, showing how the instruments used to measure sea surface temperature have dramatically improved. These measurements were made by buoys and ships in the ocean that monitor temperature. Sea surface temperature is an important indicator of a warming planet because ocean covers the majority of the earth. Slight changes in sea surface temperature can change ocean currents and impact many ocean species. Additionally, as the oceans warm, an increase in evaporation will lead to more water vapor, a very powerful greenhouse gas.

**Figure 3 — Change in Latitude of Bird Center of Abundance:** This figure shows the change in latitude of bird center abundance for 305 species of North American birds. The center of abundance is a point on the map the represents the middle of each species’ distribution. If a species shifts northward with its range, then the center of abundance would shift north as well. Each winter is represented by the year in which it began. For example, winter 2013-2014 is shown as 2013. Many people and institutions (students and scientists) have kept detailed records of birds for over a century. This data relies on people all over the continent keeping track and observing certain species of birds, including their migration arrival and departure dates.

**Figure 4 — Ice Cover in the Great Lakes:** This bar graph shows decade averages of annual maximum Great Lakes ice coverage starting from the winter of 1962-1963, when reliable coverage of the entire Great Lakes began, to the winter of 2012-2013. Bar labels indicate the end year of the winter; for example, 1963-1972 indicates the winter of 1962-1963 through the winter of 1971-1972. The average maximum for 2003-2013 was less than 43% compared to the 1962-2013 average of 52%. Less ice, coupled with more frequent and intense storms, leaves shores vulnerable to erosion and flooding and could harm fish habitat.

**Figure 5 — Arctic Sea Ice Loss:** Arctic sea ice has declined dramatically since satellites began measuring it in 1979. The extent of sea ice in September 2012, shown in white in the top figure, was more than 40% below the average for 1979-2000. The graph on the bottom left shows annual (yearly) variations in September Arctic sea ice extent for 1979-2013. It is also notable that the ice has become much thinner in recent years, so its total volume (bottom right) has declined even more rapidly than the extent. As ice cover decreases in the Arctic, it reduces the amount of reflective ice surface, allowing the dark water to absorb more energy, allowing the warming to continue. More open water and a warmer Arctic can lead to changes in the precipitation and the jet stream (a river of air in the atmosphere that steers our weather), often allowing cold air to drift farther south in the winter.

**Figure 6 — Observed U.S. Temperature Change:** This map shows the temperature changes for the U.S. from 1991-2012 compared to the 1901-1960 average (and compared to the 1951-1980 average for Alaska and Hawai’i). U.S. average temperature has increased by 1.3°F to 1.9°F since record keeping began in 1895; most of this increase has occurred since about 1970. The bar graphs show the average temperature changes by decade for each region. The period from 2001-2012 was warmer than any previous decade in every region. The simplest way temperatures are recorded are from fixed land monitor stations around the country.

**Figure 7 — Observed Increase in Frost-Free Season Length:** This figure shows how the different regions in the United States have seen an increase in the frost-free season length, from 1991-2012 (relative to the 1901-1960 average). The frost-free season is defined as the period between the last occurrence of 32°F in the spring and the first occurrence of 32°F in the fall. An increase in the frost-free season length results in a similar increase in the growing season length. A longer growing season provides a longer period for plant growth and productivity, however in some cases where moisture is limited, the greater evaporation and loss of moisture can lead to less productivity because of increased drying and longer fire seasons.
Figure 8 — Peak Bloom Date for Cherry Trees Around Washington D.C.’s Tidal Basin: This figure shows the peak bloom date each year for cherry trees in Washington D.C. The peak bloom occurs when 70% of the blossoms are in full bloom. The shaded band shows the timing of the annual National Cherry Blossom Festival. Peak bloom dates for cherry trees are occurring earlier than it did in the past. Since 1921, peak bloom dates have shifted earlier by approximately five days. The National Cherry Blossom Festival has continued to expand in length due to the earlier bloom dates.

Figure 9 — Ten Indicators of a Warming World: This figure shows some of the many indicators measured globally over many decades that demonstrate that the Earth’s climate is warming. White arrows indicate increases, and black arrows show decreases. All the indicators expected to increase in a warming world are increasing, and all those expected to decrease in a warming world are decreasing.

Figure 10 — Global Average Sea Level Change: This graph shows changes in sea level for the world’s oceans since 1880, based on a combination of long-term tide gauge measurements and recent satellite measurements. This figure shows average absolute sea level change, which refers to the height of the ocean surface, regardless of whether nearby land is rising or falling. As the temperature of the Earth changes, so does sea level. Temperature and sea level are linked for two main reasons: Changes in the volume of water and ice on land (namely glaciers and ice sheets) can increase or decrease the volume of water in the ocean and as water warms, it expands slightly—an effect that is cumulative over the entire depth of the oceans. Satellite data are based solely on measured sea level, while the long-term tide gauge data include a small correction factor because the size and shape of the oceans are changing slowly over time. (On average, the ocean floor has been gradually sinking since the last Ice Age peak, 20,000 years ago.) The shaded band shows the likely range of values, based on the number of measurements collected and the precision of the methods used.

Figure 11 — Reported Cases of Lyme Disease in the United States: This graph shows the annual incidence of Lyme disease, which is calculated as the number of new cases per 100,000 people. The graph is based on cases that local and state health departments report to Center for Disease Control’s national disease tracking system. Lyme disease is a bacterial illness that can cause fever, fatigue, joint pain, and skin rash. Lyme disease is transmitted through the bite of certain species of infected ticks (referred to commonly as deer ticks) that carry the bacteria that cause Lyme disease. Climate is just one of many important factors that influence the transmission, distribution, and incidence of Lyme disease. However, studies provide evidence that climate change has contributed to the expanded range of ticks, increasing the potential risk of Lyme disease, such as in areas of Canada where the ticks were previously unable to survive.

Figure 12 — Change in Muir Glacier from 1941 & 2004: These pictures compare the Muir Glacier of Alaska in 1941 and 2004. From 1941 to 2004, the front of the glacier moved back about seven miles while its thickness decreased by more than 2,625 feet, according to the National Snow and Ice Data Center. Glacial retreat is one of the many indicators of a warming planet. While many glaciers have been retreating for quite some time, it is the rate of retreat that is concerning. The Muir glacier is just one of many examples of glacial retreat from around the world.