

HOW WILL CLIMATE CHANGE CHANGE THE SOUTHEAST?

Regional Challenges

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It seems like we cannot turn on the TV or pick up a newspaper without reading an alarming news story about climate change impacts. Heat waves, floods, hurricanes, droughts, wildfires, insect outbreaks; all are attributed to changes in our planet's climate, largely caused by rising levels of carbon dioxide. Carbon dioxide is a major component of our "greenhouse gas" atmosphere. It is called a greenhouse because the gases in the atmosphere act like a greenhouse around the Earth, similar to a blanket on your bed. If you are cold at night, another blanket traps more of your body heat and keeps you warmer. The same is true with the Earth. Carbon dioxide acts like trillions of microscopic blankets around our planet. As sunlight passes through the atmosphere, it strikes the ground and is radiated back as heat. Without an atmosphere, the heat would be radiated back into space, and after night falls, the Earth would be as cold as the moon (about 300o below zero!). But the gases trap some of the heat and keep it from radiating back into space. So having these greenhouse gases around our planet is a good thing indeed!

However, too much of any good thing is not always good. the mid-1850's, society began to shift from using wood to coal and eventually petroleum as a primary source of fuel. These "fossil fuels" are largely composed of combustible carbon that is emitted as carbon dioxide when the fuels are burned. Since the beginning of the industrial revolution, the amount of carbon dioxide has increased from 280 part per million (ppm) to over 380 ppm in 2008. This is an increase of almost 40 percent. Think about adding 40percent more blankets to your bed – you are likely to get much warmer! But just like on your bed, no matter how many blankets you add, cold spots will always exist. The same is true with climate change; while the vast majority of the planet becomes warmer, a few areas could cool due to changes in atmospheric and ocean circulation patterns.

In 2007, the International Panel on Cli-

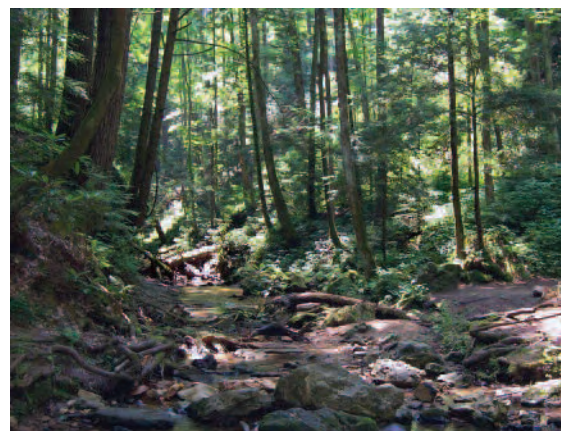
mate Change (IPCC) released the latest comprehensive report on climate change. The report states that the rate and degree of climate change will depend on what we, as a collective world, decide to do about global warming. There are basically three options. We can continue to contribute greenhouse gases into the atmosphere at the current rate. We can take various actions to reduce greenhouse gas emissions, or we can actually increase greenhouse gas emissions.

Depending on the course of action, average air temperature in the southern U.S. will rise between 2^o and 4^o C by 2100. During this time, precipitation in the southern U.S. may vary from a 5 percent decrease to a 20 percent increase. Of course nothing is magical about the year 2100. At the stroke of midnight, global warming will not go away. Air temperatures will continue to rise beyond that date if nothing is done to combat the problem. These changes in climate will have significant ecological impacts, including impacts on water resources.

The southeastern U.S. has witnessed a major increase in population over the past 50 years. Between 1930 and 2005, the region's population tripled, but distribution of the increase was not uniform. Metropolitan areas such as Atlanta and Miami saw disproportionately large increases. Water resources are among several infrastructure components that have struggled to keep pace with the growing population base. Even without climate change, several southern cities periodically experience water shortages and water use restrictions.

The combination of climate variability and high water demand places the southern U.S. in a uniquely vulnerable position regarding water resources. The western U.S. has adapted to water shortages because of the frequency of occurrence. Western water policies already in place mandate everything from municipal water withdrawal rates to homeowner landscaping options.

Projected Impacts on the Southeast



Swift Camp Creek runs through the Daniel Boone National Forest near Lexington, KY.

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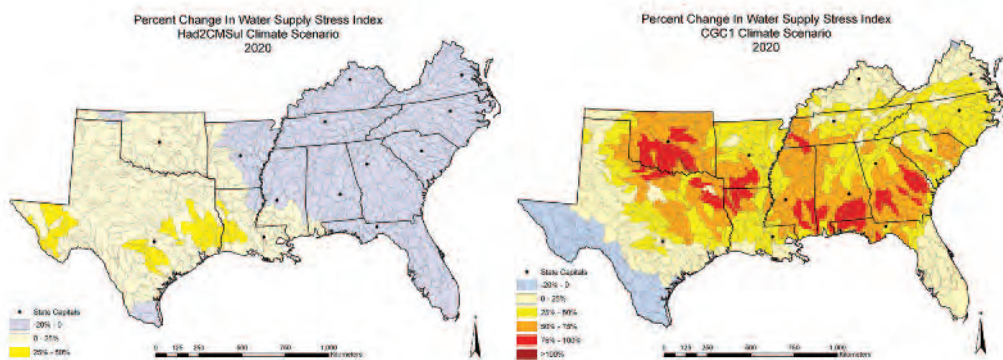
Lessons are to be learned from challenges the western U.S. is already facing. Short-term conservation measures such as implementing outdoor watering restrictions, closing car washes, and reducing restaurant water use, are “band-aid” solutions to episodic drought. Future droughts will likely be longer and more intense. Increases in reliable water supplies (e.g., through development of water sources or construction of new reservoirs) are an expensive solution. However, increasing supply will not be enough given continued population and climate change pressures.

Fundamental water use changes will also be needed. Regionally, agricultural irrigation is the second largest user of water, behind water used in energy production. Much of the irrigation occurs in relatively low population density areas and has limited impacts on metropolitan water shortfalls. However, in areas of limited water supply or where population pressure for water is high, serious consideration of water use priorities and water saving technologies (e.g. roof top rainfall collection) will be needed. Individual water use behavioral changes will also be required. Low flow shower heads and toilets, modifying outdoor watering practices, and managing landscaping choices could, in combination, significantly help to reduce water demand over the coming years and decades.

In addition to water quantity, water quality will also be impacted by climate. Since the early 1900’s, the percent of ex-

treme events (i.e. those rain events of two inches or greater in a 24 hour period) have increased by over 30%. When the rains do come, they are more severe, and this can lead to increased soil erosion and stream sedimentation. Land managers can reduce these negative impacts by leaving a buffer strip of undisturbed vegetation (trees and ground cover) at least 50 feet wide on both sides of a stream. These natural areas help to trap any overland soil flow before it can reach and contaminate the water. Away from the streams, the leaf cover from preserved forest areas will help to slow the rain drops as these fall on the soil, and reduce the amount of sediment that is being produced. In combination, land managers cannot stop climate change, but they can mitigate some of the major problems associated with its impacts.

Regardless of the how aggressively we combat the emission of greenhouse gas emissions, the planet will likely continue to warm, and weather patterns will become more extreme for many decades to come. . The challenge will be reversing global warming while minimizing the amount of pain and disruption to society. Unfortunately, the dire news regarding climate change will not fade away anytime soon. However, through aggressive measures to combat continued greenhouse gas emissions, and preparations for associated global warming impacts, we will persevere.



Both climate change models, shown in maps at left, predict an increase in water supply stress in the Southeast. The map on the far left is based on The Hadley Centre’s Had2CMSul climate change scenario and the map on the right depicts the Canadian Climate Center’s CGC1 climate change scenario.