Climate Change Implications for Yukon Flats National Wildlife Refuge

THE WILDERNESS SOCIETY

SNAP Scenarios Network for Alaska Planning

Climate Change and Alaska's National Wildlife Refuges

Alaska's 16 National Wildlife Refuges (NWR) were created to protect important fish and wildlife habitat. Some are already showing signs of climate change impacts, including wetland drying, spruce-bark beetle infestations, and increased fire frequency and intensity. A better understanding of how the land will respond to future changes is needed to help refuge managers and the people that live in or near the refuges identify where and when changes are likely to occur.

Yukon Flats NWR

The Yukon Flats NWR encompasses 11 million acres of the Yukon River basin and surrounding uplands in northeastern interior Alaska (Figure 1). Due to the impacts of climate change, the Refuge faces potentially significant changes that may alter its ecosystems, wildlife, and the lifestyles of its residents.

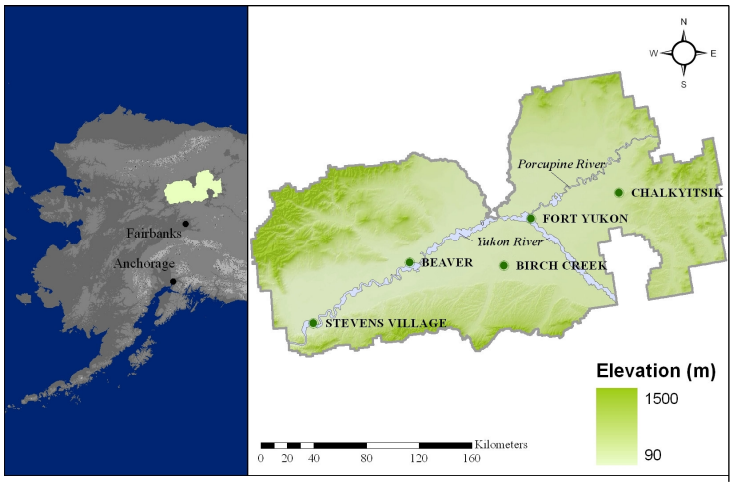

Figure 1. Yukon Flats NWR, in the interior part of Alaska, includes a number of villages that rely on the local natural resources to support their livelihoods.

In order to understand what these changes might be, we used temperature and precipitation data from five down-scaled global climate models to estimate how growing season length, climate variability, and water availability might change within the Refuge. The models assumed steady increases in CO_2 emissions from oil and gas for the first several decades of the 21st century, followed by a gradual decline in emissions as several kinds of low-emission alternative energies come into use. This emissions scenario is considered moderate, with other models predicting much greater emissions levels, and thus impacts[1].

Temperature changes

All five models project increases in temperature, averaging 1°F per decade. This translates into a rise in average annual temperature 5°F by 2040 and 9°F by 2080 (Figure 2).

Considering the natural variation in temperatures across the Refuge, this increase is likely to result in a transition from average annual temperatures below freezing (~22°F) to near or above freezing (~32°F; Figure 2).

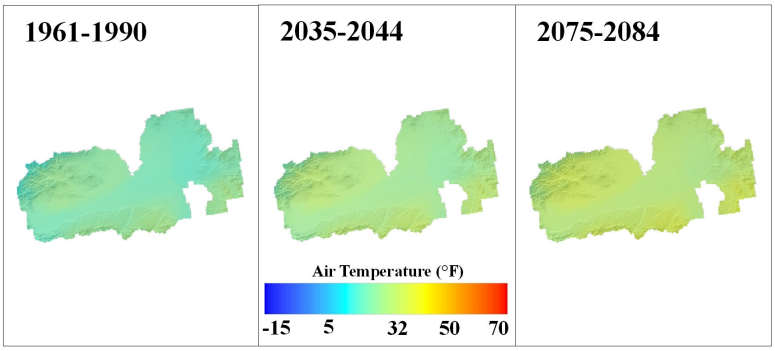

Figure 2. Average Annual Temperature in Yukon Flats NWR from modeled predictions of historical (1961-1990) and future averages.

Furthermore, the time between the first freeze and first thaw dates is predicted to lengthen by about 3 days per decade.

Thus, by the end of the century, the growing season could be about 1 month longer. This would affect wildlife mating cycles, plant growth and flowering, hunting seasons, and water availability in the soil and rivers.

[1] The emissions outlook is "A1B" scenario from the International Panel on Climate Change (IPCC) Fourth Assessment, published in 2007. The models used in this analysis included Echam5, Gfdl2.1, Miroc3.2MR, HadCM3, and CGCM3.1.

Winter temperatures are projected to change the most, increasing by as much as 12°F by 2080 (Figure 3), which would raise the mean winter temperature from a historical -3°F to 9°F.

Summer temperatures will increase but not as much as winter temperatures. Temperatures are projected to rise by 6°F on average by 2080 (from ~52°F to ~58°F). Thus, temperatures in the lowland wetlands along the Yukon River and in many villages will reach new highs rarely experienced before by approximately 2040.

Some species may benefit from these changes, while others may not be able to adapt or find suitable habitat conditions to sustain their population.

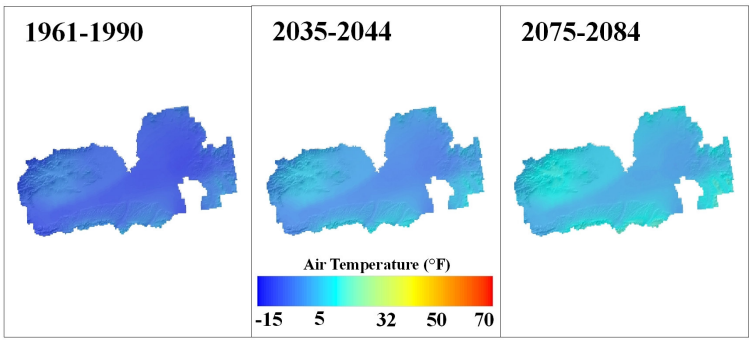

Figure 3. Winter Temperature in Yukon Flats NWR from modeled predictions of historical (1961-1990) and future averages.

Precipitation changes

Precipitation is predicted to increase across the Refuge (Figure 4), with 63% more snowfall in the winter and about 33% more rain in the growing season.

The timing and intensity of precipitation will determine how these changes affect the landscape and hydrology of the Refuge. Increased variability predicted for winter temperatures could result in more icing conditions, which could impact wildlife populations like moose.

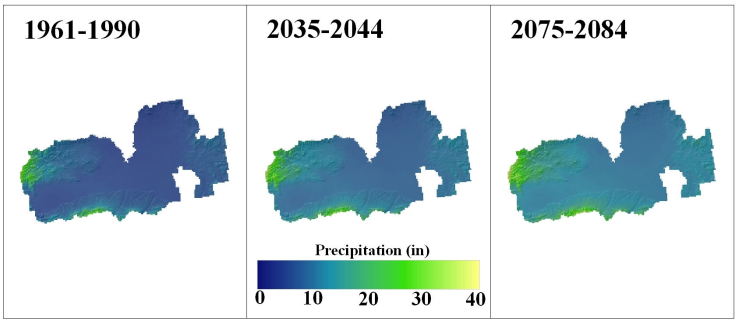

Figure 4. Annual Total Precipitation in Yukon Flats NWR from modeled predictions of historical (1961-1990) and future averages.

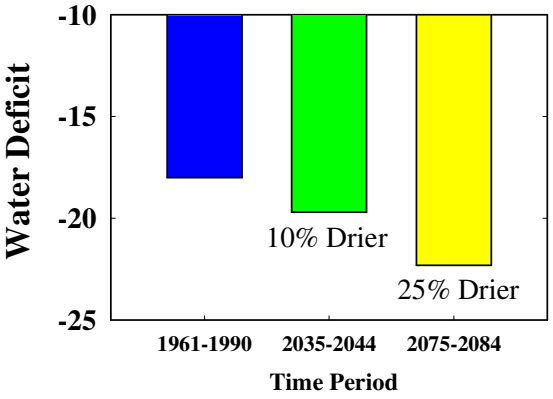

Figure 5. Historically, more water is lost to evapotranspiration than falls as precipitation on Refuge lands. Future conditions are predicted to become increasingly drier.

Despite predicted increases in precipitation, conditions are expected to become substantially drier in the summer and fall due to warmer temperatures and a longer growing season--conditions which increase evapotranspiration (Figure 5). Growing season precipitation would likely have to double from historical levels to maintain current moisture conditions. Without this precipitation, the Refuge lands and rivers are likely to become drier, increasing the risk of fire and of wetlands, lakes and streams drying.

It is important to know that predicting changes in precipitation is difficult. When the data from the models used in this analysis were compared to actual historical measurements within the Refuge, the models tended to overestimate precipitation. This could mean conditions will be even drier than we expect.

Increased monitoring of precipitation, temperature and streamflow within the Refuge would help residents and land managers better understand changes in climate and help them plan for the future.

Summary of findings

The Yukon Flats NWR is likely to become warmer and drier over the next century. Warmer temperatures will cause changes in the condition and health of wildlife habitat. Despite modest increases in precipitation, conditions will become much drier due to warmer temperatures and a longer frost-free season, affecting soil moisture and river levels. Variability in spring and fall temperatures could also affect the amount of precipitation that falls as snow vs. rain.

For more information:
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