Executive Summary for the Tetlin National Wildlife Refuge:
Projected Vegetation and Fire Regime Response
to Future Climate Change in Alaska
January, 2009

Climate change, and its impacts on fire regimes and evolving vegetation patterns, will present land managers with unique challenges in the decades to come. This document provides a summary of predicted impacts upon the Tetlin National Wildlife Refuge and a discussion of ongoing modeling activities aimed at providing definitive statewide and refuge-specific simulation results.

The project is part of a statewide analysis of future vegetation and fire regime response to projected future climate. This work is supported by grants from the National Science Foundation and the Joint Fire Science Program. Additional support has been provided by the UA Scenarios Network for Alaska Planning (SNAP) initiative and from the University of Alaska Fairbanks, US Fish and Wildlife Service, and the National Park Service.

In order to attempt to anticipate the changes likely over the next century, the study first simulated historic fire data based on an empirically derived relationship between climate and fire, and linked those simulated historic fires with the actual recorded fire perimeters for the same period. These "ground-truth-tested" historical simulation results were then applied to the five best performing predicted climate models for Alaska used by the Intergovernmental Panel on Climate Change, as well as to a sixth model scenario that represents a composite of the previous five. These models have been downscaled from a global scale to one covering Alaska at 2km resolution using a well established technique that incorporates elevation to refine the local models.

We currently hold the most confidence in the simulation results for the interior region of Alaska, which includes the Tetlin National Wildlife Refuge. However, because compatible climate and vegetation data are not available for Canada, an appropriate buffer to capture fire occurrence on the eastern edge of the simulation area was not possible. Refinements of the Boreal ALFRESCO model are ongoing and new versions will continue to improve our confidence in these results. It should be noted that the predictions included in this study become less certain as we look farther into the future, and that it isn’t possible, using this data, to simulate either the exact location of future fire occurrence or vegetation type.

In general, we expect climate change to result in substantial increases in landscape flammability during the coming century. Although precipitation is expected to increase during this time period as well, that increase is not likely to be sufficient to counter the increased evaporation and general drying resulting from the higher temperatures.

Preliminary results from the statewide simulations identify consistent trends in projected future fire activity and vegetation response. The simulation results suggest that boreal forest vegetation will change dramatically from the spruce dominated landscapes of the last century, though not as strongly or as quickly as in more central or northern portions of Alaska’s Interior. The Tetlin
simulation domain results produce the same consistent trends in projected future fire activity and vegetation response as do the state-wide simulations yet the timeline for this simulation is delayed relative to some other regions. While statewide fire activity is expected to increase throughout the end of this century with many regions experiencing the most change in the next few decades, the largest changes on the Tetlin Refuge are anticipated in mid and late century though areas north of the refuge are likely to respond earlier.

In the wake of this fire activity, we predict that deciduous vegetation will become increasingly dominant on the landscape. The large regions of mature unburned spruce existing today will likely be replaced by a more patchy distribution of deciduous forests and younger stages of spruce.

Decisions made by fire managers and refuge managers during this period of change will strongly influence the structure and pattern of vegetation across the boreal forest in Alaska. Within the simulation area, the northern portion of the region would seem to be at highest fire risk in the near future. Fire managers should consider how land management objectives may be affected by the predicted changes to natural fire on the landscape. The modeling developed for this study can be used to simulate how changes in fire management may change the potential future landscape. It can also be used to assess how particular vegetation age classes (for example, young deciduous forests or concentrations of older spruce) that may represent habitat conditions for important wildlife resources (such as moose and caribou) may be affected by the fire, vegetation, and climate interactions predicted into the future.