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 Kenai 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 (2007), 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 does not include the Kenai National Wildlife Refuge; although continued refinements to the model will increase our confidence in these results, major revisions to account for Kenai’s unique position on the edge of two biomes are not currently anticipated. 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 these data, to simulate either the exact location of future fire occurrence or vegetation type.

These model results were generated using interactions within and between tundra, black spruce, white spruce and deciduous vegetation types; the model does not incorporate Sitka spruce, hemlock or account for the spruce bark beetle outbreak. Nevertheless, we believe that the results can provide some insight into the potential future changes expected on the Kenai Refuge.

In general, we expect climate change to result in substantial increases in landscape flammability during the coming century with temperatures rising approximately 3°C which is less than the 4°C change expected throughout most of Interior Alaska. Precipitation is expected to increase during this time period as well, however, that increase may not 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 strongly suggest that coniferous forest vegetation will maintain its dominance on the refuge though deciduous vegetation will increase in acreage as fire occurrence increases. The Kenai simulation domain results are similar to the state-wide results though more moderate in both the level of change and the timing of change. This may be due to the fact that the ALFRESCO model consistently underestimated fire occurrence in the Kenai simulation area. This underestimation is probably a result of the documented refuge’s fire history which is incomplete in the state-wide large fire history database used in the ALFRESCO model.

Within the simulation area, the northern portion of the refuge region, and the area between Skilak and Tustemena Lakes would seem to be at highest fire risk especially in the later half of the century. 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.