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 Innoko 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 includes the Innoko National Wildlife Refuge, and will be refining the data in order to
further increase 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
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 future inclusion of grassland types into the
ALFRESCO model may create significant changes for the results for Innoko Refuge.

In general, we expect climate change to result in substantial increases in landscape flammability
during the coming century with temperatures rising approximately 4°C. 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 strongly suggest that boreal forest
vegetation will change dramatically from the spruce dominated landscapes of the last century.
The Innoko simulation domain results produce the same consistent trends in projected future fire
activity and vegetation response as do the state-wide simulations. However, while statewide fire activity is expected to increase throughout the end of this century, in this refuge area, it is probable that this change may be observed over the next several decades on the Innoko National Wildlife Refuge.

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 rapid change will strongly influence the structure and pattern of vegetation across the boreal forest in Alaska. Within the simulation area, all the upland regions of the refuge region would seem to be at highest fire risk in the next 50 years, with the western side of the refuge consistently showing the shortest fire return interval in all the models. 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.