Addressing Climate Change in the Forest Vegetation Simulator to Assess Impacts on Landscape Forest Dynamics

Nicholas L. Crookston[1], Gerald E. Rehfeldt, (Retired)[2], Gary E. Dixon, (Retired)[3], and Aaron R. Weiskittel[4]

Abstract—To simulate stand-level impacts of climate change, predictors in the widely used Forest Vegetation Simulator (FVS) were adjusted to account for expected climate effects. This was accomplished by: (1) adding functions that link mortality and regeneration of species to climate variables expressing climatic suitability, (2) constructing a function linking site index to climate and using it to modify growth rates, and (3) adding functions accounting for changing growth rates due to climate-induced genetic responses. For three climatically diverse landscapes, simulations were used to explore the change in species composition and tree growth that should accompany climate change during the 21st century. The simulations illustrated the changes in forest composition that could accompany climate change. Projections were the most sensitive to mortality, as the loss of trees of a dominant species heavily influenced stand dynamics. While additional work is needed on fundamental plant–climate relationships, this work incorporates climatic effects into FVS to produce a new model called Climate–FVS. This model provides for managers a tool that allows climate change impacts to be incorporated in forest plans.

See this web site for access to the model and supporting literature: http://www.fs.fed.us/fmsc/fvs/description/climate-fvs.shtml.

Keywords: species climate relationships, stand dynamics, species composition, genetic adaptation, general circulation model, climate change, carbon loads, site index, growth and yield

In: Jain, Theresa B.; Graham, Russell T.; and Sandquist, Jonathan, tech. eds. 2010. Integrated management of carbon sequestration and biomass utilization opportunities in a changing climate: Proceedings of the 2009 National Silviculture Workshop; 2009 June 15-18; Boise, ID. Proceedings RMRS-P-61. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 351 p.

[1]Forest and Woodland Ecosystems, Rocky Mountain Research Station, US Forest Service, Moscow, ID.

[2] Forest and Woodland Ecosystems, Rocky Mountain Research Station, US Forest Service, Moscow, ID.

[3] Forest Management Service Center, US Forest Service, Fort Collins, CO.

[4] School of Forest Resources, University of Maine, Orono, ME.

Note: This paper has been published. **Citation:** Crookston, Nicholas L.; Rehfeldt, Gerald E.; Dixon, Gary E.; Weiskittel, Aaron R. 2010. Addressing climate change in the forest vegetation simulator to assess impacts on landscape forest dynamics. Forest Ecology and Management. 260: 1198-1211.