Interactions of changing climate and shifts in forest composition on stand carbon balance.

Chiang, Jyh-Min*[,1], Iverson, Louis[2], Prasad, Anantha[2], Brown, Kim[1], [1] Ohio University, Athens, OH[2] USDA Forest Service, Delaware, OH

ABSTRACT- Given that climate influences forest biogeographic distribution, many researchers have created models predicting shifts in tree species range with future climate change scenarios. The objective of this study is to investigate the forest carbon consequences of shifts in stand species composition with current and future climate scenarios using such a model. The USFS DISTRIB/SHIFT model simulates changes in 135 tree species distributions in the Eastern US. These model outputs were combined with a physiologically based, generalized forest carbon balance model (PnET-II) to estimate the net primary production (NPP) contributed by respective tree species. We selected four 200 x 200 km areas in Maine, Ohio, Arkansas and Wisconsin, representing "hotspots" of potential species range shifts. Species specific parameterization of PnET-II model was made possible by archiving 1174 records of leaf traits (leaf nitrogen content, specific leaf weight, and longevity) of mature trees in the North America from the published literature. An ArcGIS based methodology was used to analyze geographic trends in leaf traits. No geographic patterns of within-species variation in leaf traits were detected. However, different species showed substantial differences in leaf traits, leading to pronounced differences between species in the contribution of NPP to the ecosystem. Based on a subset of randomly selected pixels, the effect of changing climate alone has positive effect (up to 9% increase), while new species assemblage has minor negative (up to 5% decrease) effect on NPP. Further analysis will be focused on the geographical patterns of changes in terrestrial carbon balances due to changes in climate and species composition.

Key words: climate change, carbon sequestration, tree species range shifts