

Vulnerability of Northern Forests and Forestry: The Disturbing Influence of Climate Change

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Focusing primarily on boreal forest ecosystems we examine the role of stand-replacing disturbances in a changing climate and pose the hypotheses that 1) present and near-term future carbon budgets at the forest scale are constrained by the historical and present disturbance regime; 2) changes in these regimes due to global change has a larger near-term impact on boreal forest carbon stocks than the direct influence of climate change itself; and 3) our ability to manage forest ecosystem carbon stocks is heavily dependent on our ability to influence the disturbance regime. We argue that changes (increases) in the natural disturbance regime throughout the 20th century has tended to switch the forest ecosystems of boreal Canada (and perhaps boreal Russia) from a sink to a source of atmospheric carbon. Because much of this phenomenon is a legacy of changes in the natural disturbance regime that occurred up to 100 years ago (an age-class legacy), the efficacy of near-term management interventions in influencing the near-term carbon balance of boreal systems is low and strongly subject to climatic/weather variability and other factors. We also note that the same legacy of past disturbance regimes is responsible for the sink in temperate North America (and possibly Europe), but the disturbance regime was dominated by human actions, in a different direction (reduction), and leading to a sink rather than a source while these forest systems recover from previous (anthropogenic) disturbance.