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Forest management as possible driver in mitigating climate change impacts at northern latitudes

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Climate change is likely to impact the dynamics of carbon and water cycles in forests over the next century. To date, it is still debated how forests will react. Some key variables may help in understanding the extent at which terrestrial ecosystems will be affected. Carbon Use Efficiency (CUE) and Water Use Efficiency (WUE) represent some of these key aspects. CUE represents the capacity of the forests to transfer carbon from the atmosphere to the terrestrial biomass, WUE the carbon gained for the water lost via canopy transpiration. Hence, both are key variables since they intimately represent the effects of several coupled ecophysiological processes affected by climate change. Here, we analyzed how within the 3D-CMCC-CNR FEM, forced by five general circulation model data and the four representative concentration pathways, the modeled CUE and WUE are affected by, from seasonal to over medium- and long-time period, warming, rising atmospheric [CO_2] and management, assessing at which extent each component influences model results in an existing boreal forest in Finland. The 3D-CMCC-CNR FEM model results reveal that CUE tends to decrease with warmer scenarios, and management may greatly dampen the effects but only in the short- to medium-time period. WUE can increase consistently owing to the increasing of the CO_2 fertilization if coupled with management. These results confirm also, at stand spatial scale resolution, what found globally in other recent studies and suggesting to consider for long-term period alternative forest management practices to enhance these effects in mitigating climate change.