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Enhanced growth rate and stand age leads to stronger biomass increase in primary versus managed secondary forests

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Boreal forests play a vital role in the global carbon cycle, yet the stability of this sink is uncertain during a period of rapid global environmental change. Swedish forest biomass has increased in recent decades, yet it remains unclear whether primary and managed secondary forests have changed similarly, and to what extent changes are driven by stand-age or shifts in growth curves. This is because intensive forest management practices in Sweden such as thinning, draining and fertilisation may obscure the effect of environmental changes, while rotational clear-cutting reduces the stand age. Here, we combine extensive National Forest Inventory data from 1983 to 2022 with random forest models to disentangle potential drivers of biomass change across forest types by isolating growth-curve and stand-age distribution effects. Our results indicate that management suppresses potential growth curve enhancement at a given stand-age as well as reducing the stand-age itself, leading to little net biomass change in managed secondary forests but large increases in primary forests. With the continued logging of unprotected primary forests, as well as the projected increase in warming, this has significant implications for the future boreal forest carbon stock.