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Incorrect data sustain the claim of forest-based bioenergy being more effective in climate change mitigation than forest conservation

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The urgent need for effective solutions to climate change accelerates and upscales the debate on the ongoing role of forest ecosystems and the impact of forest-based bioenergy on carbon sequestration. Numerous studies have already questioned the mitigation effectiveness of this option (e.g., Hudiburg et al. 2011, Agostini et al. 2014, Leturcq 2014, Ter-Mikaelian et al. 2015, Booth 2018, Searchinger 2018). Nevertheless, wood industries and several researchers still claim that timber harvesting is an effective contribution to a reduction of carbon dioxide in the atmosphere. The recent Opinion piece by Schulze et al. (2020), represents another case, which has been criticized by Kun et al. (2020) for using an incorrect metric, and by Booth et al. (2020) for being underpinned by invalid assumptions. Additionally, it is necessary to add that Schulze et al. (2020) base their findings on major errors in data use and calculations:

The authors suggest that the mitigation effect of managed forests ranges from 3.22 to 3.45 $tCO_{2\ equiv.}$ ha^{-1} $year^{-1}$, whereas unmanaged conservation forests would contribute only 0.37 $tCO_{2\ equiv.}$ ha^{-1} $year^{-1}$. Consequently, the regional mitigation potential of managed forests would be about 10 times higher in

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comparison to unused forests. The data used in the Opinion piece for calculations of unmanaged, strictly protected forests is based on only one repeated inventory that was conducted in the year 2010 in Hainich National Park (HNP), Germany (Nationalpark-Verwaltung Hainich 2012 – actually cited as Hainich 2015).

In HNP, past forest use as well as the progressive extension of the strictly protected areas resulted in a heterogeneous distribution of age classes. Established as late as 1997, some parts used to be a military training ground between 1935 and 1990. Whilst HNP comprises forest areas that have not been harvested for several decades and show a high density of old trees, younger stands prevail in other parts. A forest inventory in 2010 revealed a mean stock of living solid wood mass of 367.5 $m^3\ ha^{-1}$, based on 1,421 sample points (ibid.). Compared to the previous inventory in 2000 (363.5 $m^3\ ha^{-1}$ based on 1,200 sample points), the stock increase of 0.4 $m^3\ ha^{-1}\ year^{-1}$ was statistically not significant. However, the mean stock volume measured in 2010 was considerably influenced by low volumes of the additionally surveyed sample points which were located in early succession pioneer forest areas (ibid.). Taking into account only the 1,200 sample points which were used in the 2000 inventory, the mean stock in 2010 is 453 $m^3\ ha^{-1}$, resulting in a mean stock increase of 90 $m^3\ ha^{-1}$, or 9 $m^3\ ha^{-1}\ year^{-1}$ (ibid.).

Schulze et al. (2020) report an average increment of 4 $m^3\ ha^{-1}\ year^{-1}$ in unmanaged beech forests based on four different forest areas, including the incorrect increment data from HNP. Still, this average value was not used for the calculation, only the value from HNP. Considering the original increment value of 9 $m^3\ ha^{-1}\ year^{-1}$ instead of 0.4 $m^3\ ha^{-1}\ year^{-1}$, the corrected average value from three unmanaged beech forests and HNP would end up in 6.2 $m^3\ ha^{-1}\ year^{-1}$.

Applying the original increment value of HNP of 9 $m^3\ ha^{-1}\ year^{-1}$ and recalculating the carbon sequestration potential according to the method of Schulze et al., unmanaged protected forests would sequester 8.25 $tCO_{2\ equiv}$. $ha^{-1}\ year^{-1}$. Then, their climate change mitigation potential would be about 2.5 times higher compared to bioenergetically used forests. Applying the average increment value of 6.2 $m^3\ ha^{-1}\ year^{-1}$, the mitigation effect of unmanaged forests would be 5.68 $tCO_{2\ equiv}$. $ha^{-1}\ year^{-1}$, still an increase of 64%, respectively 76%, compared to managed forests (Schulze et al. stated 3.22 – 3.45 $tCO_{2\ equiv}$. $ha^{-1}\ year^{-1}$). Even using the average increment value of 4 $m^3\ ha^{-1}\ year^{-1}$, which Schulze et al. published in table 1, the carbon sequestration would be 3.67 $tCO_{2\ equiv}$. $ha^{-1}\ year^{-1}$ compared to 3.22 – 3.45 $tCO_{2\ equiv}$. $ha^{-1}\ year^{-1}$.

The only effective pathway towards climate change mitigation is to stop burning carbonaceous material as much and as fast as possible and to strengthen the natural carbon sinks instead of destroying them. In this context, burning of fresh stemwood that both increases the atmospheric GHG concentration and reduces functional natural carbon stocks as well as sinks is not reasonable.

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