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The '*global tree restoration potential*': a first estimation of the hydrological effects

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Vegetation plays an important role in the exchange of water between the land surface and the atmosphere through evaporation and redistribution of water. Hence, changes in vegetation cover alter the terrestrial hydrological cycle. Large-scale forest restoration is an effective climate change mitigation strategy through carbon sequestration and is expected to impact the water availability. A better understanding of the impact of reforestation is needed, given the numerous different reforestation missions.

Our study aims to provide an estimation of the hydrological effects of 900 million hectares of reforestation, called the '*global tree restoration potential*' (Bastin et al., 2019). We include the effects of forest planting on evaporation and moisture recycling, where evaporation effects local water availability, and moisture recycling effects both local and remote water availability. We used the conventional Budyko's moisture index framework to calculate the effects of reforestation on evaporation, and afterwards we used the UTrack dataset to calculate the changes in precipitation. The UTrack dataset presents the monthly climatological mean atmospheric moisture flows from evaporation to precipitation and is created using the Lagrangian moisture tracking model UTrack (Tuinenburg et al., 2020).

The results show that reforesting the '*global tree restoration potential*' would effect water availability for most of the Earth's surface. The global mean increase in terrestrial evaporation is 8 mm yr^{-1}. The increase in evaporation is highest around the equator (on average 20 mm yr^{-1}), with local maximum changes of up to 200 mm yr^{-1}. This is related to a relatively high restoration potential in low latitude areas, and a generally large evaporation response in high precipitation regions. Enhanced moisture recycling has the potential to partly compensate for this decreased water availability by increasing the downwind precipitation.

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