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## Towards a green water planetary boundary

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Green water - i.e., land precipitation, evaporation and soil moisture - is fundamental for the functioning of the biosphere and the Earth System, but is increasingly perturbed by continental-to-planetary scale human pressures on land, water and climate systems. The planetary boundaries (PB) framework demarcates a global safe operating space for humanity, but does hitherto not explicitly account for green water. Here, we propose a green-water boundary within the existing PB framework, of which a control variable could be defined as "the percentage of ice-free land area on which root-zone soil moisture deviates from Holocene variability for any month of the year". We provide provisional estimates of baseline departures based on CMIP6 data, and review the literature on soil-moisture induced deterioration in Earth System functioning. The evidences taken together suggest that the green water PB is already transgressed, implying that human modifications of green water need to come to a halt and be reversed. Future research needs to advance our understanding of root-zone water dynamics, including associated large-scale and potentially non-linear interactions with ecohydrology, hydroclimate, biogeochemistry and societies.