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A Budyko approach to assessing catchment deforestation impacts on the water yield to global wetlands

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Reduced evapotranspiration (ET) through the conversion of forest to grass and the resultant increase in streamflow water yields are well established, however the consequences for the water balance of standing bodies of water within catchments have received comparatively less attention. Evaluating these impacts at the annual time scale, and across the globe is difficult to parametrise using conventional water balance models, however the relative simplicity of the Budyko hypothesis enables such a first order analysis. One widely used Budyko approach allows ET to be differentiated according to a single parameter, and existing data suggests ET can be reduced by $\sim$1/3 following the conversion from forest to grass across a wide range of precipitation inputs. Using global databases of wetlands, aridity index, and current vs original forest cover, we find the water available to wetlands can increase by up to 15% of precipitation in relatively humid climates where complete deforestation has occurred. This is significant since it may convert previously ephemeral systems to permanent wetlands, or create entirely new wetlands. Moreover, a conservative estimate based on our datasets suggests 9-12% of global wetlands are significantly affected by this change in hydrology due to deforestation. Human impact studies in lake and wetland systems rarely test for changes in hydrology, and thus this effect is largely unrecognised. The latitudinal structure of these impacts, sensitivity to degree of deforestation, and sensitivity to the assumption of the 1/3 ET reduction are also explored.