

Does Evapotranspiration Increase When Forests are converted to Grasslands?

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The conversion of forests to grasslands (FGC) is a widespread land cover change (LCC) and is also among the most commonly studied changes with respect to its impact on ET; such research employs a variety of experimental approaches, including, paired catchment (PC), Budyko and land surface models (LSM), and measurement methods, including the catchment water balance (CWB), eddy covariance (EC) and remote sensing (RS). Until recently, there has been consensus in the scientific literature that rates of ET decrease when a forest is converted to grassland; however, this consensus has recently come into question. Williams (2012) applied the Budyko framework to a global network of eddy covariance measurements with the results that grasslands have a 9% greater evaporative index than forests. In addition, HadGEM2, a recent Hadley Centre LSM, produced increased ET in the northern Amazon Basin after simulating global scale tropical deforestation (Brovkin et al., 2015). Here we present an analysis of available estimates of how ET rates change with FGC to increase our understanding of the forest – grassland-ET paradigm. We used two datasets to investigate the impacts land cover change on ET. I compiled a dataset of change in ET with land cover change (Δ ETLCC) using published experiments that compare forest and grassland ET under conditions controlled for meteorological and landscape influences. Using the Δ ETLCC dataset, we show that, in all cases, forest ET is higher than grassland under controlled conditions. Results suggest that the eddy covariance method measures smaller changes in ET when forests are converted to grasslands, though more data are needed for this result to be statistically significant. Finally, GETA2.0, a new global dataset of annual ET, projects that forest ET is greater than grassland, except at high latitudes and areas where orography influences precipitation (P). The data included in this study represent the data available on forest and grassland ET comparison and reveal an important gap in the scientific literature: the lack of data available regarding forest to grassland LCC.