Impacts of land cover change on evapotranspiration: a synthesis of forest-grassland studies

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Evapotranspiration (ET) plays a vital role in the Earth's water cycle, supplying ~62% of continental precipitation, and influencing local, regional and global climates. ET also determines the amount of water input to a surface, driving rates of groundwater percolation, surface runoff and catchment outflow, and therefore influencing the water available for ecosystem and human consumption. Because ET rates depend on land cover type, anthropogenic changes such as deforestation, agriculture and urbanization have significant effects on ET.

The conversion of forests to grasslands (FGC) is a widespread land cover change and is also among the most commonly studied changes with respect to its impact on ET; such research employs a variety of experimental approaches (budyko, paired catchment, GCM, etc.) and measurement methods (water balance, eddy covariance, remote sensing, etc.). Until recently, this literature has been nearly unanimous in its conclusion that rates of ET will decrease when a forest is converted to grassland. However, this consensus has recently been questioned; using global Fluxnet eddy covariance data, where it was previously determined the grasslands have a 9% greater evaporative index than forests. In addition, it was previously concluded that in tropical regions that are not water-stressed, grasslands have equal or higher potential ET then forests. My research will provide an analysis of the literature studying the impacts of FGC on ET rates in an attempt to provide a better understanding of the forest – grassland ET paradigm.

I have assembled a database of 70 studies comparing forest and grassland ET under conditions controlled for climatic and environmental influences. Data was acquired through a literature search where selection criteria limited data to paired catchment, adjacent plots or before and after conversion experiments. Using this data I will determine if forest ET is indeed higher than grassland ET under these controlled conditions. I will then analyse the ET measurement methods to attempt to determine bias in any individual technique. Finally, I will use a previously compiled global ET dataset to determine in what, if any cases, grasslands may have higher ET than forests.

Atlantic Geology, 2016, Volume 52
Atlantic Geoscience Society Abstracts 42nd Annual Colloquium & General Meeting 2016
doi: 10.4138/atlgeol.2016.004