

Barger, NN, SR Archer, JL Campbell, CH Huang, J. Morton, AK Knapp. 2011. Woody plant proliferation in North American drylands: a synthesis of impacts on ecosystem carbon balance. *Journal Geophysical Research – Biogeosciences* 116, G00K07, doi:10.1029/2010JG001506.

Abstract

Changes in the magnitude and direction of ecosystem carbon [C] balance accompanying woody plant encroachment are among the largest contributors to the uncertainty in the North American C budget. In this synthesis we identify the important species contributing to woody encroachment, summarize our current knowledge of above- and belowground C storage change with woody encroachment, and evaluate the range of human and natural disturbance factors that alter the course of C gains and losses within ecosystems experiencing woody encroachment.

Available data indicate that relative to the historic vegetation, aboveground net primary production (ANPP) decreases with woody plant encroachment in arid regions [mean annual precipitation (MAP) < 336 mm], but increases in semi-arid and sub-humid regions (on the order of $0.7 \text{ g C m}^{-2} \text{ yr}^{-1}$ per mm of MAP over 336 mm). Soil organic carbon (SOC) response to woody plant encroachment ranged from losses of 6200 g C m^{-2} to gains of 2700 g C m^{-2} with an average accumulation of 288 g C m^{-2} across all studies and did not appear to be closely coupled to ANPP. Taken together, in the absence of disturbance, woody encroachment appears to result in a net ecosystem C gain across most species and ecoregions. However, disturbance associated with wildfire, land management practices, and drought may quickly and significantly offset these gains and should be explicitly factored into regional scale C balance estimates. Our findings may be used to better constrain future estimates of woody plant encroachment influences on the North American C budget.