30. Regional NPP and Carbon Stocks in Southwestern USA Rangelands: Land-Use Impacts on the Grassland-Woodland Balance

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Dryland ecosystems store 30% of global soil organic carbon (C), cover half the terrestrial surface, support 20% of the human population, and produce 70% of the world's livestock. The historical land cover of these geographically extensive regions was primarily grassland and savanna. However, exponential growth of the human population accompanied by fire suppression and intensification of land uses over the past century has lead to dramatic and widespread increases in tree and shrub cover in these dryland ecosystems. These vegetation changes can alter soil C storage and dynamics by changing: (i) the quantity and quality of above- and belowground organic matter inputs, (ii) the depth at which organic C is stored in soil, and (iii) environmental factors (soil moisture, temperature) that regulate rates of soil organic matter decomposition. The biogeochemical, hydrologic, and climatic consequences of this geographically extensive conversion from grass to woody plant domination are of great concern, but remain largely unknown. Moreover, we lack comprehensive information on the historic or modern rate, areal extent and pattern of woody plant expansion in the world's drylands. As a result, it is difficult to objectively or quantitatively assess implications for regional and global C and N cycling. In confronting these challenges, our team has developed novel and viable approaches for coupling field data, isotope biogeochemistry, remote sensing, and modeling to quantify the impact of woody plant encroachment on aboveground biomass and C and N pools and primary production at spatially complex local and regional scales. We are currently expanding our Texas-based work to assess land-use impacts on NPP and Cstorage in rangeland ecosystems throughout the Southwest.



Below: Woody plant aboveground biomass accumulation (A) with no management intervention, (B) interrupted by intensive clearing in the 1950s but no follow-up, and (C) clearing in 1950s and again in early 1990. Comparisons of woody cover in 1937 versus 1999 (Left) thus represent net, rather than absolute changes.

