Effects of watershed land use and geomorphology on stream baseflows in the southern Blue Ridge Mountains, NC and GA

Katie Price, Albert J. Parker, C. Rhett Jackson, Trond Reitan, and John Dowd

While it has been shown in many settings that both human land use and natural topographic variability influence stream baseflows, their interactions and relative influences have remained unresolved. Our objective was to determine the influence of human land use and watershed geomorphic characteristics in explaining baseflow variability in the southern Blue Ridge Mountains of North Carolina and Georgia. Ten-minute interval discharge data for 35 streams (in watersheds ranging in size from 3 to 146 km^2) were obtained for a period of 1.5 years, including two late-summer low flow seasons. Various baseflow metrics were calculated (1-day, 7-day, and 14-day minimum daily flows, 1 percentile 10-minute flow, and baseflow index) for three time subsets of the gage records (low flow season 2007, low flow season 2008, and water year 2008). A comprehensive suite of watershed characteristics, including factors of watershed topography, channel network morphometry, soils, land use, and precipitation were used in multiple regression analysis of baseflow variability among the 35 watersheds. Overall, geomorphic factors of drainage density and slope variability showed the strongest relationships to baseflow in this region, with percent watershed forest cover and amount of colluvium also demonstrating significant influence. Forest cover showed a consistent positive relationship with baseflow, despite the higher evapotranspiration rates generally associated with forest compared with other land covers. This highlights the importance of infiltration and recharge under undisturbed land cover in sustaining baseflows, and bears noteworthy implications for impaired flows and water resource sustainability.