Geophysical Research Abstracts
Vol. 14, EGU2012-13485, 2012
EGU General Assembly 2012

Effects of mountain resort development – a case study in Vermont USA

J. Shanley (1) and B. Wemple (2)

(1) U.S. Geological Survey, Montpelier, Vermont, United States (jshanley@usgs.gov), (2) University of Vermont, Burlington, Vermont, United States (Beverley.Wemple@uvm.edu)

The mountainous landscape of northern New England, USA, faces intense development pressure from recreational and tourism use. In 2000 we began a paired-watershed study in northern Vermont to examine the effects of alpine resort development on stream flow and water quality. To our knowledge this is the only gaged watershed study at a mountain resort. The adjacent paired watersheds have similar topography, relief, geology and forest type, and differ primarily in land use. Ranch Brook watershed (9.6 km2) is the undeveloped, nearly 100% forested control basin. West Branch watershed (11.7 km2) is the developed basin, encompassing a pre-existing alpine ski resort and state highway, with approximately 17% of the basin occupied by ski trails and impervious surfaces. Measurements during 2000-2003 showed suspended sediment yield was >2.5 times greater and concentrations of nitrate and chloride were significantly elevated at West Branch. From 2004 through 2007 the resort expanded with more ski trails, roads, parking areas, and vacation home development and now has 24% cleared land, with storm sewers draining lower developed areas of the alpine watershed. For the 11-year period of study, water yield in the developed basin exceeded that in the control by an average of nearly 21%. The higher runoff at West Branch occurred primarily as result of higher sustained base flow, driven by a more prolonged snowmelt period, and greater runoff during small events. The annual flow differential had a strong positive correlation to maximum snow water equivalent, suggesting that differences in snow accumulation may explain the flow differential. We are investigating whether these differences are a direct consequence of management activities and resulting vegetation shifts and land clearing on snow capture. Several of the highest peak flows in both watersheds have occurred in the last 2 years of the 11-yr study. Our analysis is aimed at determining whether absolute peak flows have increased disproportionately at West Branch relative to the overall flow differential. As actual pre- and post-expansion flows differ markedly from design projections, our study also bears out the need for science-based management decisions.