

Surface Water

Park analysis of changing surface water flows



What and why

Increasing urbanization and associated changes in urban land cover across the Delaware River watershed have profound effects on surface water dynamics by affecting how precipitation is routed through small watersheds into the larger river system. Urbanization can greatly increase surface water flow, while diminishing subsurface flows that recharge aquifers. Hydrological dynamics are important for park resources not only for flood events, thus community planning and human safety, but also for water quality, stream bank erosion, and aquatic life (stream biota). Modeling the location of future flow patterns in conjunction with known stressors of land use and climate change helps park managers anticipate, prepare for, and hopefully mitigate the negative impacts of these changes.

How it works

We use a hydrological model, the Soil and Water Assessment Tool (SWAT) to assess flow changes under different land use development scenarios (see associated

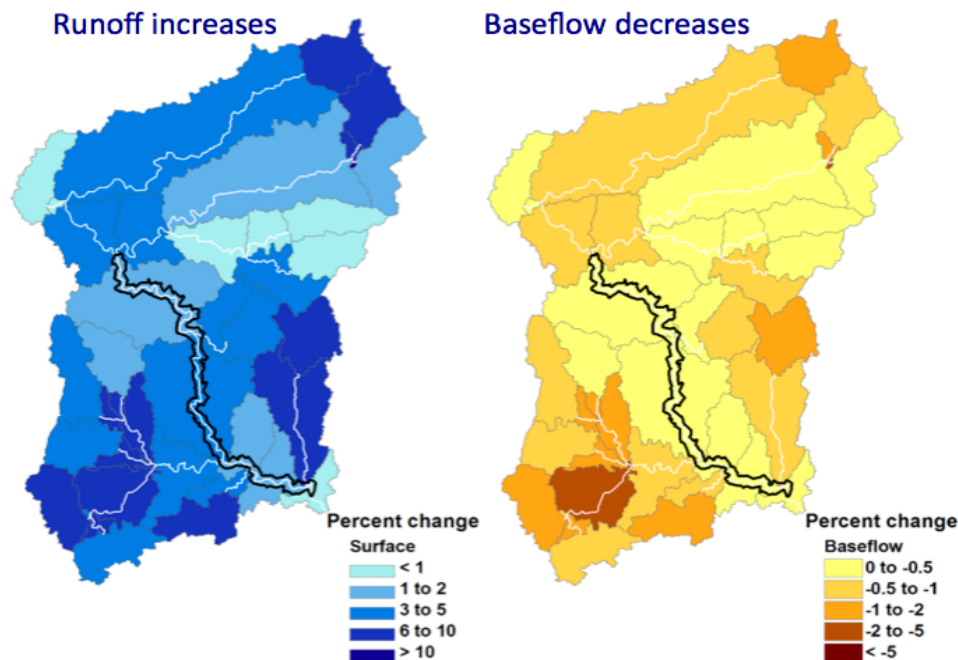
urban change and impervious cover resource briefs). The hydrology model generates river gauge calibrated predictions of the flow dynamics of streams across small watersheds, including overland flow (runoff) and sub-surface flow (groundwater).

Results

In watersheds with increased urban land use, the flashiness (extremes) of stream flow increases, producing greater overland flow (runoff) over shorter time periods and with shorter response times while also decreasing subsurface recharge, including the periods between precipitation events. Increased runoff produces greater stream flows, thus higher likelihood of flash floods and bank erosion, while decreased ground-water recharge into aquifers also reduces the minimum flow (baseflow) of streams, negatively impacting the aquatic life that streams can support.

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<http://science.nature.nps.gov/im/monitor/lulc/palms/index.cfm>



Predicted increases in urban (impervious) land cover from development (including residential housing) to year 2030 impacts average monthly runoff (left image) and sub-surface flow (right image) across the Upper Delaware watershed.

