

The effect of urbanization on flow duration curves: A case study from selected streams in the Puget Sound Basin, Western Washington

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Abstract. Land use change associated with urbanization can alter a watershed's natural flow regime, typically resulting in larger peak flows for a given precipitation event. The overall impact of urbanization on how flows of different frequencies might change over time, while important in hydrologic design, remains poorly understood. In this study, we investigate the effects of urbanization on the flow duration curves (FDCs) for several watersheds in the Puget Sound Region of Washington State. A FDC is a graphical representation of the frequency or fraction of time that a discharge magnitude is equaled or exceeded. Watersheds selected for this analysis had small drainage areas (less than 200 km²), and spanned a wide range of land use from forested to densely populated urban areas. At these sites, stream-discharge, precipitation, and watershed urbanization were analyzed for a 40-year time period (1970-2010). Using different time windows of the flow record, we were able to quantify how key flow percentiles of the FDC changed over time in response to urbanization. Preliminary results suggest that urbanization can cause the 95th-99th percentile of the daily-mean flow series to increase substantially. Additionally, the rapidity of changes in streamflow, commonly known as "flashiness", was observed to increase over the period analyzed for most of the watersheds. The results of this analysis help inform the use of FDCs in situations where the hydrologic record is non-stationary.