

Estimating an Overall Infiltration Value in an Urbanized Watershed Using High-Resolution Satellite Images and Ground Measurements

Tobias Finke^{1,2}, Susan Moran¹, Steve Yool², Jeff Kennedy^{3,4}

¹ *USDA ARS Southwest Watershed Research Center, Tucson, AZ*

² *University of Arizona, Department of Geography and Regional Development*

³ *USGS Arizona Water Science Center, Tucson, AZ*

⁴ *University of Arizona, Department of Hydrology and Water Resources*

ABSTRACT

Rain water infiltration is part of the water cycle and is strongly influenced by human activities, such as urban growth. Changes in infiltration rates due to urbanization can affect storm water runoff, soil moisture and groundwater recharge. This is of particular concern in areas of rapid urbanization and low water availability, such as the Southwestern United States. The goal of this study was to use high-resolution satellite images and a limited number of ground measurements to estimate an overall infiltration value in a small, recently developed watershed in Sierra Vista, Arizona. This estimate was compared to that for an adjacent undeveloped watershed on the area of Fort Huachuca. We measured 70 infiltration rates using a disk permeameter in the urbanized watershed and the undeveloped and undisturbed watershed on the Fort. These measurements were used to calculate a representative mean value of infiltration rates for each watershed. High-resolution satellite imagery was used to determine pervious areas in the urbanized watershed using object-based classification. The combination of the mean values derived from permeameter measurements and the spatial extent of the pervious surface from the satellite-based estimates resulted in an estimated amount of infiltrated water for the whole watershed. This amount of water is an important part to understand the water budget of the area. The comparison of the two watershed estimates will allow an evaluation of urbanization impacts on soil properties, especially changes in infiltration capacity.