

Evaluation of Effects of Ashe Juniper Control on Water Quantity, Water Quality, and Suspended-Sediment Loads in Honey Creek State Natural Area, South-Central Texas

Introduction

The U.S. Geological Survey (USGS), in cooperation with the U.S. Department of Agriculture, Natural Resources Conservation Service and the San Antonio Water System, began a study in 1999 to evaluate the effects of ashe juniper (*Juniperus ashei*) control as a best-management practice (BMP) for increasing water quantity and protecting water quality in two watersheds in the Honey Creek State Natural Area (HCSNA) in south-central Texas. In 2005, the San Antonio River Authority entered into cooperation on the study.

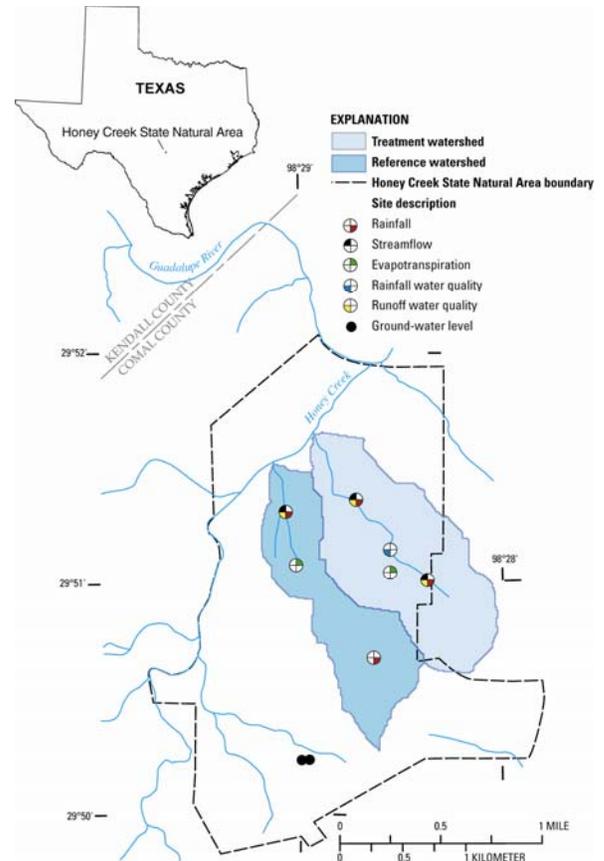
This study is a follow-up to the Seco Creek Water Quality Demonstration project (<http://wmc.ar.nrcs.usda.gov/news/secocreek.html>). Results from the Seco Creek project indicate that removal of ashe juniper trees might reduce evapotranspiration (ET) and runoff and increase water infiltration and spring flow.

The objective of this new study is to assess the effectiveness of ashe juniper control as a BMP for increasing water yields while protecting water quality on a watershed scale. This will be accomplished through a paired-watershed study in which differences in streamflow, ET, and water quality between “treatment” and “reference” watersheds and between pre-treatment and post-treatment periods will be documented and compared.

The adjacent treatment and reference watersheds are drained by first-order streams that are tributaries to Honey Creek, which is a tributary to the Guadalupe River. The treatment watershed has a drainage area of about 0.56 square mile and the reference watershed has a drainage area about 0.36 square mile.

Hydrologic and Water-Quality Data

During the first 2 years of the study, both watersheds remained untreated while baseline rainfall, streamflow, ET, and water-quality data were collected. The baseline data are documented in the USGS report “Hydrologic and Water-Quality Data,



Honey Creek State Natural Area, Comal County, Texas, August 2001–September 2003,” available at <http://pubs.usgs.gov/ds/2006/200/>.

In 2004, the ashe juniper removal BMP was implemented in the treatment watershed. With the added cooperation of the San Antonio River Authority, the data-collection phase of the study is ongoing. Throughout this phase the USGS will gage as completely as possible the hydrologic characteristics of each watershed, continuously measuring rainfall, streamflow, and ET. These data will be used to assess the effectiveness of the applied BMPs by computing statistically significant changes in the hydrologic characteristics of the watersheds—comparing the treated and reference watersheds and the pre-treatment and post-treatment periods.

Metrological Data Collection

Four tipping-bucket rain gages, one at each of the three streamflow stations and one at a stand-alone site, continuously monitor rainfall. The rainfall data will be used in the analysis of rainfall-runoff relations, suspended-sediment and nutrient loads, and soil-infiltration rates, and for the hydrologic budget analysis of each watershed.

The two Bowen Ratio ET systems collect continuous metrological data, which include net radiation, soil heat flux, soil temperature, soil moisture, differences in air temperature at two elevations, and differences in vapor pressure at the same two elevations. From these data, the energy-balance Bowen ratio method is used to calculate sensible- and latent-heat fluxes, from which ET is computed. The ET data will be used to assess the effect of ashe juniper removal on ET rates and will be a component of the hydrologic budget analysis of each watershed.



Surface-Water Data Collection

Three streamflow-gaging stations continuously monitor streamflow in the two watersheds. Stage data are measured and recorded continuously by pressure transducer gages. Weirs constructed at the sites facilitate streamflow measurement by application of stage-discharge relations developed for each of the weirs. Crest-stage gages are used to verify recorded peak stages. Unit values of streamflow are used to analyze differences in streamflow characteristics—peak flows, flow durations, and rainfall-runoff relations—of each site.



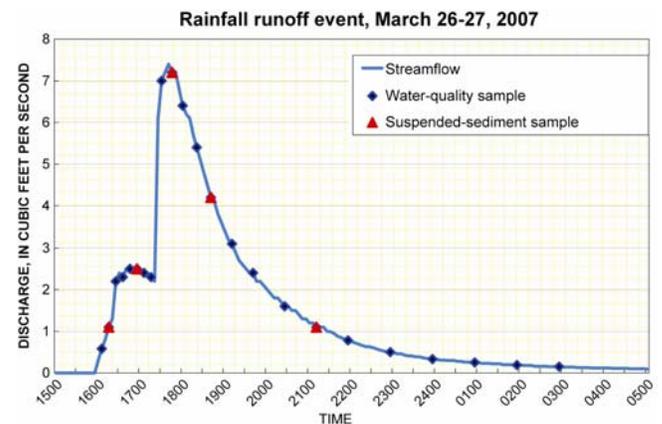
Ground-Water Data Collection

Water levels are monitored continuously in two wells at different depths, one about 15 feet deep and the other about 200 feet deep. The water-level data are measured by a pressure transducer gage and recorded at 1-hour intervals. The data will be used to

assess infiltration rates and to attempt to monitor local changes in storage in the Trinity aquifer.

Water-Quality Data Collection

The runoff water-quality data collected at the three streamflow stations are used to estimate storm loads and will provide a water-quality comparison between treated and reference watersheds and between pre-treatment and post-treatment periods. The rainfall water-quality data collected at one site in the treatment watershed are used to account for atmospheric inputs of constituents to the watersheds and to determine or verify the isotope composition of rainfall.



Data Dissemination

The rainfall amounts, streamflows, and ground-water levels are transmitted by way of the Geostationary Operational Environmental Satellite (GOES) radio at 4-hour intervals and are available on the Internet near real time. The data are in the USGS National Water Information System (NWISWeb) at <http://waterdata.usgs.gov/tx/nwis/current/?type=flow>

For more information, please contact

USGS Texas Water Science Center - San Antonio
5563 De Zavala Rd., Bldg. 2, Suite 290
San Antonio, Texas 78249
Phone: 210.691.9200 Fax: 210.691.9270