Category: Water Quantity
Indicator: Trends in 7-Day Minimum Flows

Methodology

Trends in 7-Day Minimum Flows is an indicator of the health of the low flow portion of instream flow regimes in Texas rivers. It is measured by evaluating any trend (increasing, decreasing or stable) across the last twenty years in the 7-day minimum flow (i.e., the lowest flow of 7-day duration for each calendar year) at selected river streamflow gauging stations.

We calculated this indicator by analyzing daily discharge data for selected streamflow gages using the Indicators of Hydrologic Alteration (IHA) software. We used this analysis to evaluate any trend in streamflow at each gage across the most recent 20 year period of record (1994-2013). The base data, daily discharge (in CFS), was downloaded from USGS and IBWC for each gaging station in Texas with a period of record of 20 years or greater prior to and including 2013. We excluded gages that did not have a nearly complete flow record across this period. The data was then analyzed in IHA by the following parameters: water year equals the calendar year (January – December), single period analysis (1994 to 2013), and parametric statistics.

We used the 7-day minimum flow to evaluate low flow trends. The overall low flow trend was calculated by determining the percent change per year: [7-Day Minimum slope (annual rate of change) / 7-Day Minimum mean flow (long term mean)] *100, rounded to the nearest integer. A negative percent change per year indicates a decreasing trend, a positive percent change per year indicates an increasing trend, and a percent change per year of zero indicates no trend. In addition, we analyzed these data with a Mann-Kendall Trend Test to identify any statistically significant trends. The final result is categorization of each gage into one of five categories: 1) increasing, statistically significant, 2) increasing, 3) no trend, 4) decreasing, and 5) decreasing, statistically significant.

To map this indicator, a legend showing the results for each gage is shown on a GIS layer of the analyzed streamflow gages. We also summarized this data for each Texas river basin as the number and percent of the streamflow gages analyzed in that basin that fall into each of the five categories. Users can see this data summarized in bar charts by clicking on basin outlines in the Basin Summarization map for this indicator.

Data Sources

U.S. Geological Survey. Daily Discharge for selected gages in Texas. Accessed April 2014.
http://waterdata.usgs.gov/tx/nwis/dv/?referred_module=sw

International Boundary and Water Commission. Daily Discharge for selected gages. Provided to TNC Staff June 2014.
http://www.ibwc.gov/Water_Data/histflo1.htm

The Nature Conservancy, 2007. Indicators of Hydrologic Alteration (IHA) Software. The Nature Conservancy, Charlottesville, Virginia.
https://www.conservationgateway.org/ConservationPractices/Freshwater/EnvironmentalFlows/MethodsandTools/IndicatorsofHydrologicAlteration/Pages/indicators-hydrologic-alt.aspx

U.S. Geological Survey. USGS Streamgages Linked to the Medium Resolution NHD shapefile. Accessed April 2014.
http://water.usgs.gov/GIS/metadata/usgswrd/XML/streamgages.xml#stdorder

International Boundary and Water Commission. Gage locations extracted from 2006 Rio Grande Water Bulletin and updated based on IBWC instructions to TNC Staff June 2014.
http://www.ibwc.gov/wad/Rio_Grande/2006.pdf

Texas Water Development Board. Major River Basins shapefile.
http://www.twdb.texas.gov/mapping/gisdata.asp

U.S. Geological Survey. GAGES-II shapefile. Accessed April 2014.
http://water.usgs.gov/GIS/metadata/usgswrd/XML/gagesII_Sept2011.xml#stdorder