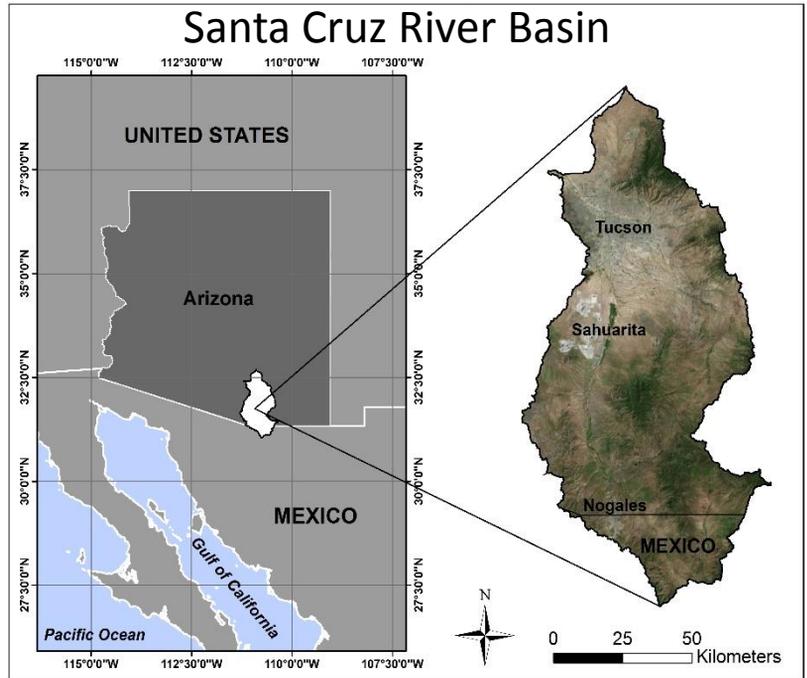


Santa Cruz River Basin at a glance

Overview.- The Santa Cruz River Basin (SCRB) is a bi-national watershed, originating in Arizona, flowing south into Mexico, then flowing north again from Mexico into the United States. Providing water for large urban centers, including but not limited to Nogales, Sahuarita, and Tucson, the Santa Cruz River is, and has always been, at the center of water related issues for hundreds of years within this region. In the presence of current global climate change, there are many economic, social, environmental, and political challenges which have presented themselves. This document will address a few of the important drivers influencing these everyday challenges.



Geographic and climate features.- Located within the Sonoran Desert of the Southwest United States (31° 46'41" N, -110°58'24" W), the SCRB is considered a semiarid region (Parker, 1993). Receiving a basinwide average of 17 inches/year (430 mm/year) (Webb and Betancourt, 1992), the Santa Cruz River (SCR) is dependent on precipitation which falls as both rain and snow on the surrounding high mountains, known as the Madrean Sky Islands. Generally, the Sonoran Desert is defined by a bimodal precipitation regime, receiving precipitation during the winter as well as during the late summer monsoon season (Webb and Betancourt, 1992). Temperatures in this region can range from as high as 115° F (47° C) in the summer and as low as 0° F (-18° C) in the winter, although winters are generally mild. The land cover within the SCR is very extreme, ranging from sub-tropical forests at the high elevations to mid-elevation grasslands and shrublands. Sahuarita is also home to one of the world's largest pecan orchards, though agriculture is generally limited within the basin.

Hydrologic features.- The SCR is considered an ephemeral stream due to water level declines from climate change and groundwater pumping (Webb and Betancourt, 1992). For instance, it is believed that groundwater pumping has lowered the water table by 250 feet (75 meters) since 1900 (UAWRRC, 2012). Historically, the SCR consisted of portions of perennial flows. However, such flows currently are dependent on wastewater effluent and have become ecological hot-spots for animals and vegetation. The river has a length of 160 miles (260 km) from Nogales to the Gila River, although the stretch from Tucson north to the Gila River (155 km) is generally dry and is considered the Upper Santa Cruz River Basin which is not included in our study portion of the basin. There are currently many discussions surrounding both the quality of the water as well as its availability (see Current challenges).

Socioeconomic features.- Within the United States, the SCR flows through Santa Cruz, Pima, and Pinal counties. Within Mexico, it flows through the northern part of the state of Sonora. In the 2010 census, the population of the city of Tucson, Arizona was 520,116 (U.S. Census). For that same year, the population for the city of Nogales, Mexico was 212,533 (UNdata). Within the entire basin, the SCR supports a population nearing 1 million people. In 1991, the Mexican government estimated that almost 45% of water within the Mexican portion of the SCR was used for agriculture (Liverman et al., 1997). Within Mexico, a majority of the crops are irrigated while a majority are groundwater fed within the United States (Liverman et al., 1997). Nevertheless, most industry in the United States does not rely on resources from the SCR.



Photograph of the Santa Cruz River about 9 miles downstream (north) of Nogales International Wastewater Treatment Plant (photo by Hans Huth). Source – USGS, 2014

Institutional features.- Because the SCR is bi-national, it requires strong coordination of water management efforts. The Arizona Department of Water Resources has created Active Management Areas (AMAs), two of which include portions of the SCR (Tucson and Santa Cruz). The AMA's were created in response to the 1980 Groundwater Management Act (ADWR, 2015), established by the Department of Water Resources. The goal of the AMA's is to be responsible for current and future management of all water resources within the respective area. The Santa Cruz AMA uses water data received from agencies in Mexico to help make decisions (Santa Cruz AMA, 1999). Within Mexico, the SCR water resources are managed by The National Water Commission of Mexico (CONAGUA). The SCR is included in Rio Concepcion Watershed Council within the Northwest region. Nevertheless, there is not a single agency solely responsible the total water resources within the SCR.

Current challenges.- Water quality and wastewater effluent. – There are many concerns within the SCR surrounding wastewater effluent recharge into the river channel. Specifically, there are questions focusing on its impact on overall water quality and purity. For example, in 2010, the Arizona Department of Environmental Quality issued a notice to the U.S. International Boundary and Water Commission for the presence of elevation levels of the toxic metal Cadmium (ADEQ, 2010). Reports like these have become more common within the SCR. In response, there are many current studies which focus on this challenge and its affects on human health, environmental health, and overall quality of the river. **Climate change and future water resources.** – Water scarcity has long been a challenge for life in the Sonoran Desert. Coupled with modern day climate change, managers are unsure on what future water availability will look like. The United States National Climate Assessment argues that rising temperatures and more extreme precipitation events will only reduce the reliability of western rivers, including the Santa Cruz, as a resource for water (Garfin et al., 2014). Although the majority of the population within SCR is not dependent on surface water from the SCR, the decline in surface water within the Santa Cruz correlates strongly with a decline in available groundwater resources in the basin. **River management and flood control.** – Despite the lack of perennial surface water within the SCR, there is concern for the potential of flooding. Over the past century, the channel has become incised resulting from previous management and policy practices. During large precipitation events, runoff from the surrounding mountains is directed into the Santa Cruz and into the incised channels. This can greatly increase the risk of flooding throughout the SCR and presents itself as a challenge within the basin. An interdisciplinary team of researchers from six countries in the arid Americas is working toward strengthening science-policy dialogue over complex water security challenges in this and other basins (<http://aquasec.org>).

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