



SANTA CRUZ RIVER

Stream Monitoring on the Upper Santa Cruz River

PROJECT SUMMARY

Introduction and Background

Riparian habitats constitute less than 2% of the land area in the American Southwest, but support the highest density and abundance of plants and animals in the region, making streams and associated riparian areas critical to the ecological integrity of the upper Santa Cruz River watershed. Riparian areas supply food, cover, and water for a large diversity of animals and serve as migration routes and habitat connectors for a variety of wildlife. They are also important in controlling water pollution, reducing erosion, mitigating floods, and increasing groundwater recharge. Although riparian systems also perform numerous ecosystem functions important to human populations, such as those listed above, riparian systems are one of the most endangered forest types in the United States.

Because of its importance, numerous agencies and organizations collect data on the Santa Cruz River. To complement and contribute to existing data collection on the Upper Santa Cruz River, the Sonoran Institute initiated monitoring data in May 2009. Methods for data collection were developed in partnership with National Park Service Sonoran Desert Network who conduct their own stream monitoring at Tumacácori National Historical Park. The Sonoran Institute's goal is to expand the work to the rest of the region, in order to improve monitoring on the Upper Santa Cruz River as a whole. Monitoring of streams by the Sonoran Institute supports a comprehensive understanding of aquatic and riparian ecosystems and integrates numerous monitoring indicators.

Monitoring Indicators

Streams are complex and dynamic systems comprised of interacting and interdependent biological and physical components. To support a comprehensive understanding of stream condition the Sonoran Institute and Sonoran Desert Network employ a holistic approach to monitoring that integrates geomorphological, hydrological and biological indicators. When investigated in combination, these indicators provide a powerful index or barometer of stream condition and function. All indicators are monitored within a reach (i.e., their monitoring is co-located), but the specific sampling locations vary among parameters. The indicators are grouped into six broad categories.



PHOTO: SONORAN INSTITUTE

Sonoran Institute scientists discuss flow measurements during a training session on the Santa Cruz River.

Stream Channel Morphology

The primary ecological functions of stream channels are to dissipate the energy associated with overland flow and to transport sediment, water, and nutrients within and from the watershed. As a result, stream channels are constantly adjusting to watershed conditions. Geomorphic characteristics of stream channels, such as channel shape, interact with biological components, most notably vegetation, to determine the type, extent, and configuration of riparian ecosystems.

Surface Water Quantity

Characteristics of surface water discharge define perennial stream systems. The probability distribution of flows over a range of magnitudes shapes the landscape and the biological systems that develop in a watershed. The amount and timing of flow is controlled by watershed events, conditions, and channel morphological characteristics. In turn, flow rates influence water quality and biological parameters.

Surface Water Quality

Water quality is a critical measure of the chemical and biological properties of aquatic systems. Aquatic ecosystems depend on the maintenance of particular water quality conditions in order to sustain life-supporting biochemical processes in plant and animal communities. Aquatic ecosystems are influenced by inputs of metals, nutrients, toxins, soil erosion, fire ash, sewage effluent, and biomass. Surface water quality Vital

Signs consist of core water quality parameters (temperature, specific conductance, turbidity, pH, dissolved oxygen, and discharge rate), and primary nutrients (nitrogen and phosphorus).

Aquatic Macroinvertebrates

Benthic macroinvertebrates are an important biological component in streams. They contribute to nutrient cycling and organic decomposition and are an important prey for fish and other aquatic vertebrates. Living on the bottom substrates or the sediment in streams, macroinvertebrate communities respond differently to a variety of stressors. Thus, macroinvertebrates can provide a powerful biological indicator of water quality and local conditions.



Sonoran Institute scientists collect aquatic macroinvertebrate samples on the Santa Cruz River



PHOTO: SONORAN INSTITUTE

Scientists seine for fish on the Santa Cruz River

Sampling Design

The sampling design for stream monitoring on the upper Santa Cruz River parks employs permanent sampling locations (reaches). The length of the sampling reach varies from location to location. All parameters of the vital signs are monitored within each reach (i.e., their monitoring is co-located), but the specific sampling locations vary among parameters. Each reach is divided into 10 equal-length segments, resulting in 11 equally spaced sampling locations at which most parameters are sampled. Sampling frequency varies by indicator (Table 1).

Table 1. Sampling frequency of monitoring indicator.

Frequency	Vital sign
Quarterly	Surface water quantity
	Surface water quality
	Riparian vegetation (photos)
Annually	Aquatic macroinvertebrates
	Fish
	Riparian vegetation (aerial extent fly-overs)
Every five years	Stream channel morphology

Fish

Fish are the highest-level organisms in the stream monitoring program. Fish assemblages can serve as good indicators of ecological conditions because fish are long-lived and mobile, forage at different trophic levels, integrate ecosystem conditions effects of lower trophic levels, and are reasonably easy to identify in the field. Fish also respond to higher-order processes that are captured in the other elements, particularly stream channel morphology, riparian vegetation, and water quantity (for physical habitat), water quality (for health), and macroinvertebrates (for food). The Sonoran Institute utilizes fish monitoring information collected by Long-term monitoring by the Friends of the Santa Cruz River and state and federal agencies.

Riparian Vegetation

The distribution and diversity of vegetation are important indicators of riparian health. Vegetation and the geomorphic characteristics of stream channels interact to determine the kind, extent and configuration of riparian ecosystems.

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