



Streams Monitoring at Bent's Old Fort National Historic Site

2014

Importance

Plants and animals tend to be more abundant and densely populated in riparian habitats than in any other habitat type, making streams and associated riparian areas critical to the ecological integrity of an area. Riparian corridors supply food, cover, and water for a variety of wildlife, and also serve as migration routes and habitat connectors. They also help control water pollution, reduce erosion, mitigate floods, and increase groundwater recharge. Riparian systems perform many ecosystem functions important to human populations, yet are one of the most endangered forest types in the United States.

Monitoring Objectives

The overall goal of the Southern Plains Network (SOPN) streams monitoring program is to detect broad-scale changes in aquatic and riparian ecological condition by observing selected ecological drivers, stressors, and processes. Specific, measurable objectives for streams monitoring on the Arkansas River at Bent's Old Fort National Historic Site (NHS) are to determine the status of and detect long-term trends in:

- **Water quality** for daily, seasonal, and annual core water quality parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity), and seasonal nutrients, metals, inorganics, and bacteria,
- **Aquatic macroinvertebrates** for relative abundance of selected taxa and community structure and selected multimetric indicators of biotic integrity,
- **Surface water quantity** for seasonal and annual base flow conditions; frequency, magnitude, and duration of low flow and flood events; and extent of wet and dry areas,
- **Channel morphology** for cross-sectional area, sinuosity, channel slope, and sediment size distribution,
- **Riparian vegetation cover** for dominant and common (>10%) perennial species, and
- **Fish** for communities on local and regional scales.

Status of the Effort

During 2013, SOPN completed routine water quality monitoring during quarterly site visits, including water quality sampling and water quantity measurements. These efforts were aided by use of a logging multiparameter water quality probe, which automatically collects and stores data. The probe was deployed in the fall, spring, and summer sampling seasons using a mount installed during the first sampling event in October 2012 (see diagram). Aquatic macroinvertebrates were sampled in May and sent to the National Aquatic Monitoring Center (BugLab) at Utah State University for taxonomic identification



Arkansas River, Bent's Old Fort NHS.

and analysis. SOPN continued its collaboration with the U.S. Environmental Protection Agency (EPA) by sending water samples from fall and summer sampling to the EPA Region 8 Laboratory for analysis of emerging contaminants (see next page). SOPN produced four field summary reports, presenting provisional data collected during quarterly sampling periods.

Management Concerns

Water Quality

There were multiple water quality exceedances at Bent's Old Fort NHS in 2013. Dissolved selenium exceeded the Colorado chronic standard for aquatic life—class 2 during all sampling events (see table, next page). Total selenium exceeded the agriculture standard during spring sampling. This segment of the Arkansas River is currently on the list of impaired waters under the Clean Water Act 303(d) for selenium, and has been since 2004. A total maximum daily load (a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards) has not been developed for selenium on this segment or adjacent segments. Selenium is considered a low priority by the State of Colorado.

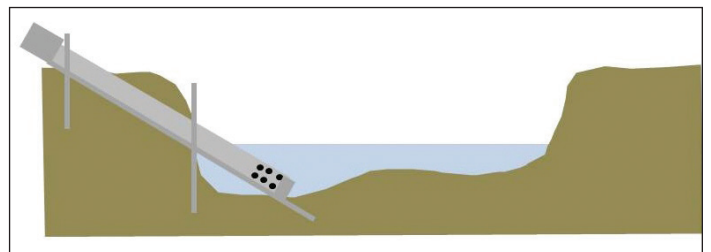


Diagram of permanent mount for logging probe. For two-week periods, the probe is deployed inside the mount, where it is protected from high-flow events and other potential disturbances.

Water quality exceedances for water year 2013, Bent's Old Fort NHS.

Parameter	Colorado state standard		Recorded value(s) (mg/L)			
	Name	Value (mg/L)	Fall	Winter	Spring	Summer
Selenium (dissolved)	Aquatic life—class 2 (chronic)	0.0046	0.0099	0.014	0.033	0.0088
Selenium (total)	Agriculture	0.02	--	--	0.021	--
Arsenic (total)	Water and fish	0.00002	--	--	--	0.0016
Manganese (dissolved)	Drinking-water supply	0.05	--	--	0.24	--
Manganese (total)	Agriculture	0.2	--	--	0.25	--
Iron (total)	Segment-specific	1.95	--	--	--	110
Sulfate	Segment-specific	902	960	920	--	940

In summer, total arsenic exceeded the standard for water and fish. Total arsenic also likely exceeded the standards in fall and winter (SOPN only tests for arsenic once each year, in summer).

In spring, exceedances were recorded for total and dissolved manganese. Dissolved manganese exceeded the standard for drinking-water supply. Total manganese exceeded the standard for agriculture.

Total iron exceeded the segment-specific standard in summer.

Total sulfate exceeded the site-specific standard in the fall, winter, and summer.

Emerging Contaminants

“Emerging contaminants” are pollutants that have not traditionally been tested for during water quality sampling and may not be adequately cleansed by current wastewater treatment methods. Examples are pesticides, pharmaceuticals, personal care products, and wastewater indicators. At Bent's Old Fort NHS, analytes detected in 2013 included 12 different pharmaceuticals (carbamazepine, desmethylvenlafaxine, gabapentin, hydrochlorothiazide, lamotrigine, meprobamate, metformin, n-Butylparaben, pregabalin, sulfamethoxazole, theophylline, tramadol) and 4 pesticides (atrazine, diuron, hexazinone, metolachlor ESA).

State standards do not exist for most of the detected compounds, and the few that do exist were not exceeded. However, there is limited information on the potential impacts of these contaminants on aquatic resources. We will continue to prioritize Bent's Old Fort NHS for emerging-contaminant monitoring and consult new research as it becomes available.

Exotic Species

Asian clams (*Corbicula fluminea*) were observed during springtime aquatic macroinvertebrate sampling. Asian clams can negatively impact both economy and ecology by blocking water intake pipes and outcompeting native clams. SOPN has not quantified the abundance and effect of Asian clams in the stream segment.

Conclusions

The Arkansas River at Bent's Old Fort NHS is a small section of a much larger aquatic system. Parameters monitored by SOPN are highly influenced by land-use activities in the upstream watershed. Dam operations, agricultural use and runoff, and other influences beyond the control of park managers can all have significant impacts on park resources. Continued monitoring and analysis of park resources will be necessary for park managers to make informed decisions about management, planning, and mitigation.

Contact

Evan Gwilliam, evan_gwilliam@nps.gov



Asian clams, an aquatic invasive species, are easily spread when their small larvae stick to boats and boots and are transported from place to place. They are more tolerant of water pollution than most native clam species. Asian clam establishment has the potential to collapse fish populations, close recreational areas, and disrupt municipal water and irrigation systems.

(McBride, J. 2013. Aquatic invasive species threatening the Crown of the Continent. <http://crownmanagers.org/publications/>)