



Monitoring of Wadeable Streams

Importance

Riparian ecosystems, which occur along waterways, can be sensitive indicators of landscape-level change. They are linked to both aquatic and upland systems, perform important ecological functions, and are biologically diverse. Riparian systems face a number of anthropogenic threats, including dams and diversions, channel-stabilization structures, invasive exotic species, livestock grazing, timber harvesting, agricultural clearing, and groundwater pumping. These disturbances can alter watershed conditions and influence riparian ecosystems downstream. Developing credible, efficient monitoring approaches will help us to assess riparian-system health and provide early warning of system degradation.

Process and Use

To monitor riparian systems, the Northern Colorado Plateau Network (NCPN) collects data on vegetation, hydrology, and geomorphology in wadeable streams. Wadeable streams may have flow that is perennial (year-round), intermittent (surface flow during certain times of the year and a shallow water table in portions of the stream), or ephemeral (surface flow for short periods during and following rain events). The network monitors wadeable streams at one site in each of four park units. Park staff selects individual streams for monitoring based on management priorities.

To track changes in plant cover and species composition over time, field crews return to the same transects year after year. This method also allows them to record the relative abundance of native and non-native species. Measuring physical drivers, including streamflow, groundwater dynamics, and changes in channel form, helps us to understand plant response to the kinds of stressors mentioned above, as well as to climate.

Information gathered from this protocol will provide park managers with (1) a baseline they can use to gauge long-term status and trends in riparian resources; and (2) information they can use to judge the effectiveness of management actions intended to protect or restore these ecosystems.

Status and Trends

In late summer and fall 2013, heavy rains created flash floods throughout the NCPN region. These floods reshaped stream channels and deposited sediment on the floodplains of the reaches we monitor. After the floods, upgrades and maintenance were needed at wells in three parks. At Capitol Reef NP, we replaced a riparian well that had sheared off in a flash flood and installed a lower-profile, instream well less likely to be damaged by flood debris. In Arches NP, we did the opposite—increased the height of the instream well to help alleviate issues related to sediment deposition and channel reshaping. A pressure transducer was installed at one reach in Natural Bridges NM to monitor flood frequency and magnitude in the canyon.

In 2014, NCPN monitoring focused on revisiting reaches that were previously monitored to quantify changes. After a reduced season in 2013 (due to the federal budget sequester), we ramped up our wadeable streams monitoring in 2014, sampling at three parks. (Zion NP was not sampled for a second year due to both budget cuts and accessibility issues related to a new private landowner.) At each park, we surveyed geomorphology and sampled vegetation at two reaches. Hydrologic monitoring continued at all parks.

In 2015, we surveyed and measured vegetation at one reach in upper Courthouse Wash (Arches NP), continued hydrologic monitoring at all parks, and published a [report](#) focusing on changes after a 2010 flood at Zion NP (see next page).

Contact

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Network park units where wadeable streams are monitored

Arches NP	Natural Bridges NM
Capitol Reef NP	Zion NP

NP = National Park; NM = National Monument



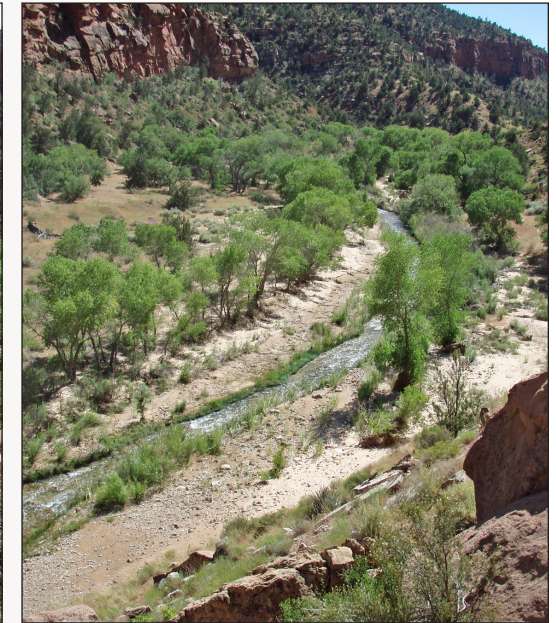
Instream monitoring well in a reach on the
Fremont River, Capitol Reef NP.

A Flood of Changes: East Fork Virgin River, Zion National Park

The flood that swept through Zion National Park in December 2010 was estimated to be a 25–40 year event. On the East Fork Virgin River, the flood peaked at 3,090 cubic feet per second (cfs), turning a usually quiet stream into a raging torrent of water that overflowed its banks for a total of 57 hours. NCPN staff monitored the East Fork Virgin River both before and after the flood (2008–2012). Analysis of the data collected has revealed some notable changes to the geomorphology and vegetation in Parunuweap Canyon.

Channel Morphology

Our surveys of Reach 1 revealed that the flood left substantial deposition on the terrace closest to the floodplain (the “modern terrace” in the figure below). To the degree that response to a single flood event can indicate a pattern, our data show that the East Fork Virgin River is currently in a cycle of deposition, which tends to occur during drier periods. Data from regional weather stations also indicate a general increase in average annual minimum temperature over the past 30–50 years for Zion NP. Increased temperature can affect the water balance of watersheds by increasing evaporation of soil moisture and transpiration by vegetation. After the flood, the channel also became wider and shallower at Reach 1 (see figure), and remained this way for over a year afterward. Changes detected at Reach 3 suggest that this reach experienced changes similar to those seen at Reach 1.



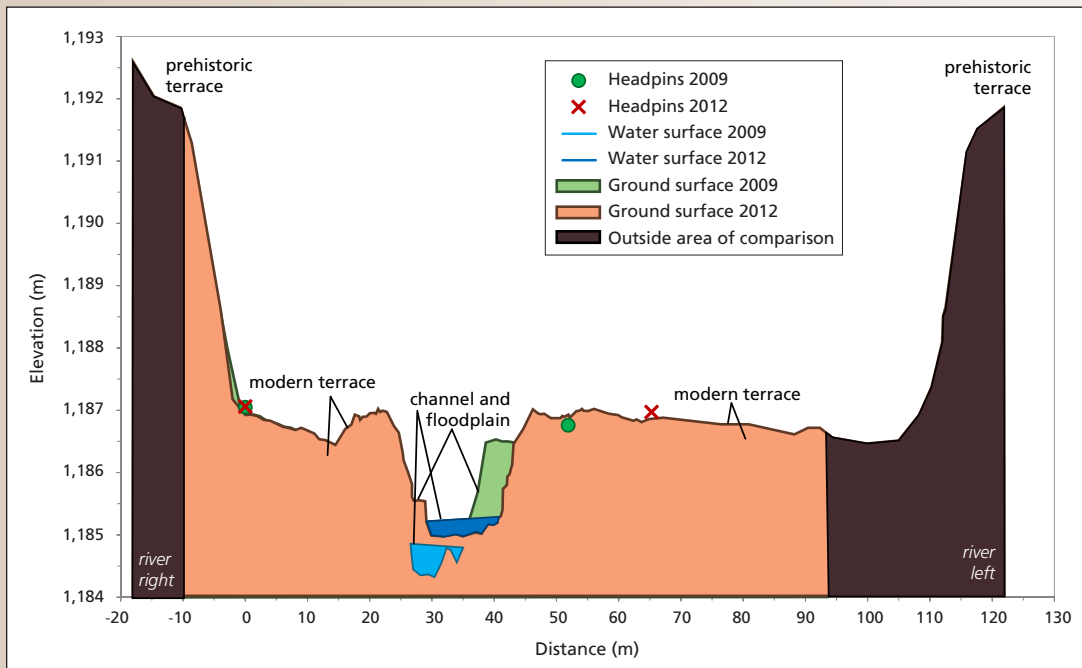
East Fork Virgin River in Parunuweap Canyon near reach 2, Zion National Park, August 2008 (left) and July 2011 (right).

Vegetation

Vegetation at the three reaches surveyed showed different responses to the flood. Species richness increased significantly at reaches 1 and 2, particularly relative to disturbance-adapted riparian species and new species. Larger floods are well known to promote germination of cottonwood seedlings in riparian areas of the Southwest. The density of Fremont cottonwood (*Populus fremontii*) seedlings increased at reaches 1 and 3, but not at Reach 2. Seedling density may not have increased at Reach 2 because there was a smaller amount of suitable area for germination at this reach than at the others. In particular, Reach 2 had higher cover of bedrock and dense shrubs adjacent to the channel.

At Reach 3, species richness and total live cover decreased. It appears that these decreases were the result of (1) erosion of the streambank, which buried or washed away species, and (2) damage to Rio Grande seepwillow (*Baccharis salicina*) on the floodplain. The live cover of this species was reduced more than that of any other species.

Download the report: <http://irmafiles.nps.gov/reference/holding/527732>



Cross-section of reach 1, transect 2, East Fork Virgin River, showing morphological changes between 2009 and 2012.