



Springs at Bighorn Canyon National Recreation Area

Springs and seeps are important for health, productivity, and biodiversity of semi-arid landscapes like those of Bighorn Canyon National Recreation Area (NRA). Most of our freshwater resources are stored below ground and springs and seeps are places where this water first reaches the surface of the earth. Small rivulets, streams or even large rivers develop from springs and are important sources of water for wildlife, plants and humans alike.

Bighorn Canyon NRA Springs

At least 35 perennial springs (springs that flow year round) have been located in Bighorn Canyon NRA. A central feature of each spring is how much water (flow) there is where the spring emerges from the ground or rock face. Springs differ with respect to how variable their flows are over time, their water chemistry, and the age of the water they discharge.

The amount of flow interacting with local lithology, topography, and climate continually determine the shape of downstream channels, help structure associated plant and animal communities, and strongly influence human decisions to develop the spring. Spring flow may also indicate groundwater reservoir size and complexity and express current and past climate conditions.

Monitoring

Springs monitoring can enhance our understanding of underlying aquifers and associated springs ecosystems. National Park Service and university scientists have been monitoring springs at Bighorn Canyon NRA to examine how spring and stream flow change over time and what causes these changes in order to protect these precious water sources.



Hillsboro Main Spring



Upper Layout Creek Spring Monitoring Site

Spring Highlight - Layout Creek

One of the most prolific springs in Bighorn Canyon NRA forms Layout Creek. Layout Creek begins at an orifice (the mouth of the spring where groundwater surfaces) high in a canyon of the Pryor Mountains above Layout Creek hiking trail and Ewing-Snell Ranch. The headwaters of Layout Creek begin in steep limestone cliffs and spring flows quickly descend in a restricted channel of limestone walls and large boulders. Out of the canyon, the creek travels through Tensleep Sandstone formations - sheets of sandstone along the lower slopes of the Bighorn Mountains that are characterized by fine to medium grained, rounded, well-sorted, pourous sandstone materials which are susceptible to movement and erosion.

Upper Layout Creek (LayoutSpr1), located high in the canyon, and lower Layout Creek (LCR2), located in an often dry channel approximately 4.2 km (2.6 miles) downstream, have been monitored for more than four years. The channel morphology and geology of the two sites are quite different; lower Layout Creek flows through the less competent (easily erodible) Tensleep formations which are more susceptible to alterations during high flows.

Status and Trends

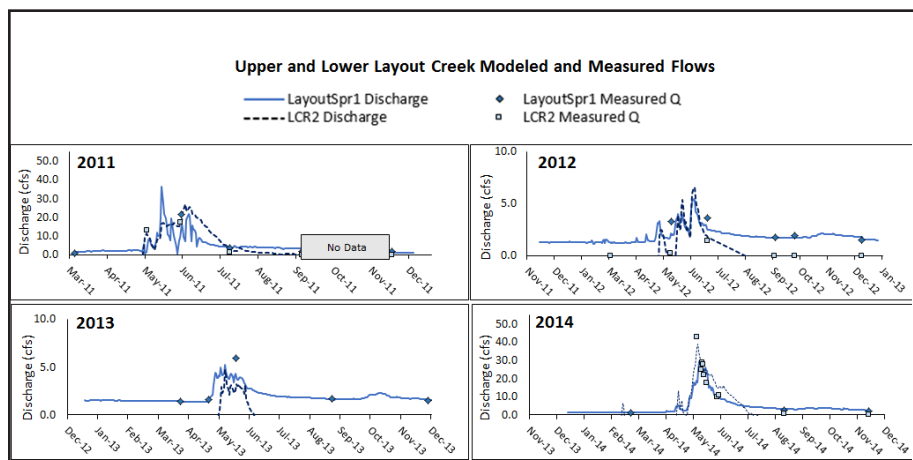
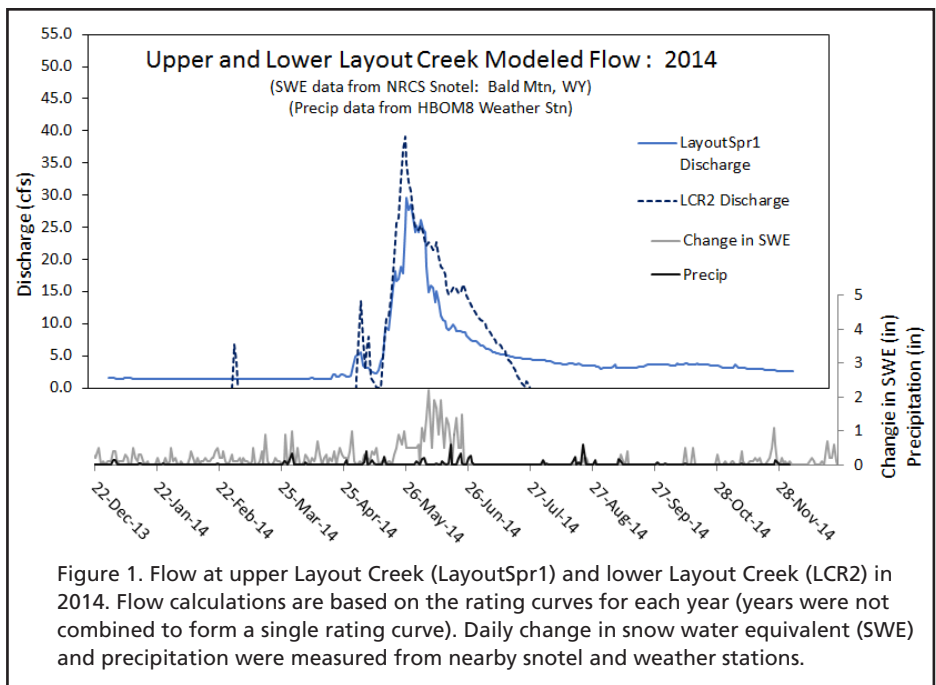
Winter precipitation in 2014 was higher than the 30-year mean. In fact, precipitation recorded in February near Lovell, WY was 800% of average precipitation. Not surprisingly, upper and lower Layout creek had elevated peak flows in 2014 (Figure 1). Flows in 2014 were similar to flows in 2011, a year that had higher than average annual precipitation, and most importantly, one that also experienced greater than average February precipitation (450%; Figure 2).

Flows for Layout Creek are estimated using a rating curve (statistically developed relationship between flow and water height). The maximum modeled discharge in late May of 2014 was 30 cfs (cubic feet per second) near the spring source in upper Layout Creek and 39 cfs in lower Layout Creek. The higher modeled flow at lower Layout Creek may be a weakness in our model, or it could indicate increased contributions from subsurface flow or ephemeral (short-lived) tributaries to the Layout Creek channel as soils may have been saturated due to melting snow and precipitation events. During spring runoff, flows at lower Layout Creek may exceed flows at upper Layout Creek, but lower Layout Creek flows are ephemeral and the channel is often dry by mid-June. Data loggers in lower Layout Creek show that the site was dry 83% of the year in 2012, 66% of the year in 2013, and only 25% of the time in 2014.

To explore the influence of precipitation on spring flow, 2014 modeled flows were plotted along with snow water equivalent (SWE) and snotel (snow monitoring)

Springs and Human Use

- Springs were no doubt important to Native Americans who seasonally used this region for at least 10,000 years, and especially to the Absaroka or Crow people.
- Similarly, springs were important to settlers such as Caroline Lockhart, the illustrious reporter, writer, and cattle rancher, who developed springs to support her 6,000 acre ranch in the Dryhead area of southcentral Montana that later became part of Bighorn Canyon NRA.
- Other ranchers relied on these springs including Erastus Ewing who came to the area for gold and ended up ranching. He relied on an appropriation of water from Layout Creek and evidence of the irrigation systems he built can still be seen along Upper Layout Creek Trail.



stations. Although we can show relationships between flow and current year precipitation, our data suggest that base flows (those outside of spring runoff) in Layout Creek are groundwater derived except during large precipitation events and/or rain on snow events where water may reach the spring orifice and upper Layout Creek during overland flow.

As air temperatures continue to rise in this region, changes in snowpack, riverflow, and vegetation are likely to occur. Continued monitoring of Layout Creek and other springs will help shed additional light on how these changes may affect spring flows in Bighorn Canyon NRA.