Indications of Beaver and Identification of Remnant Beaver Dams in Tásmam Koyóm

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There has been a significant debate regarding beavers in the Sierra Nevada that has raged for more than a century and has resulted in extreme actions including transplanting and releasing animals from out of state followed by decades of eradication programs by California Department of Fish and Wildlife (formerly Fish and Game). However, recent research has uncovered novel physical evidence that beavers (*Castor canadensis)* be native to the Sierra Nevada Range (Lanman et al. 2012).

As a restoration ecologist specializing in Montane meadows in the Sierra Nevada, I have observed beaver activity throughout the entire mountain range in hundreds of different meadows in the full range of geomorphic and hydrologic conditions. I have become adept at reading the landscape and channel geomorphology in meadows where there are distinct telltale landforms that indicate past beaver presence as well as seeing thousands of beaver dams ranging from fully intact to just tiny remnants. However, even when a dam is completely washed out, there are distinct indications still visible in the channel geomorphology such as islands, bank angle, depositional zones in a distinct wedge shape with no current cause, and dams remnants that have had sediment accreted over them and sedge colonize the backwater leaving the hint of the dam shape, but no obvious sticks with beaver sign unless one excavates below the well-developed sod. In many sites, I see hundreds of small remnants of breached beaver dams with just a small butt-end of sticks in the preferred size class and species for beavers. The distinctive pattern of beaver construction is quite obvious once you recognize it. Beaver dams typically have a triangular shape with a wider base and narrower top for stability velocity reduction and beavers lay willow or other sticks in specific orientations and orders that are very easy to recognize in the field. Areas of tributary confluences are very common locations since the dams in those areas inundate a much larger area and beavers are prone to rebuild large dams over and over in the same location. This tends to develop a complex web of channels that are very obvious from aerial photography. I look at the channel geomorphology in the field for additional clues and confirmation. The shape and angle of the banks is very distinctive upstream of a dam that has persisted for several seasons and allowed the development of sod and colonization of sedge holding the banks together. That shape and vegetation cover is persistent even after the dam has washed out for decades or more. Even if the system is actively eroding, this shape indicator is frequently encountered. Long term beaver dams tend to create slow depositional zones both upstream and downstream of the dam. These areas accrete fine sediment and then emergent marsh/wetland communities (typically *Carex* species) colonize these depositional zones. Even after the dam washes out, these depositional areas with their associated vegetation species remain and indicate earlier presence of a beaver dam.

I spent 18 days surveying the meadow and stream channel in Tásmam Koyóm in June through October, 2019. I found hundreds of remnant beaver dams sticking out from the banks under the surface of the water and landscape geomorphic forms indicating earlier presence of dams consistent

with other streams I have surveyed throughout the Sierra Nevada. Beavers are not currently present at the site. Aerial imagery of the site shows extensive networks of small side channels, bank shape and angle in many locations indicates previous beaver dam presence, and habitat, stream gradient, and vegetation community are all ideal for beaver colonization. Kate Lundquist of OAEC asked me to find a sample of a remnant dam for radio carbon dating. We knew that beavers had been introduced to the site as an erosion mitigation measure circa 1940 so we expected the dam remnants we were finding in the site to date to around that time or later. However, if we could find conclusive evidence of earlier beaver habitation, we would have a strong argument for reintroduction to the site and an additional piece of physical evidence to support the presence of beavers throughout the Sierra pre-settlement. The lack of beavers in a system that evolved with them constitutes a tremendous shift in ecological forces and processes and should be considered a primary goal for restoration. Cultural references to beavers are abundant in the Mountain Maidu tribal lore and returning beaver to the area is an explicit restoration action the tribe wishes to accomplish (Ogle 1998, Benner-Ogle 2016). There is no question among the tribal representatives that we work with that beaver were historically present at Tásmam Koyóm.

We chose an obvious dam remnant that had the telltale beaver dam shape emerging from the river right side of the channel in reach TK-1 channel unit FNRN6. The remnant was approximately 0.4 m below the surface of the water and about 0.45 m tall and 0.5 m wide at the base. The size and arrangement of the sticks were very typical of beaver dams in the Sierra Nevada with most of the wood ranging in size from about 0.5cm to 3 cm diameter. Since the sticks in the remnant are subject to the stream flows at all levels, they are frequently broken off and do not show distinct beaver sign, but if one were to excavate farther into the bank, it might be possible to recover a stick with more obvious beaver sign, but it is not unusual for remnant beaver dams to have the beaver sign broken off in high flows. There were numerous indications of beaver dams at this channel unit including several islands, trapezoidal shaped remnants covered in sod at the stream margins, and bank shape and vegetation patterns consistent with the earlier presence of a dam. We felt confident that our choice of wood to sample was definitely the remnants of a beaver dam. I had no expectations that the site would yield beaver dam remnants of such ancient pedigree. My hypothesis was that we would not get conclusive evidence of pre-settlement or pre-reintroduction beaver presence. I was extremely pleased and surprised when the results of the carbon dating were unequivocally of such ancient pedigree. However, all scientific endeavors need replication and multiple data points. This single sample is an excellent piece of novel physical evidence of pre-settlement beaver inhabitation at this site. However, it would be best to collect and run additional samples of remnant beaver dams throughout the site to get definitive proof and have more statistically significant data in order to unequivocally prove the historical presence of beaver at this site.

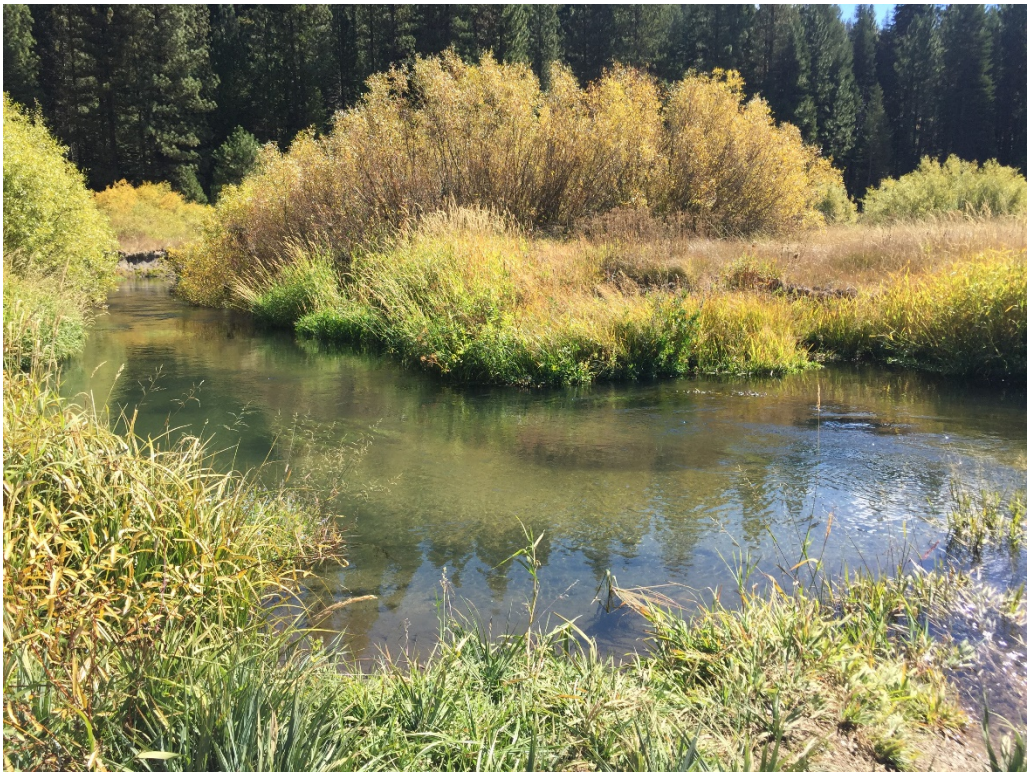

Figure 1. Just downstream from the location where the Beaver Dam remnant sample was taken. The bulging trapezoidal shaped bank on both sides of the channel indicates a buried remnant beaver dam. Beneath the sod and sedges, there are obvious remnant sticks visible under the waterline in the channel.

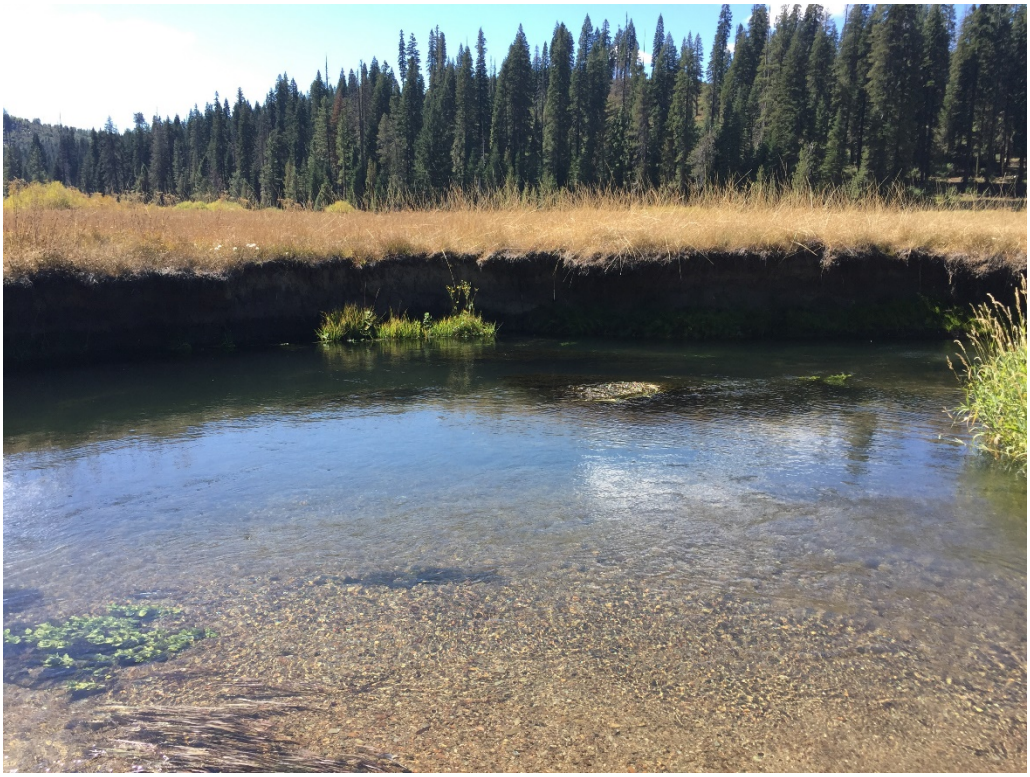

Figure 2. The remnant sample was taken from the cutbank pictured here near the small sod chunk across the stream channel. There are numerous other indicators of the earlier presence of beaver dams here including sod islands, and the remnants of the emergent marsh habitat created by the dam on river left.

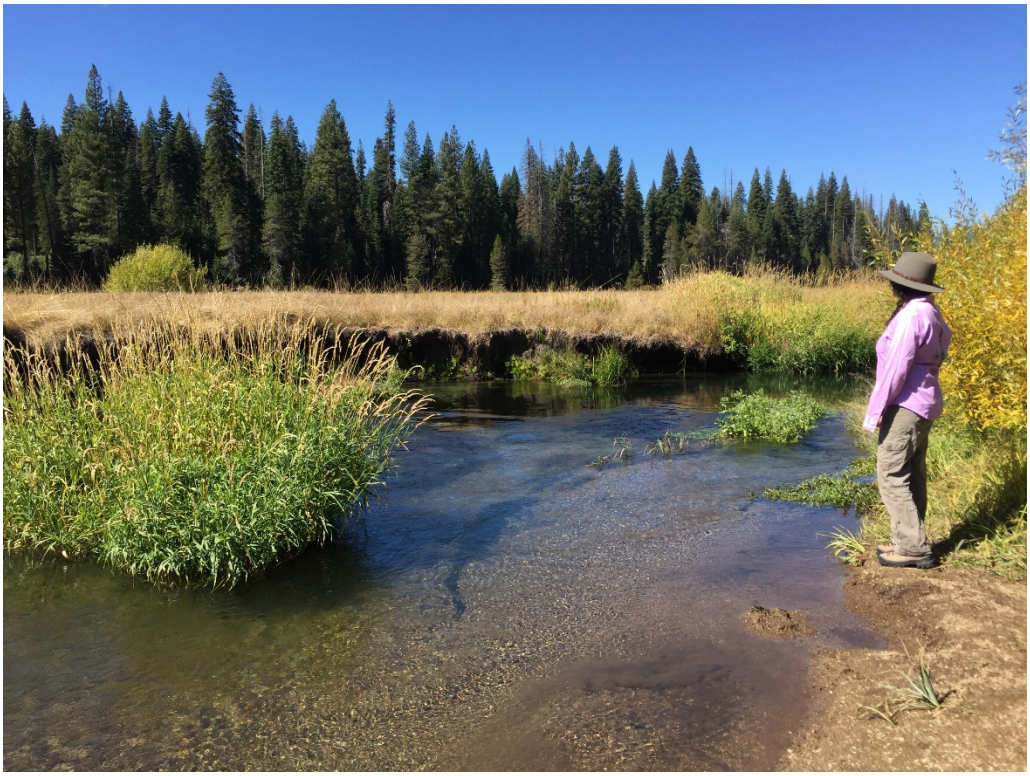

Figure 3. Remnant chunk of beaver dam with sediments accreted on top allowing for grass to colonize. The area where the person in the photo is standing was the emergent marsh habitat created by former beaver dams at this site in Tásmam Koyóm.

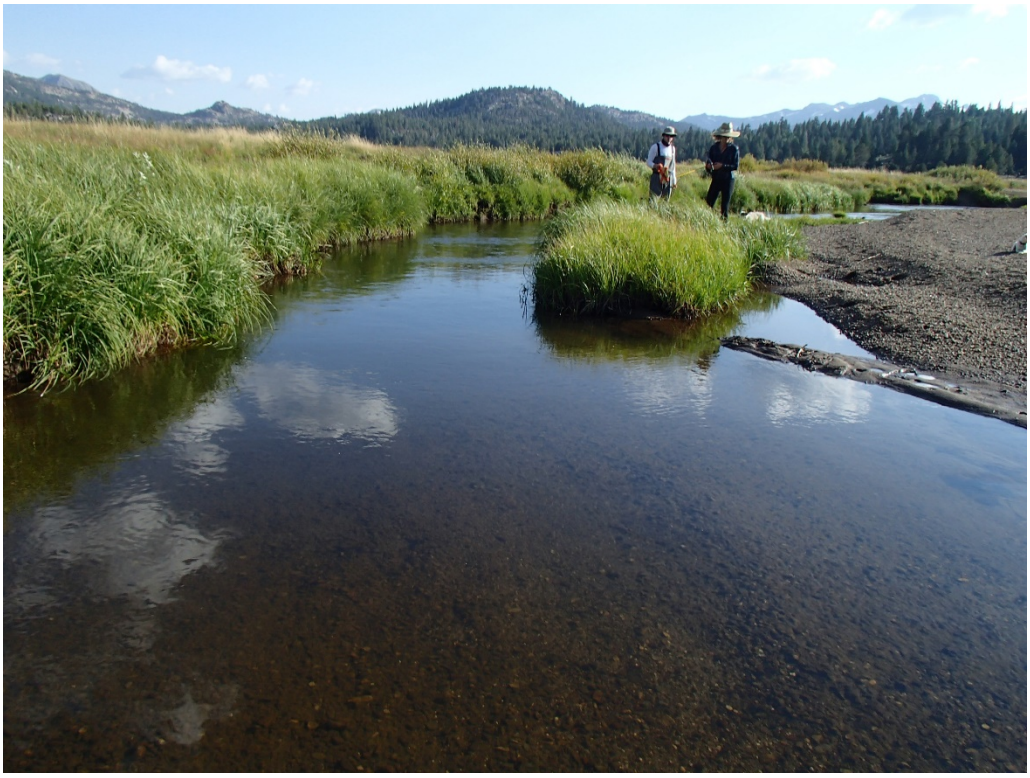

Figure 4. Typical "Beaver shaped banks" in Hope Valley, CA, 2017. The shape and vegetation cover are very typical of the area upstream of a beaver dam that remained in place for several seasons allowing sediment deposition upstream of the dam and stabilization of banks due to a higher water table and reduced stream velocity. This distinctive bank shape can persist long after the beaver dam that created them has washed out. A partial dam remnant can be seen in this photo mid-channel with telltale beaver sign sticks at the base.

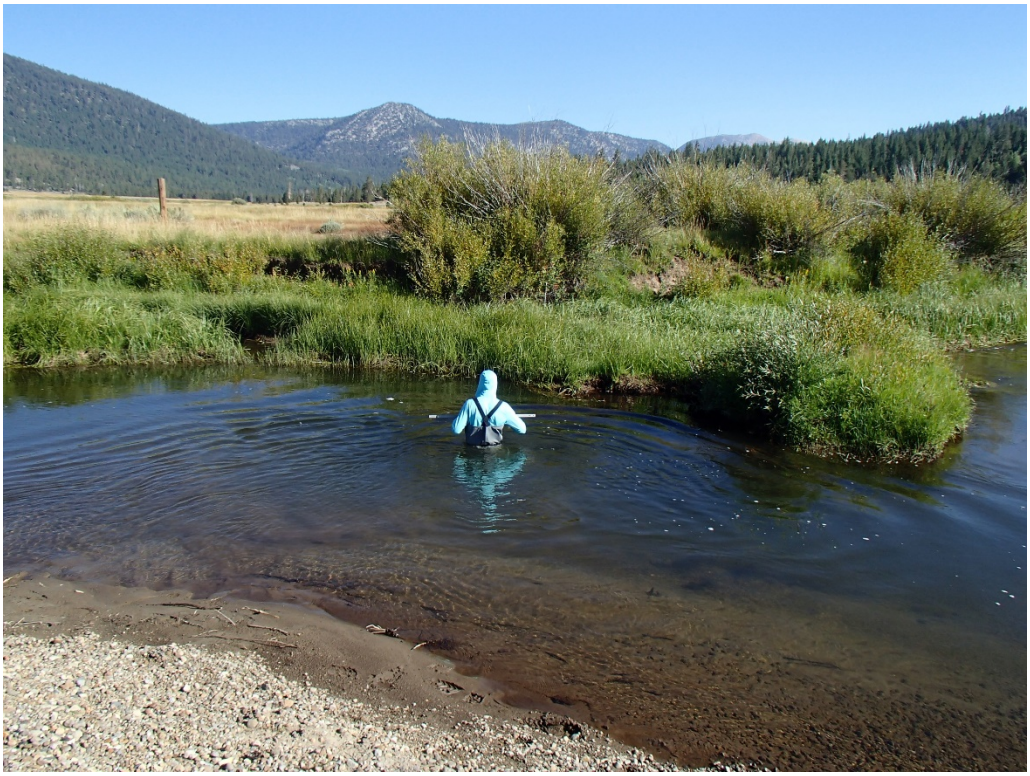

Figure 5. A remnant dam along the channel. Note the distinctive wedge shape created by the dam itself and the fine sediments leading to emergent marsh habitat on both the downstream and upstream side of the dam. When dams are partially breached like this one, they often create a scour pool where the dam once was. This geomorphic evolution can be observed consistently throughout Sierran Meadows and the landform is very distinctive. Hope Valley, 2017.

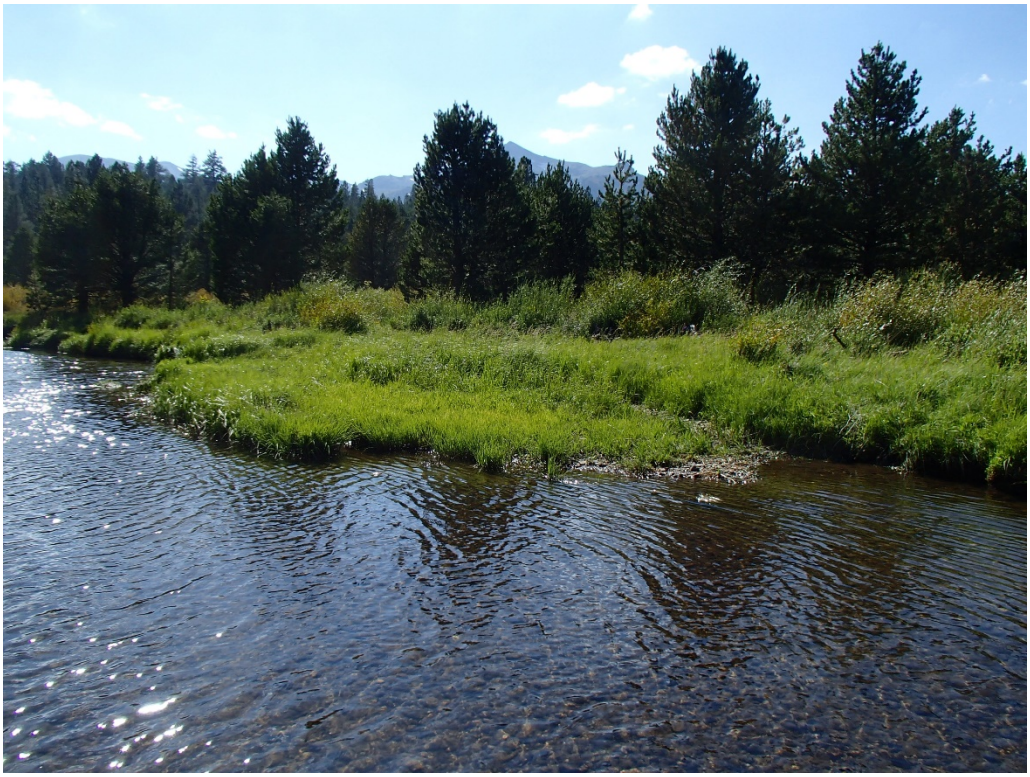

Figure 6. The beaver dam here is long gone but the inset floodplain development that occurred due to presence of the dam generating emergent marsh habitat persists and indicates the earlier presence of the dam. Dam remnants at the channel margins confirm the presence of an earlier beaver dam. Photo from Hope Valley 2017.

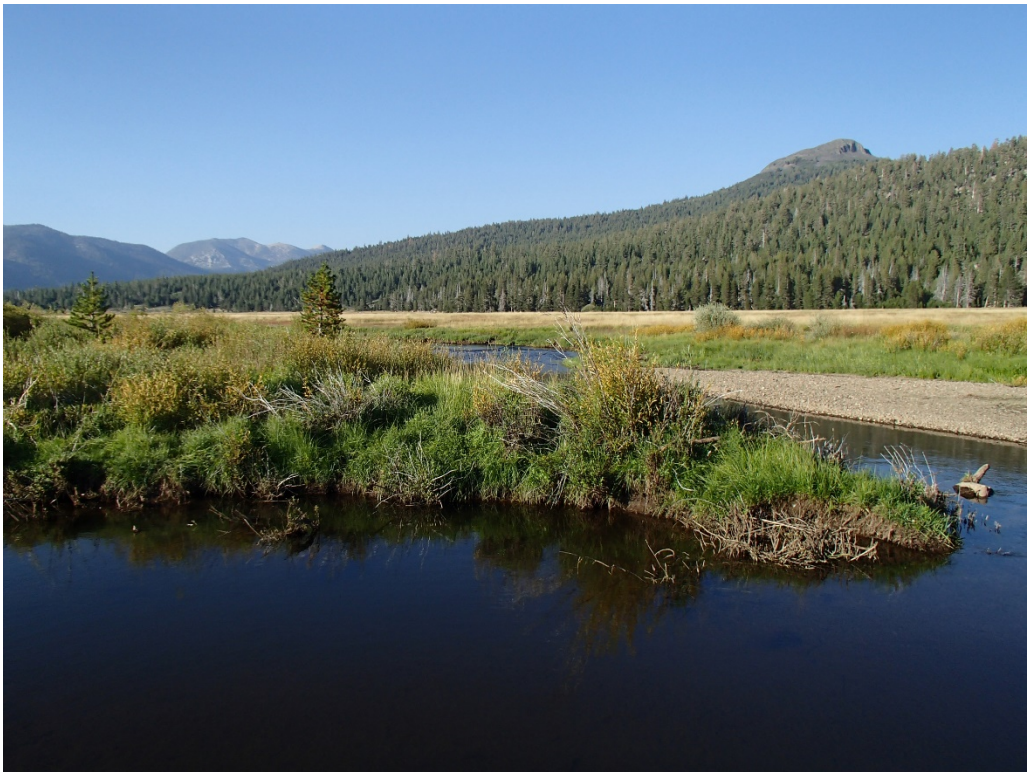

Figure 7. The beaver dam here was end cut by water creating a distinctive backwater and stream bend pattern that can be seen (and continues to evolve) ubiquitously in Sierran Meadow streams that have had beaver present. Photo from Hope Valley, 2017.

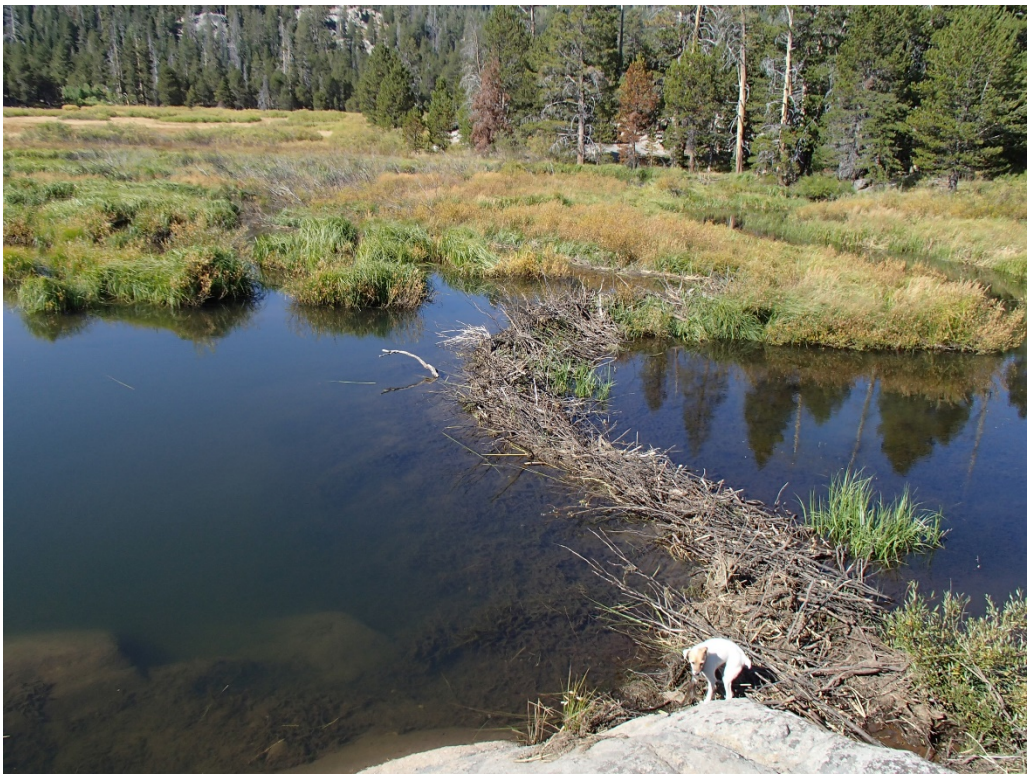

Figure 8. The typical "triangle" shape of a beaver dam with a wide base and narrow top to maximize stability and reduce stream flow. The size and arrangement of sticks within beaver dams is highly consistent and recognizable. Note the multiple flow paths and channels where the stream is backed up into a complex web of channels at a tributary. This dam was breached in winter 2017. Faith Valley, 2016.

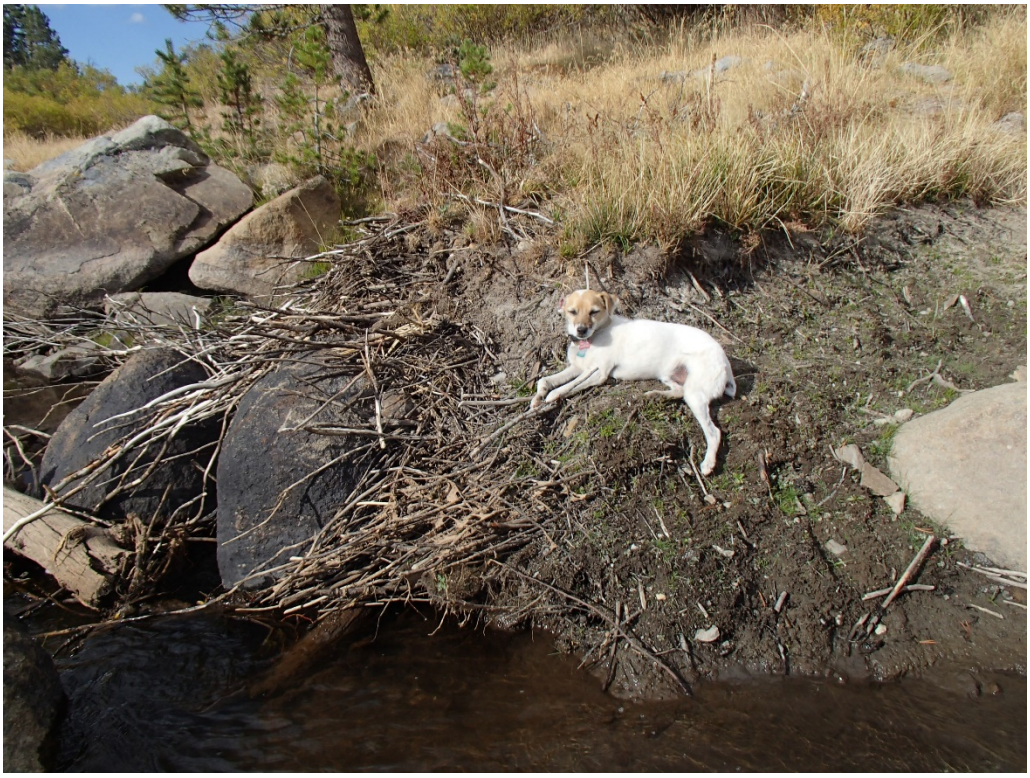

Figure 9. A large remnant dam with beaver sticks remaining in the bank. The size and arrangement is distinct and can be instantly recognized, especially with other clues from the geomorphic influence of the former beaver dam on the landscape. Faith Valley, 2016.

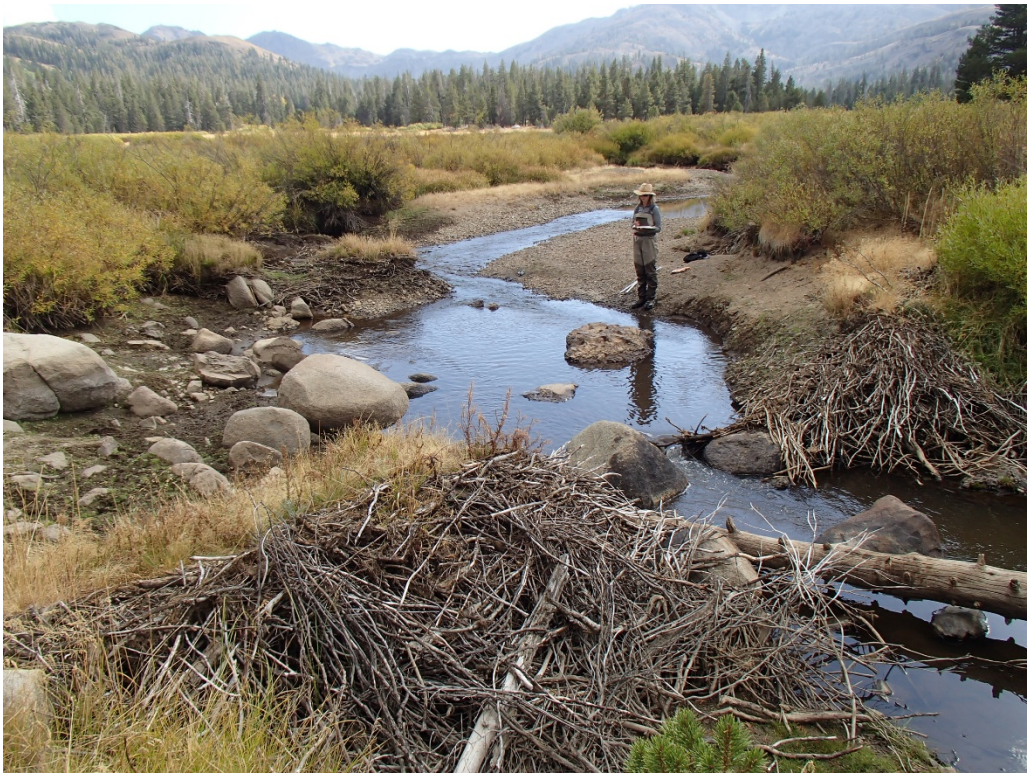

Figure 10. After the dam is breached, the geomorphology of the upstream channel shows the unmistakable influence of the former dam. Sediment deposition, sorting, and fine sediments accreted at the dam margins persist after the dam is no longer influencing the channel. Faith Valley, 2016

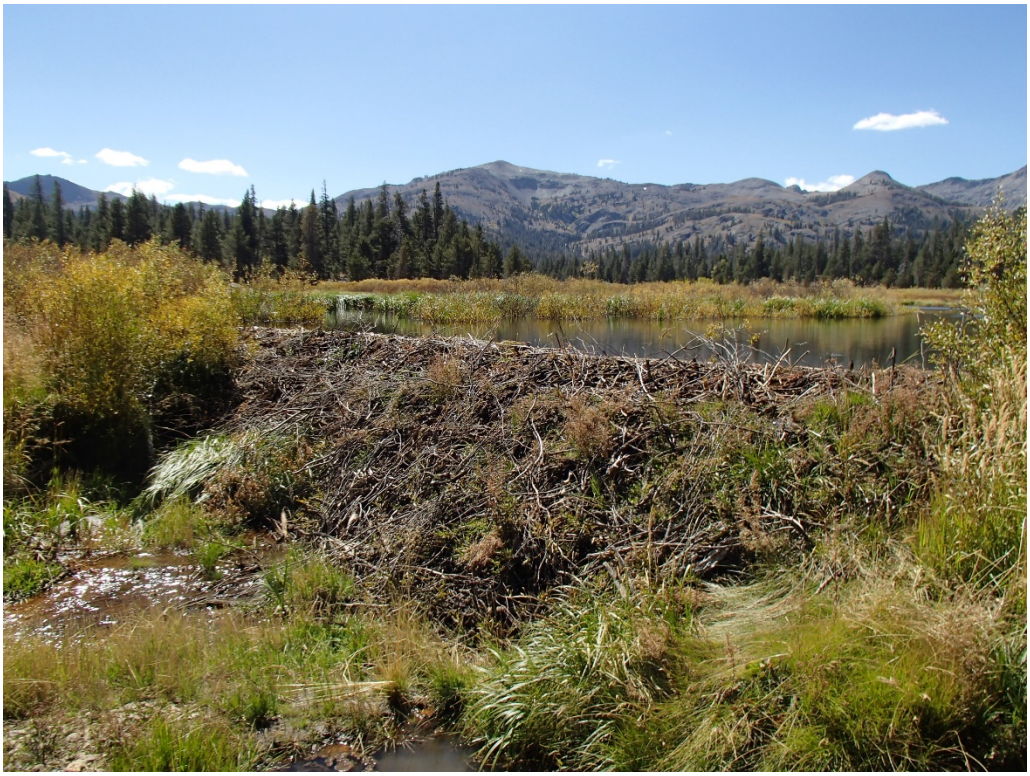

Figure 11. It is common for beavers to repeatedly build large dams at the same site, particularly at confluence areas where the area of inundation can be very large. This dam was breached in the winter of 2017 and exposed dozens of remnant dams in the same area. Faith Valley, 2016

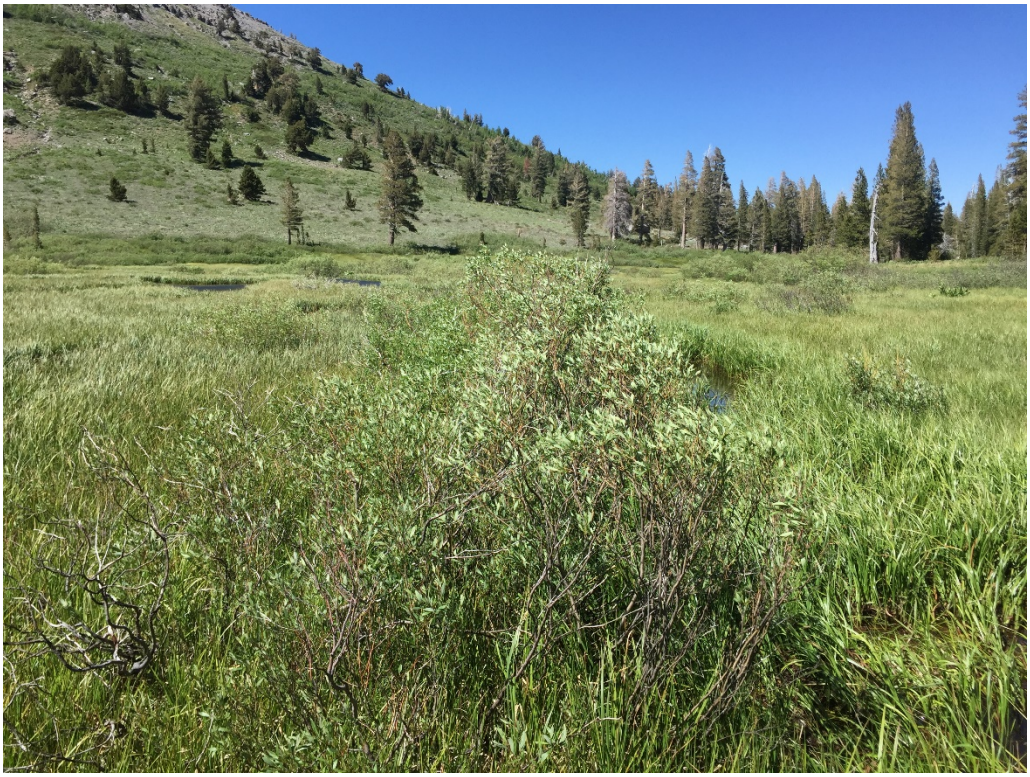

Figure 12. Sprouting willows from a low, cross valley scratch dam have a visually distinct "line" formation that I describe as beavers row cropping. Forestdale Meadow 2018.

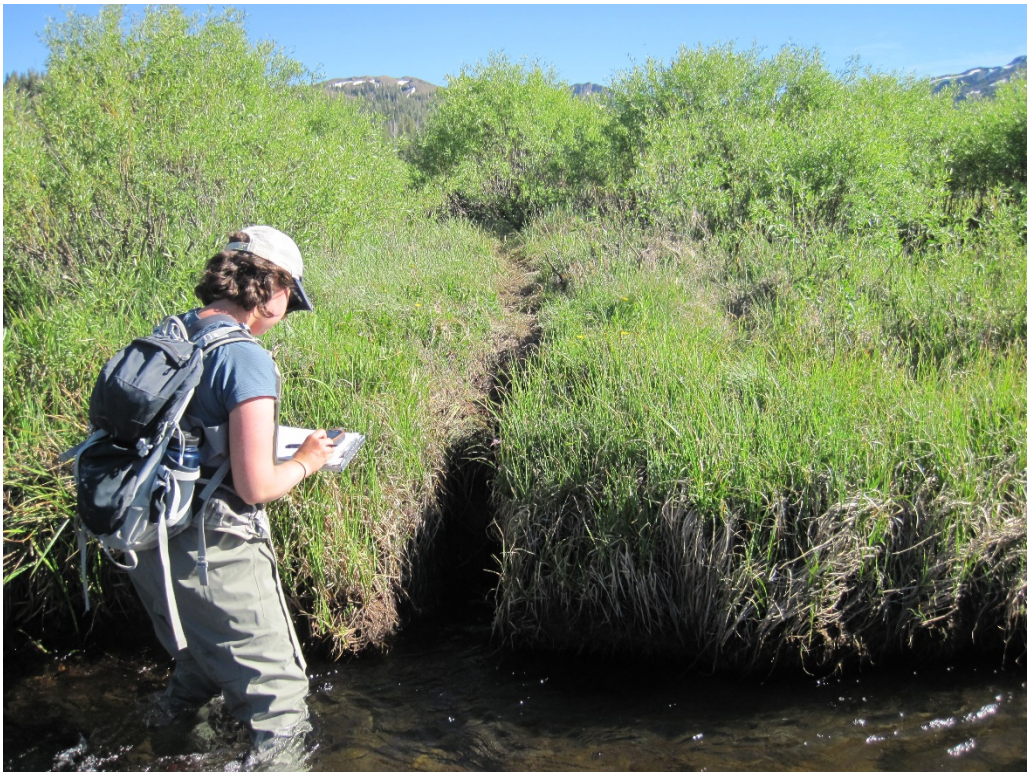

Figure 13. Beaver burrows and tunnels exposed after a dam breach leave a distinctive track that persists for a long period of time. Faith Valley, 2018.

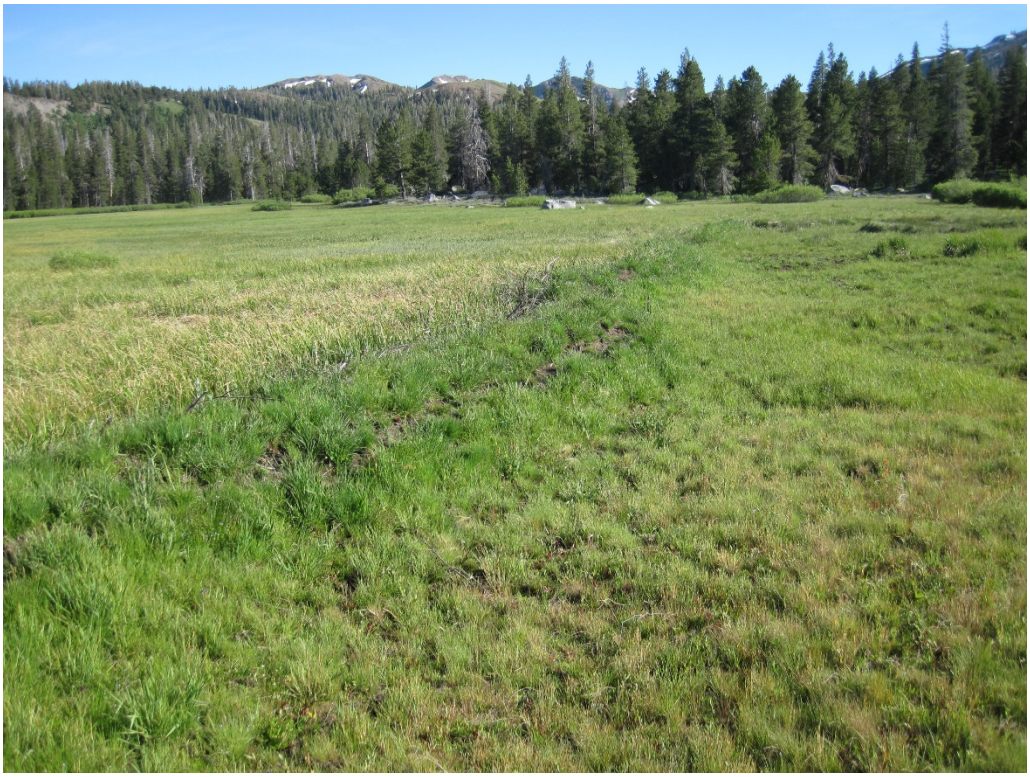

Figure 14. After the dam is breached, this small scratch dam extension across the meadow is left dry and the willows begin to sprout. Faith Valley, 2018.

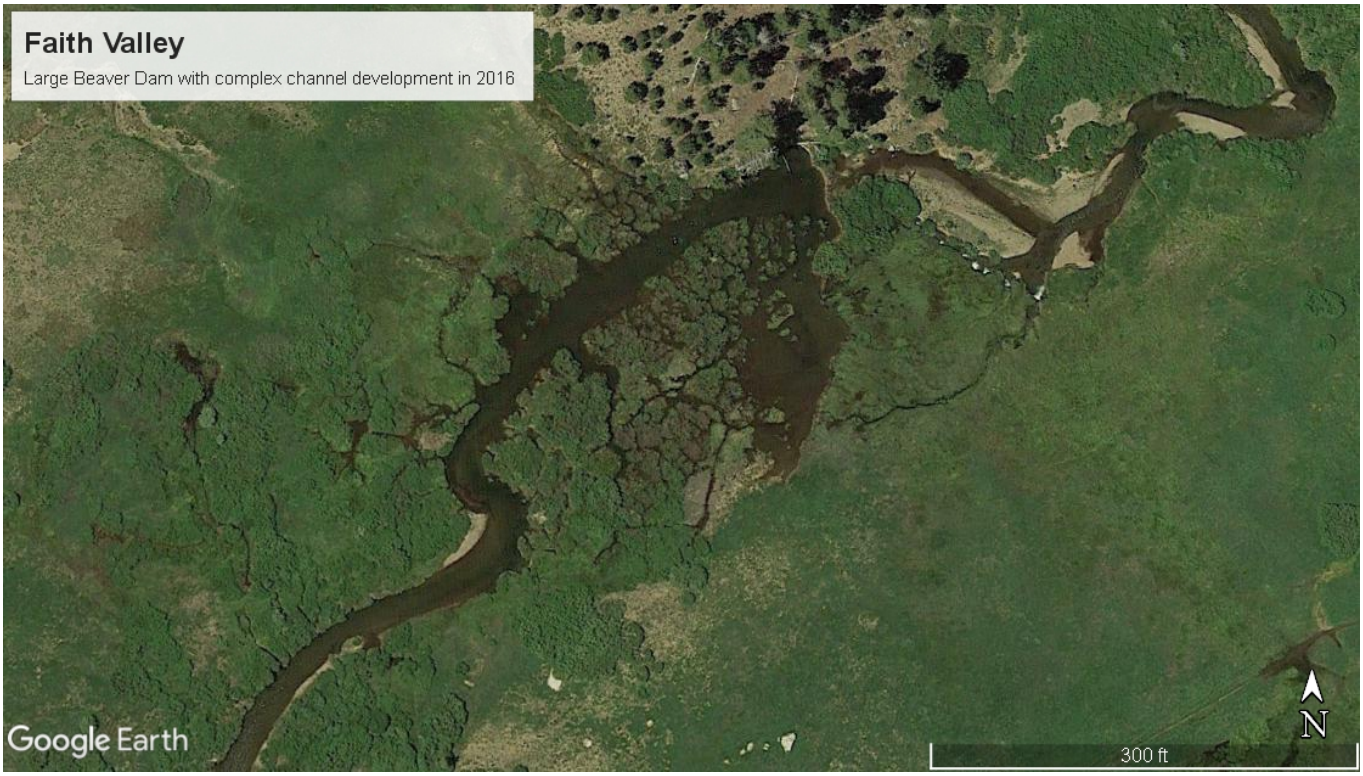

Figure 15. Beavers consistently build a dam in this zone that tends to breach every 3 to 5 years. When a large functional dam is present here it can inundate more than 13 acres with water. This dam was breached in the winter of 2017 revealing numerous remnants of other large dams in the immediate vicinity. Faith Valley.

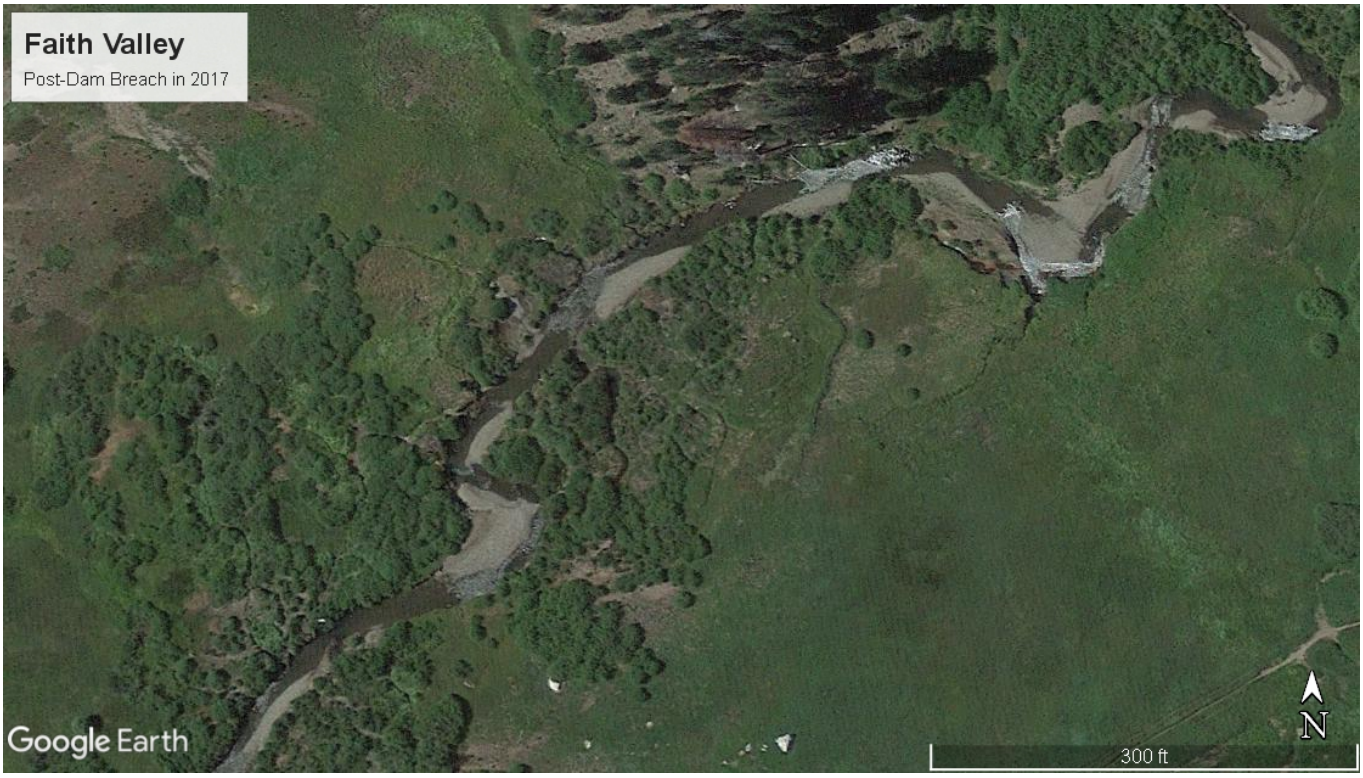

Figure 16. Post-Dam breach in 2017. Note the huge amount of sediment that was trapped behind the dam and was then washed downstream and deposited after the breach. These dynamics of dam building, inundation, breaching, sediment capture and distribution, and willow cropping are essential meadow processes that leave distinct visual remains.

References

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