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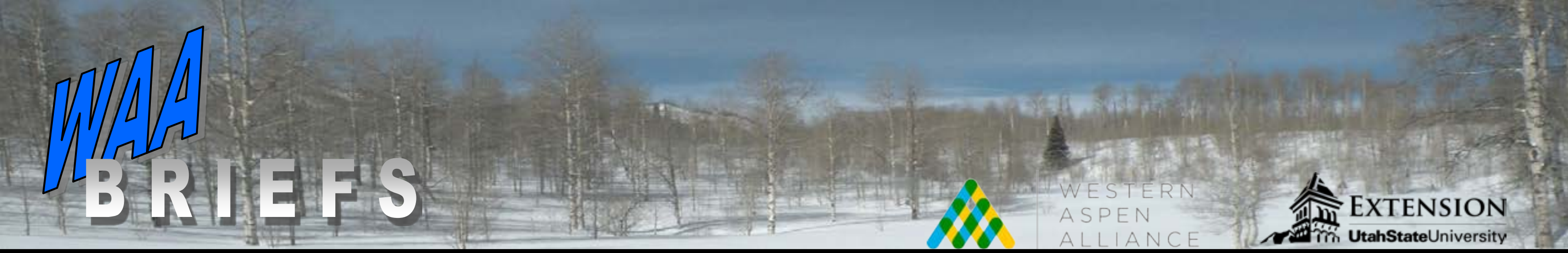

BEAVER AND ASPEN: SYNERGY AMONG KEYSTONE SPECIES

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Overview

In the West, climate change is likely to increase the frequency, intensity, and duration of drought. Restoration of soils and water storage capacity can help create resilient uplands and riverscapes (i.e., streams and the valley bottoms). Over the past two centuries, common land uses, the removal of beaver and wood, straightening of streams, and damage to riparian areas have created simplified, structurally starved, riverscapes. Degraded streams are very efficient at transporting water, sediment, and nutrients downstream. Aspen forests are also biological hotspots that have been degraded by past land uses such as overbrowsing ungulates, land clearing, fire suppression, and outright removal in favor of timber species. Loss of riverscape and aspen habitats has a disproportionate impact on biodiversity and landscape resilience. When aspen occur in or near riverscapes they are a preferred food and building material for beavers. Beaver, in-turn, can stimulate aspen regeneration, both through cutting and restoring hydrologic function in riparian areas. Adding beavers can reinstate riparian processes, increase aspen growth and diversity that extends to uplands, and buffer ecosystem sensitivity to extended drought.

Background

Riverscapes include stream channels and their valley bottoms and generally represent the possible extent of riparian areas (Wheaton et al. 2019) and are biodiversity hotspots for plants and animals. However, the scope of current riverscape degradation across the West is immense. Almost 70% of riparian areas have been degraded or lost and 67% of wadeable streams are in poor-to-fair condition (U.S. EPA 2006). A common and pervasive cause of riverscape corruption is the historic and ongoing loss of beaver dams and woody debris—referred to as "structural elements." By building dams, beaver slow water and expand groundwater availability, thus increasing aspen habitat and its many obligate species (see WAA Brief #7). Beavers were eliminated from many watersheds in the early 1800s by trapping. Additionally, wood was removed from riparian areas and streams creating structurally starved riverscapes. Without dams and wood to interrupt flow, streams tend to incise, straighten, and become efficient at transporting water, sediment, nutrients, and wood downstream. The lack of structure changes the natural "inefficiency" that streams, fish, and riparian forests require.

Aspen forests are second only to riverscapes in their biodiversity. Riparian degradation and excessive browsing by domestic or wild ungulates has reduced or eliminated regeneration while leaving mature trees to slowly die-off (See WAA Brief #2). As a result, aspen forests are generally less resilient and diverse than they were historically.

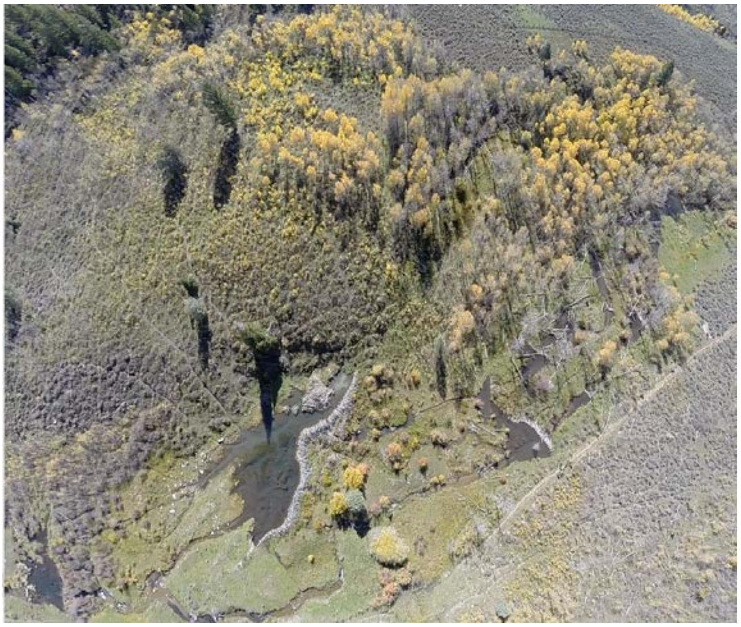

Fig 1. *Spawn Creek, Utah: large beaver dam complex that has been active for decades. Note >100m beaver trails above the pond. Also note the diverse age structure of aspen as beaver have acted like rotational crop farmers in this location.*

Aspen and beavers have a special connection as aspen are the preferred food and building material of beavers. Specifically, beaver fell mature aspen using the large limbs and trunks for dam and lodge building, while caching smaller branches to eat during winter. Beaver are known to travel further from stream channels to harvest aspen trees than other woody species (Fig. 1). Beaver fell predominantly large diameter aspen facilitating active regeneration and recruitment resulting in spatially dynamic age-diverse forests. This harvest pattern, alongside additional water availability, may extend aspen cover further upland than would be possible in the absence of aspen.

Hydrological Benefits of Beaver and Aspen

Properly functioning riverscapes that support beaver populations and dead wood recruitment are inherently *inefficient* and *messy*. Beaver dams pond water promoting overbank flow across floodplains, recharging groundwater and raising water tables (Pollock et al. 2017). Ponds trap sediment and can raise the streambed further expanding and connecting floodplains that dissipate flow energy. Intact, breached and abandoned beaver dams, create multiple and meandering channels producing complex riverscapes that provide varied wetland and riparian habitats, further boosting species diversity. Healthy riparian areas also provide wood inputs that have similar effects as beaver dams. Dynamic and moist riparian areas facilitate additional recruitment of aspen. Both aspen forests and riverscapes generally have relatively wetter soils than surrounding communities (Rogers et al. 2014). Retaining system moisture around riverscapes is a key buffering mechanism against climate-induced drought, as well as wildfire impacts (**Fig.** 3; Silverman et al. 2018).

Fig. 2. *Series of beaver ponds created on a small meadow seep (top panel). Aspen expansion near ponds (bottom panel), into drier uplands increases landscape diversity and resilience.*

Management Implications: Restoring Resilience

An interest in using beavers as a restoration tool is rapidly growing (Pollock et al. 2017). However, the extent of riverscape degradation dictates that restoration approaches be adopted that can scale to the scope of the problem (Wheaton et al. 2019). We recommend prioritized strategy of:

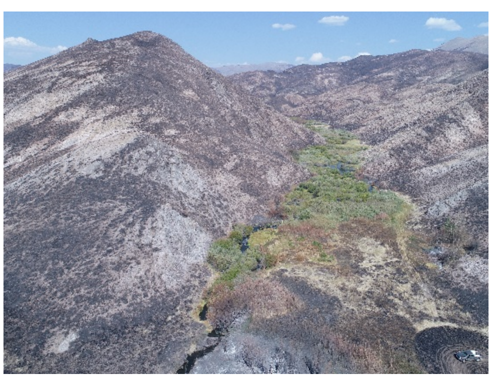

Fig. 3. *Beaver riverscape buffers against wildfire at Baugh Creek, Idaho.*

- Conserving areas with healthy riverscapes and beaver populations to act as source zones.
- Using riparian and grazing management to allow riverscapes to recover without direct intervention.
- Monitor for existing ungulate browsing levels prior to introducing beaver. Too many browsers signals an already stressed aspen system.
- Manage nuisance beaver with "living with beaver strategies" prior to lethal removal (Wheaton et al. 2019).
- Relocating nuisance beaver to areas with no beaver, but sufficient food and water and limited risks.
- Assisted recolonization: Adding beaver dam analogs (BDAs) and woody structures such as post-assisted log structures (PALS) to improve degraded riverscapes.

Key Findings:

1. Beaver and aspen work synergistically to support healthy riverscapes and diverse plant and animal communities.
2. Ground water and soil water storage, facilitated by sustainable beaver and aspen populations, increases production and resilience.
3. Successful practices using "low-tech process-based restoration are being implanted and monitored. These methods are now available for use by practitioners (Wheaton et al. 2019).
4. Past degradation of these landscapes will require a concerted effort of managing two keystone species in challenging climatic conditions

Sources

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