



Process-based Restoration in a Landscape Fire Resiliency Context

Qualitative Analysis of Pre and Post-Fire Interventions

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Rio Grande Return

Stream without Beavers

Stream with Beavers

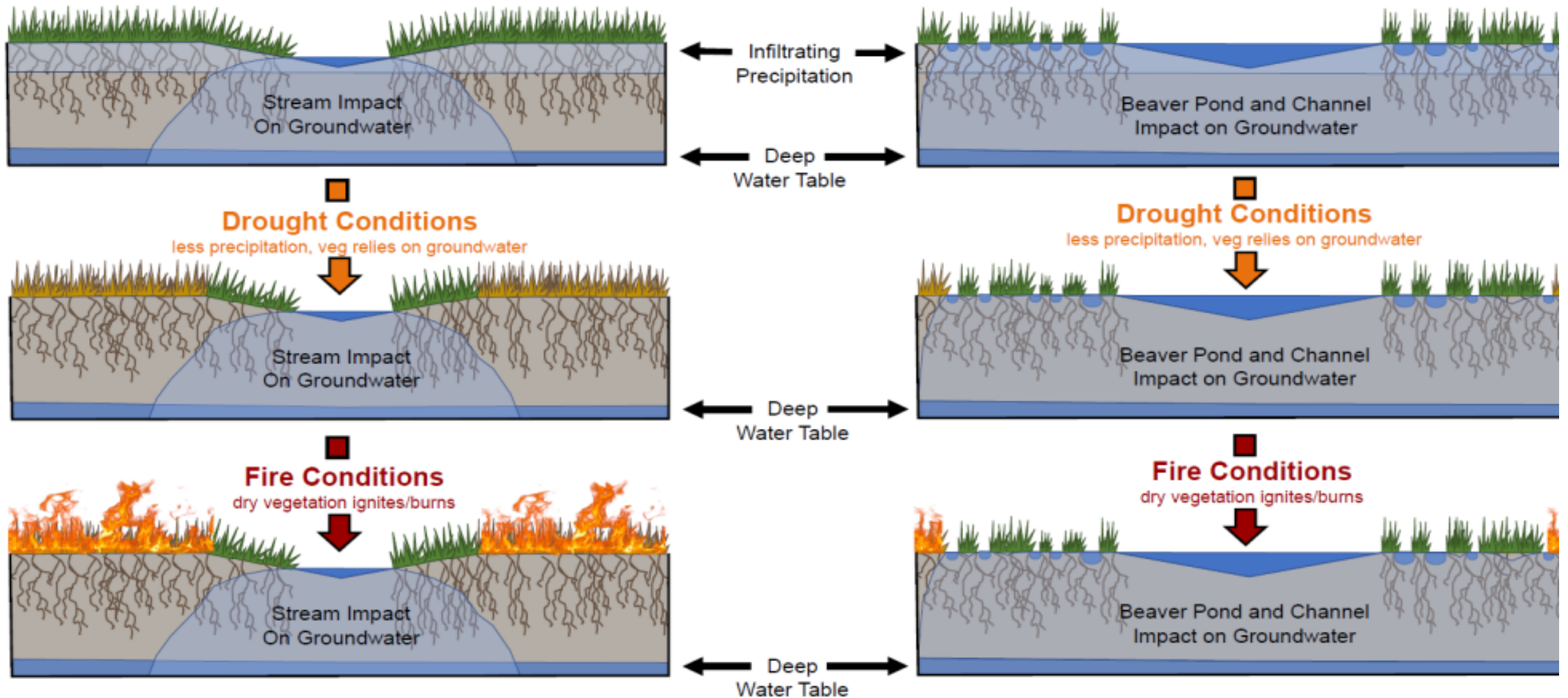


Figure from Fairfax, E. and Whittle, A. (2020), Smokey the Beaver: beaver-dammed riparian corridors stay green during wildfire throughout the western USA. *Ecol Appl*. Accepted Author Manuscript. doi:[10.1002/eap.2225](https://doi.org/10.1002/eap.2225)



Process-based Restoration Approach Grounded in Science

“Reconnecting waterways to their floodplains improves water quality and quantity, supports biodiversity and sensitive species conservation, increases flood, drought and fire resiliency, and bolsters carbon sequestration.”

– Jordan, C.E., & Fairfax, E. (2022). Beaver: The North American freshwater climate action plan. *WIREs Water*, e1592. <https://doi.org/10.1002/wat2.1592>



“Our results indicate that beaver damming plays a significant role in protecting riparian vegetation during wildfires, and that this is a consistently observable phenomenon across the landscape”

-Fairfax, E. and Whittle, A. (2020), Smokey the Beaver: beaver-dammed riparian corridors stay green during wildfire throughout the western USA. *Ecol Appl.* Accepted Author Manuscript. doi:[10.1002/eap.2225](https://doi.org/10.1002/eap.2225)





Current Condition of NM
headwater streams



Reduced riparian wetland, water storage, floodplain access...

San Antonio Creek on Valles Caldera National Preserve, Jemez Mountains



Upstream/Downstream
(not within exclosure/within)



Historic Condition: Rito Luterio, Jemez Mountains, Northern New Mexico



Shifting Baseline Syndrome

“The restoration of an ecosystem thus represents a challenge due to potential social barriers for carrying out those actions. Therefore, while historical information about ecosystems can be present, they can be difficult to recreate [42], mainly because of generational amnesia (e.g., [14]).”

. Wu, T.; Petriello, M.A.; Kim, Y.S. Shifting baseline syndrome as a barrier to ecological restoration in the American southwest. *Ecol. Restor.* 2011, 29, 213–215.



October 2020



November 2020



August 2021



September 2022



May 2020



November 2020



August 2021



September 2022

Intentions of intervention

- Increased riparian wetland width, groundwater availability for plants, regain floodplain access through sediment retention and water table elevation, and in the event of fire, debris containment and flood attenuation
- Decrease stand density adjacent to valley bottom to promote broader fire-break characteristics.





Quality AND Quantity

- Restoration projects are often failing to be undertaken on an appropriate scale
- Norman, Laura M., et al. "Natural infrastructure in dryland streams (NIDS) can establish regenerative wetland sinks that reverse desertification and strengthen climate resilience." *Science of the Total Environment* 849 (2022): 157738.





Structure Complex on Reach Scale





Water Doesn't Burn

- “Whereas fish seemed to have disappeared upstream of the Dixon Creek [beaver] dam site, the downstream water was crystal clear—and trout were thriving as though the fire had never happened. The beavers had effectively built something like a water treatment plant that staved off fire-related contamination.”
- Isobel Whitcomb, *Scientific American*, February 7, 2022

Sharp's Fire, Idaho

- Photo Credit Joe Wheaton



STRUCTURALLY-FORCED RESILIENCE TO FIRE

Riparian areas burnt to ground across entire valley bottom in most the watershed

EXCEPT, where beaver dam complexes kept the valley bottoms wet, the riparian areas did not burn!

Example of **structurally-forced resilience** to fire where beaver dam activity kept parts of the riverscape from burning, providing critical wildlife and livestock refugia during the fire, and assisting in post-fire recovery. Example from Baugh Creek, Idaho.

“Perhaps instead of relying solely on human engineering and management to create and maintain fire-resistant land-scape patches, we could benefit from beaver’s ecosystem engineering to achieve the same goals at a lower cost.”

– Fairfax and Whittle, 2020





Post-fire Restoration

- Retain sediment, prevent/heal incisions, re-establish vegetation, and rebuild access to floodplains if possible, at all



Arrest Sediment and Retain High-Value Soils if Possible



An LTPBR Approach to Low-Order
Tributaries in a Post-fire Scenario

Secured Log Structures

- Retain sediment
- Reduce downstream debris transport
- Can facilitate aggradation of historically incised channels









Pre-fire Riverscape Restoration and Post- fire Remediation

- Site Selection
- Scale is an issue
- Utilize Mimicry of Natural Processes
- And Get Beaver Back!