

Where in the
heck did all the
Cottonwoods go?
I know we
planted them...

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Benefits of Beaver

- ▶ Keystone species – “Ecosystem Engineers”
- ▶ Floodplain roughness and complexity
- ▶ Wetland creation
 - ▶ Groundwater recharge, release of cool water during low flow months
- ▶ Slowing and spreading water with dams
 - ▶ Flood reduction downstream, sediment deposition, filtration
- ▶ Storing water in ponds
 - ▶ Drought resilience, habitat for fish/waterfowl



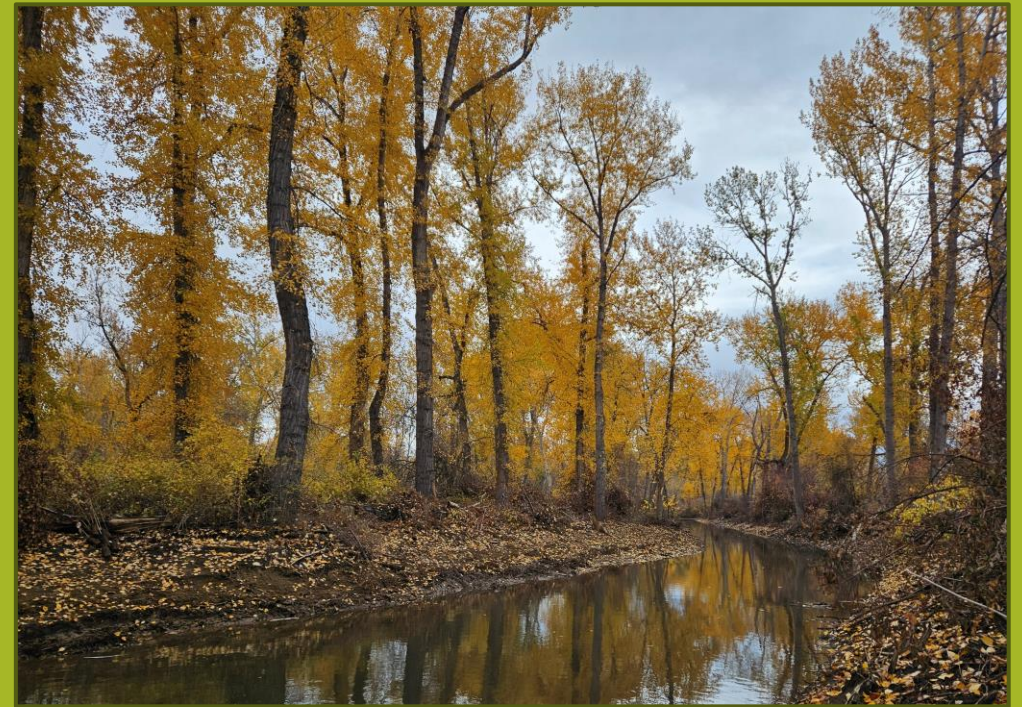
Negative Effects of Beaver on Restoration

- ▶ Difficult to establish native riparian species on rivers and streams with beaver presence
 - ▶ Preferred food: Cottonwood, aspen, birch, alder, willow¹
- ▶ Inhibit the development of sustainable populations of cottonwoods and other riparian species
 - ▶ Long term goals for riparian restoration projects:
 - ▶ Developing diverse and sustainable riparian habitat
 - ▶ Habitat for native waterfowl, other animals
 - ▶ Improving interactions/functions of riparian zone
 - ▶ **Providing shade** to cool rivers/streams for ESA listed anadromous fish



Negative Effects of Beaver on Restoration

- ▶ **Shade is extremely important for cool water in rivers:** temperatures above 68°F produce harmful effects for ESA listed salmonids/other anadromous fish (increased metabolism, increased disease susceptibility, decreased egg viability, suffocation, death)¹
- ▶ Cottonwoods provide largest amount of shade out of all PNW native riparian species, also most negatively affected by beaver damage
 - ▶ Newly planted cottonwoods easily killed by beaver damage; typically need 3-5 years of establishment to have ability to resprout after beaver damage/other browse²
 - ▶ Alder also killed by beaver if damaged too early after planting
 - ▶ Willow species readily resprout following beaver damage, become multi-stemmed or “bushier” – good for floodplain roughness



Sources:

¹<https://www.wildsalmon.org/projects/hot-water-report/hwr-2025-issue-1.html#:~:text=Impact%20of%20warm%20water%20on,and/or%20exacerbate%20migration%20blockages>

²https://www.riversedgewest.org/sites/default/files/2022-06/How_to_Plant_Willows_Cottonwoods.pdf

Importance of Protecting Cottonwoods

- ▶ Need to protect plants until project establishes the variety & age class needed to create sustainable population (ability to sucker/produce seed) before being damaged by beaver
 - ▶ Ability to resprout provides perpetual availability of forage and building materials for beaver (as well as habitat/forage for other wildlife); Production of seed provides source materials for future plant populations
- ▶ Large trees (cottonwood) change landscape
 - ▶ Nesting for native waterfowl/other bird species
 - ▶ Animal habitat
 - ▶ Reprieve from sun for animals/other plant species
 - ▶ Development of understory plant communities
 - ▶ Large woody debris input for floodplain roughness/complexity



Techniques for Protecting Cottonwoods

- ▶ Many options; some more effective than others
 - ▶ Vexar browse protectors, solid wall tubes, repellent sprays, painting bark (low cost, short term, low efficacy)
 - ▶ Wire cages, enclosures (higher cost, longer term, high efficacy)
 - ▶ Planting strategies: Willows closest to water, then cottonwoods further away from water (but beaver will travel)
- ▶ Wire cages: Built from welded wire, bamboo stakes
- ▶ Enclosures: Built from welded wire, t-posts, bamboo stakes
 - ▶ Height important consideration for both cages and enclosures (5 foot vs. <5 foot)
 - ▶ Can be used to protect other plants from beaver as well as cottonwoods



Wire Cages

- ▶ Useful for individual plants
- ▶ Useful in areas with varying topography or high amount of floodplain wood/debris
- ▶ Larger cages more effective long term
 - ▶ Larger diameter cages allow for larger plant growth, no need to install new cages as plants grow – will eventually need removal to prevent constriction
 - ▶ Taller height protects taller plants
 - ▶ Use of welded wire provides long-term stability and protection; Beaver can chew through plastic



Enclosures

- ▶ Useful for protecting multiple plants
- ▶ Lower cost per plant protected than cages
- ▶ Useful in large areas with relatively flat ground and little debris
 - ▶ Use staples to secure enclosures to the ground to prevent digging in softer substrates
 - ▶ Beaver can chew through plastic deer fencing; Welded wire provides protection from beaver



Field Example: Middle Fork John Day River

- ▶ 2020 – Current; Confederated Tribes of the Warm Springs Reservation of Oregon
- ▶ Heavy beaver damage inside 8-foot-tall project area enclosures
- ▶ 31,776 Cottonwoods installed to date; very few without cages/smaller enclosures remain – mostly bushy willows
- ▶ Began using cages/smaller enclosures in 2023, after observing high mortality on cottonwoods but no trace of dead sticks



Field Example: Middle Fork John Day River

- ▶ Heavy beaver predation, some sites only days after planting
 - ▶ 2023, right – seen one week after planting, directly adjacent to plants in smaller enclosures – bottom right
 - ▶ 2025, bottom center and bottom left – overnight beaver damage on newly installed plants, only plants in cages and smaller enclosures remain undamaged



Field Example: Middle Fork John Day River

- ▶ In summer 2025, we observed:
 - ▶ ~75% survival on plants installed in fall 2023 in smaller enclosures
 - ▶ ~80% on plants installed between spring 2023 & fall 2024 in cages
 - ▶ ~90% survival on plants installed in fall 2024 in smaller enclosures



Field Example: Amon Creek

- ▶ 2010 – 2011; City of Richland
- ▶ Riparian plants installed late 2010/early 2011
- ▶ Heavy beaver activity, 6000 linear feet of welded wire fencing installed for plant protection



Field Example: Amon Creek

- ▶ Beaver destroyed enclosures and cages in 2014, damaged numerous cottonwoods; climbed fencing to access plants
- ▶ Beaver nicknamed Einstein due to ability to gain access to protected plants



Photos courtesy of Tapteal Greenway, Richland WA (2014)



Field Example: Amon Creek

- ▶ Beaver damage in 2014 prompted Tapteal Greenway to repair/replace fencing around surviving cottonwoods
- ▶ Repair/replacement of fencing worked until Amon Creek migrated in 2020 and began flowing around protected cottonwoods
- ▶ Soil erosion around the base of plants undercut fencing and allowed beaver to dig/burrow under fences and begin damaging trees again



Photo courtesy of Tapteal Greenway, Richland WA (2020)



Field Example: Amon Creek

- ▶ 252 cottonwoods installed across 0.5-mile-long restoration area in 2010/2011
 - ▶ 10 alive as of 2/4/2026 (~4% of what was originally planted, even with beaver protection)
 - ▶ Beaver still active, fresh damage seen 2/4/2026



Field Example: Pine Creek Conservation Area

- ▶ 2002 – 2004; Confederated Tribes of the Warm Springs Reservation of Oregon
- ▶ 5-mile long CREP Project on Pine Creek Conservation Area
 - ▶ Highly incised channel
- ▶ Cottonwoods protected with solid wall tubes



Field Example: Pine Creek Conservation Area

- ▶ 2000 total cottonwood cuttings installed in 2002 along 5 miles of Pine Creek
 - ▶ Heavy beaver predation; Only ~100 cottonwoods remain within entire 5-mile stretch
- ▶ Riparian ecosystem and function has improved, but with very few large trees for shade – mostly coyote willow



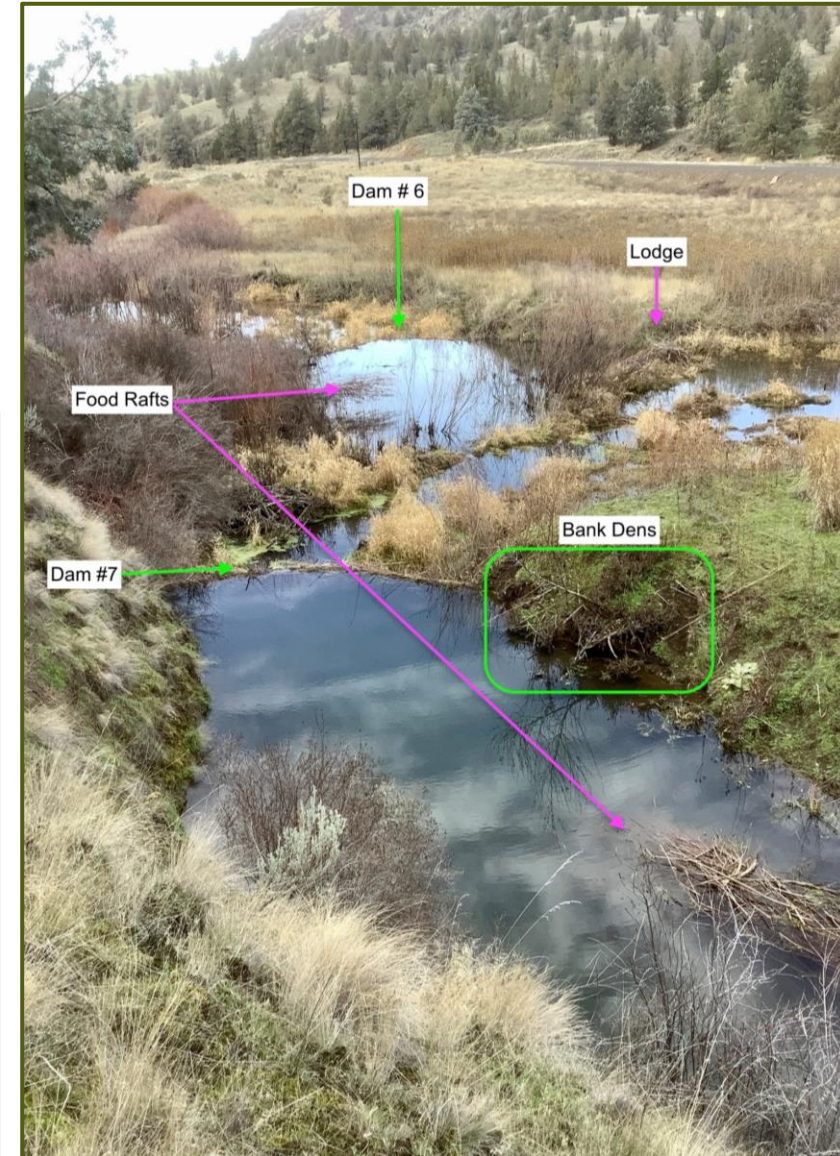
Photos courtesy of Kevin Pullen, CTWS



Field Example: Pine Creek Conservation Area

- ▶ CTWS has conducted beaver surveys along 9-mile stretch of Pine Creek over past 3 years, beaver expanding up and down the creek
 - ▶ 2023: 60-80 active dams with 9 active complexes
 - ▶ 2025: 165 dams total, 117 active dams and 11 active complexes

Photos courtesy of Kevin Pullen, CTWS



“The hope is that one day that cottonwoods and beaver will reach equilibrium and be self sustaining.”

- Kevin Pullen

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