Cottonwood Regeneration

An Interview With Katrina Strathmann, Project Manager & Plant Ecologist, Mid-Columbia Fisheries Enhancement Group

This interview between BEF's Hannah Buehler and Katrina Strathmann originally ran in the April 2022 Floodplains by Design newsletter.

Can you explain the relationship between black cottonwood regeneration, hydrological flow patterns and salmon populations?

Cottonwood stand creation — ie. cottonwood forest regeneration — is linked directly to the hydrologic flow regime of a river. Several elements of the flow regime are critical: a flood flow with adequate power to create depositional areas; a spring freshet that is on its recessional limb during the time of cottonwood seed release, of adequate volume to wet up the depositional areas (seedling recruitment sites); and a flow recession rate that does not exceed the root growth rate of the cottonwood seedlings. Of course, seedlings that establish will be the ones that are not scoured out by future flood events in the first 1-2 years of life. Researchers **Jeff Braatne** and **John Stella** have elegant ways of explaining this complex flow-recruitment relationship. Without these factors coming together — the timing and shape of flow with the timing of seed release — new forest stands are not created and our current forests will age out.

One of the fascinating things about cottonwood regeneration and flow is that mature trees play a key role in creating the depositional areas that are the very sites where new seedlings are generated.

In terms of benefits for salmon, in our lowland, arid floodplains where cottonwood are the primary source of large wood, cottonwood forests play an irreplaceable role. Large wood in the river creates scouring, creating pools and channel complexity that allows for temperature stratification — which is important because salmonids require cool water. Large trees on the floodplain provide shade that keeps water temperatures low. Large wood in the river creates hiding places from predators, and also refugia from high velocities where fish swimming upstream can rest. Salmon also require clean, clear water, and the extensive roots of cottonwood and other woody riparian shrubs and trees slow natural bank erosion, and also create roughness in flood flows, slowing water and allowing sediments to drop out of the water column. Cottonwood leaves and debris also support the aquatic food web, providing a food supply for aquatic insects, which are a primary source of food for salmon.

Katrina Strathmann

Project Manager & Plant Ecologist, Mid-Columbia Fisheries Enhancement Group

Katrina Strathmann is a restoration ecologist with Mid-Columbia Fisheries Enhancement Group. Her current passion is riparian forest restoration and using new techniques that improve establishment or are effective over large floodplain areas. Katrina brings to her work over 23 years of experience managing ecological restoration projects in a wide variety of habitats, as well as landscape-scale inventories, vegetation monitoring, invasive plant and rare plant management, and native plant propagation. Katrina worked previously on ecological restoration for the Yakama Nation and the National Park Service. She received her M.S. in Biology from San Francisco State University, studying local and landscape influences on butterfly assemblages in mountain meadows of the Sierra Nevada mountains.

What are the key barriers to black cottonwood regeneration?

Cottonwood reproduces both sexually by seed and by vegetative reproduction or what I call clonal reproduction. As a sexual reproducer, the female catkins flower is fertilized, the fruit ripens, and then the fruits burst open releasing seeds that we know as cottonwood fluff. The seed is viable for 24 to 48 hours once it gets wet, so once it hits moist soil, it needs to be in the right spot.

In terms of clonal reproduction, cottonwood can resprout from stems or or roots; this is how existing stands are maintained, but clonal regeneration does not create new forest stands.

In the Kittitas reach of the Yakima River, the human-caused factors constraining cottonwood regeneration are channel confinement (from human development such as agriculture, residential use and infrastructure) and regulated flows on the river. If there is a levee preventing the river from being able to meander, there may be an opportunity if the agriculturist is not interested in farming anymore to look at opening up that floodplain and allowing the river to move and create those depositional areas.

The Yakima River is regulated, meaning that it has multiple dams and flows are released for agriculture, often at times and volumes that are quite different from an undammed flow regime. The change in flow regime also made it hard for seedlings to establish. On the Kittitas reach, many seedlings are underwater during the summer growing season, as the summer base flow increases to meet irrigation needs instead of dropping as snowmelt drops off. The Yakama Nation and Mid-Columbia Fisheries are identifying data gaps and modeling needed to be able to propose an environmental flow that could support more cottonwood regeneration, where the timing of flow releases are slightly tweaked. Because the Yakima Basin also supports a multi-billion dollar agricultural industry, any water management will need to work around the periphery of what works for agriculture — but we believe there are opportunities.

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How do cottonwood regeneration plantings look different from other riparian plantings?

Most of our forest restoration work currently focuses on creating shade, reducing erosion and creating roughness for surface flows. We have a lot of tools available to us — it is not all conventional planting with shovels. At the simplest level, if the problem with a cottonwood stand is herbivory and there's the potential for clonal regeneration, just reducing herbivory through fencing may allow a stand to rebound. In terms of planting, Mid-Columbia Fisheries has been using what we call a "deep-planting" technique, using an augur, a hydraulic ram or trenches to plant 5 ft tall saplings so that the root masses are placed up to 4 ft deep and in moist soil — so that irrigation isn't even necessary.

We are also starting to work on a new technique we learned about from Chris Hoag, called an "irrigated seed bed" where you use farming methods to create a recruitment site downwind of an existing stand of female cottonwoods. The seed bed needs to be within 2 m of groundwater — the maximum depth for cottonwood roots. Farming equipment is used to work up a seed bed that looks like it's ready for a corn crop, then wetting it up at seed release using irrigation. With Kittitas County Public Works, we are developing a pilot seedbed project to see how this technique works on a 17-acre parcel. We hope this is a way of creating new cottonwood forest stands at a far lower cost than hiring crews with shovels and water trucks.

You can also do this type of assisted stand creation through recontouring when earth-moving restoration activities create an open floodplain at the right elevation relative to groundwater. Mid-Columbia Fisheries and partners accidentally created these conditions on a recontoured floodplain at a restoration site on Reecer Creek, which flooded in its very first year at the time of cottonwood seed release. Now there is a 5 acre stand of Mackenzie willow and black cottonwood that was created without planting and irrigating. This type of reconouring could be done to intentionally create conditions for stand regeneration in restoration sites with the right configuration and elevations.

Much of Mid-Columbia Fisheries work on cottonwood forests has been supported by the Salmon Recovery Funding Board, which provided a grant that allowed us to complete an assessment of the condition and regeneration status of cottonwood forests along 30 miles of the Yakima River. The Department of Ecology's clean water grant program also funded outreach to landowners and identification of riparian forest restoration projects stemming from the SRFB assessment. This support has been critical for understanding the scope of the problem with forests and looking for solutions.

Have you observed the timing of seed dispersal in cottonwoods changing? What impact is that having on germination and establishment?

That's one thing we're really interested in learning more about. Mid-Columbia Fisheries is working with the Yakama Nation to start identifying the timing of seed release as related to air temperatures and degree-days. Then this data can be used to model seed release timing under different climate change scenarios. One fear is that peak seed release and the spring freshet flows may become decoupled.

How do large-scale restoration of river and floodplain processes help with the regeneration of cottonwood?

There is an incredible opportunity there. In fact, some of the restoration areas that we're proposing as potential opportunities for cottonwood regeneration are potential Floodplains by Design project sites. Largely, the process-based restoration projects support natural cottonwood regeneration. Levee setbacks are essentially removing or moving constraints so that the river has more room to move. So coupling that with modifying the managed flow, the regulated flow of the river, are the two things that we think could aid in the natural regeneration of cottonwood. That's where that's where this whole project is driving, is looking for where those opportunities exist in this 30-mile reach we're working to regenerate. As we work here, and down in the Wapato reach, we can look at the other major floodplains on the Yakima River.

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Cottonwoods Are Ecologically Valuable For Many Reasons:

- Preferred nesting tree for bald eagles
- Provide nesting for many birds, including woodpeckers, owls, herons and song birds
- Protect bees with antimicrobial resin
- Facilitate forest succession in floodplains
- Reduce sediment load and erosion in rivers
- Improve water quality
- Shade water and prevent water temperature from warming
- Enhance fish habitat
- Sequester carbon from the atmosphere
- Filter pollutants out of the air

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Hydraulic ram mounted on an excavator installing 5-10 ft tall riparian plants on an 8 ft terrace bank along the upper Yakima River. Photo Credit: Katrina Strathmann