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Dam removal and freshwater mussels: effective restoration and prioritization through case studies

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A close-up photograph of a person's hands holding three freshwater mussels. The mussels are dark brown with yellowish-green highlights on their shells. The person is wearing a light-colored long-sleeved shirt. The background is a metal tray with other mussels scattered on it.

Dam Removal and Freshwater Mussels: a guide for effective restoration and prioritization



American Rivers
Rivers Connect Us

Erin Singer McCombs

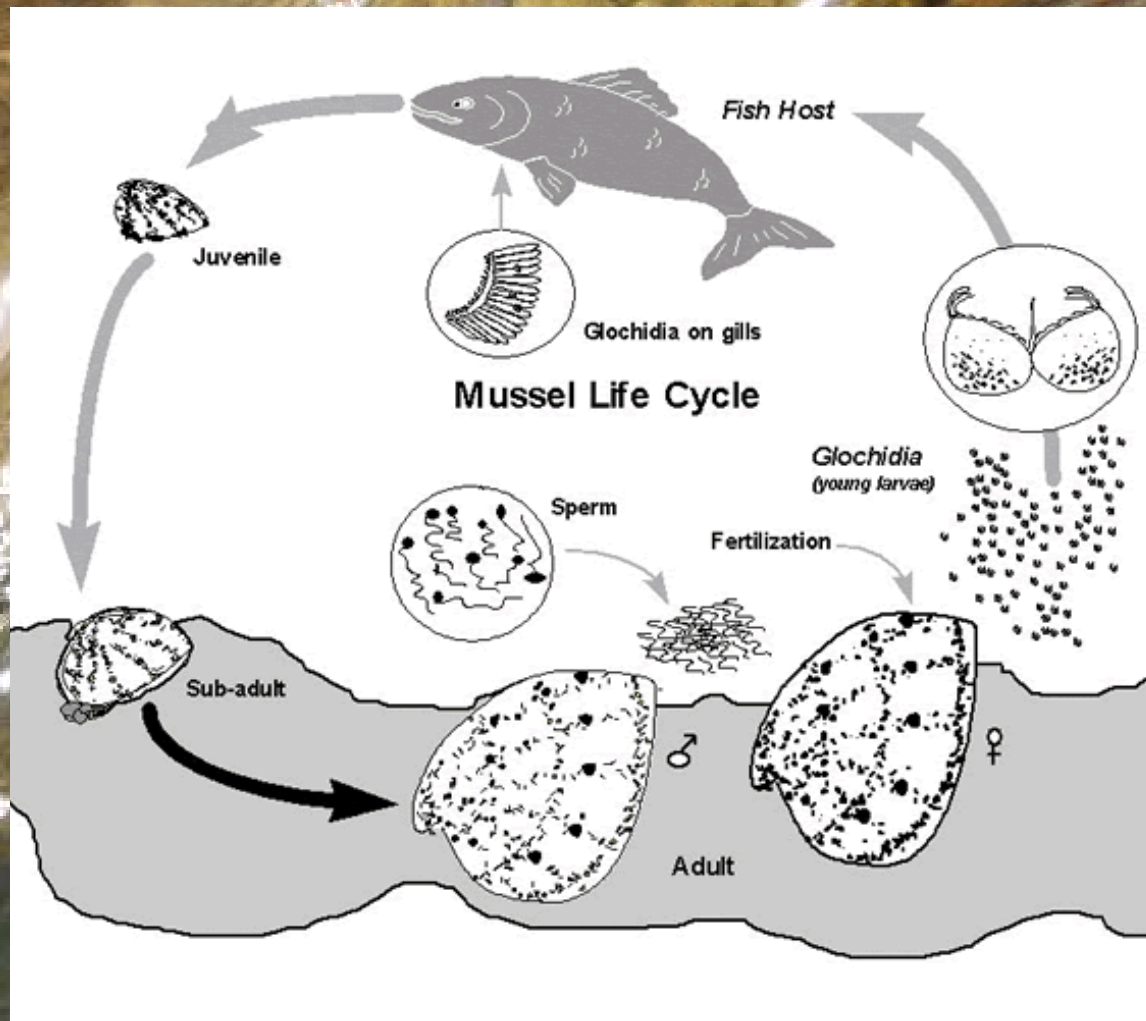
Associate Director of Southeast Conservation

Fish Passage Conference 2014 | Madison, WI

Presentation Outline

- Freshwater Mussel life history and ecology
- Dams: big and small, are they the same?
- Dam removal as restoration
- Dam removal freshwater mussel case studies
- Guidelines for effective restoration

Freshwater Mussel Life Cycle



Freshwater Mussel Life Cycle



State of the Unionids

- ~300 species in the US
- 70% extinct or imperiled
- 23% Federally listed (endangered/threatened)
- Long lived with late reproductive maturity
- Life histories and habitat requirements not understood for many species
- Important ecological role

Ecology and life history

- Filter water column
- Mix sediments
- Stabilize streambeds
- Food source for wildlife
- Inhabit range of habitats
- Long life span (30-200 years)
- Long and short term brooders



Distribution and Habitat

- Distribution largely determined by...
 - stream size
 - surface geology
 - drainage area
 - fish diversity
- Reservoirs are inhospitable to most freshwater mussel species due to...
 - sedimentation
 - low DO
 - loss of fish hosts



MC Barnhart



MC Barnhart

Dams

- Large vs. Small dams
- Run of the river vs. large hydropower dam
- Best candidates for removal?



Dam removal as river restoration

Restores...

- flow characteristics
- temperature regime (and DO)
- sediment dynamics
- connectivity
- fish passage
- vegetative cover (long-term)
- bed features & habitat (long-term)

Ensure long-term gains outweigh short term impacts

Temporary/Short Term

- Increased turbidity during construction
- Sedimentation, impacts on downstream habitat
- Impoundment habitat and bank adjustment

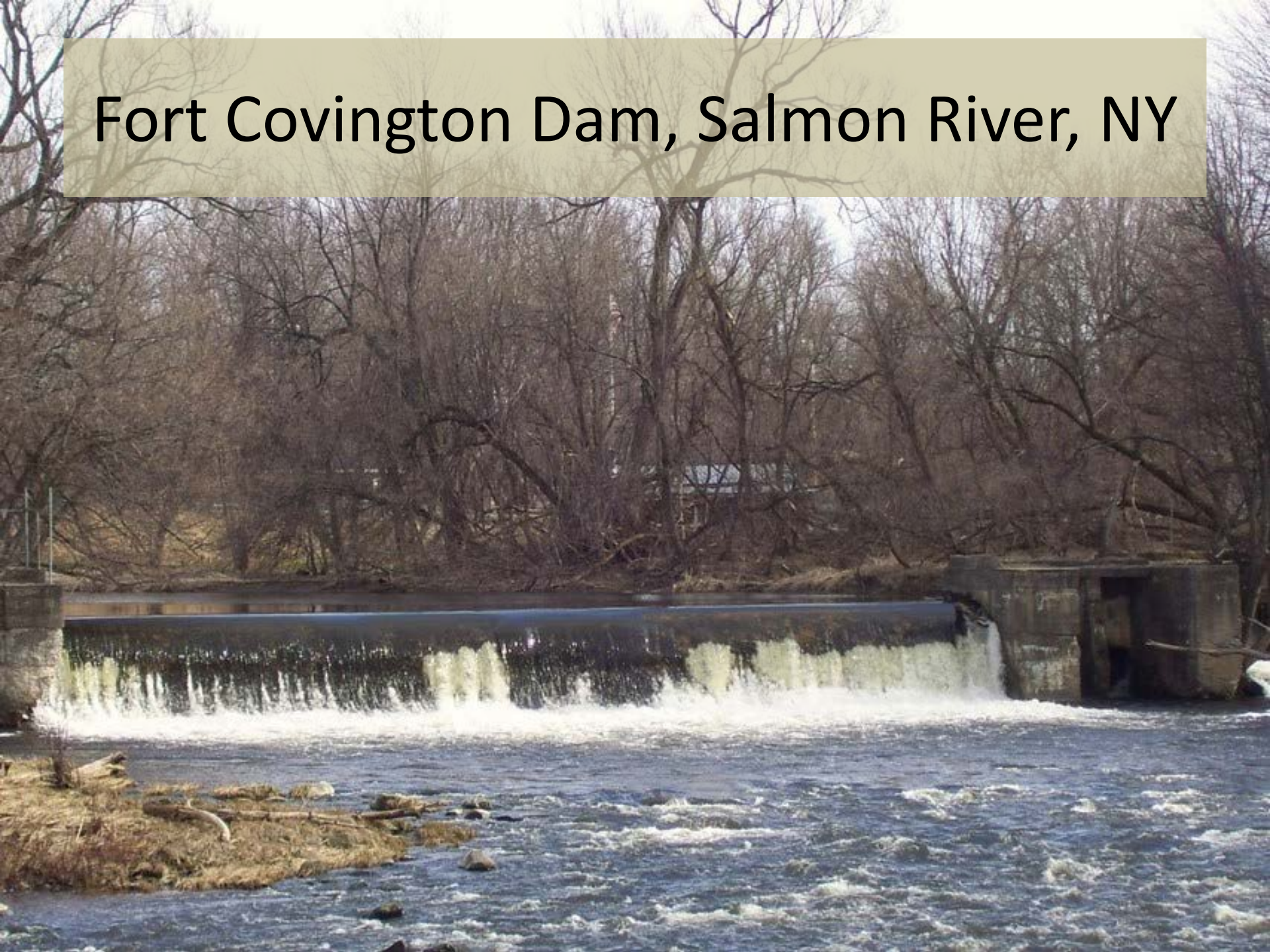
Avoid or Minimize

- Contaminant transport
- T/E species impacts (especially mussels)
- Invasive species colonization



Case Studies

Fort Covington Dam, Salmon River, NY



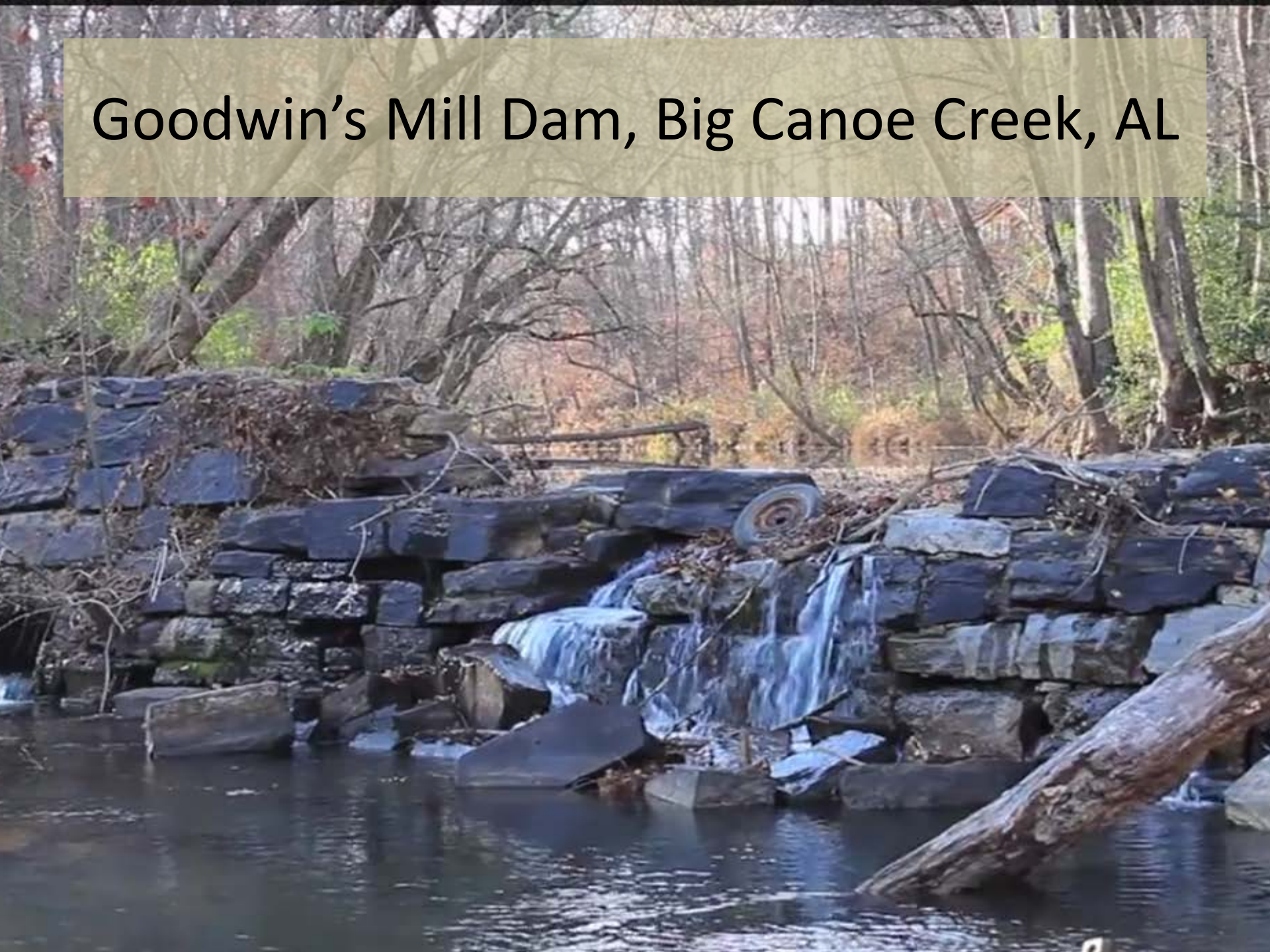
Fort Covington Dam, Salmon River, NY

Unionid Mussel Mortality from Habitat Loss in the Salmon River, New York, Following Dam Removal. 2011. Cooper, JE. In: advances in Environmental Research. Vol. 14. p 351-364.

- In 2009, the 3.2 acre impoundment was drained in 25 hours lowering the water at the dam 3.3 m.
- The rapid dewatering stranded and killed 3200 freshwater mussels.

Immediately after removal

Goodwin's Mill Dam, Big Canoe Creek, AL

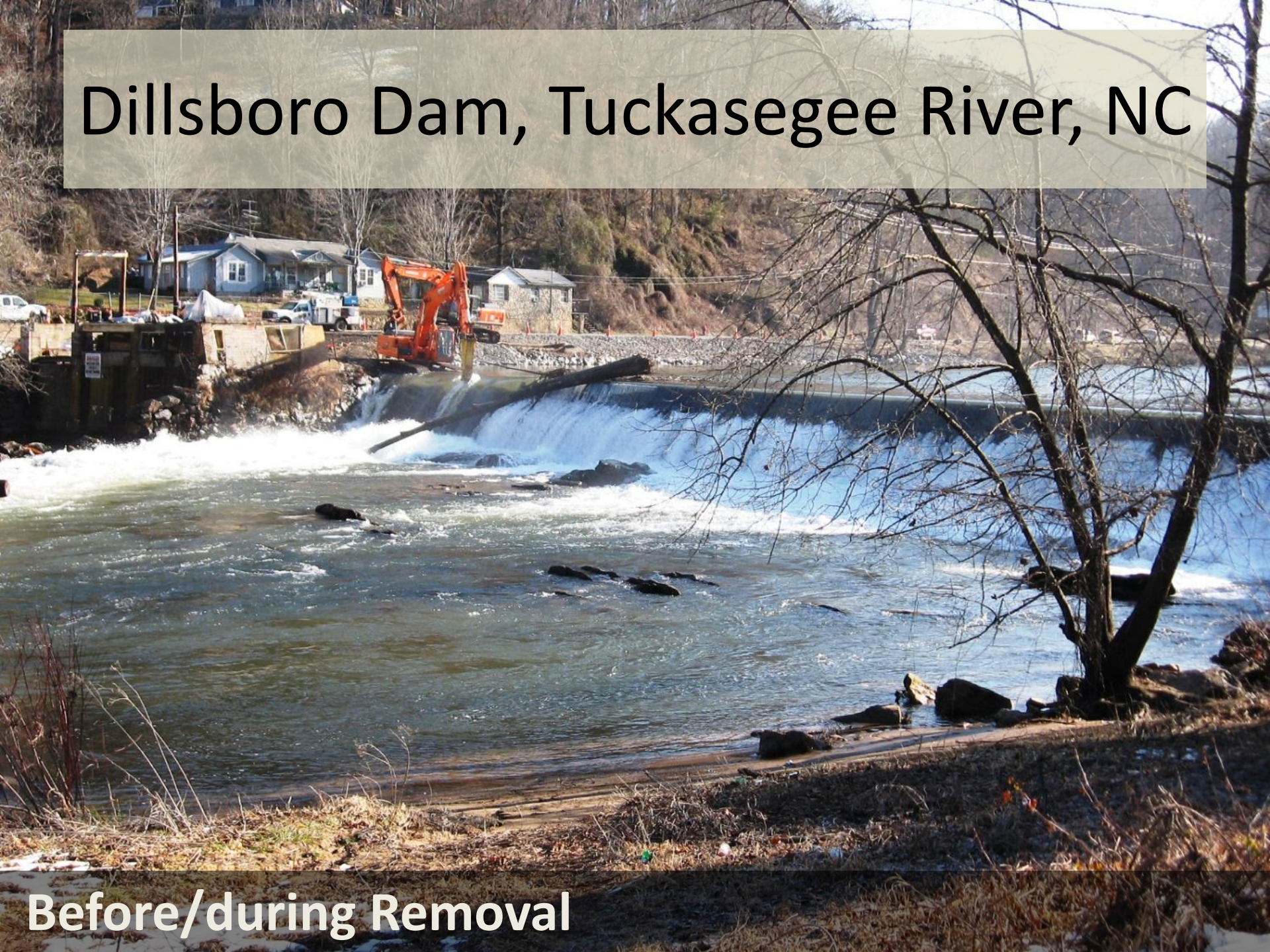


Goodwin's Mill Dam, Big Canoe Creek, AL

- Dam built in early 1900s
- Disparity in fish up and downstream of dam
- Breached
- Critical habitat for freshwater mussels
- Southern pocketbook (*Pleurobema decisum*), triangular kidneyshell (*Ptychobranthus greenii*), and one endemic mussel, the Canoe Creek Clubshell (*Pleurobema athearni*).

After removal

Dillsboro Dam, Tuckasegee River, NC



Before/during Removal

Dillsboro Dam, Tuckasegee River, NC

- Dam removed in 2009 as a part of Duke settlement.
- Federally listed Appalachian elktoe (*Alasmidonta raveneliana*) present.
- 1,137 mussels were relocated before dam removal.
- In 2010 intensive monitoring occurred in May and October.
- Confirmed mortality to date is 7 (<1%) at the relocation site.
- Appalachian elktoe now occupy the 0.9-mile formerly impounded reach, reconnecting the Tuckasegee River population.

2 months after removal

Carbonton Dam, Deep River, NC



Carbonton Dam, Deep River, NC

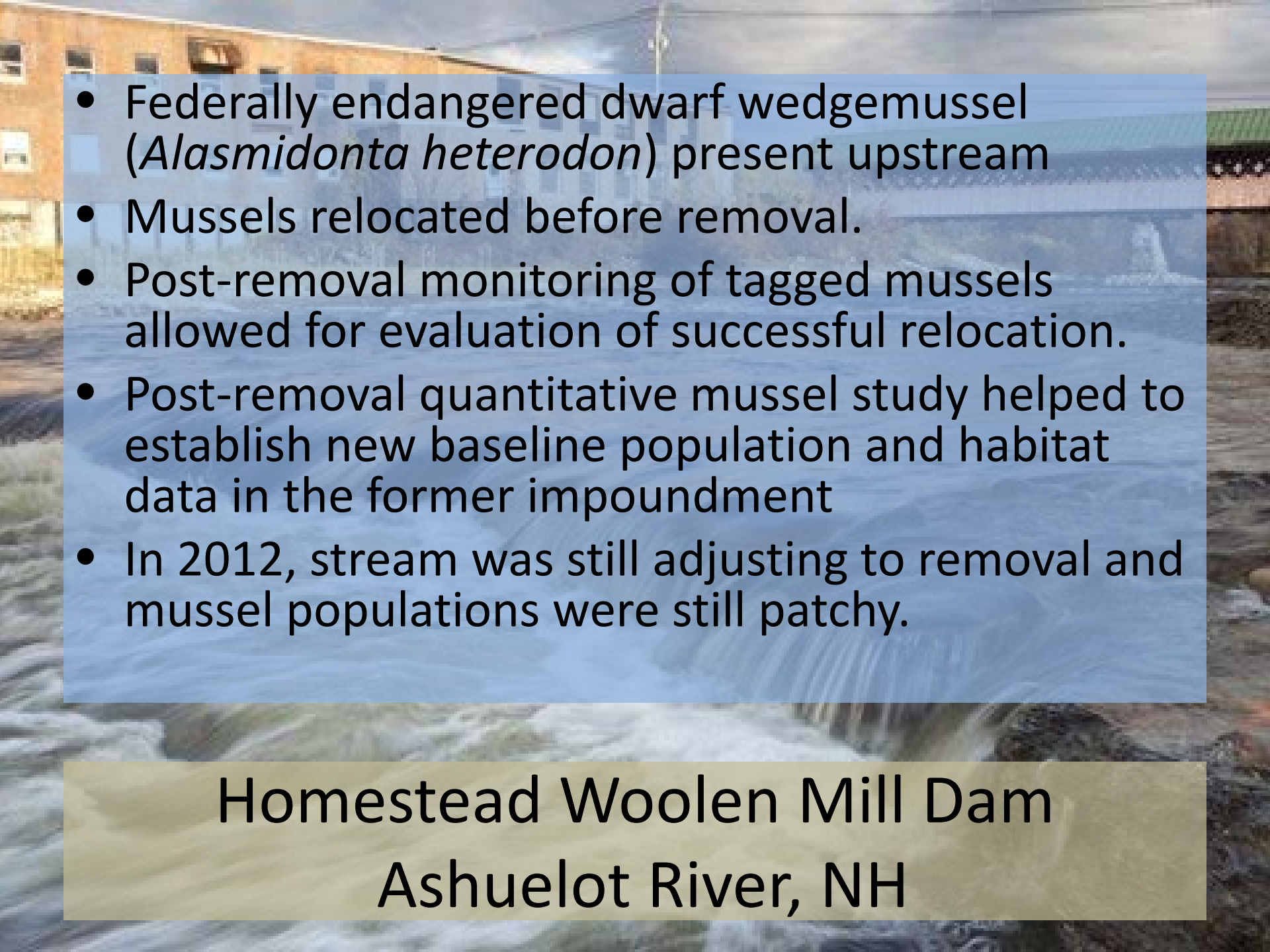
Short-term Effects of a Small Dam Removal on a Freshwater Mussel Assemblage. 2013. Heise, RJ., Cope, WG., Kwak, TJ., Eads, CB. Walkerana, 16(1): Pages 41-52.

- 4 year study post removal of Carbonton Dam
- No significant differences found in mussel density, richness, substrate composition, or mortality compared to control reach.
- Adverse short-term impacts of dam removal on freshwater mussels can be minimized with appropriate planning, timing, and removal techniques.

3 Years After Removal

Homestead Woolen Mill Dam Ashuelot River, NH



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- Federally endangered dwarf wedgemussel (*Alasmidonta heterodon*) present upstream
 - Mussels relocated before removal.
 - Post-removal monitoring of tagged mussels allowed for evaluation of successful relocation.
 - Post-removal quantitative mussel study helped to establish new baseline population and habitat data in the former impoundment
 - In 2012, stream was still adjusting to removal and mussel populations were still patchy.

Homestead Woolen Mill Dam Ashuelot River, NH

Guidelines for effective restoration with mussels present

- Prioritize breached dams with high scouring
- Identify mussels in your project area and determine distribution and life history
- Consider timing of project
- Manage sediment appropriately
 - Excavation
 - Tiered draw down
- Manage flow velocities
- Relocate mussels in heavily impacted areas
- Monitor populations pre- and post- removal
- Partner with academics



Questions?