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

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



**American Rivers**  
*Rivers Connect Us*

**Erin Singer McCombs**

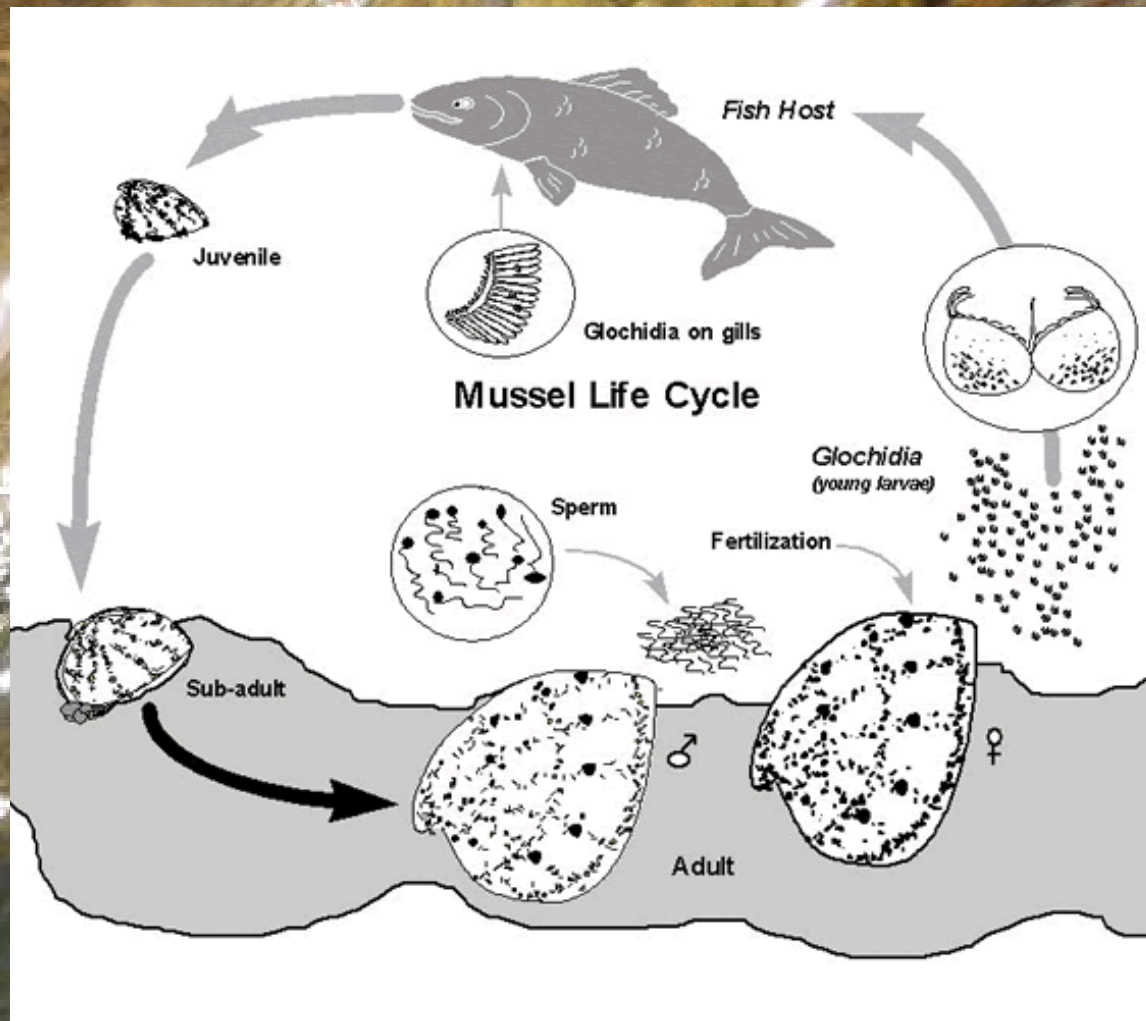
Associate Director of Southeast Conservation

*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

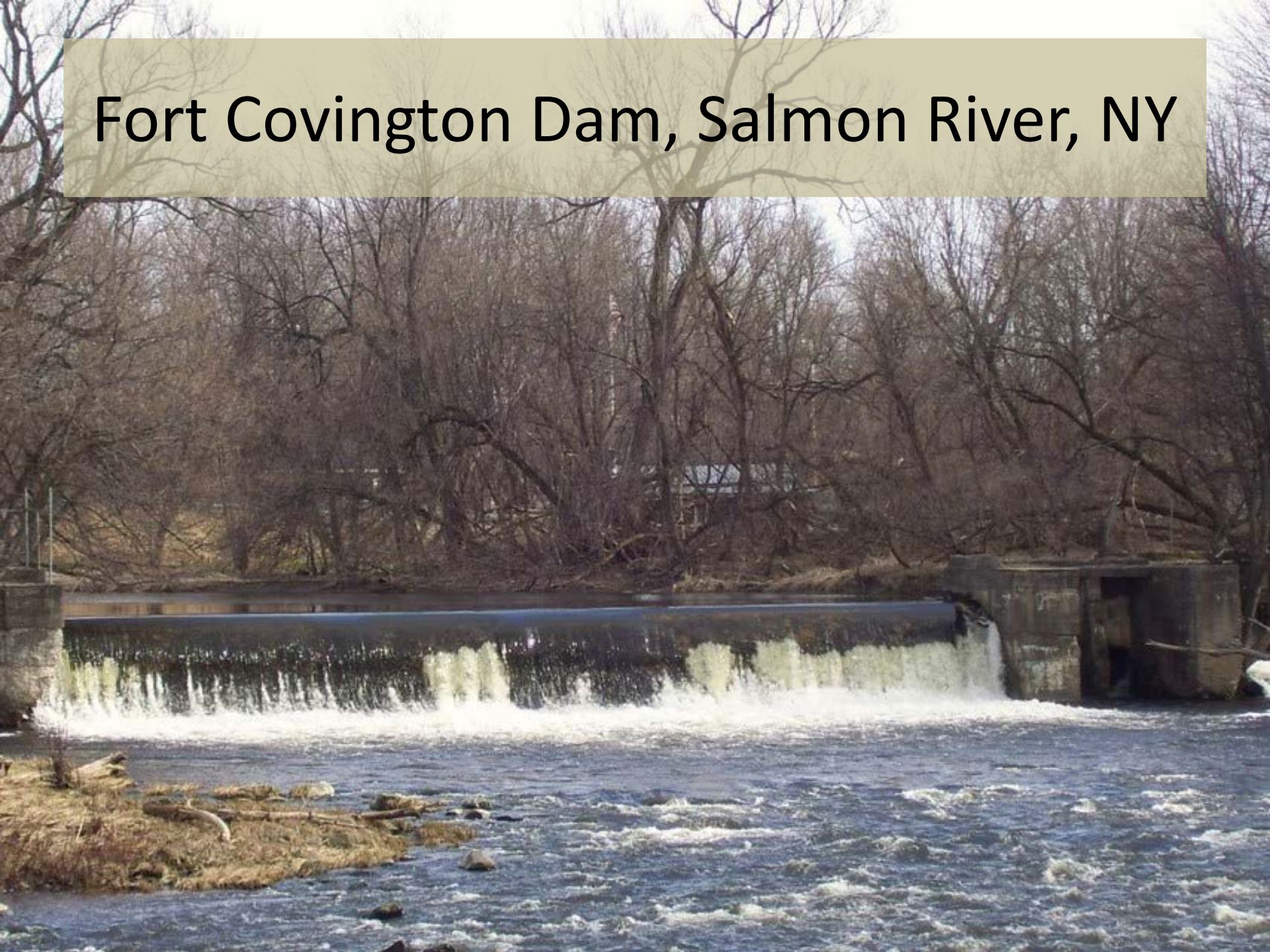
## Avoid or Minimize

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

A close-up photograph of a turtle's head and shell in a stream. The turtle's head is partially submerged, with its eyes visible. The water is splashing and creating many bubbles. The background is a blurred green forest under a blue sky with white clouds. A semi-transparent white rectangular box is overlaid on the center of the image, containing the text "Case Studies".

# Case Studies

# Fort Covington Dam, Salmon River, NY



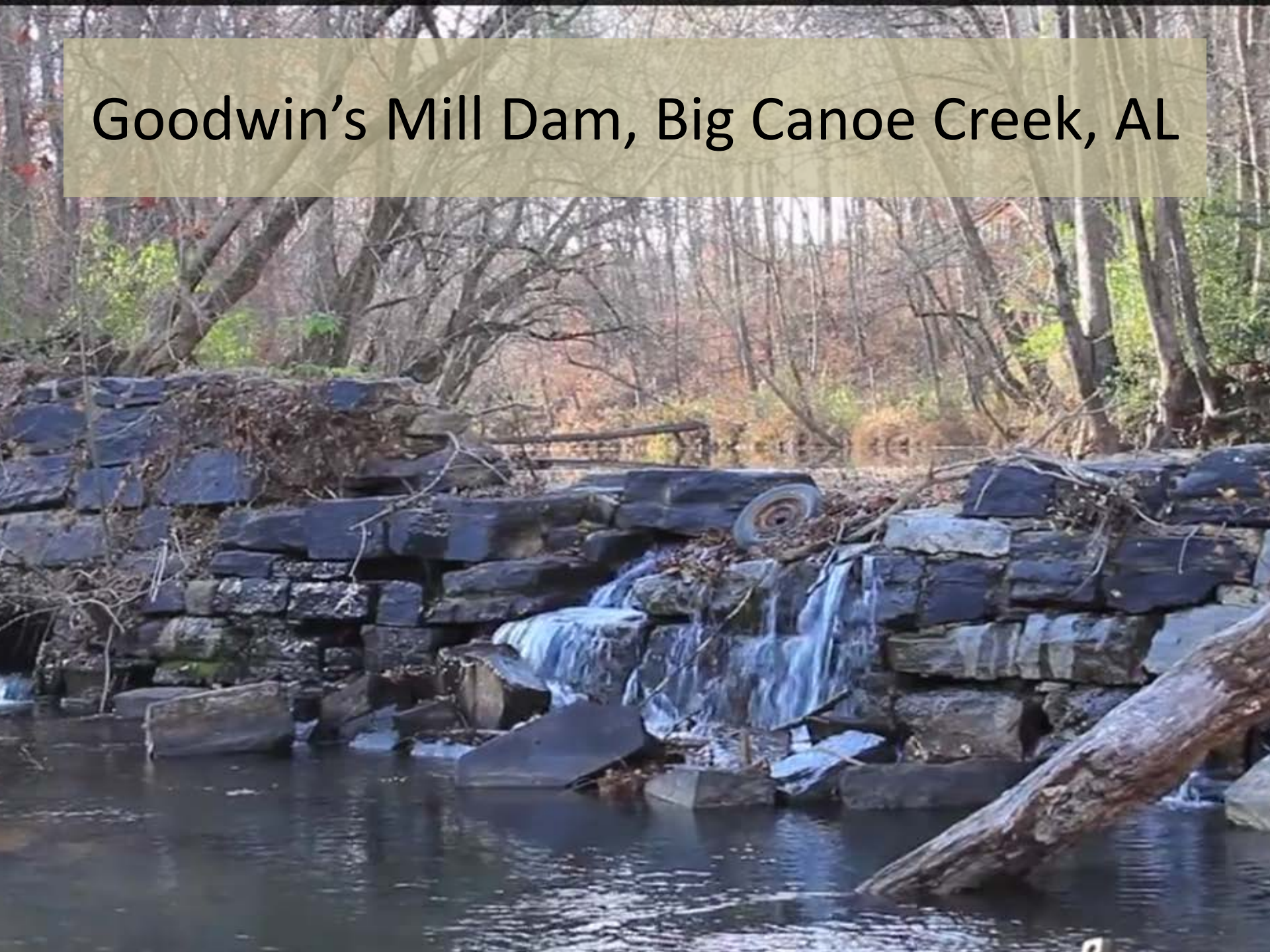
# Fort Covington Dam, Salmon River, NY

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

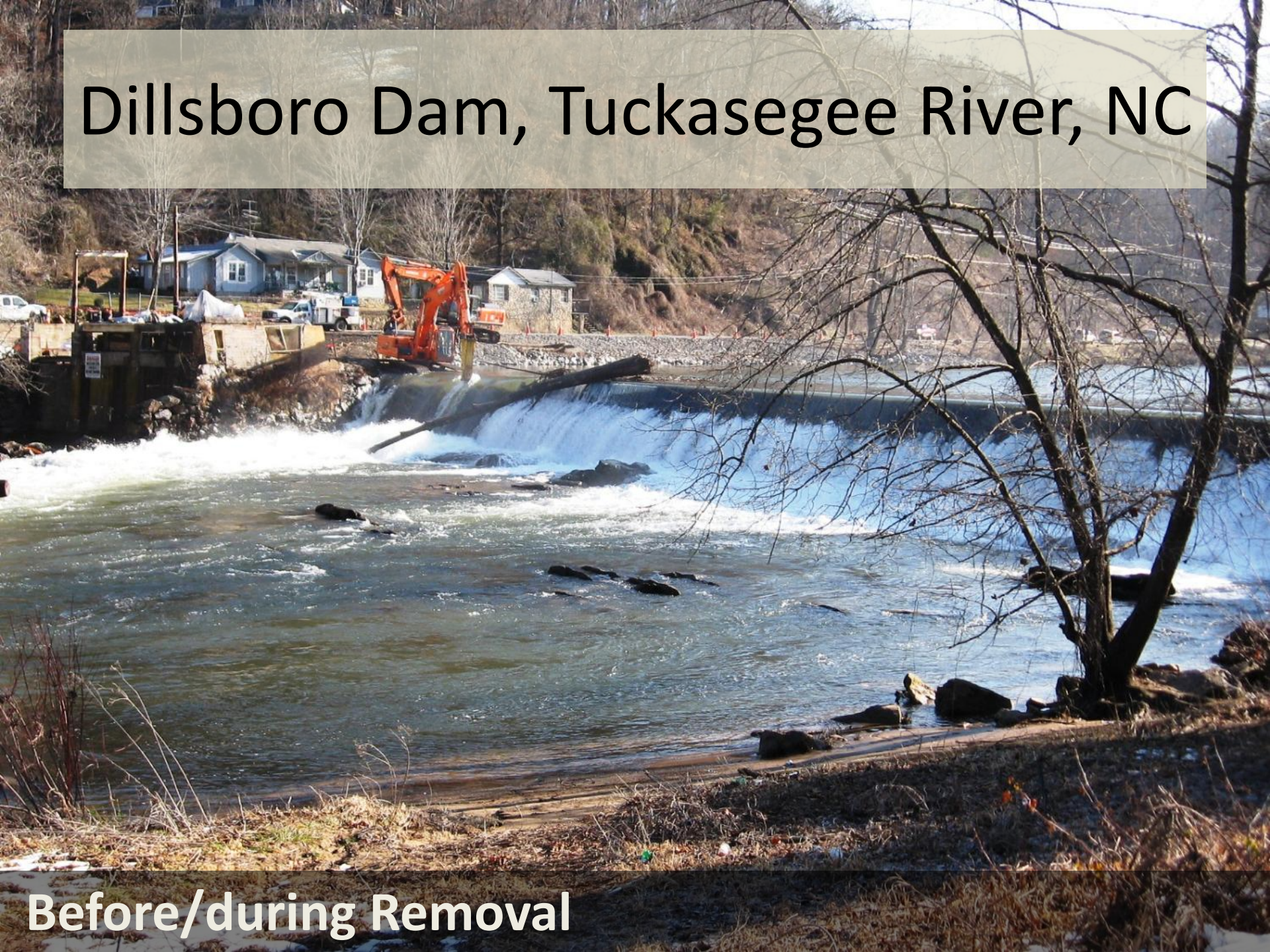


# Goodwin's Mill Dam, Big Canoe Creek, AL

- 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

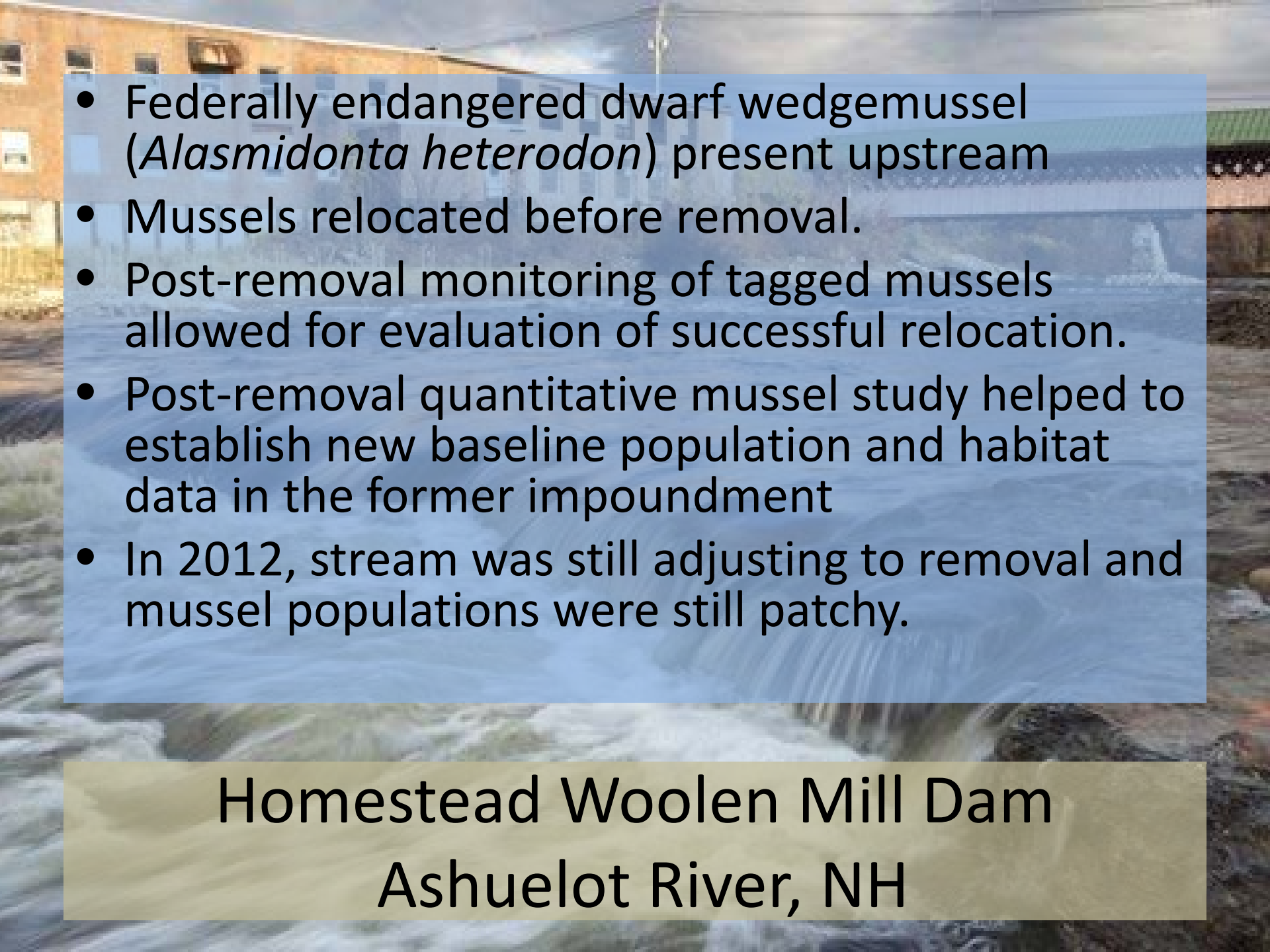
Short-term Effects of a Small Dam Removal on a Freshwater Mussel Assemblage. 2013. Heise, RJ., Cope, WG., Kwak, TJ., Eads, CB. Walkerana, 16(1): Pages 41-52.

- 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?