New England Coldwater Restoration Program

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Culvert assessment and replacement, design and engineering, dam removal, 30+ mi of in-stream wood additions
The state of New England's streams

Historic and recent forest and stream management has left most New England streams straightened, incised, and largely devoid of channel structure.
Future hydrologic/precipitation challenges

- Potential 13% increase in peak flows by 2049; 50% increase by end of century
- Variation in frequency, intensity, and timing of precipitation events
- Warmer winters and summers
- Increased potential for drought between high flow events

What does it mean for streams & riparian forest?
The current problem with streams

- The effect of streams without woody material
  - Straightened streams are shorter and steeper, hold less volume
Watershed Management Strategies to Slow the Flow for Climate Resilience

With climate change, we are seeing an increase in the frequency of extreme rain events, changes in snowfall, and higher temperatures. These changes are resulting in more floods and droughts. Climate change is expected to be a legacy of hundreds of years of altering our rivers and watersheds. Managing our watersheds with a “Slow the Flow” approach that restores natural processes can reduce the negative impacts of floods and droughts on our communities and provide a number of benefits to fish, wildlife, and人类. These management strategies add up to a more resilient water system.

Benefits

- Increase Watershed Storage
- Improve Habitat
- Increase Recreation Opportunities
- Improve Water Quality

Slow the Flow, managed streams maintain water flows that restore healthy habitats while reducing flood and drought risk.

Less Flood Risk

In our climate future without Slow the Flow strategies, stream flows are more prone to rapid fluctuations and extremely low or high water levels.

More Flood Risk
The current problem with streams

- The effect of streams without woody material
  - Straightened streams are shorter and steeper
  - Nothing to catch sediment, streams become incised
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- Little or no ‘roughness’ in the stream to slow water down
The current problem with streams

The effect of streams without woody material

- Straightened streams are shorter and steeper
- Nothing to catch sediment, streams become incised
- Little or no ‘roughness’ in the stream to slow water down

- Negative feedback loop exacerbated by increased precipitation
The current problem with streams

Also relevant to drought conditions:
- Incised streams lower groundwater conditions
Riparian forest stand age and large-wood volume at Hubbard Brook Experimental Forest, Thorton, NH

(Warren et al. 2007)

Reconnecting forests and streams
Reconnecting forests and streams

Increasing large wood can mitigate the effects of climate-induced hydrologic challenges

- Keeps sediment in the stream channel
- Protects banks from erosion
- Pushes flood water into forested floodplains, out of downstream properties
- Increases roughness and slows flood water down
- Increases nutrient cycling
Reconnecting forests and streams

Often a good idea to pair in-stream wood with upgrades to downstream infrastructure

- Infrastructure is often hydraulically undersized already
- Why ‘strainers’ and securing trees is important
Key considerations when implementing

• Maximize habitat diversity in low flow conditions

• Less than 20% reduction in canopy cover

• Works particularly well in mixed-age forest stands

• Leave bank trees and standing-dead; take diseased or otherwise vulnerable trees

• Utilize pinch points, bends, and hardy standing bank trees to secure
From drought to inundation – Jaffrey, NH

2015 Drought Conditions

The following summer
2015 Drought Conditions

The following summer
Normal and high flow conditions – Brighton, VT

Day of installation

One year after installation
Rain-on-Snow events – Deerfield, NH

Pushing water well outside of banks
Rain-on-Snow events – Deerfield, NH

Submerged large wood installation
Rain-on-Snow events – Deerfield, NH

Large log jam far extends river overflow to river left
After a winter/spring of rain-on-snow and ice jams

Aggraded gravels and cobbles raised bed several inches

New scour pool, +4’ deep

Michigan Brook in Green Mountain National Forest, VT
- Maintaining a stable channel
- Increasing floodplain access & braiding
- Raising groundwater levels
- Improving natural wood recruitment
Other Forest-River Hydrologic Interactions

Anticipated changes to forests/tree species have cascading hydrologic effects

- Slow death and loss of adult trees – lessening transpiration and groundwater uptake in spring/summer + increase in natural wood recruitment
- Sudden increase in young saplings – increased groundwater uptake
- Changes in stand composition and shading throughout year
Improving the Ecosystem Linkage

- Putting the forest back into the stream helps put the stream back into the forest
- Healthier, more resilient systems on both sides of the equation
- Potentially restoring riparian floodplain forests
- Storing flood water higher in the watershed reduces downstream impacts