

NIACS Webinar Series: Changing Hydrology

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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

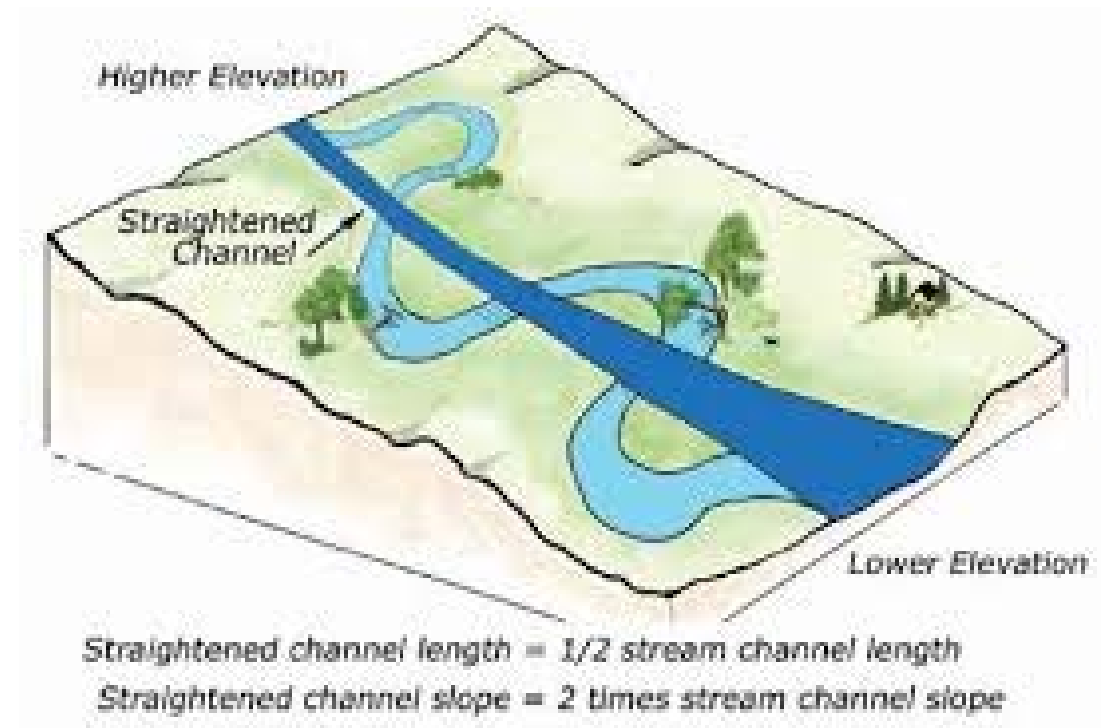


- ✎ Potential 13% increase in peak flows by 2049; 50% increase by end of century
 - ✎ Variation in frequency, intensity, and timing of precipitation events
 - ✎ Warmer winters and summers
 - ✎ Increased potential for drought between high flow events
-
- ✎ **What does it mean for streams & riparian forest?**

The current problem with streams

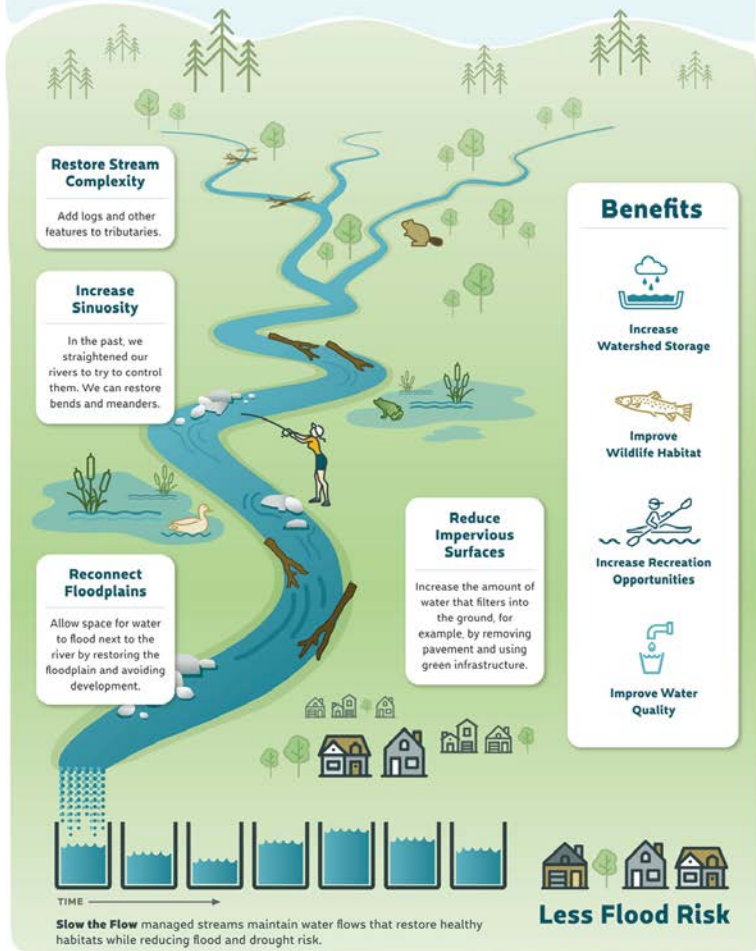


- ☞ The effect of streams without woody material
 - Straightened streams are shorter and steeper, hold less volume



Watershed Management Strategies to Slow the Flow for Climate Resilience

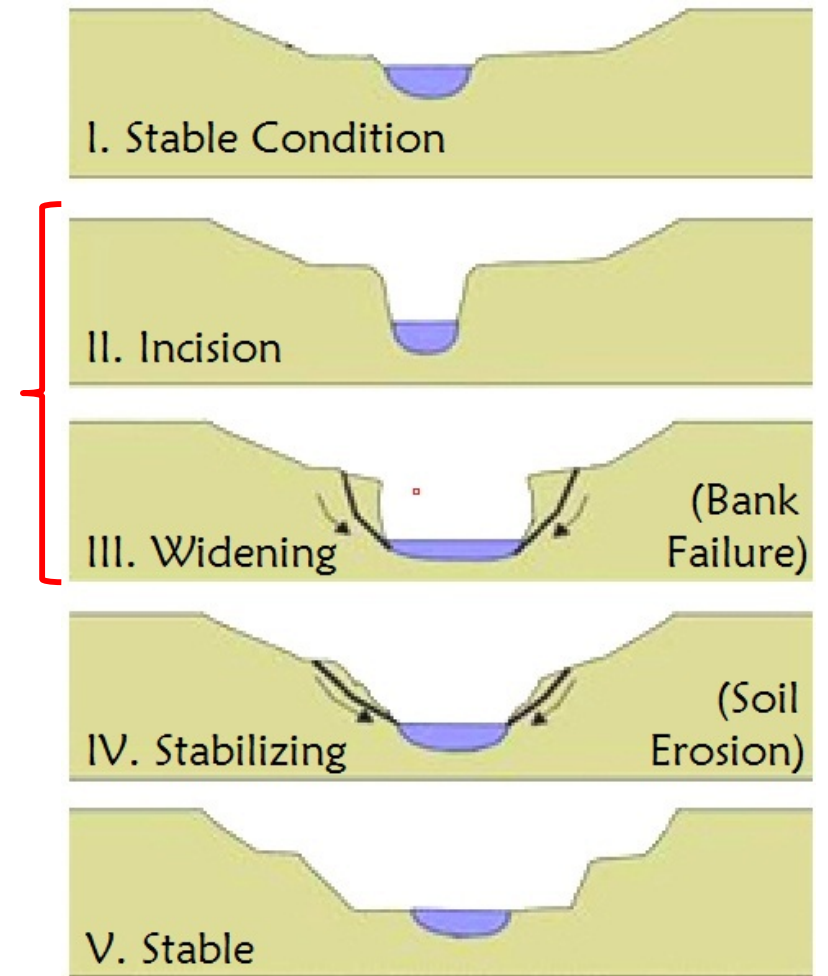
With climate change, we are seeing an increase in the frequency of extreme rain events, changes in snowfall, and higher temperatures. These changes are resulting in more floods and droughts. Climate change is overlaid on a legacy of hundreds of years of altering our rivers and watersheds. Managing our 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 co-benefits to fish, wildlife, and ecosystems. These management strategies add up to a more resilient watershed.



The current problem with streams



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 - Straightened streams are shorter and steeper
 - Nothing to catch sediment, streams become incised



The current problem with streams



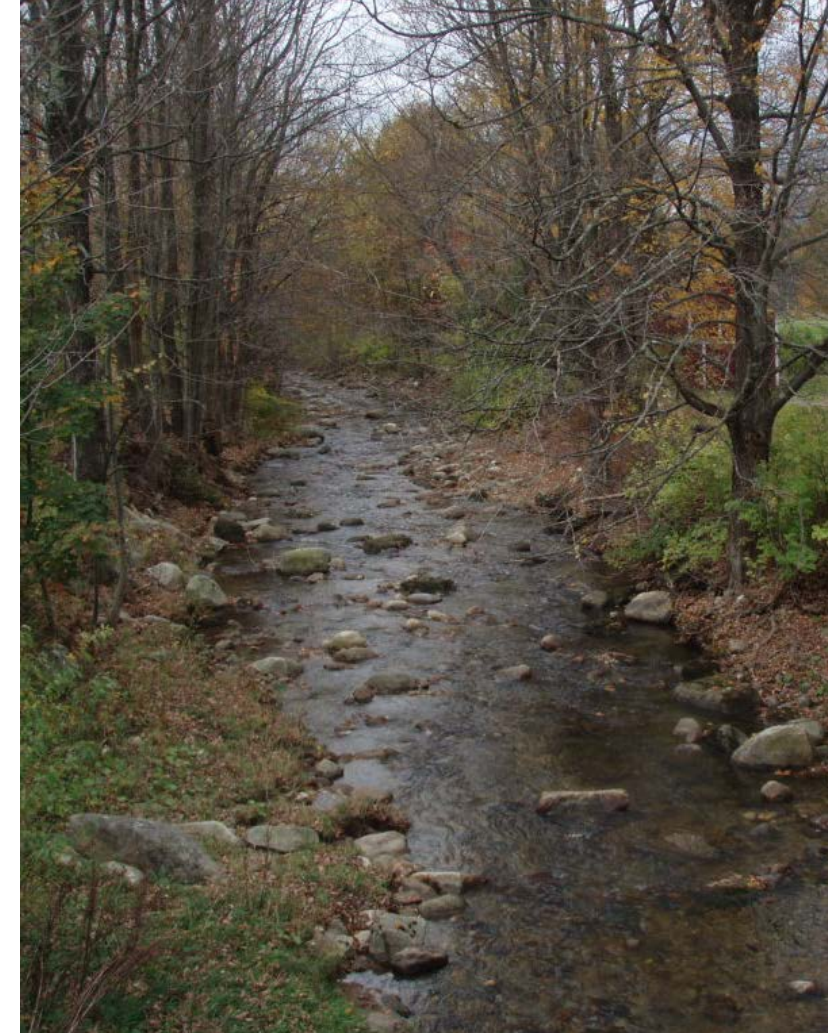
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 - Little or no 'roughness' in the stream to slow water down



The current problem with streams



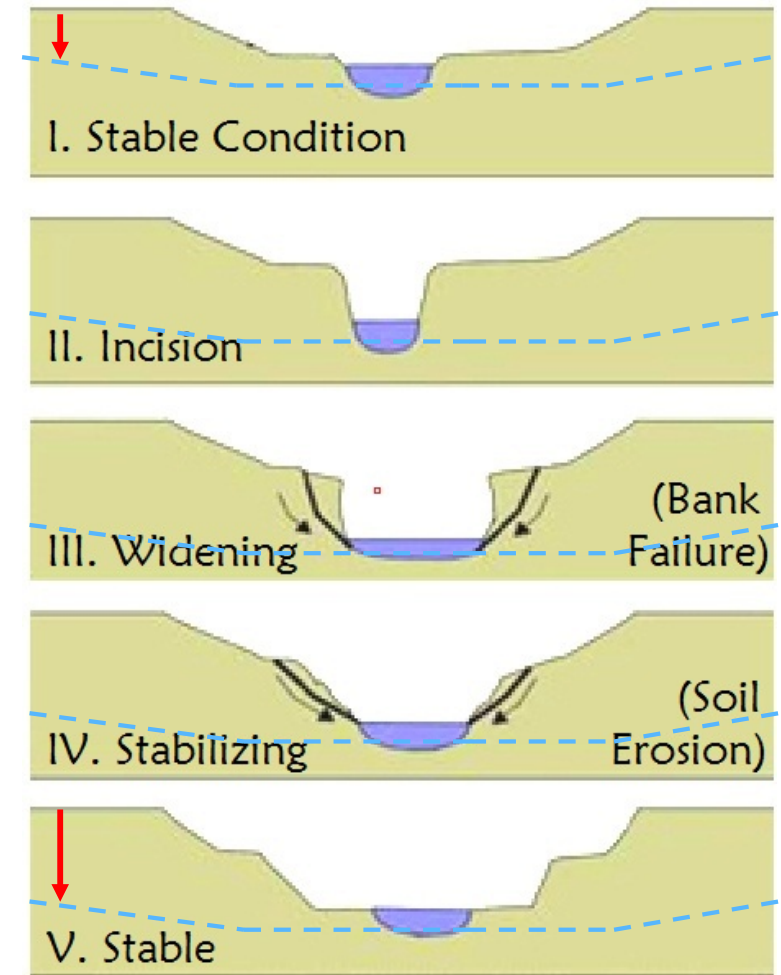
- ✎ The effect of streams without woody material
 - Straightened streams are shorter and steeper
 - Nothing to catch sediment, streams become incised
 - Little or no 'roughness' in the stream to slow water down
 - **Negative feedback loop exacerbated by increased precipitation**



The current problem with streams



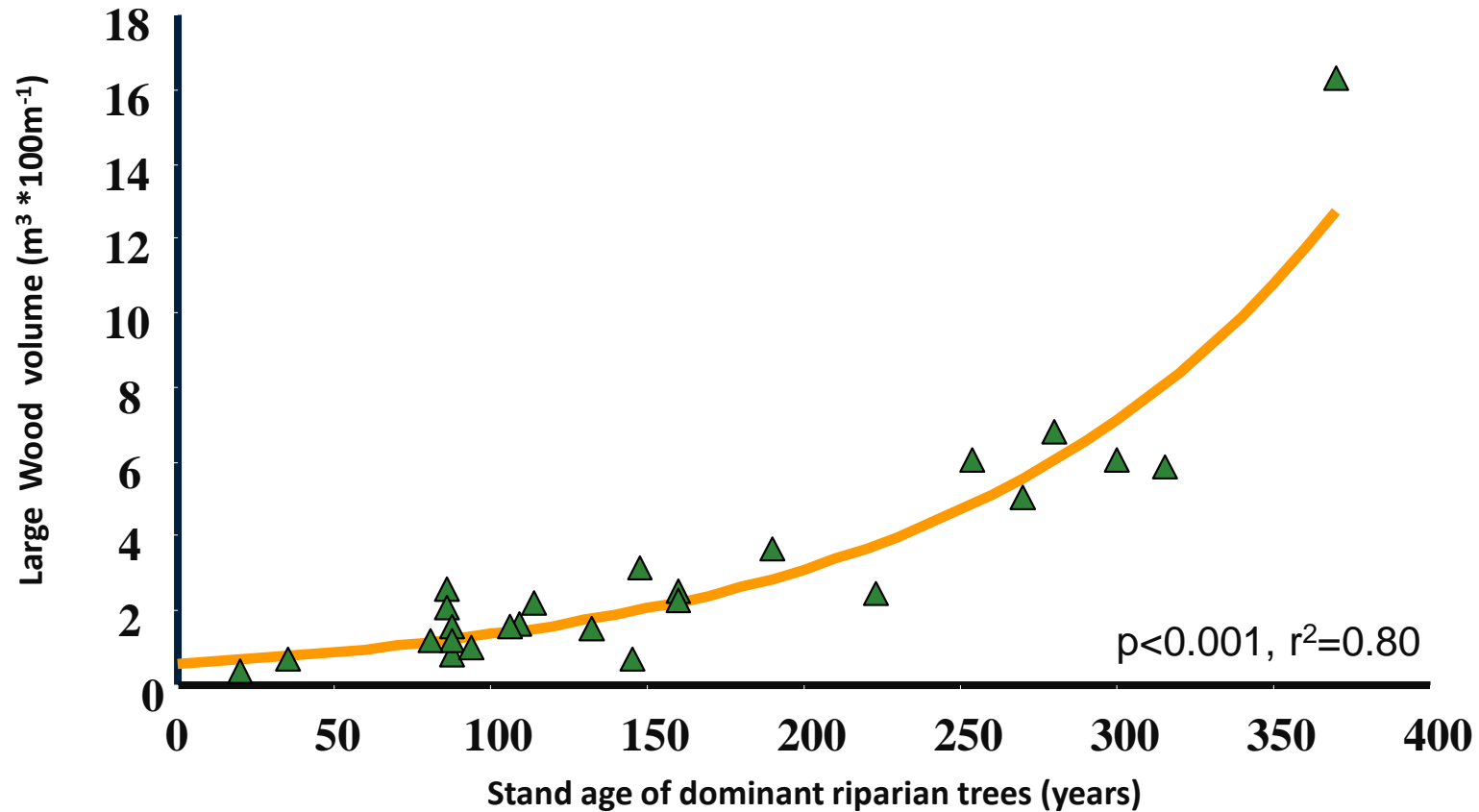
- Also relevant to drought conditions:
 - Incised streams lower groundwater conditions



Reconnecting forests and streams



Riparian forest stand age and large-wood volume at Hubbard Brook Experimental Forest, Thorton, NH



(Warren et al. 2007)

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



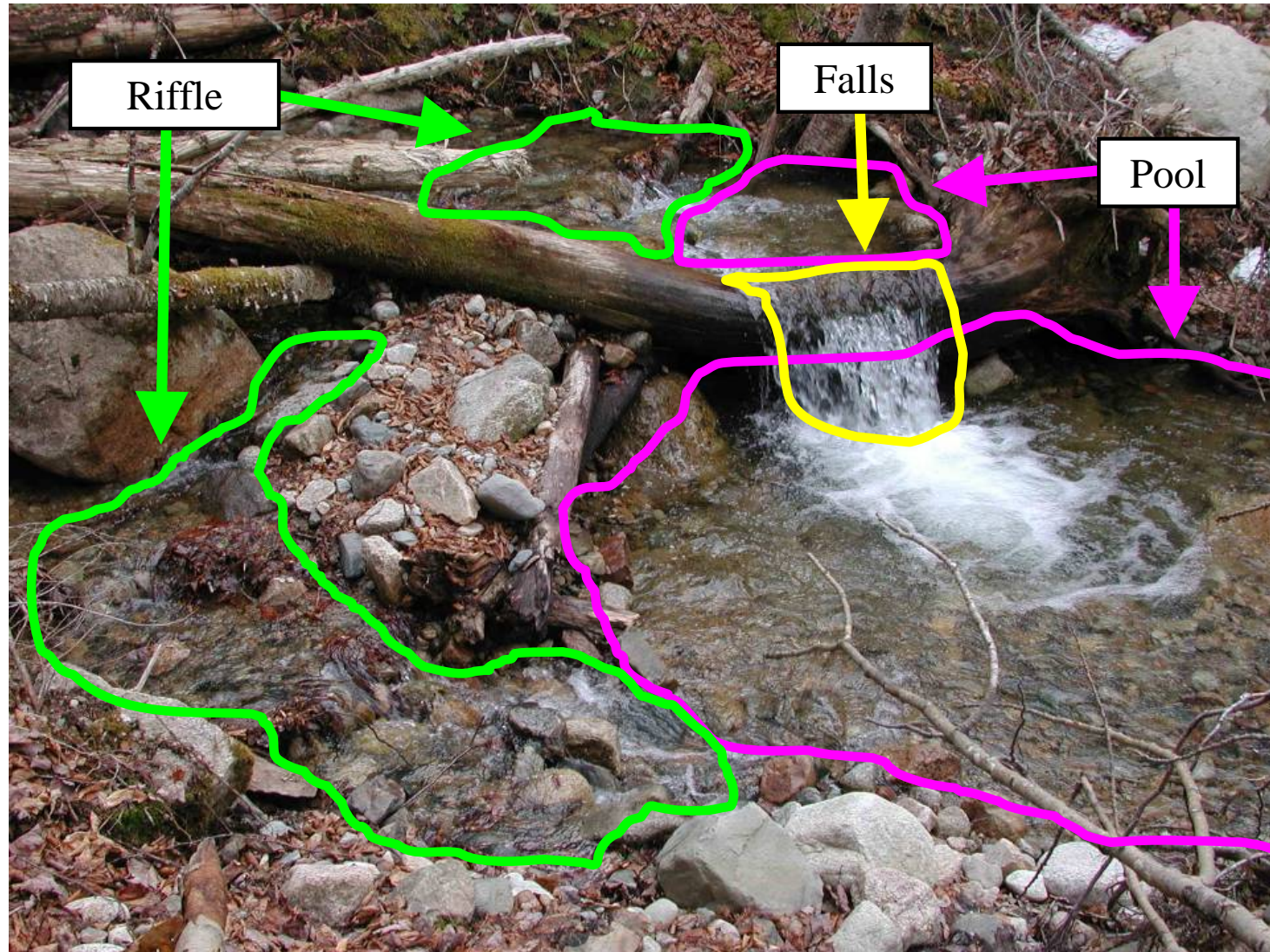
- 🐟 Often a good idea to pair in-stream wood with upgrades to downstream infrastructure
 - Infrastructure is often hydraulically undersized already
 - Why ‘strainers’ and securing trees is important



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

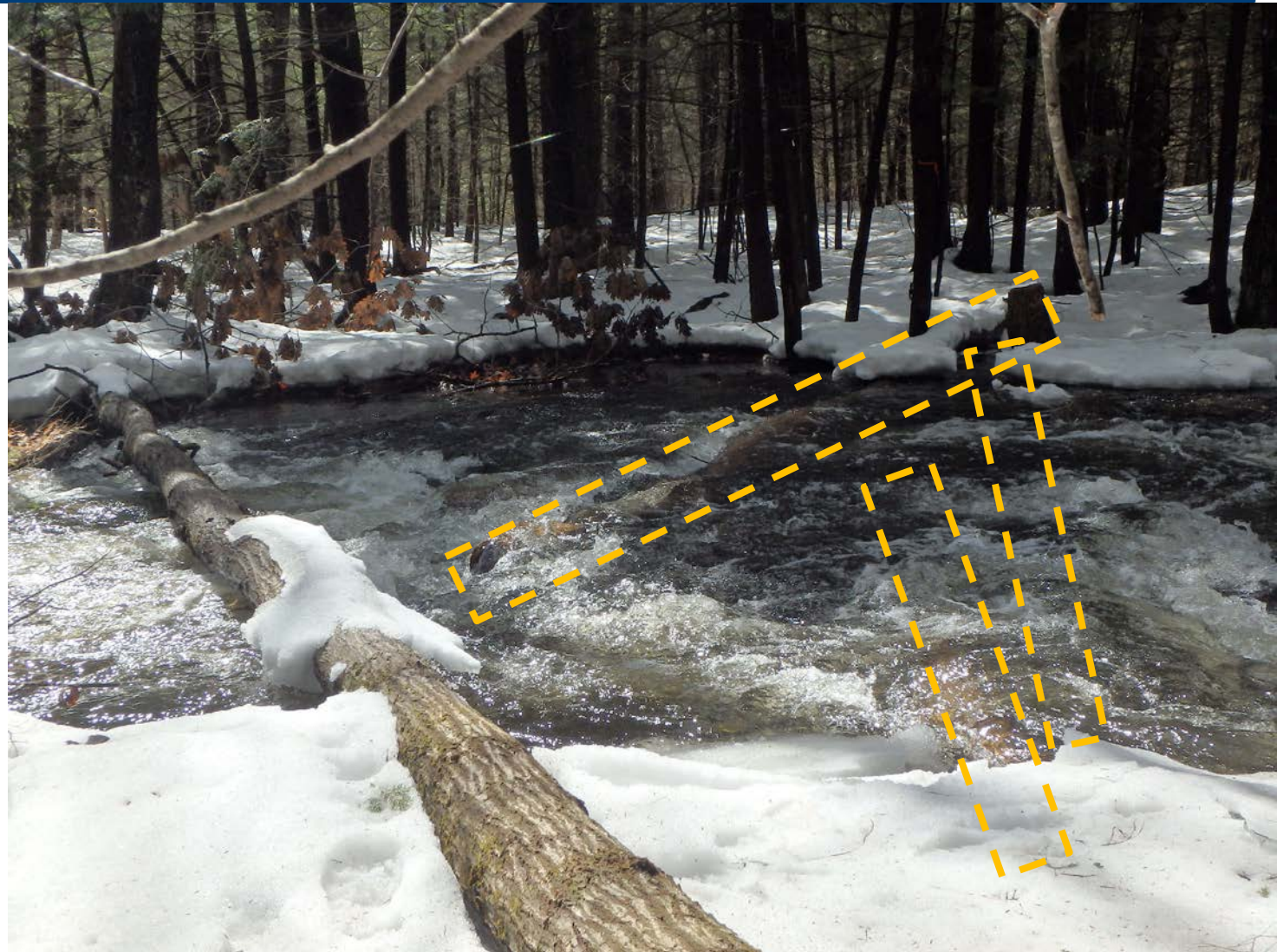
Pushing water well outside of banks



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

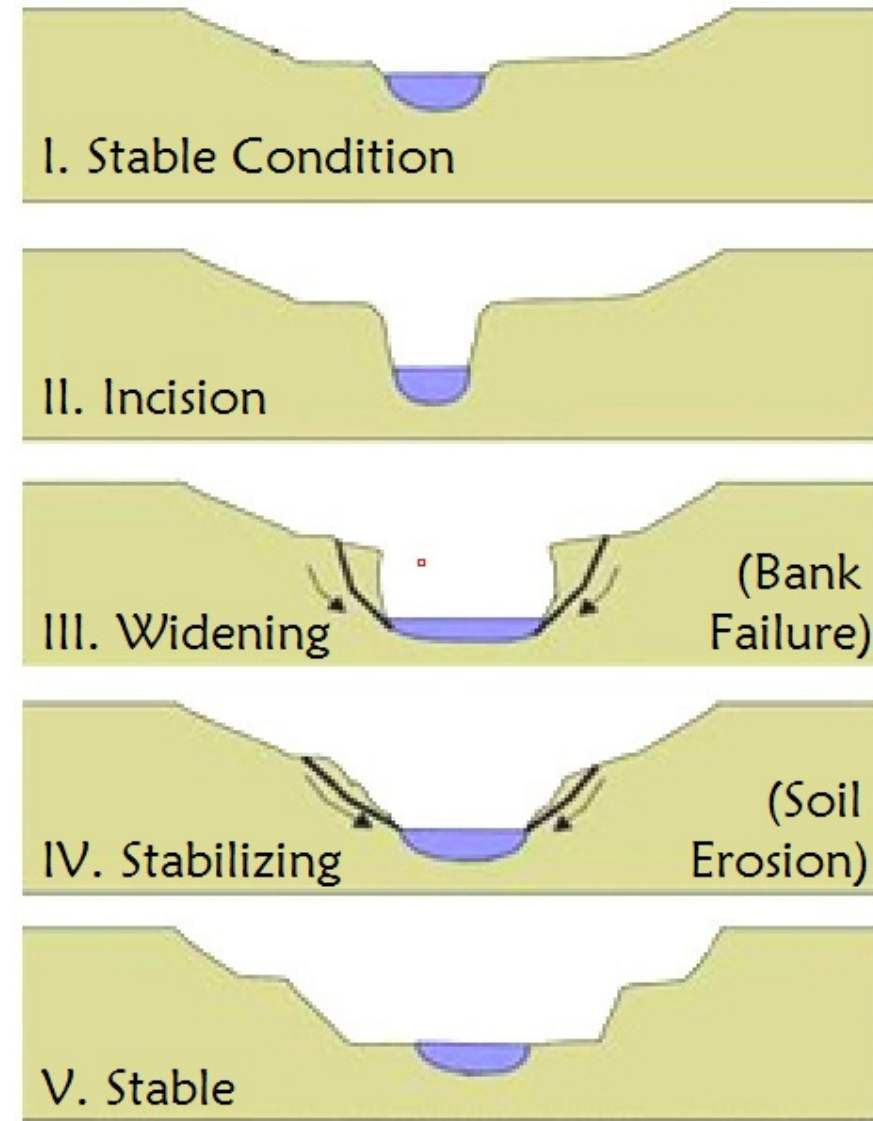
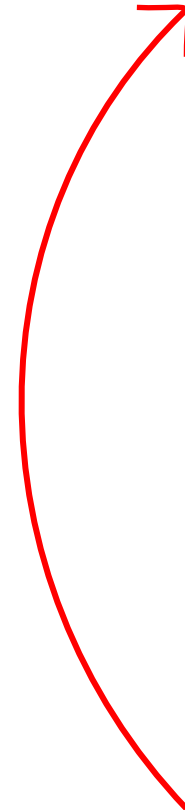


New scour pool, +4' deep



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