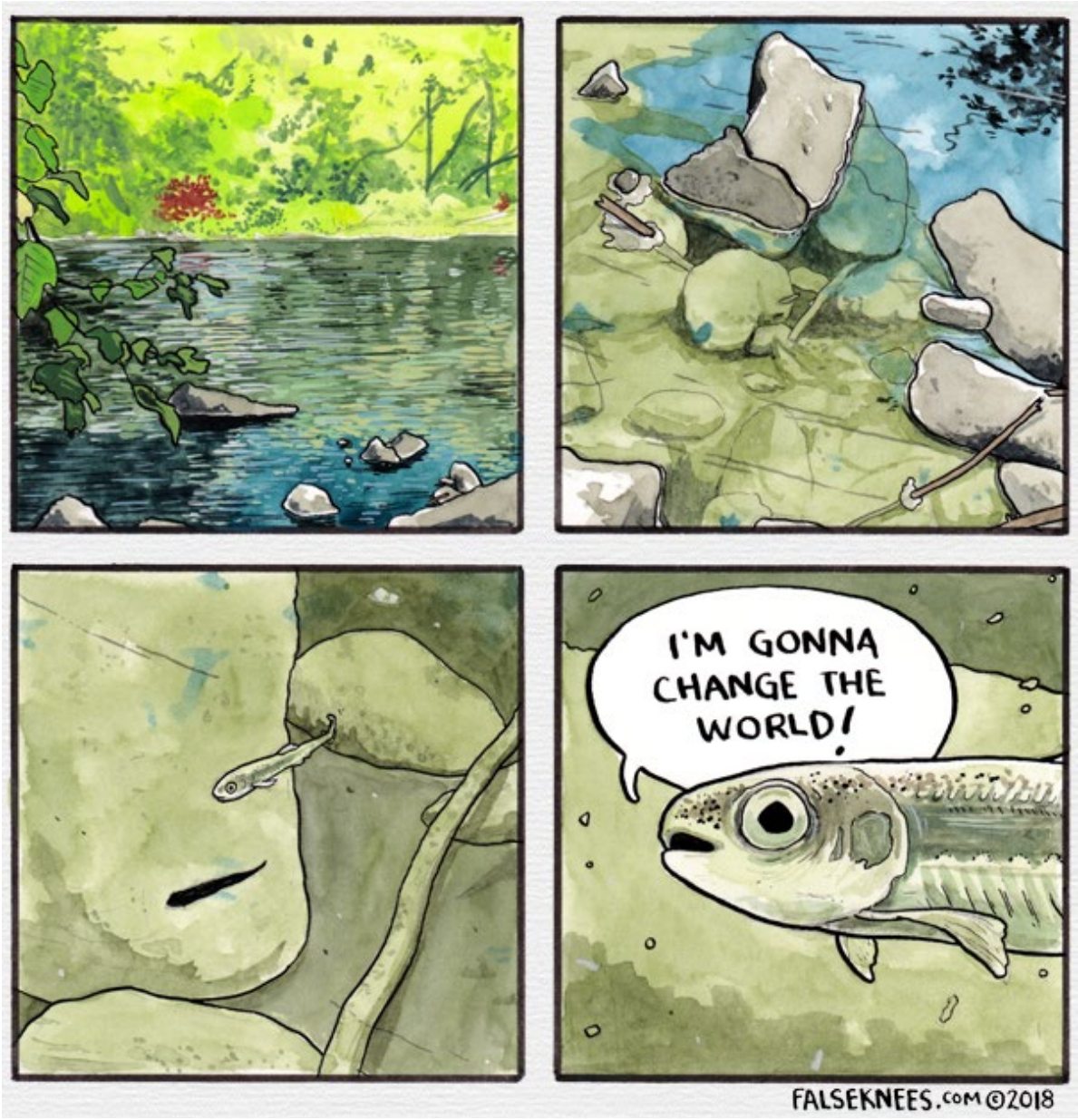
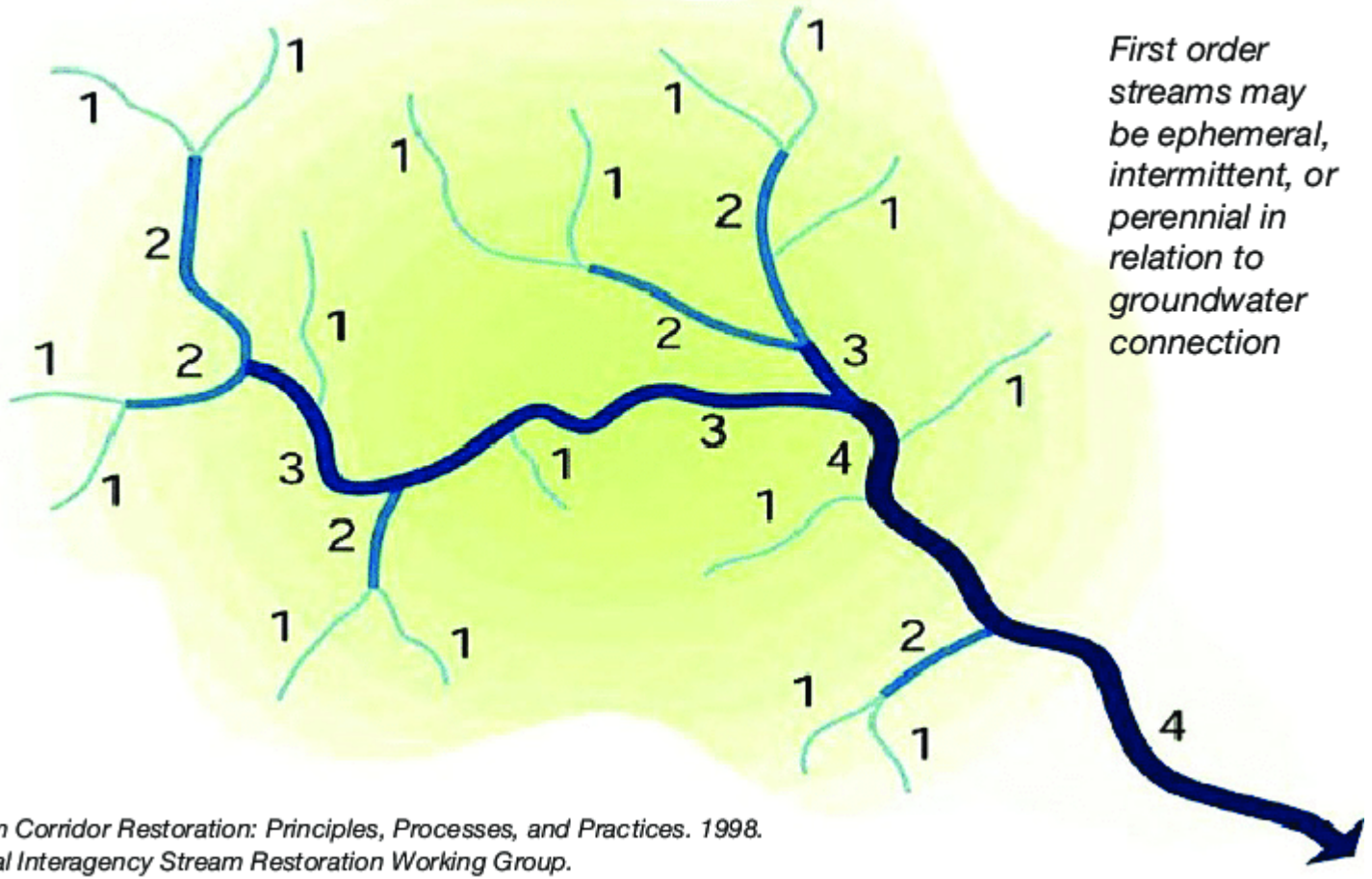


https://falseknees.com/338.html

A little bit of "sciency", but *mostly,* commonsense reasons to **focus forested riparian buffer restoration on "Headwater streams"** (with a focus on water quality…)

Strahler Stream Order:

Classification system describing position within the drainage network



First order streams may be ephemeral, intermittent, or perennial in relation to groundwater connection

Stream Corridor Restoration: Principles, Processes, and Practices. 1998. Federal Interagency Stream Restoration Working Group.

- **Stream Order:**
  - Streams are classified by their tributaries
    - First Order: No tributaries
    - Second Order: two 1st order streams merge
    - Third Order: two 2nd order streams merge

1st through 3rd order streams (roughly), AKA "headwaters"

Recognizing

headwater streams

https://extension.unh.edu/sites/default/files/migrated_unmanaged_files/Resource001818_Rep2554.pdf

Headwater streams are small streams and wetlands at the highest end of a watershed. Some are so small that they don't show up on maps. If a river network is the circulatory system of the landscape, headwater streams are the small capillaries that fan into the larger veins and arteries.

Headwater streams can start as small forested wetlands, beaver impoundments, or cascading mountain streams, varying according to the topography and geology of the surrounding landscape. Topography and geology influence the speed of water flow, the river bottom material, the plants growing around the streams, whether the stream sometimes or always contains water, and which wildlife species live in or use the stream.

Mountain streams

Mountain streams tend to have large rocks, steep grades, and flash floods. Stream salamanders, brook trout, and certain aquatic invertebrates are well adapted to these dynamic habitats.


Mountain stream

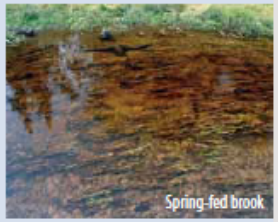

Valley stream

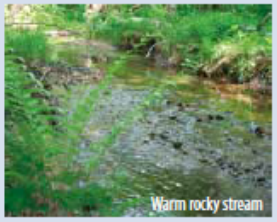
Valley streams

These streams flow through broad, flat valleys. They tend to be slow-moving and surrounded by wetland plants and shrubs. Beaver activity creates a patchwork of wetlands around the streams, including shrub swamps, wet meadows, and ponds. Wildlife are drawn to these areas including ducks, geese, turtles, amphibians, and fish.

Spring-fed brooks

These small streams flow through glacially deposited sand and gravel and originate from natural springs. Their year-round supply of cool water provides a stable environment for brook trout, particularly during hot weather.


Spring-fed brook

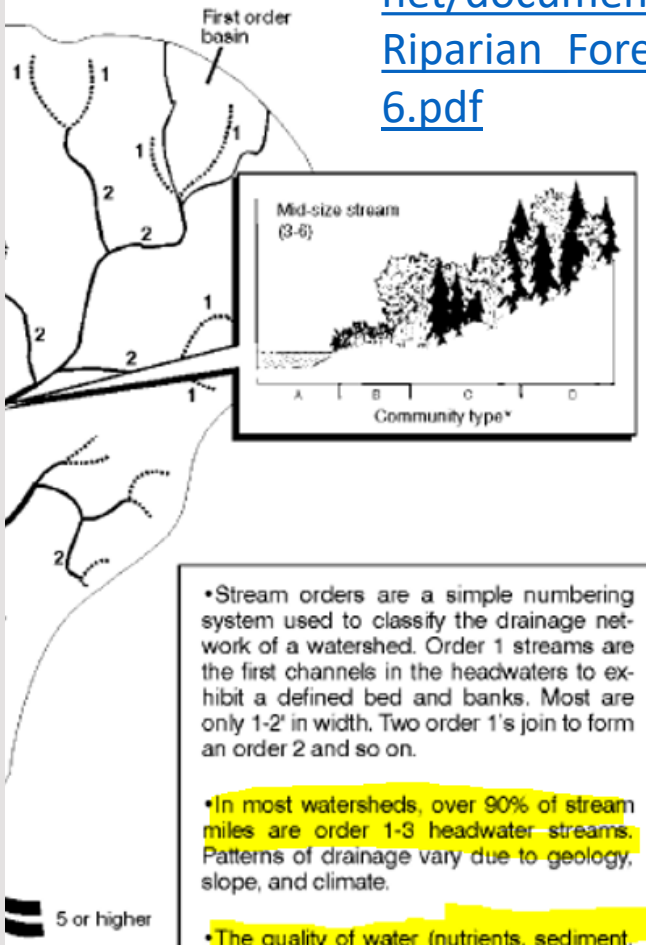

Warm rocky stream

Warm rocky streams

The riffles and pools of these rocky brooks are reminiscent of mountain or brook-fed streams, but they are too warm to support cold-water fish. They often flow between beaver ponds in hilly terrain, serving as corridors and hunting grounds for mink, northern water snake, and other wildlife.

am orders

https://www.chesapeakebay.net/documents/ACB_White_Riparian_Forest_Buffers_1996.pdf

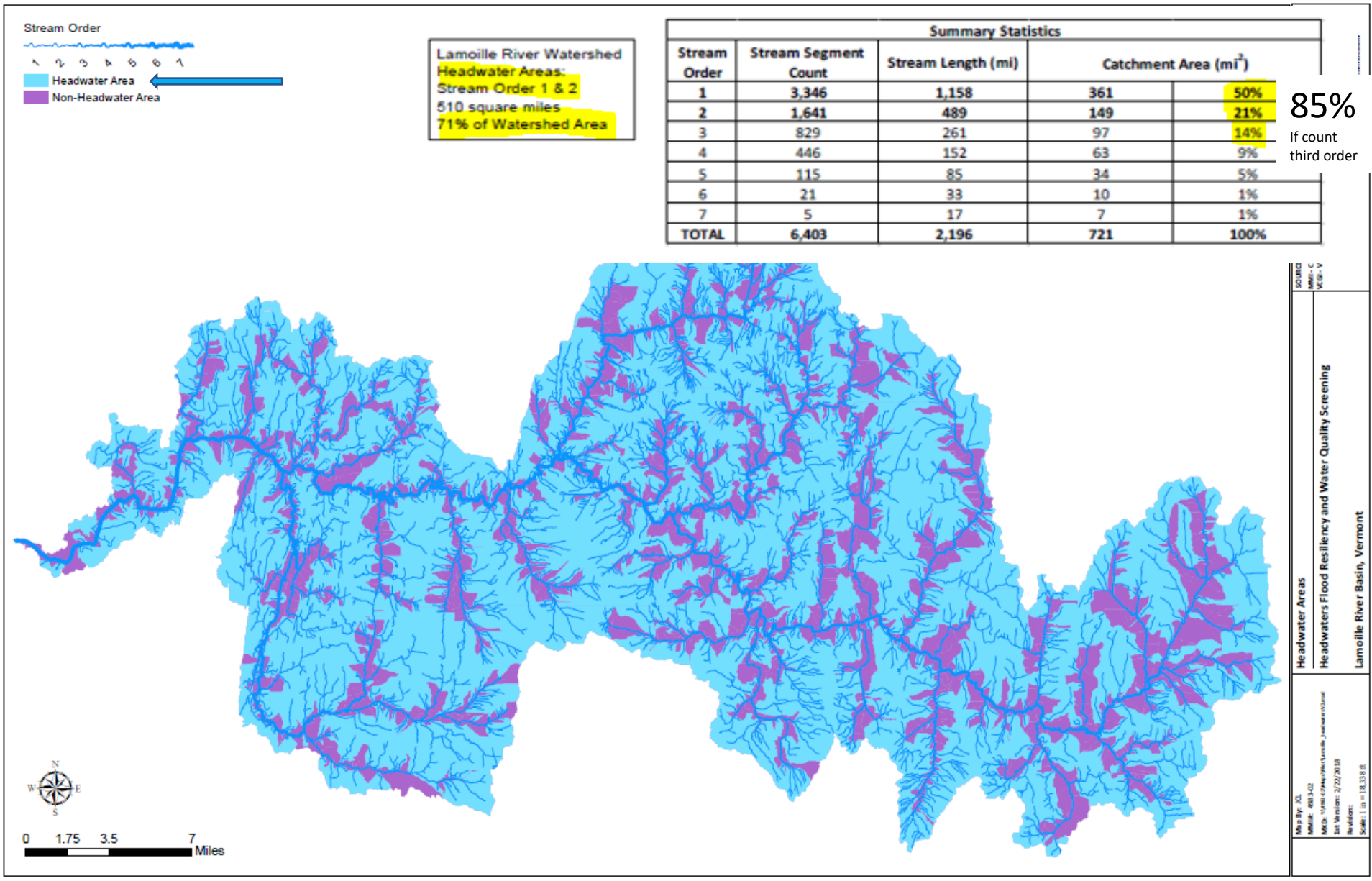


•Stream orders are a simple numbering system used to classify the drainage network of a watershed. Order 1 streams are the first channels in the headwaters to exhibit a defined bed and banks. Most are only 1-2' in width. Two order 1's join to form an order 2 and so on.

•In most watersheds, over 90% of stream miles are order 1-3 headwater streams. Patterns of drainage vary due to geology, slope, and climate.

•The quality of water (nutrients, sediment, and temperature) is affected most by the condition of headwater streams (order 1-4). Riparian forest buffers may exert their greatest influence here as the majority of water flows through the shaded riparian zone.

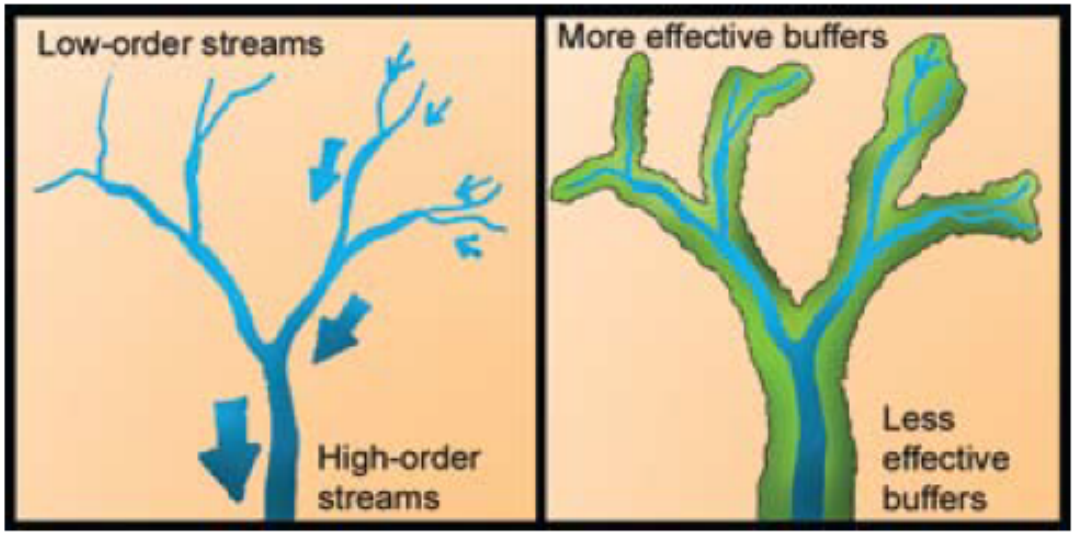
•Riparian forests may provide the greatest opportunities to enhance fish habitat on mid-order streams (3-6) and shorelines where there is sufficient large woody debris, stream structure and flow to support fish and other aquatic life.



Source: sneak preview courtesy of Shayne Jaquith, from Milone and MacBroom's (now SLR) Headwater Screening Tool report (funding by VLT and TNC)

Speaking of the Lamoille…


I’m not saying forested buffers on larger streams and rivers don’t provide functions and values…
But…



1.4 Target buffers in watersheds

Water quality buffers will be more effective in some areas than in others. Targeting buffers to areas that have high pollutant loads and suitable characteristics for pollutant removal will generally have the greatest benefit on water quality.

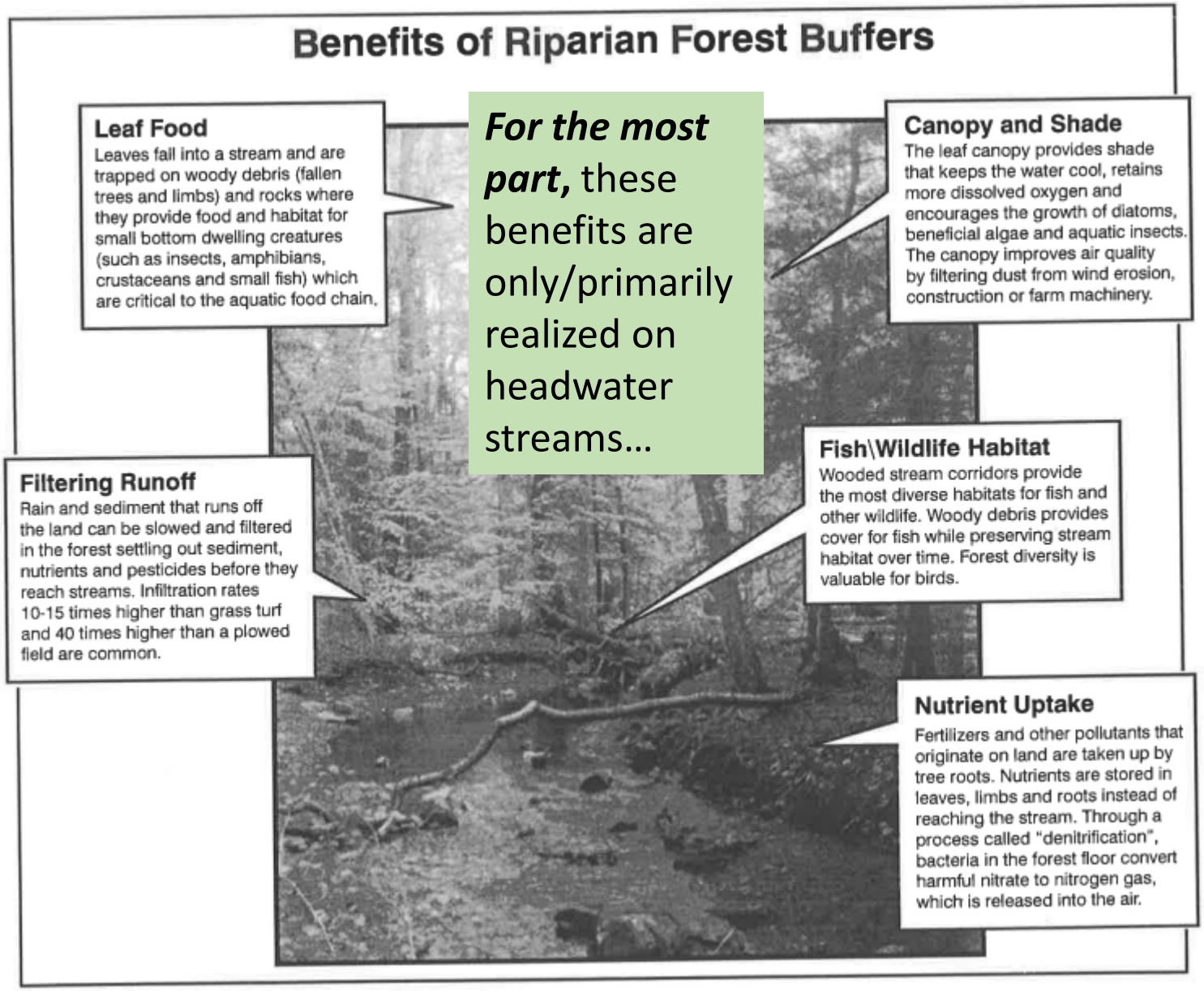
General targeting considerations

- Riparian buffers will often be more effective along small or low-order streams than larger or high-order streams since most water delivered to channels from uplands enters along low-order streams.

https://www.fs.usda.gov/nac/buffers/docs/conservation_buffers.pdf

Exciting and more effective forested buffer locations for water quality!

less effective location…



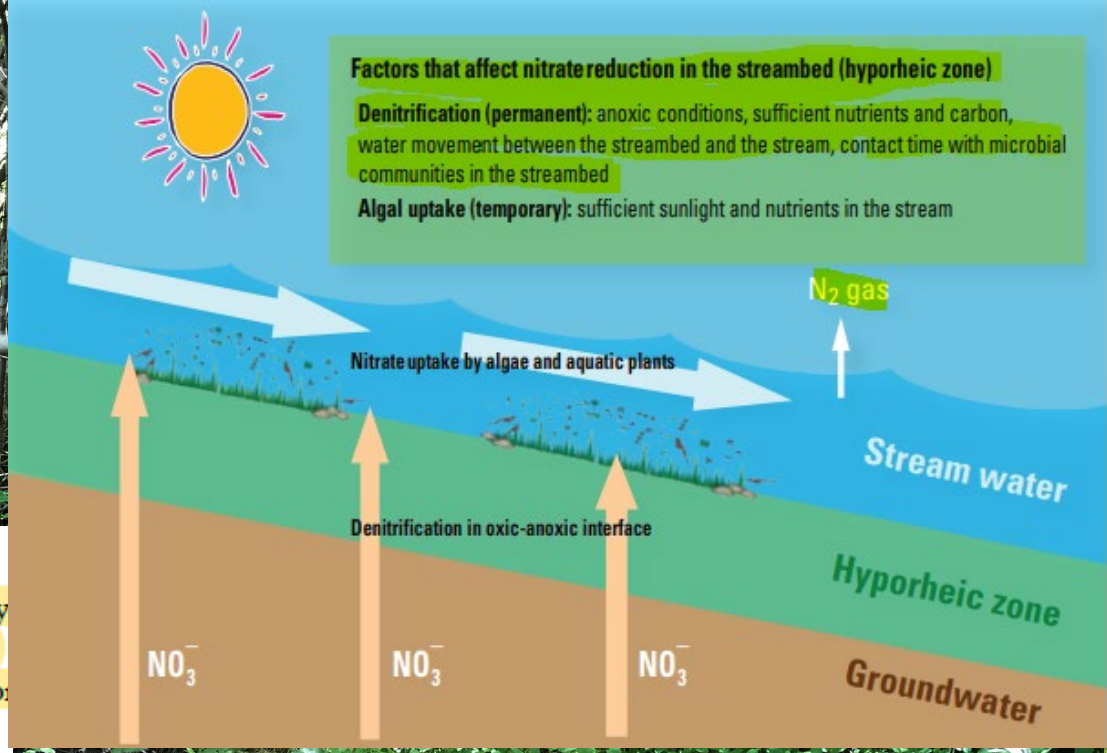
For the most part, these benefits are only/primarily realized on headwater streams…

https://www.chesapeakebay.net/documents/ACB_White_Riparian_Forest_Buffers_1996.pdf

Nutrient Transformations

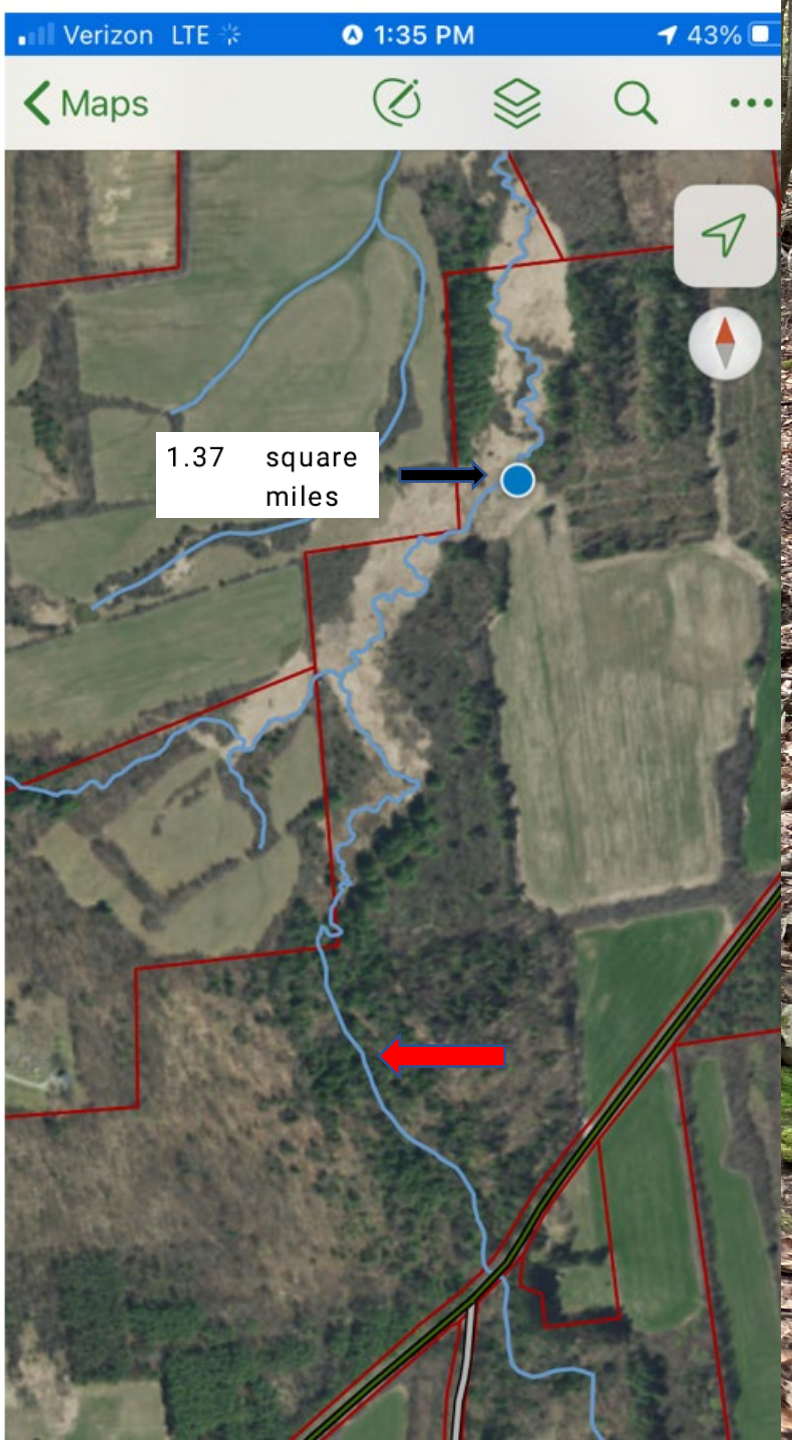
Natural streams remove nutrients from the water column due to biological uptake (algae and aquatic plants) and microbial transformations. Headwater streams are particularly important in this process, both because they dominate the total stream miles in a watershed, and because their high land surface to water volume ratio is conductive to nutrient uptake and transformation. Therefore, headwater streams play a critical role in controlling the export of nutrients to downstream waters (Peterson and others, 2001). In contrast, large rivers tend to act as transport systems moving nutrients to downstream receiving waters.

- Forested riparian buffers in headwaters (first-order streams) generate high levels of organic inputs directly from land to water, which in turn maximize in-stream processing functions that provide the "fuel" needed for downstream energy and nutrient processing.

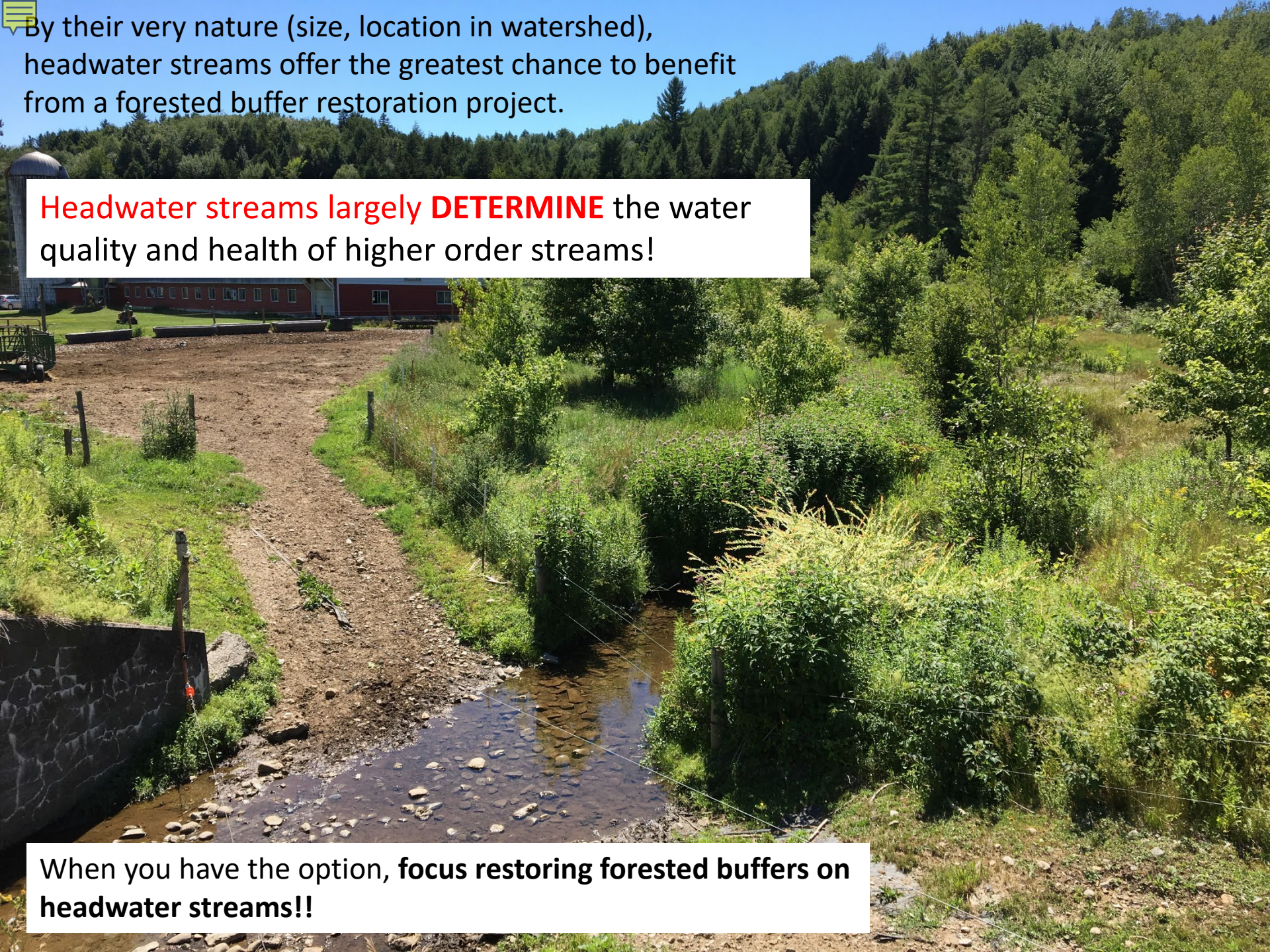



Function-filled
stream corridor!


Stream engulfed by invasive reed –canary grass, narrowed to 3', and stripped of much of it's functions and values as a stream, now more of a "surface water"


Verizon LTE
1:35 PM
43%
Maps
1.37 square miles


After CREP,
stream fenced,
reinforced cattle
x-ing installed,
buffer planted,
water tub is
behind feeder ;)


By their very nature (size, location in watershed), headwater streams offer the greatest chance to benefit from a forested buffer restoration project.
Headwater streams largely **DETERMINE** the water quality and health of higher order streams!
When you have the option, **focus restoring forested buffers on headwater streams!!**

2018 Vermont State Hazard Mitigation Plan - Approved 11/17/18

Table 44: 2018 State Hazard Mitigation Plan Actions

GOAL: Protect, restore and enhance Vermont's natural resources to promote healthy, resilient ecosystems.

Strategy	Action	Source	Category	Hazard(s) Addressed	Entities	Potential Resources	Timeline	Impact	Feasibility
Promote land management standards for State and private lands	Implement ANR's flood resilience guidelines on ANR Lands.	Aug 2017 WG (1.3.3)	Regulation/ Policy	Inundation; Fluvial Erosion	ANR, ANR's State Lands Sub-Committee	Existing State Resources	2019	Medium	High
	Expand ANR's flood resilience guidelines into a consistent State land management policy to increase and maintain flood storage and attenuation on all state-owned land.	Expert Review (RM #5, 1.3.3)	Regulation/ Policy	Inundation; Fluvial Erosion	ANR, BGS	Existing State Resources	2020	High	Medium
	Support ongoing efforts to identify strategies for funding and assisting private landowners with essential hazard mitigation and clean water projects.	Dec WG / SHMP 2013 (RM #87)	Funding/ Incentive	Inundation; Fluvial Erosion	ANR, VEM, AAFM, VTrans, High Meadows Fund	Existing State and Nonprofit Resources	Ongoing	Medium	High
	Work with land conservation organizations to include river corridor and floodplain protection provisions, and/or headwater storage in conservation easements.	Expert Review	Partnership/ Coordination	Inundation; Fluvial Erosion	ANR, VHCB, VRC, VLT, NRCD	Existing State and Nonprofit Resources	2019	High	High
Improve headwater storage	Develop an inventory of critical headwater and floodplain storage areas that would result in a measurable abatement of flooding.	WG June 2017	Data Gap	Inundation; Fluvial Erosion	ANR, USGS, TNC, VLT, UVM, VRC	TNC, State Resources	2019-2020	High	High
	Complete a pilot project in a strategic watershed, using the above inventory, to prioritize land conservation and determine the cost of averted flood damage.	Focus Group	Data Gap	Inundation; Fluvial Erosion	ANR, USGS, TNC, VLT, UVM, VRC	TNC, HMGP 5% Initiative	2020	High	High
	Conserve land identified in the critical headwater storage inventory through landowner outreach and existing conservation programs.	WG June 2017	Education/ Outreach	Inundation; Fluvial Erosion	ANR, Watershed Groups, RPCs, Land Trusts, VRC	Existing State and Nonprofit Resources	Ongoing	High	Medium
	Identify critical headwater storage areas enrolled in the Current Use program and conduct outreach to inform landowners of the value of protecting these areas during harvesting operations.	Focus Group	Regulation/ Policy	Inundation; Fluvial Erosion	ANR, AAFM, VRC	Existing State Resources	Ongoing	High	Medium
	Identify stormwater-impaired headwater storage areas where stormwater treatment and stream restoration would result in hazard mitigation co-benefits.	Expert Review	Data Gap	Inundation; Fluvial Erosion	ANR, RPCs, VEM, VRC	FEMA HMA	Ongoing	Medium	Medium

https://vem.vermont.gov/sites/demhs/files/documents/2018%20Vermont%20State%20Hazard%20Mitigation%20Plan%20-%20Final%20Adopted_Interactive.pdf