The Watershed Forestry Partnership Newsletter

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Watershed Forestry Partnership Annual Meeting– Back in Person!

Thanks to all who journeyed to the University of Vermont in March for our first in-person meeting since 2019! More than 100 people from VT, NY, CT, and RI attended and contributed their energy and ideas to make the meeting a successful one.

For those of you who couldn't make it, or want to relive the moment, recordings of the 2024, 2022, and 2021 meetings are available on the Annual Meeting page of the Watershed Forestry website.

What's not available, unfortunately, are all the great side-conversations that are always one of the best things about an in-person meeting, so be sure to attend next year to be a part of those.

An informal poll at this year's meeting revealed a preference for a February meeting instead of a March one. I have reserved the UVM Davis Center conference room for **January 20, 2025, so save the date**! More info coming later this year.

CWSP-Funded Forestry Projects-

Critical, yet Underdeveloped as a Sector

By Hilary Solomon

As part of Act 76, which distributes funding for clean water projects to regional Clean Water Service Providers (CWSPs), the Department of Environmental Conservation (DEC) developed a formula by which to determine the percentage of annual funds that will be received by each subbasin in the larger Lake Champlain Watershed. The funds, called the Formula Grant after this formulaic way of determining how much to spend in each basin, how much to allot for each sector and an average cost per kilogram of phosphorus reduction for each project type. The main goal of the Formula Grant funds is to reduce phosphorus levels in Lake Champlain and to comply with the Clean Water Act-mandated Total Maximum Daily Load (TMDL) of phosphorus for the lake.

As a by-product of the Lake Champlain phosphorus TMDL modeling limitations (remember those "gap" watersheds?**), the South Lake watershed, like the Mississquoi River watershed, has a little under half of its phosphorus reduction target assigned to non-regulatory reductions in the forestry sector. This has ramifications for all our projects, as it lowers the average funds available per project, and ostensibly mainly supports projects on forest lands. Because all projects funded through the Formula Grant must be voluntary and not part of a permit or logging accepted management practices (AMPs), the types of projects available to fund on forested lands are limited. DEC further limits available projects through their prescriptive approach in the CWIP funding policy that limits the forest road and stream incision/gully projects eligible for funding. In addition, the CWSPs and their implementing partners -namely watershed organizations and conservation districts- do not tend to focus on forestry projects, and it will likely take years for them to build relationships with property owners and develop project lists for this sector.

Though the high proportion of funds in the forest sector is worrisome for several CWSPs, there are a few bright opportunities to pursue. First, the Memphremagog Watershed Association has developed a workshop and shareable resources which highlight multiple forest project types recently funded through state funds and could very well be used as a training for other organizations. This includes project identification, development, and design resources for forest road practices like stream crossing improvements, drainage and erosion BMPs, strategic wood additions, aquatic organism passage, and road decommissioning. Our partners at Forest, Parks, and Recreation and NRCS have contacts with forestland owners and have offered to work with us.

Companies such as Vermont's Redstart Consulting, have worked under contract for DEC and successfully implemented forestry projects with Federal

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***["Gap watersheds" are those that do not meet water quality standards under any of the proposed land management or best practices scenarios in the State's TMDL Implementation Plan based on this modeling. The South Lake and Mississquoi Watersheds are examples.]*

CWSP-Funded Forestry Projects, cont'd.

(RCPP) funds, perhaps a process that could be copied for the Formula Grants with a variety of partners, and certainly an opportunity for collaboration within the Watershed Forestry Partnership.

In addition, for the FY2025 formula grants DEC has adjusted targets to allow the CWSPs to prioritize a higher percentage of their Formula Grants for outreach and project development; funds that could be used to support partner staff to build relationships and project lists in the forest sector.

So now might be the time for forestland owners to explore the feasibility of water quality projects on their land. Hopefully, as outreach providers and technical assistants, we can prioritize the time and capacity to develop those relationships and help facilitate water quality project implementation on private forest lands. At least until the first round of CWSP contracts expires in 2028, there will be funds available to support work in the forested headwaters, an important area that could contribute significantly to water quality improvements and flood resilience in the Lake Champlain Watershed. ◆

Hilary Solomon is the District Manager for the Poultney-Mettowee Natural Resources Conservation District and graduated from Duke University with a Master's Degree in Water Resources. She worked for the Ohio EPA and Ross County SWCD before moving to Vermont, and worked as the watershed coordinator for the Poultney Mettowee Watershed Partnership from 2004-2008, before returning to the PMNRCD in 2012.

Valley Brook Streambank Management Area Restoration Phase I

By Gabyrel Gianoni, Jessica Colby, & Brooke Fleischman

During the summer of 2023, Valley Brook Stream Bank Management Area (SMA) in Morgan, VT underwent a large restoration project that completely transformed the historic dairy farm. The property was recently acquired by the VT Fish & Wildlife Department (VFWD) to retire the farm and conserve the land and water in perpetuity. Phase I of the project was a collaborative effort that involved several partners to get it off the ground. The Orleans County Natural Resource Conservation District (OCNRCD) initiated conservation planning discussions with the former landowner and created the possibility for restoration. Memphremagog Watershed Association (MWA) designed and oversaw the restoration project in partnership with the VFWD, VT Department of Environmental Conservation (VTDEC), Agency of Agriculture Food & Markets (VAAFM), and The Nature Conservancy (TNC). NorthWoods Stewardship Center (NWSC) and VFWD implemented restoration work along with construction contractors Cunningham Logging & Excavation and KMC Excavation. The Intervale Center (IC) and NWSC also contributed locally collected seed from native tree and shrub species for restoration.

Valley Brook SMA pre-restoration, April 2023.

Given its historic agricultural use, the farm offered multiple restoration opportunities including floodplain and wetland restoration, improved stream passage for aquatic organisms, streambank stabilization, and water quality improvement. The property proved to be a crucial part of the landscape for flood water storage after being severely impacted by the 2023 July floods. By improving floodplain connectivity, removing undersized culverts, reconnecting streams to their alluvial fans, decommissioning eroding roads and plugging ditches connected to surface waters, the impacts these storms have on the landscape are mitigated.

Culvert Replacement

Nine problematic culverts were removed because they were incompatible with stream dimensions and geomorphology. Many also acted as barriers for aquatic organism passage, disconnecting populations due to perched outlets. Most culverts were small structures on ditched tributaries. These structures were removed, streambanks were regraded, and native wetland sod was transplanted onto the banks for improved stability. Native wetland seed was also spread in areas with

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bare soil to improve ground cover and bolster species richness.

The culvert from the main stem of Valley Brook ended up being a repurposed section of a ski lift tower from a retired local ski resort. To remove this structure, a temporary ditch was dug out around the culvert to reroute the stream. Flow through this structure was blocked using temporary dam structures placed upstream and downstream of the culvert. During removal, constant dewatering of the crossing kept sediment from getting washed downstream.

Ski lift tower culvert removal on Valley Brook.

Constructed Riffle & Streambanks

New streambanks and a riffle were constructed in place of the ski lift tower culvert on the Valley Brook mainstem. The streambanks were created using encapsulated soil lifts that wrap the soil with biodegradable material, stabilizing the newly exposed soil. Willow cuttings layered between the lifts will grow roots to provide stability over time as materials break down.

The riffle was installed to provide grade control on this steeper stream section and improve stream habitat. Constructing the riffle involved placing two logs in the stream perpendicular to the flow and keying them into the banks. These logs function as steps to break up the slope. Large rocks

Streambanks & a riffle were constructed where the ski lift tower culvert had been

were then placed along the stretch of stream to complete the riffle.

Stream Channel Realignment & Alluvial Fan Reconnection

MWA was able to reconnect a ditched tributary to its historic path. This ditched stream was highly erosive, frequently flowed onto the road, and deposited a large amount of sediment into Valley Brook. A new channel was dug, crossing the retired road and connecting the stream to the original channel on the other side. The old ditched channel was plugged to disconnect it from Valley Brook. The downslope stream bank at the crossing was constructed with encapsulated soil lifts to provide extra stability and ensure the stream would not leave its new channel and flow down the road. By reconnecting the channel, the historic alluvial fan was also reconnected, which is the section of stream where deposition of materials occurs.

Woody floodplain structures were installed across the alluvial fan to provide roughness to the floodplain, encouraging water to slow down, spread out, and deposit sediment.

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Valley Brook Restoration, cont'd.

Beaver Dam Analogues & Wetland Restoration

NorthWoods Stewardship Center crews and VT Fish & Wildlife Department staff built thirty-five beaver dam analogues (BDAs) in five ditched and channelized tributaries across the site. BDAs are a form of low-tech restoration that mimic natural beaver dams. They allow water to slow down, deposit sediment and nutrients, spread out onto the floodplain, and create wetland habitat. They are built by driving multiple posts into the streambank and streambed, and weaving branches between the posts. Mud and sod is packed into the dam along the stream bottom and banks of the structure, like in real beaver dams.

In total, 3.65 acres of wetland habitat were enhanced via removal of floodplain fill, plugging ditches, reconnecting the stream with its alluvial fan, and installing beaver dam analogues. Over twenty-five woody floodplain structures were installed to create roughness, and 4,000 willow cuttings were planted along the main stem of Valley Brook to improve bank stability and restore the floodplain forest.

NorthWoods Stewardship Center crew members weaving beaver dam analogs

Road Obliteration

1,600 ft of farm and forest road were decommissioned and obliterated. This road proved to be a serious sediment source to Valley Brook. The eroded road was decompacted and the fill removed from floodplain restoration was used to match hillslope grade. Woody material was worked into the soil and large pits and mounds were formed to create roughness. Waterbars and turnouts were installed along the obliterated road to break up steep sections and prevent water from flowing down the road.

Obliterated road with pits and mounds.

Floodplain Restoration

Modeling results and aerial imagery revealed just how disconnected portions of the floodplain near the barn were from stream overbank flow during the July 2023 flood. These areas were targeted for restoration to improve floodplain connectivity.

When the farm's barn was constructed, targeted floodplain sections were filled in to increase usable space, causing the stream to be locked into place and unable to access its floodplain. 3,500 cubic yards of floodplain fill was removed in the restoration project, amounting to excavating three feet down in some areas. Woody material was worked into the floodplain to create roughness. Once pits and mounds were again constructed to create microtopography to break up the flow of water, the new floodplain was ready to be seeded with locally sourced, native species.

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Valley Brook Restoration, cont'd.

Aerial image of Valley Brook post-flood; red lines outline flood extent; blue polygons outline targeted floodplain sections not accessed during the flood.

Direct Seeding

The Riparian Lands Native Seed Partnership (RLNSP), coordinated by Brooke Fleischman and Jess Colby, works to increase locally adapted native plant materials available for restoration projects by developing a network of nurseries, restoration practitioners, and stakeholders. By increasing partnership and infrastructure, we aim to increase capacity to meet the need for local native plant materials for projects such as the Valley Brook Streambank Management Area. In addition to fostering partnership, the RLNSP leads in best practices when working with native woody seed. These seed protocols are informed by national and international industry professionals who have researched techniques in native seed handling. Since formalizing the RLNSP in 2023, seed collection, cleaning, and storage procedures have been drastically improved and will continue to improve as more information is gathered.

Through these improved protocols, the NorthWoods Riparian Lands team realized that seeds collected in previous years (2020, 2021, and 2022) were not handling storage well and should be cast out immediately to create space for incoming higher quality seed. A lot of these seeds had not been processed as well as those collected in 2023 and were not germinating as expected during testing. In an effort to purge old collections before they deteriorated completely, the Riparian Lands team decided to use them to seed the newly formed Valley Brook Streambank Management Area following the intensive restoration efforts completed during the summer of 2023.

Initially, the goal was to utilize an ATV to maneuver a hydro-seeder around the site to sow the alder, birch, and cedar. Unfortunately, this mix of seeds clogged the machine and caused it to spread mostly seed-free water. At this point the team pivoted to broadcasting the bigger seeds (chokecherry, black cherry, highbush cranberry, dogwood, and any leftover cones or catkins) by hand. This method was effective at getting the seed out, but the seeding rate was not guaranteed to be as evenly distributed across the site.

NorthWoods Stewardship Center & Intervale Center seeding the Valley Brook floodplain.

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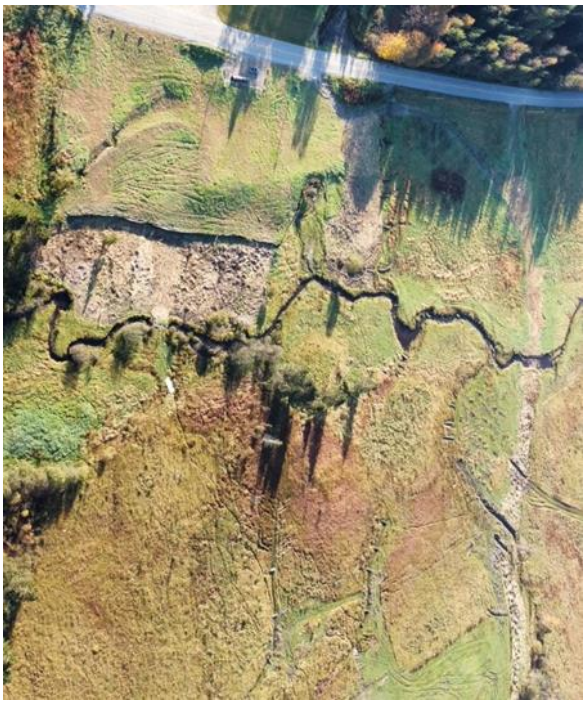
Valley Brook Restoration, cont'd.

In early May, the Riparian Lands team met up with MWA to conduct a site check of the direct seeding area and see if seedling growth was occurring. This site visit proved to be rewarding, because the team ended up finding many little chokecherries growing throughout the seeded area (pictured below). The team will continue to visit this site as the season progresses to check on further native seedling development. NorthWoods will continue to sow processed fluff remnants on this site as well - as seeds are still encapsulated in the fluff are too labor-intensive to clean.

Chokecherry seedling © Jess Colby, NWSC (5/6/24)

Phase I implementation was funded by a VT DEC formula grant through the Memphremagog Clean Water Service Provider (CWSP), via the Vermont Housing and Conservation Board (VHCB). Woody structure installation was funded by the VT Nature Conservancy. Funding for project development and designs was through the Great Lakes Fishery Commission (GLFC). Farm retirement, conservation acquisition, mitigation, and barn reclamation were funded by the VHCB's Farm Retirement Grant and the VT Agency of Agriculture via VFWD.



Aerial image of Valley Brook SMA post-restoration

Gabryel Gianoni (she/her) is Memphremagog Watershed Association's Project Coordinator, and works closely with partner organizations to restore streams, floodplains, wetlands, lakeshores, and forested headwaters across the Memphremagog basin.

Jessica Colby (she/her) is NorthWoods Stewardship Center's Riparian Lands Project Coordinator. Jess leads a seasonal crew in tree planting, seed collection, invasive species removal, and other restoration projects. She works closely with the Intervale Center's Statewide Seed Coordinator, to develop the Riparian Lands Native Seed Partnership.

Brooke Fleischman (she/her) is Vermont's Statewide Seed Coordinator and is based out of the Intervale Center's Conservation Nursery. She works closely with partners such as NorthWoods Stewardship Center, Vermont Fish & Wildlife, US Fish & Wildlife, as a part of the Riparian Lands Native Seed Partnership to address native tree and shrub seed shortages in the state.

Verterra Nursery

A new native woody plant nursery in Hinesburg, VT

By David Berg

There is a new native plant nursery in Hinesburg Vermont! Verterra Nursery is a collaboration between three colleagues (Nick Kierstead, Sam Gignoux, David Berg) who all share a passion for growing plants and promoting the use of native plants in our landscapes. Our primary goals are to provide quality native plants for habitat restoration projects in our region, to serve and educate homeowners on the benefits of native plants, and to demonstrate sound land management practices. We are planting our first crops this spring and are on track to have offerings available by this time next year.

Verterra is also pleased to announce a unique opportunity to get free plants for habitat restoration projects in the Lake Champlain Basin. Thanks to a grant from the Lake Champlain Basin Program (LCBP) and New England Interstate Water Pollution Control Committee (NEIWPCC), Verterra is able to provide plants at no cost to any group (gov. agency, non-profit, restoration practitioners, etc.) working on riparian or habitat planting projects in the Lake Champlain watershed. This opportunity is limited to a total of 7500 plants and the plants will ideally be installed before the end of 2026.

We encourage anyone interested to email us at verterranursery@gmail.com so that we can start to plan – we hope to have all of these plants designated for projects before they are harvested. The plants available for this free opportunity are from our first round of dormant cutting production and as a result will be mostly willows (mix of tree and

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Verterra Nursery, cont'd.

shrub species), dogwoods (silky and red-osier), Eastern cottonwood, and black elderberries. These cuttings have all been sourced from wild Vermont plants in the Hinesburg area and are currently being transplanted to our growing fields – they will be ready for bare root harvest and planting on projects by spring of 2025 and/or 2026. A complete list of exact species and quantities will be available this summer.

Seeding and softwood cutting production are lined up for this year as well and will include a broader range of species (maples, viburnums, larch, and many others). Our goal is to produce a diverse selection of species, and we would love to hear from any folks involved in designing and installing habitat restoration projects so we can focus on growing the species that are most desired/needed. We are excited to be a part of the habitat restoration process and look forward to collaborating with all the various groups in the conservation community that do this important work.

With our diverse experience and background in plant production and land management, we are well equipped to provide planting services as well. If interested, please email us to see if we can assist with your project. Please visit our website, Verterranursery.com (coming soon) for a little more info about who we are and to stay updated on our progress and offerings. ◆

Dave Berg attended UVM's Rubenstein School of Natural Resources and then worked at Horsford Nursery for 16 years, managing tree and shrub production before making a career transition to conservation horticulture and starting Verterra Nursery.

Sam Gignoux has owned and operated Imagine Landcare for over 30 years and has experience raising livestock in Vermont. He is also a partner and equipment manager at Verterra Nursery.

Nick Kierstead has been a vegetable farmer at many scales and a manager at Maple Wind Farm. He currently owns and operates Full Branch Tree Care in addition to being the third partner of the Verterra Nursery LLC.

Listserv posts needed! *Help promote the Watershed Forestry Partnership, your work, and your organization by posting questions, answers, insights, ideas, and news to the WFP Listerv. Once you are a subscriber to the listerv, posts can be made by emailing the text to:*

watershedforestry@list.uvm.edu.

If you are not a subscriber but would like to be, send a request to join to Shawn: shawn.white@uvm.edu

or send an email to listserv@list.uvm.edu with the following in the body of the email (no subject line needed):

subscribe watershedforestry FirstName LastName

Ausable Conservation Nursery

Rooted in Resilience

By Kiana French

The Ausable River Association (AsRA) proudly announces the launch of its newest project, the Ausable Conservation Nursery (ACN), situated on land provided by the Uihlein Foundation in Lake Placid.

Supported by funding from the Lake Champlain Basin Program, NEIWPCC, and private donors, ACN aims to bolster the local supply of native plants for riparian restoration. Led by experienced staff, including Kiana French as nursery curator and Tully Miller as nursery technician, ACN will focus on cultivating hyperlocal, elevation-hardy woody plants to enhance riparian habitats and increase flood and climate resilience.

The Uihlein Foundation's greenhouse where ACN's 2024 propagation will take place.

Initial efforts will concentrate on propagating key riparian species such as red-osier dogwood, silky dogwood, shrub willow, and red maple, sourced from local habitats. ACN staff was busy this spring collecting hardwood cuttings for propagation and seed collection is currently underway. Seedling propagation will begin in June in the Uihlein Foundation's greenhouse. These plants will be transferred to the production field for growth before being distributed for restoration projects. Fertility and weed management plans for the nursery production field include successional planting of buckwheat cover crop in early summer, followed by winter rye in late summer to prepare the field for transplanting in Fall 2024 and Spring 2025. ACN will collaborate with local stakeholders and volunteers to facilitate seed collection, propagation, and planting efforts.

The long-term goal of the nursery will be to provide AsRA with planting materials for all of its river restoration projects, and ultimately to have stock available for distribution to other landowners and organizations in the Ausable River watershed.

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Ausable Conservation Nursery, cont'd.

With the support of the Uihlein Foundation, ACN has established itself as a hub for hyperlocal native plant cultivation, addressing the need for resilient vegetation in restoration projects. By engaging volunteers and the community, ACN aims to expand its impact on stream health, habitat conservation, and community resilience in the face of climate change.

Kiana French is the Nursery Curator for the Ausable River Association's new nursery. From 2021-2023 she worked as the Nursery Coordinator for the Intervale Conservation Nursery. She has also worked in the organic farming and local food scene in NY, Hawaii, and New Zealand. When not out collecting seeds or planting trees, she spends her time skiing, biking, hiking, and exploring the mountains.

The Ausable River Association is a science-based nonprofit whose mission is advancing guarding water quality, protecting native habitats, inspiring action through outreach and recreation, and advocating science-based management. To learn more about the Ausable River Association and the Ausable Conservation Nursery project, sign up for the AsRA e-newsletter or contact Kiana French for more information. ◆

Same Mission, Same Wavelength!

How 1400 trees got planted on the Bouquet River

By Richard Redman

Over a two-day period, the Boquet River near Wadhams, New York got a facelift. Over 6000 feet of eroded banks along the river were planted with 1400 trees, some potted, some bare root and others live cuttings. The potted plants included red osier dogwoods, river birch, elderberries, cotton wood, sycamore, speckled alder, red maple, yellow birch. The bare root trees were swamp white oak and American plum. Live willow cuttings were taken on site from native willows. All the plantings were on private property. The Hainer, Pratt and Pierce families are willing landowners who want to improve the river ecology.

The money for the project originally started with a donation by the Verizon Corporation. From there it went to the Arbor Day Foundation and Trout Unlimited National. The goal was to plant 1000 trees in the Adirondak Park. When word trickled down to the TU Chapter level, the Lake Champlain Chapter jumped at the chance to do more plantings along the Boquet River, so within a day or two of the requests for site proposals, the paperwork with maps were completed, and submitted. In this case, there was no hesitation and it paid off.

Over 2- or 3-months the planning and logistics of the planting were completed, and the word went out via environmental group newsletters, e-mails, and the local press. TU National purchased the potted trees and they were delivered 4 days before the planting dates, Friday April 26, and Saturday the 27th, 2024.

Over that 4-day period, the holes were pre dug by the Juniper Hill Farm (Hainer Family) staff using a skid steer and 4 inch and 12-inch augers. Potted plants would go in 12 inch wide, 8-inch-deep holes, and the 8-foot-long willow cuttings would be in the 6-foot deep, 4-inch-wide augured holes. The potted plants were set out on the various sites in advance of the planting dates, and the willow cuttings were in tubs filled with water to keep them from drying out and dying. This preplanning effort made the planting easier for the planters. It reduced wasted time.

The Plattsburgh State University Twin Valleys site was mission control, and cabins were available for long distance travelers. All the meals and drinks were provided and purchased by TU locally through bakeries, and coffee shops. It was a great

Same Mission, Same Wavelength, cont'd.

coordination effort by all involved.

Tree planters included members of Trout Unlimited National, the Lake Champlain Chapter of TU, the Adirondack Chapter of TU, the Boquet River Association (BRASS) the local Essex County Soil and Water Conservation District (SWCD), the Adirondack Council, and Ruffed Grouse Association, plus individuals who share the same concern to protect our rivers. Over 27 planters were on site the first day, Friday, and on the second day, we had 50 planters ranging in age from their teens to their 80's.

If you review the mission statements of all the groups, we share the similar mission, to protect and enhance our cold-water streams for trout and salmon, to improve the quality and life within our watersheds, and to help preserve the water of the 6-million-acre Adirondack Park. For the individuals involved, we all share the same ecology-based wavelength! Likewise, minds, do likewise conservation work.

After two days of back-breaking bending-over, filling holes with soil, tamping out air pockets, watering trees, dragging buckets and hose, putting ribbon on trees marking them as completed, it was cold-water conservation work accomplished.

Our shared goal is to improve the riverine ecology. Trees will support the banks reducing erosion. The trees will also help collect sediment from flood waters. In the future the trees will provide shade to help cool the waters, and leaves will provide food for river invertebrates which will in turn feed the fish.

There is one simple thing about conservation. It is not about what political party you lean towards. All political parties share the same goal, wise use of our Natural Resources. We proved it, the community was brought together in a shared goal, the protection of our Boquet River. A Special THANK YOU to all of you folks who helped. ◆

Rich Redman is the Region 5 contact for the Lake Champlain and Adirondack chapters of Trout Unlimited. He retired 13 years ago from the Soil Conservation Service, where he was the District Conservationist for Clinton and Essex Counties, NY. Fly fishing & forestry are his passions, and has called the Adirondacks home for nearly 40 years.

New Research-

Summaries of interesting riparian-related articles

Widespread deoxygenation in warming rivers. Zhi, W., Klingler, C., Liu, J. et al., *Nat. Clim. Chang.* 13, 1105–1113 (2023). https://doi.org/10.1038/s41558-023-01793-3

A recent article in Nature Climate Change reports the results of a "deep learning model" that was "trained" on historical water temperature and dissolved oxygen data collected as grab samples from 580 rivers in the US and 216 rivers in Continental Europe from 1981 to 2019. They found 87% of these rivers have experienced an increase in water temperatures during this period (median increase = 0.16°C/decade in the US), and 70% showed declines in dissolved oxygen (DO) levels (0.034 mg/l/decade in the US). While most of the deoxygenation was determined to be due to higher water temperatures (in turn driven primarily by air temperatures), other factors included light intensity/turbidity, flow, and photosynthesis:respiration rates. Urban rivers have the fastest warming trend, while agricultural rivers have the highest deoxygenation rates (despite warming the least), and Northeastern and Midwestern US rivers have warmed more than in other areas studied.

Intergovernmental Panel on Climate Change climate predictions were fed into the model to forecast future water temperatures and dissolved oxygen levels. Projected river-warming and deoxygenation rates are predicted to double in the US compared to historic rates, while low-oxygen (hypoxic) conditions which adversely impact water quality and aquatic habitat are predicted to become more frequent.

Other interesting tidbits mentioned in this article:

- Hypoxic events occur in rivers much more frequently than was previously thought, occurring most often in the early morning after a night of no photosynthesis or during flooding when turbidity limits light penetration.
- Higher dissolved oxygen levels were found in urban areas with vegetation compared to areas with high amounts of impervious surfaces
- Deoxygenation can be exacerbated by high nutrient levels due to an increase in respiration versus photosynthesis. Therefore, when rivers with similar levels of warming are compared, those with more nutrient loading (i.e. urban and agricultural rivers) deoxygenate faster than those in undeveloped areas.

Restoring a Degraded Riparian Forested Buffer While Balancing Phosphorus Remediation, Biodiversity, and Indigenous Land Access. Jess Rubin, et al., *Sustainability* 16, 3366 (2024). https://doi.org/10.3390/su16083366

This paper describes a four-year study of the effectiveness of commercial mycorrhizal inoculation on phosphorus (P) removal and uptake in a riparian planting project at Shelburne Farms. While soil total P concentrations decreased by an average of 17.5% in the restored plots compared to an unrestored control, no phosphorus removal benefit was observed in inoculated plots versus uninoculated. Interestingly, transplant growth/vigor and recruitment of other species was highest in the *uninoculated* restored plot, indicating the commercial mycorrhizal dip may have a detrimental effect. The authors hypothesized the mycorrhizal species in the commercial inoculum may not have been specific for the native plant species used, and perhaps acted as parasites rather than mutualists on their host plants. The authors recommend using a native inoculum instead of commercial blends and have created a recipe for an endemic mycorrhizal inoculum that can be found here.

New Research, cont'd.

Removal of phosphorus from the system via coppicing and harvesting, particularly via the collection of plant material by local Abenaki for use in traditional medicines, food, ceremony, and art was also discussed, as was mechanical control of common buckthorn.

Modeling Phosphorus Retention and Release in Riparian Wetlands Restored on Historically Farmed Land., Wiegman, Adrian R.H., Kristen L. Underwood, William B. Bowden, Isabelle C. Augustin, Tiffany Chin, and Eric Roy. Journal of Ecological Engineering Design 1 (1) (2024). https://doi.org/10.21428/f69f093e.a06ba868

Another modeling study looked at the ability of restored riparian wetlands on previously farmed land to retain phosphorus (P). The model was calibrated with field data collected from 15 plots at 3 riparian wetland restoration sites on former farmed lands that had been out of production for 10 years and used to simulate different scenarios involving water residence time, particle settling, upstream water quality, and wetland water levels. Results of the field data found that P was captured at all sites and was highest when inundation levels were highest. Soils with high soil phosphorus storage capacity (i.e., with high levels of positively charged ions that can react with phosphate ions) retain more dissolved inorganic P.

Modeling results indicated that most wetlands under most scenarios are net P sinks, despite the fact that dissolved inorganic P, the most reactive form, was more often released than retained. Dissolved inorganic P was more likely to be released when adjacent streams had low P levels. In cases where the goal of wetland restoration is P reduction, therefore, sites on streams with high P levels where the soils have the high phosphorus storage capacity should be favored over sites with low P storage capacity on streams with low P. Sites with soils with low P storage capacity can be managed to improve P retention via biomass harvesting, topsoil removal, or soil amendments that have high P-capturing capacity.

Other interesting points in this article: The total P present at a site is, by far, stored in the first 10 cm of soil, as opposed to below-ground biomass, herbaceous vegetation, leaf litter (woody biomass not included.) Farms recently out of production will shed much more P than farms that have been out of production for a length of time, with dissolved inorganic P release rates declining on the order of 10% per year.

If you would like to submit a story for a future issue, or subscribe / unsubscribe from the Watershed Forestry Partnership mailing list, contact Shawn White at shawn.white@uvm.ed.

For more information about the Watershed Forestry Partnership, please visit the website!

Thanks to Watershed Forestry Partnership financial supporters: Lake Champlain Sea Grant, American Forests, Bruce Lisman, and UVM Extension!