Restoring Lake Champlain

Monday, November 13, 2023, 12:00pm – 2:00pm Eastern

Speakers:
- **Eric Howe**, Lake Champlain Basin Program/NEIWPCC
- **Sarah Coleman**, Vermont Department of Environmental Conservation
- **Rebecca Manners Diehl**, UVM
- **Heather Darby**, UVM Extension

Watershed Academy Webcast

- The slides for today's presentations are posted on the Watershed Academy webpage.
- A recording of the webcast will be posted within the next month.

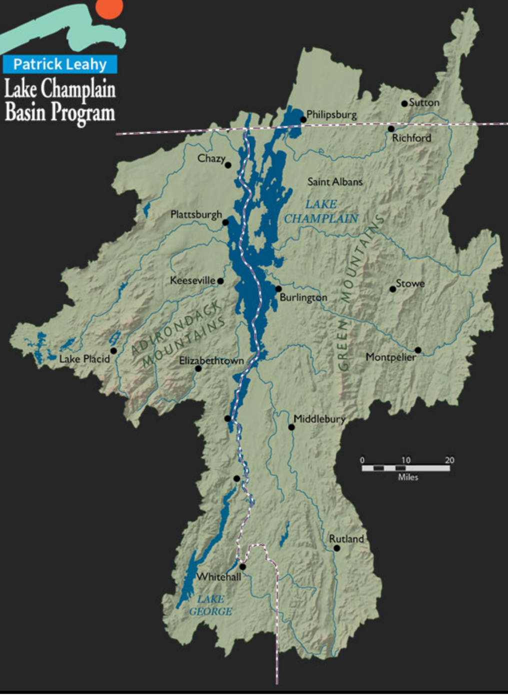
www.epa.gov/watershedacademy

Webcast Logistics

- **To Ask a Question** – Type your question into the "Questions" tool box on the right side of your screen and click "Send."
- **To Report any Technical Issues** (such as audio problems) – Type your issue in the "Questions" tool box on the right side of your screen and click "Send" and we will respond by posting an answer in the "Questions" box.

Audience Polling

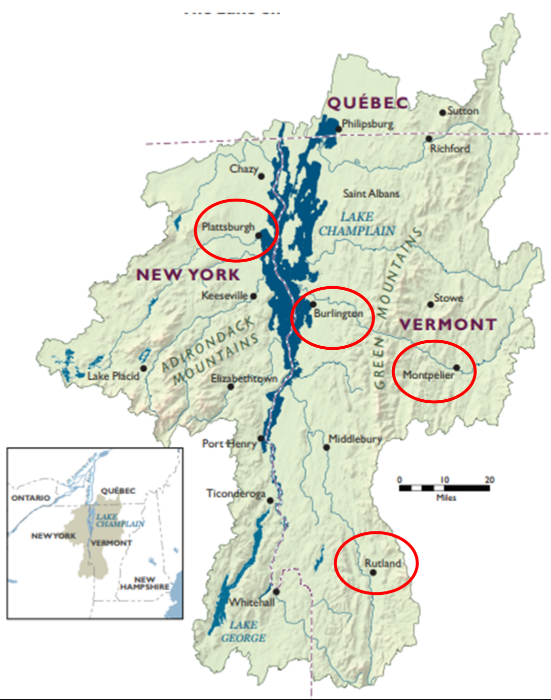
EPA Watershed Academy – Lake Champlain

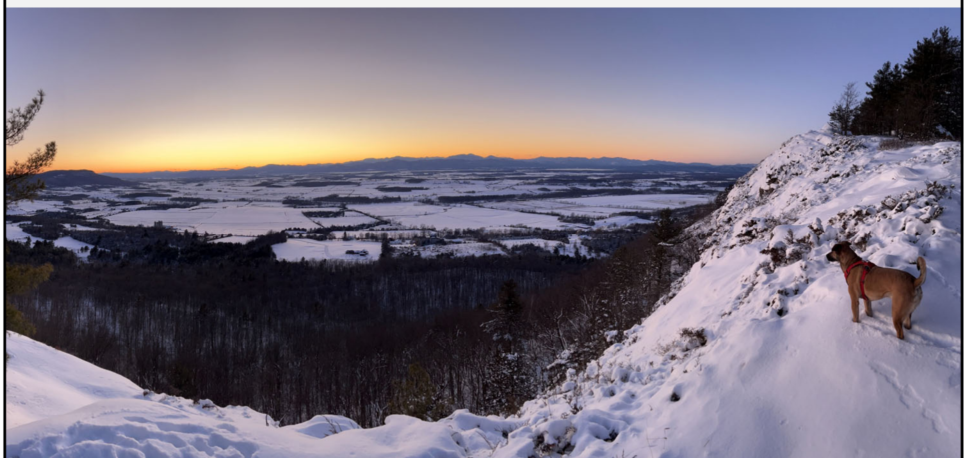


November 13, 2023

Eric Howe
NEIWPCC Program Director
Lake Champlain Basin Program
Champlain Valley National
Heritage Partnership

The Lake Champlain Basin





Looking west across the Champlain Valley from Addison County, VT

Credit: Neil Kamman

Looking east from Port Kent, New York

Credit: Kerry Crowningshield


Missisquoi River delta into Quebec
Credit: LCBP


Credit: LCBP


Lewis Creek, Vermont
Credit: LCBP


Ausable River, New York
Credit: Kerry Crowningshield

Missisquoi River, Vermont

Credit: LCBP

Burlington, Vermont

Credit: Barbara Leslie


Fort Ticonderoga in New York
Credit: LCBP


Fort Ticonderoga in New York
Credit: LCBP

Patrick Leahy Lake Champlain Basin Program

Created by

- U S Congress: in the ***Lake Champlain Special Designation Act*** of 1990.
- NEIWPCC serves as the fiscal agent for LCBP

The Lake Champlain Basin Program

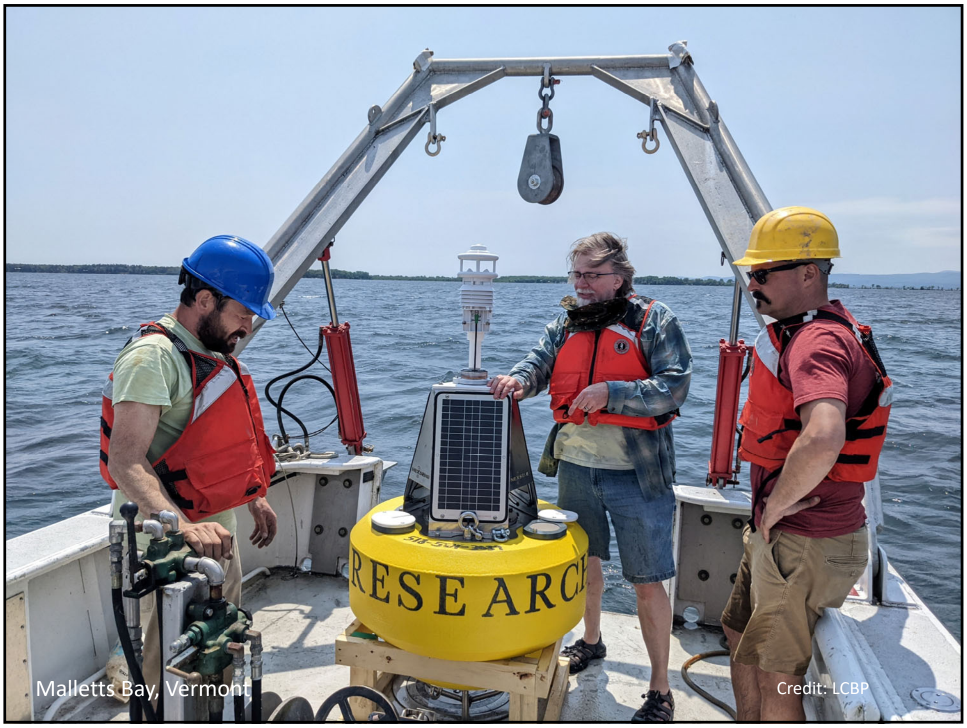
- Lake Champlain Steering Committee provides representation across jurisdictions, sectors

Watershed-based non-profit…

- That coordinates implementation of ***Opportunities for Action.***

Primary Funding Sources include:

- U.S. EPA
- Great Lakes Fishery Commission
- National Park Service


Malletts Bay, Vermont
Credit: LCBP

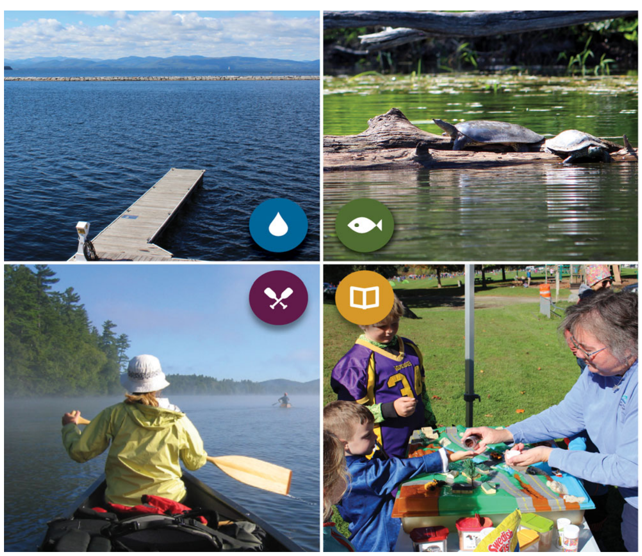

Sediment core sampling on Lake Champlain
Credit: LCBP

Winter sampling on Mirror Lake, New York

Credit: Brendan Wiltse

Clean Water

Healthy Ecosystems



Thriving Communities

Informed and Involved Public

2021
Lake Champlain
STATE
of the
LAKE
and
Ecosystem Indicators Report

Patrick Leahy
Lake Champlain Basin Program

Clean Water

Cyanobacteria

Credit: UVM Spatial Analysis Laboratory

Lake Champlain Basin Program

NEIWPCC

Figure 4.
Cyanobacteria
monitoring on
Lake Champlain
Page 11

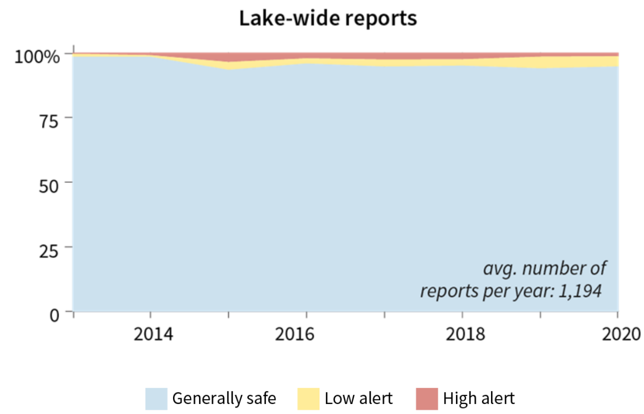


Figure 5.
Annual phosphorus
loading by
land cover
Page 13

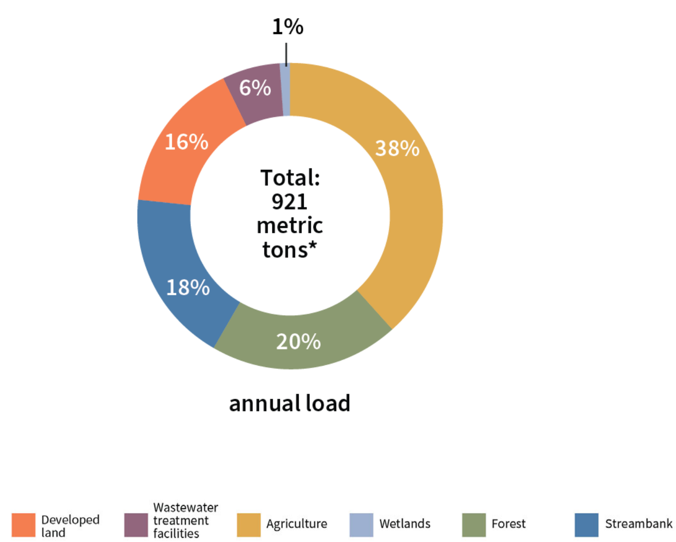


Figure 5.
Annual phosphorus loading by land cover
Page 13

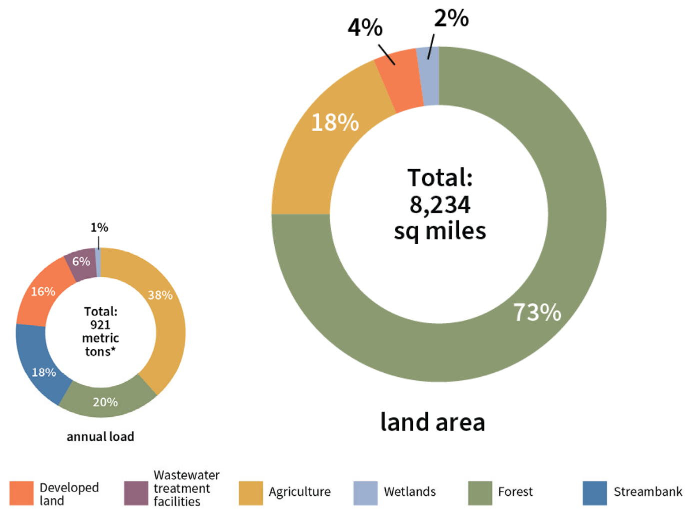


Figure 5.
Annual phosphorus loading by land cover
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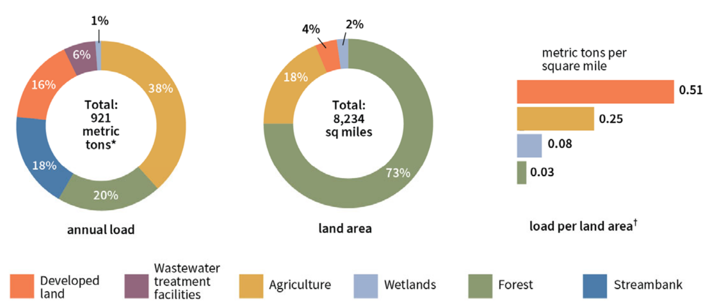
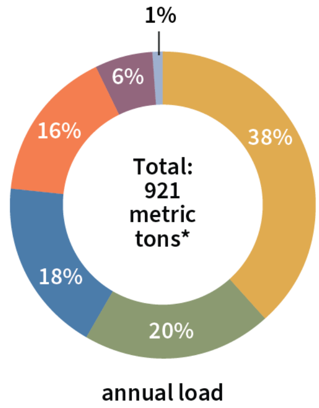


Figure 5.
Annual phosphorus loading by land cover
Page 13



Developed land | Wastewater treatment facilities | Agriculture | Wetlands | Forest | Streambank

Phosphorus TMDL allocation:
575 mt/year
Decrease of **346 mt/year (37%)**

Figure 6.
Annual average phosphorus concentration by Lake segment
Page 13

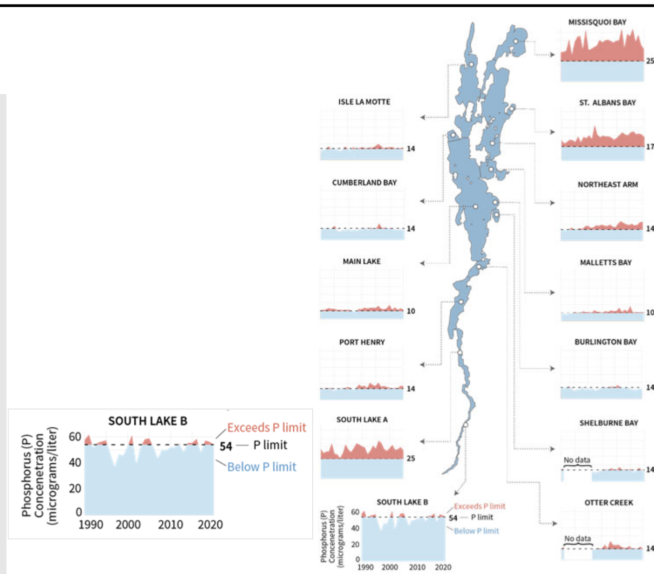
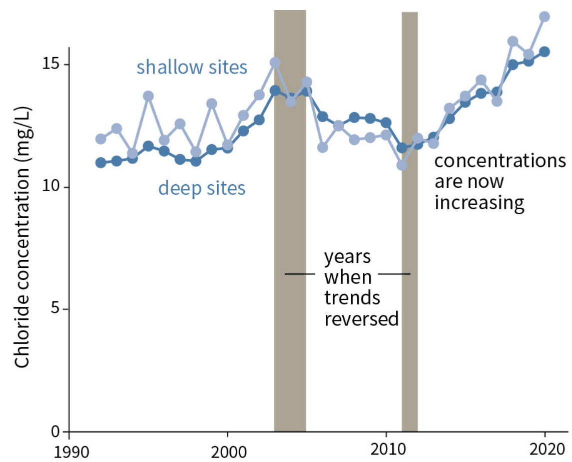


Figure 10.

Annual average chloride concentration in Lake Champlain

Page 16



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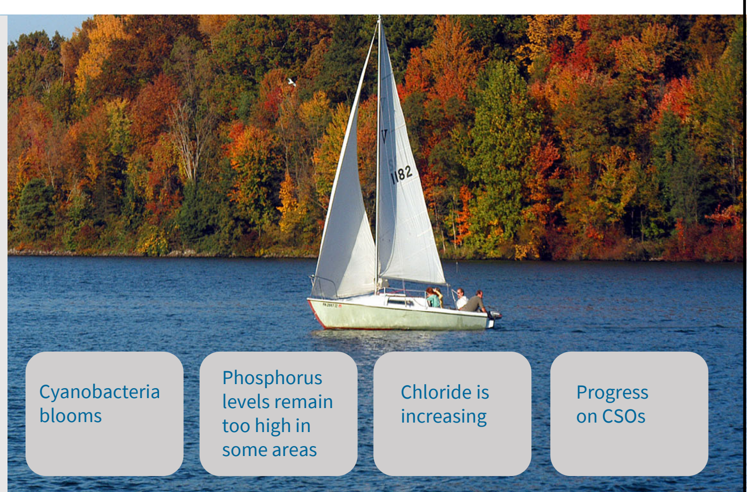
Clean water overview

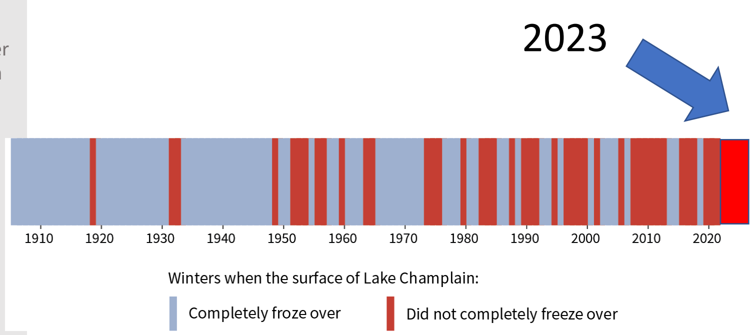


- Cyanobacteria blooms
- Phosphorus levels remain too high in some areas
- Chloride is increasing
- Progress on CSOs

Lake Champlain Basin Program | NEIWPCC

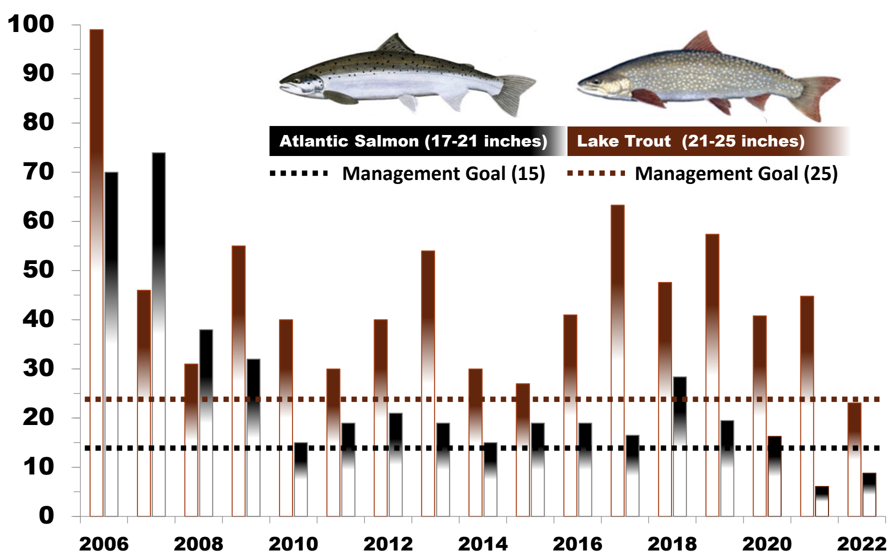
Healthy Ecosystems

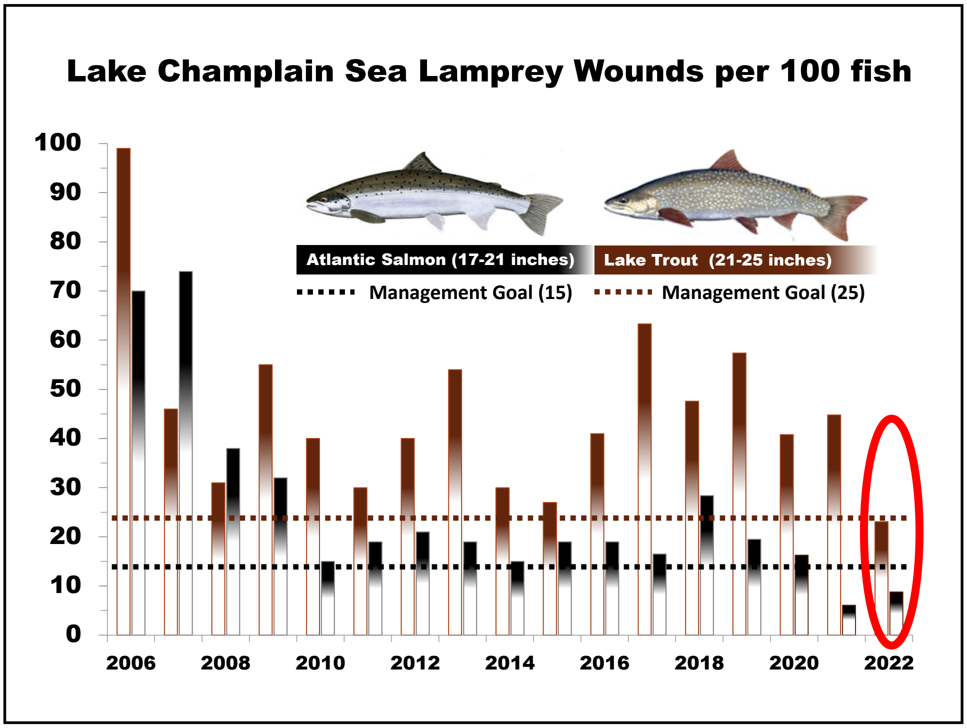
Figure 13.
Surface freeze-over of Lake Champlain
Page 21



Sea lamprey

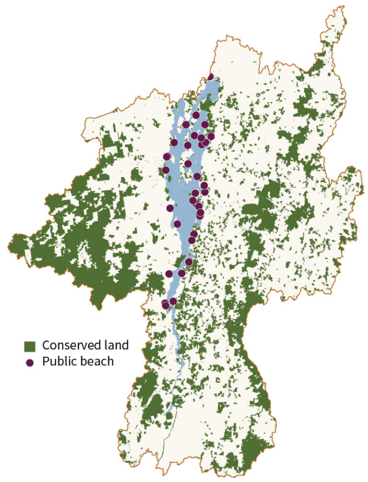
Lake Champlain Sea Lamprey Wounds per 100 fish





Thriving Communities

Figure 20.
Public beaches on Lake Champlain and conserved lands in its watershed
Page 28

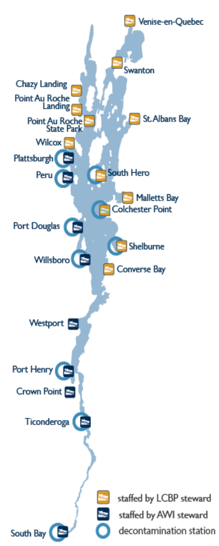


- 40% lands in basin conserved in some form
- 40+ public beaches on the Lake


Credit: SailVermont


RUTLAND RECREATI
Credit: Lake Champlain Interna

Informed and Involved Public



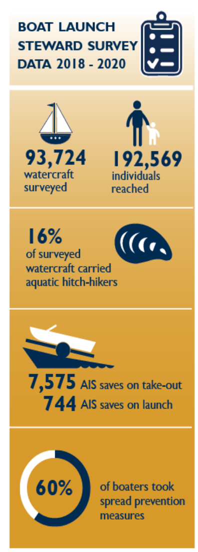


Figure 22.
Lake Champlain boat lauch steward program summary, 2018-2020
Page 31

2021
Lake Champlain
STATE
of the
LAKE
and
Ecosystem Indicators Report

Lake Champlain Basin Program

JUNE 2024
~~2021~~
Lake Champlain
STATE
of the
LAKE
and
Ecosystem Indicators Report

Lake Champlain Basin Program

Thank you!

Eric Howe, Director
Lake Champlain Basin Program
Champlain Valley National Heritage Partnership
ehowe@lcbp.org

Photos courtesy:

- Andrew Gilbertson
- Barbara Leslie
- Dr. Brendan Wiltse
- Kerry Crowningshield
- Lake Champlain International/Jack Rowell
- Neil Kamman
- Sail Vermont
- UVM Spatial Analysis Laboratory

Vermont Green Schools Initiative

Watershed Academy
Sarah Coleman, VT DEC
November 13, 2023

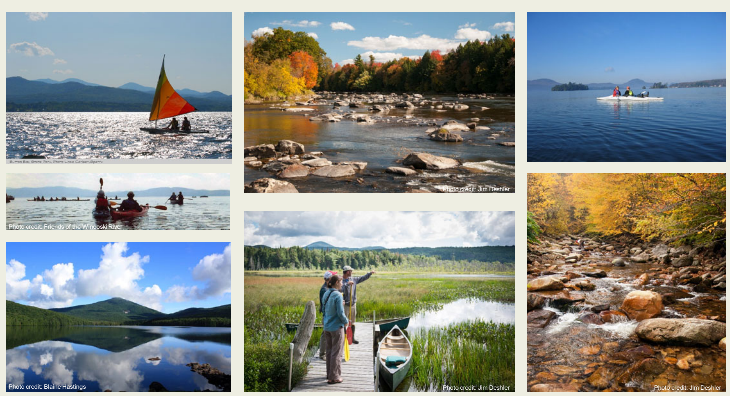
VERMONT

Outline

- Stormwater and Regulatory Context
- Vermont Green Schools Initiative
- Educational and Environmental Stewardship Opportunities

VERMONT

We care about clean water!



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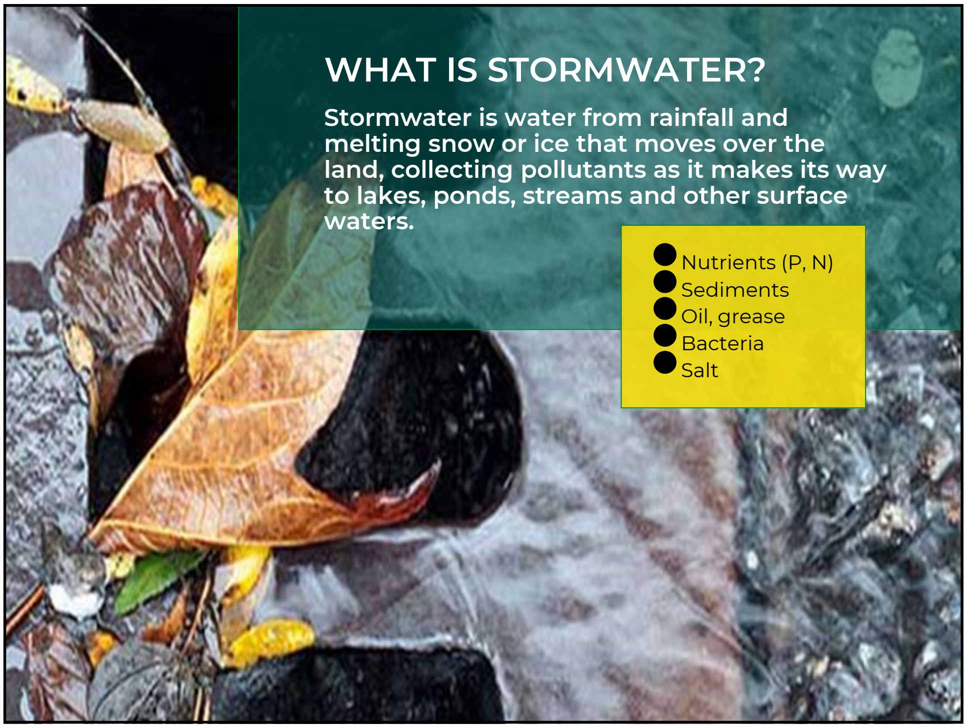
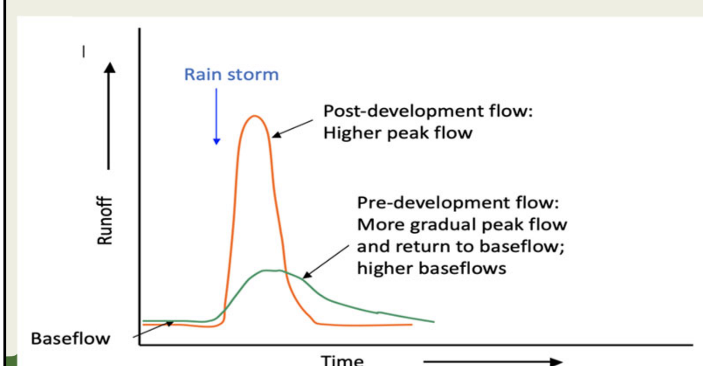


WHAT IS STORMWATER?

Stormwater is water from rainfall and melting snow or ice that moves over the land, collecting pollutants as it makes its way to lakes, ponds, streams and other surface waters.

- Nutrients (P, N)
- Sediments
- Oil, grease
- Bacteria
- Salt

Stormwater runoff in urban areas can influence water quality, habitat, erosion, and flow



Stormwater Impacts:

- Temperature
- Water clarity
- Flow volume
- Timing of flows
- Erosion / scouring
- Sediment transport

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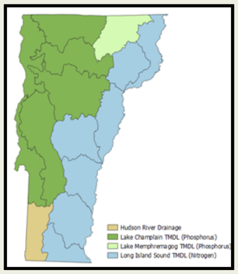
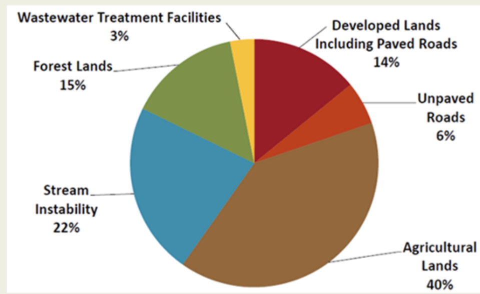
Lake Champlain Total Maximum Daily Load



Vermont's Large Scale TMDLs



The Lake Champlain P TMDL requires 21% reduction the Developed Lands sector

Vermont Clean Water Act (Act 64 of 2015) "All-in for Clean Water"

Reasonable assurance to meet nonpoint source targets:

- Water quality regulations
- Clean Water Fund
- Tracking, accounting, and reporting requirements

Stormwater General Permit 3-9050

- Important component of the Vermont Clean Water Act (Act 64)
- Assists in clean up efforts in Lake Champlain, Lake Memphremagog and stormwater impaired watersheds
- Stormwater Discharges from New Development, Redevelopment, ***3-Acre Sites***, and Previously Permitted Stormwater Discharges

What is a "*three-acre site*"?

- A site with impervious surface of three or more acres that:
  - has never had an operational stormwater permit, or
  - was permitted to standards in place prior to the 2002 Stormwater Management Manual
- These sites are required to obtain a Stormwater General Permit 3-9050 aka a ***"Three-Acre General Permit"***
- This regulation is estimated to impact 700 projects, including 8,000 landowners including about 65-70 public schools

GREEN SCHOOLS INITIATIVE GOALS

1. Achieve compliance with the Stormwater General Permit 3-9050, aka "three-acre general permit".
2. Provide Vermont public schools and Vermont State Colleges with funding assistance for the associated regulatory requirements.
3. Present educational opportunities with on-site green stormwater practices.

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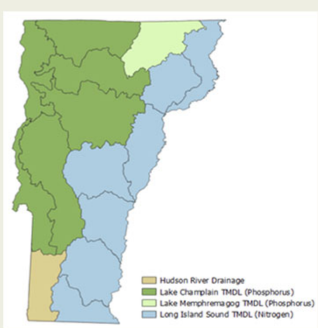
Over $20M Financial + Technical Assistance



ASSISTANCE	SOURCE
Lake Memphremagog Schools	State of Vermont Clean Water Fund American Rescue Plan Act (ARPA) funds
Lake Champlain Schools	Lake Champlain Basin Program Total Maximum Daily Load (TMDL) Implementation American Rescue Plan Act (ARPA) funds
Stormwater education, outreach activities, and capacity building	Partnership with Lake Champlain Sea Grant

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Phase 1 Permit Obtainment

November 2021 - August 2024

- School Enrollment and Outreach
- Engineering Service Procurement on behalf of Schools
- Design and permitting
- Permit Obtainment

GREENPRINT PARTNERS

VERMONT

Phase 2 Stormwater Implementation

August 2023 - December 2026

- School Enrollment and Outreach
- Selection of Schools for upcoming season
- Construction Service Procurement on behalf of Schools
- Construction in 2024, 2025, and 2026

GREENPRINT PARTNERS

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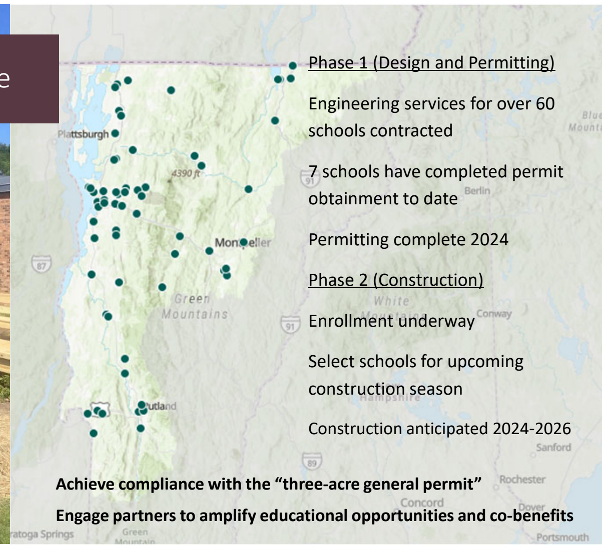
Green Schools Initiative



Phase 1 (Design and Permitting)

Engineering services for over 60 schools contracted

7 schools have completed permit obtainment to date

Permitting complete 2024

Phase 2 (Construction)

Enrollment underway

Select schools for upcoming construction season

Construction anticipated 2024-2026

Achieve compliance with the "three-acre general permit"

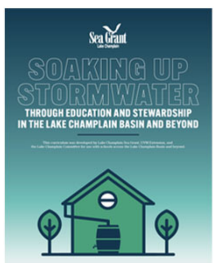
Engage partners to amplify educational opportunities and co-benefits

Stormwater stewardship and green stormwater infrastructure play key roles in improving water quality.

Amplify Co-benefits

STORMWATER EDUCATION OPPORTUNITIES
with Lake Champlain Sea Grant

K-12 Teacher Professional Development – ***including credit bearing graduate coursework***



Utilize Curriculum + Resources – ***supporting the purchase of materials to aid in stormwater and outdoor education***

Amplifying Co-benefits - ***engaging in other practices that compliment GSI projects***

Questions?

Sarah Coleman
VT Department of Environmental Conservation
Sarah.Coleman@vermont.gov

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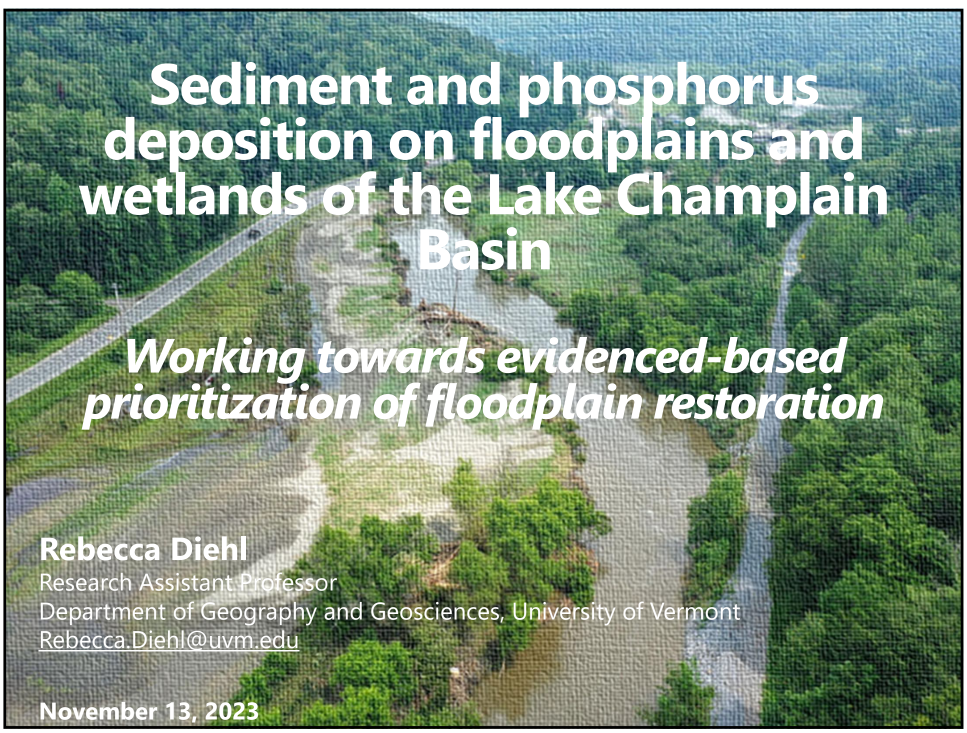

Floodplain & Wetland Monitoring Team

Rebecca Diehl, Research Assistant Professor, Department of Geography & Geosciences, UVM
Beverley Wemple Professor, Department of Geography & Geosciences, UVM
Kristen Underwood Research Associate Professor, CEMS, UVM
Eric Roy Associate Professor, RSENR, UVM
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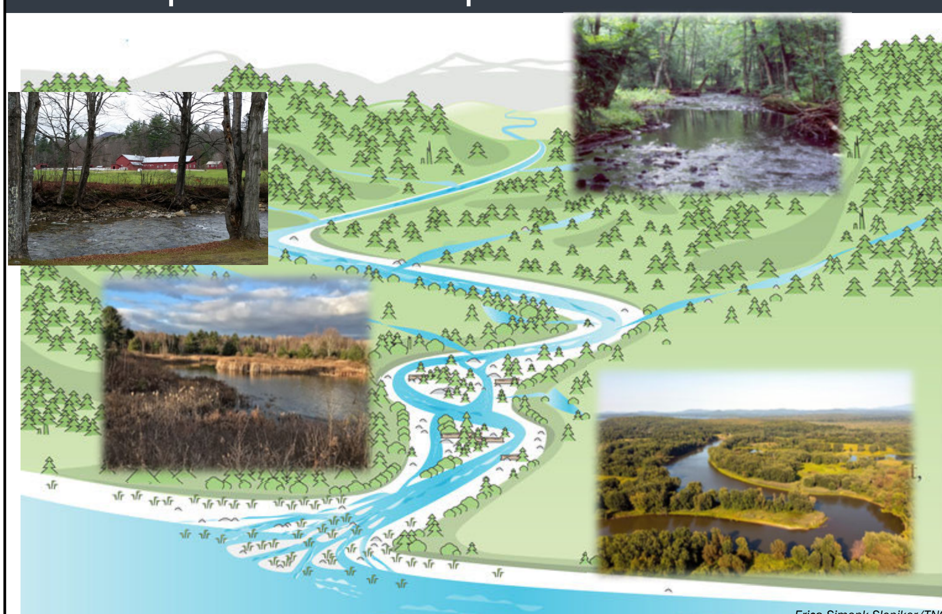
Shayla Triantafillou Department of Geography, UVM
Stephanie Drago RSENR, UVM
Don Ross Professor, Plant and Soil Sciences, UVM

VERMONT AGENCY OF NATURAL RESOURCES Department of Environmental Conservation
Sea Grant Lake Champlain
The UNIVERSITY of VERMONT
GUND INSTITUTE FOR ENVIRONMENT
Lake Champlain Basin Program
NE IW PCC
USDA NRCS United States Department of Agriculture Natural Resources Conservation Service
The Nature Conservancy

Floodplains as Phosphorus Sinks



Erica Simenk Sloniker/TNC

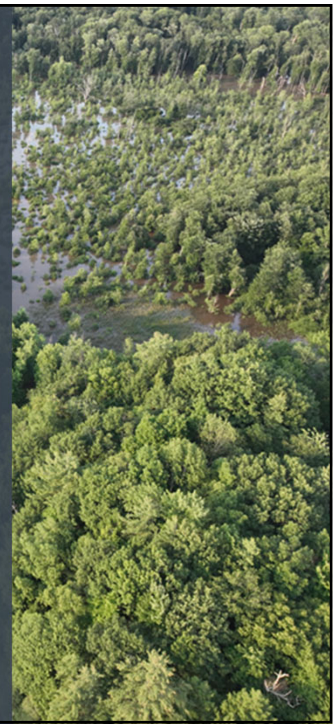
Research Objectives

To constrain the phosphorus deposition & retention capacity of floodplains in the Lake Champlain Basin

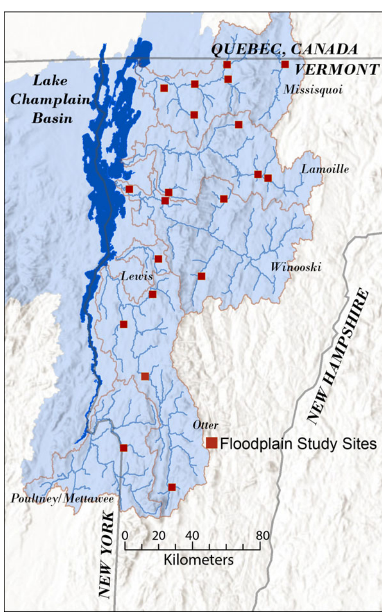
1- Build a spatially and temporally robust dataset of event-scale sediment and particulate phosphorus deposition at floodplain & wetland sites in the LCB

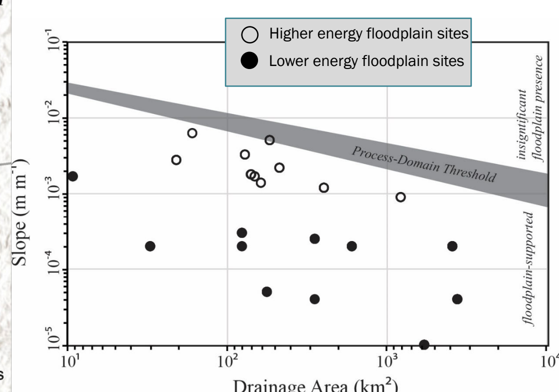
2- Identify hydrologic, topographic, and land use controls on spatial variability in deposition rates

3- Apply understanding to estimates of existing and potential sediment and phosphorus deposition & retention to identify opportunities for floodplain restoration



Floodplain Monitoring





Floodplain Monitoring

Ongoing monitoring since 2019

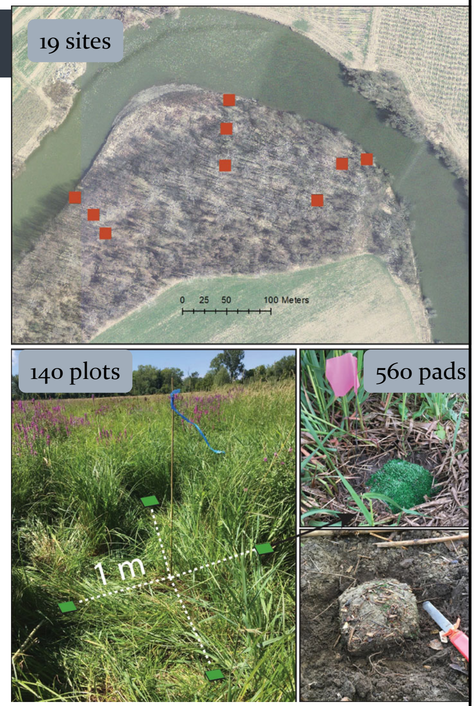
Event-scale observations

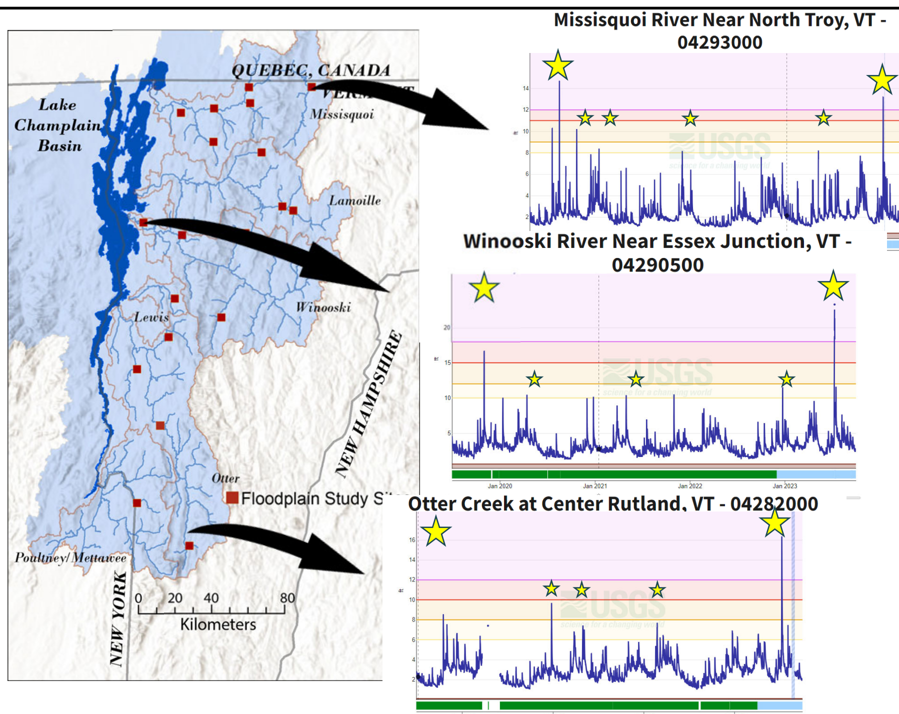
Measure mass of sediment deposited

Analyze for total phosphorus (EPA method 3050B)

Diehl, R.M., Wemple, B.C., Underwood, K.L., Ross, D. (2021). “Evaluating floodplain potential for sediment and phosphorus deposition: Development of a framework to assist in Lake Champlain Basin planning” Report to the Lake Champlain Basin Program, June 2021.

Diehl, R.M., K.L. Underwood, S.P. Triantafillou, D.S. Ross, S. Drago, B.C. Wemple. (2023). “Multi-scale drivers of spatial patterns in floodplain sediment and phosphorus deposition”, Earth Surface Processes and Landforms, 48 (801-816).





Annual Deposition Rates

Significant & Widespread Floods
November 1, 2019
>100-year RI in the North
average of 14 g P m^{-2}

July 10-12, 2023
~500 year RI flood around Montpelier

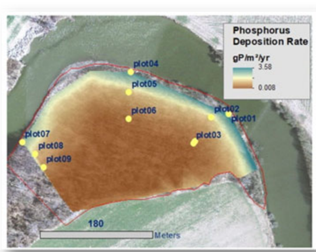
Small to Moderate Localized Floods
Varied dates by site
< 5 yr RI Flood
average of 7.8 g P m^{-2}

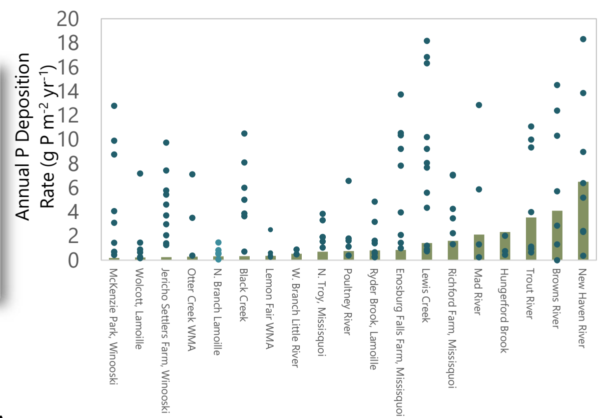
annual deposition rate of plot ($g\ P\ m^{-2}\ yr^{-1}$)

$$Dep_{yr} = \int_0^1 Dep(p)dp$$

deposition associated with an observed flood event of annual probability, p ($g\ P\ m^{-2}$)

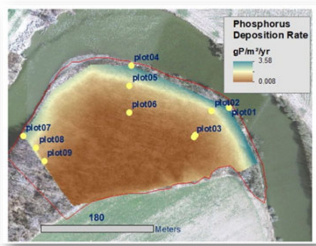
Annual Deposition Rates

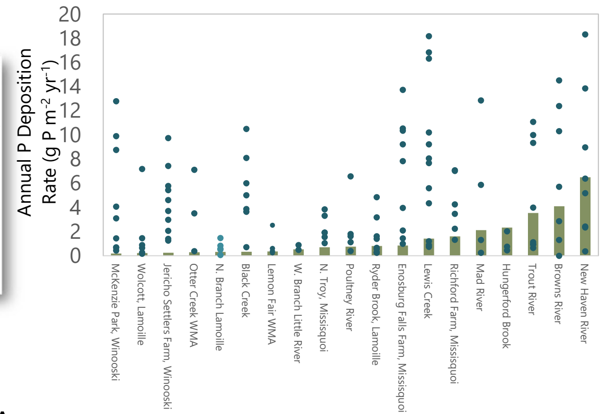




Lake Champlain Site Average
1.4 g P m^{-2} yr^{-1} (12.5 lb ac^{-1} yr^{-1}), range 0.6 to 6.5 g P m^{-2} yr^{-1}

Annual Deposition Rates



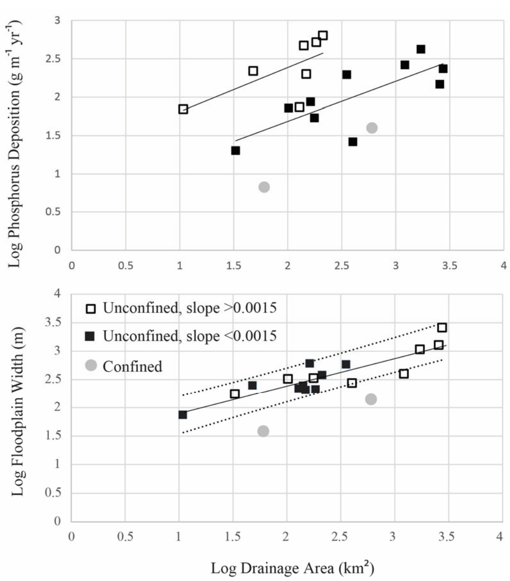


Lake Champlain Site Average
1.4 g P m^{-2} yr^{-1} (12.5 lb ac^{-1} yr^{-1}), range 0.6 to 6.5 g P m^{-2} yr^{-1}

Chesapeake Bay Site Average*
1.1 g P m^{-2} yr^{-1}

*not statistically different between regions t[33]=2.4, p=0.55
Based on McMillan and Noe (2017), Noe and Hupp (2005, 2009), and Noe et al. (2019)

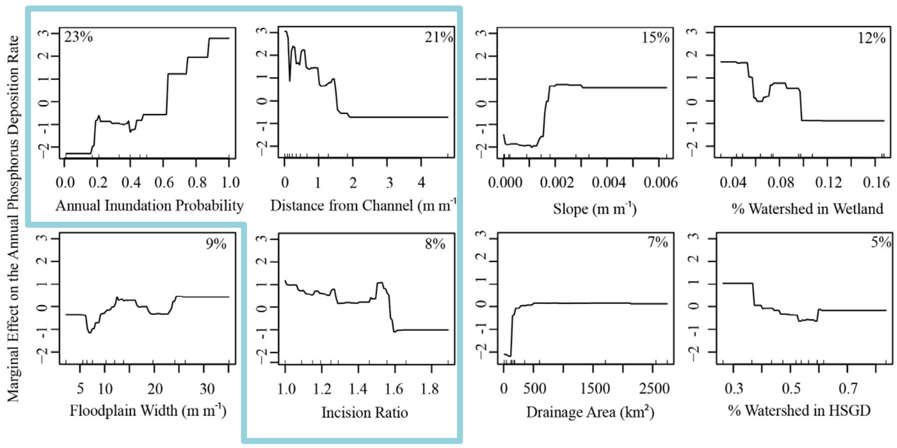
Site-Scale Variability



Through a watershed, **floodplain width**, **slope**, and **valley confinement** describe patterns in P deposition

Plot-Scale Variability

At the plot-scale, **lateral & vertical hydrologic connectivity** describe a large portion of the variability

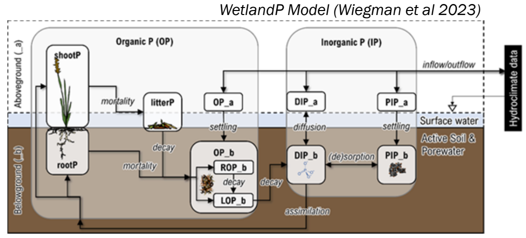


Restoration Prioritization

Can we translate our understanding of the drivers of P deposition to identify restoration opportunities?

Wetland Monitoring

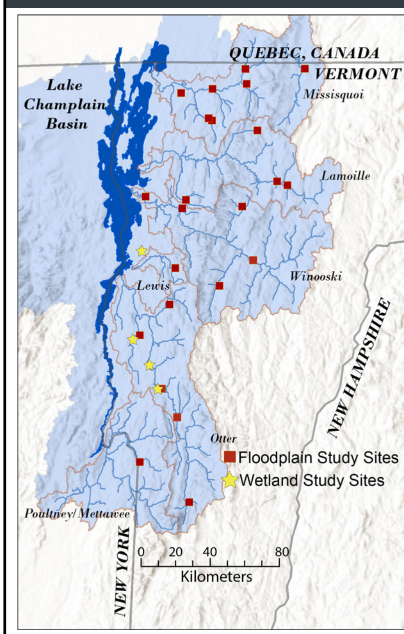
WetlandP Model (Wiegman et al 2023)

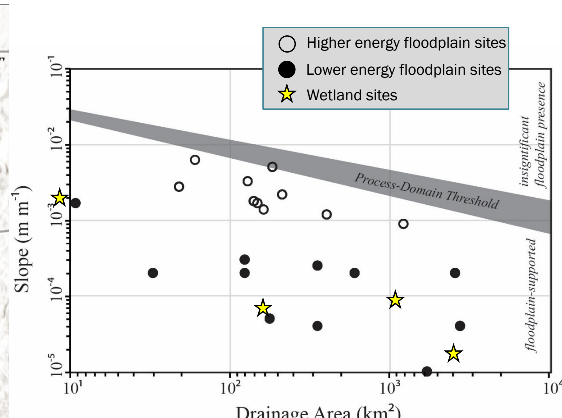


Measure deposition, and sample water and soil to understand dissolved P dynamics

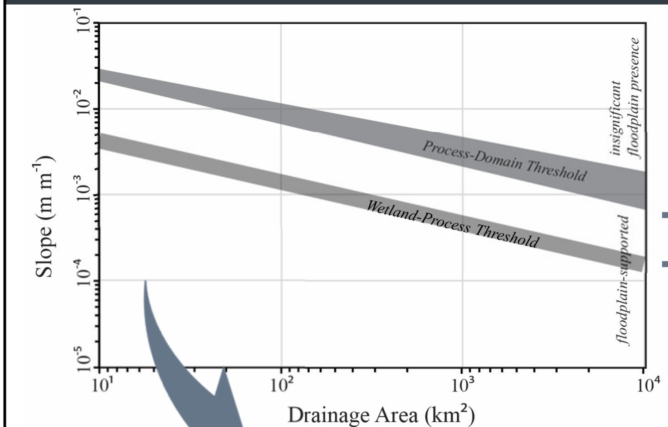
Roy, E.D., Wiegman, A.R.H., Bowden, W.B., Underwood, K.L. 2021. "Quantifying phosphorus retention in restored riparian wetlands of the Lake Champlain Basin." Report to the Lake Champlain Basin Program, October 31, 2021

Integrate Floodplain & Wetland Research





Model Applications to Estimate P Retention



Retention = Deposition

Deposition function of:
- ✓ Inundation Probability
- ✓ Incision Ratio
- Slope
- Valley Confinement

Inundation Probability > 0.5, Retention = Deposition-Dissolved P
Inundation Probability < 0.5, Retention = Deposition

Deposition-Dissolved P function of:
- Soil P Storage Capacity
- ✓ Water Residence Time
- Influent Water Quality

Evidence-Based Prioritization

Existing Conditions

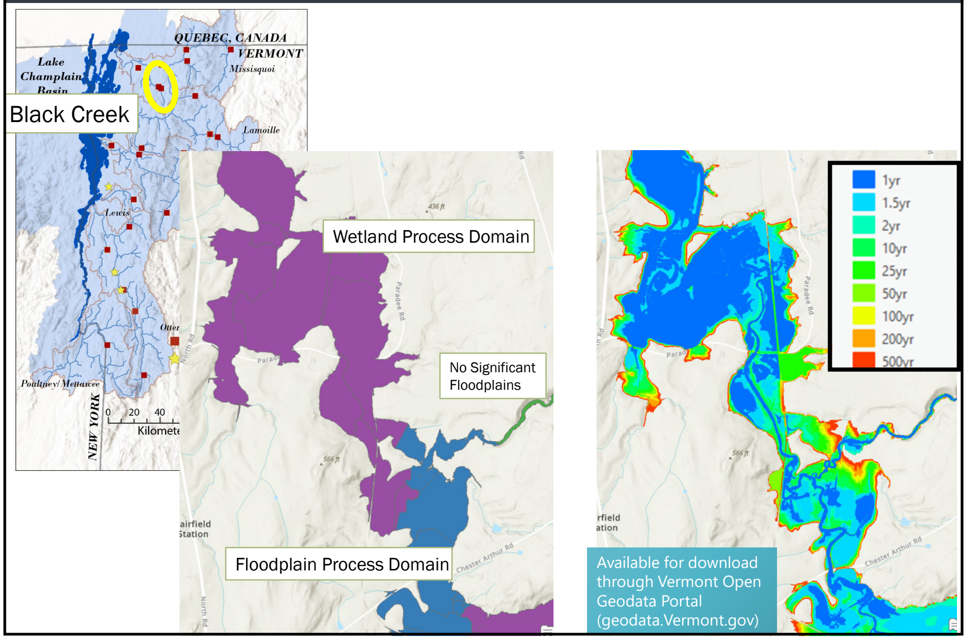
Estimate of how the floodplain functions today

Potential Conditions

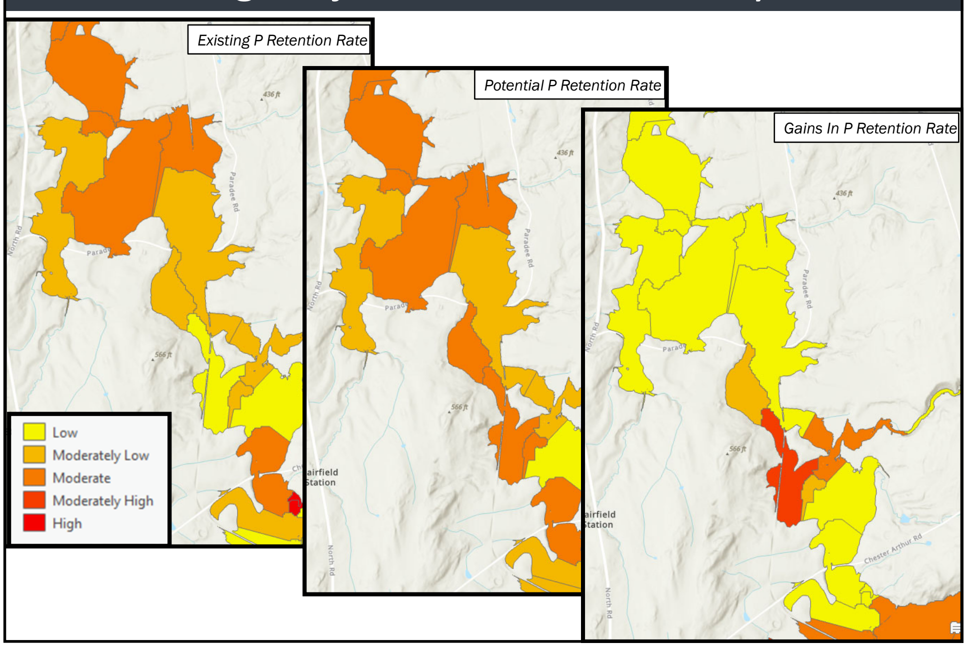
Estimate of how the floodplain may function with restoration or through time if conserved

<<<Improve Hydrologic Connectivity>>>

Prioritizing Projects for Water Quality



Prioritizing Projects for Water Quality



Concluding Thoughts

Floodplains can serve as **significant sinks of phosphorus** during floods, yet there is large variability in this function through a watershed

Valley slope & confinement as well as **hydrologic connectivity** strongest drivers in range of measured rates

We are continuing to monitor and analyze data to build our understanding of these processes.

Export not well captured in current models. Working to aggregate existing bank erosion studies

Developing geospatial layer of existing and potential phosphorus retention estimates to support the Vermont Functioning Floodplain Initiative & other stakeholders

Implementation of Whole Farm Nutrient Management to Reduce Phosphorus Loading and Improve Farm Viability in the Lake Champlain Basin

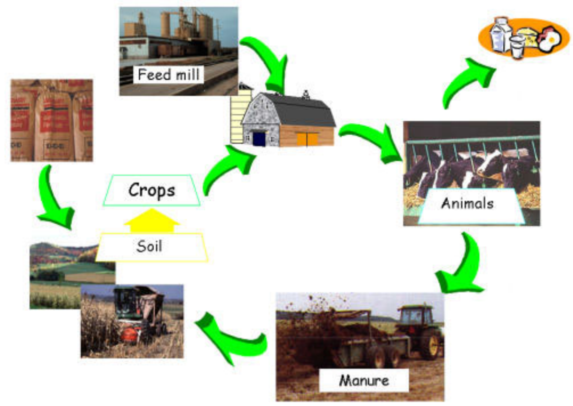
Heather Darby, University of Vermont - Extension

Project Goal

Demonstrate how, through whole farm nutrient management, improvements can be made to water quality through reduced phosphorus (P) loading and improved farm viability.

Whole Farm Approach

- Reduce Loading
- Reduce Transport
- Maximize Yield & Quality of Crops
- Optimize Rations



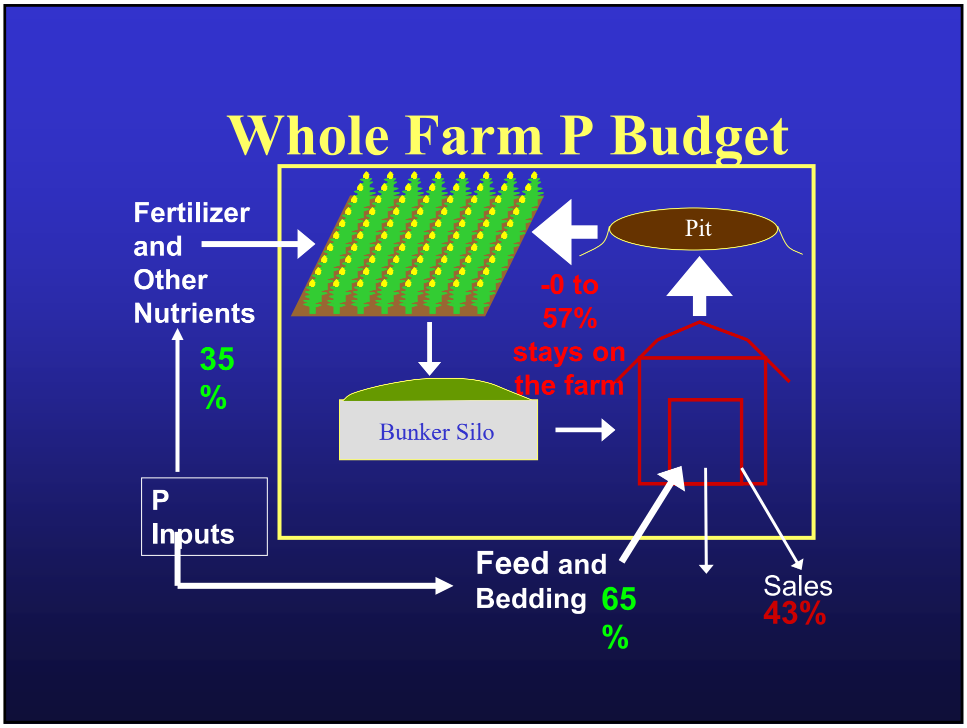
Source: Doug Beegle, Pennsylvania State University.

Whole Farm Nutrient Balance

Whole farm nutrient balance considers the location and flow of nutrients onto, within and off the entire farm.

Compares the amount of nitrogen (N), phosphorus (P), and potassium (K) and other nutrients entering the farm with the amount of nutrients leaving the farm.

Such a comparison can help in determining the economic and environmental impacts of nutrient and feed management on livestock farms.



Nutrient Management

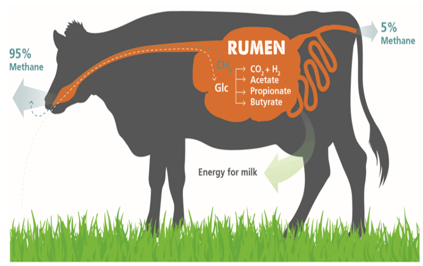
Nutrient Management Practice Standard (590)

- Combine on-farm nutrient sources, with commercial fertilizer, to meet crop needs and minimize nutrient loss.

Benefits of Precision Feed Management:

The continual process of providing adequate, not excess, nutrients to the animal and deriving a majority of nutrients from homegrown feeds.

- Improved milk components
- Less metabolic disorders; less acidosis
- Fewer foot problems
- Greater cow longevity
- Less purchased grain
- Lower vet costs
- Greater IOFC: ~30% increase



(Chase, 2012)

Benchmarks

1. Nutrient detergent fiber (NDF) intake as a percent of body weight: ≥ 0.9%
2. Forage as a percent of diet: ≥ 60%
3. Homegrown feeds as a percent of diet: ≥ 60%
4. Ration phosphorus (P) as a percent of requirement: < 105%
5. Diet crude protein: < 16.5%
6. MUN: 8-12
7. Calving interval: < 13 months
8. Cows culled < 60 days in milk: < 5%.

(Chase, 2012)

UVM Extension selected 5 farms in critical watersheds.

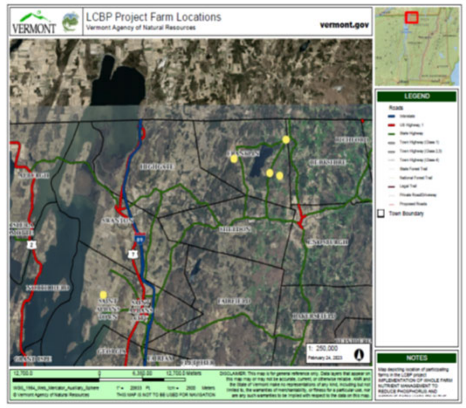
Farm #1: MFO with 400 cows and 400 replacements.
450 acres corn and 600 acres perennial forage.
Lake Carmi Watershed.

Farm #2: LFO with 750 cows and 700 replacement.
1050 acres corn and 700 acres perennial forage.
Barn fire in February of 2022.
St. Albans Bay watershed on Jewett Brook.

Farm #3: CSFO with 120 cows and 30 replacements.
140 acres corn silage and 400 acres perennial forage.
Lake Carmi Watershed.

Farm #4: MFO with 350 dry cows and heifers.
400 acres of perennial forage.
Carmi Watershed.

Farm #5: SFO with 45 cows and organic/grass-fed
300 acres of perennial forage.
Rock River Watershed.



Task 2 – Assess nutritional strategies, herd health, soil health, forage quality and quantity, conduct Mass Nutrient Balance accounting, and a NMP review.

Farm	Baseline Lbs/acre	Final Lbs/acre	Reduction
Farm 1	5.02	-3.62	100%
Farm 2	3.51	3.41	2%
Farm 3	3.62	1.39	62%
Farm 4	17.9	7.22	59%
Farm 5	3.20	1.93	40%

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Task 3 – Created a list of recommended changes and worked with farmers to develop an implementation plan that was suitable for all parties.

All the farms were considered leaders in field conservation practices.

Farms had up to date and compliant nutrient management plans.

Other practices such as no-till, cover crops, and buffers were all being implemented on the farms.

The P imports from fertilizer were extremely low on a yearly basis ranging from 0 to 0.93 tons per year.

The primary strategy to reduce P was the improvement of quantity and quality of homegrown forage.

All farms had adequate land base to produce 85% or more of the diet in forages.

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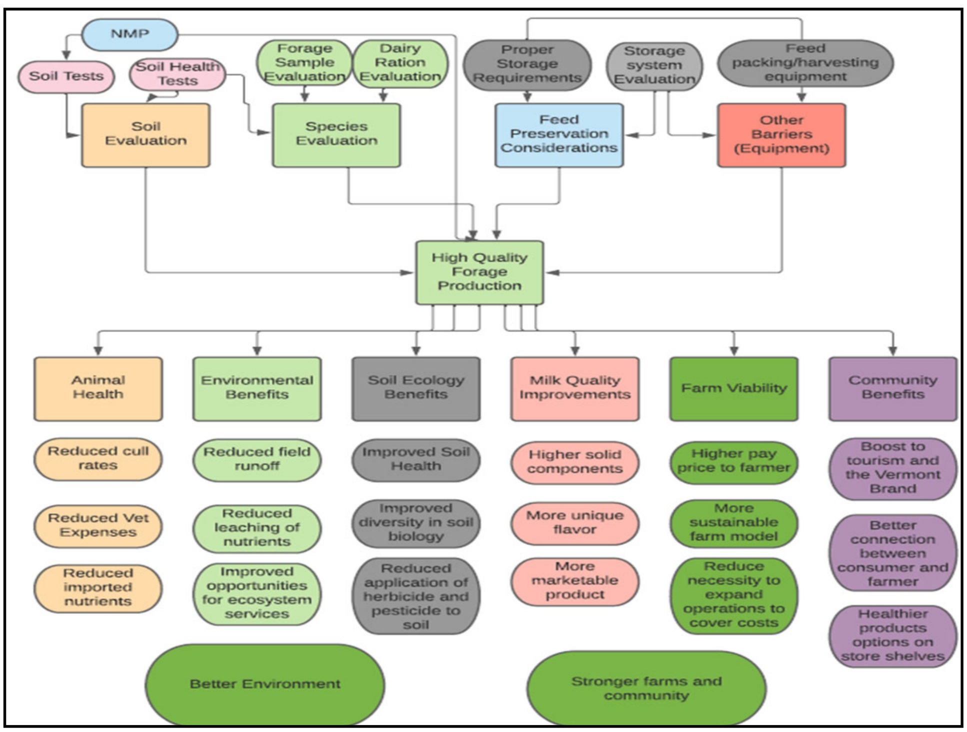


Forage Quality Targets

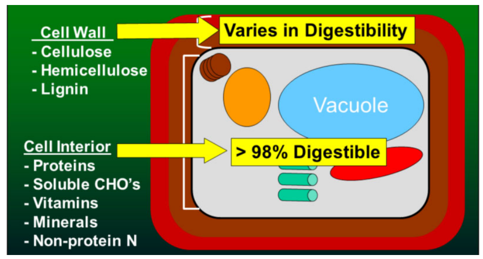
Protein	14-16%
Fiber digestibility	>60% NDFd 30-hr
Sugar	>10% ESC
Dry matter	45-60% baleage 40-50% haylage
Fermentation VFAs	
Lactic	>5%
Acetic	<2.5%
Butyric	0%

What Impacts Plant Sugars and Fibers?

- Forage species
- Field conditions
- Harvest timing
- Harvest method
- Storage

- Weather
- Seasons

Maximize Energy



Soluble Carbohydrates & Digestible Fiber

Forage Variety Selection

	DM Yield	Crude protein	WSC	Digestible NDF (48-hrs)
	tons ac^{-1}			
Fleet	4.16	0.914	0.448	1.86
Macbeth	6.67	1.48	0.675	3.01
Montana	4.56	1.07	0.501	1.91
Brome	5.13	1.16	0.541	2.26
Laura	3.75	0.857	0.483	1.64
Liherold	4.11	0.915	0.554	1.81
Preval	4.48	1.02	0.545	1.99
SW Minto	4.99	1.15	0.573	2.14
Tetrax	4.58	1.07	0.636	1.93
Meadow Fescue	4.38	1.00	0.558	1.90
Echelon	6.25	1.39	0.510	3.04
Harvestar	6.36	1.38	0.531	2.71
Inavale	5.36	1.21	0.527	2.48
Luxor	5.37	1.15	0.605	2.59
Niva	**6.69**	**1.52**	0.549	**3.14**
Olathe	6.58	1.46	0.546	3.08
Otello	5.58	1.22	0.475	2.67
Orchardgrass	6.03	1.33	0.535	2.81
Calibra	3.24	0.643	0.536	1.41
Kentaur	5.97	1.15	**0.859**	2.56
Remington	6.08	1.20	0.834	2.68
Tivoli	4.97	0.973	0.717	2.20
Tomaso	5.03	0.987	0.728	2.16
Toronto	3.94	0.804	0.595	1.73
Perennial Ryegrass	4.87	0.960	0.711	2.12

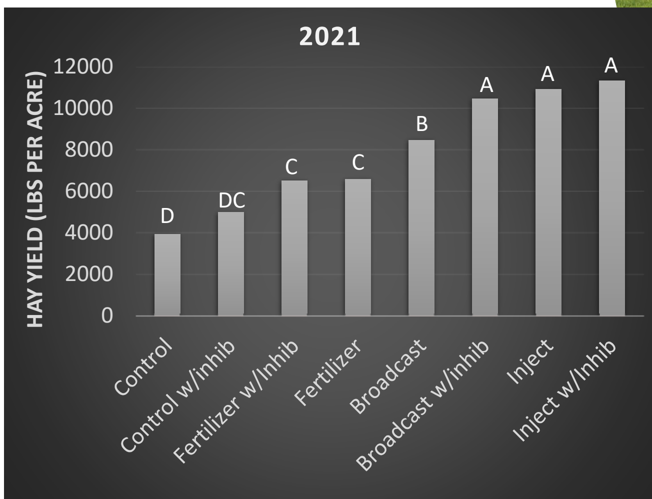
Getting it out of the field

Harvest <u>on-time</u> and <u>quickly</u> to take advantage of the highest potential quality and to retain the most of it

Diversity of stand: Grass/Legume Mixtures

Nitrogen treatment	DM yield tons ac^{-1}
Urea	1.25
Grass-legume mix	1.28
Grass alone	0.607

Inhibitors & Manure



- Inoculants
- Length of Chop
- Moisture at Harvest

4 out of 5 farms had inadequate storage



Task 4, 5, and 6 - Partners worked with the farmer as they implemented the changes, and the partners monitored the outcomes as they relate to the rest of the farm enterprise.

Farm 1. This farm's strategy was to reduce the importation of P through producing more home-grown feeds. Planted additional acres of high energy forage crops to reduce their need to purchase feeds.

Forage chop length was shortened to allow better packing the limited bunk space and to increase dry matter intake by the herd.

In the barn, herd size was optimized to minimize crowding and maximize dry matter intake of the herd.

Currently working to improve bunker storage to reduce feed losses and ultimately reduce purchased feed

Farm 2. This farm is currently rebuilding its milking facility and has no cows being milked on site.

Crop rotations improved with more fields being seeded to high energy perennial forages.

They also started to grow their own soybeans. Lastly, they hired a private nutritionist and reduced amount of purchased grain.

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Task 4, 5, and 6 - Partners worked with the farmer as they implemented the changes, and the partners monitored the outcomes as they relate to the rest of the farm enterprise.

Farm 3. Expanded the amount of corn silage to avoid having to purchase grain.

Perennial forage quality is exceptional, but adjustments were made to fertility for additional yield.

The nutritionists worked with this farm to create production groups within the herd. This allowed for more targeted grain feeding.

This farm's major issue is adequate feed storage. The system results in significant losses forcing them to purchase more grain as high-quality feed put into the bunk is degraded due to poor storage conditions. The project team helped the farm develop a short-term plan to reduce losses through utilizing wrapped round bales.

Farm 4. This farm continues to look for ways to remain viable without milk as the basis of its revenue generation. This farm raises only perennial forage but was buying corn silage.

Focused on more forage, higher quality, and less corn silage importation.

Farm 5. Overall their yields were very low and the team assisted with improved production, harvest timing, and also chop length.

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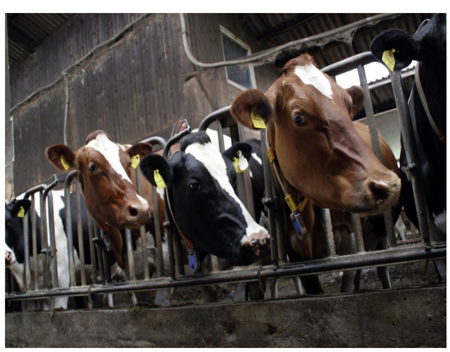
Whole Farm Forage Management

Field Management

- ↓Purchased Feeds
- ↑ Soil Storage of C and N
- ↑ Yields: dNDF, dStarch
- ↓Shrink & Spoilage
- Optimize Manure/Fertilizer (PSNT, Soil Tests, Inhibitors)
- Optimize Forage Management (Species, Harvest, Inoculants)
- Maximize Conservation (N0-Till, Cover Crops, Rotations)



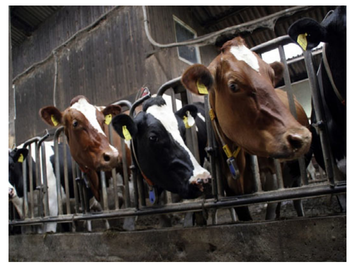
Intended Net Outcomes

↑ Cash Flow, N Utilization (Nutrition & Manure/Fertilizer)
↓P imports & LCA GHG

Cow Management

- ↑ FPCM Milk Fat Protein >6.5 lbs
- Precision Feeding
- ↑ Yields: dNDF, dStarch
- ↑ Home Grown
- ↓ Reduce Urinary N – Improve N efficiency
- Segragation/ Feed out rate
- ↓Shrink & Spoilage
- Optimize Animal #'s
- Stk density/Replacements/Longevity

Farm	Baseline % Forage	Final % Forage	Phosphorus Tons reduced
Farm 1	80	83	1.20
Farm 2	72	87	+0.15
Farm 3	75	88	0.41
Farm 4	95	99	2.35
Farm 5	98	99	0.61



Final Conclusions

Farms increased the amount of farm grown forage being fed from 79.8% to 91.6% of the total ration during the project period.

Grain as a percentage of the ration was reduced from 20.2 to 7.4%.

These changes reduced the amount of surplus P on the farm from an average 2.14 tons per year to 0.70 tons P per year.

Farms are dynamic and constantly changing/evolving.

Farms are working with grain company nutritionists that may not be pushing full forage diets.

Aspects of farm identified that could use improvement but funding sources not available.

Model created in this project an essential component for water, air, climate, and farm viability solutions.

The University of Vermont

Participation Certificate

- If you would like to obtain a participation certificate you can access the PDF in the **Handouts** section of your control panel.

Questions?

Watershed Academy Webcasts

More webcasts coming soon!

The slides from today's presentations are posted on the Watershed Academy webpage.

A recording of the webcast will be posted within the next month.

www.epa.gov/watershedacademy

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Thank You!