

# 5/2/22 - VT Ag Water Quality Partnership Science Advisory Committee Meeting

Monday, May 2, 2022  
8:13 AM

Time	Topic	Description
9:30AM	<b>Opening Remarks</b>	<p>Welcome, introduction to the Science Advisory Committee, instruction of tools used throughout the meeting.</p> <ul style="list-style-type: none"> <li>• Goals -               <ul style="list-style-type: none"> <li>○ Identify gaps for research</li> <li>○ Evaluate existing research and funding programs</li> <li>○ Efforts to refine efforts to improve</li> </ul> </li> <li>• Purpose &amp; Mission               <ul style="list-style-type: none"> <li>○ Improve water quality through outreach and technical &amp; financial assistance</li> </ul> </li> </ul>
<i>Morning Core Theme – Getting Ready: What are the big picture challenges and how can we begin to address them?</i>		
9:45AM	<b>Soil Health &amp; Sustainable Agriculture</b>	Alissa White (Post-doctoral research associate, Gund Institute, UVM) - Alissa will be discussing her recent research evaluating the status of soil health on Vermont farms, discussing the metrics and processes used and the importance of soil health in water quality and farm sustainability.
10:05AM	<b>Vermont Climate Council &amp; the Global Warming Solutions Act</b>	Ryan Patch (Agriculture Climate and Land Use Policy Manager, VAAFPM) - Ryan will be discussing the agricultural sector and VAAFPM's approach towards supporting and implementing agricultural climate mitigation and resilience building.
10:25AM	<b>NRCS Landscape Planning Tools &amp; P-Index</b>	Joe Buford (State Resource Conservationist, USDA-NRCS) - The ACPF (Agricultural Conservation Planning Framework) is an NRCS tool that evaluates landscape needs for conservation planning and prioritization. Joe will discuss how this can work in Vermont, in coordination with other planning methods such as Tactical Basin Plans.
10:45AM	<b>Discovery Acres</b>	Joshua Faulkner (Research Assistant Professor, UVM Extension) - Discovery Acres is a participatory action

	<b>Research Model</b>	research model, created to understand the impact of conservation practices on water and soil quality. In 2020, Discovery Acres was established on a privately-owned farm in the St. Albans Bay Watershed. Joshua will discuss exciting research projects beginning on this farm by Extension staff.
10:55AM	Break	
<i>Midday Core Theme – Vermont Research: Nutrients and Management</i>		
11:00AM	<b>Whole Farm Nutrient Study</b>	Heather Darby (UVM Extension Professor in agronomy and soils) - This active project will demonstrate how, through whole farm nutrient management, major improvements can be made to water quality through reduced phosphorus loading and improved farm viability. Heather will discuss how her team is working closely with five farms located in critical source areas to build a program that implements comprehensive phosphorus management strategies on a whole farm level.
11:20AM	<b>Tile Drain Filters</b>	Dave Braun (Stone Environmental) - Dave has ongoing extensive research into tile drains and the use of filters for water quality improvement and will share prior results and current projects.
11:40AM	<b>Field Practices to Decrease Phosphorus from Tile Drains</b>	Mike Winchell (Stone Environmental) - Mike will discuss this project that developed a model for representing edge-of-field phosphorus loads (surface and tile) and used the model to investigate the impacts of innovative manure management technologies on phosphorus loads.
12:00PM	Lunch	
<i>Afternoon Core Theme – Bringing National Research to the Local Level</i>		
12:30PM	<b>CEAP National</b>	Lisa Duriancik (National CEAP Watershed Assessment Leader, USDA-NRCS) - CEAP (Conservation Effects Assessment Project) is a multi-agency effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. Lisa will share some of the national efforts and her work helping to bring CEAP to Vermont.
12:50PM	<b>CEAP Vermont</b>	Joshua Faulkner (Research Assistant Professor, UVM Extension) - Joshua is leading a paired CEAP watershed

		(Conservation Effects Assessment Project) study in Addison County, as well as overseeing other CEAP-related efforts that have brought national resources to Vermont. He will share current efforts in these projects that are focusing on conservation practices and water quality impacts.
1:10PM	<b>Legacy Phosphorus &amp; Conservation Practices</b>	Dr. Peter Kleinman (Research leader and Soil scientist, ARS, USDA, Associate Professor of Soil Science, Penn State University). Peter is nationally recognized as an expert in conservation practices and phosphorus and will highlight two key research areas: legacy phosphorus and avoiding potential conservation tradeoffs associated with phosphorus.
1:40PM	<b>Closing Remarks</b>	Bringing it all together, reflecting on core themes, looking forward.
2:00PM	Adjourn	

# Soil Health & Sustainable Agriculture - Alissa White

Monday, May 2, 2022

8:19 AM

## The State of Soil Health In Vermont

- Project responding to new interest in soil health
  - Sinking carbon
  - Drought resilience
  - Increasing yields
- Need an understanding of where we are out, where we are starting from
  - Existing soil health monitoring statewide
- Goals
  - Establish baseline soil health indicators
    - Carbon stocks, ecosystem services
  - Collect standardized sampling
  - Share information back to farmers
  - Supported by many collaborators and partners
  - Build skills and capacity
- Convenience sample
- Added some strategic sampling locations to augment existing monitoring
- Sampling from - corn, pasture, hay, small number of field crops
- Soil health
  - Definition (NRCS) : Continued capacity to function as vital ecosystem that supports plants, animals, humans
  - Collection of samples
    - Cornell soil health + carbon stocks (bulk density & organic carbon)
    - Biological health
    - Management practices
- Sharing information back to farmers
  - How soils compare to peers
- Findings to date
  - Aggregate stability
    - Improves soil water retention
    - Resists erosion
    - Average across VT farm fields ~ 47%
      - Greater in fields with perennial roots
  - Bulk density
    - Indicator of soil pore space
    - Susceptible to damage, difficult to repair
    - Not a lot of data to compare to, findings are within expected range
    - Average ~1.35 g/cm<sup>3</sup>
    - 1.6 is threshold that restricts root growth
  - Organic matter

- Trended higher in hay and corn fields but not statistically significant difference
- Average is higher across all crop types in VT compared to NY
- Average is 4.3%
- By soil texture - soils with higher clay content in VT, expected to see higher organic matter content in VT
- Management - dairies have
- Soil carbon stock
  - Amount of carbon in a volume of soil
  - Average - 93 MT/ha to 30cm depth
    - Comparable to european countries
    - VT samples show large range
- Cornell assessment of soil scores
  - Generate scores for sample based on soil texture
  - VT - doing well in organic matter, water retention
    - Improvement - soil respiration

### Questions!

How do you increase soil respiration

- Add organic matter
- Aggregate stability
  - Increase days with perennial roots, reduced till, no till

Are farmers interested in learning about soil health?

- Very interested, excited to learn and improve
- See soil health as integral to operation and environmental
  - Connecting water quality practices to soil health can add to communications with farmers
- Very invested - this is something already doing and wanting to do more/better

Is aggregate stability accurate after soil samples are collected?

- Wouldn't degrade super quickly
- Is there any degradation of the indicator through sampling/handling
  - Standardized in lab testing process

# Vermont Climate Council & the Global Warming Solutions Act - Ryan Patch

Monday, May 2, 2022  
8:20 AM

## Vermont's Agricultural Mitigation Strategies

- Vermont is rural with large portion of natural and working lands
  - Important topic for global warming solutions act
  - Committee on evaluating sequestration potential on working lands
- IPCC summary of climate impacts
  - Characterized as agricultural, forestry and other land uses
  - Unique mitigation potential
    - Enhancement of emissions removal through sequestration
    - Reductions of emissions through changes in production and management practices
- Vermont Climate Action Plan
  - 3 sections address agricultural sector and its role in climate resilience
- Many parts of the Global Warming Solutions Act
  - Important - emissions reductions requirements
    - 2025, 2030, 2050
  - Agriculture role
    - GHG Emissions Inventory
      - Agriculture attributed 16%
      - Not included - harvested wood products, land use change from forestry
- Framing mitigation and emissions reductions
  - Challenges - land use practices that have water quality benefit have co-benefit for the climate, but difficult to track and credit farmers for this work
  - Sequestration rates in forestry sector would offset 42% of annual emissions
- Emissions Inventory
  - Quantified emissions
    - Enteric fermentation
    - Manure emissions
    - Soil emissions
  - Not included
    - Opportunity for soil carbon sequestration - associated offset
    - Carbon stocks
- Climate Council
  - Developed first carbon budget
  - Quantify stock and rate of sequestration
    - Dependent on crop type - interactive and changeable over time based on management practices
- State and federal programs
  - Developing emission reduction coefficients
    - Considering sequestration and net reduction in emission
- VT Climate Mitigation Priorities

- Support farmers on implementation
- Vermont specific research
  - Calibrate tools to improve quantification accuracy
- Financial and technical assistance through education and outreach
  - Highlight the investment in climate mitigation and resilience provides many co-benefits
    - Water quality
    - Food security

### Questions!

Does Vt Climate Plan include restoration of farm fields to wetlands and forests?

- Farmers participate in wetland easements
- Voluntarily restore wetlands
- Acknowledge natural resource restoration projects have climate benefit is included in action plan
- Only 12% in ag, 74% in forests
  - In context of food security - important to consider how much land area in ag production is needed to ensure northeast can support itself
- Long term climate resilience
  - Ensuring land is stewarded to support productive agriculture in the northeast

# NRCS Landscape Planning Tools & P-Index - Joe Buford

Monday, May 2, 2022

8:20 AM

## What is the ACPF?

- Ag Conservation Planning Framework
- GIS tool
- Developed in the West - working to fit to VT and northeast

## Why Use ACPF

- Promotes engagement
- Facilitates conversations with stakeholders
- Helps conservation professionals

## What is in ACPF

- Riparian management
- Control water below fields
- Control water within fields
- Build soil health

## Output

- Provides prioritization of areas well suited for conservation practices
  - Grassed water ways
  - Buffer strips
  - Impounds
  - Depression ID
  - Drainage
  - Bioreactors
  - Riparian assessment

## To see tool used

- Need to see conservation practice adoption to match with recommendations
- Calibrate tool to specifics of the region
- Look at where this has been used in other regions
  - How can this be translated to our region
  - Can help to inform understanding of stacked practices

## Extended Functionality

- Field runoff risk scouting tool
  - Looks at conservation practices, field slope, proximity
  - Quantifiable, objective, prioritization
  - Does not account for cover crop/soil health
- Riparian Assessment
  - High res elevation data
  - Doesn't recognize buffers
    - Needs more parameters to be able to estimate buffer width



### Opportunities

- Grant program or TMDL planning
- Used to identify proxy practices (translated from applicability in Western US)
- Ancillary data used for other projects, lots of data, could be developed to statewide datasets and resources

### Limitations

- Someone needs to do the work to make this useable
- Riparian buffer analysis can be improved functionally

### Weaknesses

- Subset of practices, no accounting of existing practices
- Going to take time

### Threats

- Required staffing

### Questions!

What other types of tools can be integrated into ACPF?

- FFI, Tile Drains, UAP, interface with CART?
- CART - project agency is starting to look into, ACPF is currently outside, but working to integrate into CART
- Potential to integrate other tools to work with this tool
  - Can be retrofitted
  - Requires aggregate data

# Discovery Acres Research Model - Joshua Faulkner

Monday, May 2, 2022

8:20 AM

## Discovery Acres

- Project inspired by participatory action research
- Active advisory board - agencies & farmers
  - Helping develop/define research questions that will be answered through field research
- Part of national discovery farms network
  - Brings opportunity for collaboration with other teams from other states
- Located in Jewett Brook watershed, St. Albans Bay / Franklin Co.
  - Heavy clays, poor drainage
  - Agriculturally intensive area
  - Recurring water quality issues
- Field scale research done with multiple large plots - 3-4acres each
  - Shaping of fields to create miniature watersheds
    - Monitoring stations capture surface runoff
    - Drainage tile systems in 2 of the watersheds
  - Monitoring flow - surface and subsurface
    - Automatic samplers
      - Nitrogen, phosphorus, TSS
    - Measuring yield
  - Comparing effect of conventional vs alternative (advanced BMP)
    - In drained vs undrained condition
    - How can best management practices address ?
- Installed in 2020
- Paired watershed study
  - Calibration period - 2020 - 2022
  - Treatment period - fall 2022
- Control
  - Cover crop + corn silage, surface applied manure, conventional tillage
- Treatment
  - Cover crop, no till planting, manure injection
- Provides platform for additional research and demonstration
  - GHG emissions
  - Field scale hydrology
  - Infrastructure and model is in place to use moving forward

## Questions!

Are there opportunities for tours and workshops at site?

- Yes, will be developing signage and will post field dates, we want the community to come see the site and provide input

Thoughts on roller crimper termination?

- Don't have to make a decision quite yet, but are thinking about and would like to do if possible

Has road drainage been disconnected from test plots?

- Yes

# Whole Farm Nutrient Study - Heather Darby

Monday, May 2, 2022

8:21 AM

Tighten nutrient cycling on the farm

Using variety of tools and skillsets to accomplish this

- Whole farm nutrient balance tool
- Nutrients imported
  - Animals, feed, bedding, fertilizer
- Nutrients exported
  - Animals, milk, manure, crops
- Look at net balance
  - More imports than exports - loading = more P than crops are using and increasing soil P levels over time
    - Gains to be made?
- Nutrient management plan
  - Lots goes into developing a good nutrient management plan
  - Goal - reduce loading, minimize transport
- Precision feed management
  - Improve: nutrient efficiency, non-imported feed
  - Optimize: feed and nutrient needs
  - Reduce: overfeeding
- Benchmarks set to establish goal/target for the project
  - >60% of diet feeds grown on farm (means imported 40% feed)
  - Reduce P in ration
  - Benchmarks set to increase animal health & reduce loading

Conducting whole farm nutrient planning with 5 farms in critical watersheds

- Varying operation methods/sizes etc

Results/findings

- Large farm
  - All P imported from grain
  - Diet exceeds P and N requirements
  - Less than benchmark homegrown forage
  - Improvement opportunities
    - Could up to 80% homegrown feed
    - Excellent feed quality, focus on NDFd
    - Lots of stored corn but purchasing feed - shift corn acreage to perennial forage to limit need to purchase feed
  - Lots of progress
    - Shifted 200 acres of corn to perennial
    - Adoption of no-till & rolled and crimped
    - Updated forage diet to 72%
    - Reduced P imports by 5tons/year
    - Substantial savings from reduced purchase

- Small farm
  - 100% P imports from grain
  - Optimal nutrient balance
  - 60-70% homegrown feed
  - NMP implemented
  - Soil test P within average
  - Opportunities
    - Up to 85% homegrown feed
    - Excellent feed quality, focus on NDFd
    - LIMITATION - feed storage
  - Progress (dependent on updated storage)
    - New seedings - new varieties
    - Up to 90% forage - lot of fluctuation
    - Can reduce grain by over 50%
    - Can reduce # of cows
    - Substantial savings opportunity
- Medium farm
  - Most P import from grain
  - Not enough homegrown feed, potential for up to 85%
  - Excellent feed quality, focus on NDFd
  - LIMITATION - feed storage
  - Progress
    - P loading is down
    - Homegrown grain increased
- Organic
  - Needs lots of improvement

#### Takeaways

- Need to improve perennial forage quality
- Need to improve storage on farms - good quality feed coming out of fields can be stored and used - all farms should be at 70% homegrown forage
  - High homegrown feed = low cost, high milk production
  - Lack of storage leads to spoilage
- Farms are doing well following NMP
- Land base could support higher forage diets
- Work on conservation in corn fields is showing
- Not as much focus on perennial forages
  - Nutritionists feeding what is known and available
- No cost share in these areas
- Potential and return on investment is high!

#### Questions!

What is the relationship/reception with nutritionists in moving to more homegrown feed?

- It depends, some farms have fired nutritionist as result of project
- Some nutritionists are really excited to be involved and learn

# Tile Drain Filters - Dave Braun

Monday, May 2, 2022

8:21 AM

## Tile drain primer

- Changes hydrologic behavior of field, enhancing infiltration, ground water transmission, reduces surface runoff
- Downside - efficient conduit of nutrients off farm fields into water bodies

Lake Erie "re-eutrophication" linked to proliferation of tile drains in the area

## Stone Environmental - monitoring study of tile drains

- Collecting data on concentration and P loads coming from tile drain outlets
- Foam indicates diluted manure entering tile train - really organic acids, associated with high P concentrations

## BMPs for P in Tile Drains

- Drainage water treatment with reactive media
- VT NRCS conservation practice standard for removing P
  - Technical requirements could be improved
  - Does establish cost share/funding under EQIP
- Questions
  - Mass of P to be removed
  - Influent P concentrations - how low can we go
  - Longevity - designed for 10 years but haven't been monitored
  - Cost effectiveness
  - Disposition of media at end of life
- Test in Franklin
  - Range of 60 - 90% removal - AMAZING!
  - Hydrologically - fail
- Second test
  - Built filter sleds
  - Activated aluminum worked well
  - Naturally occurring shale material in VT also worked well
  - Moved to field
    - 95 acre cornfield just outside Jewett Brook
    - In ground filter trench with black shale
    - Pipe water from below and flows up through ~2ft of media
    - Added amendments (activated alumina and activated iron) to improve filtration
  - Very expensive
  - About 50% removal with added amendments
- Stormwater pond
  - Added media (4 types individually) into storm basin
  - Pilot scale ~10ft wide filters
  - Results show good flow rates, not great removal at low influent rates, but higher influent concentrations show significant P removal (~40%), iron shavings filter performing best

- Lake Carmi - starting this summer
  - Each project is working on refining functionality
  - Improve constructability, improve performance, reduce cost
  - Testing 4 filter
- Lessons learned
  - Avoid poorly constructed - no holes!
  - Upflow/lateral flow is better than downflow
  - Important to have high hydraulic conductivity in selected media
  - Perforated, rigid pipe
  - Avoid drains with submerged outlets
  - Expect it will be possible to construct filters for most tile drains in VT
    - Most inexpensive will be VT shale with iron and alumina

### Questions!

How does P numbers for untreated tile drain compare to numbers in Lake Erie?

- Variable loads are fairly comparable to what is seen in Ohio
- .28 - .92 kg/ha/yr in Ohio
- .56 in JBW

How much of an area do the filters take up?

- Looking for areas they can be put in edge of field above the outlet pipe
- Width is 6ft trench, 10 total, scale is done by length along field edge between 20 - 40 ft

# Field Practices to Decrease Phosphorus from Tile Drains - Mike Winchell

Monday, May 2, 2022  
8:21 AM

## Modeling Impacts of Field Management Practices on Phosphorus Losses through Tile Drains

### 12 sites selected

- Permanent corn
- Soy corn rotation
- Alfalfa
- (see slides for full list)

### APEX model

- Farm/watershed model
- Simulates water, sediment, nutrient, pesticide transport
- Can simulate impacts of many management practices

### Model set up

- Through Farm PREP
- Weather data - site specific, and local
- Used best records available from farm for
  - Crop rotations
  - Tillage practices
  - Etc

### APEX calibration

- Working to calibrate to many sites across field study selection
- Minimize systematic bias in over/under estimation of P losses
- Well calibrated across 12 sites
- To account for uncertainty in soils data - additional analysis to improve from SSURGO range
  - Improved calibration statistics for calibration

### Application of Management Practices on Sites

- Conservation practices applied to 5 sites
  - 3 tile drain
  - 1 edge of field
  - 1 tile/edge of field
- Four combinations of conservation practices
- Two manure technologies
  - Difficult to estimate all benefits of management practice
    - Placement of nutrients when/where needed
    - Transportability and storage
  - Parameterized to optimal P soil
    - 100% application in spring
    - Content and application modified for technology products



- Parameterized for high P
- Two soil P scenarios
  - Optimal (5ppm)
  - High (8ppm)

#### Results - Soil

- Optimal P
  - Effectiveness highest for soluble P, lowest for sediment surface P
  - P load varies, highest sediment P
- High P
  - Conservation practices are less effective with total P
  - Larger reservoir of legacy P to continue to leach - less impactful conservation outcomes

#### Results - Manure

- Optimal
- High
  - Changes in P reduction is similar in both technologies
  - Scenario modeled reduced P applied each year over 20 year period to meet plant demand

#### Results

- More significant impact in later years of simulation

#### Questions!

##### What is DAP and EVAP

- Both separate solid and liquid components
- Some cases low density pure liquid
- Some product is mid-range liquidity
- Some product is much drier
- Idea is varying nutrient content and applicability

##### Any soil test P results that were higher?

- 8 is not particularly high, certainly lots of fields upwards of 20ppm
- Some simulations with P levels that high, results pending

##### Other parameters considered, such as crop yield changes or soil type?

- Yield - calibration checked against field sites and general ranges for the area
  - Did not do yield analysis for this study as P application rates and concentrations drawn down - would be interesting to look into
- Soil types - some variability in soil type but they are all similar in characteristics
  - Haven't done analysis on BMP effectiveness by soil type but would be good to look into

# CEAP National - Lisa Duriancik

Monday, May 2, 2022  
8:21 AM

CEAP - conservation effects assessment project

Quantify conservation practices across programs and scales

- Focus on quantifying measurable effects of conservation practices and how practices work in context of a watershed

CEAP is a national network

- Opportunity for collaboration and knowledge sharing
- Partnerships are key to getting this work done
- Producers play an important role to progressing understandings

Watershed Outcomes

- More than half of watersheds have been able to attribute improved water quality outcomes to BMP implementation
- Need to work on improved incorporation of fertilizer
  - Enhance contact of fertilizer source with soil to decrease losses

Work in VT estimating benefits of conservation practices - open data

- See slides for resources

CEAP in VT

- Applying insights to planning
  - Soil vulnerability index
    - evaluated across 13 watersheds in national network
    - Continuing to study how this can be enhanced to improve field scale planning
  - ACPF
    - Lots of validation work to improve usability of this
    - Enhancement Project
      - Field scale planning is wheelhouse of CART
      - Potential to miss conservation needs and opportunities when looking specifically at field scale
        - Area wide planning is also important
        - ACPF provides watershed scale output conservation opportunities
      - As ACPF gets run more and validated results can be utilized in combination with CART results
      - Improve interpretations and applications outside of upper midwest
        - New water quality practices
        - Opportunity for input!
        - Adding new types of practices
  - Tools can be challenging to use but important

CEAP watershed program

- Focus - address legacy timelines and lag times
- Sources found in watersheds that can impact ability to document outcomes
- Challenge for managing expectations among stakeholders and stewards who want to make a difference and are not seeing expected changes in water quality in the watershed
- Identify chronic sources
  - Understand how they mask present day effects of conservation
  - Which strategies are most effective to manage legacy P
- Working across range of scales
- Lag time quantification tracer
  - Degradation product of pesticide - formulation was changed in 2000
  - Can measure how long it is taking for water to move through groundwater and surface water based on measurement
- Ephemeral gully assessment
  - CEAP sites nation wide, including Lake Champlain
  - Field sampling and assess effects of ephemeral gullies
  - Develop new tools to model and plan for
- Manure Phosphorus Extraction System
  - Funding to bring to VT
  - Built new MAPHEX system customized to need of dairies and P reductions in VT
  - Will be doing field demonstrations and modeling to determine effectiveness and potential of P reduction if this machine is shared across watershed
  - Working with UVM to compare to other systems / options already available in Vermont

### Questions!

#### Timeline of MAPHEX?

- Hoping demos will happen this year, plan was summer 2022, experiencing some delays
- System is pretty well built at this point
- Do field evaluation and testing in VT

#### Scale of MAPHEX system?

- System built in VT can process 125,000 gallons per day
- Much larger than system shown in photos in presentation
- Designed to handle capacity to match need for VT dairies

# CEAP Vermont - Joshua Faulkner

Monday, May 2, 2022

8:22 AM

## CEAP in the Lake Champlain Basin

### Experimental Design

- Paired watershed design
  - 2 years monitoring watersheds for hydrology and quality for calibration
    - Helps establish relationship between watersheds to allow for accounting effect of conservation implementation during treatment period
  - Followed by treatment period
    - Treatment watershed - ramped up conservation practices
    - Control watershed - conservation as usual
- Control Watershed
  - Little Otter Creek
  - Heavy clay
  - ~ 50% ag land use
- Treatment Watershed
  - Monitoring east and west branch of Dead Creek upstream of wildlife management area
  - Heavy clay
  - ~ 75% ag land use
- Watershed location
  - Close proximity to ensure both watersheds receive the same climatic inputs

### Monitoring

- Sampling is automated to measure concentration and load
- Threshold set to trigger sampling based on qualifying runoff event (flow paced sampling)
- Biweekly baseflow samples also collected
- Working on capturing winter samples
  - Important time of the year for understanding nutrient flux and nutrient loss from the landscape
  - With climate change increased frequency of runoff events during winter months (more above freezing days)
  - Developing/testing freeze resistant sampling technology

### Management and Land Use

- Established consent with farmers in watershed for state and federally collected information
  - Permission to access USDA data
- Small farms outside of state and federal programs
  - One-on-one information collection to inventory field practices and cropping

### Results

- Baseflow TP and TDP
  - East branch of Dead Creek
    - Spikes in early winter/late fall in both 2020 and 2021
  - Same trend observed in Little Otter Creek headwaters

- More noise in West Branch Dead Creek
  - Still same late fall/early winter spikes
- Stormflow
  - Results support choice of Dead Creek as treatment watershed - lots of room to improve P levels
  - Much larger percentage of TP is particulate during storm events
- Have loading data
  - Combined with flow data to get loading score
- Statistical analysis of calibration period shows good results
  - Ready to move into treatment period
  - Will lean on partners to accelerate conservation implementation in treatment watershed

#### Subprojects under CEAP

- Evaluating soil health in CEAP watersheds
  - Soil health samples in 70 fields
  - Bulk density cores and carbon stocks
  - Return soil health data back to farmers
    - Opportunity to provide value to farmers for participating in project
  - Goal track soil health long term and investigate correlation to water quality
    - Will return to sample in 3-5 years and see if data samples align with changes in water quality
  - Soil health scores are high, slightly higher in dead creek

#### CEAP stacked practices study

- Field scale study within watershed study
- Evaluating effect of combined practices on P export from fields
- Paired ditch filter to assess surface and subsurface flow

#### Questions!

Can you speak more on accelerated conservation efforts? Is this something that needs multi-agency support

- Focus is pointed on this now
- Working with NRCS, agency of ag, conservation districts
- Implement mechanisms to accelerate implementation in Dead Creek watershed

Wetlands program is updating maps?

- Would be interesting to use this data to understand watershed

CEMAs can be used in planning process

# Legacy Phosphorus & Conservation Practices - Peter Kleinman

Monday, May 2, 2022  
8:22 AM

## Conservation trade-offs and legacy P - USDA legacy Phosphorus Assessment

### Conservation Tradeoffs

- Findings in early 2000s research shows range of increase/decrease of P losses through common conservation practices
  - Ex: conservation tillage, riparian buffers could increase DP
- Fall into systems
  - Avoid
  - Trap

### Trapping Processes

- Should be implemented in system approach to serve conservation objective
- When working correctly
  - Impound runoff
  - Diffuse flow
  - Reduce sedimentation
  - Enhance biological cycling and abiotic processes
- Can be modified to reduce effectiveness
  - Extreme events
  - Concentrated flows
  - Scouring, resuspension
  - P saturation
  - Reductive dissolution
    - Results in pulses of DP that can be harmful to ecosystem
  - Biological cycling
- Many examples of conservation practices that have reduced functionality
  - Riparian buffers
    - Great at trapping TP
    - Not as good at reducing DP

### Nutrient mitigation in cold climates

- Freeze/thaw cycles increases movement of extractable P

### Soil test P in buffers for Virginia, PA, MD

- Looks the same throughout study period
- Can result in stored P becoming mobilized

### Legacy P

- Residual P in environment accumulated over years
- National project coordinating over several sites
  - Building on concern of systems that are overloaded

- Phytomining studies
  - It takes many years to degrade legacy P\
- Its everywhere and can be a real challenge to conservation program

#### CEAP legacy P project

- Many sites involve dairy production
- Using various data scales
- Coordinated site characterization
  - Currently ongoing
    - Range of analyses - instream, in ditch, in field
- Hypothesis driven sampling
  - Legacy P concerns reside in portions of field where flow accumulates or can be impounded
  - Sampling around tile drains to determine where is source to drain - at surface or subsurface as well as horizontally in space
- All going into set of recommendations for dealing with legacy P at systems level

#### Mitigation Recommendations

- Soil amendments
- Phytomining
- Clean out
- Stacked practices

#### Fertilizer recommendation support tool

- Democratizing soil testing data
- Encouraging funders to support new analyses around soil fertilizer recommendations
- Come into play with management recommendations
  - Work towards draw down to crop needs

#### Management Recommendations

- What are timelines to addressing legacy P
- There is lag time to addressing legacy P

#### Questions!

Talking about strategy for reducing soil test P, reducing application is one method, can be a difficult conversation to have with farmers? could you put a number on a place to start with farmers? If soil test P is getting into the teens, where do you start?

- In extension and outreach - need to be true to science, can't just tell folks what they want to hear. Follow land grant recommendations and rates
- Still deal with a lot of people that think they need a little extra starter fertilizer, trials show that is not impactful.
- Can get contentious, but is a disservice to avoid following the science
- Wouldn't recommend pushing below thresholds without some test contract on buffer or other measure
- Fred M built in aluminum into equation in VT
- Corinne (Cornell) study put in strip trials across NY and let farmers see for themselves

- Need to keep issues in the present - continued demonstration work to convince resistant audience

A few amendments that are being tossed around and showing process?

- There is a time and place for these
- Started and ended with systems approach
- Dissolved P is a headache, esp dealing with a community that is experiencing rising tension around management and mismanagement
- Amendments can be a good quick fix
  - Means a lot out there in the environment that need to be addressed
- A lot of inherent buffering capacity in shallow soil to manage soluble P
  - At odds with pressures to expand no-till and conservation tillage

Mentioned legacy P getting to the point that secondary strategies are needed, where is the line? How do you know when is appropriate to implement these practices

- It depends what people are willing to go after
- It can be very costly and have high uncertainty associated
- There is work to show benefit of dredging at various scales
  - Performed regularly at the ditch scale
- Need to see full picture and evaluate at system level