Consider the **Secret Sauce** of a good outcome

Excerpt from *Retrospective on Lessons Learned from the Chesapeake Bay Program Strategy Review System's 3rd Cycle with Suggested Adaptations to Address the Issues*

A good outcome is:

- Clear in its objective
- Measurable
- Has a monitoring program that supports the status and progress, and reinforces the outcome
- Has partner commitment
- Resources are identified and/or available to support the efforts necessary to achieve the outcome.
- Centers the work on benefits to people and living resources, not solely water quality.

Soil Health Outcome Consideration

WQGIT Meeting: March 24, 2025

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Nonpoint Source Policy Analyst

Beyond 2025 Climate Small Group Member

Climate Small Group Recommendations Connecting to Soil Health:

<u>Recommendation</u>: Promote Carbon Stewardship as a Holistic Approach to Climate Mitigation

- Advance understanding of carbon stewardship science
- Improve consideration of carbon in land use planning and decision-making.
- Improve regional coordination around carbon stewardship using natural climate solutions

<u>Recommendation</u>: Promote Strategies for Healthy and Productive Ecosystems Under Changing Climate Conditions

- Enhance the confidence and use of nature-based solutions through improved science on the performance and design under changing climate conditions that will promote multiple ecosystem services benefits while minimizing vulnerabilities to changing climate conditions.
- Pursue the development of a CBP soil health outcome and ways to support and incentivize achievement. Soil health is the basis for overall healthy ecosystems that will enhance resiliency for living resources and biodiversity.

<u>Recommendation:</u> Promote regenerative agricultural production and regionally based food systems in the CBW

- Increase collaboration with the growing network of producers, processors, distributors, local, state, and federal government, businesses, nonprofits, and institutions working to develop and support a regenerative and regionally based food system.
- Use educational, behavioral science and marketing resources to ensure that producers and consumers understand the value of regenerative ag
- Develop mechanisms to address issues of regional carrying capacity and nutrient mass imbalance to support healthy and equitable food access and incentivize a circular approach to food and manure waste management.

- **Proposed Soil Health Outcome**: Maintain and improve soil health, the foundation for healthy ecosystems and productive working lands. By 2035, develop and implement an approach to assess and incentivize actions to improve soil health, including modeling the soil health impacts of current water quality BMPs and identifying additional BMPs and other priority actions that support both soil health and water quality.

- **Rationale:**
  - Majority of the remaining nutrient and sediment reductions are expected to come nonpoint sources, primarily agriculture, need to accelerate progress
  - Soil is foundational for healthy, productive ecosystems and working lands, improvements simultaneously improve environmental and economic outcomes and improve the resilience of working lands to changing environmental conditions
  - Emphasis on soil health in agricultural production mitigates risk to farmers from changing environmental conditions
  - A soil health outcome related to agriculture would help focus the efforts of the AgWG and Agricultural Advisory Committee and prioritize efforts and resources

P3 WIPs, 2023 RPI- EPA CBP, CAST, CESR

Soil health- The continued capacity of soil to function as a vital living ecosystem that sustains plants, animals and humans (NRCS)

Determines the capacity of soil to perform essential functions such as:

- Nutrient cycling
- Water regulation (infiltration, availability)
- Filtering and buffering (nutrients, toxics)
- Sequestering and storing carbon

Outputs: direct and indirect

- Improved water quality, air quality
- Improved water management
- Improved climate adaptation
- Improved productivity and profitability
- Reduced GHG emissions, pesticide and fertilizer use
- Improved plant health, human health, animal health

Frontiers

Taos SWCD

Economics of Soil Health Management Systems

- **Adopting soil health practices can increase yield and decrease input costs, leading to a return on investment of $3 for every $1 spent. (AFT Soil Health Case Study Analysis)**
- **NACD and SHI Study:** Applied soil health management systems (SHMS) on a range of different crop types, soil types, geographies, weather patterns, management practices

  Key findings: Crops cost less to grow, increased net farm income, some yield increases, decreased erosion and soil compaction, earlier access to fields in wet years, and increased resilience to extreme weather

  Outcome of AgWG Discussion: Eric Hughes

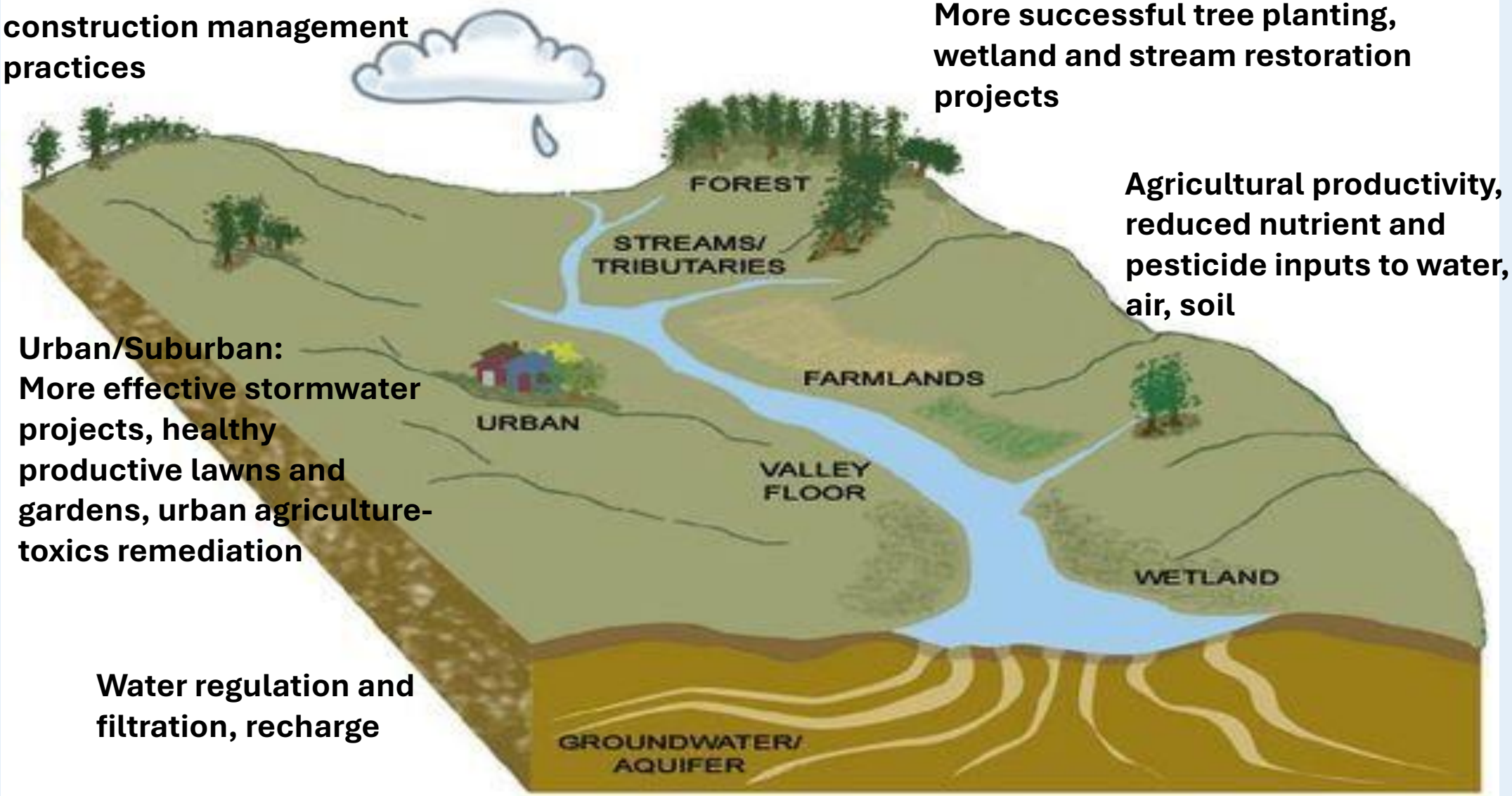
Broadening the Focus:

The quality and success of tree and buffer plantings, stream restorations, forest harvest and construction effects, working lands productivity, urban landscaping/stormwater green infrastructure/lawncare/gardening, toxics prevention and adaptation to changing environmental conditions all depend on the degree to which the health of the soil is ensured.

Soil Health Effects on a Typical Watershed

Better forest harvest and construction management practices

More successful tree planting, wetland and stream restoration projects



Agricultural productivity, reduced nutrient and pesticide inputs to water, air, soil

Urban/Suburban:
More effective stormwater projects, healthy productive lawns and gardens, urban agriculture-toxics remediation

Water regulation and filtration, recharge

Holistic adaptation to changing environmental conditions

Outcome alignment with administrative goals and legislative mandates of CBP partners:

Entity	WIP- Agriculture & Changing Env. Conditions	State Plans, Programs & Legislation	Federal Plans & Legislation
DE	Yes	DE Soil Health Partnership (Coalition)	
MD	Yes	Healthy Soils Program, Bay Legacy Act (pending) State Climate PRPS: MD Example	
NY	Yes	Soil Health and Climate Resiliency Act	
PA	Yes	Sustainable Agriculture Act	
VA	Yes	VA Soil Health Coalition (PA, MD, NY) Graze 300 Initiative	NRCS Strategic Plan for Soil Health Promotion
WV	Yes	Soil health education priority	
USDA			USDA: Climate-Smart Food and Forestry Practices, Case Studies
EPA			EPA-FRRCC Report
other			**Federal:** 5th National Climate Assessment Soil Care Act 2023- pending

Value of CBP resources to this Outcome:

- Focuses attention on soil health and facilitates collaborative ways to achieve progress-connects, supports, enhances and expands existing conservation efforts
- Expands capacity, coordination and resources to identify needs and implement the scientific, technical, economic and social mechanisms that lead to sustained improvements
- Connects outcomes and leads to better adaptation strategies and management approaches used to achieve holistic watershed health and adaptation to changing environmental conditions

Suggested Management Strategies for meeting the outcome:

Focus on using existing capacity and resources in more effective ways to improve decisions regarding management approaches and practice implementation- to maximize benefits

- Facilitate CBP stakeholder/partner participation in assessing existing resources and approaches: identifying needs/gaps/barriers, areas of overlap, and potential to expand resources and capacity through coordination and collaboration
- **Adopt a set of metrics to evaluate the impacts of conservation and management practices on soil health**
- Identify key practices (BMPs) and approaches that provide maximum return on investment in terms of efficacy, cost and multiple benefits- support those programmatically

ASSESSING SOIL HEALTH

1. Is the management moving toward healthier soil?

Indicator of progress
Toward a soil health target

2. Is the soil performing each job to the best of its ability? Functional outcomes

- Storing carbon
- Cycling carbon
- Cycling nitrogen
- Water storage
- Water infiltration
- Erosion resistance
- Suppressing diseases and pests
- Reservoir of biodiversity

SOIL HEALTH INSTITUTE

3

KEY OUTCOMES

- Soil organic C concentration, C mineralization potential, and aggregate stability represent a cost-effective, minimum suite of soil health indicators for North America.
- Equations can be used to predict changes in available water holding capacity as soil organic C concentration changes.

Stroud Water Research Center and Rodale Institute-Field Systems Trial

Evaluate BMP Effects on Soil Health:

Example: Lawns and gardens: Management methods that improve soil health create a system that is sustainable, soil microbes are a key component that drives productivity

- Each 1% of soil organic matter releases approximately 1/2 – 1 lb. of available nitrogen per 1,000 sq. ft.
- Garden soils that are >4% soil organic matter will need relatively little additional fertilizer

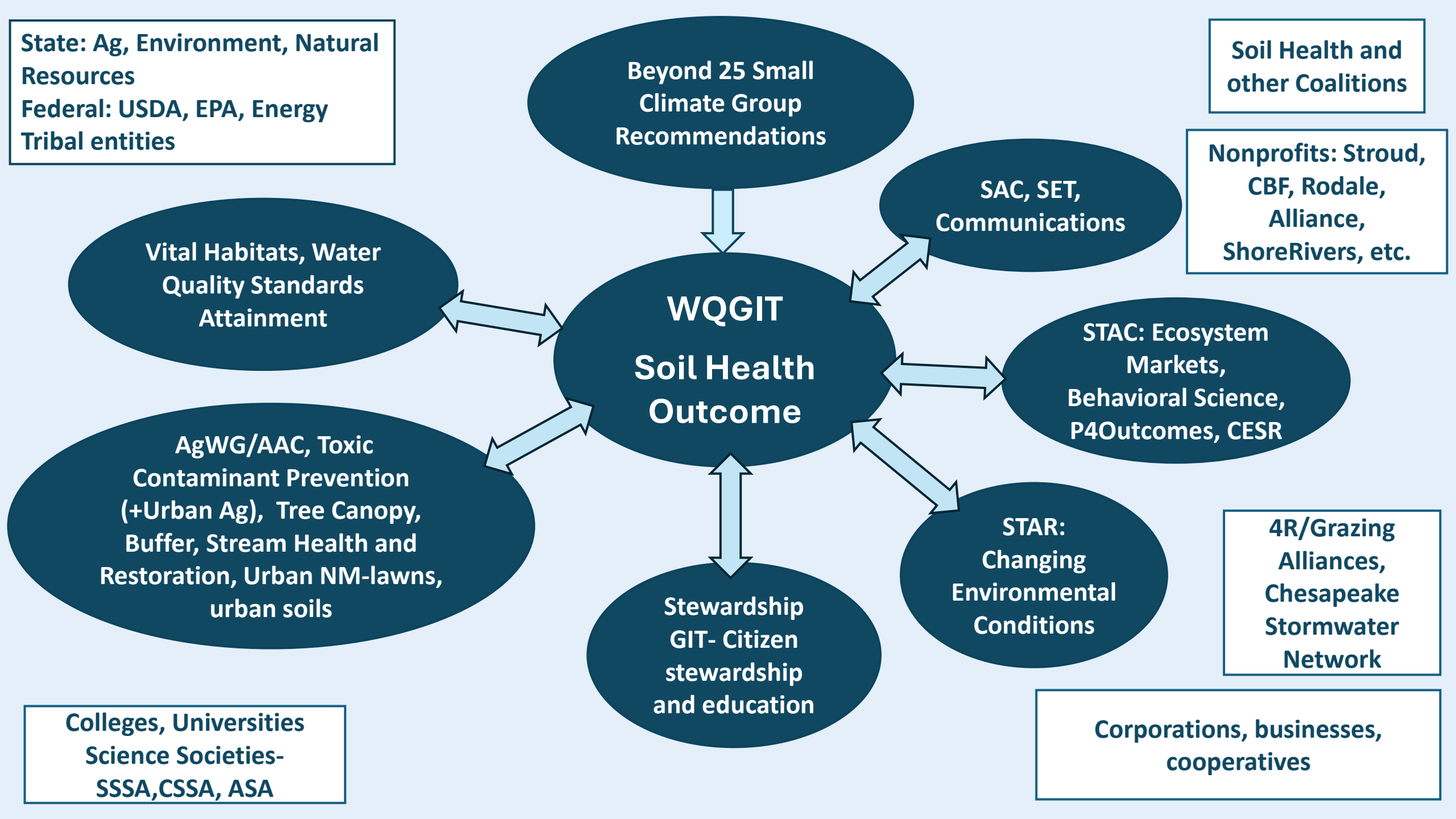
Example: Stream Restorations: Soil health is not explicitly included in current stream and floodplain restorations

- Results in loss of ecosystem services, current practices present a challenge to soil health conditions
- Recommend current crediting approaches and regulatory mechanisms for stream restorations be updated to incentivize soil health
- Inclusion of soil health will help us attain ecological services and functional uplift goals

Stream and Floodplain Restorations Lawns and Soil Health Lawns and gardens

Value of devoting CBP resources to soil health:

- ✓ A greater **CBP** focus on healthy soils would connect, support, enhance and expand existing efforts and lead to better prioritization and adaptation options for nature-based management approaches (e.g., wetlands, forest buffers, rotational grazing, etc.) used to achieve watershed health, water quality and adaption to changing environmental conditions
- ✓ **CBP** could expand capacity, coordination and resources needed to identify and support scientific, technical, economic and social mechanisms leading to sustained soil health improvements across watershed outcomes


State: Ag, Environment, Natural Resources
Federal: USDA, EPA, Energy
Tribal entities
Beyond 25 Small Climate Group Recommendations
Soil Health and other Coalitions
Nonprofits: Stroud, CBF, Rodale, Alliance, ShoreRivers, etc.
SAC, SET, Communications
Vital Habitats, Water Quality Standards Attainment
WQGIT
Soil Health Outcome
STAC: Ecosystem Markets, Behavioral Science, P4Outcomes, CESR
AgWG/AAC, Toxic Contaminant Prevention (+Urban Ag), Tree Canopy, Buffer, Stream Health and Restoration, Urban NM-lawns, urban soils
STAR: Changing Environmental Conditions
4R/Grazing Alliances, Chesapeake Stormwater Network
Stewardship GIT- Citizen stewardship and education
Colleges, Universities Science Societies- SSSA,CSSA, ASA
Corporations, businesses, cooperatives

Supplementary Slides and References

Suggested Management Strategies for meeting the outcome:

- ✓ Facilitate CBP stakeholder/partner participation in assessing existing resources and approaches: identifying needs/gaps/barriers, areas of overlap, and potential to expand resources and capacity through coordination and collaboration by 2027
- ✓ Adopt a set of metrics to evaluate the impacts of conservation and management practices on soil health by 2027
- ✓ Consider the incorporation of soil health principles and management approaches in relevant workplans by 2027
- ✓ Identify key practices (BMPs) and approaches that provide maximum return on investment in terms of efficacy, cost and multiple benefits- support those programmatically by 2030
- ✓ Improve and expand soil health education (include strategic planning, demonstration sites, field days, mentoring opportunities), communication and outreach to key stakeholders by 2033
- ✓ Explore opportunities to incentivize the incorporation of soil health principles and standards in soil related management activities including food, fiber, forestry production and lawncare- incentives may include pay for outcomes, ecosystem service markets, cost support, direct market support, corporate investment, and transitional risk abatement by 2035.

Measuring Progress (SMART: Specific, Measurable, Achievable, Realistic, Timebound)

- ✓ **What to measure:** Implementation of key practices with multiple benefits, consider soil metrics (organic carbon, aggregate stability, microbial respiration, bulk density/infiltration capacity) measures and the principles of building soil health[10, 11]
- ✓ **How to measure:** Track practice implementation & management approaches associated with soil health improvements, make use of existing soil health metric data, explore modeling options
- ✓ **Implementation partners:** Corporate partners, NGOs, nonprofits, universities, local, state and federal agencies, business entities, ecosystem service buyers, institutional and tribal entities
- ✓ **Funding sources:** Many actions can be accomplished with existing resources, explore additional funding strategies with implementation partners listed above
- ✓ **Incentives/rewards:** Decreased reliance on crop inputs/improved profits, improved plant health and land productivity, ecosystem/human/animal health, grants, cost-share, payment for outcomes, direct market rewards

References:

- **Effects on Microbiome: Nutrient Source, Tillage, Cover Crops: July 2024 Stroud Research Study: Agricultural practices influence soil microbiome assembly and interactions at different depths identified by machine learning**

  Second journal same study

  https://doi.org/10.1016/j.agee.2024.109002

- **Beyond 2025** Small Group Findings Report and Draft Priority Projects List

- **Chesapeake Progress**: https://www.chesapeakeprogress.com/clean-water/watershed-implementation-plans

- **CAST P3 WIPs and Trends Over Time**

- **Written Comments from: A Critical Path Forward for the Chesapeake Bay Program Partnership Beyond 2025 Comments from Thriving Ag Project Scientists, American Farmland Trust, and Choose Clean Water Coalition Beyond 2025 Steering Committee Report and Public Comments**

- **STAC Report Ecosystem Services**

- **Soil health economic study USDA, NRCS, NACD, SHI**: **https://www.nacdnet.org/about-nacd/what-we-do/soil/shms/**

  StoryMap to browse the project participants based on geographic distribution. Individual fact sheets can be accessed on SHI's Economics Webpage.

  - https://soilhealthinstitute.org/our-work/initiatives/economics-of-soil-health-systems/ (midwestern farms)

- **USDA: Framework for Shoring Up the Food Supply Chain and Transforming the Food System to Be Fairer, More Competitive, More Resilient:** https://www.usda.gov/media/press-releases/2022/06/01/usda-announces-framework-shoring-food-supply-chain-and-transforming

- **EPA's Potential Role in Supporting Soil Health FRRCC Report to the Administrator**: https://www.epa.gov/sites/default/files/2017-01/documents/frrcc_report_to_the_administrator.2016_002.pdf

- **Regional Analysis of Nitrogen Flow within the Chesapeake Bay, Watershed Food Production Chain Inclusive of Trade-** Paniz Mohammadpour and Caitlin, *Environ. Sci. Technol.* 2023, 57, 4619−4631 Grady*

- **USDA Climate Solutions**: https://www.usda.gov/climate-solutions

References:

- **Rutgers University Extension**: **Soil Health Purpose and Management**
- **AFT, Rodale, Stroud**
  - https://farmland.org/soil-health-case-studies/
  - https://soilhealthinstitute.org/our-work/initiatives/economics-of-soil-health-systems-on-30-u-s-farms/#overview
  - https://stroudcenter.org/projects/healthy-soils-healthy-streams-training-and-technical-assistance/
  - https://stroudcenter.org/press/pennsylvania-establishes-soil-health-coalition/
  - **Update on the DE River Watershed Impact Trial**: https://www.youtube.com/watch?v=rBBfReGxPos
  - In collaboration with Stroud Water Research Center and with funding from the William Penn Foundation, Rodale Institute is researching the links between farm management practices, soil health, and water quality. Different organic and conventional management practices will promote or degrade soil health, which can affect downstream water quality.
- **Soil Health Institute:** https://soilhealthinstitute.org/app/uploads/2022/10/SHI_SoilHealthMeasurements_factsheet.pdf
- **5th National Climate Assessment**- US Government's preeminent report on climate change impacts, risks, and responses. U.S. Global Change Research Program, Washington, DC, USA. Full report available online at: nca2023.globalchange.gov
  - https://doi.org/10.7930/NCA5.2023.CH11
  - https://nca2023.globalchange.gov/chapter/11
- **CESR Report (Ch 3 & 4)**: https://www.chesapeake.org/stac/cesr/: Pay for Outcomes, BMP prioritization, Ecosystem services
- **CEAP**: https://www.nrcs.usda.gov/ceap
- **USDA: Using climate-smart food and forestry practices:** https://www.usda.gov/climate-solutions
- **UMD Animal Waste Technology Fund Assessment Report**: https://extension.umd.edu/resource/animal-waste-technology-fund-assessment-report/

References:

- **Chesapeake Bay Forest Restoration Strategy**: https://d18lev1ok5leia.cloudfront.net/chesapeakebay/cst91_chesapeake_forest_restoration_strategy_web_508_final.pdf
- Understanding Ag: Soil Health Principles https://understandingag.com/the-6-3-4tm-explained/
- Inamdar, S. P., Kaushal, S. S., Tetrick, R. B., Trout, L., Rowland, R., Genito, D., & Bais, H. (2023). **More Than Dirt: Soil Health Needs to Be Emphasized in Stream and Floodplain Restorations.** ***Soil Systems***, *7*(2), 36. https://doi.org/10.3390/soilsystems7020036
- **VA Tech Whole Farm Planning Approach**
- **Conservation innovation fund-** ecosystem services for corporate purchasing https://www.conservationinnovationfund.org/our-mission
- The Food System | Food Systems | Washington State University
- University of Michigan: https://css.umich.edu/publications/factsheets/food/us-food-system-factsheet
- Reimagining Public Food Procurement in the 2023Farm Bill: EESI

EESI- Environmental and Energy Study Institute- Nonprofit Think Tank https://www.eesi.org/agriculture-and-climate-series

- Johns Hopkins Center for a Livable Future:

https://clf.jhsph.edu/projects/food-system-resilience/resilience-planning-guide

- **Lawns and gardens:** To the degree that we can implement management methods that improve soil health, we can create a system that is sustainable and considers the soil microbes as a key component that drives productivity. For example, increasing a soil's organic matter content in flower, fruit, and vegetable beds will reduce the need for supplemental fertilizers. Each 1% of soil organic matter releases approximately 1/2 – 1 lb. of available nitrogen per 1,000 sq. ft. Garden soils that are >4% soil organic matter will need relatively little additional fertilizer. https://extension.umd.edu/resource/improve-soil-health-climate-resilient-garden/
- **Food Systems Transformation Supporting Information: Healthy Food Access Policy Compendium for Metropolitan Washington (MWCOG)** https://www.mwcog.org/committees/food-and-agriculture-regional-member-policy-committee-farm-/
- **The Chesapeake Foodshed Assessment:** Create a Chesapeake Regional Food System "brand" and unified certification system.

  https://agnr.umd.edu/sites/agnr.umd.edu/files/files/documents/Hughes%20Center/2019__Chesapeake-Foodshed-Assessment_02.pdf
- **CBP Short Video** https://www.chesapeakebay.net/discover/videos/chesapeake-climate-regenerative-farming

Additional detail soil health related efforts:

Introduced in Senate (10/04/2023)- Soil Conservation And Regeneration Education Act of 2023 or the Soil CARE Act of 2023: pending

- Soil Care Act 2023: This bill directs the Department of Agriculture (USDA) to establish a training program for biological soil health management in Natural Resources Conservation Service (NRCS) programs.
- Under the bill, *biological soil health management* means land management methods used to increase and balance soil biology, such as microbial biomass and macrofauna, for the purpose of improving biological functions, including forming and stabilizing soil structure, cycling nutrients, controlling pests and disease, and degrading or detoxifying contaminants.
- The training program must (1) provide education, resources, and technical support to USDA personnel and third-party providers on the rapidly evolving methodologies, science, and practices for improving soil health; and (2) assist USDA personnel and third-party providers in supporting agricultural producers in understanding and implementing biological soil health management systems that regenerate farmland.
- The training program must be available twice every two years in each NRCS region and include both an online curriculum and in-person training workshops.
- The training program must be developed and delivered through cooperative agreements with entities with biological soil health management systems expertise and experience working with and training producers.
- The bill includes minimum curriculum requirements for the training program, including specific units on soil health and diversified production systems.

DE: The Delaware Soil Health Partnership (DSHP), led by SCD, is a collaboration of farmers and NRCS, DNREC, University of Delaware, and Delaware State University.

MD: Chesapeake Bay Legacy Act- support for healthy soils and regenerative practices