Attachment C

PROPOSAL COVER SHEET
Required from all respondents

Please complete and submit this Cover Sheet with your grant The completed Cover Sheet can be scanned and emailed to Thomas.anderson@mass.gov Responses can also be sent in by regular mail to Executive Office of Energy & Environmental Affairs, Division of Conservation Services, 100 Cambridge St., 10th Floor, Boston MA 02114.

Organization information to be used for the contract:

Organization Name:____BSC Group, Inc._____

Mailing address: _____803 Summer Street_____

_____Boston, MA 02127_____

Phone:_____617-896-4300_____

Email:_____gdavies@bscgroup.com_____

Website: _____

Commonwealth of Massachusetts, Vendor Code:
_VC6000173026_____
(if our organization has one)

CHIEF EXECUTIVE or authorized signatory:
_____

PRIMARY CONTACT FOR THIS GRANT REQUEST AND POSITION (provide name, phone, e-mail and address if different from above):

Gillian T. Davies
_____

Authorized Signature

_Gillian Davies_____ _Senior Ecologist / Natural Climate Solutions Specialist____
Print Name Title

FY 25 GRANT PROJECT INFORMATION

GRANT AMOUNT REQUESTED:

Total $ 99,957

TOTAL PROJECT BUDGET (from all sources, including grant.)

$ 117,457

Total project match

$ 17,500

Project name: Healthy Soils Action Plan Wetland Management & BMPs Guide

SUMMARY OF GRANT PROJECT (limit to 75 words) (Please also forward this summary of project electronically to thomas.anderson@mass.gov so we can easily cut and paste it in summary reports :

The Healthy Soils Action Plan Wetland Management & BMPs Guide, if funded, will provide tools and resources for promoting healthy wetland soils, and will be geared towards wetland professionals, volunteer conservation Commissioners and communities and will contribute to meeting HSAP Challenge Grant RFR Goals:

- Considers ways to preserve and increase existing soil organic carbon stocks and sequestration capacity
- Provides education programs for statewide healthy wetland soil training programs

BSC GROUP

Challenge Grants Implementing the Commonwealth's Healthy Soils Action Plan / NOVEMBER 18, 2024

Healthy Soils Action Plan Wetland Management & BMPs Guide

Submitted to the Massachusetts Executive Office of Energy and Environmental Affairs

Prepared by BSC Group in partnership with Regenerative Design Group, Woodwell Climate Research Center, Massachusetts Association of Conservation Commissions, and Scouter Design

BSC GROUP
BUILD | SUPPORT | CONNECT

Engineers
Environmental Scientists
Software Developers
Landscape Architects
Planners
Surveyors

www.bscgroup.com

November 18, 2024

Tom Anderson
Division of Conservation Services
Executive Office of Energy & Environmental Affairs
100 Cambridge Street
Boston, MA 02114

Dear Mr. Anderson:

The Massachusetts Healthy Soils Action Plan (HSAP) Challange Grant presents an exciting opportunity to implement the HSAP's recommended action steps to improve the current state of soil health in Massachusetts, including for wetlands. In response to this opportunity, BSC Group, together with Regenerative Design Group, Woodwell Climate Research Center, the Massachusetts Association of Conservation Commissions, and Scouter Design, has prepared a proposal to develop a "**Healthy Soils Action Plan Wetland Management & BMPs Guide**" (Guide) for your consideration.

The Guide, if funded, will be wetlands-specific, and will follow the overall structure of the HSAP Guide for Implementing the Healthy Soils Action Plan in Design and Construction[1] (Development Guide), with the goal of providing a supplemental reference with a more detailed treatment of wetland-related topics, and topics not addressed in the Development Guide, such as:

- Mosquito management
- Forestry impacts
- Ecological Restoration
- Invasive Species Management

The guide will outline best management practices (BMPs), will provide tools and resources for promoting healthy wetland soils, and will be geared towards wetland professionals/managers, volunteer Conservation Commissioners and communities. The proposed Healthy Soils Action Plan Wetland Management & BMPs Guide, if funded, will contribute to meeting the following HSAP and Challenge Grant RFR goals:

- *Considers ways to preserve and increase existing soil organic carbon stocks and sequestration capacity, potentially including updating the Massachusetts Wetlands Protection Act (Priority action #3 of 6, Massachusetts Healthy Soils Action Plan*
- *Provides education programs for statewide healthy wetland soil training programs, including developing a statewide program to recognize, educate, and incentivize wetland soil health and Best Management Practices.* (RFR for Challenge Grants Implementing the Commonwealth's Healthy Soils Action Plan (Round 2, Attachment A, Ideas and Project Suggestions)

We believe our project team is uniquely qualified to provide a practical and effective option for implementing the HSAP and its goals. Thank you for your consideration and please feel free to contact me with any questions about our proposal or require additional information.

Sincerely,

BSC Group

Gillian T. Davies

Gillian Davies, PWS, RSS, NHCWS, CESSWI
Senior Ecologist / Natural Climate Solutions Specialist

[1] The Development Guide currently is being prepared by Regenerative Design Group and a team that includes BSC Group under an ongoing HSAP Challenge Grant (HSAP Challenge Grant Project C137).

Table of Contents

Project Description

INTRODUCTION

Wetlands store approximately 30% of the world's soil carbon, while occupying only approximately 6% of the world's land surface![1]

The 2023 Healthy Soils Action Plan (HSAP) estimates that the state's forested, scrub/shrub and emergent herbaceous wetlands cover approximately 590,565 acres (~14% of Massachusetts land area), and store approximately 190 million tons of Soil Organic Carbon (SOC), the equivalent of 698 million tons of carbon dioxide. In our Massachusetts wetlands, per-acre soil organic carbon stocks average more than double the stocks found in upland forests. The HSAP reports that the vast majority of wetlands are freshwater forested wetlands, which occupy ~407,578 acres, or 69% of total Massachusetts wetland area.

Although the Wetlands Protection Act regulations offer some protection for Massachusetts wetlands, they do not yet recognize the carbon-related functions of wetland soils and their ability to keep the planet cooler and do allow a variety of impacts to wetland soils without requiring mitigation for carbon impacts.

The HSAP predicts that Business as Usual rates of wetland conversion to development will result in 84,000 more metric tons of carbon emitted per year than if smart growth measures are implemented that result in a 50% reduction in wetland conversion (see HSAP page 58). The HSAP makes over two dozen evidence-based recommendations to assist in reducing wetland carbon emissions caused by human activities. Implementing these soil-smart changes in wetland management will require education and tools for wetlands professionals, volunteer Conservation Commissioners, and others, guided by a clear roadmap and specific recommended actions.

[1] A) Jackson, R.B., Lajtha, K., Crow, S.E., Hugelius, G., Kramer, M.G. & Piñeiro, G. (2017). The Ecology of Soil Carbon: Pools, Vulnerabilities, and Biotic And Abiotic Controls. Annu. Rev. Ecol. Evol. Syst. 48: 419–445. B) Poulter, B., Fluet-Chouinard, E., Hugelius, G., Koven, C., & Fatoyinbo, L. (2021). A Review of Global Wetland Carbon Stocks and Management Challenges. In Geophysical Monograph Series. C) Zhang, Z., Fluet-Chouinard, E., Jensen, K., McDonald, K., Hugelius, G., Gumbricht, T., Carroll, M., Prigent, C., Bartsch, A., Poulter, B. (2021). Development of the Global Dataset of Wetland Area and Dynamics for Methane Modeling (WAD2M). Earth Syst. Sci. Data, 13, 2001-2023, 2021. https://doi.org/10.5194/essd-13-2001- 2021

In addition to promoting the general awareness and understanding of the Healthy Soils Action Plan among wetlands professionals, volunteer Conservation Commissioners, and others in Massachusetts, this project specifically furthers the following recommendations:

W2 - *Consider updates to design standards, regulations, construction practices, and oversight to ensure [wetland] replication and restoration efforts are effective and successful at creating/regenerating healthy wetland soil conditions.*

- **a.** Practices:
  - **i.** Improve specifications for siting replication wetlands in areas that have proven supporting hydrology.
  - **ii.** Update guidance such that the construction process of replication wetlands minimizes disturbance to the surrounding area and preserves, to the greatest extent possible, the integrity of existing native vegetation and translocation of full wetland soil profile, including roots and living shrubs and herbaceous species from the impact area to the replication area where feasible. Removal or stockpiling of wetland soils from site should be avoided or minimized. (Page 62)

W7 - Seek to revise management activities in wetlands including vegetation management, filling, dredging, or other modifications to hydrology so they account for the impacts to soil health such as additional carbon emissions, reduced sequestration, or increased sediment transport.

- **a.** Promote invasive species management that does not damage wetland soil health.
  - **i.** Develop soil-smart BMP's for invasives management.
  - **ii.** Conduct training and outreach on these BMP's. (Page 63)

This project seeks to craft a wetlands-specific guide to supplement and complement and build upon the **"Guide for Implementing the Healthy Soils Action Plan in Design and Construction" (the Development Guide)** that is currently being developed through a spring 2024 HSAP Challenge Grant. BSC Group, Inc. and Regenerative Design Group are part of the team that is developing the Development Guide, which will provide some guidance pertaining to wetland healthy soils but will need to be supplemented with a more detailed, in-depth document/tools and associated outreach to the wetlands-specific community. This more detailed **"Healthy Soils Action Plan Wetland Management & BMPs Guide" (Wetland Guide)** will be available on the **Massachusetts Healthy Soils Website (MA Healthy Soils Website)** being developed in FY24 under the FY24 HSAP Challenge Grant (i.e. Regenerative Design Group's HSAP Challenge Grant Project C137).

The Wetland Guide will contribute to the completion of the above-mentioned priority actions and recommendations by engaging a cross-section of wetland professionals (local, state, and federal regulators and government agency staff, consultants, and non-profit staff (a.k.a. wetland managers)) and volunteer Conservation Commissioners in a series of coordinated events.

The insights and recommendations generated throughout these events, will inform the final work product of this project: **"Healthy Soils Action Plan Wetland Management & BMPs Guide" (Wetland Guide)**. This will be a web-based resource, housed on the MA Healthy Soils Website developed through the spring 2024 HSAP Challenge Grant, as mentioned above. Because of the web-based format, wetland professionals/wetland managers from all sectors as well as volunteer Conservation Commissioners and property owners will be able to access findings from events, general wetland soil health information, published soil specifications, standards, and policies, case studies, and clear actions and

recommendations to improve long-term wetland soil health in Massachusetts on one single website.

The Wetland Guide will be developed in four phases over an 18-month period from January 2025 to June 2026 (see the Methodology and Timeline sections). Each of these phases will center on wetland-focused engagement events (see Team). Between events, the Project Team (led by BSC Group, a member of the HSAP Working Group, and RDG, one of the primary authors of the HSAP), will distill participant input and additional research into policy briefs. These briefs will outline the gap between current wetland management practice and related recommendations from both the Healthy Soils Action Plan and other relevant sources. In collaboration with subject matter experts, recommendations for improving typical practices and standards, and addressing common problems will be developed and refined. These recommendations and supporting resources will be presented at key wetlands-focused conferences/meetings, in webinars, and published on the MA Healthy Soils Website.

The Project Team is uniquely qualified to develop the Wetland Guide because team members include the lead authors of the HSAP (Regenerative Design Group (RDG)), a member of the HSAP Working Group (BSC Group), and the consulting team from the Massachusetts Department of Environmental Protection (MassDEP) No Net Loss of Wetland Carbon Project (BSC Group, RDG, Woodwell Climate Research Center (Woodwell) and the Massachusetts Association of Conservation Commissions (MACC)).

For the No Net Loss of Wetland Carbon Project, our team conducted an extensive literature search on wetland carbon science, policy, and management; used machine learning to map Massachusetts wetland extent and wetland carbon; developed preliminary software recommendations and mock-ups for a wetland carbon user interface; and provided MassDEP and the Massachusetts Executive Office of Energy & Environmental Affairs (EEA) with extensive policy, regulatory, and wetland management recommendations. The final report for this project is currently under review by MassDEP. This Massachusetts wetland and soil carbon background will allow the Wetland Guide Project Team to draw on internal wetland healthy soil subject matter expertise and resources, while aligning with, and avoiding duplication of, prior efforts.

GOALS + OBJECTIVES

This project meets all four primary objectives of these HSAP Challenge Grants in the following ways:

1. **Promote Soil Health:** To support demonstration type projects that document, prioritize and implement practices aimed at improving soil health and fertility.
   - › *This project includes a review of a variety of Massachusetts wetland project types and management practices that impact wetland soils, including those that are exempt from Wetlands Protection Act requirements, that are located in or near wetlands, and that demonstrate applied practices for protecting and improving wetland soil health.*
2. **Sustainable Land Management:** To encourage innovative approaches to sustainable land management that minimizes environmental degradation, enhances biodiversity and/or restores degraded soil health.
   - › *This project will engage wetland professionals/managers from all sectors (see list above) and volunteer Conservation Commissioners in compiling recommended ways they can ensure the ongoing management of wetland and wetland buffer zone soils will minimize environmental and wetland degradation, enhances biodiversity, and/or restores degraded soil health.*
3. **Community Engagement:** To foster community involvement and education in sustainable land practices and soil health improvement.
   - › *This project has an anticipated reach of over 2000 wetland professionals and volunteer Conservation Commissioners through presentations coordinated with wetlands-focused Massachusetts/New England organizations such as MACC, Association of Massachusetts Wetland Scientists, etc. Industry-relevant CEUs will be offered to incentivize participation in trainings.*
4. **Refine Tools for Municipal Soil Mapping, Assessment + Planning:** Update and distribute assessment and planning tools to enable municipalities, regional planning districts, and conservation organizations to visualize and integrate soil health into regular workflows.
   - › *The final main deliverable (the Wetland Guide) for this project will provide specific tools and recommendations for municipalities, wetland professionals/managers, state agencies, Conservation Commissions, and other conservation/wetlands organizations (including MACC) to promote and disseminate among their memberships, inform state and local policy and ordinances, and use as a reference for research and demonstration projects.*

THE CHALLENGES

Projects in or near wetlands, and the carbon, soil, and ecosystem dynamics of wetlands themselves, are inherently complex. For instance, wetland disturbance typically results in increased carbon emissions from the disturbed wetland, particularly when wetland soils are disturbed or drained.

Successful protection and restoration of wetland soil health and mitigation for impacts to soil health involve the input and collaboration of wetland professionals (see list above) from a variety of sectors and disciplines, as well as volunteer Conservation Commissioners at the local level. Additionally, professionals from other disciplines are involved in wetland management, including planners, architects, developers, environmental, structural, and civil engineers, environmental monitors, landscape architects, landscape designers, contractors, foresters, ecological restorationists, and invasive species & mosquito control professionals. However, there is no single, authoritative, and regionally specific source of information on how to achieve soil health shared between all of these wetland professionals and volunteers and that covers all of the wetland management activities that they engage in.

For many of these professionals, basic literacy on the value of wetland soils, risks of degradation, drying, draining, compaction, and a basic understanding of wetland soil health and carbon dynamics, and how it differs from upland soil health and carbon dynamics, is absent. The existing, dispersed resources available on wetland soil-smart management practices are not widely known or accessible to all of these disciplines and sectors.

As a result, often, even with the best ambitions towards sustainable wetland management practices, existing wetland soils are damaged, degraded, drained, dried, eroded, and/or destroyed.

Some of the challenges in developing a shared definition and standard for wetland soil health are outlined below:

- **Existing regionally-appropriate wetland soil health resources are non-existent or are dispersed and siloed, depending on the topic.** Much of the existing research in understanding the impact of disturbance on wetland soil health has been led by researchers in the fields of wetlands, biogeochemistry, ecology, and soil science, and is held in field-specific journals, apps, and tools. Other relevant/related documents relative to erosion and sedimentation control have been produced by professionals engaged in the development and forestry industries, and others have been produced relative to ecological restoration and installation of soils during wetland and other ecosystem restoration and replication activities.
- **Many example standards, practices, and specifications for wetland healthy soil and wetland soil Best Management Practices (BMPs) are specified by state agencies, or are maintained in private, discipline-specific certifications, or are recreated office by office. Healthy soils standards and specifications specifically addressing wetland soil carbon are few and far between, and often completely missing from guidance documents, regulatory requirements/performance standards, or professional certification requirements.** The Massachusetts Department of Environmental Protection (MassDEP) Wetlands and Waterways Program has developed: Inland Wetland Replacement Guidelines that include wetland replication soils guidance; guidance for salt marsh restoration techniques; the Massachusetts Vegetated Buffer Manual; dam-removal guidance; erosion and sedimentation control guidelines and best management practices; and stormwater policies, guidance, standards, and regulations; all of which relate to wetland soils (https://www.mass.gov/guides/wetlands-information#-wetlands-guidance-).

Relevant professional certifications include several offered by EnviroCert (https://envirocert.org/programs/); registration as a professional soil scientist through the Society of Soil Scientists of Southern New England; certification as a professional soil scientist through the Soil Science Society of America (Home - Soil | Soil Science Society of America); and certifications through the Society for Ecological Restoration (https://www.ser.org/general/custom.asp?page=Certification) and the Society of Wetland Scientists Professional Certification Program (https://wetlandcert.org/). Certifications can require mastery over specific soil-related BMPs or other aspects of soil science. These certification programs are not tailored to all disciplines involved in wetlands management and may not be affordable, or applicable to some situations in Massachusetts. Soil management literacy needs to be a universal baseline expectation for all wetland management activities and projects.

- **Introducing new science-backed best practices has a barrier to entry in practice.** The gap between the scientific understanding of how to build soil health and the economically driven systems of development needs to be addressed directly before the industries will be willing to adopt changes. In some cases, the gap may be a lack of knowledge, and in some cases the gap may be in additional costs or perceived costs that prevent an action from being readily implemented. Best practices that are easy to read and apply can be difficult to find, their application is often inconsistent, and associated training is rarely provided for the full spectrum of workers implementing these practices.
- **Standard soil management practices and specifications used for wetland management, wetland mitigation, and projects in Massachusetts often do not fully address the role and dynamics of Soil Organic Carbon (SOC) in achieving and maintaining healthy wetland soils.** The HSAP identifies SOC as the lynch pin for long-term soil health. However, standard wetland soil management practices and specifications often lack fully developed approaches and specification details for optimization of soil health and wetland function. These wetland soil management practices and specifications need to be further developed and updated to include the current understanding of SOC and wetland soil function. Furthermore, SOC represents over 80% of estimated global carbon stocks in terrestrial ecosystems, much of which is in wetlands, and represents the bulk of opportunity for the future carbon storage and sequestration capacity of Massachusetts living systems. As noted above, wetlands, due to anoxic soil conditions, hold a disproportionate amount of soil carbon both in Massachusetts and globally, on a per acre basis.
- **Soil Organic Carbon resources and management practices need to be regionally specific.** The potential for, and rate of, soil carbon sequestration is impacted by both existing soil characteristics, land cover, and climate. These are all highly regionally specific variables. Recommended actions need to be appropriate for soil types, land cover typologies, and the climate that exists within Massachusetts.
- **Avoiding Redundancy with the HSAP Development Guide.** Since the Wetland Guide team is composed of many of the same team members as those developing the Development Guide, we are uniquely positioned to avoid redundancy of content and engagement events. The Project Teams for both of these projects will coordinate and share information closely to avoid reinventing the wheel.

METHODOLOGY

This project will meet the stated goals + objectives while addressing the above challenges through the engagement of wetland professionals/managers from diverse sectors and volunteer Conservation Commissioners. This engagement-focused methodology will use gatherings of wetland professionals/managers and Conservation Commissioners to reconcile current practice with recommended methods to enable greater long-term wetland soil health in Massachusetts and beyond. Wherever possible, project events will offer relevant industry CEUs.

The primary method for achieving this goal is to engage people who influence or are actively engaged in wetland management in understanding and discussing the findings of the HSAP and the latest wetland soil organic caron science. Building a common understanding and wetland healthy soil vocabulary among Conservation Commissioners and professionals from the full range of relevant disciplines involved in wetland management is essential in ensuring that the principle of building soil health is held and maintained through the arc of a project or activity, from start to finish, concept to completion.

In order for the findings from HSAP to be implemented at an impactful scale, practitioners first need to be aware of basic wetland healthy soil principles and understand how wetland management affects soil health and climate change resilience and the carbon cycle, including understanding the fundamentals of wetland soil carbon science & dynamics and how they differ from upland soil carbon science & dynamics.

This project will avoid redundancy with the FY24 HSAP Development Guide by focusing on wetlands-specific soil health topics that are either not addressed in the Guide (i.e. not specifically related to development projects) or are addressed in a simplified manner.

For soil health topics that have been fully addressed either in the Guide or in other documents, such as stormwater management and soil erosion and sedimentation controls, or which have extensive existing guidance documents and regulations, the Wetland Guide will reference the Development Guide.

The Wetland Guide will evaluate the effectiveness of existing regulations and practices in contributing to long term wetland soil health and assess whether updates are needed. Where inadequacies, recurring or common problems, or conflicts, are identified, the Project Team will draft recommendations to present in Stakeholder Group events and publish in the Guide.

The Project Team is uniquely suited for this task, as members of the Project Team (BSC Group, RDG, Woodwell Climate Research Center, and MACC) are the consulting team for the MassDEP No Net Loss of Wetland Carbon Project, which is nearing completion. Once the MassDEP No Net Loss of Wetland Carbon Report has been approved by MassDEP for release, relevant content from that project and report can be added or referred to in the Wetland Guide. Further, BSC Group was the lead author of the MACC Wetlands Buffer Zone Guidebook, another relevant resource that can be referenced in the Wetland Guide.

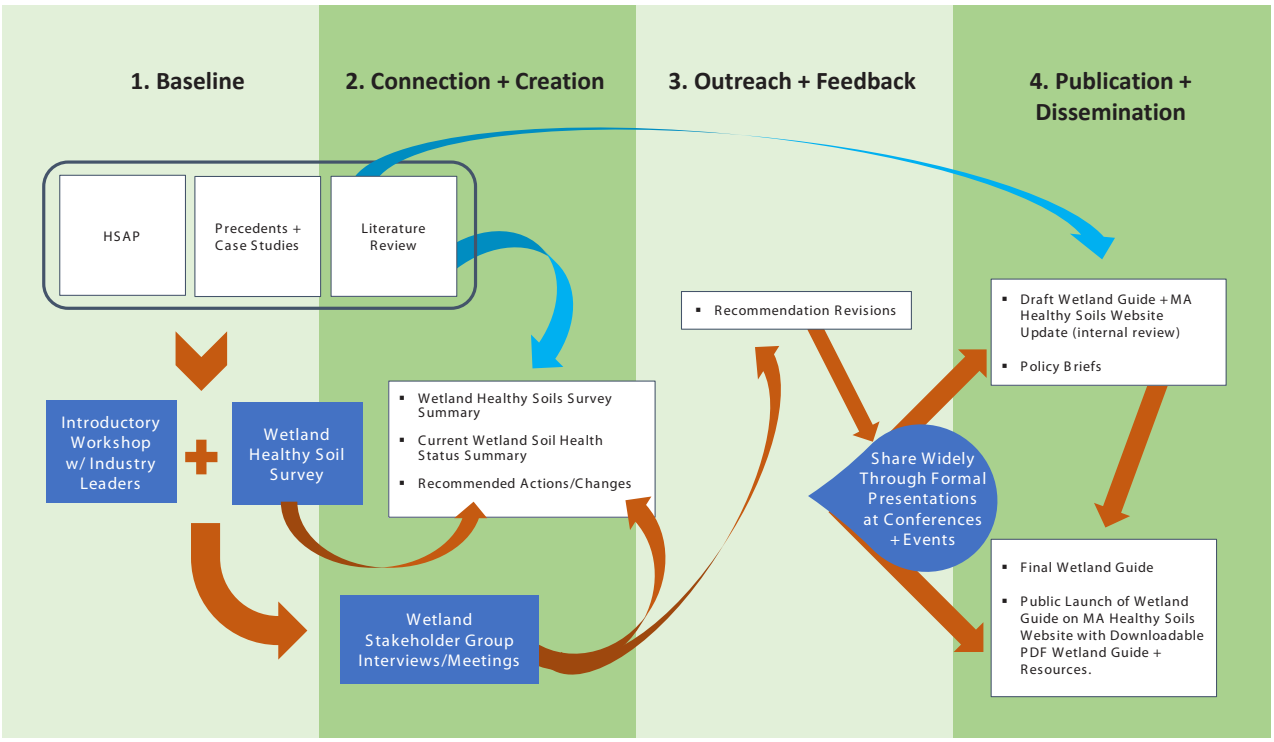
Through engaging with multi-sector wetland professionals and Conservation Commissioners we will identify leverage points for change in the current systems and practices for wetland management. These leverage points will determine the focus for pull-outs or chapters in the Wetland Guide.

Good communication, coordination, and project management is essential for any project. At the start of the project, the BSC Project Manager (Gillian Davies) will be available for a Zoom Kickoff meeting with EEA to review the project scope and budget and discuss any questions or requests.

Throughout all the Phases, the Project Team will communicate actively with EEA staff via email and quarterly project status summaries. Additionally, the Project Team will communicate actively and coordinate internally with all team members to ensure the project is accomplishing project milestones in accordance with the project timeline, stays on budget, and the actions of all team members are well coordinated. As project manager, BSC will lead project coordination and communications and will compile and submit quarterly project status summaries. BSC is highly experienced in managing projects of this size and scope, and that involve multiple consulting groups and complex client goals and concerns.

The following diagram illustrates our methodology for integrating engagement activities throughout the four phases of this project and into the final published deliverables.

Engagement Focused Methodology



Note: Project Management will begin with a Zoom Kickoff meeting between EEA and the project manager and continue throughout the project via strong communications both between EEA and the project manager and within the Project Team and will include provision of quarterly project summaries to EEA.

EXPECTED OUTCOMES + DELIVERABLES

The primary deliverables from this project will be a series of engagements and a curated set of resources for Massachusetts-based wetland professionals/managers and volunteer Conservation Commissioners.

Through participation at existing conferences and events that consistently draw high levels of attendance, we are confident this project will fulfill five key outcomes:

1. Enhance understanding of wetland soil health among wetland professionals/ managers and volunteer Conservation Commissioners,
2. Strengthen existing professional networks and support new partnerships to continue and accelerate the adoption of HSAP recommendations pertaining to wetlands,
3. Enable better communication and coordination across sectors and disciplines involved in wetland management by growing a shared understanding of wetland soil health and that factors that influence it,
4. Identify key challenges and limitations to implementing wetland related recommendations from the HSAP, and
5. Provide actionable recommendations and strategies to help wetland professionals/ managers (including private, non-profit, and public sector) and Conservation Commissions address these challenges.

The final deliverables for this project will be:

1. Presentation or facilitation of at least six (6) total Educational + Outreach Events for Wetland Management Professionals/ Managers & Volunteer Conservation Commissioners.
2. Detailed wetland management content will be added to the **Massachusetts Healthy Soils Website (MA Healthy Soils Website)**. By adding to this existing website, the wetland-specific information generated by this project will be accessible to all sectors and disciplines that engage in wetland management activities, and wetland content will be coordinated with existing content on the MA Healthy Soils Website. The MA Healthy Soils Website allows the public, volunteer Conservation Commissioners, and professionals of multiple disciplines to access the findings from events, general soil health information, published soil specifications, standards, and policies, case studies, and clear actions and recommendations to improve long-term soil health in Massachusetts, including:
    a. Aggregation of research as a curated dataset available as annotated bibliography and/or Zotero library.
    b. Custom Educational Resources as downloadable PDFs.
    c. List of resources, apps, tools, and institutions for further reading.
3. Three (3) Wetland Healthy Soil Policy Briefs for relevant agencies, including MassDEP, MassDER, MassCZM, EEA, and other state agencies.

PROJECT IN-KIND MATCH

This project includes match contributions including the following:

- Project Team members giving presentations at professional conferences and non-profit annual meetings (see Expected Outcomes + Deliverables section) will do so on a *pro bono* basis.
- Project Team office space will be available for in-person meetings and/or workshops at no cost.

This proposal document serves as the written commitment of the Project Team to provide the specified match services noted above.

DISSEMINATION OPPORTUNITIES + EVENTS

The following list of organizations have been contacted about partnering in this effort. If this proposal is funded, the Project Team anticipates working with these organizations in one or more of the following ways:

- Invite members/community to participate in Stakeholder Interviews/Meetings.
- Deliver workshops or presentations via webinars or participation in annual meetings or conferences.
- Promote public events via social media outlets + member newsletters.

The Project Team has long-standing relationships with all of these organizations, including long-standing memberships and service on organization Boards, thus facilitating communication and coordination. As noted above, MACC is a member of the Project Team.

Organization	Average Event Attendance and/or Reach	Target Event(s)
Massachusetts Association of Conservation Commissions	Average attendance of 700 people at the Annual Conference & membership/ outreach of 2,000 people.	Fall Conference (October 2025) and Annual Environmental Conference (Spring 2026), Webinar-capable
Association of Massachusetts Wetland Scientists (AMWS)	Estimated attendance of 100	Annual Meeting in 2025/2026
Society of Wetland Scientists (SWS) New England Chapter	Estimated attendance of 100	Annual Meeting in 2025/2026
Society for Ecological Restoration (SER) New England Chapter	Estimated attendance of 250	Bi-Annual Meeting in 2026
Environmental Business Council (EBC)	EBC's marketing platforms reach over 10,000 contacts throughout New England.	Webinar in 2025/2026

Budget

On the following page we have provided our proposed budget for the Healthy Soils Action Plan Wetland Management & BMPs Guide.

BUDGET

Project Phase	*Subtask*	Grant Monies	In-Kind Match Contributions
Phase 1: Baseline Research + Materials Compilation	1.1 Literature Review + Activities/ Practices Summary	$ 15,015	$ -
	1.2 Introductory Wetland Healthy Soil Workshop	$ 7,263	$ -
	1.3 Wetland Healthy Soil Survey	$ 4,146	$ -
	1.4 Project Management	$ 932	$ -
Phase 1: Baseline Research + Materials Compilation Total		**$ 27,356**	**$ -**
Phase 2: Connection + Creation	2.1 Wetland Healthy Soil Survey Summary	$ 3,293	$ -
	2.2 Current Soil Health Status	$ 11,747	$ -
	2.3 Recommended Actions/Changes	$ 6,909	$ -
	2.4 Stakeholder Group Interviews/ Meetings	$ 3,984	$ -
	2.5 Project Management	$ 745	$ -
Phase 2: Connection + Creation Total Total		**$ 26,678**	**$ -**
Phase 3: Outreach + Feedback	3.1 Draft Recommendations Revisions	$ 5,704	$ -
	3.2 Wetland Community Engagement Events	$ 627	$ 17,500
	3.3 Project Management	$ 745	$ -
Phase 3: Outreach + Feedback Total		**$ 7,076**	**$ 17,500**
Phase 4: Publication + Dissemination	4.1 Draft Wetland Guide + MA Healthy Soils Website Update - Internal Review Launch	$ 18,029	$ -
	4.2 Wetland Guide Policy Briefs	$ 8,235	$ -
	4.3 Final Wetland Guide	$ 10,700	$ -
	4.4 MA Healthy Soils Website Update - Public Launch	$ 1,136	$ -
	4.5 Project Management	$ 745	$ -
Phase 4: Publication & Dissemination Total		**$ 38,101**	**$ -**
Grand Total		**$ 99,957**	$ 17,500

Note: In-Kind value for services includes donated time from Project Team members who give presentations. Team member time donated for presentations at events is estimated as follows: 6 events x 2 people x 5 hours/event + 40 hours presentation preparation = 100. 100 x $175/hour (avg senior staff rate) = $17,500. Project Team will also donate use of office space for meetings as needed.

BSC GROUP

Organizational Capacity

The BSC Project Team for the Healthy Soils Action Plan Wetland Management & BMPs Guide project is comprised of leading organizations who are heavily involved in major climate resilience planning efforts in Massachusetts.

ABOUT BSC

BSC Group (BSC), founded in 1965, is a full-service planning and engineering consulting firm with a staff of 185 personnel and offices in Boston, Worcester, Andover and West Yarmouth, Massachusetts, as well as Glastonbury, Connecticut, and Manchester, New Hampshire. BSC has provided interdisciplinary ecological, permitting, design, planning, GIS, and construction phase services for municipal, state, and private sector clients throughout the northeast for nearly six decades. BSC's ecological team includes over 50 scientists, subject matter experts, former regulators, and advisory panel members who routinely apply their expertise to challenging projects, offering key insights and strategic benefits.

BSC PROJECT TEAM

BSC will serve as prime consultant, leading the development of the Wetland Guide, including wetlands community outreach and engagement. BSC has joined forces with members of several leading Massachusetts organizations, including Regenerative Design Group, Woodwell Climate Research Center, Massachusetts Association of Conservation Commissions, and Scouter Design, for the development of a Healthy Soils Action Plan Wetland Guide.

Each of these leaders has unique expertise and together provide unparalleled depth in wetland science and management (including relevant soil science research & practice, wetland science research & practice, ecological restoration, design, landscape architecture, engineering, and environmental monitoring fields).

Additionally, the Project Team will coordinate with Massachusetts/New England wetlands-focused organizations for dissemination of Wetland Guide information via presentations at conferences and meetings and in webinar format.

The Project Team has long-standing relationships with all of these organizations, including memberships and service on organization Boards, thus facilitating communication and coordination.

The firms represented in this Project Team have a proven track record of implementing successful projects of this scale. Individually, each of these firms has been at the forefront of climate resilience, wetland and soil carbon, wetland and soil research, and/or practice and policy work in their respective fields.

Regenerative Design Group (along with Linnean Solutions) led the production of the Healthy Soils Action Plan and was a member of the MassDEP No Net Loss of Wetland Carbon Project consulting team. **BSC Group** served on the HSAP Working Group and led the MassDEP No Net Loss of Wetland Carbon Project. **Woodwell Climate Research Center** was a member of the MassDEP No Net Loss of Wetland Carbon Project consulting team and is an award-winning world class ecosystem climate research center with a substantial focus on the carbon dynamics of wetlands. **MACC** is the non-profit that educates and supports Conservation Commissions in Massachusetts, and regularly contributes to Massachusetts wetland regulatory and policy discussions. Additionally, these firms/organizations have gone on to collaborate on four MVP Program projects that operationalized the insights and recommendations from the HSAP for municipalities.

KEY PERSONNEL

Gillian Davies, PWS, RSS, NHCWS; Casey-Lee Bastien, RLA, SITES-AP, CPSI, OSHA; Dominic Rinaldi, PE, LEED AP, OSHA; Catarina Martinez, MEM; Ethan Sneesby, RSS; Emily Alderton, PhD [BSC Group]

- **Project management + outreach & engagement + technical review + production lead.** BSC will serve as the Prime with Gillian Davies as Project Manager. BSC staff will lead the outreach & engagement program; review of wetland soil management practices and specifications; case study collection; current & recommended best management practices collection; identification of existing challenges to achieving better wetland soil health; prepare graphics; format and layout final work products; lead the creation of educational wetlands HSAP Presentations; and present at affiliate conferences.

Keith Zaltzberg, Rachel Lindsay, Bas Gutwein, Rafter Ferguson PhD, Eric Giordano, Von Harvey [Regenerative Design Group]

- **MA Healthy Soils Website coordination + technical review + production support.** RDG will assist in the technical review and the creation of educational HSAP wetland presentations; and present at affiliate conferences, as well as support development of presentation and website materials.

Jennifer Watts PhD, Taniya Roychowdhury PhD [Woodwell Climate Research Center]

- **Technical review + wetland healthy soil workshop host.** Woodwell will assist in the technical review and will host a wetland healthy soils workshop at their facility in Falmouth, MA.

Dorothy McGlincy, Michele Girard [Massachusetts Association of Conservation Commissions]

- **Technical review + wetland healthy soil workshop host** during MACC fall and spring conferences.

Terri Courtemarche, [Scouter Design]

- **Graphic Design + report formatting.** Scouter design will format reporting documents and assist with graphics.

On the following page, we have provided an organization chart demonstrating the responsibilities of the organizations on our team. Team member profiles and project descriptions can be found in Appendix A and professional resumes for all proposed team members can be found in Appendix B.

PROJECT TEAM

EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS

DIVISION OF CONSERVATION SERVICES

PROJECT MANAGER

Gillian Davies, PWS, SSSSNE, NHCWS, CESSWI

PHASE 1

LITERATURE REVIEW

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** - Contribute

Massachusetts Association of Conservation Commissions - Review

INTRODUCTORY WORKSHOP

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** - Participate

WETLAND HEALTHY SOIL SURVEY

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** + **Massachusetts Association of Conservation Commissions** - Contribute

PHASE 2

WETLAND HEALTHY SOIL SURVEY SUMMARY

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** + **Massachusetts Association of Conservation Commissions** - Review

WETLAND SOIL HEALTH STATUS SUMMARY + RECOMMENDED ACTIONS/CHANGES

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** - Contribute

Massachusetts Association of Conservation Commissions - Review

WETLAND STAKEHOLDER GROUP INTERVIEWS/MEETINGS

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** - Participate

PHASE 3

RECOMMENDED ACTIONS/CHANGES REVISIONS

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** - Contribute

CONFERENCE PRESENTATIONS

BSC Group + **Regenerative Design Group** + **Woodwell Climate Research Center** - Presenters

Massachusetts Association of Conservation Commissions - Host

Other Organizations - Host

PHASE 4

DRAFT & FINAL WETLAND GUIDE

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group**- Contribute

Massachusetts Association of Conservation Commissions - Review

Scouter Design - Graphic Design

DRAFT WEBSITE UPDATE

Regenerative Design Group - Lead

POLICY BRIEFS

BSC Group - Lead

Woodwell Climate Research Center + **Regenerative Design Group** - Contribute

Massachusetts Association of Conservation Commissions - Review

Scouter Design - Graphic Design

FINAL WETLAND GUIDE ADDED TO MA HEALTHY SOILS WEBSITE

Regenerative Design Group - Lead

Project Timeline

PROPOSED TIMELINE

This project will be conducted in four phases between January 1, 2025 and June 30, 2026

1. Baseline: Research + Materials Compilation

January to June 30, 2025

1.1. **Literature Review + Activities/ Practices Summary:** Summary of wetland soil scientific/management practice literature review, types of activities and practices impacting Massachusetts wetland soils, published industry standards/wetland soil specifications, and precedent materials (including case studies).

1.2. **Introductory Wetland Healthy Soil Workshop (1):** To establish relationships with key professional organizations and facilitate introductory presentations of the principal wetland-related findings from HSAP: Understanding the HSAP and Why Soil Health Matters for Wetlands.

1.3. **Wetland Healthy Soil Survey:** Widely distributed for industry leaders and Volunteer Conservation Commissioners to solicit knowledge, comments, and questions.

Phase 1 Milestones:

- Science & Practice Literature Review, Precedents Summary, + Case Studies.
- Introductory Wetland Healthy Soil Workshop.
- Wetland Healthy Soil Survey.

2. Connection + Creation: Evaluation, Synthesis, and Networking

March to September 2025

2.1. **Prepare Wetland Healthy Soil Survey Summary.**

2.2. **Current Soil Health Status Summary:** Prepare summary of identified gaps, conflicts, and inadequacies of current wetland soil standards, specifications, and management practices with regards to MA existing wetland soils characteristics.

2.3. **Recommended Actions/Changes:** Draft recommended actions and suggested changes to existing standards, specifications, and practices.

- **Wetland Guide Outline:** Identify at least six (6) discrete topics for the Wetland Guide PDFs. These will be targeted to fill gaps in current practices and address the leverage points identified in Phases 1 + 2.

2.4. **Two (2) Wetland Stakeholder Group Interviews/Meetings:** At these meetings, stakeholder groups explore possible avenues and actions to increase wetland soil health outcomes in their line of work, review draft recommendations, and provide feedback and suggestions to the project team.

Phase 2 Milestones:

- Summary of Wetland Healthy Soil Survey.
- Identification of Gaps + Needs.
- Guide Outline + Draft Recommendations for Changes to Existing Standards, Specifications, + Practices.
- 2 Stakeholder Group Interviews/Meetings.

3. Outreach + Feedback

May 2025 through June 2026

3.1. **Recommendations Revisions:** Revisions to draft recommendations from Phase 2 Stakeholders.

3.2. **Wetland Community Engagement Events:** A minimum of six (6) public presentations at professional conferences and/or webinars to build broader understanding and awareness of wetland soil health and get additional feedback from wetland professionals/managers and Conservation Commissioners on challenges and draft recommendations (see the table in Outcomes + Deliverables).

- *These events will offer relevant Industry CEUs where possible*

Phase 3 Milestone

- Revised Recommendations Based on Stakeholder Input.
- 6 Presentations, Workshops and/or Webinars with Targeted Wetlands Communities.

4. Publication + Dissemination

June 2025 through June 2026

4.1. **Draft Wetland Guide + Massachusetts Healthy Soils Website (MA Healthy Soils Website) Update:** Prepare Draft Wetland Guide and add Draft Wetland Guide content to MA Healthy Soils Website for Project Team, Stakeholder Group, + EEA review (internal access only).

4.2. Prepare **Three (3) Policy Briefs for relevant agencies**, including MassDEP and EEA.

4.3. **Final Wetland Guide submitted to EEA with full list of references, resources, anticipated challenges to adaptation, and suggestions for further studies**

4.4. Public launch of **Wetland Guide** content on the **MA Healthy Soils Website.**

- Endorsements by at least 3 wetland-focused Massachusetts/New England organizations. “Endorsement” is considered one or more public actions such as:
  - Linking/hosting the Wetland Guide materials on their organization’s website.
  - Publishing article(s) and press releases.
  - Sharing the Wetland Guide in social media outlets.
  - Adopting the Wetland Guide as a required reference for trainings and/or certifications.
  - Hosting presentations/workshops/webinars based on the Wetland Guide *(with industry-relevant CEUs potentially offered).*

Phase 4 Milestones

- Draft Wetland Guide Provided by November 30, 2025.
- 3 Policy Briefs for Relevant Agencies Provided by June 30, 2026.
- Final Wetland Guide and All Associated Materials Provided by June 30, 2026.
- Wetland Guide Content Added to MA Healthy Soils Website by June 30, 2026.

Project Evaluation and Monitoring

PERFORMANCE METRICS

1. A total reach of over 2000 individuals through wetlands-focused Massachusetts/ New England organizations, with direct engagement of at least 100 wetland professionals/managers and volunteer Conservation Commissioners at workshops, webinars, and conference presentations.
2. The distillation of current research on wetland management (including wetland restoration and creation) practices relative to soil health (i.e. soil organic carbon, water infiltration and holding capacity, soil structure, soil biodiversity, and net primary productivity) as applicable to Massachusetts wetland soils and wetland types.
3. Catalog of gaps in research and information, and needs for additional/ alternative management practices, restoration methods, and healthy wetland soil specifications.
4. Publicly available published Wetland Guide, with downloadable PDFs and associated web-based resources.
5. Endorsement of the Guide by at least 3 Massachusetts/New England wetlands-focused organizations.

REPORTING

Progress reports summarizing project activities and accomplishments will be submitted on a quarterly basis. The progress reports will include supplemental materials, such as copies of meeting presentations, meeting notes, attendance lists, annotated bibliographies, and recommendations. Relevant documents from the prior quarter will be submitted as a batch each quarter. The final project materials will be uploaded to the project webpage and submitted as PDF's to the EEA on or before June 30, 2026.

Sustainability Plan

POST-GRANT PROJECT SUSTAINABILITY ASSESSMENT

This project represents the continuation of a partnership established between the Regenerative Design Group and BSC Group that began during the production of the Healthy Soils Action Plan.

Since completing the majority of the HSAP work in 2021, these firms have gone on to collaborate on four MVP Program projects that operationalized the insights and recommendations from the HSAP for municipalities. It also represents a continuation of the partnership between BSC Group, Regenerative Design Group, Woodwell Climate Research Center, and the Massachusetts Association of Conservation Commissions that formed as the consulting team for the MassDEP No Net Loss of Wetland Carbon Project, a project that provides not just a collaborative team foundation, but also a shared knowledge base about wetland soil and biomass carbon; wetland and soil health; and the extent and carbon content of Massachusetts wetlands.

Regenerative Design Group has already committed to hosting + maintaining the overall MA Healthy Soils Website for up to 5 years after the completion of their 2024/2025 Development Guide HSAP Challenge Grant project, to which the Wetland Guide work products and information will be added. During the 5-year period, an alternate website host may be determined, provided they have the commitment and resources to continue the curation of the material.

Following the publication of the Wetland Guide materials, the Project Team intends to continue this work through partnerships with leading researchers, industry actors, and professional associations. As the attached firm profiles demonstrate, each of the Project Team members already has a track record of being an industry leader in bringing healthy soils, wetland carbon and climate science, and the importance of decarbonizing our projects and wetland management practices to professionals, volunteers, and the general public.

Specific follow-up projects already identified beyond the maintenance and refinement of the MA Healthy Soils Website and PDFs are the continued development and delivery of wetlands-focused trainings, presentations, workshops and webinars. The compilation of wetland healthy soil materials, information, gaps in resources, and new relationships established during the engagement activities of this project will inform the focus of future training and research, as well as propel avenues of additional funding.

There are many barriers and well-worn ways of working in, with, and near wetland soils that lead to poor soil health, unnecessary loss of wetland soil carbon to the atmosphere, and negative climate and environmental outcomes. While HSAP outlines some strategies to protect, restore, and improve wetland soil function, implementing significant changes to typical wetland management and wetland restoration/creation practices, dominant wetland soil specifications, and reliance on off-site materials requires longer-term research and the development efforts that extend beyond the timeframe outlined in the 2024 Healthy Soils Challenge Grant RFR. Recognizing that, the partners to this proposal—BSC Group, Regenerative Design Group, Woodwell Climate Research Group, and MACC -- have already begun designing and seeking funding for additional projects. These actions will be elaborated on, and informed by, the work in this project. We anticipate soliciting funding for further research and development during this and subsequent funding cycles.

We anticipate that the work described in this proposal will reveal additional needs and pathways to ensure the wetland professionals/managers and Conservation Commissions have the knowledge, materials, and tools necessary to achieve greater wetland soil health. The team assembled for this project is committed to using these findings to address these gaps through continuing and expanding collaboration.

BSC GROUP

Risk Assessment for Project, Partners, + Timeline

The members of this Project Team have an excellent track record of delivering high-quality experiences and work products on-time and on-budget.

The attached resumes and project qualification sheets provide documentation of these work products and the high degree of qualification we bring to this project, including numerous professional certifications, advanced degrees, and decades of professional experience.

It is notable to mention that two of the larger projects, Healthy Soils Action Plan and the Apple Country Natural Climate Solutions project, spanned the beginning of the COVID pandemic. This required a hard pivot to remote or distanced options in outreach, education, and field-based events. The success of these projects gives us confidence that we can navigate unforeseen challenges.

We have identified the following risks and mitigation strategies for the completion of the Guide:

- Lack of participation from key professional and volunteer segments
  - › Robust outreach built on existing relationships and networks will help keep participants accountable for their contributions to the Project.
  - › By participating in existing conferences and offering available CEUs where possible, we will bring this project to the target audiences, rather than asking them to come to a stand-alone event. Additionally, professional incentives for attending our events will be created.
- Project budget shortfalls for the ambitious HSAP Wetland Guide project outreach scope of services
  - › By participating in existing annual conferences that are planned and managed by Massachusetts/New England non-profits, costs for conducting HSAP Wetland Guide presentations, workshops, and webinars would be reduced substantially. Overall event facilitation, participant registration, and promotional costs would be managed and paid for by

the hosting non-profits, thus resulting in a cost match for this project. Project Team members will contribute presentation time as *pro bono* in-kind match, further reducing project costs.

- Staffing changes/disruptions
  - Each project team firm has a deep bench of staff that could step in should unexpected disruptions require a change of project staffing. In anticipation of this potential, the Project Team will hold regular project meetings internally with understudies and construct a resilient file sharing system accessible to all members of each firm.
- Tasks take longer than expected
  - As mentioned, each firm on the project team has a deep bench. Should tasks take longer than expected, we have the capacity to pull in additional staff to ensure that key deadlines are met, as well as a solid track record of delivering high-caliber work products.
- COVID Resurgence / Other Pandemic
  - With the exception of giving in-person presentations at conferences, project events/meetings will be conducted on Zoom or Teams, which will reduce project costs and make the events easier for attendees to fit into their busy schedules. Recorded webinar(s) will also serve as resources for future outreach and education.

In summary, we put forward this proposal as a low-risk investment due to the subject matter expertise and institutional capacity of the Project Team, the ability to deliver this scope of work within this budget and without requiring additional third-party funds for completion, and the fact that this work is primarily a compilation of existing primary research and education sources and producing essentially a communications-associated set of deliverables.

No new primary science is required for these deliverables to be successfully completed, and success is not contingent upon other third-party institutional endorsements or funding.

This project will result in development of a Wetland Guide, including a range of resources that will facilitate state-wide implementation of wetlands-related HSAP recommendations and science-based wetland soil health Best Management Practices. The project team will convene wetland professionals/managers and volunteer Conservation Commissioners in coordinated events to identify needs and gather insights. The findings will contribute to a web-based resource called “Healthy Soils Action Plan Wetland Management & BMPs Guide” hosted on the MA Healthy Soils Website that is currently being developed and funded by a FY24 HSAP Challenge Grant and by an RDG-led project team.

The Wetland Guide will include wetland soil health information, example wetland soil specifications for wetland restoration/creation projects and for work in or near wetlands, case studies, and actionable recommendations for improving wetland soil health in Massachusetts.

Appendix A

Firm Profiles and Project Experience

BSC Group

Firm Profile and Project Experience

BSC GROUP

WWW.BSCGROUP.COM

AT A glance

OFFICE LOCATIONS

HEADQUARTERS

Boston, MA

Andover, MA

West Yarmouth, MA

Worcester, MA

Glastonbury, CT

Manchester, NH

1965
BSC FOUNDED

200
TEAM MEMBERS

CORE SERVICES

Ecological Science

Permitting & Regulatory Compliance

Climate Resilience

Flood Risk Information & Modeling

Environmental Engineering

Land Surveying, GIS, Mapping & Analysis

Custom Software & Spatial Data Integration

FIRM OVERVIEW

At BSC, we partner with our clients to deliver creative and practical transportation, land development, and environmental solutions. We also help them find climate-resilient solutions. Clients trust BSC to work with them to expertly guide siting, strategically navigate regulatory processes, and holistically design infrastructure to help achieve their vision.

BSC's engineers, planners, and scientists take pride in their ability to respond nimbly to move projects forward.

We solve complex challenges by applying expertise across disciplines, sharing ideas and perspectives to see a project from every side.

The purpose of our work is to improve the quality of life in and around our communities using our skills and experience to promote balance between the built and natural environment.

Proudly employee-owned, our people are the heart of our company.

AREAS OF EXPERTISE

- Wetland and Soil Science
- Wetland Delineation
- Wetland Permitting
- Floodplain Management
- Water Quality/Water Resources Ecology
- Marine, Aquatic and Terrestrial Biology
- Botanical Surveys
- Wildlife Surveys
- Rare and Threatened Species Surveys
- Threatened and Endangered Species Permitting
- Ecological Restoration
- GIS Mapping and Assessment
- Drone-based Field Survey
- GIS Hazard and Natural Resources Mapping
- Stormwater Management and Flood Protection
- Construction Oversight and Monitoring

REPRESENTATIVE CLIENTS

MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION

MASSACHUSETTS BAY TRANSIT AUTHORITY (MBTA)

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION (MASSDOT)

NATIONAL GRID

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (MASSDEP)

EVERSOURCE

BORREGO SOLAR

GREAT RIVER HYDRO

GUIDE FOR IMPLEMENTING THE HEALTHY SOILS ACTION PLAN IN DESIGN AND CONSTRUCTION

CLIENT

Massachusetts Executive office of Energy and Environmental Affairs

SERVICES

Ecological Services

Landscape Architecture

Civil Engineering

Climate Resilience

Transportation Engineering

Environmental Engineering

The Healthy Soils Action Plan (HSAP) released by the Massachusetts Executive office of Energy and Environmental Affairs provides an assessment of the condition of our soils and a blueprint for how we can effectively conserve and protect, restore, and properly manage our soils to improve the vitality of nature around us, resilience to climate change, and the health and quality of life of our residents. However, many of the recommendations either lack a clear path to implementation or are in conflict with typical practices of the development and construction industries.

BSC is working with Regenerative Design Group and others in the development of an implementation guide for the HSAP. The guide will serve as a roadmap towards engaging a cross-section of professionals in construction, development, engineering, and design in a series of coordinated events to promote general awareness of the HSAP, distill industry input and additional research and make recommendations for improving typical soil management practices and standards, and address problems. BSC's role on the project includes serving as liason to MassDOT to coordinate conversations, solicit participation and materials, and sharing insights and experience, and:

- Participating in and hosting industry work groups
- Providing technical review and production support
- Case study collection
- Reviewing of soil specifications and MassDOT specifications
- Contributing to current & recommended best practices
- Identification of existing challenges to achieving better soil health
- Supporting the development of presentation and website materials

MASSDEP NO NET LOSS OF WETLAND CARBON

CLIENT

Massachusetts Department of Environmental Protection (MassDEP)

SERVICES

Development of Innovative Wetland Carbon Protection and Restoration Strategy, Policy, and Regulations

Software Development

Wetland Carbon Accounting Science

Wetland Extent and Wetland Carbon Data Set + Mapping + Machine Learning

Leading a consulting team, BSC is working with MassDEP to identify innovative strategies, approaches, concepts, and regulatory recommendations to achieve No Net Loss of Wetland Carbon in Massachusetts and to meet wetlands-related climate goals outlined in the *Massachusetts Clean Energy and Climate Plan for 2025 and 2030, Chapter 8: Protecting Our Natural and Working Lands*. Our project team includes BSC, Regenerative Design Group, the Massachusetts Association of Conservation Commissions (MACC), and the Woodwell Climate Research Center.

BSC researched wetland carbon policies, regulations, and projects in all 50 states as well as in other countries, researched wetland carbon bylaws and regulatory provisions in Massachusetts municipalities, and led the project team in developing innovative wetland carbon protection and restoration strategies, approaches, and regulatory recommendations, including collaborating with MACC as they updated their local wetland bylaw database.

Project team member Woodwell Climate Research Center developed Massachusetts-relevant science-based wetland carbon accounting approaches, consistent with best available wetland carbon science.

Project team member Regenerative Design Group developed a cutting-edge wetland mapping approach based on machine learning that identifies previously cryptic wetlands, such as forested wetlands, which traditional mapping methods often have difficulty detecting.

The project final report is now being reviewed by MassDEP.

Shores of Change

COASTAL FLOODPLAIN RESILIENCE

MassDEP | ResilientCoasts

CLIMATE RESILIENCY OUTREACH FOR COASTAL FLOODPLAINS AND WETLANDS

STATEWIDE

CLIENT

Massachusetts Department of Environmental Protection, Bureau of Water Resources, Wetlands Program

SERVICES

Climate Resilience

Coastal Ecology, Floodplains, & Wetlands

GIS

Public Outreach & Engagement

www.mass.gov/info-details/shores-of-change

BSC developed outreach products, including an interactive ArcGIS StoryMap, a set of brochures, a poster, and a video to communicate the purpose and of coastal floodplains, the importance of protecting them.

BSC worked with the Massachusetts Department of Environmental Protection and the Massachusetts Office of Coastal Zone Management to develop effective and visually engaging multimedia products to explain:

- Purpose and functionality of coastal floodplains
- How they support climate resilience, and prevent or minimize storm damage and flooding
- Why protecting and restoring coastal floodplains is crucially important amidst sea level rise and more intense coastal storms
- How the upcoming proposed regulatory change will assist in ameliorating these climate-related challenges

BSC provided MassDEP with multi-disciplinary expertise in ecology, coastal wetland science, climate resilience, and GIS, as well as hands-on experience working in coastal communities across the state, to develop a suite of outreach products, including an interactive ArcGIS StoryMap, a set of brochures, poster, and a video.

Through six featured locations across the Commonwealth, these deliverables describe how the floodplain serves Massachusetts communities, how worsening storms and rising sea levels impact them, and how to protect the coastal floodplain. BSC has engaged creative partners to enhance the project with professional photography, videography, and graphic design.

APPLE COUNTRY ECOLOGICAL CLIMATE RESILIENCY AND CARBON PLANNING AND ASSESSMENT

BOLTON, MA

CLIENT

Towns of Bolton and Harvard and the Devens Regional Enterprise Zone

SERVICES

Climate Resilience Planning

Climate Vulnerability Assessment

Community Stakeholder Engagement

Development of Educational Resources

Ecological Carbon Assessment

Grant Proposal Preparation

Identification of Nature-based Solutions

As part of a regional approach to climate resilience planning, BSC worked with the Towns of Bolton and Harvard and the Devens Regional Enterprise Zone (Devens) and led a multi-disciplinary consulting team that included healthy soils experts (Linnean Solutions and Regenerative Design Group) and a forest ecologist and forest carbon expert (Woodwell Climate Research Center) to provide climate resiliency and carbon planning assessment services. The project was funded by an MVP Action Grant awarded to the communities following a BSC-supported application process.

Apple Country's vast landscape of forests, farmland, wetlands, and active floodplains is essential in the area's ecological functioning, carbon functioning, and regional community and environmental resiliency. BSC's team of ecologists, landscape architects, climate resilience specialists, designers, engineers, and GIS specialists analyzed local ecological resources, conducted community outreach and engagement, and developed GIS mapping to produce predicative climate-focused documents and maps that identify and prioritize Nature-based Solutions (NbS) and best management practices and policies.

The project report highlighted opportunities for resilience and protection of wetland and forest carbon using NbS and implemented climate-smart best management practices and policies. The resulting report provided a regional perspective, analysis, and recommendations, as well as town-specific assessment and recommendations.

ROCKPORT COASTAL RESILIENCE PROJECT

ROCKPORT, MA

CLIENT

Town of Rockport

SERVICES

Nature-based Solutions

Climate Resiliency

Coastal Ecology

GIS

Community Engagement

BSC collaborated with the Rockport community to identify coastal Nature-based Solutions (NbS) to climate change. This town is a front-line coastal community experiencing significant impacts from sea level rise and coastal storms; includes environmental justice populations; an artists' community; and supports multiple harbors for one of the largest lobster fishing fleets in the area.

Natural coastal ecosystems and features have been identified as opportunities for broader climate resilience planning; a community-driven assessment of NbS will increase the capacity of the community to protect, restore, and enhance coastal ecosystem services; and educational materials and opportunities have been developed and provided, including a project website, sets of coastal ecosystem, coastal Nature-based Solutions, and freshwater ecosystem infographics, and StoryMap.

Community engagement included establishing a core team, conducting a site walk to identify priority NbS sites, promoting the project and NbS at multiple community events, conducting a youth event focused on coastal ecological science, NbS, and art, and leading a field trip to share knowledge and science about the coastal ecosystem that protects the town.

A prioritized list of NbS appropriate for approximately a dozen coastal locations will be provided to the town at the end of the project, along with a preliminary scope of work and cost estimate to implement each NbS, allowing them to respond quickly to grant funding opportunities.

NATIONAL GRID I135/J136 UTILITY ROAD PROJECT

WINCHENDON, MA

CLIENT

National Grid

SERVICES

Climate Resilience

Wetland Carbon Conservation

Wetland Restoration

Wetland Creation

Wetland Delineation

Permitting

GIS Mapping

GPS Survey

As part of our on-call licensing and permitting contract with National Grid, BSC provided ecological services for the design and construction of a permanent utility-grade road along the I135N and J136N transmission lines in Winchendon, MA. During the field investigation phase, BSC completed wetland delineation and GPS survey, GIS mapping of wetlands and environmental constraints, and local, state, and federal permit plans.

BSC guided and oversaw wetland restoration and creation activities and provided an innovative approach to wetland replication that fostered the conservation of soil carbon (climate mitigation) and enhanced drought survival (climate resilience).

This innovative approach led to:

1. An acceleration of establishing the wetland vegetative cover as well as preserving soil carbon, structure, and function by transferring intact soil profile and surface vegetation from impact area to restoration and mitigation area.
2. A reduction of both environmental impacts and financial costs: reduced area of exposed soil, eliminated need to stockpile soils, reduced work hours required to construct wetland, and reduced number of plants and supplemental soil to be purchased and the carbon emissions associated with their transport.

ENVIRONMENTAL MONITORING SERVICES FOR THE CROSBY CORNER INTERCHANGE IMPROVEMENT PROJECT

CONCORD AND LINCOLN, MA

CLIENT

Massachusetts Department of Transportation (MassDOT)

SERVICES

Construction Oversight

Environmental Compliance Monitoring

Surveying

Wildlife Habitat Monitoring

Wetland and Stream Restoration Monitoring and Design

BSC acted as the environmental monitor during the construction of the Route 2 Safety Improvement Project in Concord and Lincoln, MA, to ensure compliance with the Massachusetts Department of Environmental Protection variance, the Army Corps of Engineers individual permit, and the National Pollutant Discharge Elimination System permit program. Requirements include construction monitoring and reporting, preparation of requests for plan changes, wetland and stream restoration and mitigation monitoring
and design.

As part of wetland mitigation monitoring, BSC installed IRIS tubes to monitor development of hydric soils in mitigation wetlands, and monitored stream restoration of a previously piped stream. BSC also conducted wildlife monitoring and reported on a new wildlife tunnel, including the use of track beds and camera traps.

For Phase 2 of this project, MassDOT retained BSC again to perform wetland mitigation services for the roadway reconstruction project. For this new task assignment, BSC developed design and construction drawings to construct two potential new wetland mitigation areas in the Town of Concord, one of which is a parcel of land owned by MassDOT, and the other to include the restoration of an area owned by the Town of Concord. BSC conducted existing conditions topographic surveys and prepared ROW plans.

ENVIRONMENTAL MONITORING SERVICES FOR THE ROUTE 18 ROADWAY RECONSTRUCTION AND WIDENING

ABINGTON AND WEYMOUTH, MA

CLIENT

Massachusetts Department of Transportation (MassDOT)

SERVICES

Construction Oversight

Environmental Compliance Training and Materials

Environmental Monitoring and Reporting

Permitting

SWPPP Review and Edit

Wetland Restoration Monitoring

BSC provided environmental monitoring consulting services for the reconstruction and widening of Route 18. The project area was approximately 4.1 miles long, from Highland Place in Weymouth to Route 139 in Abington, and included the replacement of the Route 18 Bridge over the Massachusetts Bay Transportation Authority (MBTA) line. Altering approximately 12,000 square feet of bordering vegetated wetlands, it was estimated that 30,000 square feet of wetland mitigation was necessary, including restoration of a filled wetland and adherence to MassDOT soil specifications.

Acting as the on-site monitor and environmental compliance coordinator, BSC oversaw the site's overall construction and reported findings to the Massachusetts Department of Environmental Protection, U.S. Army Corps of Engineers, and MassDOT to ensure compliance with the permit conditions. BSC assisted MassDOT in completing the 30-day and 60-day pre-construction submittals to MassDEP, pursuant to the Wetlands Protection Act and WQC variance decision, and reviewed and edited the contractor's stormwater pollution prevention plan to ensure compliance with the variance.

BSC's team conducted site visits twice a week and was responsible for reviewing field conditions, inspecting sediment and erosion controls, ensuring compliance with wetland restoration plans and specifications, photo-documenting site conditions, reviewing inspection logs from the contractor, and coordinating all necessary corrective actions. BSC also produced bi-weekly reports summarizing the construction status and site constraints.

Regenerative Design Group

Firm Profile and Project Experience

resilient communities. productive landscapes. nature-based solutions.

OUR FIRM

Regenerative Design Group is a worker-owned ecological design practice dedicated to creating productive landscapes and resilient communities. We work across scales, offering innovative, practical, and flexible solutions for individuals, institutions, and communities.

Our capacity for interdisciplinary thinking is informed by our backgrounds in ecology, agriculture, conservation, architecture, and education. Grounded in the principles of permaculture design, our team weaves the elements of any project into a high-functioning whole system.

COOPERATIVELY OWNED AND RUN

Founded in 2009, Worker-Owned since 2021

Founding Board of Directors, 2021

OUR WORK

Research

We support clients and their communities in articulating their vision and goals, and bringing rigorous ecological analysis and long-term climate projections to the table.

Master Planning & Campus Design

We develop designs for campuses that combine food production and learning, guiding the transition from high-input management to diverse educational landscapes.

Regenerative Agriculture & Farm Design

We work with communities and farm owners to develop diverse farming and agroforestry systems that support the farm's social, environmental, and economic goals.

Productive Habitats & Ecosystem Regeneration

We work to restore and enhance existing natural systems that provide fresh air, clean water, food, fuel, fiber, wildlife, shelter, and wild forage.

Residential Design & Integrated Homesteads

We help homeowners envision and create beautiful, efficient homes and landscapes that invite engagement through the production of food and integration of natural systems.

Regenerative DesignGroup COOPERATIVE

www.regenerativedesignngroup.com

Massachusetts Healthy Soils Action Plan

CLIENT

Massachusetts Executive Office of
Energy + Environmental Affairs, 2019-2023

SERVICES + ACCOMPLISHMENTS

Analysis and modelling of Soil Organic Carbon (SOC) stock, segmented by land cover type

Projection of 2050 SOC flux, based on land cover change

Soil-smart planning and management priorities

Stakeholder engagement

Management of 40 person working group

PROJECT OVERVIEW

The Massachusetts Healthy Soils Action Plan (HSAP) is the nation's first effort to understand, protect, and revitalize soil function in all land uses statewide. This Plan, commissioned by Massachusetts Executive Office of Energy and Environmental Affairs, reveals the tremendous impact land use and management has on the soils of the Commonwealth and sets forth strategies and actions to increase soil health as a way to improve food security, ecosystem function, and climate resilience across the region.

Through an 18-month process the consultant team, led by Regenerative Design Group, conducted a detailed literature review and geospatial analysis to understand the key factors and dynamics that shape soil health. This included the development of a novel method for quantifying soil organic carbon (SOC) based on land cover and drainage classification.

With guidance and review of a 40-member Working Group, representing state and federal agencies, conservation organizations, scientific advisors, and community stakeholders, RDG developed a series of evidence-based strategies and actions aimed at transforming the impact of soil management on climate from a negative to a positive.

The result is a roadmap for policymakers, land managers, and soil health advocates to understand the interconnected nature of the Commonwealth's landscapes and the role they play in soil carbon sequestration and climate resilience.

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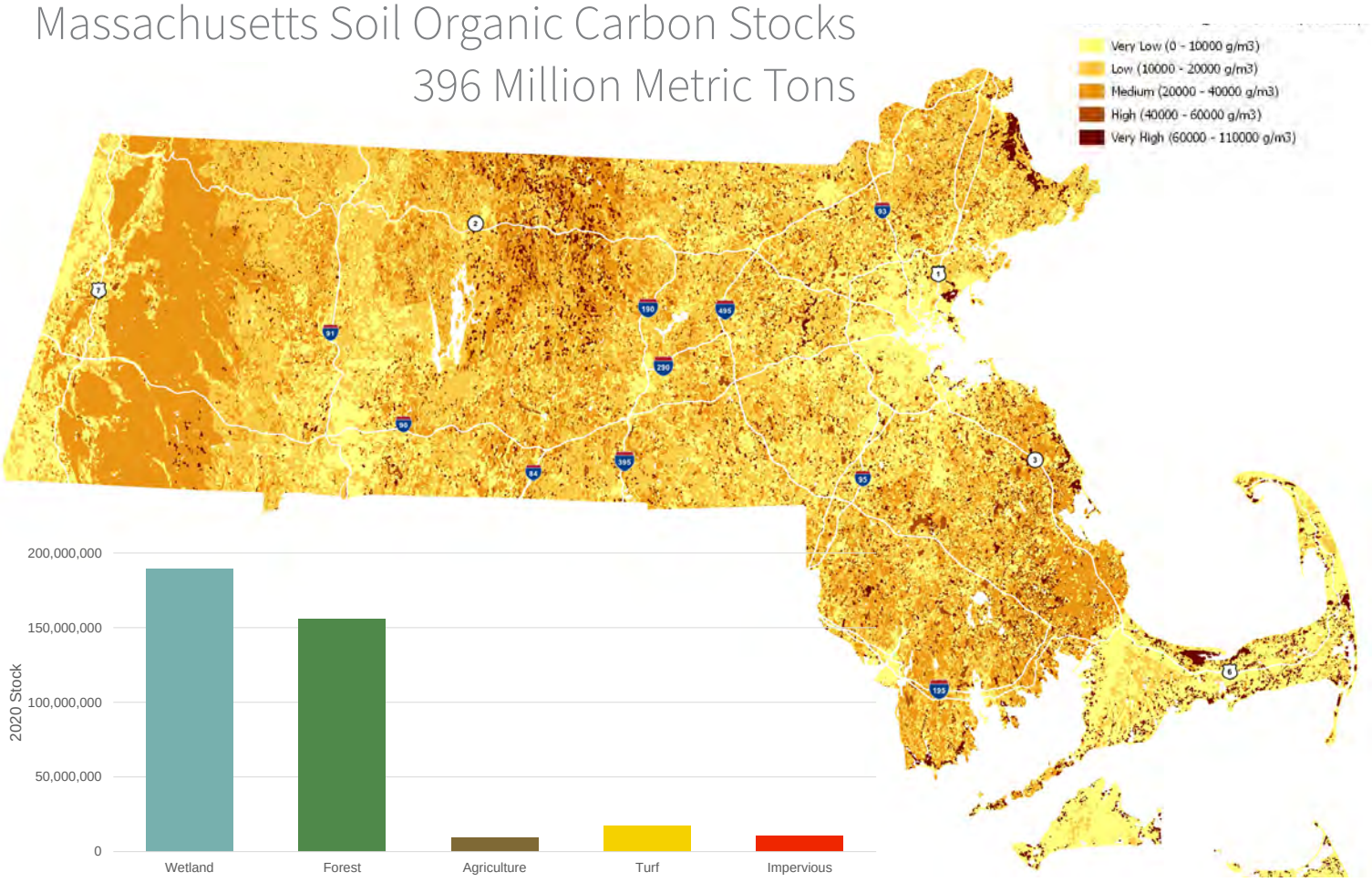
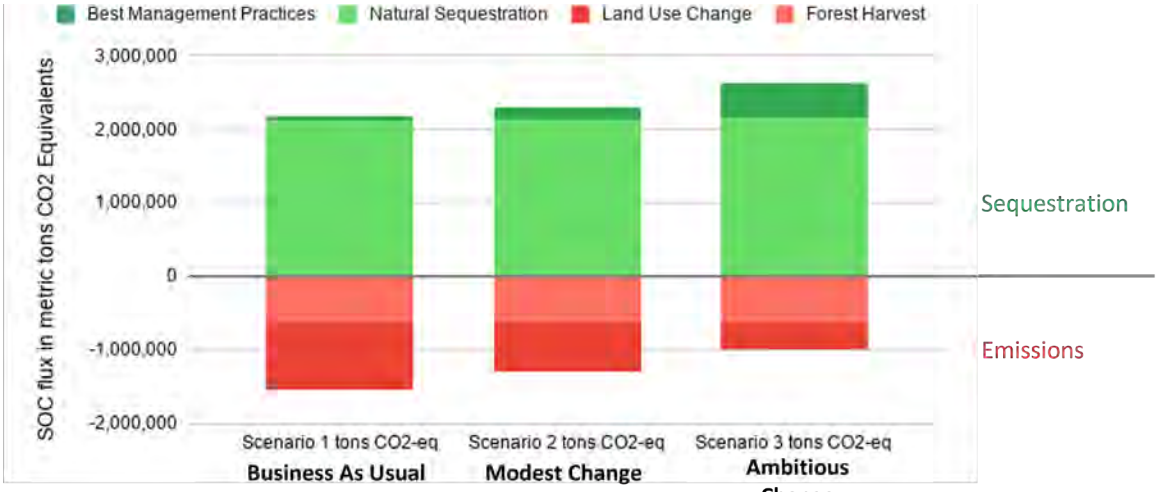
Massachusetts Soil Organic Carbon Stocks
396 Million Metric Tons



2050 Comparison of Annual Soil Organic Carbon Fluxes



Deerfield Soil Health Plan

CLIENT

Town of Deerfield
Municipal Vulnerability Preparedness Program, 2022

SERVICES + ACCOMPLISHMENTS

Analysis and modelling of Soil Organic Carbon (SOC) stock, segmented by land cover type

Soil-smart planning and management priorities

Intensive stakeholder engagement

Sample bylaws aimed at protecting and improving soil resources

Soil sampling across a variety of land types providing the basis for future soil health tracking

Design and execution of a “soil health field day” for 120 high school students

Awarded by the Massachusetts chapter of the American Planning Association for excellence in Sustainability & Resilience planning

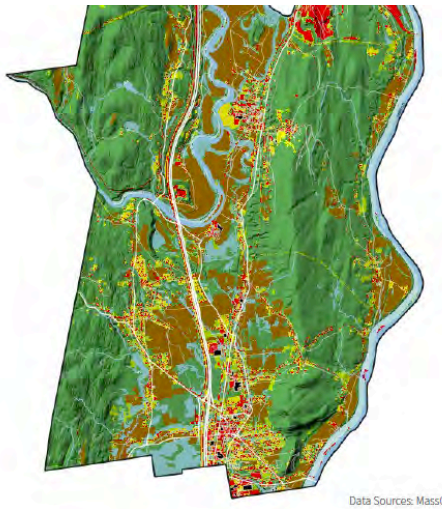
Regenerative DesignGroup

PROJECT OVERVIEW

The Deerfield Healthy Soils Project is based on the premise that protecting and improving soil function across land uses is an essential component of climate-resilient planning. The overall goal of this project was to identify the most impactful actions and strategies that the community of Deerfield, Massachusetts can implement to steward its soils in ways that support the myriad of co-benefits and beneficial functions of healthy ecosystems including enhanced carbon sequestration and storage, greater fertility, and improved water dynamics.

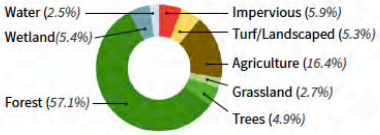
Over the course of a year, Regenerative Design Group led a process that included high resolution modeling of Deerfield’s current healthy soil resources; presentations, workshops, and conversations with stakeholders with a special focus on farmers considering the town’s large agricultural community; soil sampling across a variety of land types providing the basis for future soil health tracking; a “soil health field day” for 120 high school students; and the development of several recommendations for potential bylaw improvements aimed at protecting and improving soil resources.

This project was completed in 2022 as part of a larger Municipal Vulnerability Preparedness action in the town of Deerfield, MA. Regenerative Design Group (RDG) worked closely with Chris Curtis (Conservation Works) who was the lead planner for the larger MVP project and who was the lead author of the sample bylaws included in our report. The consultants reported directly to Deerfield’s Climate Change and Energy Committee in carrying out the work of the project. The project was recognized in 2022 by the Massachusetts chapter of the American Planning Association with it’s Sustainability & Resilience Award.



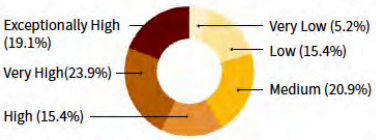
Data Sources: MassGIS 2016 Landcover

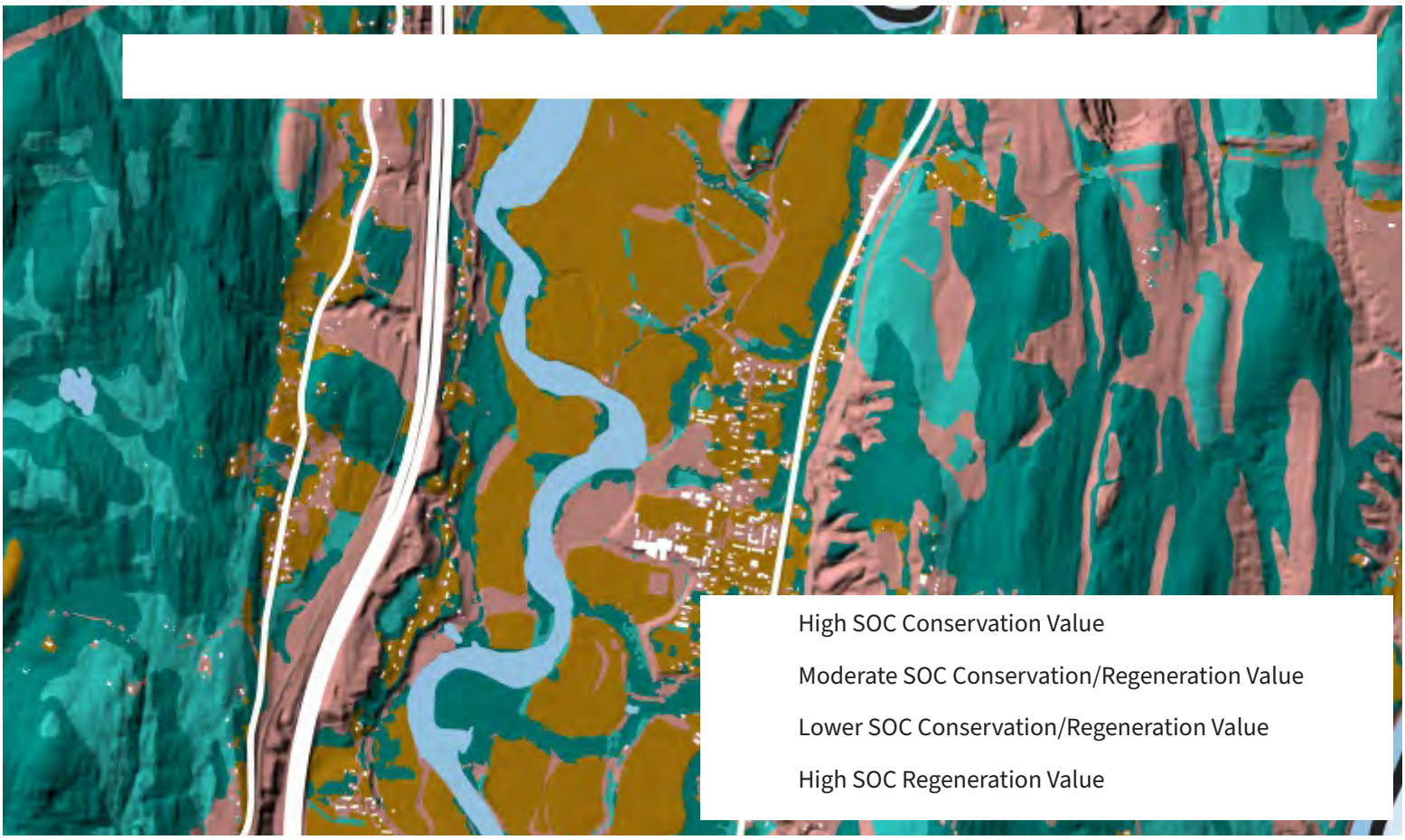
Forest	12,525 ac
Agriculture	3,506 ac
Wetland	1,160 ac
Turf & Landscaped Areas	1,123 ac
Trees	1,041 ac
Impervious	965 ac
Grassland or Shrub	571 ac
Open Water	527 ac



Data Sources: Soils SSURGO-Certified NRCS, NRCS Rapid Carbon Assessment, MassGIS 2016 Landcover

Very Low (0-20 tons/acre)	1,120 ac
Low (20-40 tons/acre)	3,299 ac
Medium (40-60 tons/acre)	4,481 ac
High (60-80 tons/acre)	3,306 ac
Very High (80-100 tons/acre)	5,107 ac
Exceptionally High (100+)	4,097 ac



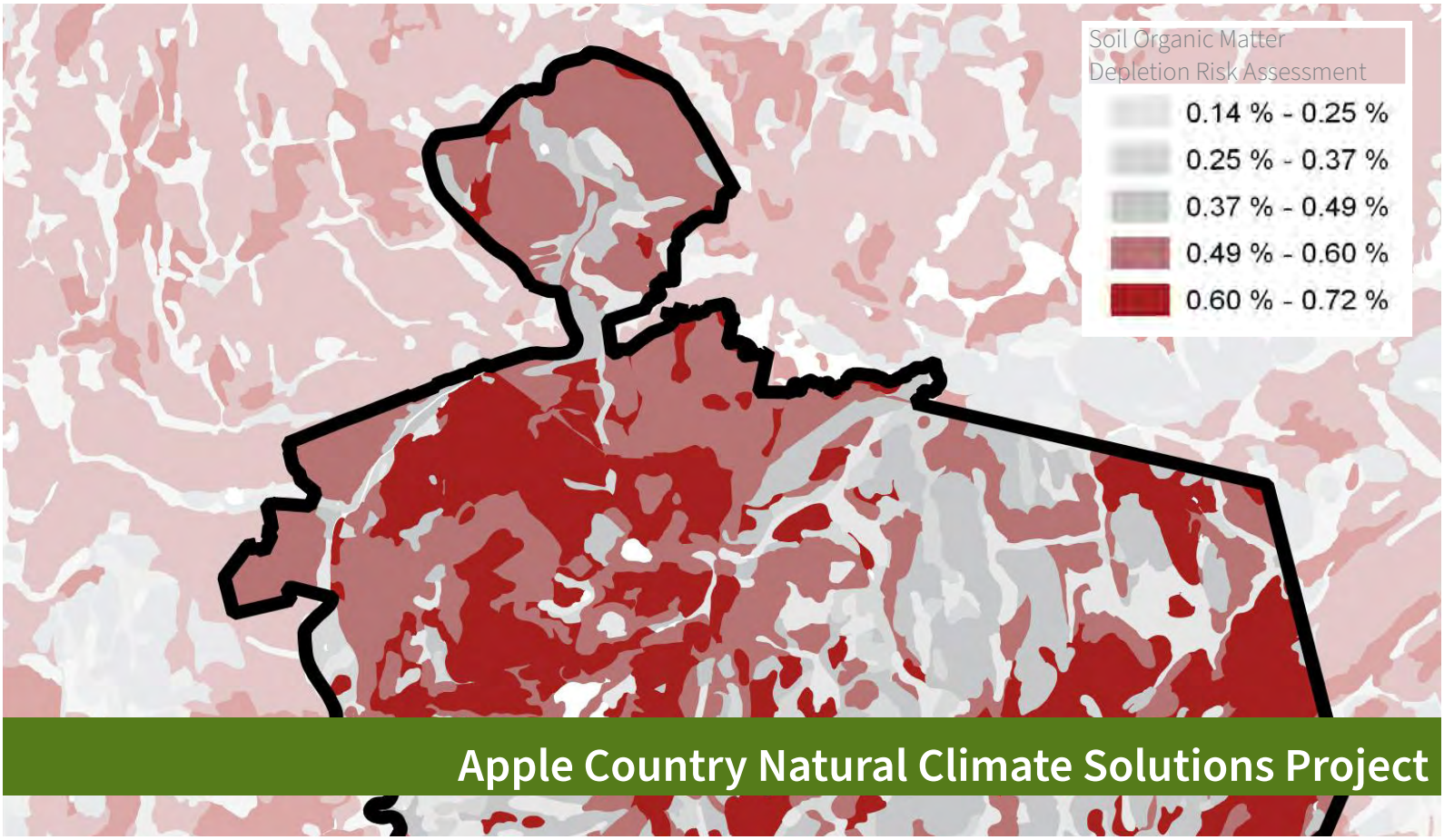


High SOC Conservation Value

Moderate SOC Conservation/Regeneration Value

Lower SOC Conservation/Regeneration Value

High SOC Regeneration Value



Apple Country Natural Climate Solutions Project

CLIENT

Towns of Bolton + Harvard with Devens Regional Enterprise Zone. Massachusetts Municipal Vulnerability Preparedness Program, 2019

SERVICES + ACCOMPLISHMENTS

Refined method for modeling soil organic carbon using land cover

Analysis and modelling of soil organic carbon stocks, segmented by land cover type

Projection of annual soil organic carbon fluxes for 2050 based on land use change predictions

Development of soil-smart planning and management BMPs

PROJECT OVERVIEW

In a regional effort to address the challenges of climate change, biodiversity loss, and regional development pressures, Bolton, Harvard, and Devens engaged BSC Group, Linnean Solutions, Woodwell Climate Research Center, and Regenerative Design Group to identify regional vulnerabilities and recommend nature-based climate solutions (NbS) that will increase the resiliency of their communities and ecosystems.

Nature-based Solutions provide cost-effective climate resilience by providing multiple co-benefits, including reduction of greenhouse gas emissions, improved water quality and water supply, reduced flooding, improved air quality, cooler local temperatures, fish and wildlife habitat and support for biodiversity, recreational and aesthetic opportunities, and improved physical and mental public health.

Regenerative Design Group led the mapping and analysis of soil carbon components of this project and contributed to the identification of NbS to increase regional climate resilience. To assist the communities to understand the impact of land use on health of their soils and contributions to climate resilience, RDG remapped NRCS soil carbon based on land cover (top right) and created an infographic of projected soil organic carbon fluxes in 2050 (bottom right).

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Land Cover Adjusted Soil Organic Carbon

When adjusted for land cover, the total stock of SOC in Apple Country increased from 2.2 million metric tons (SSURGO) to 2.8 million metric tons, a difference of 400,000 tons.

This work suggests that the amount of carbon stored in the soils of this region is underestimated. This underestimation diminishes the significance of conserving and regenerating forests and wetlands.

ORIGINAL SSURGO SOC

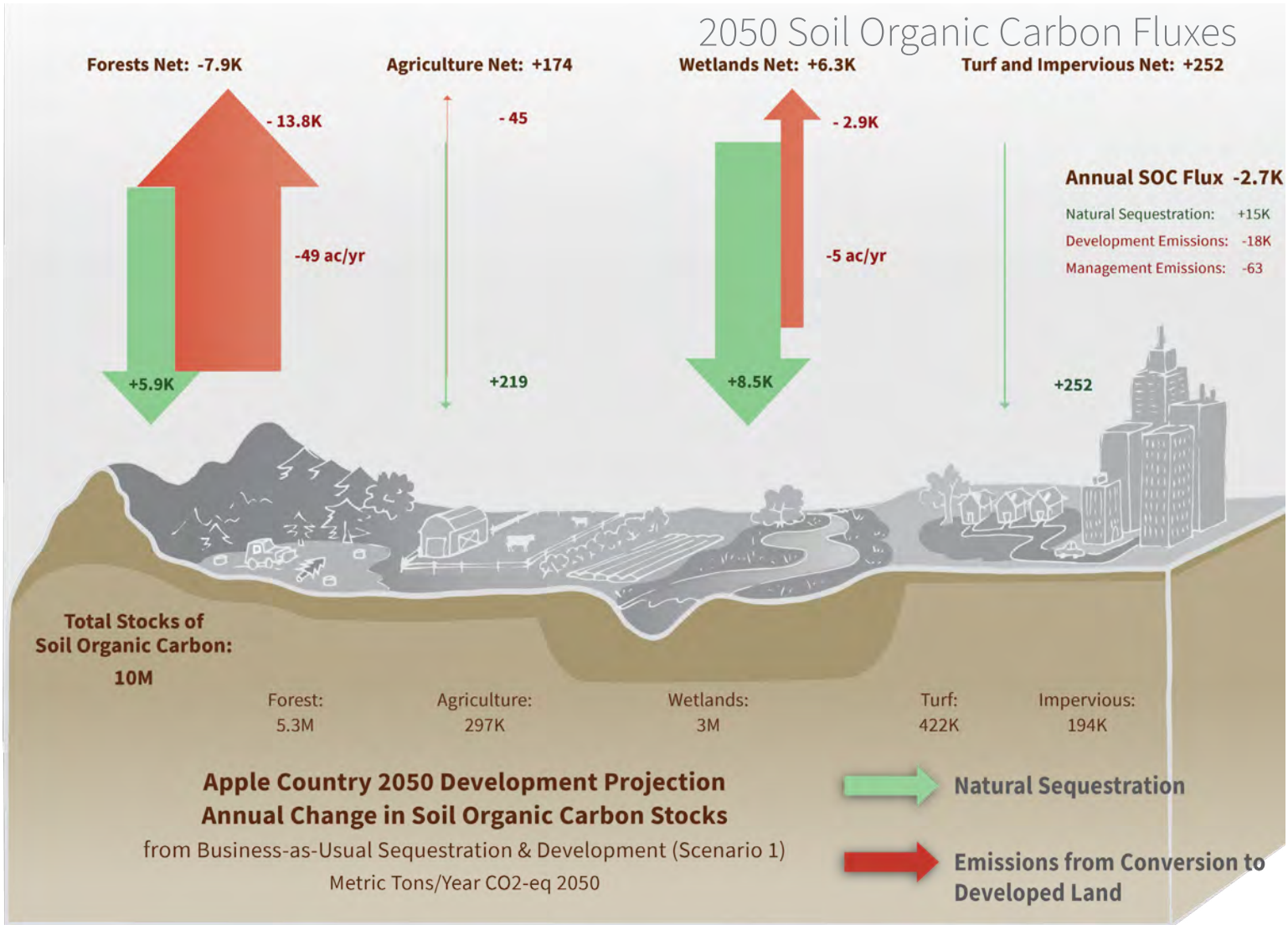
2.2 Million Metric Tons

FOREST PEDON NORMALIZED SOC

3.2 Million Metric Tons

LAND COVER ADJUSTED SOC

2.8 Million Metric Tons



SuAsCo Nature Based Solutions Project

CLIENT

Towns of Hudson, Framingham, and Natick, Municipal Vulnerability Preparedness Program, 2022-2024

SERVICES + ACCOMPLISHMENTS

Analysis and modelling of Soil Organic Carbon (SOC) stock, segmented by land cover type

Projection of 2050 SOC flux, based on land cover change

Soil-smart planning and management priorities

Selection of and recommendations for high-impact locations for nature based solutions

Focus on environmental justice and climate vulnerable populations using an analysis of a range of human health hazard data to guide project priorities

PROJECT OVERVIEW

Launched in the fall of 2022, the SuAsCo Natural Climate Solutions project is a joint effort by stakeholders in the towns of Hudson, Framingham, and Natick with consultant partners from Regenerative Design Group, Linnean Solutions, and BSC Group to identify high impact sites for nature based interventions that will support the towns' climate resilience.

With the understanding that soil health is foundational to the function of all terrestrial ecosystems, Regenerative Design Group lead an initial phase of the project aimed at establishing a baseline estimation of current soil health in the towns and analyzing the effects existing land cover and management practices have on these resources. These were summarized in a series of maps entitled Soil Functions for Resilience (top right).

From this baseline, the team completed an analysis that combines RDG's refined soil carbon predictions with other ecological data to map ecological planning priorities. The result is a map of planning districts (bottom right) with different priorities (e.g. restore and transform or plan an manage for resilience). Appropriate recommended actions for each district and an analysis of ideal candidate sites are major products of this project. Proposed sites for nature based solutions will receive a multi-stage assessment of vegetative health by drone monitoring.

This project also has a strong focus on environmental justice and improving conditions for climate vulnerable populations. Demographic data was overlaid with other data on known ecological hazards to create a human health and vulnerability map that contribute to developing project priorities.

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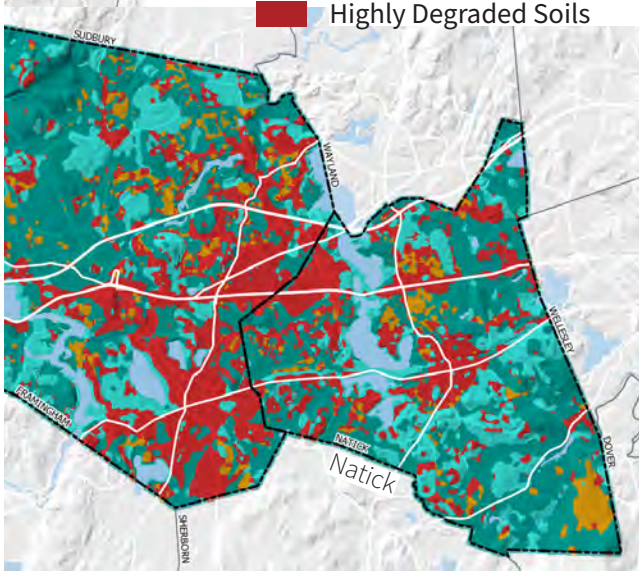
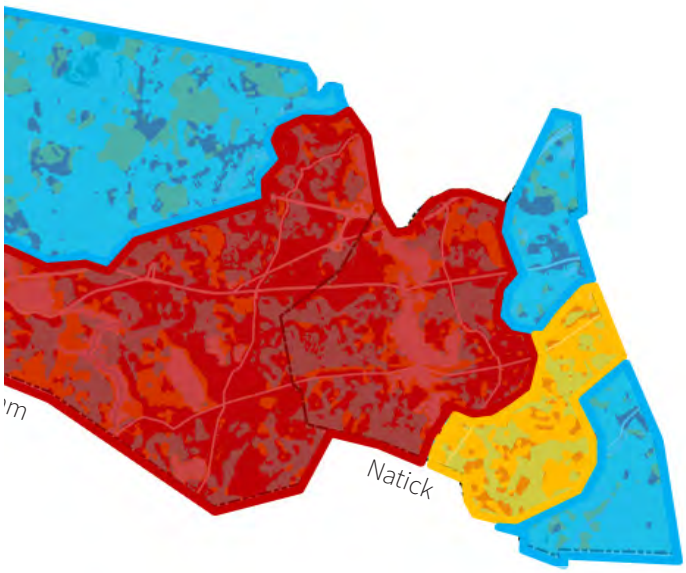
Soil Functions for Resilience

- High Performance Soils & High Carbon Soils
- Average Function Soils
- Degraded Soils with High Regeneration Potential
- Highly Degraded Soils



Ecological Planning Priorities

- Restore & Transform
- Plan & Manage for Resilience
- Intensive Intervention



Spruces Park Landscape Resource Plan

CLIENT

Williamstown, MA

SERVICES

Site Assessments

Design + Management of a Project Website

Community Survey Creation + Synthesis

Concept Development

PROJECT OVERVIEW

Spruces Park is a low-lying, mostly flat 50-acre open space park that sits in the floodplain of the Hoosic River. It was formerly the site of the Spruces Mobile Home Community, which operated for 57 years before massive flooding from Hurricane Irene in 2011 set in motion the development's closure and resettling of over 300 residents.

The park, which was purchased by Williamstown through a FEMA Hazard Mitigation Grant and is subject to FEMA regulations, has since been used for passive recreation. Our team was charged with developing a landscape resource plan that further defined ways in which the community was already using the open space, enhanced the floodplain function of the site, and integrated new uses that fit within regulatory constraints.

Organizing principles for the landscape resource plan included:

Maintain + Enhance Ecosystem Services

» Keep encroachments South of the floodway to minimize regulatory, cost and timeline constraints
» Expand and enhance floodplain plant communities

Increase Whole-Site Legibility

» Prioritize a clear hierarchy of access roads, gravel lanes, and pathways that allow for a variety of experiences; retire some of the current lanes from use
» Use "feature" trees, existing shade, congregation spots, river access, etc. to guide movement through the site

Expand Opportunities for Recreation and Gathering

» Explore a variety of configurations for mixed-use playing fields and other community field uses in the available 16 acres south of the floodway

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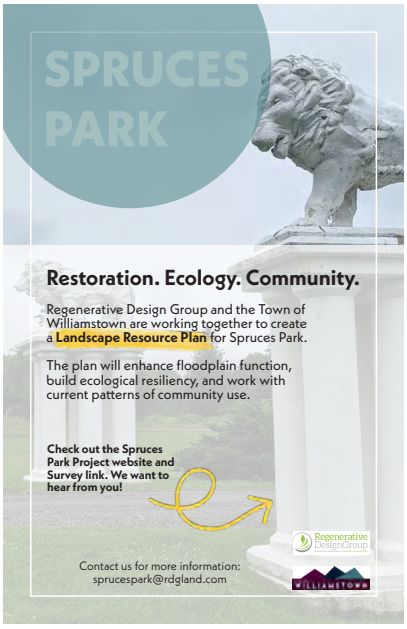
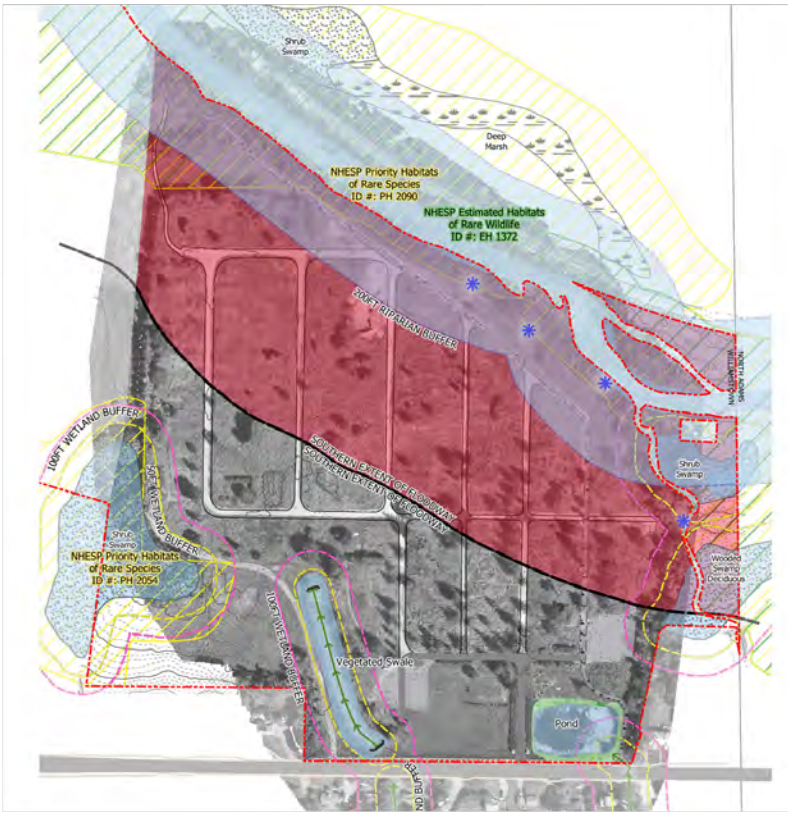
Water Resources + Regulatory





SPRUCES NORTH

Summary of Plan Goals

1. Find a balance between wilder open space and managed community uses within the park's regulatory constraints.

2. Increase whole site legibility.

3. Expand opportunites for low imapact recreation.

Leash Laws

Williamstown leash laws require dog owners and keepers to restrain their dogs physically by leash or by voice control when they are not on the owner's property. It is recommended that park rules require on-leash on the bikepath and all areas in Spruces South. Dogs should be able to be off-leash, under voice command, in most parts of Spruces North.

1 Floodplain Forest Grove

Although extensive underground utilities limit floodplain forest restoration, there are opportunities to establish plant communities typical of floodplain forests for this region. A floodplain grove is sited at the northwest entrance to Spruces and extends along the route of the river and bike path, totalling about 6 acres, and providing a counterpoint to the open meadows that define much of the park. Recommended trees include local genotypes of Silver Maple *(Acer saccharinum)*, Cottonwood *(Populus deltoides)*, Tulip Poplar *(Liriodendron tulipifera)*, Hackberry *(Celtis occidentalis)* with an herbaceous layer of Ostrich Fern *(Matteuccia struthiopteris)* and Wood Nettle *(Laportea canadensis)*.

2 The Spruces Meadow

The Spruces Meadow is currently the dominant typology at the park. Although, in landscape terms, this zone is more akin to a savannah, or mixed woodland-grassland, it is widely referred to as a meadow. Proposed changes to this roughly 14-acre zone include retiring 4 internal N-S gravel lanes, the addition of shade trees along reamining gravel lanes, and a more comprehensive network of mown meadow paths. One annual mowing in late winter/early spring to deter woodies and optimize pollinator habitat is recommended.

SPRUCES SOUTH

3 Wet Meadow

This zone unites the existing daylighted intermittent stream with the wetland to the west to create a 6.10 acre ***pollinator-supporting*** scrub-shrub wet meadow. A circuit path with boardwalk sections protects sensitive wet areas. The existing farm road still traverses this zone, but is rerouted out of the 50' buffer.

Recommended plants for this zone include Buttonbush *(Cephalanthus occidentalis)*, Sweet Pepperbush *(Clethra alnifolia)*, Red-osier Dogwood *(Cornus sericea)*, Common Spicebush *(Lindera benzoin)*, Fox Sedge *(Carex vulpinoidea)*, Blue Vervain *(Verbena hastata), and* Spotted Joe Pye Weed *(Eupatorium maculatum)*

4 Maple Lawn

The 0.70 Maple Lawn remains as a picnic zone, but with greater connectivity to other uses. In the context of surrounding changes, this area becomes more significant as a central gathering spot.

5 Nature Play

A 0.60 acre field nestled between the East Parking Lot, Wet Meadow, and Maple Lawn caters to children, families, and school groups that may not venture north into the larger open space. A playground of natural materials, sensory garden, and small fruit foraging create a unique spot within the the park.

6 Sports Field

Two interior lanes are retired, to allow for a U12-sized soccer field (80 yards x 55 yards). Alternatively, a regulation tournament field could fit here, albeit with some encroachment into the floodway (shown below).

7 Community Lawn

A 1.75 acre open space used for community events, movie nights, informal sports, and lawn picnics. Border tree and shrub plantings help to define the space and soften the edges between Route 2, parking and access lanes. A small covered platform with volunteer-maintained, ***pollinator-supporting*** gardens is sited close to the parking lot.

8 Spruces Pond Field

A 1.70 acre field that centers around Spruces Pond, this area is largely unchanged except for the addition of a fishing dock and diversifying the pond edge with wet-tolerant plants like Sweetflag *(Acorus americana)*, Water Plantain *(Alisma plantago-aquatica)*, Swamp Milkweed *(Asclepias incarnata)*, and Marsh Marigold *(Caltha palustris)*.

9 Entrance + Parking

Existing low juniper hedge is replaced with native flowering and shade trees to create a more welcoming arrival. Vehicle access is limited to the east and west parking lots. The west lot, as currently configured, can park 40 cars if spots are appropriately indicated. (*Finished layout of east parking lot is unclear based on Bike Path construction documents.)

Estimating land cover-based soil organic carbon to support decarbonization and climate resilience planning in Massachusetts

CLIENT

Journal of Soil Security, 2022

SERVICES + ACCOMPLISHMENTS

Meta-analysis of scientific literature on soil organic carbon in various land cover types

Development of land cover SOC averages

Estimation of total SOC statewide SOC stocks for Massachusetts

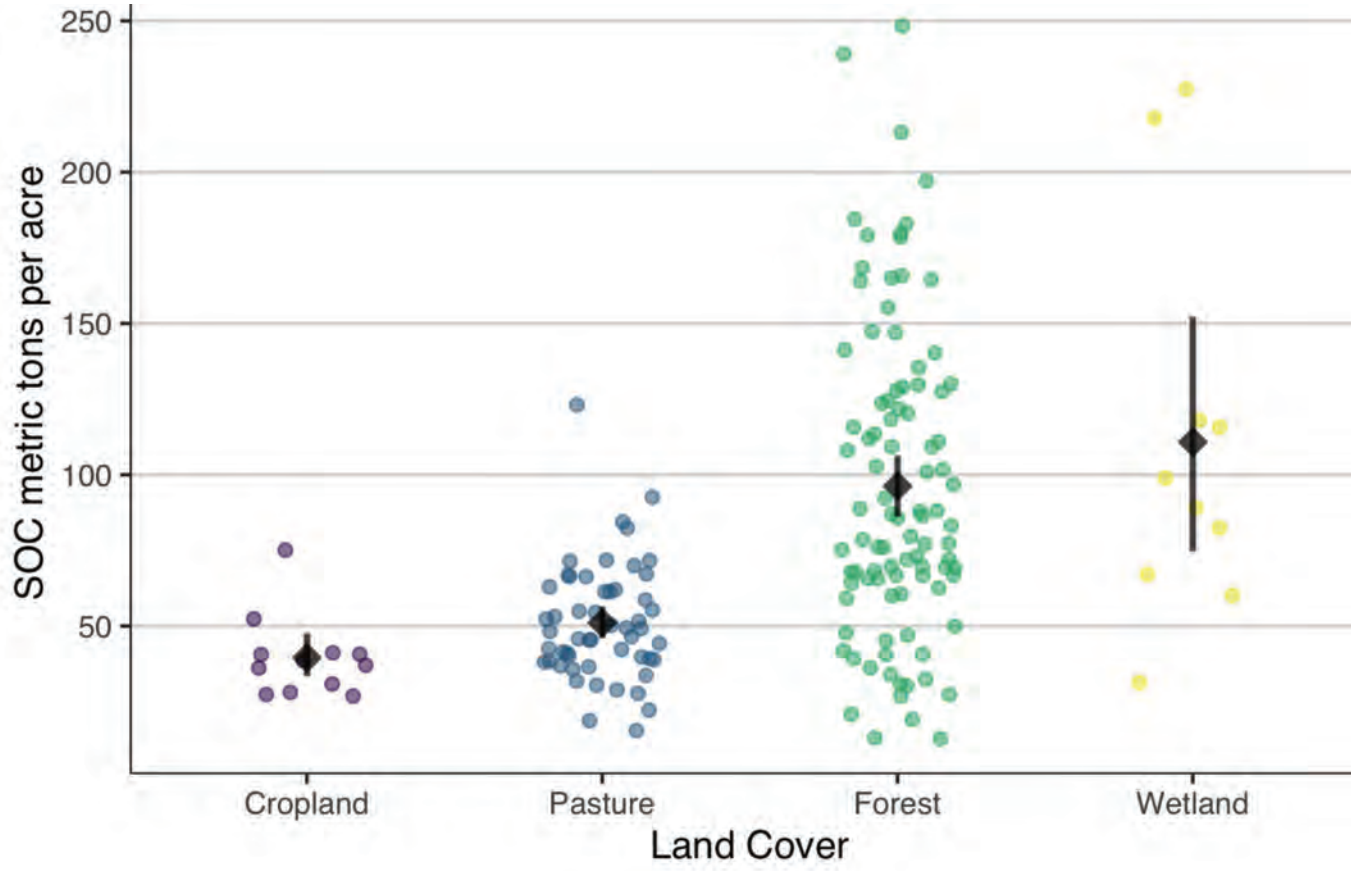
ABSTRACT

Land management and land cover change exert a strong influence on soil organic carbon (SOC) storage. As scientific, political, and business communities increase their awareness of the essential roles SOC plays in climate regulation and ecosystem functions, efforts to quantify the impacts of land use and management on SOC have increased rapidly. Existing methods of estimating SOC stocks from widely available data do not account for land cover, and are therefore of limited usefulness in understanding the impacts of past and future land use change.

This project explores a method of linking land cover to SOC, using data from public data sets and the scientific literature, to provide an SOC Inventory for Massachusetts and compares the results to those derived from a common baseline approach. Our method derives average land cover SOC values by combining data from the USDA-NRCS Rapid Carbon Assessment and the National Cooperative Soil Characterization Database with values from a meta-analysis of scientific literature. These are applied to the total area of the 20 most abundant landcover classes of Massachusetts. We compare this land cover-based approach with a baseline using SOC values found in the Soil Survey Geographic Database (SSURGO), applied to each soil map unit found within Massachusetts.

Our approach produced an estimated stock of 481 million metric tons of SOC, 29% and 109 million metric tons greater than the SSURGO baseline. We use these estimates to explore the use of the land cover based SOC values to project the impacts of likely land cover change by 2050.

Regenerative DesignGroup



CONTEXT + KEY FINDINGS

After the completion of the Massachusetts Healthy Soils Action Plan, members of RDG's consulting team published an article on the novel approach to estimating soil organic carbon at the state or larger regional scale.

Figure 3 (above) graphs the SOC mt/ha to a 1 meter depth for 172 samples tested by the National Resource Conservation Service from within 100 miles of the Massachusetts border. Cropland

An excerpt from Table 1 (right) contains the average SOC values for each major land cover type found in Massachusetts.

2016 High Resolution Land Cover Class	Average Soil Organic Carbon MT ha 1m depth	Source of SOC Value
Impervious (2)	54	Meta-analysis/ SSURGO
Developed or Open Space (5)	99	Meta-analysis/ SSURGO
Cultivated Crops (6)	81	RaCA/SCDB
Pasture or Hay (7)	126	RaCA/SCDB
Grassland or Herbaceous (8)	113	RaCA/SCDB
Deciduous Trees- non forest (9)	54	Meta-analysis/ SSURGO
Evergreen Trees- non forest (10)	54	Meta-analysis/ SSURGO
Forest (11)	214	RaCA/SCDB
Scrub/Shrub (12)	121	Meta-analysis/ SSURGO
Palustrine Forested Wetland (13)	825	RaCA/SCDB
Palustrine Scrub/Shrub Wetland (14)	825	RaCA/SCDB
Palustrine Emergent Wetland (Persistent) (15)	825	RaCA/SCDB
Estuarine Forested Wetland (16)	398	Meta-analysis/ SSURGO
Estuarine Scrub/Shrub Wetland (17)	398	Meta-analysis/ SSURGO
Estuarine Emergent Wetland (18)	398	Meta-analysis/ SSURGO

Ayer-Devens Pocket Forest Pilot Project

CLIENT

Town of Ayer
Municipal Vulnerability Preparedness Program, 2022

SERVICES + ACCOMPLISHMENTS

Stakeholder engagement

Pocket forest design

Soil testing and enhancement reccomendations

Print + digital educational materials

Town-wide analysis of ecological and social implications

Organization of a community planting day

PROJECT OVERVIEW

The aim of the Ayer/Devens Pocket Forest Project was to find the most suitable and impactful sites for planting small, dense, and diverse forests that will store and filter stormwater, cool and clean the air, increase habitat connectivity for wildlife, act as a seedbank for diverse tree species, and enhance human habitation in the Town of Ayer and the Devens Enterprise Commission.

After a robust community engagement, planning, and design process, we joined with the people of Ayer and Devens in April of this year to install one of the first pocket forests in the Northeastern US. More than 50 community members helped us prepare the soil and plant a diverse collection of trees and shrubs near downtown Ayer.

Ayer and Devens will be carrying on the momentum of this pilot project to install four more pocket forests next year (two in each town). Sites were selected based on a number of criteria that considered ecological and social factors to point towards high impact locations. We collaborated closely with BSC Group and Linnean Solutions as a consultant team to carry out this project.

Regenerative DesignGroup COOPERATIVE

What is a Pocket Forest? | Ayer/Devens Pocket Forest Project

A **POCKET FOREST** is a small, dense planting designed and managed to boost the health and livability of urban and suburban neighborhoods. These forest patches are planted to be hyper-diverse, very dense, and often include design features like snags to mimic some of the structural characteristic of old growth forests. By (re)introducing a high diversity of well-adapted species and habitat features, these clusters of trees, shrubs, and herbaceous plants provide food and shelter to local wildlife, sequester and store carbon, capture stormwater, filter air pollution, and help cool their surroundings.

Dense and Multi-Layered

Pocket forests are planted at a much higher density than typical ornamental landscapes with layers of vegetation that mimic the layers of a healthy young forest. Together these densely planted canopy trees, understory trees, shrubs, and groundcovers form a functional micro-ecosystem that can resist invasion by undesirable species and weather other disturbances.

Diverse

The diverse vegetation and structure of a pocket forest supports the biodiversity and resilience of the local ecosystem by providing habitat for a wide variety of insect, animal, and fungal life. Pocket forests also act as a seed bank that can introduce more genetic diversity to the surrounding forest areas.

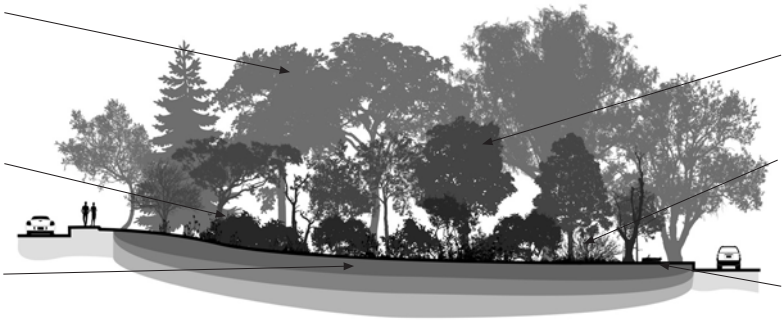
Small is Beautiful

The compact size of pocket forests allows them to fit into tight urban spaces in strategic locations to provide maximum benefit. To provide adequate function, the pocket forest should be at least about ¼ acre or about the size of a basketball court. Shape may vary greatly, but certain forest functions like air quality buffering and habitat refuge benefit from spans of 50 feet or greater.

Canopy
American Chestnut (*Castanea dentata*)
Linden (*Tilia spp.*)
Walnut (*Juglans spp.*)
White Oak (*Quercus alba*)
Sycamore (*Platanus occidentalis*)

Shrubs
Witch Hazel (*Hamamelis virginiana*)
Winterberry (*Ilex verticillata*)
Red Currant (*Ribes rubrum*)

Soil
Over time, pocket forests foster healthy soil providing functions like water storage and carbon sequestration

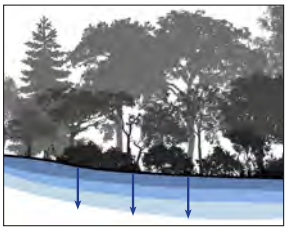


Understory
Serviceberry (*Amelanchier spp.*)
Dogwood (*Cornus florida*)
Elderberry (*Sambucus canadensis*)

Ground Cover
Wild Geranium (*Geranium maculatum*)
Mountain Mint (*Pycnanthemum muticum*)
New England Aster (*Symphyotrichum novae-angliae*)

Duff & Deadwood
Dead tree snags and leaves and branches on the forest floor provide habitat and nutrients for continued forest health

Why Pocket Forests? | Ayer/Devens Pocket Forest Project |



Water Quality & Stomwater Management

A pocket forest's dense vegetion reduces the speed of water moving over land, allowing water to penetrate and absorb back into the ground, as well as reducing the risk of flooding. Healthy soils filter and clean the water as it passes through the soil community of fungi, microbes, tiny animals, and the plants they support.

Air Quality

In the urban environment, pollution sources like exhaust from cars, buses, and trains can significantly degrade air quality. Thankfully, the large surface area of trees and their negative electrical charge act as an air filter, while releasing antiviral chemicals called phytocines which benefit plant and human immune systems.

Cooling

Urban areas have an abundance of dense materials that capture and store heat, creating what is known as 'urban heat island' effect. These hot spots can exacerbate many health and environmental problems—especially at risk are vulnerable populations who are less able to afford air conditioning or other cooling options. Through shading and evapotranspiration of water, pocket forests can aid in cooling the local environment.

Ecological Connectivity

In New England, when forest patches fall below the threshold of 100 acres or become too fragmented, many species decline or disappear. While pocket forests cannot replace all functions of a large, contiguous forest, they can help with landscape connectivity and biodiversity by serving as diversity hot spots, foraging areas, and habitat stepping stones for wildlife in the area.

Habitat & Biodiversity

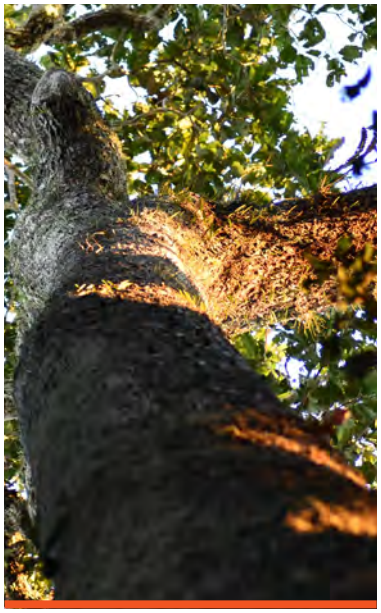
Pocket forests with diverse structure and a large variety of plant species with different needs, sizes, shapes, and life cycles are home to a higher degree of genetic diversity when compared to most naturalized urban areas. This diversity of vegetation in turn attracts a larger biodiversity of insect, animal, and fungal life all which increase local ecosystem resilience.

Mental Health & Culture

Comparative studies show that proximity and access to forests, green spaces, and even the quantity of street trees have measurable effects on cortisol, stress hormone levels and other biometrics as well as reducing both violent crimes and property crimes and increasing property value perception.

Woodwell Climate Research Center

Firm Profile and Project Experience



Woodwell Climate Research Center

CLIMATE SCIENCE FOR CHANGE

We face the greatest challenge of our time: restoring a safe and stable climate, while adapting to inevitable impacts. Science is the core of our success. Woodwell Climate Research Center is dedicated to climate science pursued in partnership with stakeholders and decision-makers to produce maximum societal benefit. Our renowned researchers investigate how human activities are affecting the flow of carbon and water—key climate factors—through the world's most critical ecosystems, from the Arctic to the tropics. Together with our global network of partners, we generate breakthrough insights into the risks we face, and the just, effective solutions we can develop.

CREATING BREAKTHROUGH INSIGHTS

Our scientists are experts in combining field data with large-scale satellite monitoring and computer modeling to generate insights that scale from local to global. Woodwell Climate experts are:

Making climate risk actionable Decision-makers need trustworthy, relevant, and detailed information about the risks we face now and in the next few decades. We work with partners to advance understanding of climate hazards, like extreme weather and fire, and their socioeconomic and geopolitical impacts, from water and food scarcity, to labor impacts, conflict, and migration.

Filling gaps in carbon accounting Thawing of Arctic permafrost could release enough greenhouse gases to threaten our climate targets, but these emissions aren't in models and budgets. Burning trees for energy emits more carbon than fossil fuels, but is often incentivized as carbon neutral. We bring rigorous, independent science to the table to ensure realistic goals and effective policies.

Realizing the potential of natural climate solutions Forests, wetlands, and soils provide our best hope for cooling the planet. We integrate ecological and social science to develop equitable, cost-effective, and evidence-based strategies ranging from finance for forest conservation, to soil carbon monitoring, wetland restoration, and agricultural land management.

WORKING IN CONCERT FOR OUTSIZED IMPACT

We work with partners, stakeholders, and government officials in more than 20 countries across six continents—from the Arctic to the Amazon, and D.C. to D.R.C. We engage throughout the research process to ensure that our insights can be integrated into real-world decision-making. This approach has delivered outsized impact for over 35 years. Woodwell Climate researchers have:

- Helped shape the UN Framework Convention on Climate Change
- Provided Congressional testimony or briefed Hill staffers dozens of times in the past five years
- Shaped the first guidelines for corporate disclosure of physical climate risk
- Informed critical Brazilian legislation to protect 30 million acres of Amazon forest
- Contributed to more than a dozen reports by McKinsey & Company on climate risk and net zero pathways

BY THE NUMBERS

PRINCIPAL INVESTIGATORS	18
TOTAL STAFF	120+
CORE PARTNERS	30+
SCIENTIFIC PUBLICATIONS	120+/yr
MEDIA MENTIONS	6,500+/yr

No Net Loss of
CARBON IN WETLANDS

No Net Loss of Wetland Carbon in Massachusetts Project Final Report

July 2024

PREPARED FOR

Massachusetts Department of Environmental Protection (MassDEP)
100 Cambridge Street, Suite 900
Boston, MA 02114

PREPARED BY

BSC Group, Inc.
1 Mercantile Street, Suite 610
Worcester, MA 01608

PROJECT TEAM & REPORT CO-AUTHORS

BSC Group, Inc.
Massachusetts Association of Conservatic Commissions
Regenerative Design Group

This report has been prepared by the No Net Loss of Wetland Carbon in Massachusetts Project Consulting Team: BSC Group, Inc., the Massachusetts Association of Conservation Commissions, Regenerative Design Group, Scouter Design, and Woodwell Climate Research Center. The specific recommendations developed by the Project Consulting Team for achieving No Net Loss of Wetland Carbon in Massachusetts have been discussed with staff from the Massachusetts Department of Environmental Protection (MassDEP) and the Massachusetts Executive Office of Energy and Environmental Affairs (EEA), who have provided valuable information and insights. However, the recommendations presented in this report do not represent policy or regulatory decisions or commitments from MassDEP or EEA. The report is intended to provide useful information for these government agencies as they develop approaches that work towards achieving No Net Loss of Wetland Carbon in Massachusetts.

Solving climate change means reducing global carbon emissions.

Climate change is driven by the increase in concentrations of CO_2 and other greenhouse gases in the atmosphere, primarily due to fossil fuel combustion. Fortunately, the Earth's forests, soils, and natural systems can be a powerful tool to slow this dangerous build-up—if they are properly conserved and managed.

Woodwell Climate scientists work across continents and fields of study to find comprehensive strategies to promote natural climate solutions for reducing carbon in the atmosphere.

Experts

Jonathan Sanderman
Carbon Program Director

Richard A. Birdsey
Senior Scientist

Brendan M. Rogers
Associate Scientist

Christopher R. Schwalm
Risk Program Director

Wayne S. Walker
Chief Scientific Officer

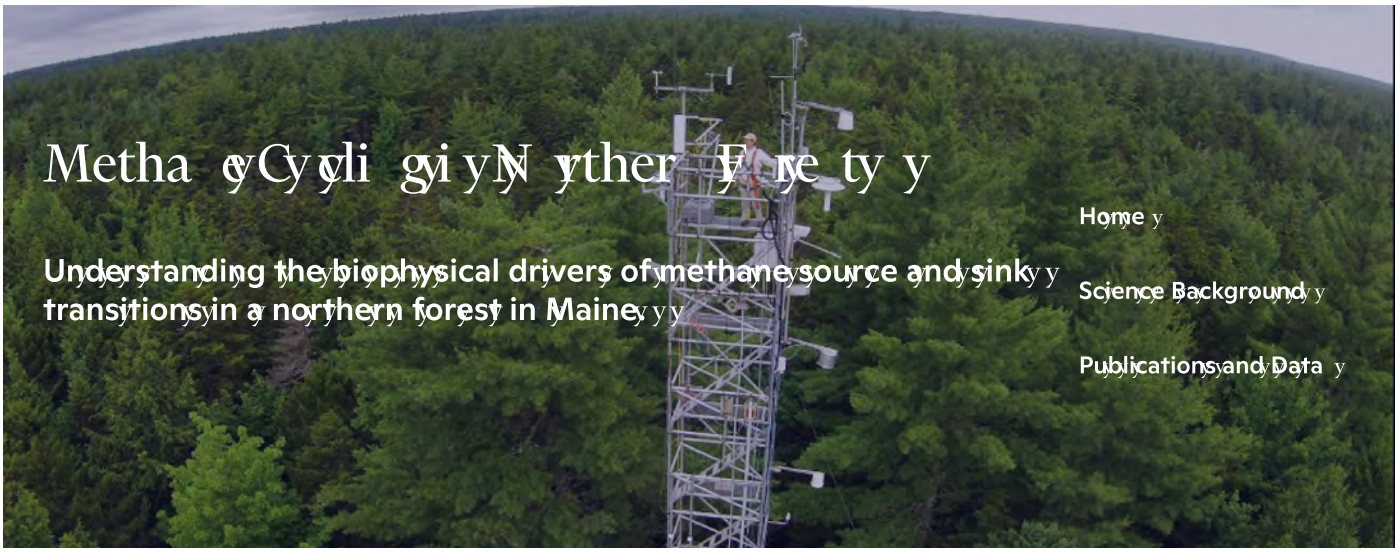
Elchin Jafarov
Senior Research Scientist

Susan M. Natali
Senior Scientist

Ludmila Rattis
Assistant Scientist, Tanguro Field Station General Coordinator

Jennifer D. Watts
Arctic Program Director, Associate Scientist

All Carbon Experts



Methane Cycling and Other Fluxes

Understanding the biophysical drivers of methane source and sink transitions in a northern forest in Maine

Research area

Arctic Carbon

Methane is second only to carbon dioxide (CO_2) in its contribution to human-induced climate change, thanks to its global warming potential ~34x greater than CO_2.

However, we understand very little about methane fluxes in forests, the processes and feedbacks that drive it, and how methane emissions or uptake will evolve with a changing climate.

Our Work

At the Howland Research Forest, ME, we are taking on this priority for biological research and improving methane flux models. Our innovative, multi-scale, and cross-disciplinary study is identifying the conditions and mechanisms driving methane sink/source activity across soil moisture gradients in northern forests.

Led by Woodwell Climate Research Center, in collaboration with the University of Maine, Emory University, Arizona State University, San Diego State University, and the USDA Forest Service, this research uses next generation DNA and RNA sequencing techniques that allow us to study microbial traits. Measuring these traits across different environmental conditions ultimately helps us learn how microbes regulate methane in sub-boreal forests may be offsetting methane emitters globally, and how this may change under future climate conditions. The Howland Research Forest serves as a case study to identify drivers and functional relationships across wet to dry soils, and from soils to canopy.

photo by Dave Hollinger

Team

Jennifer D. Watts
Assistant Scientist

Kathleen Savage
Senior Research Associate

Zoe Dietrich
Research Assistant

Collaborators

Shawn Fraver
Associate Professor of Forest Ecology, University of Maine

Debjani Sihi
Assistant Professor, Emory University

Hinsby Cadillo-Quiroz
Associate Professor, Arizona State University

Xiaofeng Xu
Associate Professor of Ecology, San Diego State University

David Hollinger
Research Plant Physiologist, USDA Forest Service

Andrew Ouimette
Ecologist, USDA Forest Service

Scouter Design

Firm Profile and Project Experience

SCOUTER DESIGN

SMART DESIGN THAT CONNECTS YOUR STORY TO YOUR AUDIENCE.

A little about us.

Transforming ideas into visual stories that resonate with your target audience is our passion and the hallmark of our work. Our collaborative approach along with listening and communicating throughout the process allows us to create the most effective solution for your project, while creating a positive experience for all.

At Scouter Design, we work with clients to create new brands and refresh existing ones. This may include a logo or creating or expanding a business's system of products such as templates, brand guides, stationery, corporate overviews, and annual reports. We make our templates functional for our clients to help streamline their process and believe that training is an integral part of that deliverable.

We want our clients to enjoy working with us as much as they enjoy the products that we deliver. Our philosophy revolves around these three concepts.

Explore. Create. Connect.

EXPLORE

Through research and exploration, we seek to uncover and understand what your audience cares about.

CREATE

We develop smart concepts and deliver custom solutions that support your vision and relate to your audience.

CONNECT

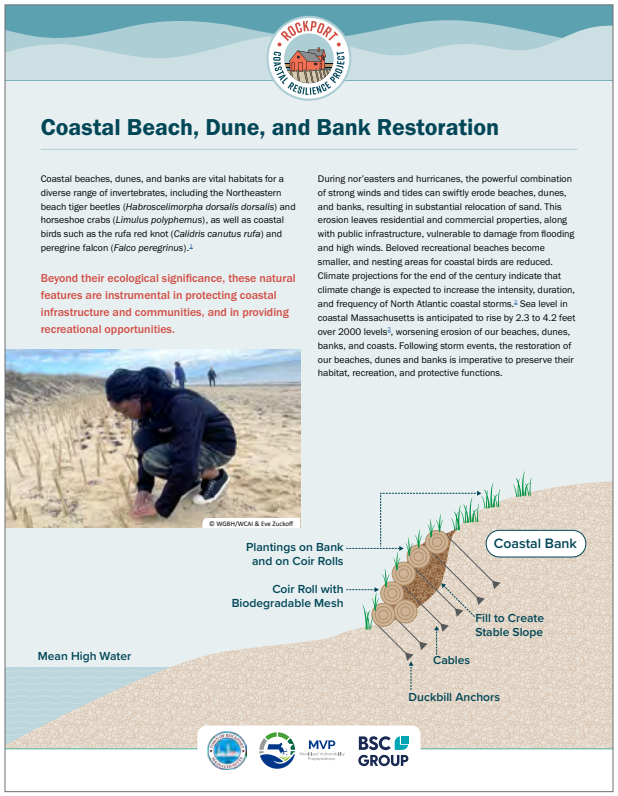
Our clear and compelling designs visually highlight your story that will engage your audience.

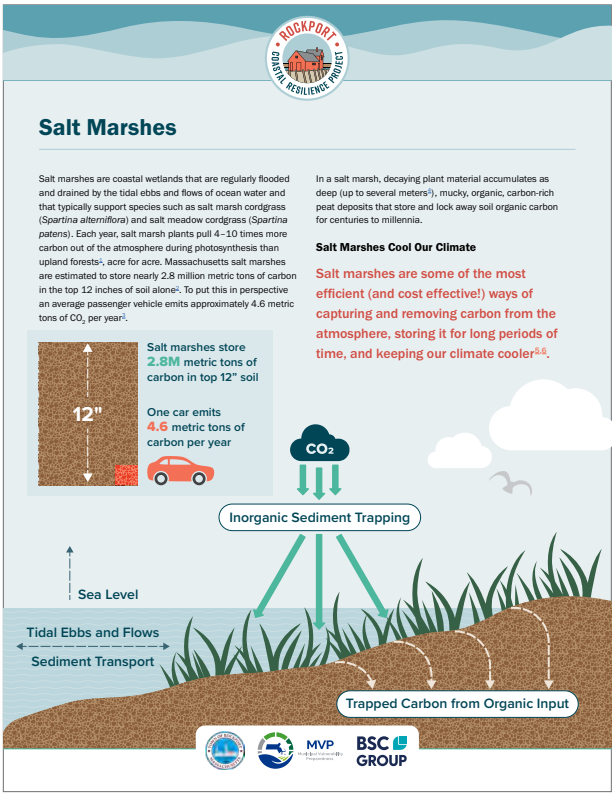
Terri Courtemarche
Principal, Graphic Designer

Terri brings over 25 years of graphic design experience creating logos, brand identities, templates, and report design to her clients. Her prior experience leading an in-house team of designers at an engineering firm exposed her to a range of clients that included state transportation agencies, municipalities, airports, and federal agencies. Currently, she works with engineering firms and environmental planners focusing on branding and climate action plans. Using her design skills to benefit others, Terri also volunteers with non-profit organizations to help them promote their work.

www.scoutergraphicdesign.com

ROCKPORT COASTAL RESILIENCE PROJECT TOOLKIT / MASSACHUSETTS





ROCKPORT COASTAL RESILIENCE PROJECT

CLIENT'S MISSION.

BSC worked with the Town of Rockport to find solutions to mitigate climate challenges along their coastline. To inform stakeholders and community, we designed a toolkit of outreach materials that BSC and Rockport could use to promote this effort.

EXPLORING IDEAS.

Creating a strong brand around an initiative helps build community engagement and interest. This toolkit included infographics, templates, and a project logo. To customize the project's brand, we drew on the character of the coastal town for inspiration for all of the brand components.

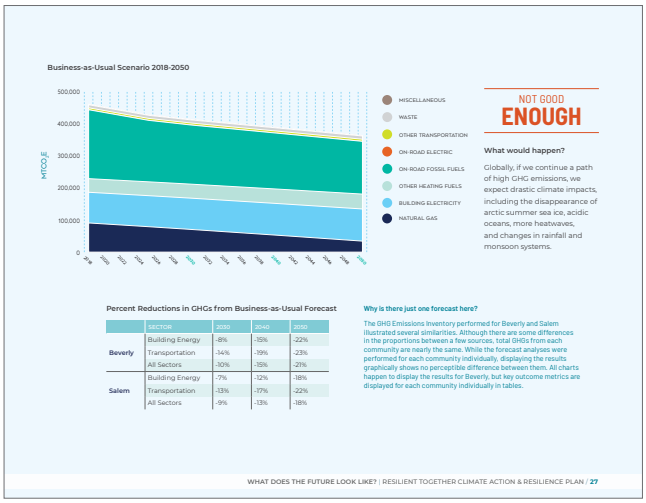
CREATING SOLUTIONS.

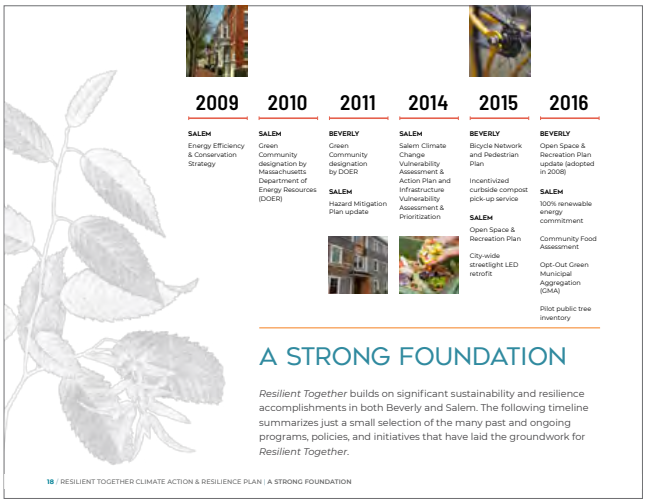
Illustrations and graphics are the best way to convey information that is complex. We created a series of infographics for the public that visually show the issues and supporting data for each topic. The graphics can be repurposed for social media and presentations.

CONNECTING PEOPLE.

Our communities are diverse. That means we can expand our reach and our message by creating the infographics in other languages depending on the languages being spoken within our community.

BEVERLY & SALEM CLIMATE ACTION & RESILIENCY PLAN / MASSACHUSETTS





BACKGROUND

Beverly and Salem worked with KLA to assess climate change within their communities and create a plan and target goals that they can achieve to address climate change.

EXPLORE

The clients wanted to highlight the inclusive process that they used to hear from and inform their communities. For this reason, it was important to show how they achieved that by using various methods such as social media, surveys, and focus groups.

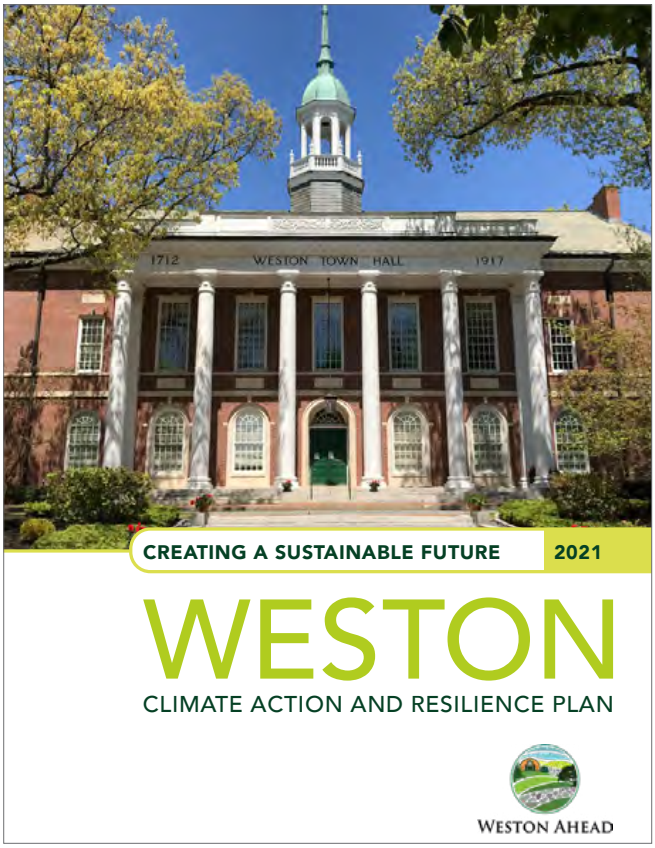
CREATE

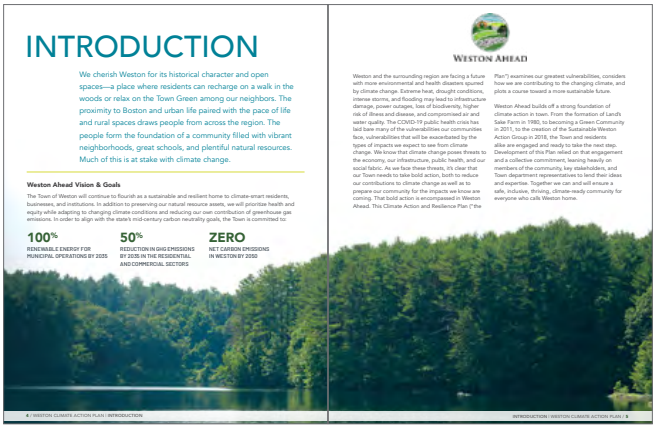
We chose to support the story by using public engagement infographics, quotes, local community stories, and photos of the community working to protect our environment.

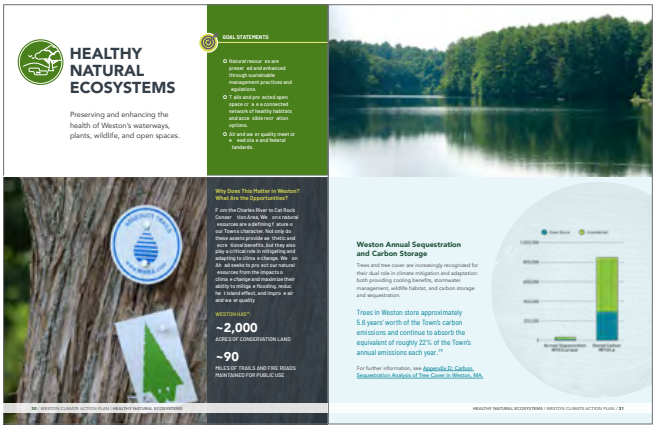
CONNECT

The interactive report was posted online for the community to review. It was also made ADA compliant so it was accessible to everyone.

WESTON CLIMATE ACTION & RESILIENCY PLAN / MASSACHUSETTS







BACKGROUND

The Town of Weston underwent the process of defining their goals for addressing climate change within their community with KLA. This report is the result of their findings.

EXPLORE

We explored different ways to tell their story in a visual way while also using their brand and logo. Creating smaller pieces of information helped make complex and technical information understandable for all readers.

CREATE

Each section used call out boxes to highlight important aspects of the plan; charts and infographics to easily grasp complex data; and imagery to add visual interest. These attributes helped deliver the overall goals of the plan in a visual and legible way.

CONNECT

This interactive report was posted on-line for the community to read and included attributes such as hyperlinks and bookmarks to make it easy to navigate and read.

BEVERLY & SALEM CAP SKILL SHEETS / MASSACHUSETTS

BACKGROUND

In conjunction with the Climate Action Plan, Beverly and Salem used skill sheets early in the process to inform the community about the different areas that most affect climate change and our environment.

EXPLORE

The information needed to be concise and easy to understand. Under these topics, the clients were able to create an awareness as to how our every day habits can impact our environment as well as how we can help.

CREATE

Local examples of where climate change was being addressed, whether large or small, were incorporated. Infographics and imagery made a compelling visual narrative and the brand created a consistent and cohesive message.

CONNECT

The skill sheets were designed in multiple languages because of the diversity in the communities. They were also ADA compliant so that the information was accessible to all readers.

Appendix B

Team Member Resumes

BSC GROUP

Gillian
Davies, PWS, RSS, NHCWS, CESSWI

Senior Ecologist/Natural Climate Solutions Specialist
Senior Associate

YEARS OF EXPERIENCE

33

EDUCATION

MES, Ecosystem Ecology
Yale University School of the Environment

BA, Psychology
Williams College

Certificate of Completion in the New England Regional Soil Science Certificate Program
University of Massachusetts

AFFILIATIONS

Global Development and Environment Institute, Tufts University, Visiting Scholar (2018-present)

Society of Wetland Scientists -Chair WOTUS ad hoc Committee, Co-Lead Climate Change & Wetlands Initiative; 2016-2017 President, Past President, President Elect

MEET GILLIAN

Gillian provides expertise and innovative solutions encompassing peer review for Conservation Commissions, ecosystem-based climate change resiliency and mitigation assessment and planning, state and federal permitting, wetland delineation, impact analysis, wetland restoration/mitigation planning, design and monitoring, expert witness testimony, and environmental construction/post construction inspection.

A well respected leader in the field of wetland sciences, Gillian holds many prestigious titles at industry organizations dedicated to promoting the understanding, conservation, protection, restoration, science based management, and sustainability of wetlands. She currently serves as Chair of the SWS WOTUS ad hoc Committee and Co Lead of the SWS Climate Change and Wetlands Initiative. She is also a Visiting Scholar at the Tufts University Global Development and Environment Institute. In the past she has held such titles as Society of Wetland Scientists (SWS) President, SWS Professional Certification Program President, SWS New England Chapter President, and Association of Massachusetts Wetlands Scientists President.

Gillian has worked extensively with Massachusetts Conservation Commissions as a peer-reviewer and previously as an education/outreach specialist for the MassDEP. She has provided numerous workshops and presentations to Conservation Commissions and other members of the wetland's professional community in Massachusetts and internationally.

AFFILIATIONS (CONT.)

Society of Wetland Scientists Professional Certification Program, 2021-2022 President; President Elect

Society of Wetland Scientists New England Chapter; 2014-2015 President, Vice President

INTECOL (International Association for Ecology) Wetlands Working Group, Member (2021-present)

Association of Massachusetts Wetlands Scientists; 2002-2003 President, Vice President

REGISTRATIONS

Registered Soil Scientist, Society of Soil Scientists of Southern New England

CERTIFICATIONS

Professional Wetland Scientist, Society of Wetland Scientists #2181 (2011)

Certified Wetland Scientist – NH #071 (1999)

Certified Erosion, Sediment, and Storm Water Inspector, Envirocert International, Inc.

Certified Municipal Vulnerabilities Preparedness Provider – MA

GOVERNMENT SERVICE

MA Executive Office of Energy and Environmental Affairs & Commission for Conservation of Soil, Water & Related Resources Healthy Soils Action Plan Work Group (2019–2020)

GOVERNMENT SERVICE (CONT.)

MA Department of Transportation Wetland Mitigation Banking Group (2018)

MA Executive Office of Energy and Environmental Affairs Natural Resources and Habitat Subcommittee to the Climate Change Adaptation Advisory Committee (2009)

MA DEP Wetlands & Waterways Circuit Rider (1999-2003)

OTHER VOLUNTEER

National Academy of Sciences, Engineering, and Medicine Transportation Research Board Panelist (2018–2022)

PROJECT EXPERIENCE HIGHLIGHTS

MassDEP No Net Loss of Carbon in Wetlands in Massachusetts Project: Statewide

Project Manager & Senior Ecologist

Led multidisciplinary team to develop strategies and methodologies for No Net Loss of Wetland Carbon in Massachusetts policies and regulations. Consulting team developed innovative wetland soil carbon mapping using machine learning and researching and developing concepts and preliminary design for an interactive carbon accounting tool for both Teal Carbon (inland freshwater) wetlands and Blue Carbon (coastal saltwater) wetlands.

SuAsCo Natural Climate Solutions Project: Hudson, Framingham, and Natick

Project Manager & Natural Climate Solutions Specialist

Coordinated consulting team and 3 urban/suburban communities with Environmental Justice communities to identify Nature-based Solutions (NbS) to climate change and biodiversity loss. Project identified opportunities for wetlands, floodplains, forests, and other ecosystems to support broader resilience planning efforts, and expanded communities' capacity to protect, restore and enhance carbon sequestration and other ecosystem services through community driven assessment of NbS; and developed educational materials and opportunities.

Ayer-Devens Main Streets Pocket Forest Pilot Project, MA

Project Manager & Natural Climate Solutions Specialist

Coordinated consulting team and 2 communities with Environmental Justice communities to improve community health and resilience through: the design and planting of a pilot pocket forest; community driven selection of, and permitting assessment for, four additional pocket forest sites; development of a project website and pocket forest educational materials; and a variety of community events including a community planting day at the pilot pocket forest.

MassDEP Coastal Floodplain Outreach

Senior Ecologist

Advised project team on coastal floodplain ecological features and functions, and effectiveness of visual and text communications to inform development of a public education outreach campaign focused on the climate resilience benefits provided to coastal communities by the coastal floodplain. The campaign included development of a coastal floodplain video, pamphlet, and StoryMap.

Apple Country Natural Climate Solutions Project: Bolton, Harvard, and Devens Regional Enterprise Zone

Project Manager & Senior Ecologist

Coordinated team of consultants and 3 communities to identify Nature-based Solutions (NbS) to climate change and biodiversity loss. Project identified opportunities for wetlands, floodplains, forests, and other ecosystems to support broader resilience planning efforts, and expanded communities' capacity to protect, restore and enhance carbon storage and sequestration and other ecosystem services by providing a model for community driven assessment of NbS; providing recommendations to improve regulations; and developing and providing educational materials and opportunities.

Rockport Coastal Resilience Project, Rockport, MA

Project Manager & Natural Climate Solutions Specialist

Led interdisciplinary team to identify coastal Nature based Solutions. Project identified opportunities for coastal NbS to support broader climate resilience planning efforts, and expanded communities' capacity to achieve greater resilience to sea level rise and coastal storms through community driven assessment of NbS; and developed educational materials and opportunities, including a website, StoryMap, and infographics.

Massachusetts Department of Transportation, Route 2, Lincoln and Concord, MA

Senior Wetland & Soil Scientist; & Certified Erosion, Sediment & Storm Water Inspector

Provided environmental monitoring services for complex highway improvements project (construction of new interchange, road widening, safety improvements), including monitoring of two large wetland replication areas (totaling 77,963 s.f.), with relocated streambeds. During monitoring of wetland mitigation areas, responsible for implementing innovative approach (IRIS tubes) to assessing hydric status of soils. The project area encompassed approximately 60 acres, is 2,751 meters long, and included multiple work areas operating simultaneously. Environmental Monitoring included responsibility for monitoring project compliance with MA Wetlands Protection Act Variance and Stormwater Pollution Prevention Plan conditions, preparing numerous reports, developing solutions to emerging issues, and coordinating with state and federal regulatory agencies, as well as MassDOT and the project contractor.

Massachusetts Department of Transportation, Route 18, Weymouth, Abington, Southfield, MA

Senior Wetland & Soil Scientist; & Certified Erosion, Sediment & Storm Water Inspector

Provided environmental monitoring services for complex highway widening projects (road widening, bridge replacement, safety improvements), including monitoring construction of wetland replication area (totaling 42,210 s.f.) and wetland restoration areas. The project area was 4.1 miles long and included multiple work areas operating simultaneously. Environmental Monitoring included responsibility for monitoring project compliance with MA Wetlands Protection Act and Water Quality Certification Variance and Stormwater Pollution Prevention Plan conditions, preparing numerous reports, developing solutions to emerging issues, and coordinating with state and federal regulatory agencies, as well as MassDOT and the project contractor.

Nashua River Communities Resilient Lands Management Project

Natural Climate Solutions Specialist & Senior Ecologist

Collaborating with the Massachusetts Association of Conservation Commissions, Gillian led development of wetland climate change by-laws and regulations for Massachusetts municipalities and tailored those bylaws and regulations to the specific needs of the Towns of Bolton and Clinton. This project aimed to improve community climate resilience and ecosystem carbon mitigation by protecting and restoring ecosystem services through the development and adoption of better land management practices and articulated through the writing of forest management and lawns and landscaping management guides.

Nashua River Watershed Natural Climate Solutions Project, Ashburnham, Fitchburg, Groton, Leominster, Pepperell, MA

Senior Ecologist

Advised consulting team for 5 urban/suburban communities with Environmental Justice communities on project to identify Nature-based Solutions to climate change and biodiversity loss. Project identified opportunities for wetlands, floodplains, forests, and other ecosystems to support broader resilience planning efforts, and expanded communities' capacity to protect, restore and enhance carbon sequestration and other ecosystem services through community driven assessment of NbS.

Route 44 Relocation Project Wetland Mitigation Monitoring, Carver/Kingston, MA

Senior Wetland & Soil Scientist

Responsible for monitoring inland wetland replication/restoration areas associated with construction of relocated Route 44, for assessing invasive species, as well as report preparation. A total of 16.58 acres of wetland replication was constructed for this project, with an additional 0.4 acres of wetland restoration.

Municipal Vulnerability Preparedness Planning Projects: Amesbury, Bolton, Georgetown, MA

Project Manager & Senior Ecologist

Responsible for projects in each municipality to work with municipal staff, stakeholders, and community members to identify existing climate vulnerabilities and community strengths, future opportunities for building community climate resilience, and prioritization of those opportunities. This work provided the communities with the basis for specific, action oriented projects to improve infrastructure, social and environmental community climate resilience, and prioritization of actions. The Georgetown MVP Planning Project included integration of the Georgetown Hazard Mitigation Plan Update.

Massachusetts Association of Conservation Commissions Wetland Buffer Zone Guidebook Project, Belmont, MA

Project Manager & Lead Author

Responsible for project to research and write comprehensive guidebook on the science and regulation of wetland resource area buffer zones and Riverfront Areas under the Massachusetts Wetlands Protection Act and local bylaws and ordinances. Preparation of guidebook includes supervision of junior staff and coordination with Massachusetts Association of Conservation Commission Buffer Zone Guidebook review team, scientific literature search, and development of recommendations for science-based review of projects under existing state regulations and local bylaws/ordinances, as well as how to develop local bylaws and ordinances supported by current scientific findings. The guidebook provides a discussion of wetland, buffer zone and Riverfront Area regulation in the context of climate change, outlining how buffer zones contribute to protection of carbon in wetlands, support climate adaptation and climate resiliency ecosystem services that wetlands provide, and protect wetlands from the impacts of climate change.

BSC GROUP

Catarina
Martinez, MEM

Resilience Planner
Associate

YEARS OF EXPERIENCE

6

EDUCATION

Master of Environmental Management (MEM)
Duke University, 2021

A.B. Integrative Biology
Harvard College, 2016

AFFILIATIONS

- Urban Land Institute
- Harvard Alumni for Climate and the Environment
- Harvard Alumni for Agriculture and Food

MEET CAT

Catarina brings experience in the fields of city and municipal level resilience, public private partnerships, regenerative agriculture and sustainable food systems, air pollution, and environmental justice, with a focus on the efficacy of policy tools, science communication (she speaks fluent Spanish), and community engagement. Catarina excels at balancing scientific accuracy with storytelling, engaging design, and broad accessibility.

PROJECT EXPERIENCE HIGHLIGHTS

Penobscot Climate Action Regional Climate Vulnerability Assessment, Bangor Area Comprehensive Transportation System, Penobscot County, ME

Resilience Planner

As part of the vulnerability assessment, Catarina was involved with the methodology, design, analysis, and development of a GIS asset mapping database and initial vulnerability asset screening report. The project involved a robust data collection and organization effort, coordination with 11 municipalities and other stakeholders such as the University of Maine, stakeholder interviews, and public meetings with community members. The assessment report addressed key environmental, infrastructure, and community assets in the region, including the local economy and health.

Municipal Vulnerability Preparedness (MVP) 2.0, Commonwealth of Massachusetts' Executive Office of Energy and Environmental Affairs (EEA)

Resilience Planner

Involved in multi consultant project to reformulate the MVP planning process, which provides support for cities and towns in Massachusetts to identify climate hazards, assess vulnerabilities, and develop and implement actions plans to improve resilience to climate change. Catarina focused on stakeholder engagement and the creating of tools to support the refreshed approach, specifically the development of written, visual, and videographic content as well as a GIS dataset for a robust web tool that guides cities and towns through the task of identifying their vulnerabilities using mappable data and other resources, such as the Massachusetts Department of Public Health.

Climate Resilience and Equity Metrics Development Project, Massachusetts Bay Transit Authority (MBTA) Capital Delivery

Resilience Planner

Involved In multi consultant project to develop preliminary metrics for all equity and resilience-related features for MBTA projects from preliminary design (15% design completion) through construction. The process involved performing a baseline analysis, stakeholder interviews, workshops, development of metrics, and a Memo of Findings. Catarina focused primarily on the final presentation of the baseline analysis spreadsheet, which included 44 documents, 350 indicators, and identification of all measurable targets relating to different project phases (such as construction or maintenance/operations), to different equity themes (including race, ethnicity, language, and disability), and to different climate change targets (via both mitigation and adaptation).

Stow Acres Climate Resilience Master Plan, MA

Resilience Planner

Supported outreach and engagement efforts for the Climate Resilience Master Plan, including community events, development/dissemination of a community survey, and the development of presentation materials to inform community about essential Plan steps, such as the Natural Resources Inventory.

Rockport Coastal Resilience, Rockport, MA

Resilience Planner and Assistant Project Manager

Supported the Town in its execution of a (MVP Action Grant to analyze the Rockport coastline to identify (with community support) approx. 15 sites for analysis of future Nature based Solutions projects.

PRIOR TO JOINING BSC GROUP, CATARINA WAS INVOLVED WITH THE FOLLOWING PROJECTS:

Climate Action Research, Harvard Business School, Boston, MA

Research Associate

Catarina was responsible for conducting interdisciplinary research on Climate Action and other resilience and equity projects (as well as other topics such as public private partnerships during COVID 19 response and leadership) in cities across the United States and Europe, including Miami and Chicago. Catarina engaged businesses, non-profits, professors, and other stakeholders through meetings and interviews to provide information to synthesize with the research team. Catarina assisted with the generation of multiple Harvard Business School case studies and affiliated documents.

Carbon Experimentation, Indigo Agriculture, Boston, MA

Analyst

Catarina was responsible for gathering and synthesizing scientific research on regenerative agriculture which required acquiring complex data from databased and scientific literature to inform the future of Indigo's Carbon program (which allows farmers to receive carbon credits for their carbon offsets, in turn increasing soil health and reducing greenhouse gas emissions). She presented information to various company representatives and outside partners via both written and visual methods.

BSC GROUP

Casey-Lee Bastien, RLA

Landscape Architect
Associate

YEARS OF EXPERIENCE

23

EDUCATION

BS, Landscape Architecture, University of Massachusetts, Amherst

REGISTRATIONS

Landscape Architect

- MA #1554 (2008)
- RI #LA.0000667 (2018)
- NH #00192 (2021)

CERTIFICATIONS

- SITES-AP (2017-2019)
- Certified Playground Inspector (CPSI) (2013-Present)
- OSHA Construction Safety and Health

MEET CASEY-LEE

Casey Lee designs landscape solutions that speak to the purpose and personality of a site so that it resonates with the client and users. His passion to research and innovate defining features into his designs adds meaning and value to a wide variety of project types including parks, streetscapes, transportation, institutions, and natural habitats. He has experience in horticulture and lighting design and provides coordination and design of graphic and sculptural arts, digital modeling, fabrication, and installation.

Casey Lee has a strong regard for social justice and works diligently to bring the right solution to every project regardless of the means available to a community.

PROJECT EXPERIENCE HIGHLIGHTS

Nature-based Solutions Program for Towns in the Nashua, Sudbury, Assabet, and Concord River Watersheds, Mystic River Watershed, and other communities including Rockport, Georgetown, Burlington, and Amesbury, MA

Landscape Architect/ Ecologist/ Planner

Developed a selection matrix for assessment of the value and feasibility of Nature based Solutions (NbS) Green Infrastructure (GI) and policy to compare restoration or enhancement project sites within each community. He developed project primer memos describing modular nature-based solutions, their prerequisites and implementation for each NbS in the matrix. He developed a unit based estimating tool for scoping NbS projects to support conceptual budgeting for project comparison. Provided subject matter expert desktop analysis for the selection of NbS project sites and content. He led community site walks and field analysis teams of local stake holders and subject matter experts for NbS GI project selection.

I-495 Wetland Restoration Along Concord River, Lowell, MA

Landscape Architect

Provided wetland replication support for environmental monitoring efforts along the Concord River. Supported the development of a green infrastructure solution, including modifications to the contributing upland watershed through baffles and level spreaders over enhanced cultural grassland; stabilizing green grout soils and plantings within the stone to slow and cool storm water; and utilization of root wad snags, live fascines, and live stakes in addition to standard wetland replication and erosion control. To prevent highway closures, developed a plan to use canoes for implementation, enabling the project to be completed at a fraction of the projected cost and within the same season.

Island End River Daylighting, Adaptive Management Plan Chelsea and Everett, MA (ACOE)

Landscape Architect/Project Manager

BSC was asked to take over management and monitoring of riverbank revegetation after completion of the structural daylighting project performed as part of site redevelopment. Previous plantings had failed, and it was determined that a new methodology was required. Caseylee developed an adaptive landscape management plan to be implemented and overseen by BSC Ecologists and City staff. This included green grout planting of tidal saltmarsh and coastal bank grasses, and top of bank nurse plantings to alter the microclimate. New plantings required a solar powered tidal river drawn irrigation system, desalination, and an invasive species management plan.

Island End River Living Shoreline, Chelsea and Everett, MA

Landscape Architect/Project Manager

Provided landscape architecture for the planning, community outreach, digital modeling, web design, planting design, detailing of grey/green nature-based living shoreline/ storm resiliency features, estimating, permitting support, and construction documents for a linear quarter mile of riverbank and a half mile of associated riverfront area. The project included new universal access trails, riparian corridor and riverbank restoration planting, habitat enhancements, structured saltmarsh plantings, educational interpretive signage, and related amenities to improve natural function and accessibility.

Constructed Wetland Restorations, MassDOT, Various Locations, MA

Landscape Architect

Coordinated with environmental scientists regarding invasive species control, canopy restoration, flow correction, species and habitat enhancement, design of constructed wetlands, and salt marshes for the inspection and analysis of constructed drainage ways and wetlands at various locations. Designed correction and restoration of these facilities to meet MassDOT, local conservation commission, and Army Corps of Engineers requirements. Recent projects include Route 110, Amesbury; Lagoon Pond Drawbridge, Martha's Vineyard; Sudbury River Bridge Route 9, Framingham; Route 44 interchange, Carver; and Regional Transportation Center, Woburn.

Chelsea Greenway, Chelsea, MA

Landscape Architect

Designed landscape architecture for the environmental restoration and interpretive wildlife habitat formation at a former landfill between the Mill Creek tidal river and the Chelsea Greenway. Bordered on the upland side by a mixed use commercial and high density residential neighborhood, this restoration balances ecological and recreational needs. Developed management strategies for invasive species and contaminated soils as well as tidal influence and saltmarsh restoration. Produced estimates and feasibility analysis of invasive vegetation management methods, including saltwater inundation, controlled burning, and mechanical and chemical methods. This was followed by the development of engineered habitat archetypes to restore the site to one of prime wildlife value paired with interpretive features and passive recreation.

Cambridge Discovery Park, Cambridge, MA

Landscape Architect

Served as landscape architect for the redevelopment of Acorn Office Park which included creating a combined stormwater restoration pond/wetland system, passive recreation park, and associated streetscape with trail connections. Provided analysis, design, and construction documents; coordinated with architect and subconsultants, and provided coordination during construction. Special challenges included active utility systems integrated into the existing facilities, accommodation for pedestrian access across Route 16, viewshed preservation, and proximity of the Little River.

Blackstone Gateway Park, Worcester, MA

Landscape Architect

Part of the initial planning and design of this project for many years, responsible for the development of trails and elevated boardwalks with overlooks and bridges along and over the Blackstone River. Tasks associated with this project included development of gateway gardens, boardwalk and bridge details, ecological restoration planting plans, compensatory flood storage, geotechnical analysis, and interpretive signage.

BSC GROUP

Dominic
Rinaldi, PE, LEED AP BD+C

Civil Engineer

Senior Associate

YEARS OF EXPERIENCE
28

EDUCATION
BS, Civil Engineering
Carnegie Mellon University

REGISTRATIONS
Professional Engineer

- MA #45074 (2002)

CERTIFICATIONS
- LEED Accredited Professional
- OSHA Construction Safety and Health
- Troxler Nuclear Testing

AFFILIATIONS
- American Council of Engineering Companies/Massachusetts
- U.S. Green Building Council - Massachusetts Chapter

MEET DOMINIC
Dominic is a project manager with BSC Group. He applies his background in land development and site construction to develop reasonable and cost effective solutions in a variety of areas. He is familiar with federal, state, and local regulations pertaining to site design and has worked for many public and private sector clients. Dominic is also familiar with the latest in computer aided design software. His past experience in the construction field also aids in his ability to efficiently perform construction period services.

PROJECT EXPERIENCE HIGHLIGHTS

Apple Country Natural Climate Solutions Project: Bolton, Harvard and Devens Regional Enterprise Zone
Project Engineer

Responsible for engineering services that support Nature-based Solutions to climate change and biodiversity loss. Project identified opportunities for wetlands, floodplains, forests, and other ecosystems to support broader resilience planning efforts, and expanded communities' capacity to protect, restore and enhance carbon sequestration and other ecosystem services by providing a model for community driven assessment of NbS; providing recommendations to improve regulations; and developing and providing educational materials and opportunities.

Greening Lord Pond Plaza, Athol, MA
Project Engineer

Worked with Athol to secure MVP Action Grant funding for the development of a feasibility study at Lord Pond Plaza to identify climate resilient solutions. These solutions address urban heat island effect and inland flooding and diminish social, environmental, and infrastructure vulnerabilities while creating much needed greenspace downtown. Coordinated efforts to successfully achieve the town's downtown revitalization goals and become more resilient to climate change.

Horseneck Beach Campground, Department of Conservation and Recreation, Westport, MA
Civil Engineer

Provided engineering services for the planning of a 500 acre, waterfront park encompassing 100 existing campsites, as well as associated roads and utilities. Responsibilities include the review and assessment of physical plant conditions, development of an existing conditions report, preparation of a study report for buildings in the area, and the development of preliminary designs to address all structural deficiencies, places for infrastructure improvement, as well as utility upgrades. BSC is also responsible for preparing preliminary designs for all associated campground amenities, including shade pavilion, basketball court, fire rings, and playgrounds. Community outreach was needed to address the needs and wants of campers utilizing the area.

Northeastern University Marine Science Center Shoreline Protection Project, Nahant, MA
Project Manager

Provided design, permitting and construction support services for shoreline protection and beach nourishment at Northeastern University's Marine Science Center. The project involves the construction of a man-made, planted "dune" with sand and cobble beach nourishment to protect existing utilities, roadway, and infrastructure from on going shoreline erosion. Permitting under the Massachusetts Wetlands Protection Act is being performed and an application for a construction grant from the Massachusetts Office of Coastal Zone Management was prepared. Design services include existing conditions survey, grading, cross sections, dune landscaping, and preparation of long term operations and maintenance plans.

Boston Parks and Recreation Department, Park Overview Engineering Services, Various Locations in Boston, MA
Project Manager

Responsible for managing BSC's past on call contract with the Boston Parks and Recreation Department (BPRD), managing and overseeing the engineering services for various design improvement projects to BPRD's park systems. Specific tasks included testing, inspections, studies, analysis, drawings, construction documents, cost estimates, construction observation, and other related engineering services for park improvements, city wide.

Northeastern University Marine Science Center Beach Restoration Feasibility Study, Nahant, MA
Project Manager

Prepared a feasibility study for beach restoration and shoreline protection at Northeastern University's Marine Science Center. The study included evaluations of the regional physiographic conditions, site topography, soil conditions, flood plain and other wetland resource areas, the ongoing rate of beach erosion and profile change, and the regulatory requirements for potential restoration and protection. The study presented various alternatives.

Childe Hassam Park, South End, Boston
Project Engineer

Provided engineering services in cooperation with the property owner, the Boston Parks Department, The Friends of Childe Hassam Park retained BSC to design a passive park for their South End neighborhood in Boston. BSC's team of designers created a park that combined artwork, landscaping, seating, and a plaza area configured as two outdoor rooms in a keyhole design. Performed site grading and stormwater management design as well as permitting a new water service for irrigation through the Boston Water and Sewer Commission.

Myles Standish Industrial Park, Taunton, MA
Project Engineer

Performed preliminary roadway and lot layout as well as utility design for the expansion of an existing industrial park. Prepared preliminary stormwater management system design focusing on Low Impact Development (LID) techniques including water quality swales, bio retention areas, and constructed stormwater wetlands. Prepared site and utility related components of an Environmental Notification Form (ENF) as well as Draft and Final Environmental Impact Reports (DEIR and FEIR) through the Massachusetts Environmental Policy Act (MEPA). Prepared written responses and supporting documentation to public comments submitted through the MEPA permitting process.

Freedom Estates, Bedford, MA
Project Engineer

Performed site design services for a cluster subdivision designed to preserve wetland areas and open space for the Town of Bedford. Design services included site layout and grading, roadway layout, stormwater management, and utilities. Additionally, prepared and permitted a Sewer Extension Permit with the Massachusetts Department of Environmental Protection.

BSC GROUP

Ethan
Sneesby, RSS

Wetland Scientist

Associate

YEARS OF EXPERIENCE

5

EDUCATION

MS, Crop and Soil Environmental Science
Virginia Tech University

BS, Environmental Science and Management
University of Rhode Island

CERTIFICATIONS

- 40-Hour OSHA

REGISTRATIONS

Registered Soil Scientist, Society of Soil Scientists of Southern New England (SSSSNE)

MEET ETHAN

Ethan is experienced with various methods of soil and wastewater sampling and analysis as well as GPS and GIS related to utility projects and open water bathymetric and soil mapping. Ethan has his master's degree in crop and soil environmental science from Virginia Tech. As a graduate assistant, he worked on the evaluation of wetland water budget modeling software as well as on the construction of a library of target hydroperiods for common wetland types in Virginia, Maryland, and North Carolina. Ethan has extensively studied wetlands, soil morphology, soil conservation and their impact on environmental quality.

Ethan's advanced skillsets are put to use supporting BSC's peer review efforts, working on National Grid and Eversource projects, and assisting the firm's environmental engineering group. Ethan has a strong background in soils and wetland hydrology which serve as a boon when performing review of disturbed or complicated wetland systems where vegetation cannot be relied upon to protect our resources adequately.

PROJECT EXPERIENCE HIGHLIGHTS

Melink Solar Development, 179 Greenwich Road, Ware Conservation Commission, Ware, MA

Wetland Scientist & Soil Scientist

Responsible for wetland delineation peer review including Riverfront Area and review of two Notices of Intent on two parcels (37 acres and 38 acres). Ethan reviewed the project for compliance with Ware Conservation Commission Wetland Protection Bylaw (Chapter 30 3) and the Massachusetts Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and associated regulations (310 CMR 10.00 et al.). Additionally, BSC provided findings and comments relative to the project's compliance with MassDEP Wetlands Program Policy 17 1: Photovoltaic System Solar Array Review 225 CMR 20.00: Solar Massachusetts Renewable Target (Smart) Program.

Spencer Conservation Commission, 10 Meadow Road, Notice of Intent, Spencer, MA
Wetland Scientist

Responsible for the wetland delineation peer review including BVW and associated Buffer Zone, and 200 foot Riverfront Area. Reviewed the project for compliance with the Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and associated regulations (310 CMR 10.00 et al.).

Amesbury Conservation Commission, Notice of Intent for 9, 14, and 15 Estes Street and Estes Street Improvements. Amesbury, MA
Wetland Scientist

Responsible for Wetland Delineation peer review regarding the Notice of Intent (NOI) for a site identified as Overlook at Estes, Amesbury, MA comprising 9 Estes Street, Map 63, Parcel 22, 14 Estes Street, Map 63, Parcel 21, 15 Estes Street #R, Map 63, Parcel 19, and Estes Street Improvements. Reviewed the project for compliance with the Amesbury wetland regulations, and Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and associated regulations (310 CMR 10.00 et al.).

Robbins Road over Robbins Brook Bridge Replacement, Winchendon, MA
Wetland Scientist

Performed wetland delineation services in support of the Town of Winchendon's replacement of the Robbins Road over Robbins Brook Bridge. Prior to BSC's design of the bridge's replacement, Ethan demarcated the boundaries of jurisdictional wetland resources (e.g., inland bank and bordering vegetated wetland), which contributed to the preparation of a Bordering Vegetated Wetland Field Data Form for inclusion with the Notice of Intent Application (NOI).

Bellingham Conservation Commission, Peer Review of Abbreviated Notice of Resource Area Delineation 180 Paine Street, Bellingham, MA,
Wetland Scientist

Responsible for the wetland delineation peer review including BVW and associated Buffer Zone, Isolated Vegetated Wetland (IVW), Bank to a Pond, Inland Bank to Streams (intermittent and perennial) and associated Buffer Zone, Bordering Land Subject to Flooding (FEMA Flood Zone AE), and 200 foot Riverfront Area. Reviewed the project for compliance with the Bellingham wetlands protection by law, and Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and associated regulations (310 CMR 10.00 et al.).

Amesbury Conservation Commission, Peer Review of Abbreviated Notice of intent, 91 Macy Street, Amesbury, MA
Wetland Scientist

Responsible for the wetland delineation peer review Including Riverfront area. Reviewed the project for compliance with the Amesbury wetland regulations, and Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and associated regulations (310 CMR 10.00 et al.).

National Grid, Wetland Delineation and GIS Mapping Services for E5F6 Transmission Line Insulator Replacement Project, Shelburne to Millbury, MA
Wetland Scientist

Responsible for providing National Grid with wetland delineation and GIS mapping support services for the proposed Transmission Line Insulator Replacement Project (IRP). Ethan performed wetland delineation mapping services, including data collection of dominant plant species, characterization of soils, and general hydrological field indicators within the project right of way. Data collection also included all major features (e.g., wetlands, beaver dams, crushed culverts, culvert crossings, stone walls, pipelines, and fences), which were geotagged with photographs using Trimble units/ESRI's collector. Collected features were stored in an online geodatabase, allowing the photographs and data to be intuitively viewed within an ESRI web application.

Eversource Energy, F132 Line Structure Replacement Project, Pittsfield and Lanesborough, MA
Wetland Scientist

Responsible for providing environmental consulting services for a Line Structure Replacement project from Pittsfield to Lanesborough, MA. for BSC's contract with Eversource Energy. Ethan performed field identifications of wetlands within the limits of the project right of way and prepared federal wetland field data forms to document the delineation of federal wetlands at locations where wetland impacts were likely to occur. This data collection also included obtaining stream and access road widths for construction planning purposes.

BSC GROUP

Emily
Alderton, PhD, PWS

Environmental/Ecological Scientist

YEARS OF EXPERIENCE

11

EDUCATION

PhD, Freshwater Ecology
University College London

MSc, Aquatic Science
University College London

BSc, Zoology
University College London

MEET EMILY

Dr. Alderton is an ecological scientist, specializing in freshwater ecology and habitat restoration. Her academic work has included studies of wetland plant and invertebrate diversity, monitoring of otter diet and behavior, and the restoration of wetlands using historic seedbanks. In addition to her academic work, Emily has served as a steering group member for the Norfolk Ponds Project, a UK charity focused on restoring wetlands and biodiversity within agricultural landscapes. Within this role she contributed to reports and management plans for restoring wetlands and led practical training sessions for landowners and conservation practitioners. She continues to be heavily involved in conservation volunteering.

Emily worked part time for six years for ENSIS Ltd., a London based environmental consultancy, where she contributed to aquatic plant and water quality surveys for the EU Water Framework Directive. She has extensive experience working with a number of rare and protected species in the UK, including Eurasian otter, great crested newt, and white-clawed crayfish.

While living in the US, she held voluntary roles with the New England Wildflower Society (conducting rare plant surveys), and on the Ecological Advisory Committee for the City of South Bend, Indiana. Professionally, she has contributed to rare species habitat assessments, municipal open space & climate preparedness programs, and a wide range of federal, state, and local environmental permits and reports with BSC.

PROJECT EXPERIENCE HIGHLIGHTS

No Net Loss of Carbon in Massachusetts Wetlands, MassDEP, MA
Researcher and Writer

BSC is assisting MassDEP in the development and expansion of Wetland Protection Act regulations and guidelines, to better protect the key role of wetlands in carbon sequestration and storage. Emily has been involved in the research and report preparation for this Project, focusing on the science and policy behind protecting the carbon value of wetlands.

No Net Loss of Carbon in Massachusetts Wetlands, MassDEP, MA
Researcher and Writer

BSC is working with MassDEP on a public outreach Project on the importance of protecting and restoring Coastal Floodplains. Emily has been working on a StoryMap website and accompanying brochures and posters, which illustrate the vital role coastal floodplains play in protecting both the built and natural environment.

Nashua River Municipal Vulnerability Preparedness, Bolton, MA

Researcher and Writer

BSC is leading development of wetland climate change by laws and regulations for municipalities in Massachusetts and tailoring those bylaws and regulations to the specific needs of the Towns of Bolton and Clinton. Emily was heavily involved in researching how climate change has been incorporated into existing bylaws and regulations across MA, where gaps and areas for improvement still lie, and drafting initial suggestions for towns to consider incorporating into their bylaws.

Invasive Species Management Plan, US Fish & Wildlife, Hockomock Swamp, MA

Field Surveyor

Responsible for locating and mapping populations of the invasive common reed *Phragmites australis* and contributing to a management plan for the control and removal of this species. Specific duties included locating and mapping invasive species populations, researching the most up to date management practices for Phragmites, and completing a detailed report and management plan for controlling existing populations within the project site.

Merrimack River Boat Launch Project (Andover), Edgewater Trail (Boston), and Goddard Park Improvement Project (Auburn), MA

Researcher and writer

Prepared various state and local permits for public recreation and open space Projects, including the construction of the Edgewater Trail in Boston (a proposed greenway along the Neponset River), Merrimack River public boat launch and dock, and footbridge and park improvement project.

NHESP Rare Species Habitat Assessment, National Grid, Multiple Cities, MA, RI, and CT

Field Surveyor

Responsible for conducting habitat assessments for a range of NHESP priority listed species, including Blanding's and Eastern box turtle, blue-spotted and marbled salamander, and the ringed boghaunter dragonfly. Specific duties included research into habitat requirements and preferences of NHESP target species, surveying areas of NHESP Priority/Estimated Habitat, identifying dominant vegetation and Massachusetts Community Types within NHESP Priority/Estimated habitat areas, identifying potentially important habitat for target species within these areas, and contributing to a detailed report of existing habitat conditions, and recommendations for reducing disturbance within potential rare species habitat.

Conservation Management Plans and Rare Species Protection

Researcher and Writer

Emily has prepared a number of Conservation Management Plans (CMPs) for minimizing and mitigating harm to rare species, for Projects where work is occurring within rare species habitats. These have included plans for turtles, salamanders, and invertebrates.

Becker Pond Dam Removal Project

Researcher and writer

Emily has been involved in the research, writing, and permitting phases of the Becker Pond Dam removal Project in Mount Washington, MA. This is a stream restoration Project being conducted by The Nature Conservancy (TNC), for which BSC provided permitting services.

Wetland Delineations, Eversource and National Grid, Multiple Cities, MA, RI, and CT

Wetland Delineator

Multiple National Grid/Eversource right of ways within Massachusetts, Rhode Island and Connecticut. Specific duties included assisting with wetland plant identification, wetland flagging, soil sampling and characterization, and taking GPS locations of wetland flags.

The Ghost Ponds Project, University College London/Norfolk Ponds Project, Norfolk (UK)

Project Leader

The Ghost Ponds Project, a collaborative project between University College London and The Norfolk Ponds Project. The project focused on the potential for 'resurrecting' buried 'ghost ponds' (ponds which had previously been in-filled during agricultural land consolidation) and using the buried seed and egg banks within these sites to restore aquatic biodiversity within farmland landscapes. The project involved detailed mapping and spatial analysis (GIS) of historic and modern pond locations, ecological surveys of existing and restored ponds, the publication of scientific papers and management guidelines for the re-excavation of ghost ponds and running public open days and training sessions for landowners and conservation practitioners, on how to excavate ghost ponds and restore existing overgrown ponds. This work formed the basis of Emily's PhD.

BSC GROUP

George
Andrews, GISP

GIS Director
Senior Associate

YEARS OF EXPERIENCE
11

EDUCATION
BS, Geography

BA, Communications, Worcester State University

CERTIFICATIONS
- Certified GIS Professional (GISP)
- NOAA Coastal Inundation Mapping
- OSHA 10-Hour Construction
- FAA Certified Remote Pilot
- MVP Certified

MEET GEORGE
George supports projects with geospatial analyses, digital mapping, modeling, database development, and data digitization. He collaborates with clients to bring new technology solutions which support their goals for continuous improvement to processes and operations. George is integral to the growth of the GIS practice at BSC and is responsible for GIS and GIS web applications for many discipline areas.

George is constantly undertaking R&D challenges, striving to innovate both for clients and within BSC. George is a BSC Subject Matter Expert (SME), a go to for GIS, sUAS, and technology implementation and use company-wide.

George is instrumental to the growth of BSC's GIS practice to serve all BSC disciplines and provide more effective service to clients.

PROJECT EXPERIENCE HIGHLIGHTS

Apple Country Natural Climate Solutions Project, Bolton, Harvard, and Devens, MA
Senior GIS Analyst

Led and coordinated the GIS effort between all municipalities and organizations for the duration of the Apple Country project. Designed and developed mapping documents highlighting dozens of ecological and climate-oriented datasets and their impacts to stakeholders. Performed resiliency, wetland, and landcover analyses for each municipality using a diverse variety of public and private datasets. Produced an Apple Country web application hosting all project related geospatial features for public viewership and input.

SuAsCo Natural Climate Solutions Project, Hudson, Framingham, & Natick, MA
Senior GIS Analyst

Led and coordinated the GIS effort between all municipalities and organizations for the duration of the SuAsCo project. Designed and developed mapping documents highlighting dozens of ecological and climate-oriented datasets and their impacts to stakeholders. Performed resiliency, wetland, and landcover analyses for each municipality using a diverse variety of public and private datasets. Produced a SuAsCo web application hosting all project related geospatial features for public viewership and input, and managed project StoryMaps.

Coastal Resiliency Project, Beverly, MA
GIS Analyst

Produced inundation maps and datasets for the Beverly coastal vulnerability analysis. Using the latest Boston Harbor Flood Risk Model data, modeled future climate change scenarios by geoprocessing USGS LiDAR data in conjunction with local tidal data and the latest accredited scientific projections to calculate probable areas of inundation. Performed vulnerability analyses of critical locations in Beverly and laid the groundwork for continued mapping, modeling, and in depth analyses of the Beverly Waterfront.

Massachusetts Vulnerability Preparedness (MVP) GIS Mapping and Analysis, Various Locations, MA
Senior GIS Analyst

Developed web applications and mapping figures for public outreach throughout the MVP planning process. Performed analysis of potential climate change vulnerabilities using public and private datasets, including heat, sea level rise, flood hazards, earthquakes, tornadoes, and snowfall. Provided MVP program support for the municipalities of Amesbury, Bolton, Athol, New Marlborough, and Sheffield.

Sea Level Rise Mapping and Modeling, Northeastern University Marine Science Center, Nahant, MA
GIS Analyst

Performed a GIS pilot study to assess the Marine Science Center's vulnerability to projected sea level rise and climate change for a Coastal Zone Management grant proposal. Used USGS LiDAR data, local tidal data, and the latest accredited scientific projections to calculate probable areas of inundation proximate to the Marine Science Center. Produced multiple high resolution (1 meter) maps highlighting areas vulnerable to impending sea level rise.

Department of Conservation and Recreation, Invasive Species Management Plan, Statewide, MA
GIS Analyst

Designed and developed an invasive species geodatabase for BSC field surveys spanning major DCR parks and open space in Massachusetts. Generated standardized maps for each surveyed park displaying invasive species distribution and survey results. Updated, refined, and organized existing DCR geospatial data, and conducted GIS analyses to assist producing prioritization matrices for the inventoried parks.

Nashua River Communities Resilient Lands Management Project
Senior GIS Analyst

George led GIS efforts and developed a GIS data viewer and mapping for the project website to assist with developing wetland climate change by-laws and regulations for municipalities in Massachusetts. BSC is assisting the Towns of Bolton and Clinton to improve residents' quality of life and enhance ecosystem services in the participating towns through the development and adoption of better land management practices and by laws and regulations updated to better effect climate mitigation and adaptation.

Camp Curtis Guild Invasive Species Inventory, Lynnfield, Reading, North Reading, & Wakefield, MA
Senior GIS Analyst

Designed, developed, and maintained a robust invasive vegetation species geodatabase populated by BSC field surveys for MAARNG Camp Curtis Guild. Generated multiple custom invasive species mapping figures covering all training areas, highlighting invasive population distribution, and other environmental resources. Developed an interactive online mapping application displaying and summarizing project results.

Division of Fisheries and Wildlife, Common Reed (Phragmites australis) Inventory, Hockomock Swamp Wildlife Management Area, West Bridgewater, Easton, and Raynham, MA
GIS Analyst and sUAS Pilot

GIS Analyst and sUAS Pilot for the development of an invasive species management plan for MassWildlife's Hockomock Swamp wildlife management area. Due to deep water and impassable terrain, Mr. Andrews organized and conducted a series of aerial sUAS (drone) surveys covering over 2,000 acres of the project area. He utilized the remotely sensed sUAS data to generate accurate and high resolution orthomosaic imagery to assist identifying and locating stands of invasive Phragmites australis (Common Reed). The phragmites areas were subsequently digitized and organized into a geodatabase, and the resulting data analysis was a key component of the management plan.

Regenerative DesignGroup

Keith Zaltzberg-Drezdahl

Managing Director, Head of Planning, Worker-Owner

Keith is a founding partner of Regenerative Design Group where he leads planning initiatives focused on ecological resilience and community well-being. With a background rooted in resilience planning, urban agriculture, and permaculture design, Keith combines rigorous analysis with a strong social justice mission to shape landscapes rooted in place and community. His approach to planning is grounded in understanding the ecological and social potential of place, rigorous analysis, and systematic assessment. His work includes leadership roles in projects such as the Massachusetts Healthy Soils Action Plan, where he played a pivotal role in understanding the impact of land use on soil health and carbon sequestration. His strategic insights have also guided regional climate resilience initiatives, contributing to the development of nature-based solutions that enhance environmental quality and community resilience. He shares his expertise as a lecturer and instructor at The Conway School and Smith College, focusing on sustainable design principles and environmental stewardship, and holds a BS in Environmental Design from UMass-Amherst.

FOCUS AREAS

- Landscape Carbon Accounting & Planning
- Resilience Planning & Adaptive Design
- Soil Resource Planning
- Regenerative Agriculture & Urban Farm Design
- Project Management

TECHNICAL SKILLS

- GIS Mapping and Analysis
- AutoCAD
- Adobe Creative Suite

LECTURES + WORKSHOPS

- Soil Organic Carbon Estimation, Soil Science Society of America.
- Developing Healthy and Resilient Communities: A Case Study, Architecture Boston Expo
- Regenerative Design for Change Makers, Omega Institute

SELECTED PROJECTS

MA No Net Loss of Carbon in Wetlands | MassDEP

Development of a wetland mapping approach based on machine learning that identifies previously ambiguous wetlands. This project aims to identify innovative strategies, approaches, concepts, and regulatory recommendations to achieve No Net Loss of Carbon in Wetlands in Massachusetts. Project team includes BSC Group, the Massachusetts Association of Conservation Commissions (MACC), and the Woodwell Climate Research Center.

Nashua River Watershed-Wide Nature Based Solutions | Fitchburg, Leminster, Ashburnham, Pepperell, and Groton, MA

MVP Project. Produce a multi-layered analysis of soil health challenges and opportunities for the 454 square mile Massachusetts portion of the Nashua River Watershed. Part of a larger MVP project to determine priority sites for nature-based solutions in the five project communities.

Hudson-SuAsCo Nature Based Solutions Project| Hudson, Framingham, and Natick, MA

MVP Project. Use a robust process of remote data analysis and community engagement to identify high impact sites for nature-based olutions that will support the towns' climate resilience. Focus on soil-carbon and landcover mapping and analysis to guide priority sites.

Nashua River Resilient Lands Management | Clinton and Bolton, MA

MVP Project. Development of management and stewardship guides and identification of leverage points for town bylaws changes to increase the resilience and functioning of important landscapes and ecosystems in Clinton and Bolton.

Soil Health Assessment | Deerfield, MA

MVP Project. Analysis of exisiting soil function by land cover and assessment of vulnerabilities and opportunities for soil health. Scope included healthy soils workshops and outreach events. *2022 Sustainability + Resiliency Award from the American Planning Association - Massachusetts Chapter*

Soil Health Productivity Assessment & Planning | Trustees of Reservations

Collaborated with American Farmland Trust to assess field-specific soil health and whole-site ecological health of seven Trustees farm properties. Designed and facilitated three workshops for Trustees staff and land managers. Final report included recommendations for soil health management, agroecological interventions and a discussion of trade-offs.

Climate Resiliency and Carbon Planning | Apple Country, MA

MVP Project. Collaborated with BSC Group and Linnean Solutions to assess and analyze ecological resources, and provide recommendations for nature-based solutions in the Towns of Bolton and Harvard and the Devens Regional Enterprise Zone. Extensive mapping, community outreach, site walks, and soil health assessments.

Soil Resource Assessment & Planning | Massachusetts Healthy Soil Action Plan

Project lead for a 10-person project team and 50-person working group in GIS-analysis, scientific literature review, expert interviews, and broad stakeholder engagement to develop a comprehensive Healthy Soils Action Plan for all major land uses in Massachusetts. *2023 Special Recognition Award for Significant Value to Landscape Architecture from the Boston Society of Landscape Architects*

Greenhouse Gas Environmental Impact Assessment | Massachusetts Environmental Policy Act Office

Provided QAQC and technical team support in the development of a model to estimate greenhouse gas emissions and carbon sequestration loss from tree clearing associated with proposed expansion of a utility right of way.

Regenerative Land Use Experiment | Major Northeast Utility Company

Assessment of potential for additional carbon sequestration through innovative land and vegetation management practices on ROW lands across three state for a major utility. Led in-depth study of current land cover, carbon stocks, and management practices to develop high level toolkits for land management teams.

SELECTED PUBLICATIONS

Gutwein, S., Zaltzberg-Drezdahl, K., Toensmeier, E., & Ferguson, R. S. (2022). Estimating land cover-based soil organic carbon to support decarbonization and climate resilience planning in Massachusetts. Soil Security, 9, 100076. https://doi.org/10.1016/j.soisec.2022.100076

Regenerative DesignGroup

Von Harvey

Communications Specialist

Von is a communicator and designer who applies user experience (UX), web, graphic, and marketing design to tell stories and engage with people and communities. She believes technology should have a positive impact on humanity, which includes being equitable and sustainable. Von holds a BA from Hampshire College and has professional certifications in UX design, graphic design, and digital marketing.

FOCUS AREAS

» Web and digital user experience (UX) and accessibility design
» Digital Marketing + Content Strategy

TECHNICAL SKILLS

» WordPress, Drupal, Squarespace, and Webflow CMS platforms
» MailChimp Email Marketing
» Google Analytics
» Adobe Creative Cloud

SELECTED PROJECTS

Massachusetts Healthy Soil Guide | Greenfield, MA

Created WordPress-based website for the Massachusetts Healthy Soil Guide for Construction and Development, making soil health practices and resources accessible and actionable for site construction and landscaping professionals.

PREVIOUS POSITIONS

Center for New Americans | Northampton, MA | 2023–present

Communications Specialist

- Manage WordPress CMS-based website, including content, usability, and layout updates
- Provide content and marketing strategy for social posts, blog content, and print materials

Vinka Design | Florence, MA | 2012–present

Prinicipal

- Design and implement digital marketing and advertising, content strategy, UX, and Websites for clients with a focus on artists and authors; examples include betsyhartmann.com and onematchfilms.com

UMass Amherst College of Engineering | Amherst, MA | 2021-2022

Associate Director of Communications and Digital Media

- Coordinated with team and senior leadership to ensure all digital content, including a 5,000-page website and 3 social channels, was accurate, strategic, and reflective of the user journey for various audiences
- Designed print and digital marketing materials and collateral for various offices and departments, including significant development campaigns

Regenerative DesignGroup

Sebastian Gutwein

Managing Director, GIS Specialist, Worker-Owner

Sebastian is a living systems designer whose extensive experience draws from the arts, ecology, politics and place. His extensive experience allows him to integrate diverse disciplines into comprehensive planning strategies that address complex challenges such as water conveyance, agricultural programming, and intricate GIS analysis. Since 2015, Sebastian has been the Land Surveying and Digital Design Instructor at The Conway School. He continues to expand his expertise in leveraging geospatial technology for innovative landscape planning and management solutions.

FOCUS AREAS

- Resilience Planning & Site Design
- Whole Systems Integration
- Landscape Analysis & Assessment
- Food Systems Evaluation & Design
- Implementation, Construction & Project Management
- Solar Site Design & Housing Layout

TECHNICAL SKILLS

- Digital Rendering
- GIS Analysis + Assessment
- Document Production & Design
- Land Surveying

SELECTED PROJECTS

MA No Net Loss of Carbon in Wetlands | MassDEP

Lead data and GIS analyst for a wetland mapping approach based on machine learning that identifies previously ambiguous wetlands. This project aims to identify innovative strategies, approaches, concepts, and regulatory recommendations to achieve No Net Loss of Carbon in Wetlands in Massachusetts. Project team includes BSC Group, the Massachusetts Association of Conservation Commissions (MACC), and the Woodwell Climate Research Center.

Soil Resource Assessment & Planning | Commonwealth of Massachusetts

Lead data and GIS analyst. Developed novel, data-driven model to quantify statewide soil organic carbon stocks and assess impact of land cover change on soil carbon.

Municipal Vulnerability Preparedness Projects: Soil Resilience Planning | Various Municipalities, MA

Lead data and GIS analyst. Development of unique and comprehensive models that combine soil and other ecological data with social and cultural information to identify high impact locations for nature based solutions for climate resilience. Mapping and research support for community engagement workshops and outreach events.

Greenhouse Gas Environmental Impact Assessment | Massachusetts Environmental Policy Act Office

Land use and carbon analyst. Directed development of environmental impact assessment model for greenhouse gas emissions and carbon sequestration loss from tree clearing associated with proposed expansion of a utility right of way.

Regenerative Land Use Experiment | Major Northeast Utility Company

Land use and carbon analyst. Assessed potential for additional carbon sequestration through innovative land and vegetation management practices on ROW lands across three state for a major utility. Conducted in-depth study of current land cover, carbon stocks, and management practices to develop high level toolkits for land management teams.

SELECTED PUBLICATIONS

Gutwein, S., Zaltzberg-Drezdahl, K., Toensmeier, E., & Ferguson, R. S. (2022). Estimating land cover-based soil organic carbon to support decarbonization and climate resilience planning in Massachusetts. Soil Security, 9, 100076. https://doi.org/10.1016/j.soisec.2022.100076

Regenerative DesignGroup

Rachel Wyatt Lindsay

Head of Site Design, Senior Designer, Worker-Owner

As Head of Site Design at Regenerative Design Group, Rachel works principally with organizations and homeowners to create productive, resilient landscapes. She draws from her experiences in organic farming, Latin-American sustainable development, and art to approach design with cultural sensitivity and environmental integrity. Rachel approaches projects of all scales through a soil, carbon, and water conservation lens, looking for opportunities to reduce the environmental impact of design installation while meeting the client's goals and aesthetic preferences. Her projects encourage people to engage deeply with their local ecosystems and apply holistic and low-stress approaches toward gardening and landscaping. A worker-owner at RDG, Rachel was a member of the steering committee that led the ownership transition process and has been the Treasurer of the Board of Directors since its establishment in 2022.

FOCUS AREAS

- Low Impact Site Design
- Soil Smart Design & Practices
- Productive & Edible Landscape Design
- Regenerative Small-Scale Agriculture & Gardening
- Ecosystem Integration with Native Plants
- Pollinator Habitat
- Project Management

Technical Skills

- Project Management
- Construction Support
- Site Analysis
- Detailed Site Design
- Hand + Digital Rendering
- Auto CAD, Adobe, + GIS
- Document Production

SELECTED PROJECTS

Healthy Soils Guide for Site Design + Construction | Commonwealth of Massachusetts

Project manager and outreach coordinator of a multi-firm collaboration to develop guidelines for the implementation of the Healthy Soils Action Plan in site design and development projects.

Estate Garden | Concord, MA

Lead designer and project manager for 2,000 sq. ft. of terraced production gardens with surrounding orchard, greenhouse, and small livestock managment area.

Soil Resource Assessment & Planning | Commonwealth of Massachusetts

Research assistant, coauthor, and document production manager for the Healthy Soils Action Plan for all major land uses in Massachusetts. *2023 Special Recognition Award for Significant Value to Landscape Architecture from the Boston Society of Landscape Architects.*

Low Impact Forest Residence | Hurley, NY

Site design and construction support for a new home in a pine, oak, and hickory forest, with a rapid rate of re-establishment due to strict limitation on soil disturbance, rigid soil amendment specifications, and native plant designs.

Ecologically Sensitive Residence | Wayland, MA

Landscape design for a pre-existing home surrounded by ecologically valuable wetlands and floodplain forest. Plans included the relocation of snapping turtle nests, minimal soil disturbance, and a native-forward plant palette.

Residential Site Grasslands Regeneration | Littleton, MA

Soil and ecosystem restoration for an 8-acre clear cut new home site, including

the establishment of edible landscaping, 4 acre native meadow, and successional restoration of an oak, red maple, and American chestnut forest.

The Gann Farm | Gann Academy, Waltham, MA

Supporting design services for an existing 3-acre student farm, including regenerative principles for no-till vegetable production, outdoor classroom, and a 1-acre food forest.

RiverMills Green Infrastructure Renovation | Chicopee, MA

Lead designer for site analysis, troubleshooting, vegetation inventory, and stormwater infiltration renovation plans for an existing green infrastructure system at the RiverMills Senior Center, a brownfield redevelopment project in the Riverfront Area of the Chicopee River.

Urban Pollinator Streetscape | Northampton, MA

Lead designer for the transformation of a lawn-dominated landscape into a fully perennial multi-season pollinator habitat garden with rainwater collection and infiltration.

Tropical Agroforestry Farm Assessment + Land-Use Master Plan | Gashora, Rwanda

Associate designer and document production management for the Rwanda Institute for Conservation Agriculture preliminary feasibility assessment.

EDUCATION + PROFESSIONAL DEVELOPMENT

- B.A. Anthropology + Studio Art, Wesleyan University, 2005
- M.S. Ecological Design, The Conway School of Landscape Design, 2015
- Massachusetts Association of Conservation Commissions Fundamentals Certificate, 2022
- Greenfield Conservation Commission, 2016-2018, Vice-Chair 2018-2022
- SosteNica: The Sustainble Development Fund of Nicaragua, Board Member 2012 - present
- Agroecology and Biointensive Agriculture, Las Cañadas, Cooperative, Huatusco Mexico, 2010
- Fullbright Scholar, Nicaragua 2009

LECTURES + WORKSHOPS

- *Unlocking the Carbon Potential of Soils (with Chris Hardy, Sasaki, and Gillian Davies, BSC Group) - American Society of Landscape Architecture 2024 Conference, Washington D.C.*
- *Healthy Soils at Home - Greening Greenfield, Greenfield MA*
- *Soils for High Functioning Landscapes - Ecological Landscape Alliance Season's End Summit*
- *Eco-Friendly Solutions for the Home Garden and Landscape* and *Regenerative Farming: Sustainable agriculture and its ties to global well-being* - Wesleyan University Institute of Lifelong Learning
- *Planning for Change: Design and Land Management in a Time of Climate Change* - Simsbury Land Trust
- *Rain Gardens: Why they are important, and how to make one that works* - Springfield Garden Club
- *Green Infrastructure Workshop Series* - City of Holyoke, MA + Pioneer Valley Planning Coalition
- *Designing Gardens for the Benefit of All* - Association of Professional Landscape Designers

Regenerative DesignGroup

Rafter Ferguson

Senior Researcher

Rafter specializes in research, education, and training focused on integrating agroecology, racial equity, and full-spectrum social justice into sustainable development practices. He applies participatory research and design methods, combining quantitative and qualitative data analysis with popular education approaches. His expertise spans agroforestry, climate change mitigation and adaptation, and grassroots farmer-centered development initiatives. Rafter is committed to fostering resilient communities through innovative planning strategies that prioritize environmental stewardship and social equity.

SKILLS

» Group facilitation + public speaking
» Multivariate statistics, data analysis, and visualization with R/RStudio (including dimension reduction, clustering, bootstrapping, and Bayesian and frequentist multilevel modeling)
» Software: Google Drive Suite, Microsoft Office Suite, iWork Suite

EDUCATION

» University of Illinois at Urbana-Champaign Ph.D., Crop Sciences, 2015
» University of Vermont M.S., Plant and Soil Science, 2011
» Bard College B.A., Anthropology, 2001

SELECTED PROJECTS

MA No Net Loss of Carbon in Wetlands | MassDEP

Data, GIS analysis, and technical writing for a wetland mapping approach based on machine learning that identifies previously ambiguous wetlands. This project aims to identify innovative strategies, approaches, concepts, and regulatory recommendations to achieve No Net Loss of Carbon in Wetlands in Massachusetts. Project team includes BSC Group, the Massachusetts Association of Conservation Commissions (MACC), and the Woodwell Climate Research Center.

Hudson-SuAsCo Nature Based Solutions Project|
Hudson, Framingham, and Natick, MA

MVP Project. Research and integrate relevant data to create infographic and related materials that reveal a comprehensive picture of the effect of timber harvest on the above and below ground carbon storage in aging forests. Materials are used to make the case for town bylaws and planning strategies towards promoting proforestation where applicable.

PROFESSIONAL EXPERIENCE

Interlace Commons | 2022-Present

Justice, Equity, and Diversity Consultant

- Qualitative research with BIPOC farmers to address barriers to agroforestry adoption
- Co-author of report “From the Roots Up: Centering racial justice to build transformative agroforestry” (with Ruth Tyson)
- Co-author of curriculum for technical service providers “Working with People, Working Across Difference: Social Competencies to Grow Agroforestry” (with Ruth Tyson)

Union of Concerned Scientists Washington, DC | 2018-2021

Scientist, Food and Environment Program

- Research, communication, and advocacy bridging agroecology and sustainability with farmer-centered equity issues
- Build and manage relationships with grassroots coalition partners with a focus on BIPOC-led and -centered organizations

Haverford College Haverford, PA | 2016-2018

Mellon Postdoctoral Fellow and Visiting AP of Environmental Studies

- Developed and ran original courses on politics and science of sustainable agriculture, the climate crisis, and related issues
- Organized "Beyond the Grassroots," a 1-day symposium bringing together agroecology researchers, organizers, and farmer-activists

University of Lisbon Lisbon, Portugal | January-July 2016

Postdoctoral Research Fellow with EU project "Bottom-up Climate Adaptation Strategies Towards a Sustainable Europe"

- Designed, co-organized, and taught an international course on research design for research professionals, graduate students, and grassroots activists
- Facilitated visioning and strategy sessions for interdisciplinary research on bottom-up adaptation strategies with lab members in the Centre for Ecology, Evolution, and Environmental Change

SELECTED PUBLICATIONS

Gutwein, S., Zaltzberg-Drezdahl, K., Toensmeier, E., & Ferguson, R. S. (2022). Estimating land cover-based soil organic carbon to support decarbonization and climate resilience planning in Massachusetts. Soil Security, 9, 100076. https://doi.org/10.1016/j.soisec.2022.100076

Spangler, K., McCann, R. B., & Ferguson, R. S. (2021). (Re-)Defining Permaculture: Perspectives of Permaculture Teachers and Practitioners across the United States. Sustainability, 13(10), 5413. https://doi.org/10.3390/su13105413

Toensmeier, E., Ferguson, R., & Mehra, M. (2020). Perennial vegetables: A neglected resource for biodiversity, carbon sequestration, and nutrition. PLOS ONE, 15(7), e0234611. https://doi.org/10.1371/journal.pone.0234611

Ferguson, R. S., & Lovell, S. T. (2017). Diversification and labor productivity on US permaculture farms. Renewable Agriculture and Food Systems, 1–12. https://doi.org/10.1017/S1742170517000497

Ferguson, R. S., & Lovell, S. T. (2017). Livelihoods and production diversity on U.S. permaculture farms. Agroecology and Sustainable Food Systems, 41(6), 588–613. https://doi.org/10.1080/21683565.2017.1320349

Ferguson, R. S., & Lovell, S. T. (2015). Grassroots engagement with transition to sustainability: diversity and modes of participation in the international permaculture movement. Ecology and Society, 20(4), 39. https://doi.org/10.5751/ES-08048-200439

Ferguson, R. S., & Lovell, S. T. (2013). Permaculture for agroecology: design, movement, practice, and worldview. A review. Agronomy for Sustainable Development, 34(2), 251–274. https://doi.org/10.1007/s13593-013-0181-6

For other publications see: Complete publication list. Google Scholar. ResearchGate.

Regenerative DesignGroup

Eric Giordano

Assistant GIS Analyst, Worker-Owner

Eric is a designer, musician, and avid composter. He began his journey in ecological design in NYC, where he built rainwater harvesting systems, ran a composting hub, and consulted on several garden projects. He received a Permaculture Design Certification from the Center for Bioregional Living, a Master Composter Certification from the NYC Compost Project, a Certificate of Horticulture from the Brooklyn Botanic Garden, and a Masters of Science in Ecological Design from the Conway School. Eric is dedicated to rethinking the way we meet human needs in a way that honors and regenerates Earth's living systems.

FOCUS AREAS

- Resilience Planning & Site Design
- Landscape Analysis & Assessment
- Food Systems Evaluation & Design

TECHNICAL SKILLS

- Digital Rendering
- GIS Analysis + Assessment
- Document Production & Design
- Drone Surveying

SELECTED PROJECTS

Municipal Vulnerability Preparedness Projects: Soil Resilience Planning | Various Municipalities, MA

Mapping and production support to develop unique and comprehensive models that combine soil and other ecological data with social and cultural information to identify high impact locations for nature based solutions for climate resilience. Research and production for community engagement workshops and outreach events.

Nashua River Watershed-Wide Nature Based Solutions | Fitchburg, Leminster, Ashburnham, Pepperell, and Groton, MA

GIS analysis of soil health challenges and opportunities for the 454 square mile Massachusetts portion of the Nashua River Watershed. Produced 93 page report that clarified high level strategies for promoting soil health specific to each project community.

Hudson-SuAsCo Nature Based Solutions Project| Hudson, Framingham, and Natick, MA

Support remote data analysis and community engagement to identify high impact sites for Nature-based Solutions that will enhance the towns' climate resilience. Focus on soil-carbon and landcover mapping and analysis to guide priority intervention sites.

Deerfield Healthy Soils Project | Deerfield, MA

Mapping, research, graphics, and report production for a comprehensive guide to protect soil health in Deerfield, MA. Included recommended bylaw updates for protecting vulnerable soil resources. *2022 Sustainability + Resiliency Award from the American Planning Association - Massachusetts Chapter.*

Greenhouse Gas Environmental Impact Assessment | Massachusetts Environmental Policy Act Office

GIS analysis and development of environmental impact assessment model for greenhouse gas emissions and carbon sequestration loss from tree clearing associated with proposed expansion of a utility right of way.

JENNIFER D. WATTS

CURRICULUM VITAE

October 2024

Woodwell Climate Research Center

149 Woods Hole Road, Falmouth, MA 02540 1644 USA

C: (406) 581 8449 | E mail: jwatts@woodwellclimate.org

Woodwellclimate.org/staff/Jennifer-watts

Researchgate.net/profile/Jennifer Watts 7

EDUCATION

2017	Ph.D., Systems Ecology (*Remote Sensing and Ecosystem Modeling*); College of Forestry and Conservation, University of Montana, Missoula. Dissertation: Potential contrasts in CO_2 and CH_4 flux response under changing climate conditions: a satellite remote sensing driven analysis of net ecosystem carbon budget for arctic and boreal.
2008	M.S., Land Resources Management (*Land Rehabilitation*); Department of Land Resources & Environmental Sciences, Montana State University, Bozeman. Thesis: Monitoring of cropland practices for carbon sequestration purposes.
2006	B.S., Land Resources Management (*Soils and Geospatial Technology*); Department of Land Resources & Environmental Sciences, Montana State University,

PROFESSIONAL EXPERIENCE

July 2024	Associate Scientist & Program Director, Woodwell Climate, Falmouth, MA.
July 2019	Assistant Scientist, Woodwell Climate Research Center, Falmouth, MA.
Sep 2017	Affiliate Professor of Remote Sensing, Montana State University, Bozeman, MT.
2017 2019	Postdoctoral Researcher, Woodwell Climate Research Center, Falmouth, MA.
2016 2017	Postdoctoral Researcher, NTSG, University of Montana, Missoula, MT.
2010 2016	Research Assistant, NTSG, University of Montana, Missoula, MT.
2009 2010	Research Assistant, Spatial Science Center, Bozeman, MT.
2008 2009	USGS Northern Rocky Mountain Science Center, Bozeman, MT.

PEER-REVIEWED JOURNAL ARTICLES (SELECTED)

1) Xia, Y, J Sanderman, JD Watts, et al. (2024) Coupling remote sensing with a process model for the simulation of rangeland carbon dynamics. *J. Advances Modeling Earth Systems*. In Press.
2) Virkkala, A, B Rogers, **JD Watts**, KA Arndt, S Potter, et al. (2024) An increasing arctic boreal CO_2 sink offset by wildfires and source regions. *Nature Climate Change*. In Press.
3) Xia, Y, J Sanderman, **JD Watts**, MB Machmuller, S Ewing, C Rivard (2024) Leveraging legacy data with targeted field sampling for low cost mapping of soil organic carbon stocks on extensive rangeland properties. *Geoderma*, 448. https://doi.org/10.1016/j-geoderma.2025.116952.
4) **Watts, JD**, M Farina, JS Kimball, L Schiferl, Z Liu, K Arndt, D Zona, et al. (2023) Carbon uptake in Eurasian boreal forests dominates the high-latitude net ecosystem carbon budget. *Global Change Biol.*, https://doi.org/10.1111/gcb.16553

5) Mullen, AL, **JD Watts,** BM Rogers, ML Carroll, CD Elder, J Noomah, Z Williams, JA Caraballo Vega, et al. (2023) Using high-resolution satellite imagery and deep learning to track dynamic seasonality in small water bodies. *Geophysical Res. Lett*., https://doi.org/10.1029/2022GL102327.

6) Du, J, J Kimball, R Bindlish, JP Walker, **JD Watts** (2022) Local scale (3 m) soil moisture mapping using SMAP and Planet SuperDove. *Remote Sensing*, 14, 3812. https://doi.org/10.3390/rs14153812.

7) Miller SM, MA Taylor, **JD Watts** (2018) Understanding high latitude methane in a warming climate. *Earth & Space Science News*, https://doi.org/10.1029/2018EO091947

8) ***Watts JD***, JS Kimball, A Bartsch, KC McDonald (2014) Surface water inundation in the boreal Arctic: impacts on regional methane emissions. *Environmental Res. Lett*, 9, https://doi.org/10.1088/1748-9326/9/7/075001

PROFESSIONAL REPORTS (SELECTED)

1) Pan Arctic Methane: Current monitoring, capabilities, approaches for improvement, and implications for global mitigation targets. https://www.wilsoncenter.org/publication/pan arctic methane current monitoring capabilities approaches improvement and
2) Carbon Monitoring Plan for Northern Great Plains Grazing Lands. Woodwell Climate. Prepared for the National Fish and Wildlife Foundation. In Press.
3) MA – No Net Loss of Carbon in Wetlands scoping study. BSC Group. Prepared for MA DEP and EEA.

PROFESSIONAL ACTIVITIES AND SERVICE (SELECTED)

Workshop/Meeting Organizing Committees (Recent, External):

2024-present: NASA Earth Science Advisory Committee member

2024-present: Meridian Group NRCS Carbon working group Chair

2023-present: National Fish & Wildlife Foundation carbon MMRV co lead

2019-present: Woodwell Rangeland Carbon science co lead

2022-present: Woodwell Wetland CH_4 emission mapping lead

2023: WMO International GHG Symposium, Observations & Models Session Chair

2023: 103rd AMS High latitude Water and Carbon Cycles in a Warming World Session Co-chair

2022: Woodwell/Turner/Montana State Rangeland Carbon Workshop, Co-Lead Organizer

2020: Woodwell High Latitude CO_2 and CH_4 Flux Workshop Co-organizer

2019: NASA ABoVE Data and Model Synthesis Group Co-chair

Journal Reviewer

Science; *Nature*; *Global Change Biology*; *Geophysical Research Letters*; *Remote Sensing of Environment*; *Remote Sensing*; *Biogeosciences*; *Wetlands Ecology & Management*; *Environmental Research Letters*

Taniya RoyChowdhury, Ph.D.

RESEARCH SCIENTIST
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Phone: (614) 619 2131
Google Scholar Citation
ORCID id: 0000 0002-4028 7996

A. Education and Training

Pacific Northwest National Laboratory	Microbiology	Post doc	2017
Oak Ridge National Laboratory	Biogeochemistry	Post doc	2015
The Ohio State University, USA	Soil Science	Ph.D.	2012
University of Calcutta, India	Agricultural Chemistry & Soil Science	M.S.	2005
University of Calcutta, India	Chemistry (Honors)	B.S.	2003

B. Professional Experience

2022-Present	Research Scientist II, Woodwell Climate Research Center, Falmouth, MA
2020-2022	Research Soil Scientist, USDA ARS, Davis, California
2018-2020	Principal Faculty Specialist, Environmental Science & Technology Department, University of Maryland, College Park
2008-2011	Graduate Teaching Associate, Soil Science, The Ohio State University
2007-2008	University Fellow, Soil Science, The Ohio State University
2005-2006	Post Masters Research Fellow, Microbiology, University of Calcutta, Kolkata, India

C. Research Emphasis: Soil Microbial Ecology, Biogeochemistry, Carbon Cycle, Global Change

D. Selected Projects

1. **Shallow or Deep: Can cover crops make soil carbon stick**? The emerging complexities of soil microbial carbon cycling, stabilization and destabilization mechanisms must inform cover crop management to more accurately predict climate benefits of cover cropping, yet are almost completely ignored in the current discussion on climate smart agriculture. Here we interrogate the impacts of mixed species cover crops on microbially mediated carbon dynamics along soil depth increments up to 60 cm that is expected to represent a gradient of cover crop root density.
2. ***represent a gradient of cover crop root density*** **Pathways of carbon metabolism under cover crops.** Soil carbon sequestration has a high potential to mitigate climate change, but our predictive understanding of soil organic carbon stabilization mechanisms remains uncertain due to over simplistic accounting of microbial properties in biogeochemical models used to evaluate outcomes of agronomic management. Using a cutting edge highly resolved data science approach to quantification of the chemically diverse carbon substrates available for microbial uptake, this project will determine the impacts of carbon chemical diversity on soil carbon and nutrient cycling.
3. **Impact of cover crops on full soil profile carbon.** This project seeks to understand the impact of cover crops on soil carbon properties down to one meter depth by sampling at a number of replicated cover crop trials on commercial farms.
4. **Leading indicators of soil carbon change.** Change in soil carbon often takes many years to a decade to detect. This project seeks to understand if other measurements of forms of organic matter and microbial functions can be good predictors for longer term soil carbon change.

SCOUTER DESIGN

Terri Courtemarche

PRINCIPAL/GRAPHIC DESIGNER

978.235.0339 / terric@scoutergraphicdesign.com

PORTFOLIO: www.scoutergraphicdesign.com

EDUCATION

BFA, University of North Florida / 1992

IDEO: Design for Change 2019 / Unlocking Creativity 2019 / From Superpowers to Great Teams 2018

EXPERIENCE

Scouter Design / Chelmsford, MA / Jan. 2020-present

Explore. Create. Connect.
Smart design that connects your story to your audience.

- Collaborate with clients to develop new brands or expand on existing ones
- Logo and visual identity development
- Design branded collateral and templates, training
- Report and infographic design
- Design 508 compliant accessible documents

VHB / Watertown, MA / Nov. 1993- Dec. 2019
Graphic Design Manager

- Art direct, mentor, train, and inspire an in-house team of designers
- Designed deliverables including project branding, branded collateral for public outreach efforts, report design, infographics, presentations, email marketing, and signage/interpretive panels
- Developed templates and provided training to colleagues
- Created 508c accessible documents
- Used brainstorming and conceptualizing exercises to push the boundaries of design

AIGA Mentorship Program / 2018

PRO BONO

Reach out and Read, MN / Infographic design
San Jose Library, CA / Infographic design
Tennessee Commission on Children & Youth, TN / Logo design
Nashoba Neighbors, MA / Logo design & Annual Report
St. Theresa School, MA / Logo design

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