Nature-Based Solutions (NBS)

are adaptation measures focused on the **PROTECTION, RESTORATION, and/or MANAGEMENT** of ecological systems to safeguard public health, provide clean air and water, increase natural hazard resilience, and sequester carbon. Incorporating NBS in local planning and design projects produces long-term solutions that benefit human and natural systems.

MVP
Municipal Vulnerability Preparedness

*One of the MVP Program's Core Principles is to **EMPLOY NATURE-BASED SOLUTIONS** when addressing community challenges and increasing climate change resilience. What are Nature-Based Solutions? And how can communities incorporate them in MVP Planning and Action Projects?*

NBS offer numerous co-benefits to communities, including:

⇒ **CLIMATE RESILIENCE** by reducing risks from flooding, erosion, drought, and heat islands, keeping our most vulnerable neighbors and community assets safer;

⇒ **COST-EFFECTIVE ALTERNATIVES** to the large investments needed to modernize our aging infrastructure, or providing unanticipated repair work and safety improvements resulting from climate change hazards;

⇒ **SUPPORTING ECOSYSTEM SERVICES** through biodiverse systems, nature provides clean air, clean water, and food security;

⇒ **SPURRING ECONOMIC ACTIVITY** creating jobs in local natural resource-based industries (including agriculture, forestry, construction and maintenance, outdoor recreation and tourism); and

⇒ **ENRICHING HUMAN HEALTH AND WELL-BEING** by providing opportunities for outdoor physical activity and visual and physical connections to restorative outdoor spaces.

Municipalities ready to implement priority actions with **MVP Action Grant** funding, may consider the steps outlined in this toolkit to incorporate Nature-Based Solutions with their projects.

1. Learn More—about the role of Nature-Based Solutions in Climate Adaptation.
2. Team Up with Partners –local organizations can help understand regional vulnerabilities.
3. Craft NBS Projects –learn about strategies and get inspired by example projects.

Please reach out to hillary.king@mass.gov with comments, suggestions, updates, and/or additional project, tool, and resource suggestions. Special thanks to Sara Burns, Melissa Ocana, Danielle Perry & Alexandra Vecchio for their review and contributions to this Toolkit.

1. Learn about the role of Nature-Based Solutions in Climate Adaptation

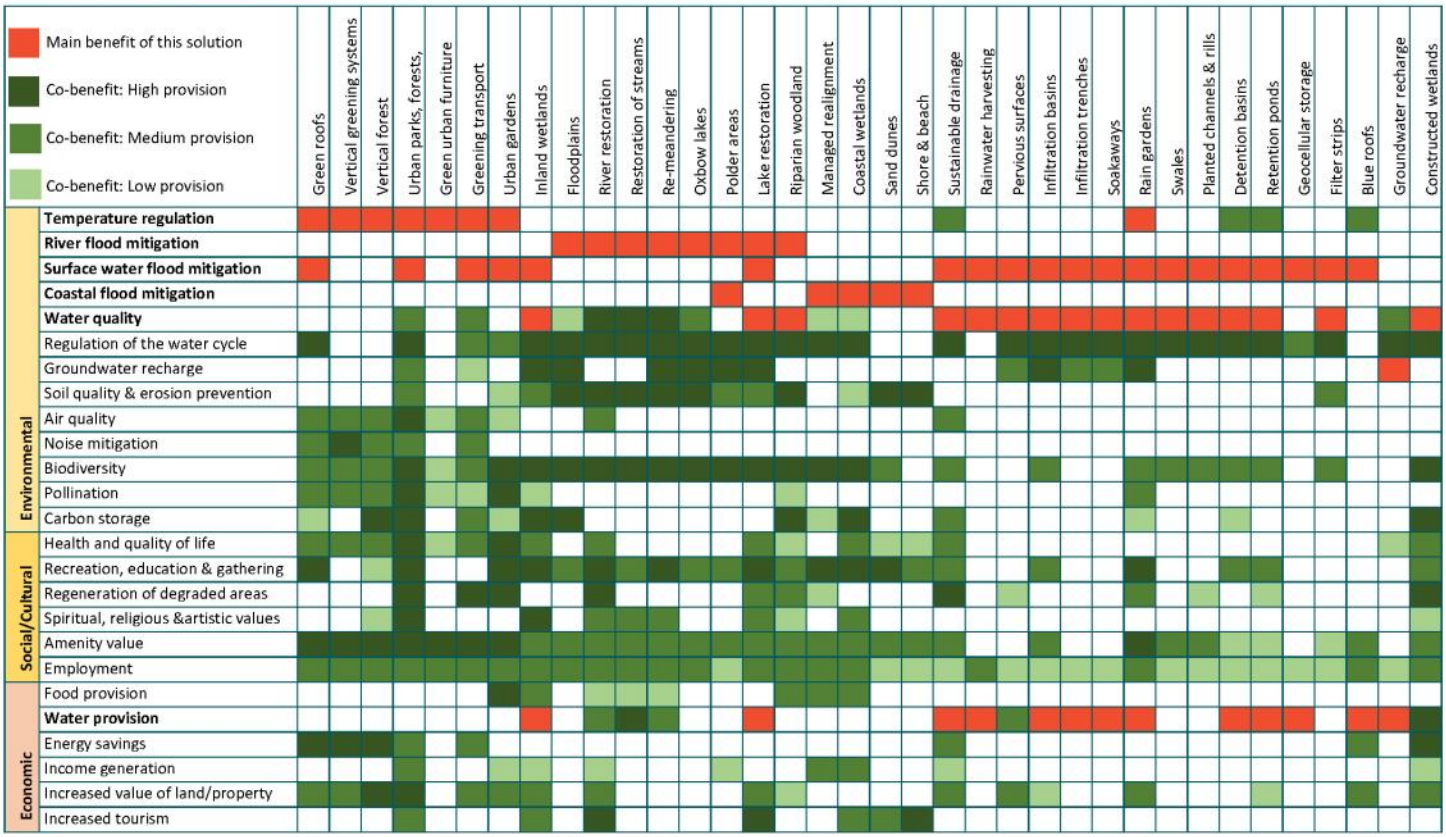
Today, the Commonwealth is experiencing stronger, more frequent storms, longer periods of drought, more days over 90-degrees, and rising sea levels that enhance flooding and erosion – and our communities are struggling under these conditions. Trends show that these climate change hazards are expected to increase in severity over the coming decades, causing even more strain on our society, environment, and infrastructure. This strain includes public health risks associated with heat, polluted water, poor air quality, and safety risks from unprecedented flooding impacts.

The challenges presented by these conditions demand holistic approaches to the way we plan, design, develop, and interact with our environment. NBS can help us prepare and respond to these unprecedented challenges:

- NBS is a broad toolbox which includes projects that increase climate resilience and promote public health, clean water, and/or carbon sequestration by protecting and/or restoring existing ecosystems like forests and wetlands.
- NBS manage the hazardous impacts of the built environment— like floodwater and pollution runoff from paved areas — when strategies like green stormwater infrastructure are employed.
- NBS can be designed and implemented to achieve multiple benefits, and can be increasingly self-sustaining through time, especially those that protect or restore functioning ecosystems.

Whether your location is urban, rural, or somewhere in between, there are NBS adaptation opportunities you can utilize – from policy, education, and land conservation strategies, to restoration and management approaches.

This table illustrates benefits provided by nature-based solutions. Source: Compendium of Nature-based and 'grey' solutions to address climate- and water-related problems in European cities, released March 2020 by GROWGREEN.



1. Learn about the role of Nature-Based Solutions in Climate Adaptation (page 2 of 2)

Ecosystem Services

Healthy ecosystems provide direct and indirect benefits to our communities. The following is a list of "goods and services" that are produced in nature. The list is a result of consolidated research completed by the Sustainable SITES Initiative, and listed in the listed in the SITES v2 Rating System For Sustainable Land Design and Development.

• GLOBAL CLIMATE REGULATION	Maintaining balance of atmospheric gases at historic levels • Maintaining healthy air quality • Sequestering carbon
• LOCAL CLIMATE REGULATION	Regulating local temperature, precipitation, and humidity through shading, evapotranspiration, and windbreaks
• AIR AND WATER CLEANSING	Removing and reducing pollutants in air and water
• WATER SUPPLY RETENTION	Storing and conserving water within watersheds and aquifers
• EROSION AND SEDIMENT CONTROL	Retaining soil within an ecosystem • Preventing damage from erosion and siltation
• HAZARD MITIGATION	Reducing vulnerability to damage from flooding, storm surge, wildfire, and drought
• POLLINATION	Providing for the reproduction of crops and other plants
• HABITAT FUNCTIONS	Providing refuge and reproduction habitat to plants and animals, contributing to the conservation of biological and genetic diversity and evolutionary processes
• WASTE DECOMPOSITION AND TREATMENT	Breaking down waste • Cycling nutrients
• HUMAN HEALTH AND WELL-BEING	Enhancing physical, mental, and social well-being as a result of interaction with nature
• FOOD AND RENEWABLE NON-FOOD PRODUCTS	Producing food, fuel, energy, medicine, or other products for human use
• CULTURAL BENEFITS	Enhancing cultural, educational, aesthetic, and spiritual experiences as a result of interaction with nature

Suggested resources for more information about NBS:

- ◊ Taking Cues From Nature to Adapt to Climate Change: A Communications Resource for Nature-Based Solutions – written for practitioners to provide more climate adaptation and ecosystems context for nature-based solutions and highlight their many co-benefits for people and nature (Mass ECAN).
- ◊ An Overview of NBS by the Nature-Based Solutions Initiative, based at the University of Oxford. Definition, guiding principles, examples, and an animation "explaining the fundamental importance of restoring and protecting natural habitats to help us adapt to the impacts of climate change and slow further warming."
- ◊ Mass Audubon's Value of Nature Fact Sheets looking at the financial and health benefits provided to us by forests, coastal areas, wetlands & waterways, grasslands & farmlands, and urban green spaces.
- ◊ Global Standard for Nature-Based Solutions – released 7/23/20 by the International Union for Conservation of Nature (IUCN) to increase demand for and mainstream NBS, while ensuring their quality and credibility.
- ◊ This Compendium of NBS presents nature-based and 'grey' solutions to address climate- and water-related challenges in European cities. It focuses on the six challenges: heat stress, river flooding, surface water flooding, coastal flooding, water scarcity, and poor water quality. (GrowGreen partnership)
- ◊ NOAA Digital Coast: A website focused on helping communities address coastal issues. Includes a short video describing nature's benefits along the coast.
- ◊ Massachusetts Resilient Lands Initiative: Expanding Nature's Benefits Across the Commonwealth, A Vision and Strategy. January 2023.
- ◊ Municipal Natural Assets Initiative – assists Canadian municipalities with managing natural assets, including aquifers, forests, streams, riparian areas and foreshores.
- ◊ Community Grant Finder: Commonwealth resource for Potential NBS Funding and/or Technical Assistance

2. Team up with local organizations to understand regional vulnerabilities

By engaging with a diverse set of partners and understanding basic ecological processes, municipalities can craft competitive MVP projects with a strong NBS component.[1] Implementing NBS successfully and effectively is an interdisciplinary process that requires the broad knowledge base and expertise of residents and professionals of various backgrounds.

Your MVP Regional Coordinator is poised to assist in identifying the right players for your potential MVP Planning Process or Action Project. The following agencies/organizations may be integral to assisting your community with identifying potential NBS for a more resilient future:

- ⇒ Municipal Staff / Commissions
  - Conservation / Natural Resources Dept.
  - Agricultural Commission
  - Tree Warden / Forestry Department
- ⇒ Regional Planning Agencies
- ⇒ Local Land Trusts
- ⇒ Watershed Associations/Groups
- ⇒ Massachusetts Ecosystem Climate Adaptation Network (Mass ECAN)
- ⇒ Non-Government Organizations (NGOs)
- ⇒ Community-based environmental groups
- ⇒ Faith-based social/climate justice groups
- ⇒ Local schools / educational institutions
  - science, planning, and/or design departments;
  - environmental groups/clubs/societies; etc.
  - environmental educators
- ⇒ Tribal Communities
- ⇒ Wetland professionals, ecologists, and other environmental scientists
- ⇒ Arborists, landscapers, farmers, foresters
- ⇒ Landscape Architects, Engineers, and other environmental design professionals

Talk with these potential partners to make connections throughout your community and understand its natural characteristics, history, and culture. Engaging with community members impacted by shifting climate hazards will help ensure that the risks and experiences of the hazards are fully understood, and that solutions include primary outcomes and co-benefits that will appeal to and improve the lives of those most at risk.

Regulatory agencies across the state may also have knowledge about, or efforts related to, resilience actions you are considering. Please reach out to your MVP Regional Coordinator for assistance in contacting these agencies:

- ⇒ MA Department of Environmental Protection (DEP)
- ⇒ MA Division of Ecological Restoration (DER)
- ⇒ MA Office of Coastal Zone Management (CZM)
- ⇒ MA Division of Fisheries & Wildlife (DFW)
- ⇒ MA Division of Marine Fisheries (DMF)
- ⇒ MA Division of Conservation Services (DCS)
- ⇒ MA Division of Conservation and Recreation (DCR)
- ⇒ US Environmental Protection Agency (EPA), Region 1
- ⇒ US Fish & Wildlife Service (FWS), Northeast Region
- ⇒ US Army Corps of Engineers (USACE), New England District

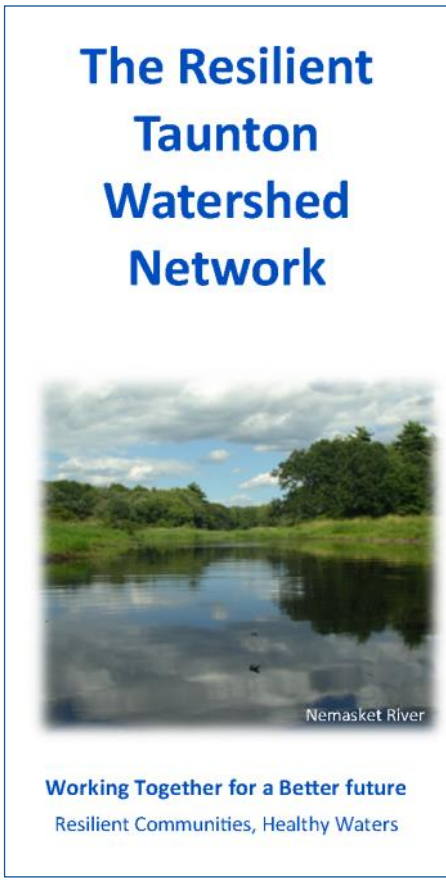
[1] *Though this toolkit is focused on employing NBS, all MVP Core Principles should be addressed when considering adaptive strategies. Not only can this help build a competitive MVP Action Grant application, but also provide the community with a holistic framework for making lasting change.*

Nature-Based Solutions Partnership Spotlight

Formed in 2014, the Resilient Taunton Watershed Network's (RTWN) overarching goal is to *promote the resiliency of the Taunton Watershed in the face of climate change and development, considering ecological outcomes as well as economic, social, and environmental justice issues.* **RTWN meets bi-monthly as a collaborative group with representatives from over 15 local, non-profit, state, regional, and federal agencies and organizations including:**

- ⇒ Bridgewater State University
- ⇒ Horsley Witten Group
- ⇒ Manomet Center for Conservation Sciences
- ⇒ MA Department of Environmental Protection
- ⇒ MA Division of Ecological Restoration
- ⇒ MA Executive Office of Energy and Environmental Affairs
- ⇒ Metropolitan Area Planning Council
- ⇒ Narragansett Bay Estuary Program
- ⇒ National Park Service
- ⇒ The Nature Conservancy (TNC)
- ⇒ Old Colony Planning Council
- ⇒ Save the Bay
- ⇒ Southeastern Regional Planning & Economic Development District (SRPEDD)
- ⇒ Taunton River Watershed Alliance
- ⇒ US Environmental Protection Agency (EPA)
- ⇒ Wildlands Trust

We recommend taking a look at the group's website for more information. RTWN has also developed an interactive map of restoration projects identified throughout the watershed.



A true partnership model, RTWN members meet bi-monthly to leverage our combined resources, knowledge, and skills, and work through an integrated watershed approach towards measurable results in order to:

- Advance both ecological and economic well-being by protecting natural resources;
- Promote ecological restoration;
- Integrate climate change concerns;
- Support future development patterns that use land and infrastructure efficiently; and
- Assist municipal officials and residents in meeting their local goals while considering a broader watershed perspective.

A resilient watershed ... has the capacity to adjust to stresses and disturbances, while still able to provide valuable ecosystem services and functions, such as provision of a clean and plentiful water supply and flood protection. We are working together to identify and implement the most promising solutions that advance both ecological and economic well-being by protecting existing green infrastructure, promoting ecological restoration, integrating climate change concerns, and supporting programs and future development patterns that use land and infrastructure efficiently to improve conditions for all residents.

Source: SRPEDD website (accessed 10/23/2023).
https://srpedd.org/environment/watershed-planning/resilient-taunton-watershed-network-rtwn/

3. Craft projects that promote ecological and public health.

When thinking about nature-based solutions projects that might work for your community and developing an MVP grant proposal:

- Consider lessons learned from responses to past climate events;
- Involve local partners - residents, business owners, and community leaders - in the process of generating solutions;
- Learn about successful strategies and barriers encountered by other communities, regions, and organizations;
- Think about using new technologies and reusing existing technologies in new ways; AND
- Consider a variety of strategies and different timelines.

One approach to planning for NBS that could apply at any scale is to investigate the root cause of the issue at hand and explore solutions that could reverse or mitigate the cause rather than temporarily treating symptoms (see example on next page).

Nature-Based Solutions can be explored over various scales, from a single parcel to a regional watershed. Holistic planning can help deploy NBS to address inland and coastal flooding, increasing heat, and other climate impacts, at any scale.

Keeping in mind the Nature-Based Solutions definition provided at the top of this toolkit, the next several pages provide project ideas and resources for you to think about ways to protect, restore, and manage the ecological health in your own community.

- ◊ Case Study 1: NBS as Planning, Capacity-Building, and Policy
- ◊ Case Study 2: Land Acquisition as NBS
- ◊ Case Study 3: Restore with NBS
- ◊ Case Study 4: NBS Management

Additional NBS Case Studies from other resources:

- ◊ The Division of Ecological Restoration Project Map: explore over 100 of DER's projects, restoring acres of tidal wetlands and miles of rivers and freshwater habitats. DER also actively assists municipalities in re-placing undersized, perched, and/or degraded culverts located in an area of high ecological value through their Culvert Replacement Municipal Assistance Grant Program.
- ◊ Naturally Resilient Communities (Using Nature to Address Flooding) – successful project case studies from across the country to help communities learn and identify Nature-Based Solutions.
- ◊ Urban Nature Atlas: contains 1,000 examples of NBS from across 100 European cities. Search by setting type, challenges addressed, and/or project cost (EU).
- ◊ Climate Adaptation Knowledge Exchange (CAKE) case studies are searchable by scale, sector, climate change impacts, location, adaptation phase, and habitat. Managed by EcoAdapt, the tool allows you to search their database of documents and tools as well as projects.
- ◊ FEMA - Types of Nature-Based Solutions: Browse NBS practices in three categories: watershed/landscape scale, neighborhood or site-scale, coastal practices.

3. Craft projects that promote ecological and public health. (page 2 of 2)

Address the Root Cause

One approach to planning for NBS that could apply at any scale is to **investigate the root cause of the issue** at hand and explore solutions that could reverse or mitigate the cause rather than temporarily treating symptoms.

Nature-Based Solutions can be explored over various scales, from a single parcel to a regional watershed. Holistic planning can help deploy NBS to address inland and coastal flooding, increasing heat, and other climate impacts, at any scale.

As a hypothetical example, in a developed area experiencing increasing floods, the root cause might be that development has disrupted the natural flow of water drainage. Here, the pavement and existing undersized stormwater infrastructure may be exacerbating the flooding.

Some Nature-Based Solutions for this issue include:

- Removing excess pavement and implementing green stormwater infrastructure that relies on plants, soil, and grading to slow and store rain water and runoff.
- Engineering the solution using climate change data makes that same solution more climate resilient by addressing the projected increase in precipitation.
- Engaging landowners in this drainage area to address the problem, and providing education and outreach materials on ways to treat and store stormwater creates awareness and individual responsibility.
- Planting trees and other vegetation in the area may also help with air quality, heat, and/or public health impacts to increase the co-benefits of a project.

Top: 1943 USGS Map— there is a brook shown along the roadway labeled "Crescent."

Middle: photograph and arrows indicating area of a flooding issue.

Bottom: 1983 USGS Map— shows 40 years of development has nearly erased the brook, but the land still drains to a low point in the road-way here.

Nature-Based Solutions in Planning, Capacity-Building, and Policy

NBS Protection strategies often include non-structural work, like reviewing ordinances and bylaws to develop conservation, natural resource, or flood overlay districts. Often planning and regulatory projects will help lay groundwork to support future NBS implementation.

Some initial considerations for planning and other "non-structural" NBS projects may include:

- Collect data and understand the climate challenges faced by the natural resources and ecosystems in your municipality.
- Identify and fill critical information gaps, like mapping stormwater infrastructure or modeling it using projected precipitation data to highlight future flooding areas.
- Perform a feasibility assessment, for example, to find where a rain garden or constructed wetland would be beneficial to a certain area.
- Review and revise local guidelines or regulations to allow and/or encourage NBS like Low Impact Development (LID).
- Generate support and understanding for NBS by providing staff and/or community training on green infrastructure maintenance, or community outreach to increase awareness of climate change and ecosystem services.

A Resilient Deerfield River Floodplain

With Action Grant funding awarded to the Town in FY18, FY19, and FY20, Deerfield has been addressing flood resilience along the Deerfield River through multiple efforts:

- Updating zoning and development controls in the floodplain.
- Incorporating new flood maps into bylaw updates.
- Revising zoning/bylaws to promote climate resilience and low impact development.
- Creating a town-wide green infrastructure policy for public projects.
- Public climate awareness engagement.
- Emergency flood evacuation planning.
- Design, permitting and construction for replacing priority culverts.
- Installing green stormwater infrastructure.

On April 22, 2020, the Selectboard adopted a Green Infrastructure and Climate Resiliency Policy. The goals of the policy are to:

1. Promote the use of green street facilities and green infrastructure in public and private development as a cost-effective and sustainable practice for stormwater management in current and future projects wherever possible.
2. Promote climate resiliency in public buildings and infrastructure and private development.

Deerfield's Green Infrastructure Policy and Bylaws can be seen here

Tools and resources for planning and regulatory NBS projects:

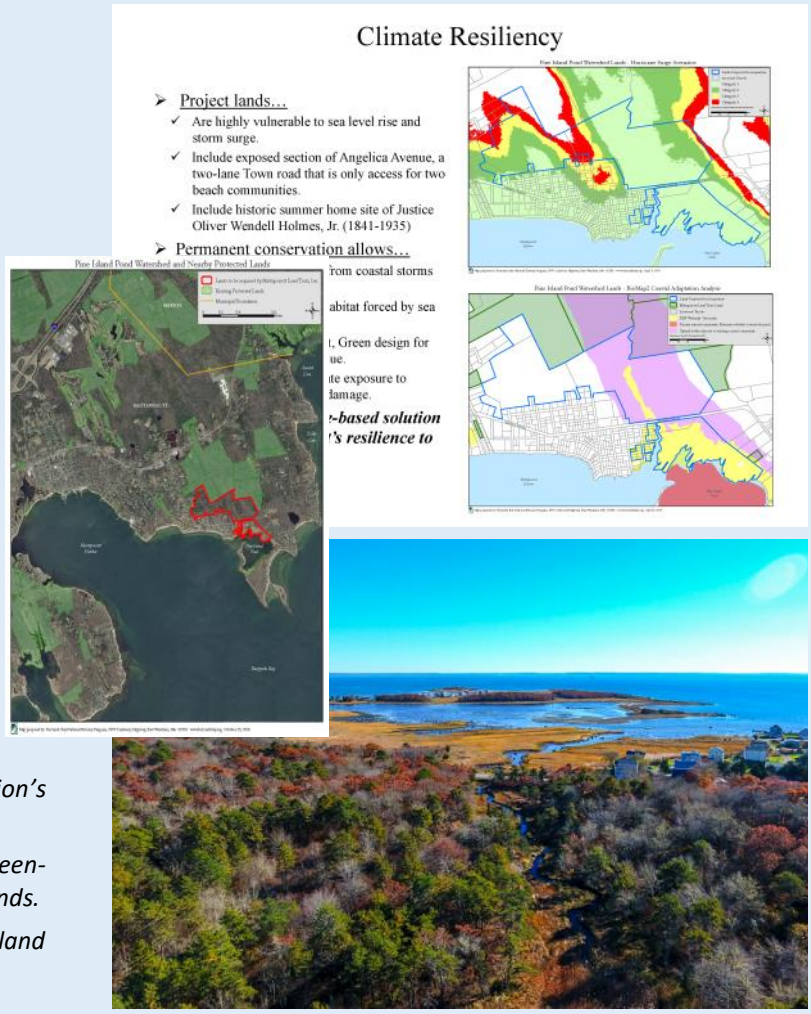
- ◊ Metropolitan Area Planning Council (MAPC) Climate Resilience Land Use Strategies: Regulatory Language and Policy Examples.
- ◊ The Massachusetts Wildlife Climate Action Tool provides a good introduction to creating a stand-alone climate action plan, or ways to integrate climate change (and NBS) into other existing plans (like hazard mitigation, open space and recreation, transportation improvement, or master plans).
- ◊ Mass Audubon's (LID) Fact Sheets: This series of five fact sheets helps community officials, residents, and others understand the benefits of Low Impact Development (LID), Green Infrastructure (GI), and sustainable design.
- ◊ EcoAdapt's resources for vulnerability assessments: three resources providing guidance to conducting and analyzing climate change risk and vulnerability assessments from: 1) National Wildlife Federation and partners, 2) NOAA Coastal Services Center, and other researchers.
- ◊ The Nature Conservancy Procurement Guide to Nature-Based Solutions: designed to help communities utilize the right RFP language that will allow experts to respond with their best recommendations for managing flood and stormwater hazards.

Land Acquisition as a Nature-Based Solution

More tangible NBS "protection" strategies include conservation easements and land acquisitions – these often support multiple co-benefits, for instance: hazard mitigation, air and water cleansing, wildlife protection, recreation and/or agricultural opportunities, etc.

Mattapoisett's FY19 Action Grant

This partnership between the Town, the Mattapoisett Land Trust and the Buzzards Bay Coalition resulted in the purchase of **120 acres** of pristine forest, streams, freshwater wetlands and coastal salt marsh. The conservation restriction, co-held by the Town and Buzzards Bay Coalition, will safeguard this important water system into the future and prevent additional development from occurring within an area vulnerable to coastal storm flooding. Additional co-benefits include air and water cleansing, wildlife protection, and expanded recreational opportunities.



***Top**: Climate data and projections show this location's high vulnerability to sea level rise and storm surge.*

***Middle**: Acquisition property outlined in red. Green-shaded parcels highlight nearby, existing protected lands.*

***Bottom**: photograph looking south toward Pine Island Pond from the project area.*

Links to other NBS conservation resources and programs:

- ◊ Wildlife Conservation Society (WCS) Climate Adaptation Fund: Practitioner Resources include reports and guides for those looking to use and/or fund conservation approaches to address climate change impacts.
- ◊ Community Incentives for Nature-Based Solutions: This TNC guide looks at FEMA's Community Rating System (CRS) to leverage natural solutions to protect communities and reduce flood insurance premiums.
- ◊ Portland Water District (PWD, Maine): This utility supplies water to over 150,000 people in Southern Maine, with and active land conservation program and outreach/free education programs through their website.
- ◊ Charles River Natural Valley Storage Area: *Through 30 September 2016, the project* [harnessing ecosystem services for flood protection through natural resource protection and other NBS] *has prevented approximately $11,932,000 in flood damages (not counting for inflation)* – from the Area's USACE 2017 Draft Master Plan.
- ◊ Philadelphia's LandCare Program is a partnership between the City and the Pennsylvania Horticultural Society (PHS) that seeks to turn vacant lots into "positive public green space." (PHS, 2020)
- ◊ Massachusetts Resilient Lands Initiative: Expanding Nature's Benefits Across the Commonwealth, A Vision and Strategy. January 2023.

Restore Disrupted and Degraded Ecosystems with Nature-Based Solutions

In areas where ecological functions may have previously been disregarded, damaged, or destroyed, reestablishing natural systems will often support multiple co-benefits. For instance: hazard mitigation, clean air/water/soil benefits, public health improvements, recreation opportunities, shoreline protection, etc.

Falmouth's FY19 Action Grant

The culmination of over a decade of funding and partnerships, MVP funding aided in Phase 2 restoration of the river, including:

- Removing a “Middle Dam" and replace with a new pedestrian boardwalk.
- Replacing a failing public road-stream crossing (culvert).
- Restoring the site's remaining 39 acres of cranberry bog complex.
- Reconstructing 3,000 linear feet of the Coonamessett River.

More information about the project can be found on the Coonamessett River Trust website.

Additional MVP Action Grant Project Examples:

Arlington: Mill Brook and Wellington Park	Corridor revitalization project that builds on an existing initiative led by the Town and Mystic River Watershed Association. (FY18)
Northampton: Pine Grove Golf Course	FY20 Grant to (1) restore natural hydrology of an adjacent brook through targeted reforestation, soil aeration, & removal of drainage infrastructure, and (2) develop masterplan for the future restoration of wetlands and stream channels on the 105-acre site.

More ways to restore with NBS:

- Remove paved surfaces on vacant lots to improve soil health, plant vegetation that attracts pollinators, and/or allow stormwater runoff to soak into the ground.
- Include green roof design, outdoor classrooms, and a robust site restoration plan to the property identified for reuse as the community’s new school.
- Construct living shorelines, which are a self-sustaining solution for erosion protection. Example: Plant beachgrass on coastal dunes to reduce erosion and maintain vegetation that can reduce storm surge impacts.
- Master planning and prioritizing restoration projects through urbanized areas, such as daylighting streams, resizing culverts, or discontinuing and removing roadways. These types of projects, in hand with stormwater management techniques mentioned in the next section – can leverage multiple NBS to maximize co-benefits and climate resilience for a broad cross-section of the community.

Links to other NBS restoration resources and programs:

◊ The Massachusetts Healthy Soils Action Plan, released 2023.

◊ Greening the Gateway Cities – MA Urban Canopy Project

◊ Resilient Taunton Watershed Network – Map of restoration projects throughout the watershed

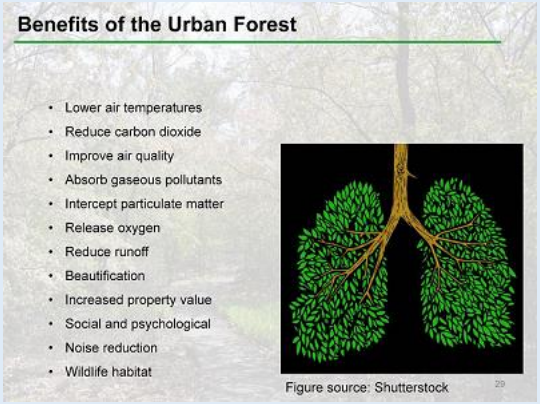
◊ Division of Ecological Restoration Project Map across MA

Manage Ecosystem Services for Sustainability

This category of NBS looks to the history of human land and resource management in our various communities and sectors of the economy. These NBS approaches will incorporate elements of ecosystems, or mimic natural processes in human-built and altered areas, including anything from urban centers to rural and working landscapes (including agricultural and forestry land).

Brookline's FY20 MVP Action Grant

The Town of Brookline developed a research- and data-based, actionable Urban Forest Climate Resiliency Master Plan (UFCRMP). In addition to identifying opportunities for tree planting, the plan also includes recommendations on operations, budget allocation, best management practices, and emergency response procedures. Recommendations have considered specific climate impacts on Brookline's tree canopy.



Forum presentations in 2020 outlined the goals of the project and process as the following:

- Position the Town to proactively and equitably prepare for and protect against the impacts of climate change on public and private trees.
- Mitigate the impacts of climate change by strengthening the ecological functions and values provided by a healthy, balanced and sustainable tree canopy.
- Identify areas/communities that are under-served in terms of tree planting and/or are more vulnerable to the impacts of climate change.
- Conduct outreach and engage the community throughout the process. Educate the public on topics including (but not limited to) climate change, climate equity, urban heat island effect, and the functions and values of the urban canopy as it relates to climate.

More information can be found on the City's project webpage

More MVP Action Grant Project Examples:

Boston: Moakley Park	The City created a vision plan with design updates to existing open space for flood storage, while re-programming recreational space with/for the community. Co-benefits include addressing storm surge & sea level rise projections for high emission scenarios; recreation, human health/wellness; community-building
Millbury: Armory Village Revitalization Project	The town is Incorporating green infrastructure best management practices (BMPs) while preparing other mobility improvements along Main Street and revitalizing the downtown area. Co-benefits include increased flood storage; stormwater infiltration; water quality; urban cooling

More ways to manage with NBS:

- Encourage sustainable agriculture and forestry practices to support the needs of community members with local farm and forest products. (Consider this article from TNC's Perspectives Blog: Regenerative Food Systems, *producing food—whether on land or at sea—in ways that actively restore habitat and protect biodiversity in and around production areas while reducing greenhouse gas emissions.*)
- Initiate or support urban forestry and tree planting programs. (Resource: USFS Urban Forestry Toolkit)
- Incorporate NBS into new construction, redevelopment, and retrofits.
- Provide incentive toward personal land stewardship; enabling our homes, economy, and built landscapes to foster healthy air, water, and food systems.

Links to other NBS management resources and programs:

◊ Siting Nature-Based Solutions for Climate Resilience: this TNC mapping tool aims to support natural hazard resilience planning at the local level. This product can be used to identify opportunities for conservation and restoration and how they overlap with drought susceptibility and inland and coastal flooding hazards, and habitat co-benefits. (Link to document with additional information and methodology)

◊ MassWildlife Habitat Management Toolbox: A variety of tools are used by MassWildlife to create, restore, and maintain a diversity of open habitat types, including grassland, shrubland and young forest.

◊ Grow Green: Compendium of Nature-Based and 'grey' solutions to address climate- and water-related problems in European cities. This March 2020 document presents nature-based and 'grey' solutions to address climate- and water-related challenges in European cities. It focuses on the six challenges that are most common across European cities and which can be addressed through nature-based solutions: heat stress, river flooding, surface water (or pluvial) flooding, coastal flooding, water scarcity, and poor water quality.

◊ Engineering with Nature is *the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaborative processes*. (US Army Corps of Engineers)

◊ Living Shorelines in New England:
- State of the Practice overview - 2017 TNC report providing a range of practical considerations for property managers, regulators, coastal municipal leaders, scientists and practitioners, who are interested in advancing living shoreline policies and practices.
- Profile pages - detailed fact sheets for 8 types of living shorelines, with information on design schematics/ techniques, siting characteristics/ design considerations, case studies, etc.)

◊ US EPA Resources:
- Green Infrastructure Cost-Benefit Resources
- Soak Up the Rain stormwater public outreach and education website
- EPA Resilience and Adaptation in New England (RAINE) database: a collection of vulnerability, resilience and adaptation reports, plans and webpages at the state, regional and community level.
- How's My Waterway Tool assembles publicly available water quality data into a user-friendly package of information to help identify areas where green infrastructure can improve water quality, assist in the ecological restoration of water bodies, and have a positive impact on aquatic resources and recreational opportunities.

◊ US Department of Agriculture (USDA) Northern Forests Climate Hub provides
- Technical support for land managers to respond to drought, heat stress, floods, pests, shifts in habitat suitability, sea level rise and coastal erosion of forests, and any other forest and ecosystem challenges in the context of climate change.
- Regional assessments on ecosystem vulnerability and adaptation planning.
- Outreach and education for land managers to understand climate change, and education on adaptation in order to minimize risks.