

Taking Cues from Nature to Adapt to Climate Change



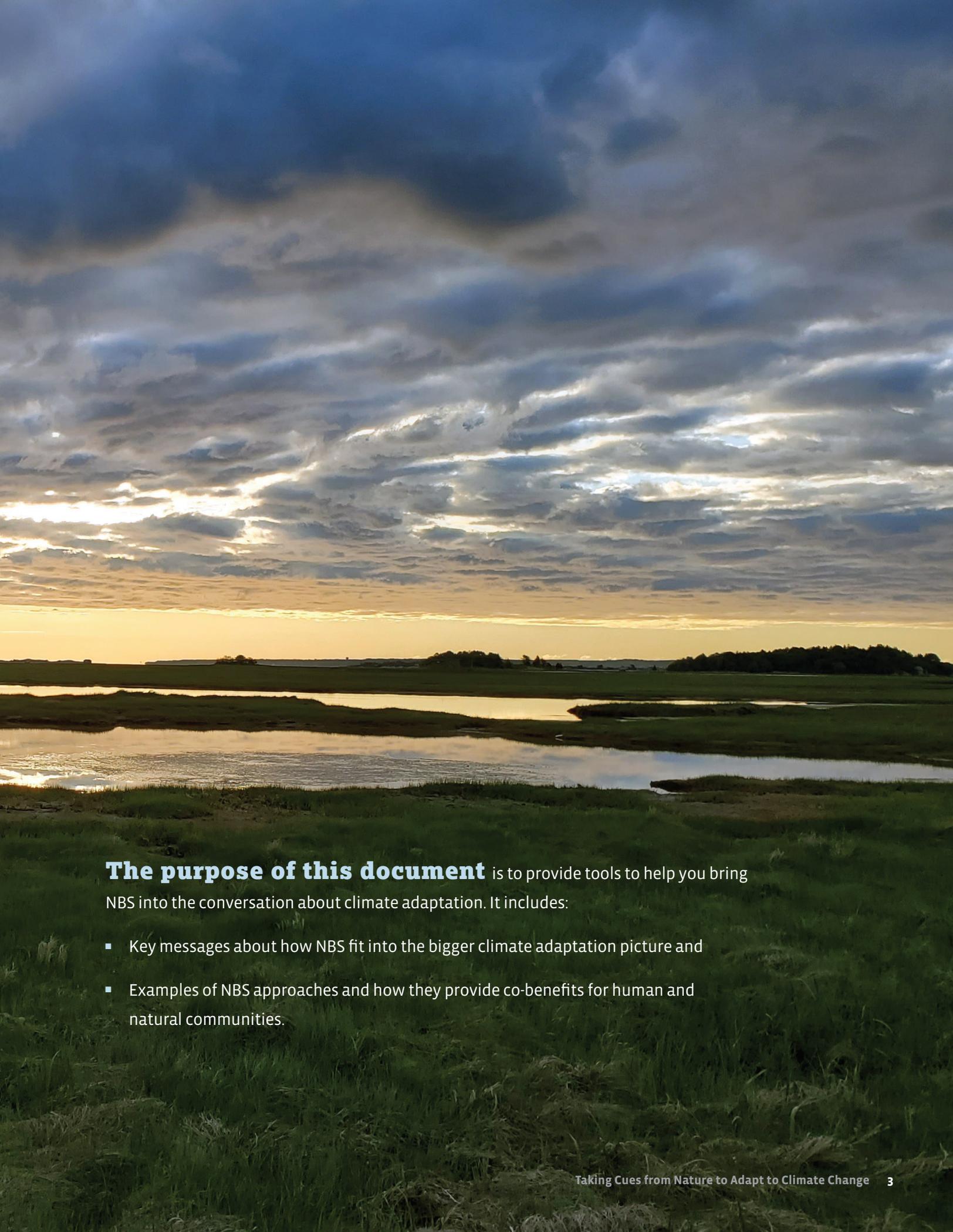
A COMMUNICATIONS RESOURCE FOR NATURE-BASED SOLUTIONS



To help people, wildlife, and the ecosystems we all rely on adapt to climate change, we need to take advantage of a diverse portfolio of tools and approaches, many of which come directly from the natural world.

Nature-based solutions (NBS) incorporate or use natural systems or mimic natural processes to address natural hazards like flooding, erosion, drought, and heat islands. While NBS can play an important role in helping communities adapt to climate change impacts, they are often left out of conversations when stakeholders are making decisions about how to respond to these problems. As practitioners and professionals committed to advancing climate adaptation actions that benefit people and nature, it is our role to mainstream NBS and help communities apply these approaches in the right place at the right time.

► *This salt marsh in Essex is part of the 20,000 acre Great Marsh, the largest coastal marsh ecosystem in New England. Healthy salt marsh ecosystems can buffer communities from the effects of coastal storms and sequester carbon, helping to build climate resilience. Photo credit: Sarah Towle, courtesy of The Trustees*



The purpose of this document is to provide tools to help you bring NBS into the conversation about climate adaptation. It includes:

- Key messages about how NBS fit into the bigger climate adaptation picture and
- Examples of NBS approaches and how they provide co-benefits for human and natural communities.

Key Messages

Nature-based solutions are designed to work with physical, biological, geological, and chemical processes in natural systems, rather than against them.



► **Nature based solutions—such as this living shoreline built with coconut fiber logs—absorb wave energy and enhance the local ecology while stabilizing shorelines. In contrast, traditional stone revetments and seawalls can degrade ecological conditions while reflecting wave energy to other vulnerable areas.** Photo Credit: Wolf Matthewson TNC

About Climate Adaptation

- Climate adaptation means preparing for and responding to climate change impacts.
- We should prioritize adaptation actions that are win-wins: providing co-benefits to both people and ecosystems at the same time.
 - We need to help species and ecosystems adapt for their own sakes, and for their roles in natural communities that diversify life on earth.
 - We need to protect human communities from unavoidable climate impacts, such as increases in flooding, heat, and storms.
 - People are intricately tied to the ecosystems we rely on for services, such as clean air and water.



- When we can incorporate actions that leverage existing ecosystems and enhance biodiversity into resilience planning and action, we can often produce co-benefits for natural and human communities.
- To avoid unintended negative consequences (maladaptation), we must always consider the broader impacts of our actions and collaborate with partners across sectors.



▶ Resilient infrastructure, such as this stream crossing, allows sediment, wood and large volumes of water from more intense rain storms to pass without flooding the road or getting blocked by debris. Well-designed culverts also optimize aquatic connectivity for fish and wildlife movement.
Photo credit: Division of Ecological Restoration

About Nature-based Solutions

- Nature-based solutions (NBS) incorporate or use natural systems, mimic natural processes, or work in tandem with traditional approaches to address natural hazards like flooding, erosion, drought, and heat islands. Incorporating NBS into local planning and projects produces long-term solutions to benefit both human and natural systems.
 - Nature-based solutions provide services to promote natural hazard resilience, public health, clean water, and carbon sequestration.
 - NBS may include natural infrastructure, green infrastructure, hybrid green-gray solutions, and low impact development.
 - Natural Climate Solutions are a type of NBS designed to store carbon and reduce greenhouse gases for climate change mitigation.



- NBS can provide cost-effective, long-term adaptation solutions while serving to beautify our communities. Gray infrastructure projects, like levees, are strongest the day they are constructed. Their structural integrity deteriorates over time. Whereas, nature-based solutions are at their weakest the day they are established, but strengthen over time, keeping pace with climate change. Think of an oyster reef: these shellfish naturally fuse together as they grow, forming rock-like reefs offshore that help diffuse wave energy.
- NBS should always be considered upfront even if ultimately they may not always be the best choice or may need to be considered in conjunction with gray infrastructure.
- As with all adaptation actions, NBS should be considered carefully to avoid potential maladaptation. For example, using invasive species when planting will provide ecosystem services of water filtration or storm resiliency, but we will lose ecosystem resilience and benefits to native species.
- When done well, NBS produce co-benefits for ecosystems, species, and people — they can provide improved infrastructure resilience, community protection, habitat diversity, ecosystem services, and carbon sequestration all at once.

Incorporating NBS in local planning and projects produces long-term solutions and benefits for both human and natural systems.

THREE NATURE-BASED SOLUTIONS EXAMPLES ON THE FOLLOWING PAGES





▶ *Nature-based solutions can also support job creation and industry, such as forestry for wood products or green infrastructure workforce development.*

Photo Credit: New England Forestry Foundation

Forest Conservation and Climate-Smart Stewardship

How it provides co-benefits for climate adaptation:

The trees in our backyards, city streets and wide open spaces provide multiple climate solutions through their many natural functions. As our climate gets warmer and wetter, we will increasingly look to trees to help cool our cities and absorb flooding from intense rainfall events. Trees also shade streams to maintain habitat for coldwater fish like trout, and help moderate extreme temperatures and weather events for wildlife. We will increasingly rely on forests both to adapt to climate change, and curb the source of the problem (our carbon pollution). Each year, Massachusetts forests remove about 14% of the state's heat-trapping carbon emissions, but we must keep them intact to preserve this function. Forests are also vulnerable to climate change, especially when combined with other stresses such as development pressure, insect pests and diseases. Conserving large forested landscapes is a common-sense action that will aid climate adaptation and mitigation for nature and people.



▶ *Forests provide many co-benefits for climate adaptation along with ecosystem services such as filtering air pollution.*

Photo credit: Peter Marotta courtesy of The Trustees

Where it is being used:

Many land trusts are teaming up to tackle forest conservation at a larger scale to create corridors that allow wildlife to navigate around human development and find the natural conditions they need amid a changing climate. The MassConn Sustainable Forest Partnership is working across 38 towns in two states to protect land in a 30,000-acre heavily forested area – and assist private landowners to keep their forests healthy. For example, at Opacum Land Trust’s 140-acre former Morneau Farm in Southbridge, foresters trained to keep climate in mind removed 12 acres of invasive weeds including barberry and knotweed, and strategically harvested timber to diversify tree species and provide patches of young



forest habitat for birds like the Chestnut-sided Warbler. Trees here and in neighboring conserved forestland can also help improve air quality in Southbridge, an “asthma capital.” Wetlands on site protect water quality downstream and reduce runoff into the river system.



► This area is part of the “Emerald Forest,” a relatively unfragmented region of forests, wetlands, and lakes along the MA/CT border. Complementing these large forest areas are urban tree planting efforts in downtown Southbridge. Trees can reduce the urban heat island effect, providing much needed shade and cooler temperatures. Photo credit: New England Forestry Foundation

Green Infrastructure

as a Stormwater Management Tool



How it provides co-benefits for climate adaptation:

Rain gardens and bioswales are vegetated areas that allow stormwater to collect and filter into the ground, rather than flowing as runoff over pavement or other impermeable surfaces. Rain gardens and bioswales are often low impact and low cost options for managing stormwater, and can be paired with other green infrastructure solutions. They can also help existing systems adapt to climate impacts like increased precipitation and drought events, since they are effective at both reducing flow velocity and flooding during periods of intense rain and improving groundwater recharge. The plantings in rain gardens and bioswales can also provide numerous co-benefits by providing habitat for wildlife, such as pollinators, removing contaminants before they reach the water table, and creating aesthetically pleasing and restorative green spaces for people in otherwise paved hard landscapes.



Where it is being used:

Mass Audubon's Broad Meadow Brook Wildlife Sanctuary is home to multiple rain gardens which were planted in the summer of 2017. The rain gardens were designed to manage all the stormwater from the parking lot, which doubled in size due to the construction of a new Education Center, and to capture rooftop runoff, allowing water to infiltrate back into the ground. Plantings for the gardens were carefully chosen to be native species that support pollinators through a variety of flower structures and bloom times. Some of the plantings include wild bergamot, swamp milkweed, penstemon, rudbeckia, and little bluestem grass. The rain gardens not only serve as an adaptation tool, but also as a focal point for educational programming and as a visible model of urban resilience for the Worcester community.



► **Green infrastructure, such as rain gardens, can help prevent runoff and provide habitat for vital pollinator species. People and wildlife rely on these species to pollinate plants for food.** Photo credits: Mass Audubon

Living Shorelines



How they provide co-benefits for climate adaptation:

Living shorelines are natural or nature-based coastal infrastructure that use vegetation alone or in combination with other natural materials to stabilize eroding shorelines and buffer flood impacts while maintaining or restoring the natural land-water interface. They promote the continuation of natural coastal processes and function, and provide valuable habitat. Living shorelines have many benefits for people and nature in light of sea level rise including: shoreline stabilization to protect built infrastructure and natural resources in the upland, buffering of flood impacts, water quality improvement via filtration of stormwater runoff, carbon sequestration, recreation, and protection or creation of habitat for aquatic and terrestrial species.



► *Volunteers plant marsh vegetation at the Collins Cove living shoreline. Living shorelines stabilize shorelines, buffer flood impacts, provide habitat, and sequester carbon.*

Photo credits: The Nature Conservancy



Where it is being used:

The City of Salem, Massachusetts, in partnership with Salem Sound Coastwatch and the MA Coastal Zone Management program, recently restored 800 linear feet of salt marsh (~0.75 acres) at Collins Cove. Once established, the roots of the restored salt marsh vegetation and the build up of organic material in the marsh will stabilize the shoreline, reduce the impacts of incoming wave action, and protect an upland walking path. Additionally, the restored marsh will provide important nursery habitat for commercially and recreationally important finfish and a source of food and shelter for birds and other wildlife.



To learn more about nature-based solutions, see the *Naturally Resilient Communities Guide* or the forthcoming *Municipal Vulnerability Program Toolkit*.

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(Front cover photo credit) Klopfer Martin Design Group, Fisher Hill Reservoir Park, Brookline.

(Back cover photo credit) Copley Wolff Design Group, Spaulding Rehabilitation, Charlestown.

