FEMA

BUILDING COMMUNITY RESILIENCE WITH NATURE-BASED SOLUTIONS

STRATEGIES FOR SUCCESS

PHOTO: *People enjoying a greenspace at sunset.*

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ACKNOWLEDGEMENTS

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INTRODUCTION

This is the second in a series of guides to help community leaders use nature-based solutions (NBS) to minimize the risks of natural hazards. The first guide, Building Community Resilience With Nature-Based Solutions: A Guide for Local Communities (A Guide for Local Communities), makes the case for using NBS. It tells readers how to include NBS in community planning, and it goes over funding options.

This guide gives community leaders five main strategies to carry out NBS projects:

- Building Strong Partnerships.
- Engaging the Whole Community.
- Matching Project Size With Desired Goals and Benefits.
- Maximizing Benefits.
- Designing for the Future.

This is not a technical guide for planning, constructing or funding NBS. It covers the value of each strategy and suggests how to move forward with NBS projects.

Communities across the United States are facing the impacts of natural disasters. Flooding, heat, drought, landslides, wildfires and other hazards threaten lives, properties and economies. Because of climate change, these events happen more often with more intensity and more costs. They can overwhelm current public services and assets. They can also forever change cities and towns. Local communities plan for and carry out risk reduction strategies to address these hazards.

NBS are among many tools that can help reduce damage and increase a community's ability to bounce back from a disaster. When designed the right way, NBS can absorb floodwaters, reduce a wildfire's intensity and minimize droughts. NBS also offer many added benefits, also called multiple or co-benefits, that can address several issues at once. For example, they can:

- Improve air and water quality.
- Lower air temperature.
- Improve a community's appearance and well-being.
- Increase wildlife habitat.
- Increase nearby property values.
- Provide workforce development, educational and recreational opportunities.

Learn more about these benefits in A Guide for Local Communities.

What Are Nature-Based Solutions (NBS)?

NBS add natural features or processes to the built environment. Some people use the terms green or natural infrastructure, bioengineering, or Engineering with Nature®.

What Is Traditional Infrastructure?

Traditional infrastructure means hard structures designed to work for specific issues. Examples include water and wastewater treatment plants, pipes, concrete ditches and seawalls. It is sometimes referred to as gray or hard infrastructure.

What Are Hybrid Solutions?

Hybrid solutions combine NBS and traditional infrastructure. These are very useful in areas at high risk for natural hazards or areas with lots of development.

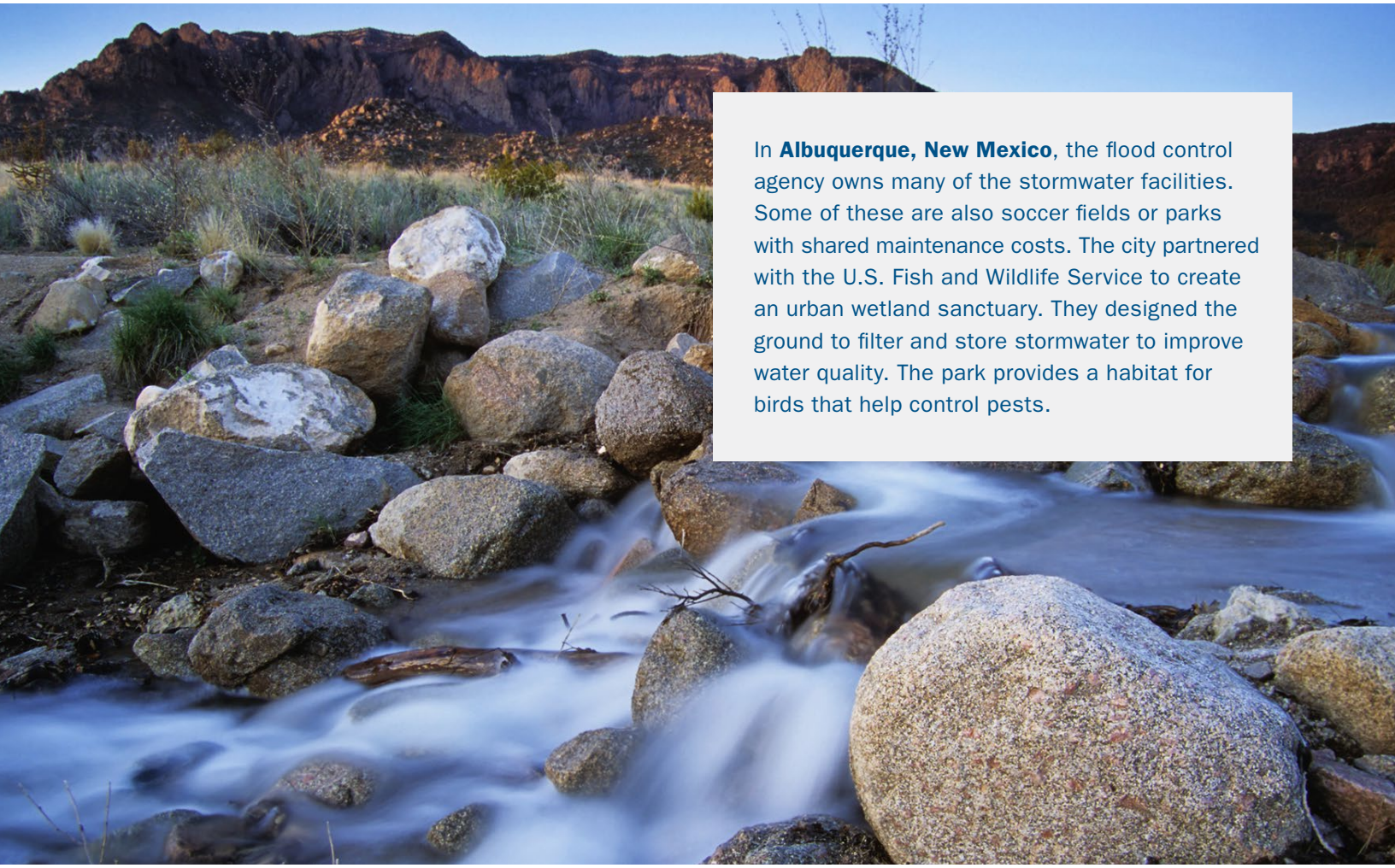
NBS can also save communities money. They often need less human involvement to recover from impacts of weather events. This can lower disaster response and recovery costs. For example, flooding events may damage roadways or sidewalks. However, stormwater parks are designed to withstand large amounts of water, and the natural elements may remain unharmed or can regrow. Finally, NBS sometimes need less upfront investment and less upkeep than other solutions. They can even extend the life of traditional infrastructure as part of a hybrid solution.

NBS come in a range of options. That is what makes them so effective. They can also work across sectors. For example, smaller, urban NBS can help address rain events in areas with more people. Larger projects that restore habitat can help address high-impact wildfire and flood events. NBS can also work with transportation, parking or school construction projects in urban and rural areas.

NBS work best as part of local, regional and state planning efforts around:

- Hazard mitigation and risk reduction.
- Climate resilience.
- Watershed management.
- Source water protection.
- Land use and economic development plans.

Working NBS into these plans helps make sure that different solutions address many community challenges, not just hazard risk reduction. A Guide for Local Communities provides tips for adding NBS to community plans.



In **Albuquerque, New Mexico**, the flood control agency owns many of the stormwater facilities. Some of these are also soccer fields or parks with shared maintenance costs. The city partnered with the U.S. Fish and Wildlife Service to create an urban wetland sanctuary. They designed the ground to filter and store stormwater to improve water quality. The park provides a habitat for birds that help control pests.

PHOTO: *A rocky stream flows through the desert at sunset.*

ABOUT THIS GUIDE

Implementing NBS projects follows the same general process as traditional infrastructure projects. This guide covers five key strategies that work for every NBS project. These strategies can be applied across projects so they meet risk reduction, climate resilience and other community goals.

The Five Strategies

BUILDING STRONG PARTNERSHIPS.
NBS projects work best when different partners and organizations rally around common goals. Communities will benefit most by establishing partnerships early and fostering them through the life of a project.

ENGAGING THE WHOLE COMMUNITY.
Community engagement is key to carrying out NBS projects that work for the Whole Community. Community and project leaders will see better results by reaching out to all community members early and often.

MATCHING PROJECT SIZE WITH DESIRED GOALS AND BENEFITS.
The range of NBS and hybrid solutions provides many options to reduce risk. The size and reach of an NBS project, or group of projects, should match the level of benefits a community wants.

MAXIMIZING BENEFITS.
NBS offer many different benefits to communities. By making small additions to project designs or combining multiple solutions, communities can get more for their investment.

DESIGNING FOR THE FUTURE.
This means planning for a combination of changes in climate, population patterns and community development. Doing so helps communities implement solutions that can adapt to changing risks and reduce impacts of future events.

These strategies are meant to provide community leaders with resources for success, including case studies about how others have used the strategies to advance their project. Investing in them at the correct time is the key to carrying out successful NBS projects (Figure 1). Communities can choose how to best use each strategy, or combination of strategies, based on what they think is the right path for them.

NATURE-BASED SOLUTIONS

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Investing in these management strategies at the right times during the project lifecycle is key to successful and sustainable nature-based solution projects.

FIGURE 1: *Timeline for investing in key strategies during NBS projects.*

STRATEGY ONE OF FIVE

BUILDING STRONG PARTNERSHIPS

KEY IDEAS

1 Projects involving many organizations rallying around common goals are more likely to have the benefits a community values. This, in turn, helps make projects more resilient, effective and equitable.

2 Partnerships are good investments of time and resources. Communities will benefit most by establishing partnerships early and fostering them through the life of a project.

3 Partners should be clear about the resources they can contribute and work together to set goals for the partnership and the project.

WHY STRONG PARTNERSHIPS MATTER

The multiple benefits of NBS naturally foster diverse and inclusive partnerships. Diverse partners working towards common goals will improve project results for everyone. They bring a wide range of strengths and expertise to the table, which benefits the Whole Community.

Strong partners who understand the time needed and are willing to stay through the end are essential. Good partnerships are also based on trust. They encourage learning across the group and support creating solutions together. They also allow for organizations to align their missions and priorities.

Whole Community

The Whole Community means anyone in the area directly and indirectly affected by the project. Community members may include:

- Individuals and families, including those with access and functional needs.
- Businesses.
- Faith-based and community groups.
- Nonprofits.
- Schools.
- Media outlets.
- All levels of government.

Potential partners can include:

- Local, state and federal government agencies.
- Hazard mitigation officials.
- Conservation nonprofits.
- Community organizers.
- Environmental justice organizations.
- Tribal representatives.
- Chambers of commerce.
- Recreational groups.
- Academia.

Partnerships can also form within a community and with neighboring communities. City departments (public works, emergency management, health) can work together to identify risks and how NBS can reduce them (Figure 2). Community leaders can then reach out to neighbors to learn from their experiences. Internal city or town partnerships tie closely to Strategy Two, Engaging the Whole Community.

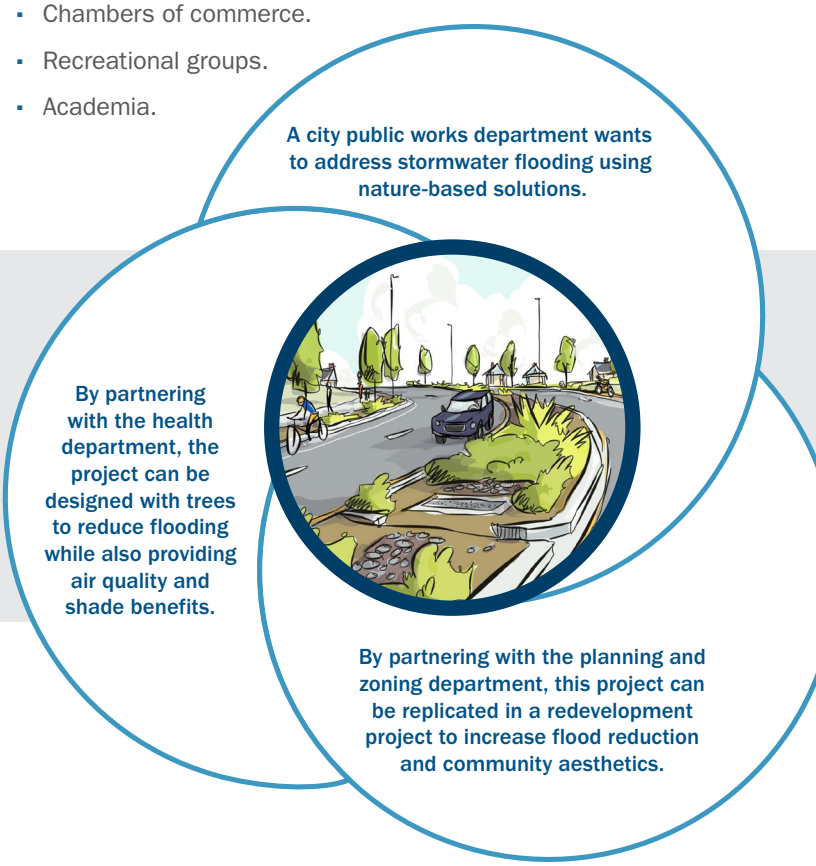

FIGURE 2: *Multiple departments within a town can partner to achieve multiple goals with one project.*

Partnerships can benefit everyone involved by:

- **Using skills and experience across the life of a project.** Projects have many stages, including:
  - Community engagement.
  - Project scoping and design.
  - Construction.
  - Monitoring.
  - Maintenance and adaptative management.

  Having partners with diverse backgrounds can add value to each stage. Also, different partners can work on different stages at the same time. A strong partnership also provides a safety net if staff leave. This is especially true for smaller communities – they can lean on partners with more capacity and history on the project.
- **Using and getting funds.** NBS need funding for the life of the project, which could span many decades. Projects can also run over budget, especially if they include newer methods. Partnerships can combine funds to help reduce financial risks across the life of a project. This can include helping with matching funds for grant-funded projects. Public and private funders also tend to like partnerships.
- **Increasing project innovation and community trust.** NBS may be new to a community. Community leaders may want to think about new ways of doing outreach, obtaining funding, designing and constructing a project. Learning from different partners, including nearby communities, will help spur new thinking. Diverse partnerships with community groups can also help build trust by sharing credible information.
- **Addressing many community challenges.** Communities face many complex social, economic and environmental challenges. They often require different solutions working together. Strong partnerships that represent the Whole Community and diverse thinking will help ensure that NBS address the most important community issues.

MAKING IT HAPPEN

Building relationships that benefit many partners will take time. Partners want to "see" themselves in the project while also asking what they can do to help achieve others' goals.

Key steps to building strong partnerships include:

- **Start early and set clear goals.** Community leaders will benefit from developing project partnerships before planning begins. It is important to have a goal for the partners to unite around at the start. Then partners should be clear about what they bring to the table, what roles they will play, and what they each hope to achieve beyond the risk reduction goals.
- **Be transparent about resources.** Partners need to be clear on what technical and financial capacity they can bring to the table. This will help identify gaps and ways to fill them. Partners can identify gaps by listing their strengths and available resources for each project stage listed above.
- **Brainstorm possible partners.** Project leads should think of other community needs besides reducing risk that NBS may address. Also, think about the different partnership roles that need to be filled. Knowing this will help create a list of possible partner organizations. For example, faith-based groups make great partners for community outreach. Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement is a resource from the U.S. Environmental Protection Agency (EPA). It explores how communities can find good partners.
- **Clarify the structure.** Partnerships can be informal with loosely defined roles. They can also have a formal, well-defined structure. Well-defined partnerships with a motivated champion and high levels of teamwork have the most impact. Having one main point of contact for the community will help with communication.
- **Create a project steering committee.** Ideally, each partnership will have a steering committee with at least the following roles. Partners can fill more than one role.
  - *Project Lead*
    - Drives project development and execution.
    - Serves as the main point of contact.
    - Identifies funding sources and leads development of applications.
  - *Community Official*
    - Serves as the main point of contact for local government.
    - Provides a local viewpoint.
  - *Convening Partner*
    - Leads partner meetings.
  - *Communications/Engagement Partner*
    - Leads development and rollout of the engagement and strategic communications plans.
  - *Ecological/Technical Partner*
    - Guides project design along with technical experts (likely contracted).

In **Washington state**, the Puget Sound Partnership, The Nature Conservancy and the state government came together to create Floodplains by Design. The public-private partnership uses state funding for projects focused on flooding, drought and conservation issues. Projects range from relocating levees for salmon habitat and flood storage to preventing development on farmland.

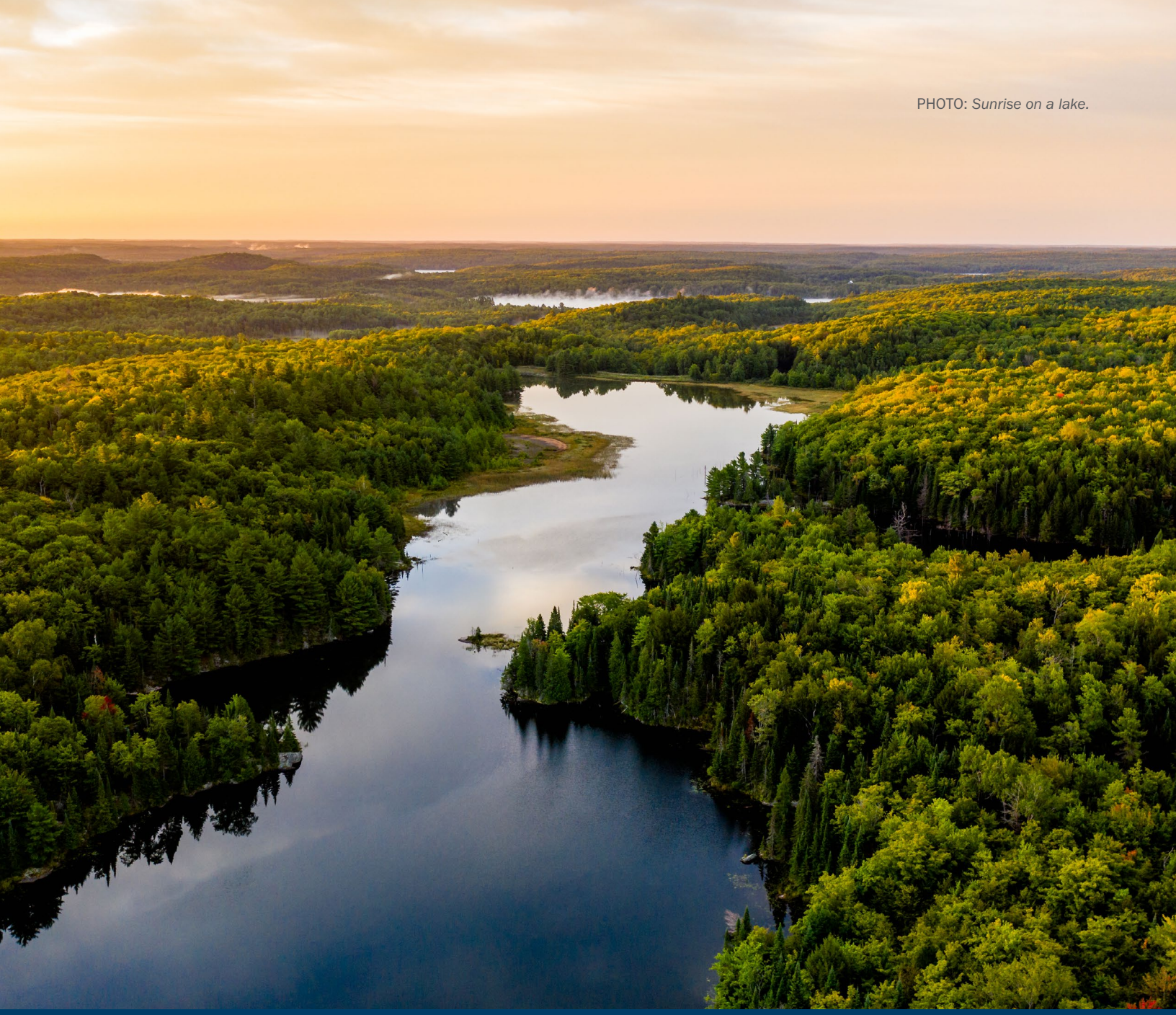

PHOTO: *Sunrise on a lake.*

MORE RESOURCES FOR BUILDING STRONG PARTNERSHIPS

Building Alliances for Climate Action: Advancing Climate Action Through Partnerships.

From: Resilient Nation Partnership Network (RNPN), FEMA and NASA

Focus: Captures stories of partnerships across the country that address climate change impacts.

Building Alliances for Equitable Resilience

From: RNPN, FEMA and the National Oceanic and Atmospheric Administration (NOAA)

Focus: Describes how diverse perspectives can make communities more resilient for everyone.

Regional Adaptation Collaborative Toolkit

From: The Alliance of Regional Collaboratives for Climate Adaptation (ARCCA)

Focus: Offers a framework for creating a regional adaptation network. It also offers guidance for structuring a regional collaborative, and insights into effective governance for engaging stakeholders in new collaborative relationships.

CASE STUDY

Project Name: Missouri River L-536 Large-Scale Levee Setback
Project Location: Atchison County, Missouri
Date Completed: Summer 2021
Type of NBS Used: Levee setback
Primary Risk Mitigation Benefit(s): Riverine flooding

After the Missouri River flooded in March 2019, Atchison County Levee District #1 planned a NBS to help minimize future flooding events. They chose a levee setback, which moves a levee further inland so floodwater has more room to move. When finished, the project also improved wildlife habitat by creating over 1,000 acres of floodplain and 400 acres of wetlands.

PHOTO: *Partners collaborating on the Missouri River Levee Setback. Photo credit: Route 3 Films*

The project was a success because of multiple partners working together to help with the large size of the project and amount of funding needed. Partners included:

- Missouri Department of Conservation.
- Missouri Department of Natural Resources.
- Missouri River Recovery Program.
- Missouri State Emergency Management Agency.
- Natural Resources Conservation Service.
- Northwest Missouri Regional Council of Governments.
- The Nature Conservancy.
- U.S. Army Corps of Engineers.

The levee district also worked with residents, landowners and multiple government and conservation partners. This partnership gave the levee district resources and expertise to help overcome the many challenges it faced during the design and construction of the project. For example:

- Many partners provided help with grant applications and funding.
- Other partners supported environmental assessments and helped acquire land.
- The local levee district used its relationship with local residents to ensure the success of the project. Considering the needs of the impacted landowners was a priority.
- The Nature Conservancy regularly brought together the partners, which helped to maintain forward progress. They also facilitated conversations to identify obstacles and creative solutions.

STRATEGY TWO OF FIVE

ENGAGING THE WHOLE COMMUNITY

KEY IDEAS

1 By getting the Whole Community involved, project leads can design NBS to benefit everyone, including underserved communities and socially vulnerable populations.

2 It is important to engage the community early in the planning process. This gives all community members a voice in shaping decisions.

3 Engaging the Whole Community results in projects that reduce risks and address other community needs. It also helps the community take ownership of the project once it is finished.

Community Engagement: Common Definitions

- **Underserved Communities:** Underserved communities are populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social and civic life. Historically, the following groups have been underserved and denied full and equal treatment:
  - Black, Latino, Indigenous and Native American persons, Asian Americans and Pacific Islanders, and other people of color.
  - Members of religious minorities.
  - People with disabilities.
  - Lesbian, gay, bisexual, transgender and queer (LGBTQ+) people.
  - People who live in rural areas.
  - People who live in poverty.
- **Social Vulnerability:** This is an individual or group's potential for loss. Certain factors affect their ability to prepare for, respond to or recover from an event like a flood. The most at-risk members in a community often experience the greatest losses from disasters.

WHY ENGAGING THE WHOLE COMMUNITY MATTERS

Performing outreach with equity at the forefront means engaging the Whole Community throughout the project. This means involving everyone in project planning, design and beyond.

NBS allow for many project design options. Looking at different options with the Whole Community at the table helps create a design that factors in everyone's needs.

The many benefits of engaging the Whole Community can include:

- **Improving project design.** Including community members during the early planning stages creates a project design that maximizes impacts. Community members have local knowledge that can improve the value of the project. They can point to locations where the hazard impacts are worst. They can also improve the design to get benefits the community needs and wants.

  Involving underserved communities and socially vulnerable populations helps direct benefits to those who need them most. By considering who benefits from the project and who may experience negative impacts, the community can improve environmental justice. Project leaders who correct possible harms during a project can help those at highest risk improve their ability to recover. This promotes solutions that support the Whole Community.

Projects That Benefit All

FEMA defines equity as the consistent and systematic fair, just and impartial treatment of all individuals.

Designing a project with equitable outcomes involves underserved communities and socially vulnerable populations in the planning process. For example, choosing a project location can go beyond where hazard impacts are worst to consider the most affected groups. Committing to equity in the planning process creates more equitable outcomes for the community.

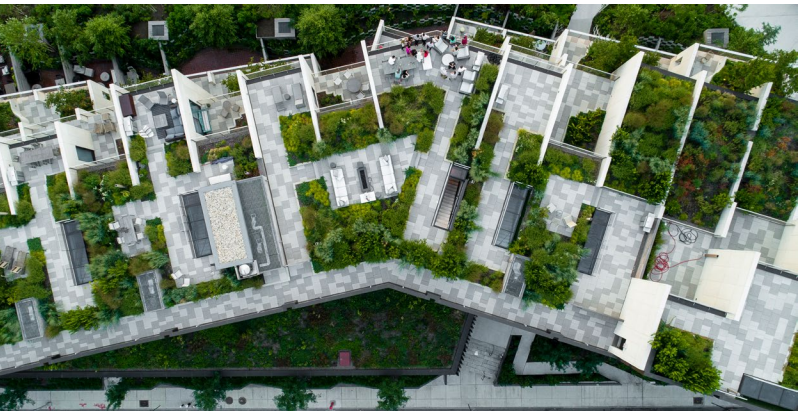

PHOTO: *Aerial view of rooftop gardens.*

- **Empowering communities.** Sharing knowledge about NBS with the entire community during planning helps people feel like they have a say. It lets community members make informed decisions to reduce their risk. This builds local capacity to take action for those who need it most, including underserved and socially vulnerable community members. The educational piece of an NBS project may last long after the project is completed.

- **Helping address limited resources.** Community members can help local government staff with limited resources fill these gaps. Working with prominent community groups, such as youth organizations or church groups, can mobilize volunteers to expand engagement efforts. Volunteers from local groups can also get even more people engaged. They can share outreach materials and even help with construction, depending on the project. Leveraging community involvement can create community caretakers for the project's lifetime.

- **Building support for current and future projects.** Involving people in a project helps increase the chance they will support and take ownership in the project. Providing meaningful volunteer opportunities for the public is a great way to achieve both. This groundwork will contribute to future successes as well. Community members will better understand NBS and how they help improve the community for the future.

MAKING IT HAPPEN

Each community is unique. Engagement depends on factors such as the people, geography, economy, hazard risk and impacts, and other community challenges.

Best practices for building community support and designing projects with equitable impacts include:

- **Create a clear engagement plan before bringing in the community.** An engagement plan identifies the who, when and how of engagement. It should include strategies for engaging with historically underserved communities and socially vulnerable populations. The plan can be based on the project's risk reduction goal and the project's additional benefits. The community's input will shape how the risk reduction goal is met, but the risk reduction itself cannot change.

  The FEMA Flood Risk Communication Toolkit for Community Officials helps leaders make and execute engagement plans. This toolkit offers a starting point for local officials to begin planning outreach and engagement for an NBS project. It includes templates and guides to design a communication plan, public meetings and a social media strategy.

- **Start engagement in the early planning stages.** This will create chances for meaningful community input and help increase buy-in. If there is too much planning before engaging with the community, then it can seem like the project is happening to the community rather than with it. Project leads should bring initial ideas and stay open to new ideas and changes. Starting early lets community members meaningfully shape the project rather than just comment on decisions that have already been made.

- **Talk about the value of NBS to the community.** The concept of NBS is still new to most people. Explaining NBS and all the benefits is key to gaining support. Providing community members with similar examples of NBS that are relevant to the community's needs is a great way to start the conversation for an NBS project. Strategy Four, Maximizing Benefits, has more on this.

The Trust for Public Land (TPL) expanded its Community Green Schoolyards program to **Tacoma, Washington**. The program uses NBS to capture stormwater runoff. It has also worked to reduce the impact of urban heat island effect. By turning paved schoolyards into public green spaces, this program reduces hazard risks and increases social equity.

TPL prioritized community engagement and used students' input to design the project. The students learned about nature-based water management over several weeks. This approach gives the students ownership over the project and empowers the next generation to take action.

PHOTO: *Searching the river for wildlife.*

In **Lenexa, Kansas,** the parks and recreation department wanted an NBS to manage invasive plants. The invasive species were harming the native plants that help restore the stream corridor of Sar-Ko-Par Trails Park. The city brought in goats to eat the invasive plants so the floodplain could recover.

This unique NBS gave the city a great chance for public outreach. They took goats to local events and educated the public about floodplain management. Community members watched the goats work and learned how native plants help reduce flood risk.

- **Identify common project goals with the community.** Projects best meet community needs when they factor in local concerns and opinions. Project leads can create a set of risk reduction outcomes before going to the community. They can then work with the community to lay out its other priorities. Working through challenges and finding solutions with community members provides a true chance for engagement.
- **Continue engagement after the project.** Whole Community engagement is an ongoing process. Some NBS are clearly visible and offer space for interaction, such as rain gardens and stormwater parks. Whether an NBS site is visible or not, adding educational signs about its benefits is a great way to engage with residents during and after construction of a project. These efforts can sustain support for NBS that outlast one project's lifetime.

When **Martin County, Florida**, began doing living shoreline projects, it chose sites the public could see. This increased overall awareness of the project benefits and supported the county's goal of getting more homeowners to use NBS on their property.

MORE RESOURCES FOR ENGAGING THE WHOLE COMMUNITY

Climate and Economic Justice Screening Tool

From: Council on Environmental Quality, Executive Office of the President

Focus: Helps identify disadvantaged communities. The 2022 beta version of the tool provides socioeconomic, environmental and climate information to guide decisions that may affect these communities.

Guide to Supporting Engagement and Resiliency in Rural Communities

From: FEMA

Focus: Offers steps for designing outreach and engagement activities for rural communities, which have unique challenges.

Guides to Expanding Mitigation

From: FEMA

Focus: Shows how community leaders can support efforts to minimize risks of hazards by engaging with different groups and sectors. Some guides discuss equitable engagement and planning:

- FEMA's Guide to Expanding Mitigation: Making the Connection to Equity.
- FEMA's Guide to Expanding Mitigation: Making the Connection to the Whole Community.
- FEMA's Guide to Expanding Mitigation: Making the Connection to People with Disabilities.
- FEMA's Guide to Expanding Mitigation: Making the Connection to Older Adults.

Digital Coast Meeting Engagement Tools

From: NOAA

Focus: Provides resources and meeting activities to help project leads with stakeholder outreach.

Step-by-Step Guide to Integrating Community Input into Green Infrastructure Projects

From: The Environmental Law Institute

Focus: Talks about how and why to engage with community members and factor their input into an NBS project.

CASE STUDY

Project Name: Cook Park
Project Location: Atlanta, Georgia
Date Completed: Opened June 2021
Type of NBS Used: Stormwater park
Primary Risk Mitigation Benefit(s): Stormwater flooding

Cook Park is one example of a successful NBS project that focused on community engagement. The project used community resources and public involvement to convert a flooded housing site into a public park with NBS. The park has a 2-acre pond, pools, wetlands and a playground. It can store up to 10 million gallons of stormwater runoff while giving residents a safe, clean place to enjoy.

This project succeeded because of the teamwork and engagement of residents, project leaders, the Trust for Public Land and the city of Atlanta. Project leaders started by working with community leaders and local government staff and continued to build a relationship with residents. Many conversations happened over a cup of coffee. The project team did more engagement by attending local festivals, neighborhood association meetings and church gatherings. Community members received updates during planning and construction, so they always knew what was happening.

As trust grew, residents shared other needs and hopes beyond flood reduction. The park includes a splash pad for kids, pavilions for picnics, large sidewalks for accessibility, trees and structures for shade, and a pond that attracts wildlife. These features were included in the park design because the residents were given the time and platform to voice their needs. Today, Cook Park allows residents to play and relax knowing that their flood risk has been significantly reduced, and they helped make it happen.

PHOTO: *Aerial view of Cook Park in downtown Atlanta, Georgia. Photo credit: HDR 2021 Paul Dingman*

STRATEGY THREE OF FIVE

MATCHING PROJECT SIZE WITH DESIRED GOALS AND BENEFITS

KEY IDEAS

1 The range of NBS and their benefits lets a community adapt the project to meet risk reduction goals.

2 The best results come when a community designs an NBS project or group of projects to match what they hope to achieve — especially for risk reduction.

3 Communities can meet risk reduction goals by including NBS in community plans and policies. This includes upgrades of existing infrastructure. It also helps them get more of the benefits that NBS provide.

WHY MATCHING PROJECT SIZE WITH DESIRED GOALS AND BENEFITS MATTERS

A community can match NBS to the hazards and risks they want to minimize. This helps them meet risk reduction goals and see the many benefits. The variety of NBS lets a community adapt an approach to meet their project needs, whether using a standalone NBS or a hybrid solution.

- **Project size affects the level of risk reduction.** As discussed in A Guide for Local Communities, NBS have different sizes. These range from small, site-specific solutions (such as rain gardens and living shorelines) to large, watershed or landscape ones (forestry management and floodplain repair). Project size often matches the level of risk reduction. Smaller projects solve local hazards at a specific site, while larger projects help solve landscape issues like wildfire, drought and flooding. Figure 3 shows how different NBS can be used across landscapes.

  A community does not always need major habitat repair projects. And large solutions can include many smaller projects. A set of rain barrels and green streets, for instance, can do a lot to help a neighborhood avoid stormwater flooding.

Tyndall Air Force Base on the Gulf Coast of Florida began using hybrid approaches after Hurricane Michael in 2018. Its pilot projects include traditional infrastructure, like reinforcing seawalls, and NBS, like sand trapping to promote dune growth and placing sediment along the barrier islands.

- **Customize projects.** By adapting NBS and hybrid solutions, communities can reduce risk and meet many of their resilience goals. This is especially true for hybrid solutions, which communities can customize to meet a variety of goals. Communities can avoid stormwater flooding by upgrading roads and storm drains while adding natural elements to create a green street, for example. This can improve things like pedestrian safety, neighborhood appearance and pollinator habitats.

USING NATURE-BASED SOLUTIONS ACROSS LANDSCAPES

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NBS projects can be larger in size in rural or less developed areas. These solutions reduce risk for communities by working at the source in coastal, mountain and rural lands nearby.

FIRE MANAGEMENT

SETBACK LEVEE

LAND CONSERVATION

TREE CANOPY

PERMEABLE PAVEMENT

GREEN ROOFS

RAIN GARDENS

RAINWATER HARVESTING

GREEN STREETS

In more developed areas, small NBS and hybrid projects can add up over time. Many different types of NBS can work across a community to reduce risk at a larger scale.

WATERFRONT PARKS

LIVING SHORELINES

CORAL REEF

COASTAL WETLANDS

FIGURE 3: *Using different NBS across rural to urban landscapes.*

WATERSHED SCALE

LAND CONSERVATION

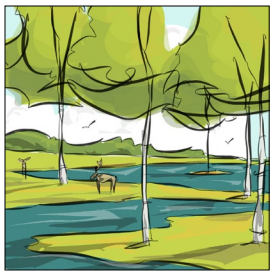
Land conservation is one way of preserving interconnected systems of open space that sustain healthy communities.

Land conservation projects begin by prioritizing areas of land for acquisition. Land or conservation easements can be bought or acquired through donation.

GREENWAYS

Greenways are corridors of protected open space managed for both conservation and recreation.

Greenways often follow rivers or other natural features. They link habitats and provide networks of open space for people to explore and enjoy.



WETLAND RESTORATION AND PROTECTION

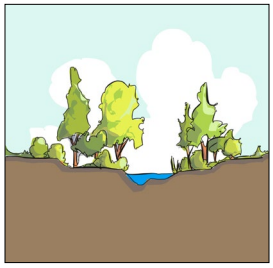
Restoring and protecting wetlands can improve water quality and reduce flooding. Healthy wetlands filter, absorb, and slow runoff.

Wetlands also sustain healthy ecosystems by recharging groundwater and providing habitat for fish and wildlife.

STORMWATER PARKS

Stormwater parks are recreational spaces that are designed to flood during extreme events and to withstand flooding.

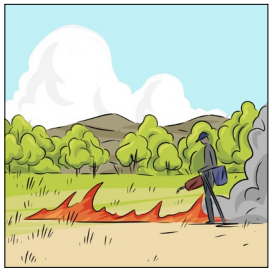
By storing and treating floodwaters, stormwater parks can reduce flooding elsewhere and improve water quality.



FLOODPLAIN RESTORATION

Undisturbed floodplains help keep waterways healthy by storing floodwaters, reducing erosion, filtering water pollution, and providing habitat.

Floodplain restoration rebuilds some of these natural functions by reconnecting the floodplain to its waterway.



FIRE MANAGEMENT

Like storms, fires are a natural part of a healthy landscape. Methods like prescribed burns decrease the amount of brush and other fuels. This helps to reduce the severity of fires. You can also use mechanical methods in fire management.

Proactively managing land for fire makes humans safer and landscapes healthier.

WATERSHED SCALE

BIKE TRAILS

Bike trails and nearby greenspace can absorb the impact from flooding. They also reduce the urban heat island effect.

Bike trails provide recreational opportunities and connect people to nature.

HABITAT MANAGEMENT

Healthy lands can absorb shocks and repair themselves after storms and other hazards. Managing a habitat can help it better absorb flood waters and improve water quality. It also reduces fire risk, prevents erosion and provides many other benefits.

You can manage a habitat with both natural and mechanical methods.

SETBACK LEVEE

Levees provide a vertical barrier against storm surge or river overtopping. A setback moves the levee away from the river or coast. This provides extra space for flood water.

Setback levees provide extra flood protection and reduce erosion. They also support healthier and more dynamic river and coastal systems.

NEIGHBORHOOD OR SITE SCALE

RAIN GARDENS

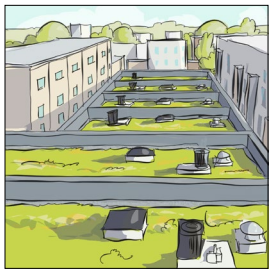
A rain garden is a shallow, vegetated basin that collects and absorbs runoff from rooftops, sidewalks, and streets.

Rain gardens can be added around homes and businesses to reduce and treat stormwater runoff.

VEGETATED SWALES

A vegetated swale is a channel holding plants or mulch that treats and absorbs stormwater as it flows down a slope.

Vegetated swales can be placed along streets and in parking lots to soak up and treat their runoff, improving water quality.



GREEN ROOFS

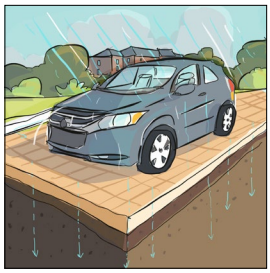
A green roof is fitted with a planting medium and vegetation. A green roof reduces runoff by soaking up rainfall. It can also reduce energy costs for cooling the building.

Extensive green roofs, which have deeper soil, are more common on commercial buildings. Intensive green roofs, which have shallower soil, are more common on residential buildings.

RAINWATER HARVESTING

Rainwater harvesting systems collect and store rainfall for later use. They slow runoff and can reduce the demand for potable water.

Rainwater systems include rain barrels that store tens of gallons and rainwater cisterns that store hundreds or thousands of gallons.



PERMEABLE PAVEMENT

Permeable pavements allow more rainfall to soak into the ground. Common types include pervious concrete, porous asphalt, and interlocking pavers.

Permeable pavements are most commonly used for parking lots and roadway shoulders.

TREE CANOPY

Tree canopy can reduce stormwater runoff by catching rainfall on branches and leaves and increasing evapotranspiration. By keeping neighborhoods cooler in the summer, tree canopy can also reduce the "urban heat island effect."

Because of trees' many benefits, many cities have set urban tree canopy goals.

NEIGHBORHOOD OR SITE SCALE

TREE TRENCHES

A stormwater tree trench is a row of trees planted in an underground infiltration structure made to store and filter stormwater.

Tree trenches can be added to streets and parking lots with limited space to manage stormwater.

GREEN STREETS

Green streets use a suite of green infrastructure practices to manage stormwater runoff and improve water quality.

Adding green infrastructure features to a street corridor can also contribute to a safer and more attractive environment for walking and biking.

URBAN GREENSPACE

Urban greenspace reduces the urban heat island and improves air quality. They can also absorb flood waters to reduce flooding elsewhere.

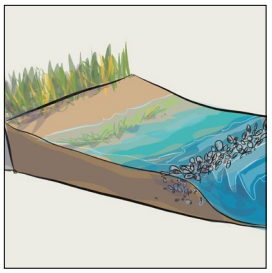
Greenspace also provides more recreational opportunities and beautifies a community.

COASTAL AREAS

COASTAL WETLANDS

Coastal wetlands are found along ocean, estuary, or freshwater coastlines.

They are often referred to as “sponges” because of their ability to absorb wave energy during storms or normal tide cycles.



OYSTER REEFS

Oysters are often referred to as “ecosystem engineers” because of their tendency to attach to hard surfaces and create large reefs made of thousands of individuals.

In addition to offering shelter and food to coastal species, oyster reefs buffer coasts from waves and filter surrounding waters.

DUNES

Dunes are coastal features made of blown sand. Healthy dunes often have dune grasses or other vegetation to keep their shape.

Dunes can serve as a barrier between the water’s edge and inland areas, buffering waves as a first line of defense.

WATERFRONT PARKS

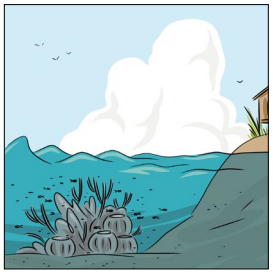
Waterfront parks in coastal areas can be intentionally designed to flood during extreme events, reducing flooding elsewhere.

Waterfront parks can also absorb the impact from tidal or storm flooding and improve water quality.

LIVING SHORELINES

Living shorelines stabilize a shore by combining living components, such as plants, with structural elements, such as rock or sand.

Living shorelines can slow waves, reduce erosion, and protect coastal property.



CORAL REEF

Coral reefs serve as a natural breakwater. They absorb wave energy and protect the coast from erosion and flooding.

Coral reefs support about a quarter of the ocean’s biodiversity. They can also provide recreational opportunities and support local economies.

SAND TRAPPING

Sand trapping is a method to make and support coastal dunes. Sand trapping fencing helps to build up the front of a dune.

Healthy dunes serve as a natural barrier between the coastline and inland areas. They reduce flooding and provide habitat for coastal animals and plants.

MAKING IT HAPPEN

It can be overwhelming to think about doing many projects at once or starting a large habitat improvement project. The following best practices can help ensure that the type and size of an NBS or hybrid solution matches a community's goals:

- **Determine project size (site, neighborhood, watershed/ landscape) based on the risk reduction goal.** A risk assessment, which is required for hazard mitigation plans, will help inform what level of risk to minimize. This also gives communities a broader look at possible solutions, from NBS to traditional. In a risk assessment, community leaders can also think about how future climate, land use and demographic conditions will change risk. Find more information on conducting a risk assessment for future conditions in Strategy Five, Designing for the Future.

- **Include NBS in main plans and policies.** Including NBS or hybrid solutions in community plans, like land use or transportation, can help meet both project and community-wide goals. This works well when project leaders use several small solutions in a neighborhood or combine them with larger efforts across a region. Including these solutions in hazard mitigation plans will also make sure the projects are eligible for FEMA funding. One effective strategy is to work NBS into existing laws and policies, such as zoning and building codes and those for land use. This includes updating any local codes that conflict with NBS. "One-off" projects may make sense when a community is first testing NBS. But making NBS official lets community leaders use them in a broader way.

  A Guide for Local Communities offers more tips for working NBS into any planning efforts. Another guide is Incorporating Nature-Based Solutions Into Community Climate Adaptation Planning from the National Wildlife Federation and EcoAdapt.

Paradise, California, is rebuilding from the fires of 2018 by developing "Resilience Parks." These parks will be open space, specially managed to reduce future fire risk. Project partners engaged the Conservation Biology Institute, and they will do a technical analysis to determine the ideal size and placement of the parks. The goal: turn these areas into a connected network of parks that provide fire risk reduction, recreation and habitat conservation.

- **Upgrade current infrastructure with hybrid solutions.** A community can upgrade its capital improvement projects already underway. Community leaders may want to consider hybrid solutions for projects such as:
  - Water and sewer.
  - Transportation.
  - Redevelopment.
  - Housing.

  New hybrid projects can also grow partnerships and funding opportunities beyond traditional sources.

PHOTO: *Natural landscape in the Everglades, southern Florida.*

MORE RESOURCES FOR MATCHING PROJECT SIZE WITH GOALS AND BENEFITS

Green Infrastructure Toolkit

From: Georgetown Climate Center Focus

Focus: Provides guidance for integrating NBS into existing planning and regulatory processes.

Practical Guide to Implementing Green-Gray Infrastructure

From: Green-Gray Community of Practice

Focus: Explores how to identify, fund, finance, plan, design, construct and monitor green-gray infrastructure projects, including ideas for hybrid projects.

Naturally Resilient Communities Partnership Website

Focus: Features over 50 NBS and case studies of different sizes based on hazard, region and more. It also includes a Procurement Guide to Nature-Based Solutions, which gives communities guidance, tips and best practices for drafting NBS proposals.

PHOTO: *River flowing through forested and plateaued landscape.*

CASE STUDY

Project Name: KC Water's Smart Sewer Program
Project Location: Kansas City, Missouri
Date Completed: Ongoing
Type of NBS Used: Rain gardens, bioswales, green roofs
Primary Risk Mitigation Benefit(s): Stormwater flooding and climate change

Kansas City leaders have added NBS elements to traditional infrastructure to reduce stormwater flooding. They have partnered with the EPA to address its sewer and stormwater overflows during rain events by combining NBS and traditional infrastructure. Together, they are repairing and replacing various parts of the system. They aim to use 480 acres of NBS to capture 85% of flow during typical rainfall events by 2040.

When planning these projects, KC Water engages the public at community meetings. By learning about neighborhood needs, project leaders can prioritize different types of NBS. The Smart Sewer program is using small-scale solutions like rain gardens, green roofs and pervious pavers to go with larger projects, which include:

- Bioswales.
- Permeable pavement.
- Infiltration trenches.
- Prairies.
- Detention wetlands.

NBS help the city meet its stormwater flooding and overflow goals, as well as its goal to have net zero emissions by 2040.

PHOTO: *Green infrastructure at Liberty Courtyard in Kansas City, Missouri. Photo credit: KC Water*

STRATEGY FOUR OF FIVE

MAXIMIZING BENEFITS

KEY IDEAS

1 NBS have a variety of benefits that can help a community with other risks and needs. Smart planning and design help a community see the most benefits.

2 Making small additions to project designs can help combine more project benefits. This leads to a greater return on investment.

3 Knowing how to define the top benefits helps community leaders find more project funding sources.

WHY MAXIMIZING BENEFITS MATTERS

NBS have a variety of benefits that communities can learn to define and maximize. Making small additions to project designs can help combine more project benefits. This leads to a greater return on investment. It can also help address the excess risk to underserved populations and vulnerable communities.

Reducing risk to natural hazards is a main goal. But it is just as important to include the many other benefits of NBS in the design. This makes sure projects are meeting a community's needs, and it helps:

- **Improve overall community resilience.** Natural hazards can create many challenges that can grow due to climate change. But the social, economic and environmental benefits of NBS can help neighborhoods, sectors and stakeholders overcome their challenges. This improves a community's ability to bounce back from hazards.
- **Get others to accept NBS.** Some NBS are new, others are not. But talking about and designing them to reduce the impacts of hazards is still new. Knowing how to promote their many benefits will help project leaders gain community, political and other stakeholder support. Project leaders can show the near-term benefits of projects when they identify and promote a variety of solutions. This is important when communities might not see some of the benefits for a few years, like fewer floods or wildfires.
- **Provide access to more funding opportunities.** It is important to reach a community's goals for reducing risks. This helps get project funding from FEMA. But additional benefits can also attract new and different mixes of funding. Communities often must measure the benefits to be eligible and show them in strategic ways. Find out more about possible funding sources in A Guide for Local Communities.

MAKING IT HAPPEN

Designing a project to include many benefits can be exciting and challenging. To get the most benefits, stakeholders will have to know about tradeoffs. The best way to talk about this is by engaging the community members. This makes sure that projects meet the needs of community members. Other practices include:

- **Doing informal "benefit assessments" with community members.** Community outreach can help project leaders find more benefits of NBS beyond reducing hazard risks. Do this with surveys early in the project planning stage. Assessments can also help boost local support for a project. For more, see Strategy Two, Engaging the Whole Community.

- **Highlighting key benefits throughout the project area and over time.** Often, community members do not see all the benefits right away (such as workforce development or educational opportunities). And some benefits may be further from the project site (like flood reduction downstream from habitat repair). It is important that project leaders show where the benefits happen and let people see them. The Communication Plan Guide in the FEMA Flood Risk Communication Toolkit for Community Officials gives tips on creating strong messages for the public.

- **Presenting project design options to show different benefits.** Different project designs can provide different benefits. For example, permeable pavers may reduce flooding for a project site, but rain gardens could be better for people's quality of life. Presenting different project designs, including a "traditional only" option, can call out different pros and cons. This can also get community members talking about what is best. The project partners can work with the project engineer to find which options to highlight.

  Talking about tradeoffs always brings different points of view, but everyone's views and goals will not always match. Be sure to address all views. Community outreach and strong partnerships will help make talks about tradeoffs productive.

- **Coming up with ways to measure different project benefits.** Project leaders can help tell the story of their project by measuring some of the benefits. This helps a lot when several small projects have combined benefits. It improves public outreach, fundraising and other support. Taking measurements can range from complex to simple. The complex way usually requires engineering studies. Some simple ways include:
  - Recording the air temperature on a city block before and after trees are planted.
  - Recording the number of homes likely to benefit from a forest management project.
  - Measuring the number of river miles repaired.
  - Capturing the number of short- and long-term jobs created.

- **Being clear about possible challenges.** Project leaders can respond to the challenges of NBS easier when they plan early. For example, riverfront parks can become popular with dog walkers, which can negatively affect water quality. Community leaders can support solutions that minimize those challenges and address such issues in the project outreach strategy.

At Exploration Green in **Clear Lake, Texas**, the community built local support to transform a golf course. The 200-acre space holds up to 500 million gallons of stormwater. It is fitted with ADA-accessible trails for hiking and biking, native trees and grasses for wildlife conservation, and wetlands for habitat protection. The facility also has an education and outreach program. It partners with nearby schools to teach kids about environmental conservation and stormwater management.

FEMA Funding of NBS Projects

FEMA has recently updated and expanded the Ecosystem Service Values for the Benefit Cost Analysis (BCA) Toolkit. These values and other policy changes have made it easier to include NBS in FEMA-funded hazard mitigation projects. These standard values are embedded into FEMA's BCA toolkit, calculated as "dollar per acre per year" values according to land cover type. Any hazard mitigation project that creates or modifies land cover, like buying land or restoring a stream, can include these standard values. Find more information in the report, FEMA Ecosystem Service Value Updates. The report explains how FEMA created the new values and summarizes the new and updated land cover types.

Promoting Nature-Based Hazard Mitigation Through FEMA Mitigation Grants, a guide developed by The Nature Conservancy, also provides information on how Hazard Mitigation Assistance (HMA) grants can fund NBS. This includes an overview of selecting the right NBS for a given hazard and location; FEMA HMA requirements; and how to get the most benefits for a given project.

Environmental & Historic Preservation (EHP) Primer for Nature-Based Hazard Mitigation provides information and best practices for doing EHP reviews. The guide is intended for larger NBS projects.

MORE RESOURCES FOR MAXIMIZING BENEFITS

Benefit Accounting of Nature-Based Solutions for Watersheds
From: United Nations CEO Water Mandate and Pacific Institute
Focus: Details a step-by-step process to identify benefits of NBS, from design stage through execution.

EPA's Green Infrastructure website offers resources to help communities carry out projects, including:

- Enhancing Sustainable Communities with Green Infrastructure: A Guide to Help Communities Better Manage Stormwater while Achieving Other Environmental, Public Health, Social, and Economic Benefits
  From: EPA
  Focus: Explains how to develop a vision to improve a community using NBS.
- Green Values Strategy Guide: Linking Green Infrastructure Benefits to Community Priorities
  From: The Center for Neighborhood Technology
  Focus: Highlights the ways that NBS benefit communities, including improved public health, safer transportation and increased economic development.

National Risk Index
From: FEMA
Focus: Online tool to help communities understand their risk to 18 natural hazards.

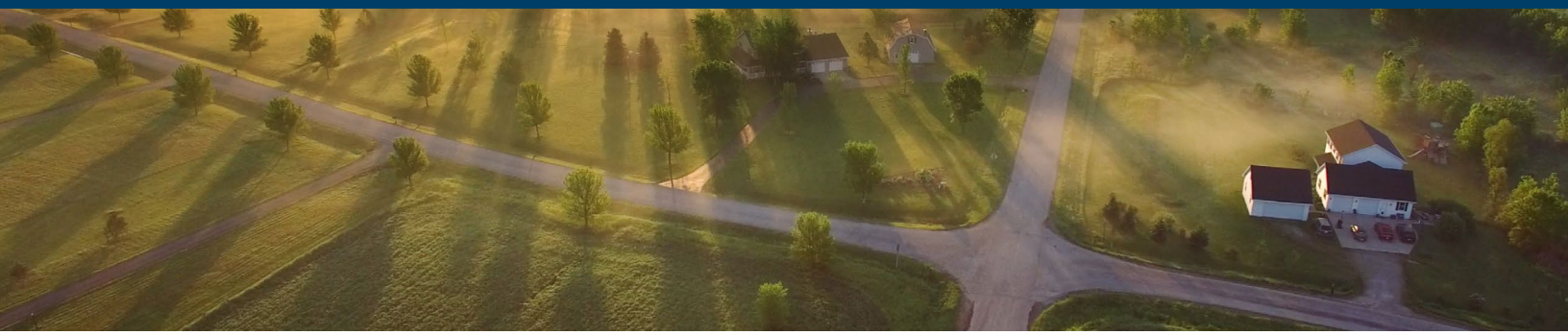


PHOTO: *Sunrise through ground fog with long shadows and sunbeams.*

CASE STUDY

Project Name: Green Heart Louisville
Project Location: Louisville, Kentucky
Date Completed: Ongoing
Type of NBS Used: Urban greening
Primary Risk Mitigation Benefit(s): Heat island effect and stormwater flooding

Louisville has some of the worst air quality in Kentucky and high rates of chronic disease. So, city leaders are investigating how urban greening affects human health, especially around heart disease, obesity and stress. They are planting thousands of trees and other plants in an underserved neighborhood. The project, named Green Heart Louisville, includes a partnership between the city and academic institutions such as the University of Louisville.

The project team studies how trees and plants affect certain chronic diseases. It also measures the effect on air pollution, urban heat island effect and flooding. These can all affect human health.

The team is studying the effect of the layout of the plantings as well. They found that the arrangement, heights and species of trees can affect the benefits. Their study also reported that efficient design can help future projects achieve their goals. These include:

- Reducing heat.
- Improving air quality.
- Controlling noise.
- Managing stormwater.
- Promoting biodiversity.
- Increasing property values.
- Lowering energy bills.

PHOTO: *Green Heart Louisville workers planting a tree.*
Photo credit: Tom Fougerousse/University of Louisville

STRATEGY FIVE OF FIVE

DESIGNING FOR THE FUTURE

KEY IDEAS

1 **Future conditions** combine three major factors that shape how hazards affect a community: climate change, population patterns and community development.

2 Communities that plan for future conditions in NBS projects adapt to changing risks in a cost-effective way. This planning reduces the impacts that hazard events have on people, infrastructure and the economy. It also helps to ensure that the project provides added benefits throughout the life of the project.

3 Planning for an unknown future can be challenging. Communities can use widely accepted data to assess future scenarios and choose the best solutions for them.

WHY DESIGNING FOR THE FUTURE MATTERS

Communities plan for future conditions because risk changes over time. Planning for future conditions in the design of NBS and other mitigation projects helps reduce long-term risk and provides benefits for years to come.

- **There are three factors of future conditions.** Future conditions affect a community's exposure to hazards and the impacts they can have. Communities must plan NBS with three factors in mind to better understand risk and reduce long-term impacts of hazards. These factors are:
  - *Population patterns*. As people move and demographics shift, risks change. More people living in a community means that more people may be exposed to a hazard event. Likewise, people leaving known hazard areas may reduce risk. This factor is especially important when talking about socially vulnerable populations. For example, a community with an older population may have a harder time responding to and recovering from a hazard event.
  - *Land use and community development*. Risks change as communities change how they use the land. Open spaces that benefit people may be lost to development. NBS can help address some of this loss, restore the ecosystem's natural benefits and reduce the impacts of a hazard event on a community. Understanding how land use and community development decisions affect risk can help community leaders choose the best NBS design.
  - *Climate change*. Many communities face more and changing disasters due to climate change. These events are growing worse and more frequent. Looking at possible scenarios and impacts can help communities design NBS that guard against those impacts.

- **Planning addresses complex changing conditions.** NBS can generate short-term benefits for changing population patterns and community development while also working toward long-term climate resilience. Because NBS can provide risk reduction, social and economic benefits, they are uniquely able to address the complex challenges of future conditions. There is more information on NBS' benefits in Strategy Four, Maximizing Benefits.
- **Planning works toward adaptive management.** To plan for an uncertain future, communities should design projects that help with overall adaptation efforts. Designing NBS for future conditions can boost the project's ability to withstand changing hazard risks. It also increases a community's ability to adapt to increased risks and bounce back from hazard events.

Local Planning

It has always been a requirement that local hazard mitigation plans discuss the probability of future hazards. The 2022 Local Mitigation Planning Policy Guide clarifies that the discussion of probability must include considerations for climate change and other future conditions. State, tribal and territorial mitigation plans also require considerations of future conditions.

MAKING IT HAPPEN

- **Use data-informed future conditions scenarios.** Community leaders cannot predict the future, but they can use widely accepted data to assess future scenarios for climate change, sea level rise, population changes, development changes and other topics. There are some data resources at the end of this chapter that project leaders can use. These resources can give community leaders a starting point for assessing future risks. It is important to communicate with certainty about the data and tools when talking with project partners, stakeholders and the public.
- **Plan for the long-term.** Changes in risk due to future conditions could affect a project's ability to succeed. Also, the ability of a project to reduce risk under current conditions may decrease under future conditions. Designing for future conditions can help an NBS project keep its value over time.

  For planning purposes, project leads should start with the built project's useful lifespan as a reference point. Starting here narrows down how far out to plan within a range of possibilities. Ideally, leaders will plan a project for at least 20 to 50 years out. This is comparable to a home mortgage. That can help community members

PHOTO: *Countryside landscape with mountain and lake in summer.*

understand the long-term goal, since it is still within their lifetime. From there, they should design NBS projects based on future projections for that planning horizon. This helps communities plan long-term without getting overwhelmed with options.

- **Do several assessments of current and future conditions if needed.** Many elements will affect the outcomes of future conditions, and some scenarios may not meet a project's aims. Assessing future conditions with different planning scenarios can give a community locally informed data and maps. Comparing the results of the assessments can help a community choose a scenario that has the intended outcome in the project design.

- **Adopt planning scenarios that work best for the community.** When planning for an uncertain future, consider a range of scenarios for different hazards, population patterns and development changes. Having options helps to plan for the uncertainty of future conditions. Communities can choose a planning scenario that fits their priorities. The chosen scenario can then inform the project design. Project leaders should consider the community's vulnerability in terms of geography, demographics and economy.

  The U.S. Climate Resilience Toolkit offers community leaders several resources to start planning for future conditions. The toolkit includes data, training, reports and more to help communities better understand risks and become more resilient. This is a great place to start, whether a community needs training, risk assessments, or a better understanding of the potential impacts to their community.

- **Develop an adaptive management plan for the project.** An adaptive management or maintenance plan for a project is important to lay out who will be responsible for ongoing care. This plan, which can be part of a community's capital improvement plan if appropriate, gives directions for making adjustments and repairs based on expected and unexpected changes. The EPA Green Infrastructure Operations and Maintenance website includes resources that can inform maintenance plans. Conservation partners can also help develop adaptive management plans for projects that involve habitat restoration.

MORE RESOURCES TO DESIGN FOR THE FUTURE

FEMA's Planning for Future Conditions Job Aid

Focus: Offers an overview of how future conditions can affect different hazard risks. It talks about different planning tools and offers a list of resources communities can use to learn more about addressing changing risks.

FEMA Resources for Climate Resilience

Focus: Introduces FEMA programs that advance community climate resilience. It covers analysis tools, planning programs and funding opportunities available to FEMA's state, local, tribal and territorial partners.

Resources for assessing current and future risks:

- EPA's Climate Change Indicators explore a key set of indicators related to the causes and effects of climate change. These indicators also provide important input to the National Climate Assessment and other efforts to understand and track the science and impacts of climate change.
- NOAA's Coastal Flood Exposure Mapper lets coastal communities across the U.S. assess possible coastal flood hazards. These include sea level rise, storm surge, high tide, tsunami and combination flooding. The tool illustrates exposure of various demographics, infrastructure and natural resources to these hazards.
- NOAA's Sea Level Rise Viewer shows community-level impacts from sea level rise. The mapper offers data on water depth, flood frequency, socioeconomic vulnerability and more.
- The Union of Concerned Scientists' Heat Index Thresholds Mapper shows the projected rise in extreme heat due to climate change. It presents data for 48 states at a county level. It includes different scenarios for four different heat index thresholds and allows data downloads.

CASE STUDY

Project Name: Lightning Point Shoreline Restoration
Project Location: Bayou La Batre, Alabama
Date Completed: Summer 2020
Type of NBS Used: Coastal restoration
Primary Risk Mitigation Benefit(s): Coastal flooding and coastal/riverine erosion

After decades of coastal erosion from hurricanes and other storms, the shoreline of Bayou La Batre in Mobile County, Alabama, is getting a new life. Local officials have designed the Lightning Point Restoration Project to reduce the impacts of future sea level rise and storm surge scenarios.

The project was a joint effort of the city of Bayou La Batre, the Alabama Department of Conservation and Natural Resources, Mobile County and several other organizations. Rebuilding the shoreline helps protect the community from an anticipated 0.83-foot increase in sea level during the project's 25-year lifespan.

The project design features several NBS. A low-impact parking lot with NBS provides better stormwater management. It also created 40 acres of marsh, tidal creeks and upland habitats to support local wildlife.

The project achieved four main goals:

- Shoreline protection.
- Habitat creation.
- Managed access.
- Beneficial use of dredged material.

Team members used a 25-year planning scenario to plan for future conditions. They built 1.5 miles of breakwaters and two jetties to protect the shoreline from future storms. They also developed a plan for making repairs and fixing what is not working well. This will help the structures remain resilient to sea level rise after their 25-year lifespan.

PHOTO: *Lightning Point shoreline after restoration. Photo credit: Sam St John, FlytheCoast.com*

CONCLUSION AND NEXT STEPS

Climate change is making natural hazard events more severe. And existing issues will cause these hazards to affect underserved and socially vulnerable communities the most. With so many options, nature-based solutions help communities reduce their risks in the face of changing conditions. They also help address existing social and economic shortfalls.

The strategies in this guide offer a path to carry out NBS projects. Communities can choose which solutions will work best for their risk profile, goals and needs.

Next Steps

Taking a few important first steps will help community leaders advance NBS projects. These include:

- Review local plans (e.g., hazard mitigation or watershed management) to find possible projects where NBS can play a role in reducing risk. Clarify the main risk reduction goal and the level of impact desired.
- Gather community partners to talk about the project's value and to think of other possible partners.
- Explore other goals and benefits that partners would like to discuss during community engagement, and identify key future conditions that could influence the project.
- Start working with local community representatives to draft the community's NBS path.

PHOTO: Riverfront park with boardwalk in Little Rock, Arkansas.

FEDERAL NATURE-BASED SOLUTIONS TRAININGS

FEMA and its federal agency partners have developed different training programs to help community leaders and partners with NBS projects. Here are some to help local communities get started:

- Nature-Based Solutions for Mitigating Hazards is a course offered by the National Disaster Preparedness Training Center. It provides information on NBS, including planning and implementation resources, as well as common barriers for their use. Leaders will find what they need to select and promote NBS as a way to make their communities safer.
- NOAA Digital Coast Nature-Based Solutions for Coastal Hazards is a course that prepares coastal managers to plan and carry out NBS to reduce hazards in their communities. The two-part course includes a 1-day in-person or virtual event that allows participants to interact with peers and local experts.
- Creating Co-Benefits Through Hazard Mitigation Planning and Water Resource Management is a course hosted by the EPA's Watershed Academy. It explores how EPA's water quality planning and FEMA's hazard mitigation planning processes can align around NBS. The training reviews EPA water quality and FEMA hazard mitigation programs, identifies areas of potential overlap in planning efforts and funding opportunities, and provides case studies of successful projects.

PHOTO: Individual gardening plots in urban community garden.

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