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FLORIDA PRACTITIONERS FIND CONSENSUS ON ADVANCING NATURE-BASED SOLUTIONS

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Contents

About EDF	2
Executive Summary	3
Introduction	5
Results	6
Recommendations	10
 Develop Clear and Straightforward Permitting. Boost Long-term Funding for Monitoring and Maintenance Create Design Guidance Raise Public Awareness. Create Accessible Tools to Quantify the Value. Invest in Technical Assistance for Communities. Expand Workforce Development. Enhance Interagency Coordination 	10 12 13 14 16 17 18 19
Conclusion	20
Methods	21
References	23
Appendix A: Acronyms and Abbreviations	26
Appendix B: Modeling Florida Through a Systems Thinking Workshop	27
Appendix C: Practitioner Survey	29
Appendix D: Additional Survey Responses	31

About EDF

Founded in 1967, the Environmental Defense Fund (EDF) is a global leader in developing practical, science-based solutions to critical environmental challenges. EDF helps governments, businesses, and communities create and implement locally driven solutions. These efforts focus on recovering from disruptive events and building long-term resilience to environmental hazards.

Executive Summary

Florida faces increasing environmental challenges from severe storms, chronic flooding, and sea-level rise. Nature-based solutions (NBS)—strategies that leverage natural processes to protect, restore, and manage ecosystems—offer a vital pathway to ensure Florida's resilience and safeguarding communities. In addition to increasing long-term resilience to environmental shocks and stressors, NBS can offer numerous benefits, including habitat preservation, flood mitigation, improved water and air quality, and opportunities for recreation and tourism. Many types of NBS also have a higher return on investment compared to gray infrastructure. However, despite these advantages, NBS remain underutilized and often overlooked in Florida.

To better understand the barriers hindering broad NBS implementation and identify actionable strategies for improvement, the Environmental Defense Fund (EDF) conducted a workshop and a survey of 90 practitioners working in NBS across key sectors: local and county governments, non-profit organizations, water management districts, academia, engineering, contracting, and consulting. While the survey directly asked for recommendations for EDF to strengthen NBS implementation in Florida, we opted to share this information more broadly. Many suggestions require collaboration across government, private, and non-profit sectors and extend beyond the immediate scope of EDF's work. Furthermore, this information provides valuable insights for stakeholders across sectors by highlighting systemic challenges and policy strategies identified by a diverse group of statewide experts. Their insights revealed the following key priorities for scaling up NBS in Florida, presented, generally in the order of their popularity as recommendations:

1. **Develop Clear and Straightforward Permitting:** Over half of practitioners identified complicated permitting as a key roadblock. Participants noted that simplifying local, state, and federal processes, especially for small-scale NBS projects, would speed up approvals and bring benefits to communities sooner.

2. **Boost Long-term Funding for Monitoring and Maintenance:** Financial support for monitoring and maintenance were, respectively, the second and fourth most significant barriers to NBS implementation. Investing in monitoring and maintenance would enable data-driven adjustments to improve effectiveness and ensure communities continue to benefit from projects in the long term. 3. **Create Design Guidance:** More than a third of practitioners identified the lack of standardized design guidelines as a significant barrier. Developing a "menu" of tested NBS designs or a comprehensive design manual could simplify permitting, provide practical options for engineers unfamiliar with NBS, and still allow for innovative, site-specific solutions.

4. **Raise Public Awareness:** Over 32% of practitioners highlighted a significant gap in public awareness and support of NBS. Suggestions ranged from creating interactive maps of projects across Florida to producing one-page summaries in multiple languages with images and simple text, as well as brief videos featuring success stories from property owners and local governments.

5. **Create Accessible Tools to Quantify the Value:** Practitioners emphasized the need for accessible tools to quantify and communicate the economic, social, and ecological benefits of NBS projects. Simplified assessments would help prioritize projects that offer the best return on investment and long-term outcomes.

6. **Invest in Technical Assistance for Communities**: 26% of participants highlighted that securing funding for NBS projects can be challenging due to varying financial requirements and application stipulations. Many survey respondents expressed the need for increased technical and social support to help local governments and community organizations navigate these challenges and submit competitive applications.

7. **Expand Workforce Development:** 21 practitioners noted a growing need for expertise in NBS design, engineering, construction, and maintenance. Expanding training programs in design, construction, and maintenance would ensure Florida has the workforce to implement these solutions at scale.

8. Enhance Interagency Coordination: Disjointed coordination between state and federal agencies emerged as a critical challenge, with 23% of respondents identifying it as a top barrier. Practitioners recommended fostering collaboration through roles like Chief Resilience Officers or centralized working groups. These structures could align agency efforts, streamline communication, and enable more cohesive planning.

By addressing these recommendations, Florida can unlock the full potential of nature-based solutions. These steps will strengthen the state's capacity to protect its communities and ecosystems, paving the way for a more resilient future.

Introduction

Coastal and inland communities across the United States face increasing environmental hazards such as sea level rise, extreme storm events, and chronic flooding (U.S. Global Change Research Program, 2023). This vulnerability is particularly pronounced in Florida, which has six of the top 10 U.S. counties with the highest number of jobs at risk from flooding (NOAA, 2024). To address these challenges, Florida has made notable progress, including establishing its Office of Resilience, appointing a Chief Resilience Officer, and dedicating substantial funding for resilience projects focused on flooding and sea level rise.

Nature-based solutions (NBS)—strategies that work with nature or as part of nature to protect, restore, and manage natural ecosystems—are powerful tools for adapting to a changing climate (Seddon et al., 2020). In addition to increasing long-term resilience to environmental shocks and stressors, NBS offers numerous benefits, including habitat preservation, flood mitigation, improved water and air quality, recreation, and tourism (Chausson et al. 2020; Seddon et al. 2021; Seddon, 2022). Notably, NBS also presents a high return on investment: for example, in many Florida regions, every dollar invested in mangrove restoration is estimated to save over \$15 in flood protection (Beck et al., 2022). However, traditional "gray" engineering strategies like dams, levees, and seawalls are still the default strategy for storm protection and flood resilience, especially in southeastern states such as Florida (Reguero et al., 2018; Dario et al., 2024).

To explore how Florida can become a leader in NBS, the Environmental Defense Fund (EDF) conducted in 2024 a small virtual workshop and a statewide survey of 90 Florida practitioners from major sectors of NBS implementation: local government, non-profit organizations, water management, county government, academia, and engineering. Practitioners a) analyzed Florida's system of implementing NBS, b) determined major barriers to adoption, and c) outlined actionable recommendations for strengthening implementation efforts.

While the survey directly asked for recommendations for EDF to strengthen NBS implementation in Florida, we opted to share this information more broadly. Many suggested strategies require collaboration across government, private, and non-profit sectors and extend beyond the immediate scope of EDF's work. Furthermore, this information provides valuable insights for stakeholders across sectors by highlighting systemic challenges and policy strategies identified by a diverse group of statewide experts.

This report explores the current landscape of NBS in Florida, the challenges to their broader implementation, and strategies for overcoming these barriers. The report also highlights actionable pathways to integrate NBS into Florida's climate adaptation efforts and infrastructure planning for a more resilient future.

Results

Overview of the participants

The survey gathered data on respondents' professional backgrounds, including their sector of employment (e.g., federal government, academia, private sector) (Figure 1). It was distributed via email, listservs, and newsletters from relevant organizations, and practitioners were encouraged to share the survey within their networks to enhance participation. We directly emailed the survey to 266 practitioners. This outreach strategy led to a total of 90 responses (see Appendix C for a full copy of the survey).



Figure 1: Categories that best describe the professional roles of survey respondents. Participants could select multiple categories, reflecting the diverse sectors involved in naturebased solutions (NBS) implementation in Florida. This figure illustrates the range of professional backgrounds represented in the survey.

Identifying barriers to implementation

Workshop participants identified ten key stages of implementing nature-based solutions: political support, public awareness/community engagement, scoping, planning, permitting, funding, design, construction, monitoring/assessing project outcomes, and maintenance postconstruction.

We asked survey respondents to choose at most three phases of implementation where "naturebased solutions are most likely to be hindered", with the option to write in additional phases not listed in the question (Figure 2). Survey respondents were also encouraged to explain why NBS solutions are prone to challenges at the phases they selected.



Figure 2: Phases of implementation where nature-based solutions (NBS) in Florida are most likely to be hindered, as identified by survey respondents. Participants could select up to three phases, leading to a total count greater than the number of respondents. This figure highlights the critical stages where NBS projects encounter the most significant obstacles.

During the practitioner workshop, participants also described eight main barriers to implementing nature-based solutions in Florida (See Appendix B). We asked survey respondents to choose up to three of "the biggest barriers to implementing nature-based solutions" (Figure 3). Survey respondents were given the option to identify additional barriers not listed in the question and an optional free response section to explain their selections.



Figure 3: Key barriers to implementing nature-based solutions (NBS) in Florida, as identified by survey respondents. Participants were allowed to select up to three barriers, resulting in a total count exceeding the number of respondents. This figure underscores the most prevalent challenges practitioners face when advancing NBS projects.

Identifying opportunities for change

Using the discussion from the practitioner workshop, we identified eleven main recommendations or opportunities for enhancing the implementation of nature-based solutions in Florida. We asked survey respondents to choose up to three of the recommendations that the Environmental Defense Fund should prioritize to enhance the implementation of NBS in Florida most effectively (Figure 4). Survey respondents were also given the option to identify additional barriers not listed in the question and an optional free response section to explain their selections.



Figure 4: Recommendations that should be prioritized by the Environmental Defense Fund to most effectively enhance the implementation of nature-based solutions (NBS) in Florida, according to survey respondents. Participants were asked to select up to three recommendations, with the option to add additional suggestions. This figure highlights the strategies deemed most influential for advancing NBS implementation in the state.

Recommendations

1. Develop Clear and Straightforward Permitting

Workshop and survey participants overwhelmingly identified updating and simplifying permitting processes as a critical opportunity to move more NBS projects from concept to fruition. Over half of respondents picked "complex and lengthy state permitting systems" as one of the biggest barriers to implementing NBS. Several respondents noted that the current permitting system's complexity, cost, and duration often incentivize property owners and decision-makers to pursue traditional gray infrastructure instead of NBS. As one participant noted, "I work a lot with private property owners and once they hear what is required for permitting or how long they would have to wait for permits many want a different option." Even for property owners or decision-makers who might be open to or benefit from NBS, the practical and perceived difficulty of permitting can make it seem like traditional grey infrastructure is the only viable option. Harmonizing state and federal permitting processes and expanding permit exemptions were high-priority strategies for scaling up implementation.

Nature-based solutions often fall under multiple jurisdictions with different permitting criteria. This complexity is especially pronounced when attempting to permit living shoreline projects, a type of NBS that uses natural materials like marsh grasses, oyster reefs, and mangroves to stabilize shorelines. Currently, applicants must navigate two distinct living shoreline permit exemptions from the Florida Department of Environmental Protection (DEP) and the U.S. Army Corps of Engineers (Corps). While the Corps permits projects extending up to 30 feet from the mean low waterline (<u>Barry et al., 2019b</u>), DEP limits projects to just 10 feet from the mean high waterline (<u>Barry et al., 2019a</u>). Exemptions, when approved, can dramatically reduce the time and cost associated with permitting. However, this mismatch in state and federal permitting criteria can increase the time, cost, and complexity of permitting living shoreline projects.

Practitioners suggested different avenues to address the requirement for two distinct living shoreline exemption permits for a single project. Over 42% of survey respondents emphasized the need to expand permit exemptions as a top priority, and nearly as many advocated for a joint state and federal permitting for living shorelines and other NBS. Participants emphasized that streamlining the permitting process through a unified living shoreline permit exemption could reduce the complexity of navigating both systems, making living shorelines a more appealing and practical option for coastal protection and resilience.

Practitioners also noted the opportunity to update requirements for permit exemptions that currently limit the effectiveness of eligible NBS, especially living shorelines. For example, the current design restrictions of DEP's living shoreline permit exemption can increase costs and reduce effectiveness. The exemption's height and location limits do not consider future sea level rise, potentially compromising the long-term resilience of eligible projects (Martin et al. 2024). Specifically, DEP's permit exemption does not allow living shorelines such as oyster reef breakwaters to be built above the mean high water line (Barry et al., 2019a). As one practitioner observed, "With projected sea level rise, building reefs just level with average high tides won't even offer as much protection during current high water events, let alone rising water levels." To permit more resilient and protective living shorelines such as taller oyster reefs, projects need to get an individual permit which takes longer to approve and is more expensive (Martin et al. 2024). As a result, designers often create plans to meet permitting rules, rather than the optimal design for the site's resilience.

Several participants also pointed out that the Florida Administrative Code (F.A.C.) 18-21 has a permitting requirement that favors grey engineering over living shorelines. For homeowners to build within 25 feet of their waterfront property line, F.A.C. 18-21 requires a waiver signed by adjacent property owners, even if the project stays within their property boundaries. However, traditional structures like seawalls, bulkheads, and riprap are exempt from this requirement (18-21.004(3)(d)). Participants noted that living shorelines do not have this exemption, making living shorelines harder or even impossible for property owners to pursue. One survey respondent described a project where a neighbor successfully pressured a property owner to build a seawall instead of an oyster reef by refusing to sign the required waiver.

Expanding permit exemptions to cover more robust living shoreline designs with lower maintenance costs could encourage property owners to choose living shorelines over traditional hard structures (<u>Martin et al. 2024</u>). Updating and expanding these regulations, based on the latest science regarding living shoreline performance and sea level rise, would allow property owners and decision-makers to prioritize the most effective designs rather than focusing on meeting outdated permitting requirements.

Streamlining and modernizing the permitting processes for NBS is essential to fostering their widespread adoption. Harmonizing state and federal permitting requirements and expanding permit exemptions to incorporate robust, future-focused designs can significantly reduce the complexity, cost, and time associated with implementing these projects. Addressing

inconsistencies and redundancies in the current system would empower property owners and decision-makers to choose adaptive, resilient solutions over traditional gray infrastructure. By updating permitting frameworks to reflect cutting-edge science and accommodate anticipated impacts like sea-level rise, Florida can position itself as a leader in innovative and sustainable coastal resilience strategies.

2. Boost Long-term Funding for Monitoring and Maintenance

Workshop attendees and survey participants emphasize the critical need to invest in long-term monitoring and maintenance to ensure the best outcomes for NBS. Respondents highlighted that data gathered from sustained monitoring is essential for informing future NBS projects and consistent maintenance is crucial for ensuring that the benefits of these projects are sustained over time. However, practitioners highlighted that limited funding opportunities for these postconstruction activities pose a significant challenge.

Participants identified the lack of financial support for monitoring and maintenance as the second and fourth most significant barriers to NBS implementation, respectively. Despite their importance, many grant programs do not fund these activities. Out of 56 federal funding sources listed by the Environmental Protection Agency for "green infrastructure and nature-based solutions," only 22 fund monitoring and assessment of project outcomes (EPA, 2024). In the same list of federal funding sources, only 12 out of 56 can be used for operations and maintenance (EPA, 2024). Similarly, Florida's Statewide Flooding and Sea Level Rise Resilience Plan, a vital funding source, excludes "operations, and maintenance activities" (Fla. Stat. §380.093(5)).

Expanding funding for long-term monitoring represents a critical opportunity to scale up NBS implementation. Of the 90 respondents, 24 selected "increasing funding opportunities for voluntary long-term monitoring" as a top opportunity for advancing NBS adoption. One participant proposed that NBS grant funding should require monitoring periods of at least five years, allowing for a more comprehensive evaluation of ecological and social outcomes. Another option is to incentivize Resilient Florida grant applications that include long-term monitoring plans for NBS projects. Such approaches would ensure stakeholders can assess NBS effectiveness comprehensively, make data-driven improvements, and enhance project resilience over time.

While most grant funding generally supports the design and installation of NBS, long-term success also depends on regular maintenance to ensure ecosystems continue to function. As one respondent wrote, "If the operations of maintaining are not done, its value as a solution is diminished. It is a common problem for a community." Providing dedicated funding for operations and maintenance would help ensure that NBS continue to deliver benefits, including flood mitigation, habitat restoration, and climate resilience.

By prioritizing funding for both monitoring and maintenance, stakeholders can enhance the durability and performance of NBS. This approach will help maximize the long-term impact of these solutions, fostering stronger, more resilient communities and ecosystems throughout the state.

3. Create Design Guidance

Currently, there are no overall NBS guidelines tailored to Florida's unique ecosystems and regions. Over one-third of participants identified the absence of standardized design guidelines as a significant barrier to implementation, while more than 16% noted that the design phase is a common bottleneck for advancing NBS projects. As one respondent explained, this absence of standardized designs complicates and prolongs the NBS permitting process because there are fewer proven concepts to expedite approvals.

More than 25% of respondents identified developing standardized design guidelines as a top opportunity for EDF to improve the current system of implementing nature-based solutions. Multiple workshop and survey participants stated that standardized design guidelines would make permitting easier. One workshop attendee recommended combining standardized design guidelines with permitting reform by streamlining the permit process of projects that follow these guidelines.

Other participants proposed alternatives to traditional guidelines, such as design menus or manuals. One survey participant suggested a "menu" of "vetted and tested NBS designs that are recognized through long-term monitoring would help justify the approval of NBS solutions to permitting and planning staff." Similarly, another practitioner recommended the creation of a "Living Shoreline Manual for the state" with practical recommendations for design, permitting, and planning. A menu of tested designs or an NBS manual would assist in streamlining permitting and give feasible ideas to engineers unfamiliar with NBS while allowing for innovative and site-specific designs.

While the lack of standardized guidelines remains a significant obstacle, it represents an opportunity to enhance NBS adoption. By developing state-specific guidelines, menus, or manuals through collaboration among practitioners, regulators, and researchers, Florida can simplify permitting, promote innovative designs, and accelerate the implementation of nature-based solutions tailored to its unique environmental and resilience challenges.

4. Raise Public Awareness

Workshop and survey participants stressed the need to improve communication strategies for NBS. Eighteen respondents identified "increasing visuals and supportive communication" as key to advancing NBS. Much of the public and even elected officials do not understand why NBS are needed or how they benefit communities. NBS rely on a potentially less familiar idea that healthy ecosystems benefit people. Restoring ecosystems and using hybrid structures that mix traditional engineering with natural processes can offer many benefits. Logically, people who are unfamiliar with the benefits of natural ecosystems are less likely to prioritize strategies that protect, restore, or harness those ecosystems.

Elected officials and decision-makers tend to stick with traditional grey infrastructure because it is what they are familiar with or what has been used in the past. Consequently, practitioners consistently highlighted the public's lack of familiarity with NBS as a critical barrier. Political support and public awareness were respectively the third and fourth most frequently identified phases where nature-based solutions are inhibited. Furthermore, nearly a third of survey respondents chose "lack of public awareness and support for NBS" as a top barrier to implementation.

Practitioners emphasized that showcasing successful pilot projects and providing clear, basic information about NBS could boost public awareness and address other barriers to political support. One practitioner wrote, "NBS needs to have a large 'marketing' plan...to get the word out to everyone and why they should modify their thinking and preferences." Key recommendations for these communications include explaining the types and benefits of NBS and sharing successful case studies. Suggestions ranged from creating interactive maps of projects across Florida to producing one-page summaries in multiple languages with images and simple text, as well as brief videos featuring success stories from property owners and local governments.

Highlighting positive outcomes and relatable examples can help normalize NBS, making them more appealing to homeowners, developers, and government agencies. Compelling visuals and simple, easy-to-understand materials could also serve as valuable tools for local NBS advocates who may lack the resources to create their own communications. Additionally, featuring stories from relatable and trusted sources could help solidify the perception of NBS as a consensus issue.

Drawing from successful communication campaigns in the non-profit, government, academic, and federal sectors, Florida can create effective materials to introduce the public to NBS, highlight their benefits, and guide implementation. The following are four examples of successful visual and communication campaigns for nature-based solutions:

i. Nonprofit: Through a series of workshops led by The Nature Conservancy, the Nature-Based Exchange developed a website, pocket guide, Instagram page, podcast episodes, and several reports with compelling graphics for general audiences (<u>Nature-Based Exchange</u>, <u>2023</u>).

ii. State government: Louisiana's Coastal Protection Restoration Authority partnered with Scape, an innovative landscape architecture firm, to make their 2023 Coastal Master Plan with easy-to-understand graphics and diagrams to explain NBS strategies that enhance the resilience of Louisiana's coastline (<u>Coastal Protection and Restoration Authority, 2023</u>).

iii. Academia: Florida Sea Grant has begun to increase public awareness about living shorelines, a type of NBS, by building demonstration living shoreline projects and creating a variety of publications, infographics, and workshops as well as a website with an interactive map of projects constructed in different Florida counties (<u>Martin et al. 2024</u>).

iv. Federal government: Engineering with Nature (EWN), a program of the US Army Corps of Engineers, has created a comprehensive website and a successful podcast about different strategies to align natural and engineering processes. EWN has also leveraged photography through several volumes of *Engineering with Nature: an Atlas*, which contains dynamic case studies, methodologies, and success stories of NBS (<u>Bridges, et al. 2018</u>).

Despite using various avenues and techniques to increase visuals and communications, all the campaigns described above a) engage powerful visual storytellers such as landscape architects and b) utilize media and platforms familiar to their audiences. The outreach models described

above could be emulated with a larger NBS campaign tailored to Florida's ecosystems, regions, and communities.

5. Create Accessible Tools to Quantify the Value

Participants observed a significant gap in information, particularly when it comes to measuring the impacts of NBS. As one respondent explained, "It is more difficult to place clear markers of benefit to NBS because the gains are not always clearly observed (where a pond removes flooding it's obvious and quantifiable), but how do you quantify a growth in community benefit with a wetland park?" Several open-ended responses identified the need to better quantify and communicate the benefits and outcomes of nature-based solutions. Participants noted this lack of accessible methods for evaluating NBS benefits can lead to an overreliance on traditional, grey infrastructure, which has more established methods for calculating benefits.

Developing accessible, easy-to-understand tools to quantify and communicate the economic and social benefits of nature-based solutions could address many barriers to implementation. Simplifying the estimation of benefits would help communities and government officials prioritize projects that offer the best return on investment and long-term outcomes. Additionally, by illustrating benefits such as water quality improvement, flood mitigation, increased property values, enhanced recreational opportunities, and boosted tourism, decision-makers could make the case for NBS without requiring public consensus on broader issues like climate change or sea-level rise.

Several existing tools and frameworks already provide a foundation for this work. For example, <u>Stanford University's Natural Capital Project</u> has developed 20 models to map and value the benefits of alternative management choices, identifying areas where investments in NBS can enhance human development and conservation. However, these models typically require expertise in complex geographic information systems, making them inaccessible to the public and non-experts.

Conversely, tools like <u>i-Tree</u> demonstrate the value of user-friendly platforms. i-Tree enables anyone to estimate the environmental benefits of urban tree planting projects in terms of air pollution reduction, stormwater mitigation, energy savings, and tree canopy growth. While

highly accessible, i-Tree focuses only on urban forestry and does not address the full spectrum of NBS options.

To bridge this gap, Florida could develop an intuitive, tailored tool focused on the state's most relevant nature-based solutions and key ecosystem benefits for its residents. Such a tool would translate existing scientific models into actionable, quantifiable metrics, empowering communities to assess and advocate for solutions aligned with their unique needs, resources, and goals.

6. Invest in Technical Assistance for Communities

Survey respondents identified the need for increased technical and social support to help local government and community organizations scale up the implementation of NBS. Participants identified securing funding for NBS projects as a major challenge, citing the significant financial demands and the varied stipulations of different funding sources. Respondents specifically noted that smaller cities and communities often do not have the dedicated staff, subject-matter experts, and funds to meet the requirements for grant applications and requirements.

Out of 90 participants, 24 ranked navigating multiple funding applications and requirements as a top barrier. One participant explained, "There is a steep learning curve that decisionmakers...go through to take advantage of other options available to them. There is a need for information and training." Additionally, many participants noted many communities struggle to identify funding opportunities and are not aware of existing resources.

To address this gap in resources and awareness, respondents suggested using webinars, workshops, and one-on-one technical assistance. Such resources could provide clear, detailed guidance on funding and permitting processes, covering essential topics like financial incentives, approval timelines, and contact information for waiving permitting fees.

For example, by investing in additional technical and social support for applicants of the Resilient Florida grant program, legislators and officials build on the success of the program. The Resilient Florida program has allocated over \$1.4 billion toward initiatives addressing vulnerabilities to flooding, storm surge, sea level rise, and extreme storms (Resilient Florida Program, 2024). Staff from the Florida Department of Environmental Protection (DEP) offer a range of support services to help applicants navigate the process (Resilient Florida Program, 2023). These include webinars for general program information, office hours for answering

questions up to six months before the portal closes, and pre-submittal application reviews. Staff also assist in preparing GIS files for proposed project locations. However, due to high submission volumes, this level of assistance is not guaranteed within three months of the application deadline.

A quick review of the geographic distribution of Resilient Florida Implementation grants suggests that awards are concentrated in larger, wealthier coastal communities such as Tampa Bay, Broward, and Miami-Dade County. Meanwhile, smaller communities and less affluent areas, including those in the Big Bend, Panhandle, and Heartland regions, are underrepresented (Resilient Florida Program, 2024). This pattern suggests that well-resourced communities are better equipped to apply for and secure grants.

Increasing the Resilient Florida program's budget and staff could allow the DEP to provide technical assistance and resources to applicants. This support would ensure that smaller and under-resourced communities can submit competitive applications that address local needs. These additional resources and technical support would ensure critical projects across Florida are funded and more residents benefit from this vital program.

7. Expand Workforce Development

Participants emphasized the need and opportunity to build a larger workforce with knowledge about nature-based solutions. Notably, 21 out of 90 survey participants identified "developing a larger workforce with NBS knowledge" as a top opportunity for improving the implementation of nature-based solutions. Several open-ended respondents observed that engineers, consulting firms, or contractors generally lack experience in designing nature-based solutions. As one respondent observed, "Many recognized consulting firms are only used to using hard engineering." Survey and workshop participants noted that this lack of experience or familiarity with NBS contributes to a general overreliance on traditional, grey engineering solutions.

Workforce development and targeted training can help meet growing demands for expertise in NBS within the engineering, design, and contracting fields. Florida's workforce can be expanded by a) creating training courses and certification programs on NBS for contractors, engineers, architects, and planners, and b) offering vocational or technical education for young people and adults starting new careers.

Existing professional development programs can serve as models for expanding Florida's workforce. As previously mentioned, Florida Sea Grant offers training courses about living shorelines for marine contractors (Florida Sea Grant, n.d.). Similarly, the National Oceanic and Atmospheric Administration (NOAA) and the Federal Emergency Management Agency (FEMA) created virtual modules for planning professionals about using NBS to mitigate environmental hazards and improve water quality (NOAA, n.d.). The Louisiana Watershed Initiative also has a "Working with Nature" training series that provides the knowledge and training necessary to design and develop NBS projects that address various environmental hazards (Louisiana Watershed Initiative n.d.). Florida-specific professional development programs could follow these models while providing tools for NBS development tailored to Florida's unique ecosystems, communities, and permitting system.

Collaborating with Florida's colleges, universities, technical schools, and professional associations can also help create the next generation of NBS experts. Offering vocational training, technical education, or apprenticeships in NBS design, construction, and maintenance for young people and adults starting new careers would expand Florida's expert workforce and help residents access in-demand jobs. For example, Louisiana's New Harmony High School educates students through the lens of coastal restoration and preservation with project-based learning and community partnerships (<u>New Harmony High, 2024</u>). New Harmony and other training programs can serve as a model for expanding the depth and breadth of Florida's workforce knowledge of nature-based solutions while creating job opportunities.

8. Enhance Interagency Coordination

Workshop and survey participants highlighted the need for improved coordination between state and federal agencies on NBS efforts. 23% of respondents identified disjointedness between state and federal agencies as a top barrier to implementing nature-based solutions. Practitioners in both methodologies observed that NBS efforts are often fragmented due to the involvement of multiple agencies with overlapping responsibilities and limited communication. In open-ended responses, participants noted that this disjointedness leads to a) uncoordinated internal and public communication, b) additional complexity in navigating funding opportunities, c) difficulty managing distinct permitting requirements and applications, and d) gaps in strategic planning.

Nearly 19% of respondents ranked increasing interagency coordination through Chief Resilience Officers or working groups as a top opportunity for enhancing the implementation of naturebased solutions. Other open-ended responses specifically looked toward the position of Florida's Chief Resilience Officer and the Office of Resilience as an ideal coordinator of interagency and multi-level efforts to implement nature-based solutions. One respondent suggested that the Florida Office of Resilience "should be at the head of these efforts" and ensure information is "clearly disseminated". Another open-ended response suggested having "a one-stop shop for anyone looking for resources" would help unify the "several groups in the state overlap their messages and goals".

Florida has made strides in interagency resilience planning through the creation of formal and informal committees, such as Mitigate FL and the Mitigation and Resilience Coordination Working Group. Although not specifically mentioned by workshop participants, these groups or a newly established working group—could be leveraged to enhance interagency communication and collaboration on implementing nature-based solutions, as is done in Louisiana, South Carolina, and other states. Enhancing interagency coordination would further unite different agencies around NBS as a tool for disaster mitigation and resilience planning, as well as ultimately improving the state's capacity to prepare for and adapt to natural hazards.

Conclusion

Nature-based solutions (NBS) present a vital opportunity for Florida to build resilience and address growing environmental challenges. While NBS offer significant benefits—ranging from flood mitigation and habitat preservation to improved air and water quality—their widespread adoption is hindered by several barriers. By leveraging insights from practitioners across key sectors, this report provides actionable recommendations to overcome the systemic barriers limiting NBS implementation in Florida.

By addressing permitting complexities, ensuring sustained funding for monitoring and maintenance, developing design guidance, and expanding public awareness, Florida can ensure more NBS projects go from concept to fruition. Additionally, quantifying the economic and social benefits of these solutions, providing technical assistance to local communities, investing in workforce development, and enhancing interagency coordination will further unlock the capacity of NBS to serve as a cornerstone of Florida's resilience strategy. Integrating NBS into climate adaptation and infrastructure planning will not only protect communities but also unlock opportunities for long-term prosperity. By addressing these recommendations today, the

state can lay the groundwork for a resilient, vibrant, and equitable future, ensuring its communities and ecosystems thrive in the face of future challenges.

Methods

Our research process involved three phases: 1) drafting Florida's current system for implementing nature-based solutions (NBS), 2) hosting a small workshop with NBS practitioners, and 3) surveying a larger group of practitioners across the state. Practitioners represented Florida's key NBS sectors: county and municipal governments, environmental nonprofits, engineering, academia, and water management districts. We defined implementation as compassing the full life cycle of NBS, including scoping, planning, permitting, funding, design, construction, monitoring, assessment, and maintenance.

Drafting the current system

We began by identifying key components of Florida's NBS implementation system using two systems-thinking tools: the causal loop diagram and the iceberg model (for more information on systems thinking, see Results). These tools helped to map out the existing relationships, feedback loops, and underlying structures that influence the state's NBS processes.

Nature-based solutions practitioner workshop

Next, we organized a virtual, two-and-a-half-hour workshop with six practitioners from key sectors. Participants represented county government, municipal government, environmental non-profits, engineering, academia, and water management districts. The objectives of the workshop were threefold: a) review and provide feedback on our drafted causal loop and iceberg model, b) highlight "bright spots" where progress in NBS implementation is already being made, and c) identify barriers and problematic areas within the system that hinder further NBS adoption. Feedback from the workshop informed our understanding of Florida's NBS landscape and shaped our subsequent survey design.

Survey of nature-based solutions practitioners

The workshop served as a focus group to inform the design of a statewide survey targeting NBS practitioners. We distributed the survey via email, listservs, and newsletters of relevant organizations, including county governments, chief resilience officers, the Florida Climate

Institute, the University of Florida Coastal Edges Newsletter, the Florida Estuarine Restoration Team, the Waterkeeper Alliance, the Florida Native Plant Society, and 1000 Friends of Florida. Practitioners were encouraged to share the survey within their networks to maximize participation, resulting in a total of 90 responses.

The survey collected data on respondents' professional backgrounds, including their sector of work (e.g., federal government, academia, private sector), and asked them to identify the types of NBS (e.g. living shorelines, urban tree canopy, most relevant to their roles). Participants were also asked to rank how frequently they work on NBS projects and assess the overall effectiveness of NBS implementation in Florida.

The survey also gathered insights from practitioners on the effectiveness and barriers of implementing NBS in Florida. It includes questions on perceived effectiveness, phases of implementation that face challenges, key barriers to NBS adoption, and recommendations for enhancing the implementation process. Practitioners were also encouraged to provide additional comments and suggestions to inform future strategies.

Analysis

The primary author reviewed and thematically categorized the free-response data, while quantitative survey responses were analyzed and visualized using R programming.

References

Barry, S. C., Martin, S., & Sparks, E. (2019). A Homeowner's Guide to the Living Shoreline Permit Exemption Part 1: Florida Department of Environmental Protection: SG187, 2/2019. *EDIS*, 2019(1). <u>https://doi.org/10.32473/edis-sg187-2019</u>

Barry, S. C., Martin, S., & Sparks, E. (2019b). A Homeowner's Guide to the Living Shoreline Permit Exemption Part 2: United States Army Corps of Engineers: SG189, 3/2019. EDIS, 2019(2). <u>https://doi.org/10.32473/edis-sg189-2019</u>

Bean, E., Lewis, C., Radovanovic, J., & Jarrett, L. (n.d.). GSI maintenance and planting manual: Guidance for maintenance and planting of Green Stormwater Infrastructure practices within Florida [Manual]. University of Florida. <u>https://ffl.ifas.ufl.edu/media/fflifasufledu/docs/gsidocuments/GSI-Maintenance-Manual.pdf</u>

Beck, M. W., Heck, N., Narayan, S., Menéndez, P., Reguero, B. G., Bitterwolf, S., Torres-Ortega, S., Lange, G.-M., Pfliegner, K., McNulty, V. P., & Losada, I. J. (2022). Return on investment for mangrove and reef flood protection. *Ecosystem Services*, *56*, 101440. <u>https://doi.org/10.1016/j.ecoser.2022.101440</u>

Bridges, T. S., Bourne, E. M., King, J. K., Kuzmitski, H. K., Moynihan, E. B., & Suedel, B. C. (2018). *Engineering with nature: an atlas*. Environmental Laboratory (US). https://ewn.erdc.dren.mil/atlas-series/

Center for Coastal Solutions, University of Florida. (n.d.). *Nature-based solutions at Tyndall Air Force Base*. Retrieved November 13, 2024, from <u>https://ccs.eng.ufl.edu/what-we-do/nature-based-solutions/nature-based-solutions-at-tyndall-air-force-base/</u>

Chausson, A., Turner, B., Seddon, D., Chabaneix, N., Girardin, C. A., Kapos, V., ... & Seddon, N. (2020). Mapping the effectiveness of nature-based solutions for climate change adaptation. *Global Change Biology*, *26*(11), 6134-6155. <u>https://doi.org/10.1111/gcb.15310</u>

Coastal Protection and Restoration Authority. (2023). *Louisiana's comprehensive master plan for a sustainable coast* (4th ed.). <u>https://coastal.la.gov/our-plan/2023-coastal-master-plan/</u>

Dario, C., Curley, C., & Mach, K. J. (2024). Shaping coastal nature-based solutions: Perceptions and policy priorities of living shorelines. *Nature-Based Solutions*, *6*, 100179. <u>https://doi.org/10.1016/j.nbsj.2024.100179</u>

Florida Department of Environmental Protection. (2015). Know what you need before you build: Shoreline stabilization and the Department of Environmental Protection. <u>https://floridalivingshorelines.com/wp-content/uploads/2015/05/DEP-shoreline-stabilization.pdf</u>

Florida Sea Grant. (n.d.). *Living shorelines training*. Florida Sea Grant. Retrieved November 13, 2024, from <u>https://www.flseagrant.org/workforce-training/living-shorelines-training/</u>

Forrester, J. W. (1994). System dynamics, systems thinking, and soft OR. *System Dynamics Review*, *10*(2-3), 245-256.

Kim, D. H. (1999). Introduction to systems thinking (Vol. 16). Pegasus Communications.

Louisiana Watershed Initiative. (n.d.). *Nature-based solutions*. Retrieved November 13, 2024, from <u>https://watershed.la.gov/nature-based-solutions</u>

Narayan, S., Beck, M. W., Wilson, P., Thomas, C., Guerrero, A., Shephard, C., Reguero, B. G., Franco, G., Ingram, C. J., & Trespalacios, D. (n.d.). *Coastal wetlands and flood damage reduction: Using risk industry-based models to assess natural defenses in the northeastern USA*. Retrieved from <u>https://doi.org/10.7282/T3GH9M7M</u>

Nature-Based Exchange. (2023). *The Nature-Based Solutions Community of Practice*. Retrieved November 13, 2024, from <u>https://www.naturebasedexchange.org/</u>

New Harmony High. (2024). *New Harmony High*. Retrieved November 13, 2024, from <u>https://newharmonyhigh.org/</u>

NOAA Office for Coastal Management. (n.d.). *Nature-based solutions: The basics*. Retrieved November 13, 2024, from <u>https://coast.noaa.gov/digitalcoast/training/nbs-basics.html</u>

NOAA Office for Coastal Management. (2024). *Employment in Coastal Inundation Zones*. Retrieved December 16, 2024, from <u>https://coast.noaa.gov/states/fast-facts/employment-coastal-inundation-zones.html</u>

North Carolina Office of Recovery and Resiliency. (2024). Funding database. Resilience Exchange. <u>https://www.resilienceexchange.nc.gov/find-funding/funding-database</u>

O'Donnell, J. E. (2017). Living shorelines: a review of literature relevant to New England coasts. Journal of Coastal Research, 33(2), 435-451. <u>https://circa.uconn.edu/wp-content/uploads/sites/1618/2019/07/Living-shorlines_a-review-of-literature-relevant-to-New-England-coasts.pdf</u>

Reguero, B. G., Beck, M. W., Bresch, D. N., Calil, J., & Meliane, I. (2018). Comparing the cost effectiveness of nature-based and coastal adaptation: A case study from the Gulf Coast of the United States. *PLOS ONE*, *13*(4), e0192132. <u>https://doi.org/10.1371/journal.pone.0192132</u>

Resilient Florida Program. (2024). *Resilient Florida grants web dashboard* [Data dashboard]. <u>https://experience.arcgis.com/experience/d4f2e042f59e4b2eaee108c0777a0937/page/Implem</u> entation/?views=Fiscal-Year-%28IMP%29

Resilient Florida Program. (2023, July). Resilient Florida 62S-8 program guidance for applicants (Version 3) [Manual]. <u>https://floridadep.gov/rcp/resilient-florida-program/documents/resilient-florida-applicant-guidance-manual</u>

Scyphers, S. B., Gouhier, T. C., Grabowski, J. H., Beck, M. W., Mareska, J., & others. (2015). Natural shorelines promote the stability of fish communities in an urbanized coastal system. *PLOS ONE*, *10*(6), e0118580. <u>https://doi.org/10.1371/journal.pone.0118580</u>

Seddon, N. (2022). Harnessing the potential of nature-based solutions for mitigating and adapting to climate change. *Science*, *376*(6600), 1410-1416. <u>https://doi.org/10.1126/science.abn9668</u>

Seddon, N., Daniels, E., Davis, R., Chausson, A., Harris, R., Hou-Jones, X., ... Wicander, S. (2020). Global recognition of the importance of nature-based solutions to the impacts of climate change. *Global Sustainability*, *3*, e15. https://doi.org/10.1017/sus.2020.8

Seddon, N., Smith, A., Smith, P., Key, I., Chausson, A., Girardin, C., House, J., Srivastava, S., & Turner, B. (2021). Getting the message right on nature-based solutions to climate change. *Global Change Biology*, *27*(6), 1518-1546. <u>https://doi.org/10.1111/gcb.15513</u>

Tampa Bay Regional Planning Council. (n.d.). *Resilient shoreline model ordinance*. Retrieved November 13, 2024, from <u>https://tbrpc.org/model-shoreline-</u> ordinance/#:~:text=The%20new%20Resilient%20Shoreline%20Model%20Ordinance%20temp late,shorelines%20on%20bay%20waters%20and%20riverine%20systems

U.S. Environmental Protection Agency. (2024a). *Green infrastructure funding and technical assistance opportunities*. Retrieved November 13, 2024, from <u>https://www.epa.gov/green-infrastructure/green-infrastructure-funding-and-technical-assistance-opportunities#federal</u>

U.S. Environmental Protection Agency. (2024b). *Environmental Justice Thriving Communities Technical Assistance Centers (EJ TCTACs)*. Retrieved November 13, 2024, from <u>https://www.ejtctac.org/</u>

U.S. Global Change Research Program. (2023). *Fifth National Climate Assessment*. Crimmins, A. R., Avery, C. W., Easterling, D. R., Kunkel, K. E., Stewart, B. C., & Maycock, T. K. (Eds.). U.S. Global Change Research Program. <u>https://doi.org/10.7930/NCA5</u>

Appendix A: Acronyms and Abbreviations

BCA	Benefit-Cost Analysis		
Corps	U.S. Army Corps of Engineers		
CRS	Community Rating System		
DEP	Florida Department of Environmental Protection		
EPA	U.S. Environmental Protection Agency		
ERDC	Engineer Research and Development Center		
ESA	Endangered Species Act		
EWN	Engineering With Nature		
FLCommerce	Florida Department of Commerce		
HUD	U.S. Department of Housing and Urban Development		
NEPA	National Environmental Policy Act		
NEPs	National Estuarine Programs		
NOAA	National Oceanic and Atmospheric Administration		
NBS	Nature-Based Solutions		
Resilient FL	Resilient Florida Program		
SPGP	State Programmatic General Permit		

Appendix B: Modeling Florida Through a Systems Thinking Workshop

Systems thinking, first developed by Forester (1994), is a holistic approach to problem-solving that considers the relationship between various components within a system. The iceberg model is a powerful tool in systems thinking that helps uncover the underlying causes of issues by dividing problems and solutions into visible and hidden components, akin to the tip and submerged portion of an iceberg (Kim, 1999). At the tip of the iceberg are events and outcomes, what is most visible and apparent. Below events and outcomes are patterns of behavior that represent large-scale patterned actions which are the immediate, direct causes of events. At the next level are structures that directly influence patterns and describe rules, norms, processes, and institutions. Beneath structures are mental models or values, assumptions, and beliefs that shape the system.

During our practitioner workshop, we asked the participants what aspects of our drafted iceberg resonated and what components were missing. The iceberg model in Tab. 1 reflects the participant's comments and recommendations.

Participants also explored a causal loop of Florida's system of nature-based solutions (Forester 1994). A causal loop is a system thinking tool that represents the relationships between the components of a system, illustrating how changes in one part of a system can affect others over time. Specific recommendations during the causal loop activity were also incorporated into the iceberg model described in Table 2.

Events or Outcomes	 Climate/ecological disasters (severe flooding, fish kills, algae blooms) Water/environmental quality 		Implementation of nature-based solutions Pilots/experimental projects Community resilience	
Patterns of Behavior	 Funding comes after disasters Political will/support Focus on short-term planning 		 Engaged communities Siloing 	
Structures	•ESA/NEPA •Federal funding (FEMA, HUD, Corps) •FEMA BCA •Corps BCA •NOAA •State funding •EPA •Existing infrastructure •Design standards	Governor's Office Office of Resilience DEP FLCommerce ERDC/EWN Resilient FL (inc. Living Shorelines) CRS NEPs (National Estuarine Program)	 FWC NFWF Non-profits & foundations Water management districts Local & county governments CERP Contractors & consultants 	 Adaption planning (Vulnerability Assessments, comprehensive development master plan, land use plan) Permitting Available space Staffing & expertise Community capacity
Mental Models	 Federal government as protector Reactive rather than proactive Pride in Florida's natural resources Cultural value of nature Profit maximization 		 Partisanship/distrust c Property rights Mutualism Greenwashing 	of environmentalism

Table 1: Iceberg model of Florida's current system of implementing nature-based solutions. Blue text represents specific recommendations, additions, or revisions made by workshop participants.

Appendix C: Practitioner Survey

The following survey was completed on Microsoft Forms by practitioners working in different sectors of implementing nature-based solutions:

1. **Optional:** If you are willing to be contacted for an interview regarding your survey responses, please provide your **NAME**.

2. **Optional:** If you are willing to be contacted for an interview regarding your survey responses, please provide your **EMAIL**.

3. What category(s) best describes your work?

- o Municipal or local government
- County government
- Regional government (including Water Management Districts and Regional Planning Councils)
- State government
- Federal government
- Tribal government
- Non-profit, non-governmental organizations
- Academia
- Private sector/consultant/contractor (ex. engineer, landscape architect, planner)
- Other [Fill in]

4. Whether scoping, planning, permitting, funding, design, construction, monitoring, assessment, or maintenance, **how frequently do you work on the implementation of nature-based solutions in your work**?

- Very Frequently
- Frequently
- Occasionally
- o Rarely
- Very Rarely
- 5. What types of nature-based solutions are relevant to your work and goals?
 - Wetland restoration
 - Mangrove restoration
 - Oyster reef restoration
 - Coral reef restoration
 - Forest restoration
 - Dune restoration
 - Reinforced dunes
 - Beach renourishment
 - Floodplain restoration
 - Bioswales
 - Urban tree canopies
 - Riparian buffers
 - Living shorelines
 - Artificial reefs
 - Wave attenuation devices
 - Green roofs
 - Permeable pavements

- Rain gardens
- Other hybrid (nature-based integrated with gray) structures
- Other [Fill in]

6. Based on your current role, rate the overall effectiveness of implementing nature-based solutions in the state of Florida.

• Very Effective

- Effective
- Neutral
- Ineffective
- Very Ineffective

7. In Florida, at what phase of implementation are nature-based solutions most likely to be hindered? *

[Pick up to three that apply]

- Political support
- Public awareness/community engagement
- Scoping
- Planning
- Permitting
- Funding
- o Design
- Construction
- Monitoring/assessing project outcomes
- Post-construction maintenance

8. Optional: Why are nature-based solutions most likely to be hindered at the phase(s) of implementation that you selected above?

9. A small workshop of nature-based solutions practitioners identified the following barriers within Florida's system of implementing nature-based solutions. What do you identify as the biggest barriers to implementing nature-based solutions? You can also add a barrier that is not listed here. [Pick up to three that apply]

- Complex and lengthy state and federal permitting systems
- Lack of standardized design guidelines
- Disjointedness between state and federal agencies
- o Lack of public awareness and support for NBS
- Lack of experts with knowledge about NBS
- Navigating multiple funding applications and requirements
- Lack of funding and attention to long-term monitoring and assessment of NBS
- Lack of funding to maintain NBS projects post-construction
- Other [Fill in]

10. Optional: Explain or elaborate on your choices for the previous question.

11. The same small workshop identified the following recommendations to enhance Florida's system of implementing nature-based solutions (NBS). Which recommendations should Environmental Defense Fund prioritize to most effectively enhance the implementation of NBS in Florida? You can also add a recommendation that is not listed here. [Pick up to three that apply]

• Expanding permitting exemptions or expediting timelines for NBS projects

- Promoting joint state and federal permits for living shorelines and other NBS
- Developing standardized design guidelines
- Increasing interagency coordination through Chief Resilience Officer positions or working groups
- Establishing clear standards for the environmental quality assessments that are often required for permitting large NBS projects
- Forming multi-agency permitting review boards
- Changing local policy ordinances to support NBS
- o Increasing visuals and supportive communication around NBS
- Developing a larger workforce with NBS knowledge
- Developing comprehensive funding guide(s) with information about state and federal funding for NBS
- Increasing funding opportunities for voluntary long-term monitoring and assessment of NBS projects
- Other [Fill in]

12. As specifically as possible, how would EDF most effectively implement the recommendations that you choose above? For example, what actions should EDF prioritize to streamline the current permitting process for nature-based solutions?

13. Please add any additional recommendations/opportunities, comments, thoughts, questions, etc. here.

Appendix D: Additional Survey Responses

The following supplemental figures summarize responses to additional survey questions.

Frequency Participants Engage in NBS Projects

Very Rarely Rarely Cocasionally Frequently Very Frequently



Supplemental Figure 2: Frequency with which survey respondents engage in various phases of nature-based solutions (NBS) implementation, including scoping, planning, permitting, funding, design, construction, monitoring, assessment, and maintenance. This figure highlights how often practitioners work on different stages of NBS projects in their professional roles.



Supplemental Figure 3: Types of nature-based solutions (NBS) relevant to the work and goals of survey respondents. Participants could select multiple NBS types, reflecting the diversity of NBS strategies used across different sectors and projects. This figure highlights the NBS approaches most commonly associated with respondents' professional activities.

Effectiveness of Florida's Implementation of NBS

Very Ineffective Ineffective Neutral Effective Very Effective



Supplemental Figure 4: Respondents' ratings of the overall effectiveness of implementing nature-based solutions (NBS) in Florida, based on their current roles. This figure provides insight into practitioners' perceptions of how successfully NBS projects are being carried out across the state.