A Roadmap for Restoring Mangrove Creeks in The Bahamas

Environmental Defense Fund

Bahamas Sportfishing Conservation Association

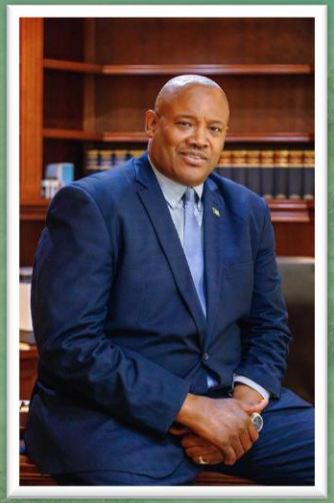
Russell Craig & Associates
AN ENVIRONMENTAL & NATURAL RESOURCE PLANNING AGENCY

Perry Institute FOR MARINE SCIENCE

Foreword

“The Bahamas is a gem. We are a jewel. But unless we protect, maintain, and sustain what we have to pass it onto the next generation, they will not have what we have today. It was made for you, and it was made for me, so we must do everything in our power to protect, serve, maintain, and pass it on in as good of a condition as we met it – if not better – to the generations that will succeed us.”

- Hon. Minister Vaughn Miller



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Executive Summary

Mangrove ecosystems protect Bahamian communities from hurricane damage, erosion and rising sea levels. They provide critical habitat for wildlife and the fisheries that feed and employ Bahamians.

But throughout The Bahamas, over 100 mangrove creeks have been blocked by roads and other obstructions, slowing or completely stopping the flow of water. These "blocked creeks" fragment delicate ecosystems, degrading their ability to protect and nourish people and nature.

Restoring The Bahamas' mangrove creeks is a national priority to conserve biodiversity; support fisheries, livelihoods, and food security; and to future-proof the coastline against climate change. Here, we present a roadmap outlining critical considerations and steps towards a coordinated national restoration program.

This roadmap provides an overview of the services that mangrove creeks provide, examples of creek restoration, identification of high priority sites for restoration in Andros, New Providence, and Eleuthera, and a step-by-step guide to implementing community-centered creek restoration.

Mangroves in The Bahamas

Mangroves are uniquely adapted to thrive at the interface between land and sea.

The Bahamas has 250,000 hectares of mangrove habitat. More than half of these are found on Andros, with Grand Bahama and Abaco also having large mangrove stands.

The Bahamas' mangrove ecosystems play important roles in coastal ecosystem health, stabilizing shorelines, protecting communities and supporting biodiversity.

Mangroves face growing threats from unsustainable development and climate change.

Globally, mangroves are threatened by sea level rise and deforestation.

In The Bahamas, damaging hurricanes also have the power to destroy mangroves. On Grand Bahama, 22% of mangroves were destroyed and another 14% were damaged during Hurricane Dorian.[1]

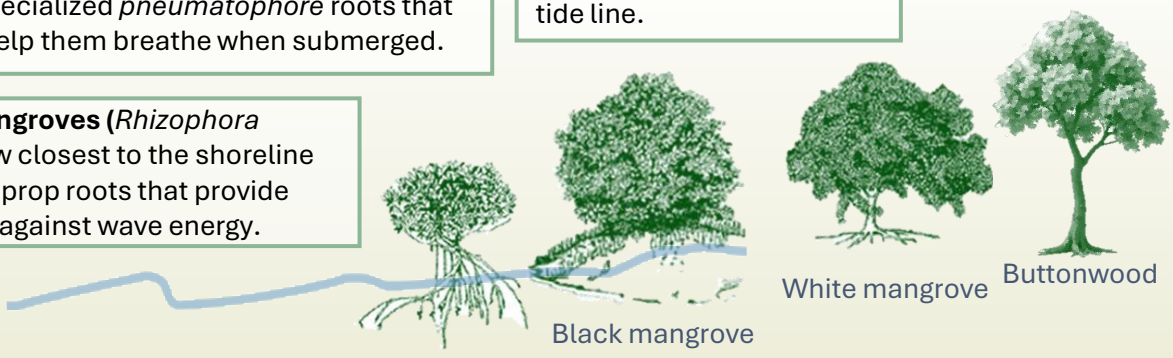
[1] (2022) Mangrove report card for The Bahamas

Buttonwoods *(Conocarpus erectus)* are closely associated with mangrove ecosystems.

White mangroves *(Laguncularia racemosa)* grow furthest inland, well above the high tide line.

Black mangroves (*Avicennia germinans)* grow around the high tide line with specialized *pneumatophore* roots that help them breathe when submerged.

Red mangroves (*Rhizophora mangle)* grow closest to the shoreline with aerial prop roots that provide stability against wave energy.



Mangrove community structure

Biodiversity

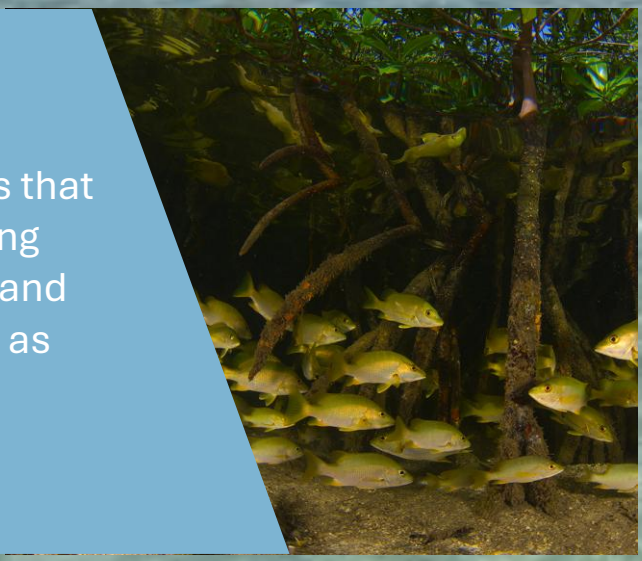
Mangrove ecosystems provide food and shelter for wildlife both above and below water. Fish, crabs, shrimp and turtles find refuge in their root systems and inlets. In their branches, birds find a haven to rest and raise their young.

Community Livelihoods

Mangroves provide a wealth of opportunities for Bahamian communities. Fly fishing, small-scale commercial fishing, bird guiding and mangrove honey provide sustainable, long-term opportunities for community livelihoods.

Food Security

Most of the important fishery species that feed Bahamian communities including spiny lobster, queen conch, grouper and snappers use mangrove ecosystems as nursery grounds.



Climate Resilience

Climate change is causing more extreme temperatures and weather patterns in The Bahamas. Sea levels are rising and storms are strengthening, threatening lives and infrastructure.

Mangroves can play important roles in both ecosystem-based adaptation to climate change and climate change mitigation, increasing ecological and social climate resilience in The Bahamas.

Coastal Protection

Healthy, intact mangrove ecosystems protect coastal communities from storms, flooding, and erosion which are expected to worsen under climate change. Mangrove roots dissipate wave energy, slowing storm surges and stopping flood waters from rushing further inland.

Carbon Sequestration

Mangroves absorb atmospheric carbon dioxide and store it in their roots, branches and sediments. Some estimates suggest they sequester up to 10x more carbon dioxide than terrestrial forests, making them powerful climate allies.

Cultural Connections

Many Bahamians have strong connections to mangroves through their communities, their work as fishers or fishing guides, or through leisure activities. Residents of islands with healthy mangrove forests often express a deep appreciation for the ecosystem services they provide.

"They have also been important to our village as the rights of passage from one generation to the next. Traditionally, the older generation carried the younger generation to the creek to teach them how to fend for themselves, how to feed themselves."

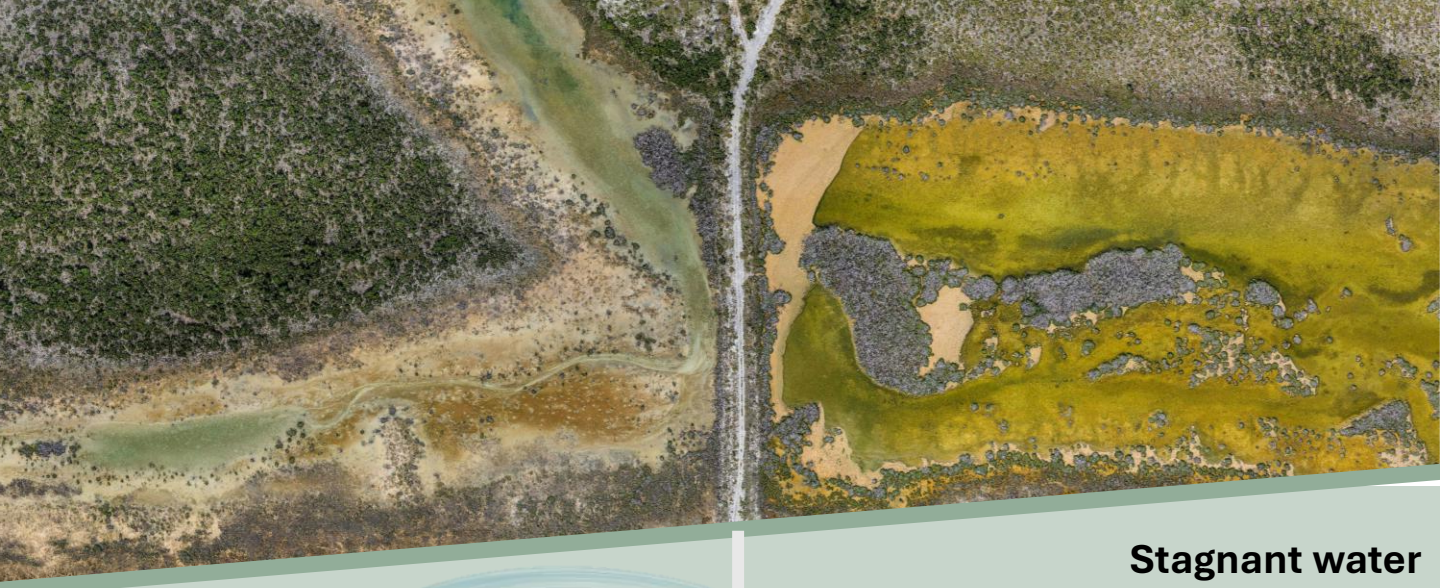
- New Providence resident

"They protect the coastal areas. I think that's one of the main reasons that we are called Mangrove Cay too, because we have a lot of mangroves. It also prevents us from having horrible hurricanes."

- Andros resident

"One of the wonders of the island, [mangroves] protect us from storm surge and are nurseries for the fish and when the big fish come, they feed off of them, they give us a lot of food."

- Eleuthera resident



Stagnant water

Tidal flushing from the ocean

Blockage

Blocked Mangrove Creeks

Mangrove ecosystems rely on tidal creeks to flush them with clean ocean water.

Throughout The Bahamas, many mangrove creeks have been blocked by roads. These blockages create trapped, stagnant water on the inland side of the blockage that can produce terrible smells and provide a breeding ground for mosquitoes, bacteria and harmful algae.

Blocked creeks prevent marine life from migrating upstream to find shelter and food. Populations of fish can be cut off from feeding or breeding grounds.

Blocked creeks make flooding events more likely as storm floods face bottlenecks and overflow across roads and into low-lying communities.

We need to unblock mangrove creeks to restore ecosystem health, reduce flood risk and protect communities from storm damage.

Community Stories of Change

Residents who live and work around blocked mangrove creeks have seen firsthand the impacts of ecosystem fragmentation and degradation on biodiversity and fisheries.

"A few years ago, near Adelaide, there was a development. All the mangroves along the beach were bulldozed. They even drove into the water to get rid of the mangroves that were sprouting. Because Nassau is small... we have just a few [mangroves] and they are the ones that we really need to protect. "

– New Providence resident

"[The change] has hurt my community. Places where we used to fish, there's no more fish. The populations of fish are dying out in this area. You can't fish like you used to because the nursery system is dying out. During the summer months, the fish are dying out because there is no flow, no oxygen."

– Andros resident

Approaches to Mangrove Creek Restoration

Restoring mangrove ecosystems is more than just planting trees. Restoring natural hydrology by unblocking mangrove creeks is essential to create the right conditions for mangroves to spread their seeds, naturally repopulate suitable areas, and thrive for the long term.

Restoration projects can range from small to very large depending on the complexity and cost of the project. At the smallest scale, community groups can clear vegetation and sediment or widen drainage ditches at relatively low costs. At the largest and most complex scale, major engineering works will be needed to build bridges and reconstruct roadways, requiring larger budgets and coordination across government departments.

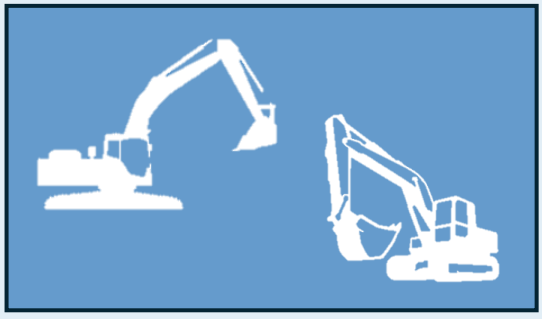
Restoration Works

Small-scale projects can be as simple as digging a drainage ditch, clearing out debris from culverts and bridges, and planting mangroves only if necessary, after hydrology is restored.

Cost < $10,000

Mid-scale projects include re-engineering bridges to widen openings, or installing/ expanding culverts to increase water flow.

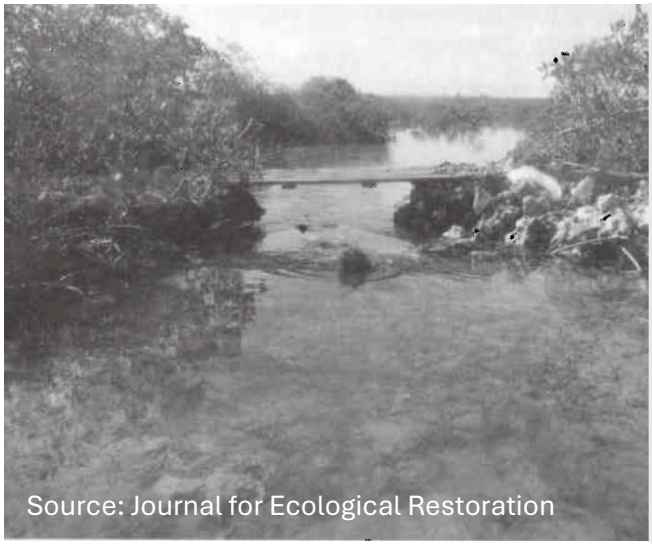
Cost $10,000 – $500,000



Large-scale infrastructure projects include building new bridges, dredging channels, removing mangroves to widen historic channels

Cost > $ 500,000

Successful Restoration Projects



Source: Journal for Ecological Restoration

Small-scale Example

Man-o-War Sound, Andros Island

Completed in May 2004, cost of $200 in materials and many volunteers. Removed a dirt footpath that was blocking water flow and built a wooden bridge in place.

Source: Bahamas National Trust

Mid-scale Example

Bonefish Pond, New Providence

Removed over 35 tons of debris with the help of volunteers and heavy machinery. Hydrology was partly restored by removal of blockages and digging new channels.

Source: OPM.gov.bs

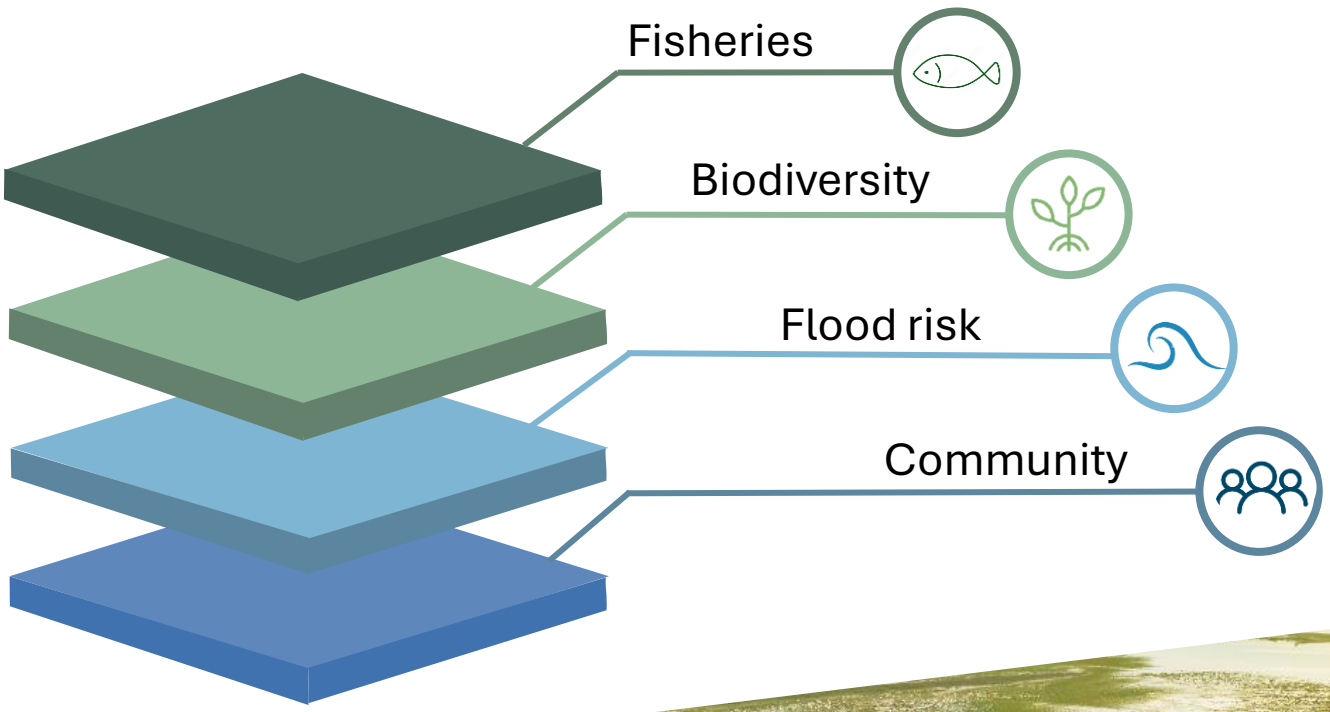
Large-scale Example

London Creek, Andros Island

The new bridge was opened in December 2020, restoring water flow to nursery habitat for important species like bonefish, snapper, and smalltooth sawfish. The project took around 2 years and cost $2.1 million

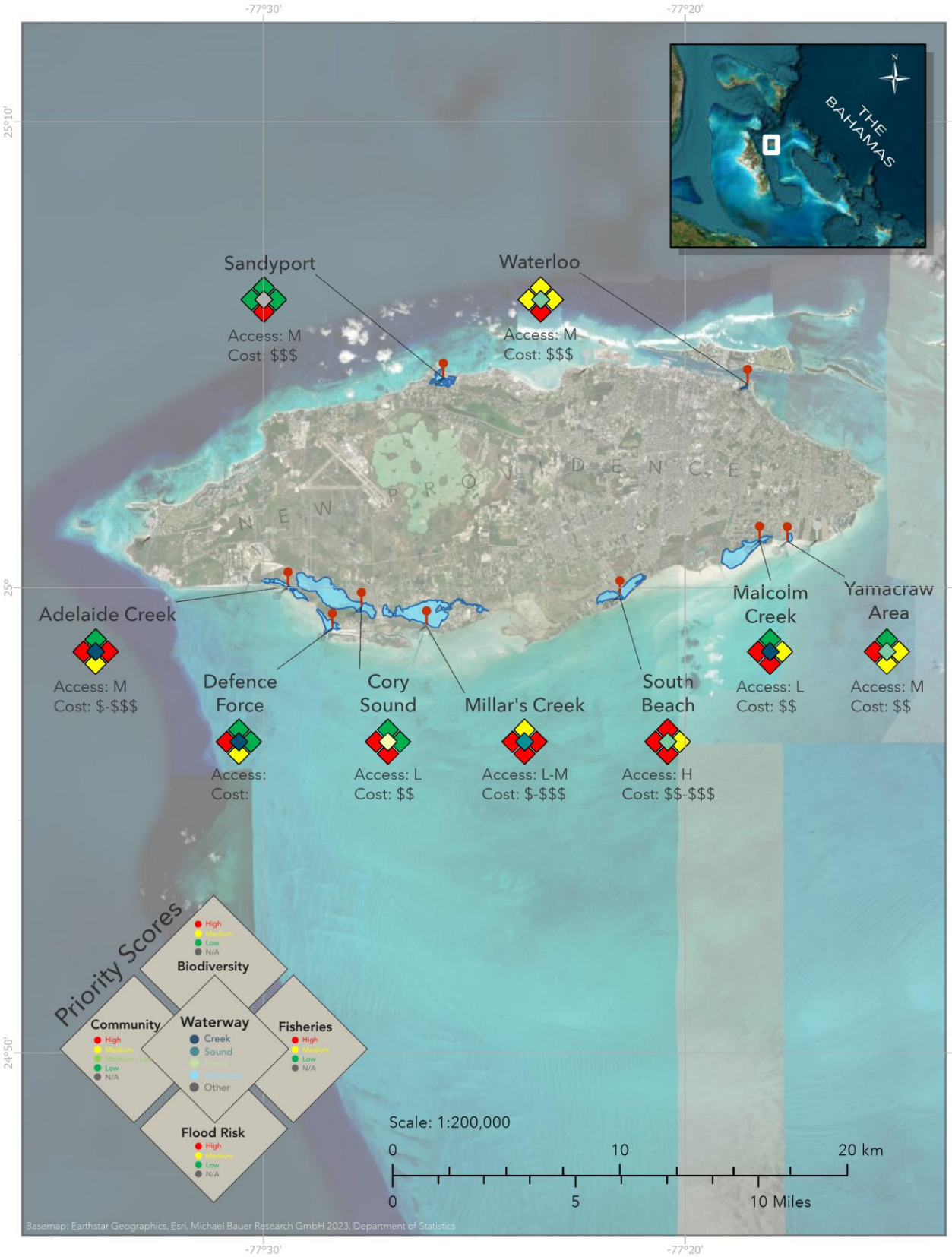
Prioritizing High-Value Restoration Sites

Choosing which sites to restore - or which sites to restore first - requires communities and government to prioritize projects according to the value that restoration will bring. We present a prioritization framework that incorporates four different values: the value of restoration for improving habitat for important fishery species, the value for increasing biodiversity, the value for reducing storm surge flood risk, and the social and cultural value that communities place on restoration. We can "stack" different types of benefits to see which sites have the greatest benefits across different types of values.



New Providence blocked waterways

New Providence has 9 creek systems with blockages. The highest priority creeks for restoration are all on the southern shore where communities are highly vulnerable to flood risk and where there is strong opportunity to restore habitat for important fishery species.



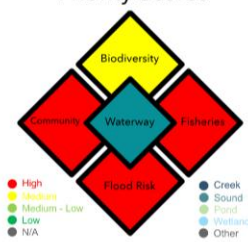
High Priority Case Study 1: Millar's Creek, New Providence

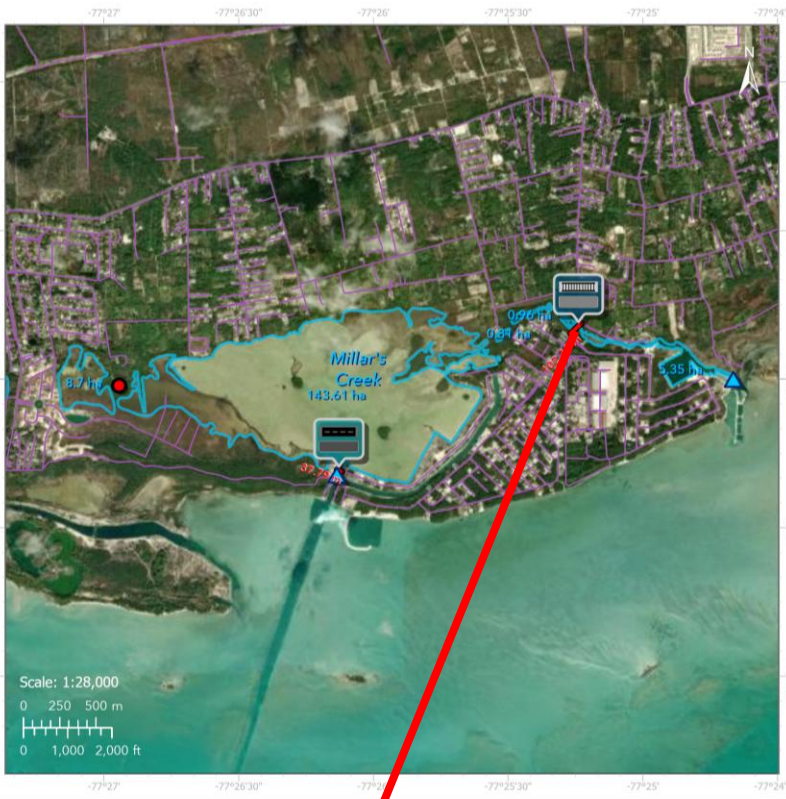
Blocked Area: 153.58 ha
Total Area: 158.93 ha
Percentage Blocked: 96.63 %

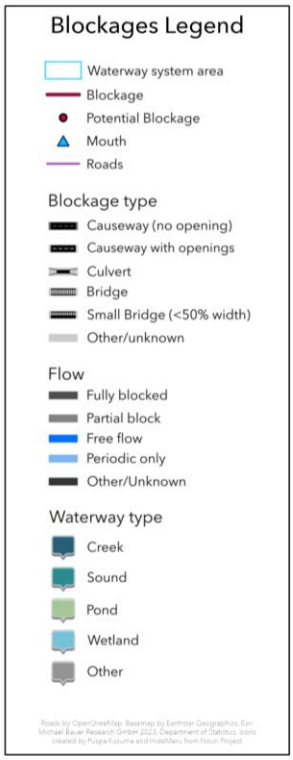
Blockages: 2
Mouths: 1

Accessibility: L-M
Cost: $-$$$

Priority Scores



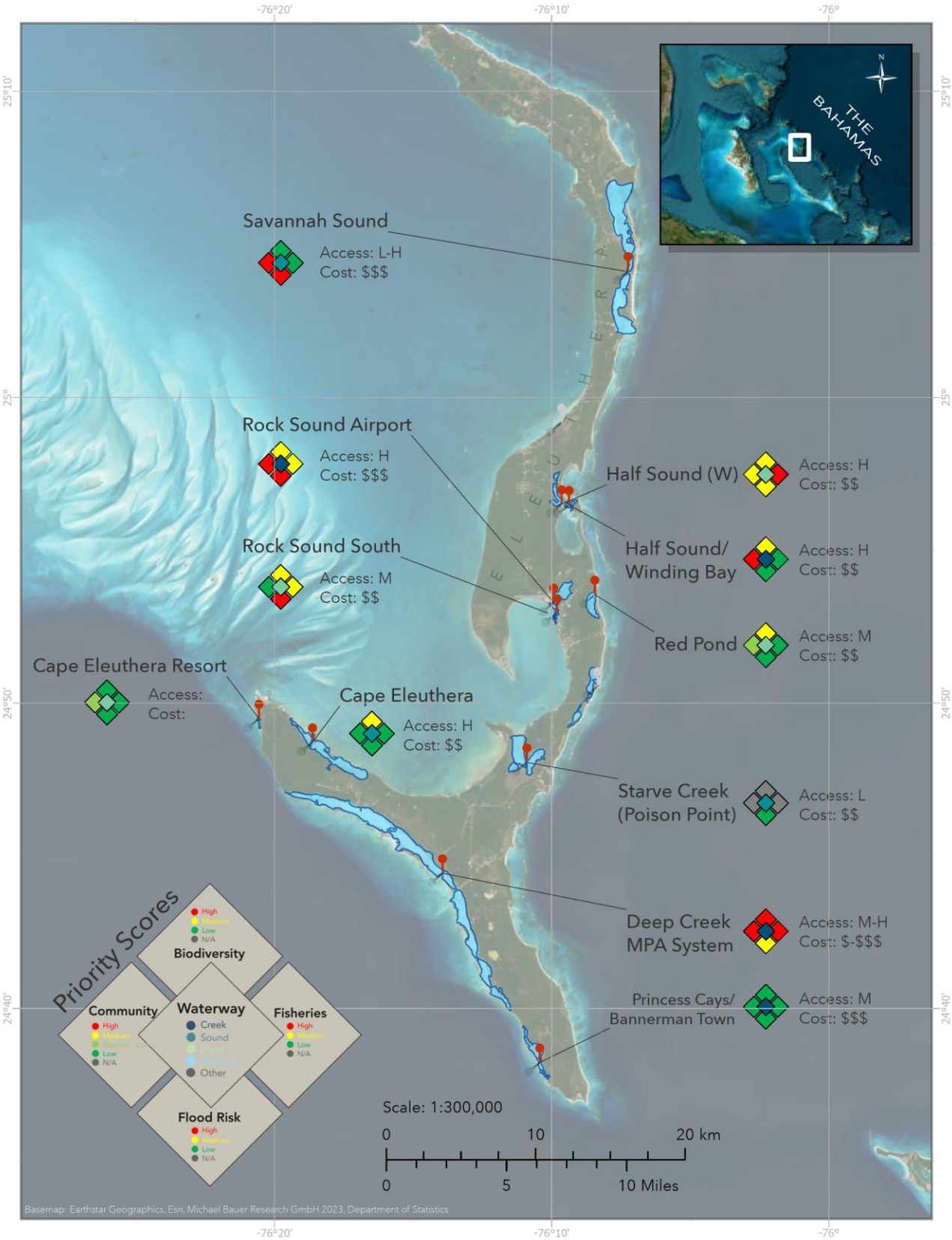




Millar's Creek is on the southern shore of New Providence. The creek is blocked by a bridge and a causeway, each with partial flow. The area is prone to high flood risk and communities value restoration of this site to protect the growing population who live in this area. Restoration has high potential to enhance fisheries and biodiversity.

South Eleuthera blocked waterways

Southern Eleuthera has 11 blocked waterways. The highest priorities for restoration include the Deep Creek MPA system which has high potential to support increased biodiversity and fisheries habitat, and the Rock Sound Airport which has high flood risk and strong community support.



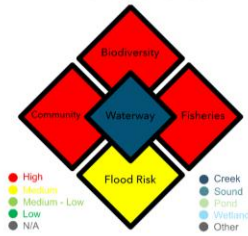
High Priority Case Study 2: Deep Creek to John Miller's, Eleuthera

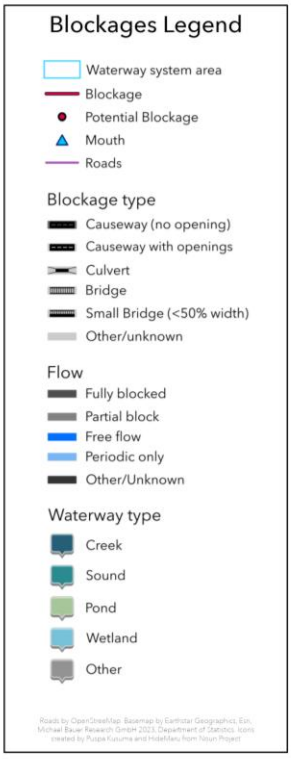
Blocked Area: 96.56 ha
Total Area: 1,000.01 ha
Percentage Blocked: 9.66 %

Blockages: 5
Mouths: 7

Accessibility: M-H
Cost: $-$$$

Priority Scores

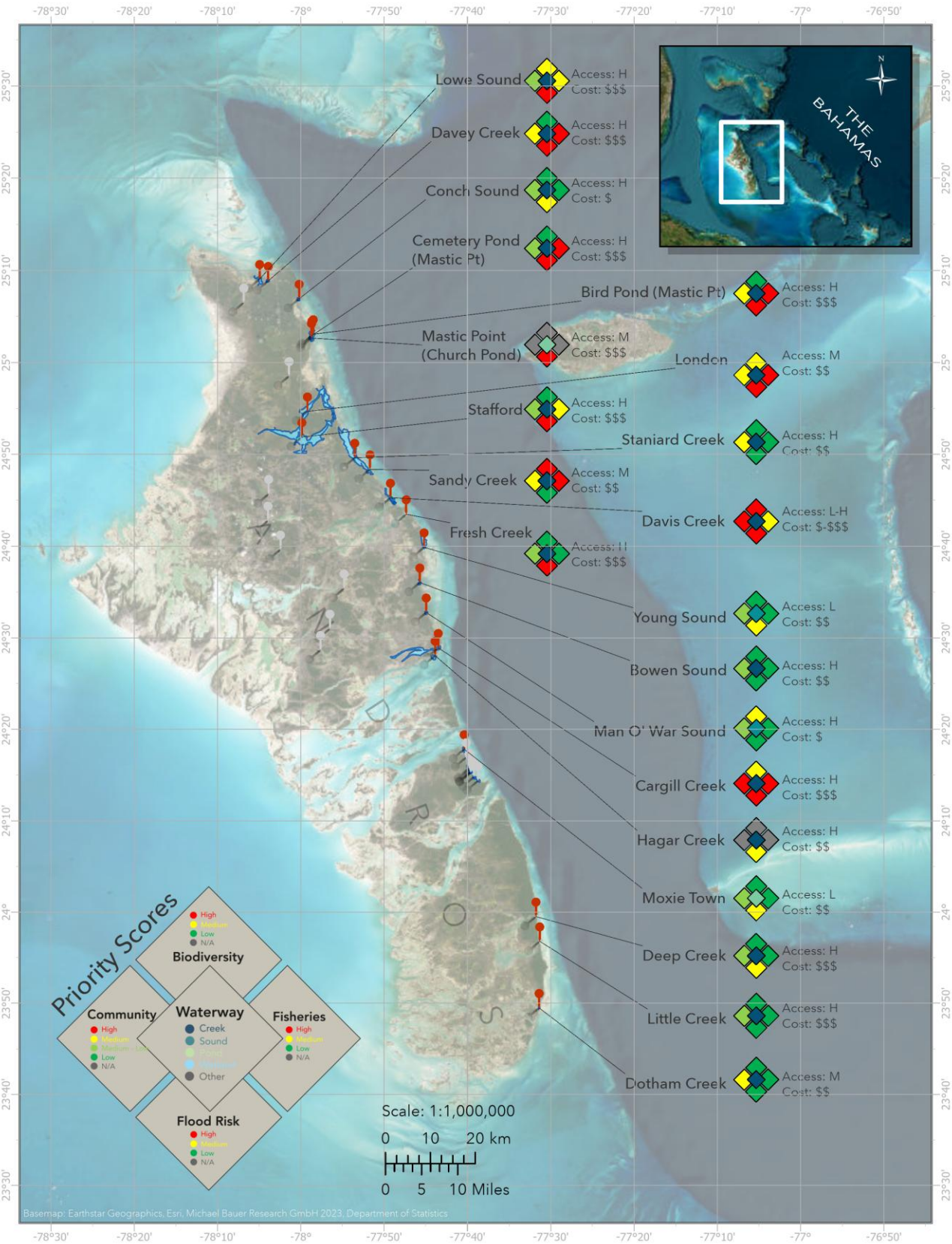




Deep Creek is on the southwest shore of Eleuthera. The creek is blocked in many locations. The blockage seen here is a dirt footpath with partial water flow. The area has moderate exposure to storm surge flood risk but strong community support for restoration and high potential to support increased fishery habitat and biodiversity.

Andros blocked waterways

Andros Island has 21 blocked waterways, mostly on the eastern side of the island. The highest priorities for restoration are places like Cargill Creek and Davis Creek where restoration could support increased fishery production and fishing habitat to support community livelihoods.



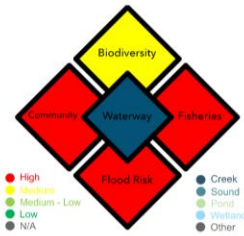
High Priority Case Study 3: Cargill Creek, Andros

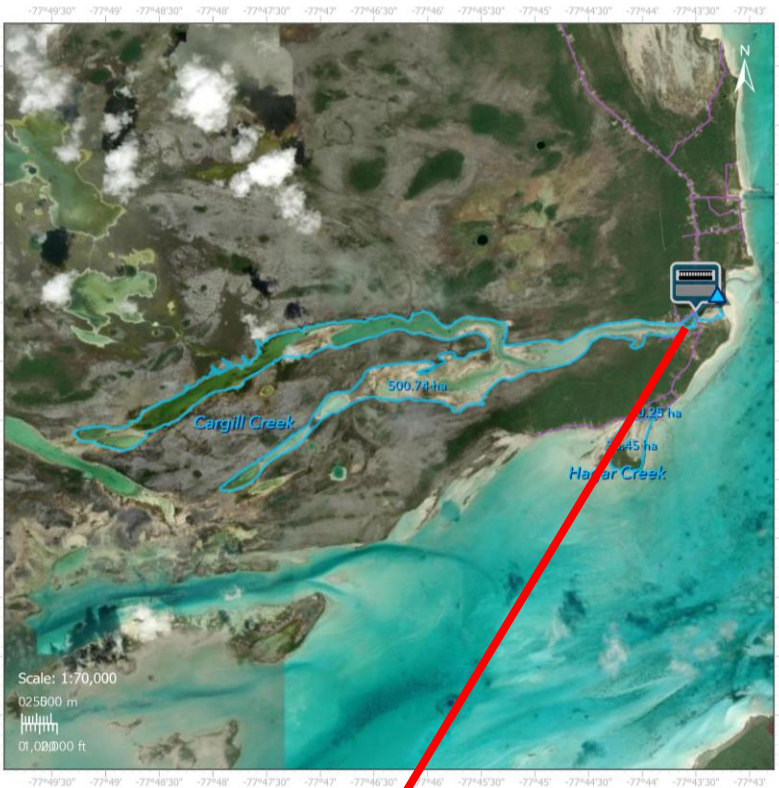
Blocked Area: 500.74 ha
Total Area: 511.86 ha
Percentage Blocked: 97.83 %

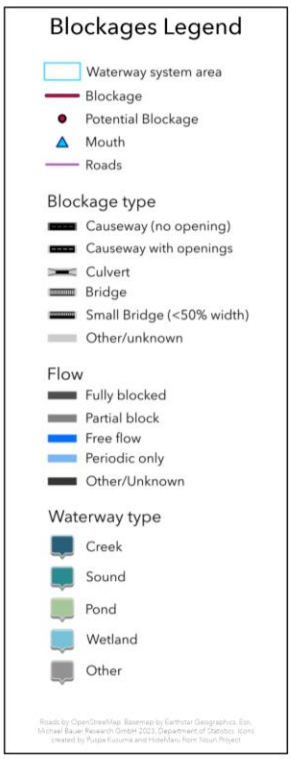
Blockages: 1
Mouths: 1

Accessibility: H
Cost: $$$

Priority Scores

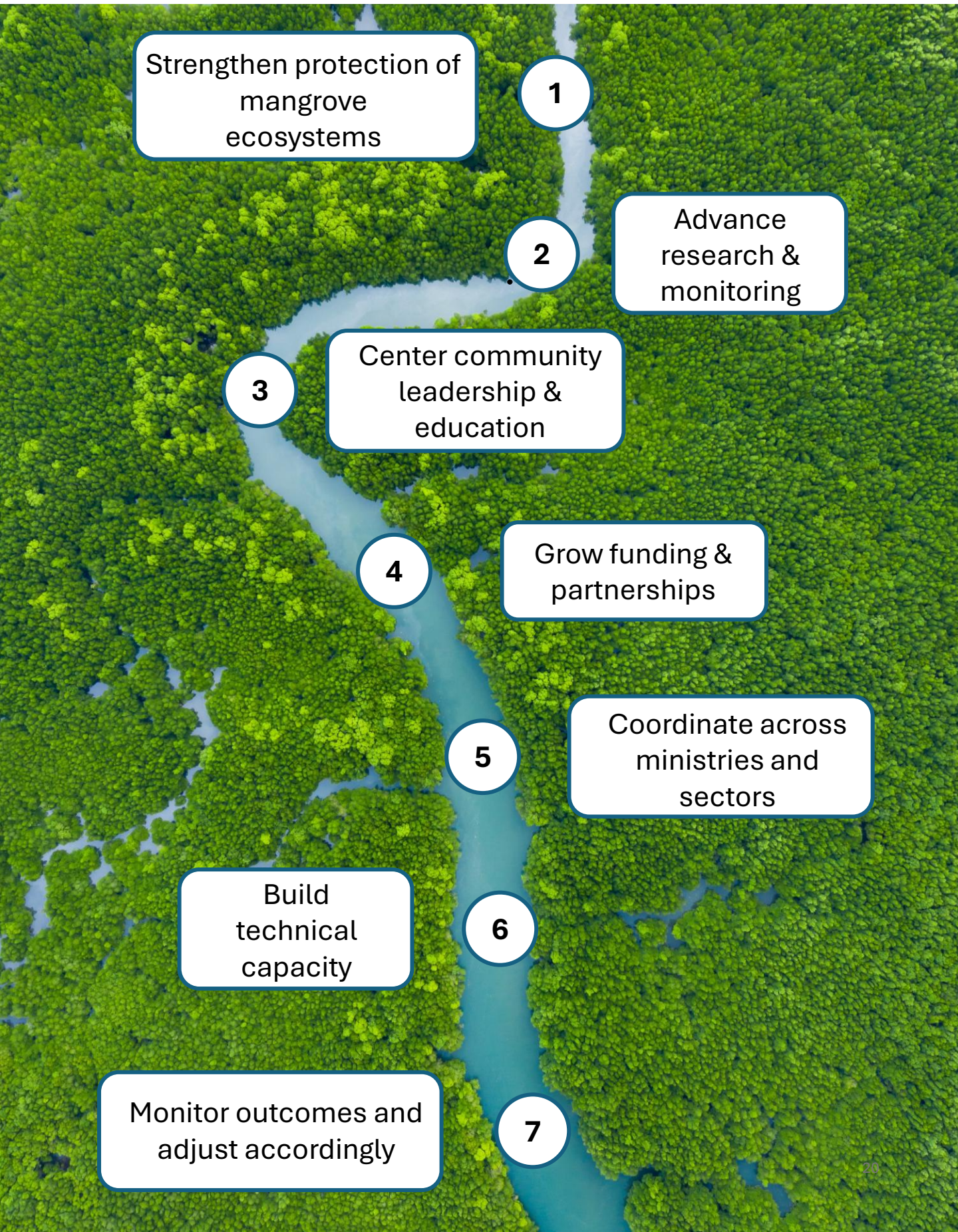


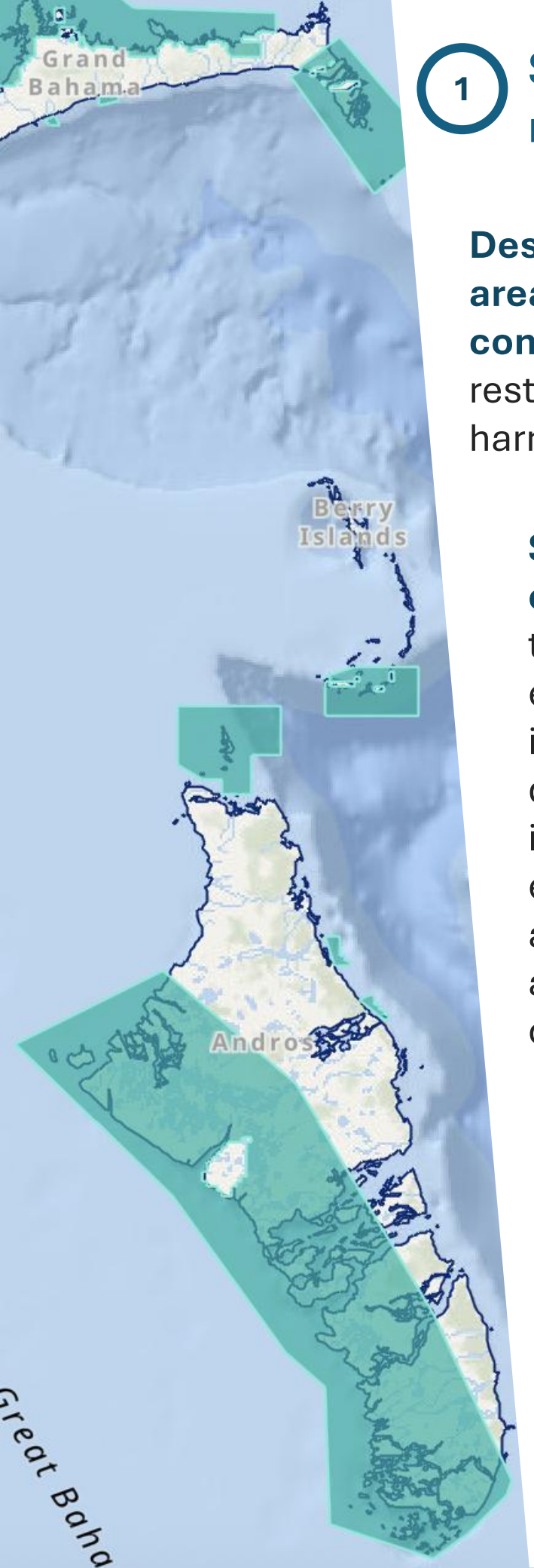




Cargill Creek is on the eastern side of Andros, in Behring Point. The creek supports many local livelihoods and is used heavily by fishing guides and commercial fishermen as a safe harbor. The channel is only wide enough for one boat to pass through, and boat accidents have already occurred. Upstream areas were historically rich with nursery habitat.

Recommendations to Advance Mangrove Creek Restoration Across The Bahamas





1 Strengthen protection of mangrove ecosystems

Designate critical mangrove areas as protected zones or community conservation areas, restricting development and harmful activities.

Strengthen policies and enforcement mechanisms to protect mangrove ecosystems from illegal cutting and habitat destruction. This could include updating zoning laws, establishing buffer zones, and regulating activities such as coastal development to conserve mangroves.

Build *with* nature and steer new private developments away from creating new blockages, ultimately helping mangroves protect communities and infrastructure.

2 Advance research and monitoring

Identify, map and prioritize existing mangrove creek ecosystems and blockages on all islands to create a national inventory of creek restoration needs, prioritized based on community feedback and goals of the project partners.

Invest in and support "home grown" scientific research to better understand mangrove ecosystems and threats, including destruction from development and major storms.

3 Center community leadership and education

Build public awareness campaigns in coordination with local communities, schools, and businesses about the importance of mangroves, their role in coastal protection, biodiversity, and their economic value in sectors like tourism and fisheries.

Promote and develop programs for sustainable livelihoods that promote stewardship of mangrove ecosystems, such as ecotourism, flats fishing, birdwatching, or mangrove-based agroforestry practices like bush tea and mangrove honey.

4 Grow funding and partnerships

Secure government and international funding to advance large-scale restoration projects.

Explore innovative funding sources including corporate social responsibility initiatives and biodiversity credits as sources of community, non-profit, and government fundraising.

Maximize local benefits from financing and international partnerships by creating national policies and coordination frameworks that incentivize investments in Bahamian jobs and skills.

5 Coordinate across ministries and sectors

Coordinate across government agencies, environmental organizations and academic institutions to enhance research, provide expertise, and develop innovative restoration techniques.

Raise awareness across departments to prevent new creek blockages caused by future public and private development projects.

Create a restoration office or officer to maximize the efficiency and impact of restoration efforts by tracking restoration projects and coordinating across government departments and with non-governmental and private sectors.

6 Build technical capacity

Build capacity for Bahamian research institutions and researchers to advance conservation and restoration strategies and tools.

Train and invest in local authorities and government staff on effective mangrove restoration and monitoring methods and technologies.

Participate in national and international **communities of practice** to remain informed.

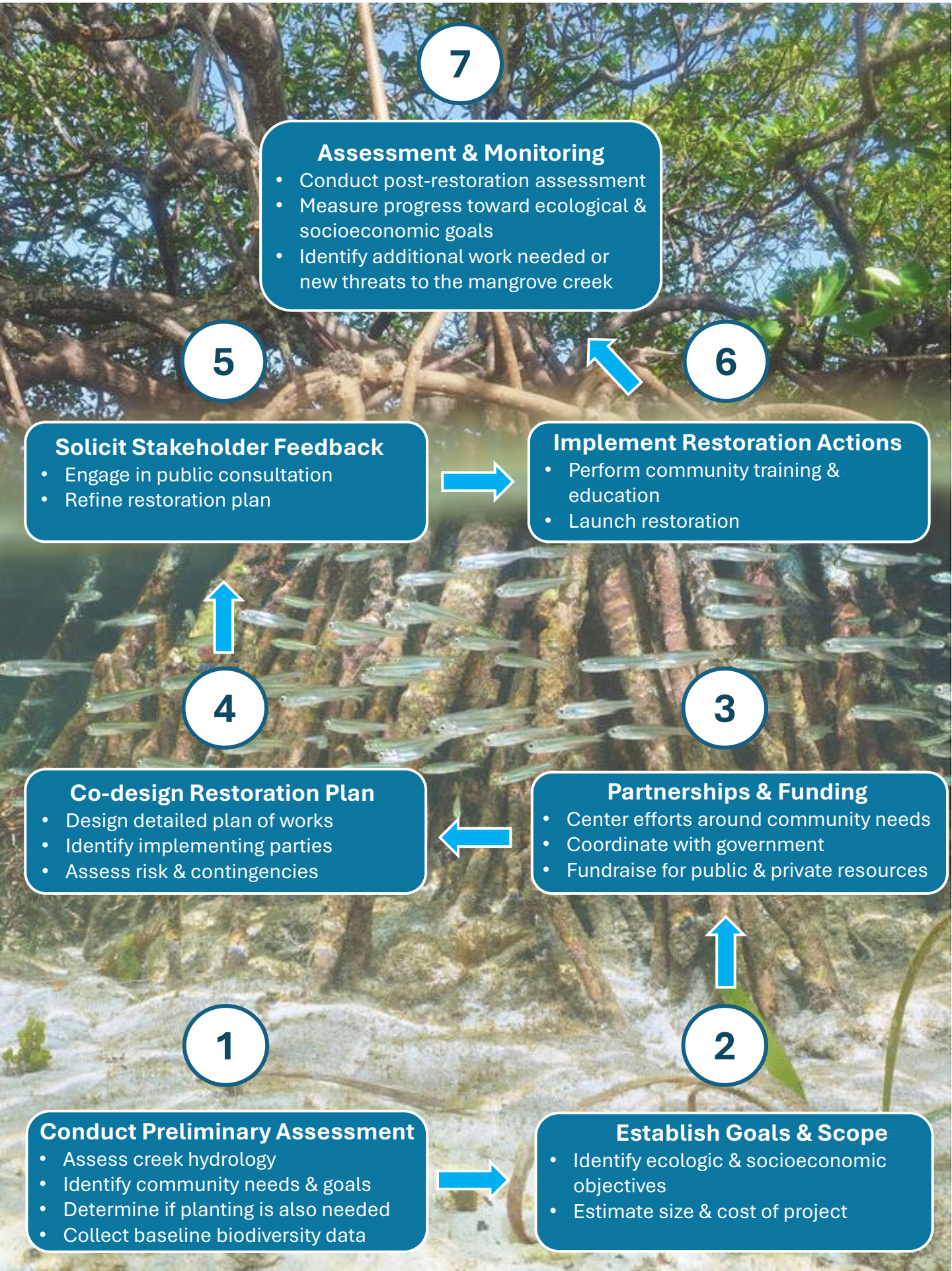
Work with small and large-scale local contractors to maximize expertise and economic benefits from creek restoration projects.

7 Monitor outcomes and adjust when necessary

Conduct post-restoration assessments to quantify ecosystem and community benefits created by the restoration project.

Use adaptive management strategies to adjust restoration efforts as new challenges and new information arises, ensuring that mangrove ecosystems are resilient to changing conditions.

Step-by-Step Guide to Restore a Creek



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Assessment & Monitoring

- Conduct post-restoration assessment
- Measure progress toward ecological & socioeconomic goals
- Identify additional work needed or new threats to the mangrove creek

5

Solicit Stakeholder Feedback

- Engage in public consultation
- Refine restoration plan

6

Implement Restoration Actions

- Perform community training & education
- Launch restoration

4

Co-design Restoration Plan

- Design detailed plan of works
- Identify implementing parties
- Assess risk & contingencies

3

Partnerships & Funding

- Center efforts around community needs
- Coordinate with government
- Fundraise for public & private resources

1

Conduct Preliminary Assessment

- Assess creek hydrology
- Identify community needs & goals
- Determine if planting is also needed
- Collect baseline biodiversity data

2

Establish Goals & Scope

- Identify ecologic & socioeconomic objectives
- Estimate size & cost of project

Training and Technical Resources

Bahamas Blocked Creek Research and Restoration Project Materials and Report

Mangrove Action Project: Mangrove Restoration, It's More than JustPlanting

Mangrove Action Project: Resource Library

Mangrove Alliance: Best Practice Guidelinesfor Mangrove Restoration

Wetlands International: Mangrove Restoration Video Series