Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad & Tobago (Tech4CoastalResilience)

Icacos Community Resilience Plan

April 4, 2025

Acknowledgements

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Cover photo: View of Icacos coastline, Credit CANARI 2024

1. Overview

The Icacos Community Resilience Plan aims to guide coastal planning and resilience actions and identify ways to reduce vulnerability and adapt to climate change and other coastal changes in Icacos, Trinidad. It is based on the key findings from the vulnerability and capacity assessment in Icacos completed in 2021 and the inputs from community residents and other key stakeholders from an action planning workshop in 2024.

The Plan has been developed under the "Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad and Tobago (Tech4CoastalResilience)" project, which is being implemented from 2023-2025 by the Caribbean Natural Resources Institute (CANARI) in partnership with the Fisheries Division, Ministry of Agriculture, Land and Fisheries and the Department of Marine Resources and Fisheries, Tobago House of Assembly. The project aims to improve the resilience of vulnerable coastal communities to climate change impacts in Trinidad and Tobago (T&T). It is supported by the "Harnessing Innovative Technologies to Support Resilient Settlements on the Coastal Zones of the Caribbean (HIT RESET Caribbean)" programme. HIT RESET Caribbean is funded by the ACP Innovation Fund implemented by the Organization of African, Caribbean and Pacific States (OACPS) and European Union (EU).

2. Approach and methodology

The process to develop the Plan was facilitated by CANARI and the Fisheries Division, Ministry of Agriculture, Land and Fisheries. It was designed to be interactive and participatory, engaging the community in practical exercises and discussions to support action planning for coastal resilience. See Appendix 1 for the agenda for the Icacos Community Action Planning workshop.

The process engaged fisherfolk, other coastal resource users and community-based organisations (CBOs), including the Icacos Fishing Association, Icacos Fisherfolk United and Icacos Fisherfolk Limited, and key government agencies including the Institute of Marine Affairs, Coastal Protection Unit and Office of Disaster Preparedness and Management. See Appendix 2 for the list of participants.

The Plan is based on findings from the vulnerability and capacity assessment in Icacos completed in 2021. The assessment involved desk review and community scoping, participatory mapping and geographic information systems (GIS), household surveys and development of an impact and capacity matrix to collect data and better understand local impacts from climate change and other issues affecting the coast. The findings were further reviewed and validated in the action planning workshop in 2024. See Appendix 3 for the vulnerability and capacity assessment findings and summary poster here.

3. Priorities for Action

A range of actions to adapt and build coastal resilience have been identified as part of the Plan (see section 5 and Appendix 4 for further details). In particular, key climate-related impacts from coastal erosion and saltwater intrusion due to sea level rise, sargassum influxes, damage to coastal habitats and property/ infrastructure, flooding, unpredictable rainfall and issues accessing potable water, and decline in fisheries and agriculture-related livelihoods were highlighted by participants. These priorities for action were therefore identified for Icacos over the short to medium term (1-6 years):

- Conservation and restoration of Icacos wetlands/mangroves to address threats from coastal erosion and saltwater intrusion with sea level rise and from dry spells and low water levels

- Coastal rehabilitation and protection of shoreline, including beach nourishment, replanting native species and revetments/other relevant infrastructure
- Construction of fishing facility, including fish processing area, lighting, ramp and provision of a safe space to store boats and engines, at appropriate site to withstand coastal erosion
- Development of hydroponics/aquaponics, aquaculture and mariculture to diversify livelihoods and income sources for fisherfolk and other residents, including training and affordable financing for equipment and materials
- Improved access to insurance for fisherfolk, farmers, guesthouses, tour operators and related local businesses to address risks from extreme weather and property/equipment damage
- Adoption of climate-smart and sustainable farming practices (e.g. agroforestry, intercropping and integrating bee keeping) in coconut production and other agriculture and development of value-added products to increase income, including training and business support
- Increased use of water storage tanks and rainwater harvesting to improve water access for residents, farmers and fisherfolk, and essential services (e.g. schools, health centre)
- Improved management of migrant camps, including number of persons and access to water and sanitation to address rising incidence of diseases and security concerns, and increased patrols by Coast Guard, police and other relevant authorities to address illegal migration

Prioritisation was based on the level of impact or risk to the community that the action can address, whether it benefits multiple sectors and community needs, and whether it can be implemented in the short to medium term.

Two of these priorities for action were selected as feasible options for further support under the Tech4CoastalResilience and other current projects given the available timeframe and budget: conservation and restoration of Icacos wetlands and mangroves; and development of alternative livelihoods for fisherfolk and other residents, including training and affordable financing for equipment and materials. CANARI and Fisheries Division will follow up to implement one action.

4. Use of this Plan

This Plan serves as a guide for coastal planning and resilience actions in the Icacos community. It should be used and further operationalised by key government agencies, including the Coastal Protection Unit, Fisheries Division, Institute of Marine Affairs, Office of Disaster Preparedness and Management and Siparia Regional Corporation, CBOs and residents in Icacos, and relevant civil society organisations and the private sector to inform efforts to address climate and other changes.

It is also aligned with, and contributes to, the National Adaptation Plan and Integrated Coastal Zone Management Policy Framework for Trinidad and Tobago.

Figure 1: Participants at the Icacos Action Planning Workshop (Source: CANARI 2024)

5. Summary of Icacos Community Resilience Plan

Note the table below includes only the key climate-related impacts and priorities for action identified and highlighted by participants. The full list of all the identified impacts and actions is in Appendix 4.

** = top priorities

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
Fisheries and marine resources						
<u>Coastal erosion and saltwater intrusion</u> due to sea level rise, more intense storms and storm surge Impacts: - Degradation and loss of fish nursery and key habitat if mangroves /Icacos wetlands decline - Damage to fishing landing site on beach and reduced access for fisherfolk	Vulnerable areas: - Great Icacos Lagoon - San Jose Lagoon - Fish landing site on Icacos Beach Vulnerable groups: - Fisherfolk (including boat owners) - Recreational fishers - Households relying on fishing as key income source - Other fisheries-related businesses	- **Conservation and restoration of mangroves/ wetlands (if significant sea level rise, allow for shift to saltwater wetland) and coastal vegetation along beach - **Construction of fishing facility, including fish processing area, lighting, ramp and provision of a safe space to store boats and engines, at appropriate site to withstand coastal erosion	- Coastal Protection Unit (CPU)/ Ministry of Works and Infrastructure (co-lead) - Fisheries Division and Forestry Division/ Ministry of Agriculture, Lands and Fisheries (co-lead) - Icacos fisherfolk organisations (co-lead) - Fisherfolk - Institute of Marine Affairs (IMA), Environmental Management Authority (EMA) - Town and Country Planning Division,	- Technical expertise (ecosystem restoration, sustainable fisheries management, climate adaptation) - Financing (significant amount for constructing facility) - Equipment - Materials - Seedlings for restoration - Labour (can be provided by local community	Short to medium term (1-6 years)	- Increase in health and extent of mangroves/ wetlands and fish nurseries - Reduced costs from damage or loss of fishing landing site and access to beach

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
		- Shift to fishing further out if nearshore fisheries decline, and use more efficient and climate-smart practices (e.g. fish finders, fish aggregating devices [FADs] and fuel-efficient boat engines) - **Development of hydroponics/ aquaponics, aquaculture and mariculture to diversify livelihoods for fisherfolk and other residents, including training and provision of equipment/ materials - Improved research and monitoring to inform response	Ministry of Planning, Economic Affairs and Development - Siparia Regional Corporation - Local community groups - SpeSEAS, Caribbean Natural Resources Institute (CANARI) and other NGOs - Caribbean Fisheries Training and Development Institute (CFTDI) - University of West Indies (UWI) - UN Food and Agriculture Organization (FAO) - Caribbean Agricultural Research & Development Institute (CARDI) - Inter-American Institute for Cooperation on Agriculture (IICA)	groups for clean-ups and monitoring)		

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
<u>Sargassum influxes</u> Impacts: - Blockage of fishing landing site on beach and reduced access for fisherfolk - Damage to boats, engines and nets/other fishing gear while at sea - Decrease in fishing days and related income - Rotting sargassum has strong odour (hydrogen sulphide gas) and can impact health of fisherfolk and nearby village	Vulnerable areas: - Fish landing site on Icacos Beach - Icacos village Vulnerable groups: - Fisherfolk (including boat owners) - Recreational fishers and beachgoers - Elderly, infants and others who suffer from respiratory diseases - Households along coast/relying on fishing as key income source - Other fisheries-related businesses	- Regular beach clean ups to avoid pile-up of large amounts of sargassum - Adoption of preventative measures to reduce damage to boat engines (e.g. cages for propellors to keep out sargassum) and gear - Access to insurance for boats, engines and gear and personal insurance for fisherfolk - Diversification of livelihoods (e.g. aquaculture, mariculture, and collection and use of sargassum to create value-added/ commercial products like liquid fertiliser),	- National Sargassum Taskforce (co-lead) - Fisheries Division /Ministry of Agriculture, Lands and Fisheries (co-lead) - Icacos fisherfolk organisations (co-lead) - Fisherfolk - Siparia Regional Corporation - IMA and EMA, Ministry of Planning, Economic Affairs and Development - Ministry of Health - Office of Disaster Preparedness and Management (ODPM) - Local community groups - CANARI and other NGOs - CFTDI - UWI - FAO	- Technical expertise (marine science, sustainable fisheries, climate adaptation) - Financing - Equipment - Materials - Labour (can be provided by local community groups for clean-ups and monitoring)	Short to medium term (1-6 years)	- Reduced length of time that sargassum stranded on beach - Reduced costs from damage or loss of boats, engines and gear by fisherfolk - Increased number of fisherfolk engaged in alternative livelihoods

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
		including training and provision of equipment/ materials - Improved research and monitoring to inform response	- CARDI - IICA - Finance and insurance providers			
<u>Dry spells/ droughts</u> Impacts: - Water shortages and reduced access to potable water, affecting ability to produce ice and clean/ process fish - Decline in water levels in wetlands and impacts on fish nurseries, other species and their habitats	Vulnerable groups: - Fisherfolk - Recreational fishers - Households relying on fishing as key income source - Other fisheries-related businesses	- Installation of water storage tanks and rainwater harvesting, including solar-powered pump, to improve water supply for fish landing site - Use of salt ice as melts slower and lasts longer - Control of outflow/inflow of water to Icacos wetlands to maintain adequate water levels and key habitats	- Fisheries Division /Ministry of Agriculture, Lands and Fisheries (lead) - Water and Sewage Authority (WASA)/ Ministry of Public Utilities - CPU/Ministry of Works and Infrastructure - IMA and EMA/ Ministry of Planning, Economic Affairs and Development - Siparia Regional Corporation - Icacos fisherfolk organisations - Fisherfolk - FAO	- Technical expertise (climate adaptation, water resources management) - Financing - Equipment - Materials - Labour	Short term (1-3 years)	- Improved, regular supply of potable water for fisherfolk - Water levels remain same/improve in Icacos wetlands

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
Agriculture						
<u>Coastal erosion</u> due to sea level rise, more intense storms and storm surge, and rough seas Impacts: - Significant erosion and damage of cocal estate lands, especially along the coast - Reduced coconut production and income from cocal estates, which is compounded by unsustainable practices, praedial larceny and disease in coconut trees	Vulnerable area: - Coral Point (3-5 metres eroded between 2021 – 2024) Vulnerable groups: - Cocal estate owners and workers - Households relying on coconut production as key income source - Other local businesses related to coconut production and products	- **Coastal rehabilitation and protection in erosion-prone areas - **Development of further value added coconut products to increase income, including training of local residents and provision of small business support - Research into new coconut varieties and improving disease detection and treatment - Increased police patrols and security for cocal estates to address praedial larceny	- Agricultural Planning and Forestry Divisions, Ministry of Agriculture, Lands and Fisheries (co-lead) - Coconut Growers Association (CGA) (co-lead) - CPU/Ministry of Works and Infrastructure - IMA and Town and Country Planning Division, Ministry of Planning, Economic Affairs and Development - Siparia Regional Corporation - T&T Police Service - Cocal estate owners and workers - Network of Rural Women Producers T&T (NRWPTT) - Local businesses	- Technical expertise (climate-smart, sustainable agriculture, coastal engineering and restoration) - Financing - Equipment - Materials - Seedlings for planting and rehabilitation - Labour	Short to medium term (1-6 years)	- Reduced costs from damage of cocal estate lands and disruption of production - Income from coconut production and value-added products for local residents remains same/increased

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
			- UWI - FAO - CARDI - IICA			
<u>Extreme and unpredictable weather</u> including heavy rainfall, high winds and storms Impacts: - Damage to vegetable crops, coconut trees and livestock due to flooding and high winds - Decline in crop productivity with changing rainfall patterns and increase in pests - Limited market access with blockage of roads and bridges due to flooding, fallen trees with high	Vulnerable groups: - Small-scale farmers - Local agri-businesses/ rural women producers - Households relying on farming as key income source	- **Adoption of climate-smart and sustainable agricultural practices to reduce loss and damage and increase productivity (e.g. shade houses, agroforestry, intercropping and integrating of bee keeping), including awareness raising on climate impacts and solutions, training and affordable financing for equipment/ materials - Improved early warning systems for extreme weather targeting farmers and agri-	- Ministry of Agriculture, Lands and Fisheries (co-lead) - Farmers and their organisations (co-lead) - CGA - Local agri-businesses - NRWPTT - ODPM - TTMS - Siparia Regional Corporation - UWI - FAO - CARDI - IICA - Finance and insurance providers - Telecommunicat-ion service providers	- Technical expertise (climate-smart agriculture, disaster management) - Financing - Equipment - Materials - Labour	Short to medium term (1-6 years)	- Reduced costs for loss and damage from extreme weather to farmers and agri-businesses

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
winds and land slippage/soil erosion		businesses (e.g. SMS alerts) - Improved access to insurance for farmers and agri-businesses				
Water and Health						
<u>Rising air temperatures</u> Impacts: - Heat stress and related health impacts - Increased incidence of vector-borne diseases (e.g. dengue fever, zika etc.) - Increased demand, but reduced access, to water and sanitation (already limited access to pipe-borne water)	Vulnerable groups: - Children, elderly and pregnant women - Households in high-risk areas - Venezuelan and other migrants in camps	- Improved community/ district health services to address heat stress and other diseases, including public education and awareness raising - Use of environmentally-friendly mosquito control - **Improved management of migrant camps, including number of persons and access to water and sanitation in camps, and increased patrols by Coast Guard,	- Ministry of Health/ Regional Health Authority (lead) - Ministry of Education - WASA/Ministry of Public Utilities - ODPM - T&T Coast Guard - Siparia Regional Corporation - Local schools - Elderly care providers - Habitat for Humanity Trinidad and Tobago - Caribbean Regional Public Health Agency (CARPHA) - Pan-American Health Organisation (PAHO)	- Technical expertise (public health, climate adaptation) - Financing - Equipment - Materials - Labour	Short to medium term (1-6 years)	- Reduced incidence of heat stress and health-related impacts - Reduced incidence of mosquito and other vector-borne diseases - Improved, regular supply of potable water for residents and essential services

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
		police and other relevant authorities to deter migrants - **Increased use of water storage tanks and rainwater harvesting to improve water supply and access for residential purposes and essential services (e.g. schools, health centre)	- United Nations High Commissioner for Refugees (UNHCR)			

Appendices

Appendix 1:

Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad & Tobago (Tech4CoastalResilience)

Icacos Community Action Planning Workshop
July 16, 2024

CONCEPT NOTE

Background

The project, "Integrating digital technologies and participatory tools to support coastal community resilience in Trinidad and Tobago (Tech4CoastalResilience)", is being implemented from 2023-2024 by the Caribbean Natural Resources Institute (CANARI) in partnership with the Fisheries Division, Ministry of Agriculture, Land and Fisheries and the Department of Marine Resources and Fisheries, Tobago House of Assembly. It aims to improve the resilience of vulnerable coastal communities to climate change impacts in Trinidad and Tobago (T&T). It is supported by the "Harnessing Innovative Technologies to Support Resilient Settlements on the Coastal Zones of the Caribbean (HIT RESET Caribbean)" programme. HIT RESET Caribbean is funded by the ACP Innovation Fund implemented by the Organization of African, Caribbean and Pacific States (OACPS) and European Union (EU).

CANARI, the Fisheries Division, Ministry of Agriculture, Land and Fisheries and Department of Marine Resources and Fisheries, Tobago House of Assembly are conducting action planning workshops in ten coastal communities – Blanchisseuse, Carli Bay, Icacos, Mayaro, Matelot and Moruga in Trinidad and Castara, Roxborough, Speyside and Scarborough in Tobago – from June to August 2024 under the project. These workshops will involve validating the findings from the vulnerability and capacity assessments conducted in these communities to better understand local impacts from climate change and other issues affecting the coast, and prioritising actions to build local resilience. This will inform efforts to implement specific coastal resilience actions under the project and in the future.

Workshop goal and objectives

The goal of this workshop is to engage community residents in Icacos and other key stakeholders to review and validate key impacts from climate change and other changes and related vulnerabilities and prioritise strategies to adapt and build coastal resilience.

The specific objectives of the workshop are to:

- review findings from the vulnerability and capacity assessment completed in 2020-2021 in Icacos in terms of key impacts and vulnerabilities related to climate change and other changes, including for the fisheries and tourism sectors and related livelihoods;
- conduct participatory action planning to improve understanding of and identify ways to reduce vulnerability and adapt to climate change and other changes; and
- prioritise specific strategies to adapt and build coastal resilience in Icacos.

Workshop venue
The workshop will be held July 16, 2024 from 9:30am – 3:15pm at the Cedros Community Centre, Cedros, Trinidad.

Target group
The workshop will target 20-30 participants, including fisherfolk, hotel and tour operators, other coastal resource users and community-based organisations in Icacos. The project partners and government and civil society organisations involved in fisheries, coastal and marine management, climate change and disaster risk management in Icacos will also be engaged. This includes:

- key government agencies involved in adaptation, disaster risk management and coastal and marine resource management, including Fisheries Division, Institute of Marine Affairs, Office of Disaster Preparedness and Management and the Siparia Regional Corporation;
- civil society organisations, including fisherfolk organisations, environmental non-governmental organisations (NGOs), women's, youth and other community groups; and
- private sector, including fisherfolk and hotel and tour operators.

Approach
The workshop will be facilitated by CANARI in collaboration with the Fisheries Division, Ministry of Agriculture, Land and Fisheries. It will be designed to be interactive and participatory, engaging the community in practical exercises and discussions to support action planning for coastal resilience.

Outputs
A local action plan for building coastal resilience will be developed based on the key findings from the vulnerability and capacity assessment in Icacos and the inputs from community residents and other key stakeholders. Specific strategies to adapt and build coastal resilience in Icacos will also be identified to be further implemented under the project.

Travel and meals
CANARI will cover the costs of the venue and meals for all participants. Local travel to Icacos may also be covered for civil society representatives where needed.

Provisional Agenda

July 16, 2024	
9:30 am	Registration of participants
10:00 am	Opening remarks, welcome and introductions Overview of the project and workshop objectives
10:45am	Presentation and Q&A – VCA findings for Icacos community Group discussion – Validating VCA findings for Icacos community
12:00 pm	**Lunch**
1:00 pm	Introduction to participatory scenario planning Interactive exercise – Participatory Scenario Planning for Icacos community
2:15 pm	Group discussion – Prioritising strategies to adapt and build coastal resilience of Icacos community
3:05 pm	Wrap up and next steps for project
3:10 pm	Closing remarks
3:15 pm	**End of workshop**

For more information, please contact CANARI at Ainka Granderson, Resilience Programme Manager at ainka@canari.org or Kerresha Khan, Technical Officer at kerresha@canari.org or call 638-6062

Appendix 2: Participants List for the Icacos Action Planning Workshop

NO.	FULL NAME	ORGANISATION	TITLE	EMAIL
1	Maritsa Harry	Coastal Protection Unit	Senior Research Specialist	mharry@mowt.gov.tt
2	Christopher Alexis	Institute of Marine Affairs (IMA)	Research Officer	calexis@ima.gov.tt
3	Jesse Williams	University of the West Indies (UWI)	Teaching Assistant	Jesse.williams@sta.uwi.edu
4	Gia Gaspard Taylor	Network of Rural Women Producers T&T (NRWPTT)	President	president@nrwptt.net
5	Andrea Alfred	Fisheries Division	Data Collector	Sexyandera1988@gmail.com
6	Edria Harry		Retired staff – Inter-American Institute for Cooperation on Agriculture (IICA)	edbharry@yahoo.com
7	Allys Forte	Fisheries Division	Fisheries Officer	Fd.yachim@gmail.com
8	Deonanan Bisseson	Icacos Village/Fishing Association	Fisherman	-
9	Anand Bissessar	Fisheries Division	Fisheries Assistant	Anandbissessar579@gmail.com
10	Melissa Jittan-Gazee	Office of Disaster Preparedness and Management (OPDM)	Hazard Mitigation Assistant	mgazee@hotmail.com
11	Tehuti Griffith	ODPM	Clerical Assistant	tehutigriffith@gmail.com
12	Ainka Granderson	Caribbean Natural Resources Institute (CANARI)	Resilience Programme Manager	ainka@canari.org
13	Kerresha Khan	CANARI	Technical Officer	Kerresha@canari.org
14	Anastacia LeeQuay	CANARI	Administrative Officer	Anastacia@canari.org

Appendix 3. Icacos Vulnerability and Capacity Assessment

Overview of community

An overview of the Icacos community is provided below, including the geography, demographics, socio-economic activities, and previous assessments in the area of relevance to climate change.

Icacos, Trinidad

Geography

Icacos is located on the southwestern peninsula of Trinidad, with the Gulf of Paria on its northern coast and the Columbus Channel to the south. It is the closest point on the island to the South American mainland, and only 11km from Venezuela.

The peninsula consists mainly of unconsolidated sediments prone to erosion and transport (Kenny, 2000). Dynamic circulation patterns where the waters of the Columbus Channel enter the Gulf of Paria cause many areas of erosion and accretion. At Coral Point, the end of the Icacos Beach Road, the shoreline has receded about 150m in the last 100 years (Kenny, 2000). Icacos point is an area of extreme accretion where sand is deposited after being transported along the Columbus Channel and from Columbus Bay. Highly turbid waters are typical of the Columbus Channel and Gulf of Paria. These factors influence the composition of fish and invertebrate communities.

There are no coral reefs due to the Orinoco River that discharges into the Columbus Channel.
However, there is a large area of wetlands including the Great Icacos Lagoon and the San Jose Lagoon, that is home to a diversity of plants and wildlife.

Demographics

Based on the last 2011 census, Icacos has a population of 1,093 people (586 are male and 507 are female). Of these residents, 81 are elderly (65 years and older), 239 are minors (15 years and under) and 773 from the working population (CSO, 2011). However, there has been a significant influx of Venezuelan migrants due to Venezuela's political and socio-economic upheaval since 2019 into Icacos given its close proximity and serving as a key port of entry.

Socio-economic activities and concerns

- Only 49.7 percent of Icacos' working population is employed, while 1.1 percent are seeking employment according to the last census (CSO, 2011).
- A significant percentage of Icacos residents work on the surrounding coconut estates, but the local economy centres primarily around fishing.
- There are approximately 140 fishers operating from 70 fishing vessels (Mieux, 2019). The main fishing methods include surface handline (à la vive, monofilament and banking). Common species landed include sierra mackerel, snapper, tarpon and cro cro (Fisheries Division, 2016).
- There is a dilapidated fishing facility but no jetty.
- There are reports that theft and kidnappings of fishers at sea have occurred linked to illegal activities (e.g. human and drug trafficking between Venezuela and Trinidad and Tobago).

Past assessments

BioBlitz, which is an annual event led by the UWI Zoological Museum and the Trinidad and Tobago Field Naturalists' Club, was held in Icacos in 2017 to conduct a rapid biodiversity assessment of the peninsula's swamps, mud volcanoes, coconut plantations, long beaches and coastal environment. This included aquatic and oceanic surveys to assess biodiversity in the coastal environment. Oil spills in the Gulf of Paria and coastal erosion were identified as key threats to coastal biodiversity based on the rapid assessment (Rutherford 2017).

Methodology

The vulnerability and capacity assessment (VCA) in Icacos was conducted from 2020-2021 by CANARI and a field team of four persons trained as part of the two-day VCA training workshop held in December 2019 in Trinidad[1].

Participatory geographic information systems (P-GIS) and impact and capacity matrix tools were applied in Icacos in a half-day workshop on February 28, 2020. Production of maps based on information gathered in the workshops was supported by a GIS expert who digitised and input maps into GIS. The field team then conducted 79 surveys over four weeks. Surveys targeted fisherfolk, including fishers, fish processors and vendors, and selected households and individuals that are representative of various demographics, livelihood activities and sectors and vulnerable groups identified in the P-GIS and impact and capacity matrix exercises.

The field team included the fisheries extension officer from the Fisheries Division, Trinidad operating in the community and fishers from the Icacos Fisherfolk United. The field team collectively encompassed a mix of competencies, including in climate change, fisheries and socio-economic/community development, to ensure a holistic approach and effective implementation.

Figure 1. Participatory mapping exercise in Icacos, Trinidad. Photos show fisherfolk and other residents of Icacos detailing the identified climate change hazards and associated impacts and vulnerabilities.

Key climate change impacts and vulnerabilities for Icacos

The specific findings from the applications of the three VCA tools in Icacos are detailed below.

Participatory mapping and GIS Findings

Stakeholders identified and mapped a range of climate-related hazards that they had experienced, or which will pose a significant risk to the community of Icacos, particularly the fisheries sector, and specific vulnerable areas and groups during the participatory GIS exercise. These hazards include:

- Inland flooding as a result of the river mouth being blocked during high tides and storm surge, and this will be exacerbated with SLR. This flooding extends into the community via rivers, leading to community infrastructure being impacted such as schools, religious institutions, businesses (e.g. bars and shops) and residential buildings.
- Coastal erosion, which especially affects the beach and mangrove ecosystems, including the fish landing site where boats are pulled on shore.

[1] https://canari.org/wp-content/uploads/2018/02/CC4FISH-TT-VCA-Training-Workshop-Report-Jan2020.pdf

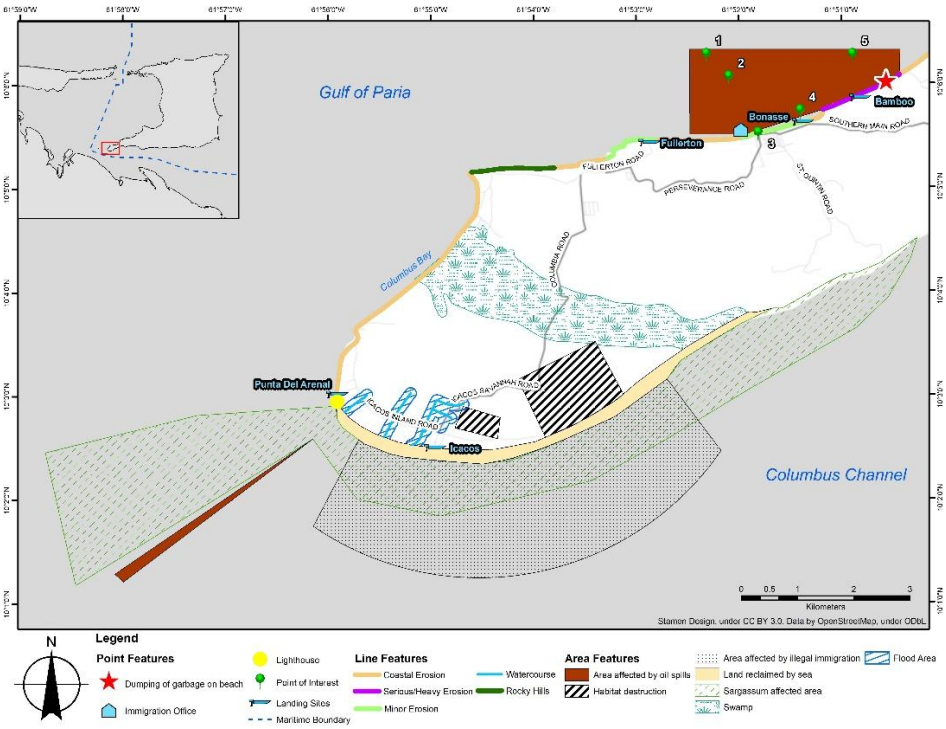
- Sargassum influxes that impact beaches and affect fisheries sector operations in Icacos. Fishers have observed sargassum along the entire extent of their fishing area.

The other key hazards identified include:

- Habitat destruction, particularly removal of mangroves that protect the coast by private developers, which has led to increased coastal erosion.
- Illegal immigration from the nearby mainland of Venezuela as a result of the political and socio-economic crisis in Venezuela. The distance between Icacos and the coast of Venezuela is only 11 km, and illegal migrants often hire boats and enter Trinidad and Tobago at this point.
- Pollution, particularly from oil spills, where fish kills and impacts to other marine and coastal species (e.g. shorebirds) have been observed. Pollution also occurs as a result of improper disposal of solid waste (e.g. fishing gear, coconut trees from nearby coconut estates and 'white waste' such as appliances from residential homes).

The local knowledge captured through the P-GIS exercise was digitised and entered into a GIS for integration with scientific knowledge and other data. See Figures 2 and 3 show the GIS map developed through digitisation of the annotated satellite imagery maps created during the exercise.

Figure 2. Participatory map of Icacos. The map was developed through discussions with community stakeholders on key climate change hazards and related impacts and vulnerabilities.



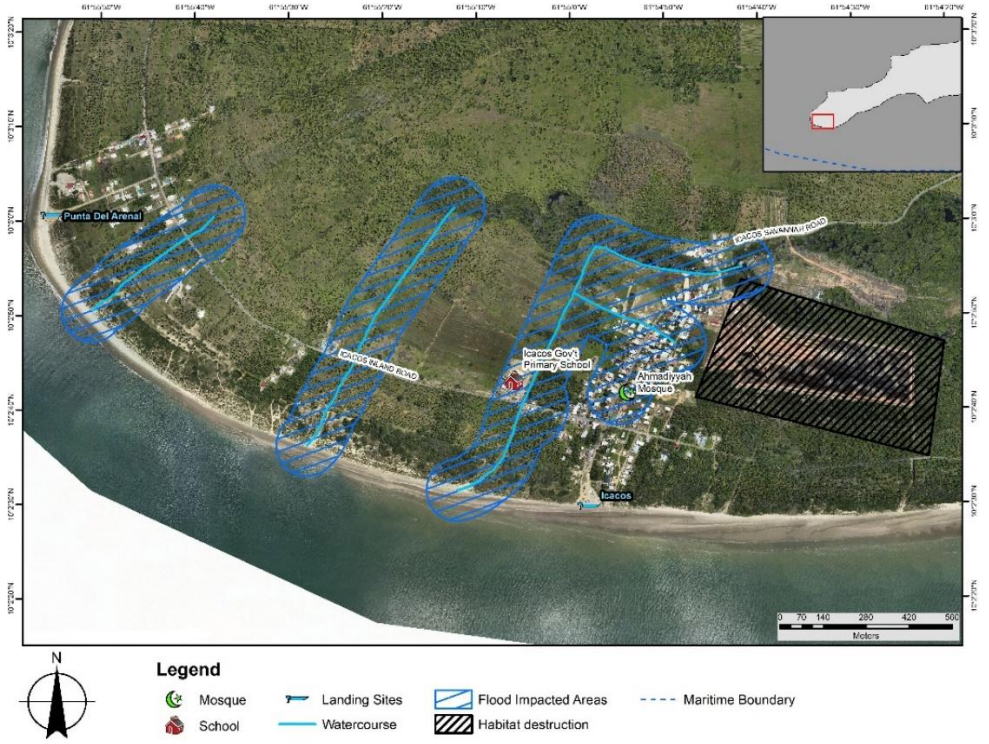
Source: CANARI (2021).

Local knowledge provided by stakeholders in Carli Bay, Trinidad during the *Workshop for the Vulnerability and Capacity Assessment of Icacos* (December 4th & 5th 2019). Map created using: EPSG:4158 coordinate system, Surveys and Mapping Division, Ministry of Agriculture, Land and Fisheries (2014 Aerial Orthomosaic) and Esri World Imagery, *ArcGIS Online* (available at: https://services.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer, accessed February 25, 2025).

Points of interest

#	Description
1	Following a 2013 oil spill, herring and sardines have not been observed returning to the area by fisherfolk
2	Flood gate
3	Sick pelican observed in 2019; suspected to have eaten polluted bait fish by fisherfolk
4	Annual testing by oil company (formally known as Petrotrin). Test station is located outside La Brea. High levels of pollution, which travels to these waters and effects the fishing industry.

Figure 3. Map of Icacos developed through discussions with community stakeholders on key climate change hazards and related impacts and vulnerabilities.



Source: CANARI (2021).

Local knowledge provided by stakeholders in Carli Bay, Trinidad during the *Workshop for the Vulnerability and Capacity Assessment of Icacos* (December 4th & 5th 2019). Map created using: EPSG:4158 coordinate system, Surveys and Mapping Division, Ministry of Agriculture, Land and Fisheries (2014 Aerial Orthomosaic) and Esri World Imagery, *ArcGIS Online* (available at: https://services.arcgisonline.com/arcgis/rest/services/World_Imagery/MapServer, accessed February 25, 2025).

Impact and capacity matrix findings

Fisherfolk and other community stakeholders ranked the identified climate-related hazards that they had experienced, or which pose significant risk to Icacos and specific vulnerable areas and groups, during the impact and capacity matrix exercise. They also identified potential coping and adaptation strategies to address the impacts of identified hazards.

Coastal erosion was ranked the top hazard with high to medium impact identified by stakeholders for all fisheries assets (such as boats, gear and fish landing site), community infrastructure (such as residential areas, religious institutions, schools and roads) and natural resources (such as beaches, wetlands and related biodiversity). Flooding along rivers also poses significant risk to the Icacos community, particularly to community infrastructure in low-lying areas, while sargassum influxes

impact fisheries' assets and livelihoods considerably. Stakeholders further identified pollution, particularly from oil spills, as an ongoing risk to fisheries and marine resources. They noted a number of oil spills in the past from the country's oil and gas sector operations in the Gulf of Paria that adversely impacted Icacos fisherfolk and their fishing grounds.

Stakeholders identified potential coping and adaptation strategies to address the impacts of these key hazards. Coastal protection via ecosystem-based solutions (e.g. mangrove restoration to buffer against storms, surge and SLR) and infrastructural solutions was highlighted to address coastal erosion. Use of proper waste disposal avenues was highlighted to address pollution (e.g. local government highlighting collection dates for different types of waste from the community). Stakeholders also noted the need for education and awareness on climate change and pollution, highlighting the impacts on local livelihoods and well-being. Stakeholders also identified the need to foster and strengthen partnerships between government agencies, fisherfolk and other community-based organizations and the village council to mobilise resources to address sargassum influxes (e.g. via regular beach clean-ups). See Table 1 for full results of the impact and capacity matrix.

Table 1. Impact and capacity matrix for Icacos, Trinidad.

Key:	3 – High Impact	2 – Medium Impact	1 – Low impact	0 – No impact	Blank – N/A

Assets/ infrastructure/ resources	Hazards									
	sargassum	crime/ larceny	pollution	oil spill(s)	coastal erosion	sea level rise	storm surge/ flooding	poaching	pests/ diseases	habitat destruction
Fisheries assets										
Fishing boats	2	3	3	3	2	1				
Fishing gears (nets, etc)	2	3	3	3	3	1				
Fishing access	3	1	2	1	2	1				
beach	3	1	3	3	3	3	3		1	3
sea	2.5	1	3	3	2	1				
Fisheries assets total	**12.5**	**9**	**14**	**13**	**12**	**7**	**3**		**1**	**3**
Community infrastructure										
Fish landing site (building)			3		3		3			
jetty			1		3		1			
lighthouse			1		3		1			
church			3		3		3			
school			3		3		3			
roads			3		3		3			
estates (passionfruit, coconut)			3		3		3			
homes			3		3		3			
Community infrastructure total			**20**		**24**		**20**			
Natural resources										
Icacos wetlands					3		1	2	1	3
reefs					2		1	1	3	3
marine biodiversity					3		1	3	1	3
land biodiversity					3		1	3	3	3
Natural resources total					**11**		**3**	**9**	**8**	**12**
All categories total	**12.5**	**9**	**34**	**13**	**47**	**7**	**27**	**9**	**9**	**15**
Potential coping/adaptation	General coping and adaptation strategies were discussed by stakeholders for all categories of assets:									

Assets/ infrastructure/ resources	Hazards									
	sargassum	crime/ larceny	pollution	oil spill(s)	coastal erosion	sea level rise	storm surge/ flooding	poaching	pests/ diseases	habitat destruction
strategies?	- Replanting of mangrove to buffer against coastal erosion, suggested with the possibility of having replanting efforts be a community project. - Education and awareness on importance of mangrove ecosystem to prevent dumping in mangrove habitats or clearing of mangrove. - Building of revetments or other infrastructural measures for coastal protection in addition to mangrove replanting - Improved coordination and mobilisation of manpower and resources for clean-up of sargassum influxes and other solid waste (old fishing gear and coconut trees from estates being dumped on the beach); possibility of hiring community members to do clean-up as they are in the area and would be on-site rather than external contractors. - Education and awareness on climate change and its impacts as well as on proper waste disposal (e.g. awareness raising on Regional Corporation's schedule for white waste collection). - Improved enforcement of laws to ensure environmental protection (e.g. Environmental Management Authority and Regional Corporation to enforce pollution regulations and investigate and prosecute persons illegally clearing land) and human security (e.g. Coast Guard patrols to prevent risk of theft/kidnapping at sea)									

Source: CANARI (2021).

Survey findings

A total of 98 surveys were administered in Icacos, with 40 percent being female and 53 percent male. The majority of respondents were aged 20-39 and 40-59 representing 37 percent and 40 percent of the total, respectively. Survey responses disaggregated by age and gender revealed no significant differences in responses among groups.

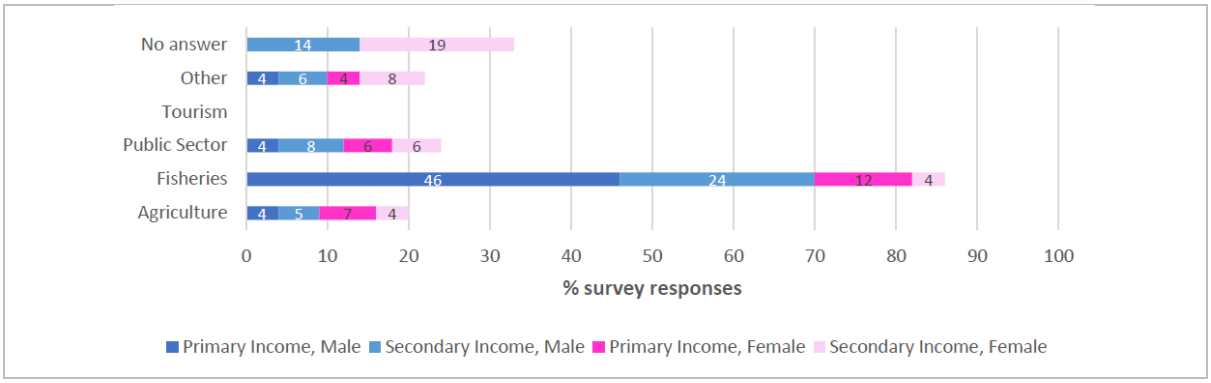
The majority of survey respondents in Icacos indicated their primary source of income was the fisheries sector at 60 percent (Table 2). The highest percentage of secondary income sources also fell within the fisheries sector at 33 percent. 10 percent of respondents were unemployed. The majority of survey respondents working within the fisheries sector are male and span the ages 20-59 years, although a number of women surveyed are employed in the sector. However, 19 percent of women did not give a response to source of income (Figure 4).

Table 2. Sources of income for Icacos survey respondents

Source of income	agriculture	fisheries	public sector	tourism	other	no answer
Primary source	10%	60%	9%	0%	20%	0%
Secondary source	9%	33%	13%	0%	13%	31%

Source: CANARI (2021).

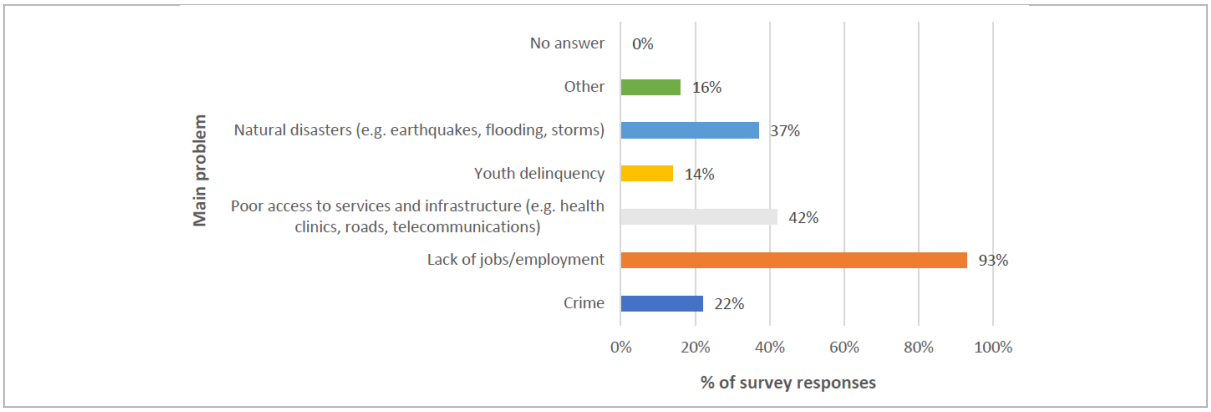
Figure 4. Sources of income for Icacos survey respondents, by gender.



Source: CANARI (2021).

Lack of jobs/employment was the main problem identified by 93 percent of Icacos respondents. Poor access to services and infrastructure (42 percent of respondents) and natural disasters (37 percent of respondents) were also highlighted to a lesser degree as issues affecting their households or livelihoods (Figure 5).

Figure 5. Main problem affecting Icacos respondents' households and livelihoods.

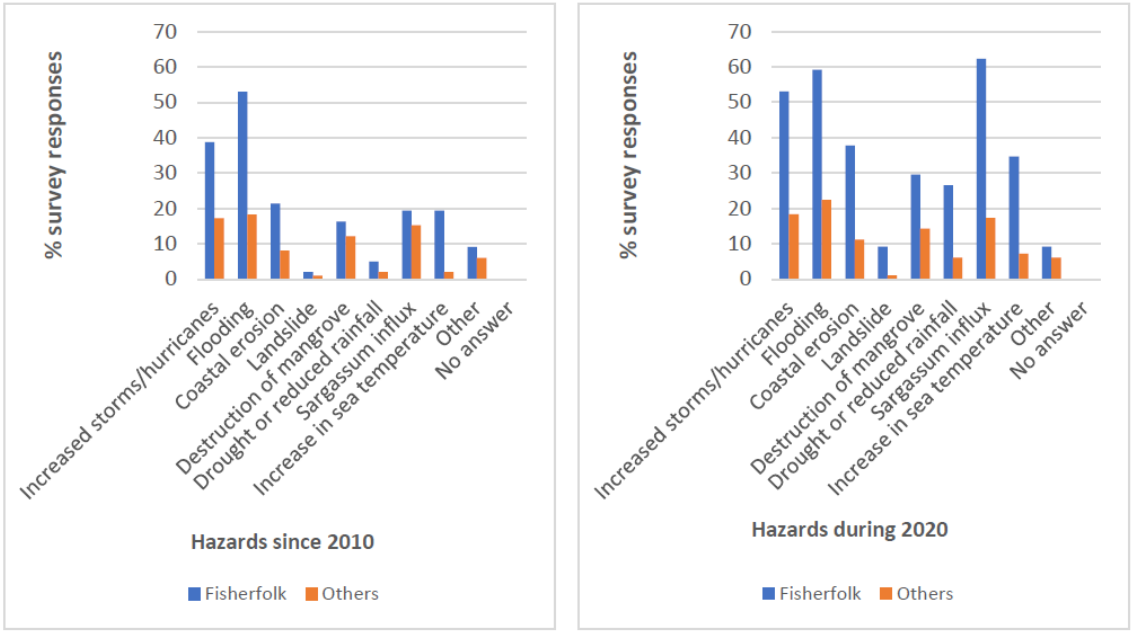


Source: CANARI (2021).

Climate and related hazards affecting Icacos

Overall, flooding, increased storms, coastal erosion and sargassum influxes were identified as the main hazards during the year 2020 and from 2010-2020. Also, notable was the increased mention of drought/reduced rainfall throughout 2020, which likely reflects the drought conditions experienced across the Caribbean region from 2019 to 2020 (Figure 6).

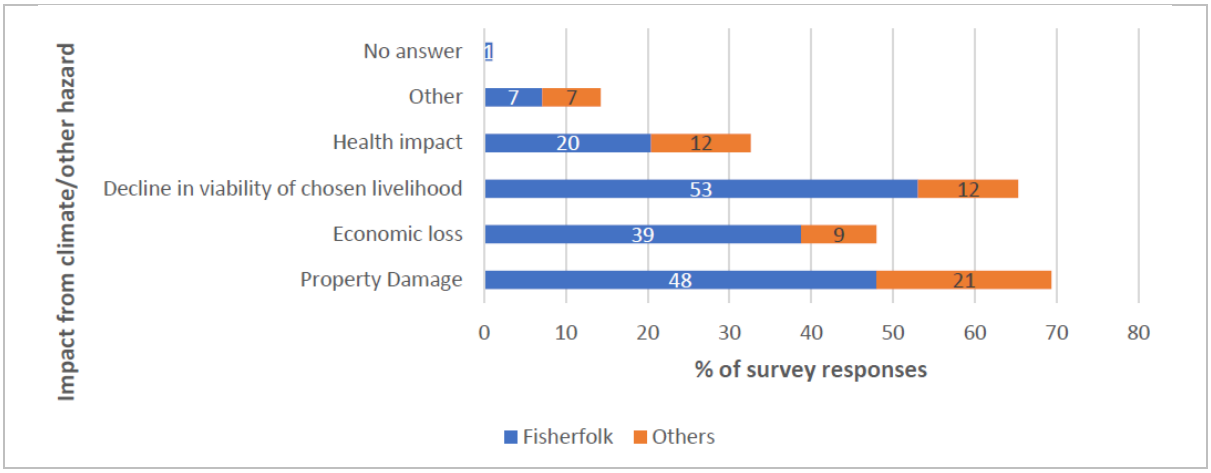
Figure 6. Climate and other hazards affecting households and livelihoods in Icacos since 2010 and during 2020.



Source: CANARI (2021).

Notably, fisherfolk identified sargassum influxes, coastal erosion and increase in sea temperatures as key issues affecting their household or livelihood in significantly greater numbers than other respondents since 2010. This is likely due to the fact these hazards impact directly on the fishing grounds and fish landing site on the beach in Icacos affecting fishing operations and related livelihoods. As a result of the hazards identified, 69 percent of Icacos respondents suffered property damage, 65 percent indicated a decline in the viability of their chosen livelihood and 48 percent reported economic losses, including both fisherfolk and those engaged in other sectors (Figure 7).

Figure 7. Resulting impacts from climate and other hazards identified by Icacos respondents.



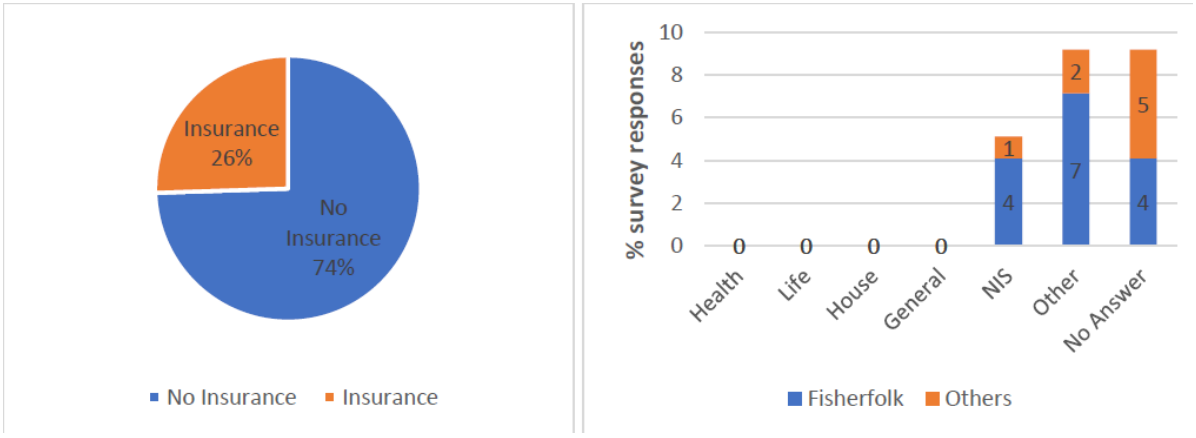
Source: CANARI (2021).

Recovery methods and coping and adaptation strategies

Of those surveyed, 27 percent of respondents indicated they were still recovering from the identified hazards and their impacts, 18 percent had initiated self-recovery options to cope and 16 percent had not yet recovered. 63 percent of respondents had taken 24+ months to recover, 18 percent 12-24 months and 5 percent took only 6-12 months to recover. Only 6 percent of respondents took less than 6 months to recover from identified hazards and their impacts.

74 percent of survey respondents had no insurance. Of the 26 percent that possessed insurance, only 5 percent were part of NIS. The 9 percent of respondents indicating other insurance did not specify the type of insurance. Fisherfolk comprised the majority of respondents indicating insurance overall.

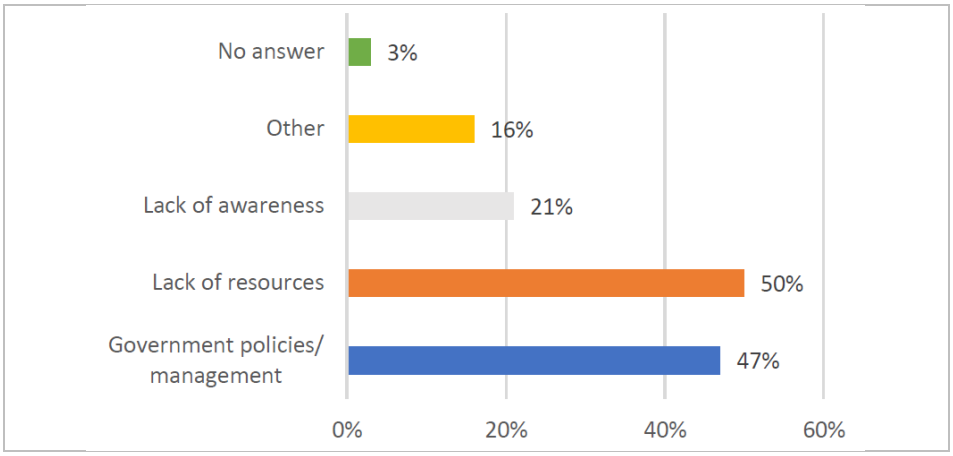
1. Insurance status and type of Icacos survey respondents



Source: CANARI (2021)

Respondents largely indicated that adaptation measures were not present within the community of Icacos.

Figure 8. Main barriers to implementing adaptation measures in Icacos, Trinidad.



Source: CANARI (2021).

In terms of the main barriers to implementing adaptation measures, 50 percent of respondents indicated lack of resources and 47 percent highlighted weak government policies and management. Lack of awareness was also identified by 21 percent of respondents.

Summary of findings

A summary of the key climate change impacts, vulnerabilities and adaptation priorities for Icacos is outlined in Table 3.

Table 3. Key climate change impacts, vulnerabilities and adaptation priorities identified by Icacos stakeholders using the VCA tools.

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
Coastal and marine biodiversity and ecosystems			
• Storms • and storm surge • Warmer sea temperatures • Sargassum influx • Inland flooding particularly along riverbanks • Drought/ reduced rainfall	• Coastal erosion impacting beaches and coastal vegetation, including loss of fringing mangrove along coastlines that still have mangroves. • Marine ecosystems impacted by influx of sargassum and sedimentation from rivers.	• The coastline of Icacos including beaches, mangroves and other coastal vegetation. • Wetlands and rivers further inland being impacted due to changes in salinity as a result of sea level rise and increased frequency of storm surge.	• Replanting of mangrove to buffer against coastal erosion, and education and awareness on the importance of mangrove ecosystems. • Building revetments, sea wall or other type of infrastructure for coastal protection. • Mobilising partnerships among government agencies and local fisherfolk/ community organizations to

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
			enable coordinated action for clean-up of sargassum on beach and landing site.
Livelihoods and socio-economic practices			
• Increased storms and storm surge • Warmer sea temperatures • Sargassum influx • Inland flooding particularly along riverbanks • Drought/ reduced rainfall	• Damage to or loss of fishing boats, gear and landing site on beach due to storms, storm surge and sargassum influxes. • Decline in catch and fisherfolk's income due to increasing storms and sargassum influx impacting fishing operations. • Low-lying areas of community being impacted by floods and possibly storm surge, including damage to and disruption in operations of schools, religious institutions, businesses and residential homes. • Water shortages for households and coconut estates that do not have access to piped water supply during droughts.	• Fisherfolk in Icacos and those dependent on the fisheries sector for their livelihoods (e.g. fishers, boat owners, vendors), including their family members dependent on their income. • Households impacted by damage to community infrastructure (e.g. schools, religious institutions) and residential homes. • Business owners and employees working in low-lying areas prone to flooding • Households and coconut estates affected by water shortages.	• Mobilising partnerships among government agencies and local fisherfolk/ community organizations to enable coordinated action for clean-up of sargassum on beach and landing site. • Improving flood protection.
Settlements and infrastructure			
• Increased storms and storm surge • Warmer sea temperatures • Inland flooding particularly along riverbanks	• Property damage and loss of coastal infrastructure due to coastal erosion and storm surge. • Property damage and loss of community infrastructure in low-lying areas due to inland flooding.	• Fishing facility (although not in use) • Community infrastructure (e.g. schools, businesses, residential homes, and roads). • Businesses (e.g. bars, restaurants, shops, etc.) impacted by inland flooding.	• Replanting of mangrove to buffer against coastal erosion, and education and awareness on the importance of mangroves. • Building revetments, sea wall or other type of infrastructure for coastal protection.

Climate-related hazards	Key impacts	Vulnerable groups and areas	Priorities for adaptation
			• Improving flood protection.

Stakeholder Validation

A validation exercise was conducted in Icacos as part of the action planning workshop on July 16, 2024 to determine if there were any significant changes to the key climate change impacts and vulnerabilities identified in the VCA in 2020-2021.

Below is a summary of updates shared by community residents:

- Mangroves are growing back naturally and helping to protect the coastline along Icacos. Estimated that around 200 feet of land regained.
- With return of mangroves, coastal and marine life has returned including chip-chip, conch etc. along nearshore areas
- The Icacos wetlands are home to vibrant biodiversity, including Scarlet Ibis and flamingos and wildfowl that migrate from South America. However, they are threatened by long, very dry spells like during the 2024 dry season, where the wetlands dry out along the access road and saltwater intrusion occurs into the freshwater marshes. This is compounded by the fact that water flow into the wetlands is heavily influenced by a system of drains and how often they are opened and closed.
- Currently, there is growing interest in the Icacos wetlands as a tourist attraction for birdwatching and other eco-tourism, and there are a number of tours that frequent the area and residents within the community who clean-up the garbage and maintain the area.
- Significant coastal erosion is occurring in specific parts of the Icacos peninsula. E.g. drone monitoring observations by the Coastal Protection Unit indicate that as much as 3-5 metres have been lost between 2021 – 2024 in areas such as Coral Point impacting coconut estates in this area.
- A significant and ongoing increase in Venezuelan migrants has occurred in Icacos since 2021, with estimates of 1,000-5,000 persons living in an informal camp on the beach. This has raised significant health, sanitation and security concerns, with outbreaks of diseases, lack of potable water and sanitation and a rise in crime including prostitution. UN is providing social welfare support and funding to the migrants, including $2,700 TT per month.
- There are insufficient patrols by the police, Customs and Coast Guard to deter migrants and illegal activities related to drug and human trafficking.
- Declining interest in agriculture e.g. vegetable crops and coconut plantations due to loss and damage from extreme weather, theft of equipment and praedial larceny. Additionally, there is also an issue related to stray animals e.g. cattle, goats and wild pigs entering and damaging crops.
- There is increasing competition with Venezuelan fishers in waters in and around Icacos and therefore more fishing pressure and security risks.
- There is an increase in number of mosquitoes in the community during rainy season, with swarms observed. Fortunately, these are not disease-carrying mosquitoes like the *Aedes egypti*.

Based on the above, they also recommended additional actions to adapt and build resilience:

- A feasibility study needed to better understand the coastal dynamics in Icacos, with certain areas rapidly eroding and others accreting, before any capital works are undertaken for coastal protection.
- Ongoing monitoring of the Icacos wetlands, including water flow into the area and water levels and impacts of drying and further saltwater intrusion, to inform efforts to conserve the area and maintain its hydrology.
- Targeted efforts to address issues facing agriculture, especially the coconut estates, as this is an important source of income for the community.
- Improved efforts to address migrant crisis and the poor conditions in camp on the beach in Icacos to avoid further disease outbreaks and crime spilling over into the wider community.

Appendix 4. Icacos Community Resilience Plan

Bold = priority impacts and actions; ** = top priorities

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
Fisheries and Marine Resources						
<u>Coastal erosion and saltwater intrusion</u> due to sea level rise, more intense storms and storm surge **Impacts:** - **Degradation and loss of fish nursery and key habitat if mangroves /Icacos wetlands decline** - **Damage to fishing landing site on beach and reduced access for fisherfolk**	**Vulnerable areas:** - **Great Icacos Lagoon** - **San Jose Lagoon** - **Fish landing site on Icacos Beach** **Vulnerable groups:** - **Fisherfolk (including boat owners)** - **Recreational fishers** - **Households relying on fishing as key income source** - **Other fisheries-related businesses**	- ****Conservation and restoration of mangroves/ wetlands** - **(if significant sea level rise, allow for shift to saltwater wetland) and coastal vegetation along beach** - ****Construction of fishing facility, including fish processing area, lighting, ramp and provision of a safe space to store boats and engines, at appropriate site to withstand coastal erosion**	- **Coastal Protection Unit (CPU)/ Ministry of Works and Infrastructure (co-lead)** - **Fisheries Division and Forestry Division/ Ministry of Agriculture, Lands and Fisheries (co-lead)** - **Icacos fisherfolk organisations (co-lead)** - **Fisherfolk** - **Institute of Marine Affairs (IMA), Environmental Management Authority (EMA)** - **Town and Country Planning Division, Ministry of Planning,**	- **Technical expertise (ecosystem restoration, sustainable fisheries management, climate adaptation)** - **Financing (significant amount for constructing facility)** - **Equipment** - **Materials** - **Seedlings for restoration** - **Labour (can be provided by local community groups for**	**Short to medium term (1-6 years)**	- **Increase in health and extent of mangroves/ wetlands and fish nurseries** - **Reduced costs from damage or loss of fishing landing site and access to beach**

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
		- Shift to fishing further out if nearshore fisheries decline, and use more efficient and climate-smart practices (e.g. fish finders, fish aggregating devices [FADs] and fuel-efficient boat engines) - **Development of hydroponics/ aquaponics, aquaculture and mariculture to diversify livelihoods for fisherfolk and other residents, including training and provision of equipment/ materials - Improved research and monitoring to inform response	Economic Affairs and Development - Siparia Regional Corporation - Local community groups - SpeSEAS, Caribbean Natural Resources Institute (CANARI) and other NGOs - Caribbean Fisheries Training and Development Institute (CFTDI) - University of West Indies (UWI) - UN Food and Agriculture Organization (FAO) - Caribbean Agricultural Research & Development Institute (CARDI) - Inter-American Institute for Cooperation on Agriculture (IICA)	clean-ups and monitoring)		

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
<u>Sargassum influxes</u> Impacts: - Blockage of fishing landing site on beach and reduced access for fisherfolk - Damage to boats, engines and nets/other fishing gear while at sea - Decrease in fishing days and related income - Rotting sargassum has strong odour (hydrogen sulphide gas) and can impact health of fisherfolk and nearby village	Vulnerable areas: - Fish landing site on Icacos Beach - Icacos village Vulnerable groups: - Fisherfolk (including boat owners) - Recreational fishers and beachgoers - Elderly, infants and others who suffer from respiratory diseases - Households along coast/relying on fishing as key income source - Other fisheries-related businesses	- Regular beach clean ups to avoid pile-up of large amounts of sargassum - Adoption of preventative measures to reduce damage to boat engines (e.g. cages for propellors to keep out sargassum) and gear - Access to insurance for boats, engines and gear and personal insurance for fisherfolk - Diversification of livelihoods (e.g. aquaculture, mariculture, and collection and use of sargassum to create value-added/ commercial products like liquid fertiliser),	- National Sargassum Taskforce (co-lead) - Fisheries Division /Ministry of Agriculture, Lands and Fisheries (co-lead) - Icacos fisherfolk organisations (co-lead) - Fisherfolk - Siparia Regional Corporation - IMA and EMA, Ministry of Planning, Economic Affairs and Development - Ministry of Health - Office of Disaster Preparedness and Management (ODPM) - Local community groups - CANARI and other NGOs - CFTDI - UWI	- Technical expertise (marine science, sustainable fisheries, climate adaptation) - Financing - Equipment - Materials - Labour (can be provided by local community groups for clean-ups and monitoring)	Short to medium term (1-6 years)	- Reduced length of time that sargassum stranded on beach - Reduced costs from damage or loss of boats, engines and gear by fisherfolk - Increased number of fisherfolk engaged in alternative livelihoods

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
		including training and provision of equipment/ materials - Improved research and monitoring to inform response	- FAO - CARDI - IICA - Finance and insurance providers			
<u>Dry spells/ droughts</u> Impacts: - Water shortages and reduced access to potable water, affecting ability to produce ice and clean/ process fish - Decline in water levels in wetlands and impacts on fish nurseries, other species and their habitats	Vulnerable groups: - Fisherfolk - Recreational fishers - Households relying on fishing as key income source - Other fisheries-related businesses	- Installation of water storage tanks and rainwater harvesting, including solar-powered pump, to improve water supply for fish landing site - Use of salt ice as melts slower and lasts longer - Control of outflow/inflow of water to Icacos wetlands to maintain adequate water levels and key habitats	- Fisheries Division /Ministry of Agriculture, Lands and Fisheries (lead) - Water and Sewage Authority (WASA)/ Ministry of Public Utilities - CPU/Ministry of Works and Infrastructure - IMA and EMA/ Ministry of Planning, Economic Affairs and Development - Siparia Regional Corporation - Icacos fisherfolk organisations - Fisherfolk - FAO	- Technical expertise (climate adaptation, water resources management) - Financing - Equipment - Materials - Labour	Short term (1-3 years)	- Improved, regular supply of potable water for fisherfolk - Water levels remain same/improve in Icacos wetlands

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
<u>Extreme weather</u> due to heavy rainfall, storms, high winds and rough seas Impacts: - Damage to boats, engines and nets/other fishing gear, and to fish landing site - Blocked access due to floods and fallen trees/debris in nearshore and along one main road - Safety issues at sea for fisherfolk with stronger winds and rougher seas (compounded by theft and security concerns linked to illegal	Vulnerable groups: - Fisherfolk (including boat owners) - Recreational fishers - Households relying on fishing as key income source - Other fisheries-related businesses	- Safety at sea training, access to required equipment (e.g. GPS, VHF radio) and improved early warning systems for fishers - Regular clean ups of beach and nearshore to avoid pile-up of fallen trees/debris - Access to insurance for boats, engines and gear and personal insurance for fisherfolk - Increased patrols by Coast Guard for emergency response and addressing crime and thefts at sea	- Fisheries Division/ Ministry of Agriculture, Lands and Fisheries (co-lead) - Icacos fisherfolk organisations (co-lead) - Fisherfolk - ODPM - T&T Meteorological Service (TTMS) - T&T Coast Guard - Siparia Regional Corporation - Local community groups - CFTDI - UWI - FAO - Insurance providers - Telecommunicat-ion service providers	- Technical expertise (marine and fisheries science, disaster response) - Financing - Equipment - Materials - Labour (can be provided by local community groups for clean-ups)	Short to medium term (1-6 years)	- Reduced costs from damage or loss of boats, engines and gear - Reduced number of safety incidents reported by fisherfolk

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
activities between Venezuela and Trinidad and Tobago) - Decrease in fishing days and related income due to weather conditions and equipment damage						
<u>Rising ocean temperatures and shifting fish distribution</u> Impacts: - Decline in fish catch and income (e.g. certain species prefer cooler, deeper waters). This is compounded by increased fishing pressure with	Vulnerable groups: - Fisherfolk - Households relying on fishing as key income source - Other fisheries-related businesses	- Adoption of fish aggregating devices (FADs) with proper use and management - Shifting to other fishing areas and types of fish species - Awareness raising among fisherfolk on sustainable fishing practices (e.g. harvest rates, mesh size, anchoring) - Development of hydroponics/	- Fisheries Division/ Ministry of Agriculture, Lands and Fisheries (co-lead) - Icacos fisherfolk organisations (co-lead) - Fisherfolk - CANARI - CFTDI - UWI - FAO - CARDI - IICA	- Technical expertise (marine science, sustainable fisheries, climate adaptation) - Financing - Equipment - Materials - Labour	Short to medium term (1-6 years)	- Increased catch and size of fish from FADs - Increased variety of fish species caught (including nearshore and pelagic species) - Increased number of fisherfolk engaged in alternative livelihoods

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
Venezuelan migrants. - Increase in distance travelled to catch fish and fuel costs due to shifting fish distribution		aquaponics, aquaculture and mariculture to diversify livelihoods for fisherfolk and other residents, including training and provision of equipment/ materials				
Agriculture						
<u>Coastal erosion</u> due to sea level rise, more intense storms and storm surge, and rough seas **Impacts:** - **Significant erosion and damage of cocal estate lands, especially along the coast** - **Reduced coconut production and**	**Vulnerable area:** - **Coral Point (3-5 metres eroded between 2021 – 2024)** **Vulnerable groups:** - **Cocal estate owners and workers** - **Households relying on coconut production as key income source**	- ****Coastal rehabilitation and protection in erosion-prone areas** - ****Development of further value added coconut products to increase income, including training of local residents and provision of small business support** - **Research into new coconut varieties and**	- **Agricultural Planning and Forestry Divisions, Ministry of Agriculture, Lands and Fisheries (co-lead)** - **Coconut Growers Association (CGA) (co-lead)** - **CPU/Ministry of Works and Infrastructure** - **IMA and Town and Country Planning Division, Ministry of Planning,**	- **Technical expertise (climate-smart, sustainable agriculture, coastal engineering and restoration)** - **Financing** - **Equipment** - **Materials** - **Seedlings for planting and rehabilitation** - **Labour**	**Short to medium term (1-6 years)**	- **Reduced costs from damage of cocal estate lands and disruption of production** - **Income from coconut production and value-added products for local residents remains same/increased**

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
income from cocal estates, which is compounded by unsustainable practices, praedial larceny and disease in coconut trees	- Other local businesses related to coconut production and products	improving disease detection and treatment - Increased police patrols and security for cocal estates to address praedial larceny	Economic Affairs and Development - Siparia Regional Corporation - T&T Police Service - Cocal estate owners and workers - Network of Rural Women Producers T&T (NRWPTT) - Local businesses - UWI - FAO - CARDI - IICA			
<u>Extreme and unpredictable weather</u> including heavy rainfall, high winds and storms Impacts: - Damage to vegetable crops, coconut trees and livestock due to flooding and high winds	Vulnerable groups: - Small-scale farmers - Local agri-businesses/ rural women producers - Households relying on farming as key income source	- **Adoption of climate-smart and sustainable agricultural practices to reduce loss and damage and increase productivity (e.g. shade houses, agroforestry, intercropping and integrating of bee keeping), including	- Ministry of Agriculture, Lands and Fisheries (co-lead) - Farmers and their organisations (co-lead) - CGA - Local agri-businesses - NRWPTT - ODPM - TTMS - Siparia Regional Corporation	- Technical expertise (climate-smart agriculture, disaster management) - Financing - Equipment - Materials - Labour	Short to medium term (1-6 years)	- Reduced costs for loss and damage from extreme weather to farmers and agri-businesses

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
- **Decline in crop productivity with changing rainfall patterns and increase in pests** - **Limited market access with blockage of roads and bridges due to flooding, fallen trees with high winds and land slippage/soil erosion**		**awareness raising on climate impacts and solutions, training and affordable financing for equipment/ materials** - **Improved early warning systems for extreme weather targeting farmers and agri-businesses (e.g. SMS alerts)** - **Improved access to insurance for farmers and agri-businesses**	- **UWI** - **FAO** - **CARDI** - **IICA** - **Finance and insurance providers** - **Telecommunicat-ion service providers**			
<u>Hot, dry spells</u> with rising air temperatures and variable rainfall Impacts: - Heat stress and changes in productivity in crops and livestock	Vulnerable groups: - Small-scale farmers - Local agri-businesses/rural women producers - Households relying on farming as key income source	- **Adoption of climate-smart and sustainable farming practices to address heat and water stress and improve productivity (e.g. shade houses, hydroponics/ aquaponics, agroforestry),	- Agricultural Planning Division and Forestry Division/ Ministry of Agriculture, Lands and Fisheries (co-lead) - Farmers and their organisations (co-lead) - CGA	- Technical expertise (climate-smart agriculture, water resources management, fire and disaster management) - Financing - Equipment	Short to medium term (1-6 years)	- Reduced incidence of heat stress-related impacts - Improved regular supply of water for farmers and agri-businesses

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
- Water shortages for farms and agri-businesses and limited ability to process agricultural products - Increase in forest fires and related threats to lives, property/ infrastructure and farms		including awareness raising on climate impacts and solutions, training and affordable financing for equipment/tools - **Increased use of water storage tanks and rainwater harvesting to improve access to water supply for farms and agri-businesses - Improved early warning systems for extreme weather targeting farmers and agri-businesses (e.g. SMS alerts) - Improved forest fire management - Improved access to insurance for farmers and agri-businesses	- Local agri-businesses - NRWPTT - WASA - ODPM - Siparia Regional Corporation - TTMS - T&T Fire Services - UWI - FAO - CARDI - IICA - Finance and insurance providers - Telecommunicat-ion service providers	- Materials - Labour		
Tourism						

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
<u>Coastal erosion and saltwater intrusion</u> with sea level rise, more intense storms and storm surge, and rough seas Impacts: - Decline in visitors and income due to reduced beach access and reduced health of Icacos wetlands and related wildlife - Loss and damage of tourism-related property and infrastructure, including main access road	Vulnerable areas: - Great Icacos Lagoon - San Jose Lagoon - Icacos Beach Vulnerable groups: - Tour operators - Guesthouse owners in Icacos and surrounding Cedros area - Vendors and other tourism-related businesses operating near beach/wetlands - Households dependent on tourism as key income source	- Beach nourishment and rehabilitation using native coastal vegetation - Conservation and restoration of Icacos wetlands as key wildlife habitat and tourist attraction - Promotion of alternative cultural/heritage attractions - **Improved access to insurance for tour operators and tourism-related businesses - Managed retreat from low-lying and other at-risk areas to reduce future loss of property/ infrastructure and related livelihoods	- Ministry of Trade, Investment and Tourism (co-lead) - CPU/Ministry of Works and Infrastructure (co-lead) - T&T Incoming Tour Operators' Association (TTITO) (co-lead) - IMA, EMA and Town and Country Planning Division/ Ministry of Planning, Economic Affairs and Development - Forestry Division/ Ministry of Agriculture, Lands and Fisheries - Siparia Regional Corporation - Tourism-related businesses - Local community groups - SpeSEAS, CANARI and other NGOs	- Technical expertise (coastal engineering, ecosystem restoration, climate adaptation) - Financing (significant costs for managed retreat) - Equipment - Materials - Labour (can be provided by local community groups for restoration/ rehabilitation)	Medium to long-term (4-10 years)	- Reduced costs for loss and damage of property and local tourism-related businesses

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
			- National Trust of Trinidad and Tobago - UWI - Insurance providers			
<u>Extreme weather</u> including heavy rainfall, high winds and storms Impacts: - Loss of electricity and access to the community due to floods and fallen trees, which block or damage electric lines and main access roads - Loss and damage of tourism-related property and infrastructure - Decline in tourism-related	Vulnerable groups: - Tour operators - Guesthouse owners in Icacos and surrounding Cedros area - Vendors and other tourism-related businesses - Households dependent on tourism as key income source	- Improved disaster response for clearing blocked roads and drains, including training and equipping community emergency response team (CERT) - Upgrade and maintenance of access road, bridges and drainage/ waterways (including use of raised bridges and durable materials) - Shifting to renewable energy sources (e.g. solar PV and micro hydro) for reliable	- Ministry of Works and Infrastructure (co-lead) - Ministry of Trade, Investment and Tourism (co-lead) - TTITO - Siparia Regional Corporation - ODPM - Trinidad and Tobago Electricity Commission (T&TEC)/Ministry of Public Utilities - Ministry of Energy and Energy Industries - Guesthouse owners - Vendors and other tourism-related businesses - Local community groups	- Technical expertise (engineering, construction, climate adaptation) - Financing (significant costs for infrastructure upgrade and maintenance) - Equipment - Materials - Labour	Short to medium term (1-6 years)	- Reduced costs for repair or maintenance of roads and bridges - Reduced costs for loss and damage to local tourism-related businesses

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
activities and income		access for tourism-related businesses - Improved access to insurance for tour operators and tourism-related businesses	- Insurance providers			
Water and Health						
<u>Rising air temperatures</u> **Impacts:** - **Heat stress and related health impacts** - **Increased incidence of vector-borne diseases (e.g. dengue fever, zika etc.)** - **Increased demand, but reduced access, to water and sanitation (already limited access to pipe-borne water)**	**Vulnerable groups:** - **Children, elderly and pregnant women** - **Households in high-risk areas** - **Venezuelan and other migrants in camps**	- **Improved community/ district health services to address heat stress and other diseases, including public education and awareness raising** - **Use of environmentally-friendly mosquito control** - ****Improved management of migrant camps, including # of persons and access to water and sanitation in camps, and increased patrols**	- **Ministry of Health/ Regional Health Authority (lead)** - **Ministry of Education** - **WASA/Ministry of Public Utilities** - **ODPM** - **T&T Coast Guard** - **Siparia Regional Corporation** - **Local schools** - **Elderly care providers** - **Habitat for Humanity Trinidad and Tobago** - **Caribbean Regional Public Health Agency (CARPHA)**	- **Technical expertise (public health, climate adaptation)** - **Financing** - **Equipment** - **Materials** - **Labour**	**Short to medium term (1-6 years)**	- **Reduced incidence of heat stress and health-related impacts** - **Reduced incidence of mosquito and other vector-borne diseases** - **Improved, regular supply of potable water for residents and essential services**

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
		by Coast Guard, police and other relevant authorities to deter migrants - **Increased use of water storage tanks and rainwater harvesting to improve water supply and access for residential purposes and essential services (e.g. schools, health centre)**	- **Pan-American Health Organisation (PAHO)** - **United Nations High Commissioner for Refugees (UNHCR)**			
<u>Extreme and variable rainfall</u> leading to floods and dry spells/droughts Impacts: - Decline in availability and quality of potable water (already limited access to pipe-borne water)	Vulnerable groups: - Young children, elderly and persons with co-morbidities - Households without pipe-borne water - Local businesses without pipe-borne water - Venezuelan and other migrants in camps	- Increased use of water storage tanks and rainwater harvesting and water-efficient systems, including solar-powered pumps - Construction of solar-powered desalination plant to improve water supply	- Water and Sewage Authority (WASA)/ Ministry of Public Utilities (lead) - Ministry of Health/ Regional Health Authority - Ministry of Homeland Security - Siparia Regional Corporation - Property owners - Local schools and businesses	- Technical expertise (water resources management, renewable energy, engineering) - Financing (significant costs to build and maintain plant) - Equipment	Medium term (4-6 years)	Improved, regular supply of potable water to Icacos community

Community impacts & risks	Vulnerable areas & groups	Actions to adapt/build resilience	Roles and responsibilities (Lead/supporting actors)	Required resources	Time frame	Indicators of Success
- Reduced access to sanitation - Increased incidence of water-borne diseases (e.g. cholera)		- Improved community/ district health services to address water stress and water-borne diseases	- Habitat for Humanity Trinidad and Tobago - Global Water Partnership-Caribbean (GWP-C) - UNHCR	- Materials - Labour		