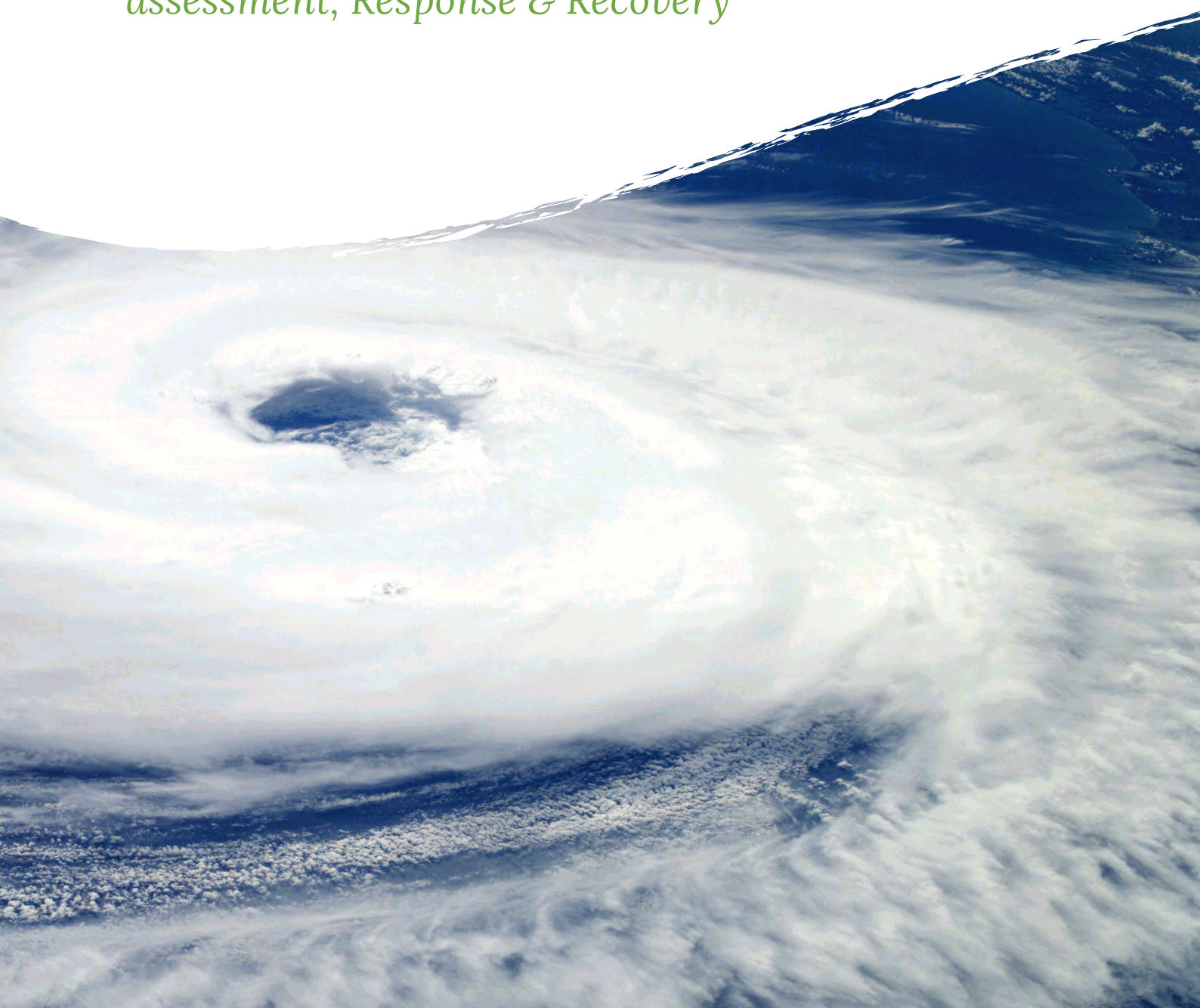
Dutch Caribbean Nature Alliance
Safeguarding nature in the Dutch Caribbean

Dutch Caribbean Natural Disaster Response Manual

Planning, Preparation, Rapid assessment, Response & Recovery



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Authors: De Meyer, K., MacRae, D.R.

About this document

This Natural Disaster Response Manual was produced for the Dutch Caribbean islands of Saba, St. Eustatius and St. Maarten with the support of the Dutch Caribbean Nature Alliance (DCNA).

The Manual provides guidance on how to deal effectively with hurricanes and severe weather events from a natural resource management perspective. The need for response protocols for similar events, such as sargassum influx and pandemics, was identified by managers and space has been left for such additional protocols to be included. The humanitarian aspect of disasters, including personal safety and basic needs (water, food, shelter), take precedence over this document and are not included here.

The Manual provides a tool to assist park managers and staff with disaster management; preparation, response and recovery. The content includes an introduction to hurricanes, details on planning and preparing for a severe weather event, assessing the impact on natural resources and how to deal with response and recovery.

	Purpose/scope
Manual document	MS WORD and PDF document, available as a flip book, printable and downloadable to mobile devices. This is intended to help conservation practitioners, protected area managers and their staff, better prepare for and manage the impact of natural disasters, primarily hurricanes, and associated severe weather events on their protected areas and species.
Plan and templates workbook	Excel spreadsheets with templates that can be customised for field use including response plan (who does what), preparation of tool, first aid and hurricane boxes and kits, contact lists, personnel details, budgets, response protocols, work logs.

Acknowledgements
The content of this plan came from a number of sources including, most importantly, conversations with Tadzio Bervoets (Dutch Caribbean Nature Alliance), Dr. Erik Bowman (St. Eustatius National Parks Foundation), Kai Wulf (Saba Conservation Foundation) and Melanie Meijer zu Schlochtern (Nature Foundation St Maarten).

Inspiration, information and graphics have been drawn from The Nature Conservancy's 'Early Warning and Rapid Response Protocol' (Zepeda-Centeno C., Padilla-Souza C., Huitrón-Baca J.C., Macías-Constantino M., Shaver E., Nava-Martínez G. and García-Salgado M.A. (2019). Early Warning and Rapid Response Protocol: Actions to mitigate the impact of Tropical Cyclones on Coral Reefs. The Nature Conservancy. 69 pgs.) amongst numerous other sources.

Manual design: Deviate Design, Bonaire

Citation
De Meyer, K., MacRae, D.R. (2020) 'Dutch Caribbean Natural Disaster Response Manual'.

*The word '**hurricane**' comes from the word Hurakan – the Mayan god of wind and fire.*

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Figures and tables

Introduction

Hurricanes, tropical storms and associated severe weather events are a fact of life every year from June to November for the Dutch Caribbean. Other potential disasters include earthquakes, volcanoes, tsunamis and related events, such as the recent ash dome collapse on Montserrat.

In September 2017 an extremely powerful storm and the first category 5 hurricane to hit the region (Figure 1), claimed over 100 lives as it swept through the Caribbean. Hurricane Irma passed Saba and St Eustatius, making landfall on St Maarten where winds ripped through the island, wrecking the airport, smashing boats and demolishing 70% of residential houses*. It was the worst natural disaster to hit St Maarten and the cost of damage was estimated to be in excess of Euro 2.5 billion. Just two weeks later the islands were battered for a second time by Hurricane Maria.

Hurricanes have always been a feature of the Caribbean. Aside from abundant sedimentary evidence, the first well documented hurricane record comes from 1502 when Christopher Columbus narrowly avoided being shipwrecked by a hurricane off the Dominican Republic. His was the only vessel of a 31 ship fleet to survive the sea voyage back to Spain.

Over time the region's natural environment has evolved to withstand and to recover from natural disasters, including hurricane events. But populations are growing and the pressure on our islands natural resources is unprecedented. In addition to local threats, predictions indicate that the frequency and severity of severe weather events in the Caribbean is likely to intensify dramatically as a result of global climate change.

Whilst we cannot prevent natural disasters, we can be better prepared and organised to deal with them and their aftermath. That's what this Disaster Response Manual is all about: helping protected area managers and their staff with their disaster management; planning, preparation, assessment, response and recovery.

The production of this manual was made possible with funding from the Dutch Caribbean Nature Alliance's Emergency Fund in the aftermath of Hurricane's Irma and Maria.

Stay safe !

Category	Wind Speed (mph)	Damage at Landfall	Storm Surge (feet)
1	74-95	Minimal	4-5
2	96-110	Moderate	6-8
3	111-130	Extensive	9-12
4	131-155	Extreme	13-18
5	>155	Catastrophic	19+

Figure 1: Hurricane category listings
Source: Early Warning and Rapid Response Protocol (2019) Zepeda Centeno et al.
https://www.dailymotion.com/video/x60eccw

Purpose

This Natural Disaster Response Manual or "Disaster Manual" is intended to help conservation practitioners, protected area managers and their staff, better prepare for and manage the impact of natural disasters, primarily hurricanes, and associated severe weather events on their protected areas and species.

The Manual is organised in five sections:

1. **Planning:** is about ensuring that your protected area is disaster ready

2. **Preparation:** ('Early warning') outlines the work which need to be done as soon as an early warning of a severe weather event has been issued

3. **Rapid assessment:** provides techniques for rapidly assessing the impact of a natural disaster (level of damage and amount of debris) on protected areas to help prioritize response

4. **Response:** includes 'first aid' and clean up

5. **Recovery:** outlines long term care including restoration plans, nursery facilities etc. and an evaluation of the disaster response

How to use this Manual

This Natural Disaster Response Manual is intended provide you with quick access to essential information in an easy to use format, utilizing a stepwise approach to disaster management with flow charts, checklists, procedures and templates.

The Disaster Manual consists of a manual and a series of excel spreadsheets and is available as:

- **MS Word document:** needs to be reviewed and updated annually

- **PDF document:** for use on hand-held devices

- **Loose-leaf binder:** allows checklists and templates to be removed and plasticized for use in the field

- **Excel spreadsheets** with templates which can be adapted, customised and printed for field use

- **On-line repository** [curated by the Dutch Caribbean Nature Alliance]

The disaster management cycle for the islands of St Eustatius, St Maarten and Saba will follow a series of steps. (Figure 2).

Figure 2: Proposed steps for the implementation of an early warning and Rapid Response Protocol (www.nature.org)

Understanding Hurricanes (tropical cyclones)

Hurricanes, also known as 'tropical cyclones' are amongst of the most destructive natural events. They are low pressure systems with organised thunderstorm activity which form in the tropics and sub tropics. Winds move continuously in a circular motion known as 'closed circulation'. Hurricanes travel counter-clockwise in the Northern hemisphere (and clockwise in the Southern hemisphere). The maximum effects of the hurricane are typically felt in the *right front quadrant*, where wind speeds are strongest, storm surge is highest and the possibility of tornadoes is greatest (Figure 3). Hurricanes are classified by their maximum sustained wind speed (Table 1).

Table 1: Wind speed classification of Hurricanes

	Windspeed (mph)	Windspeed (km/h)
Tropical depression	< 39	< 62
Tropical storm	39-73	62-118
Hurricane	74 +	119 +

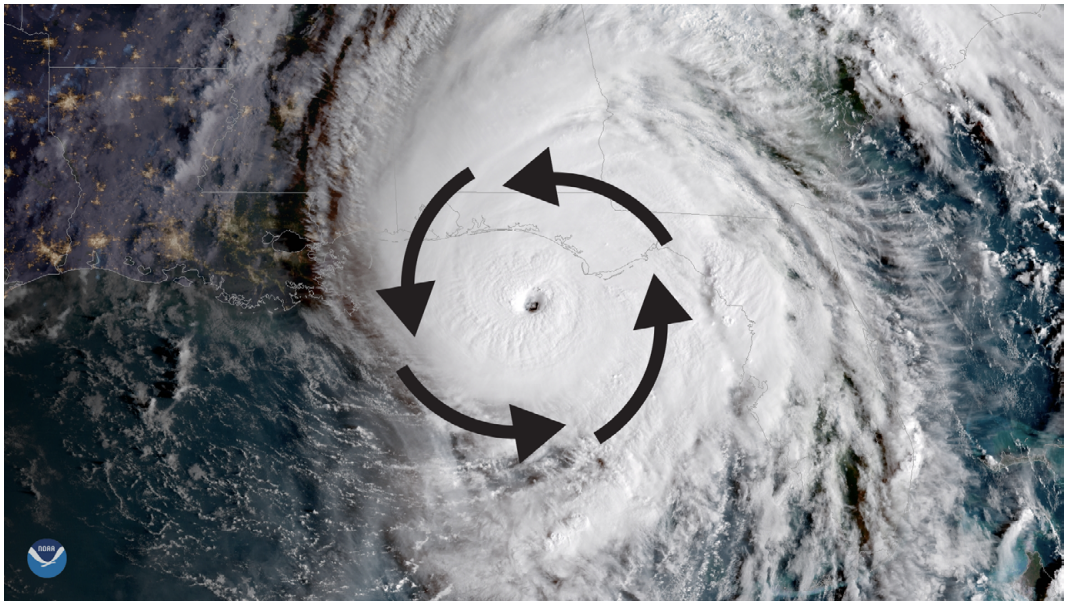


Figure 3: NOAA: satellite image showing the closed circulation wind pattern that is characteristic of a hurricane

Anatomy of a hurricane

Eye: occurs within the core of the hurricane and typically has a diameter of 20 to 40 miles across. The whole storm spins around the eye. Conditions inside the eye are characterized by calm winds, clear skies, and low air pressure.

Eye wall: surrounds the eye and has a diameter ranging from 5 to 30 miles wide. The eye wall is where the most powerful and destructive winds and the heaviest rains occur.

Rain bands: a collection of dense clouds forming a spiral that wraps around the eye wall. Rain bands are responsible for the pinwheel appearance of the hurricane. These dense groups of storms spin slowly and can be 50 to 300 miles across.

Saffir – Simpson Scale

In the early 1970s, Herbert Saffir, an engineer, and Robert Simpson, a meteorologist, developed a scale to describe the likely effects of hurricanes. The scale has five categories, increasing in intensity from 1 to 5 (Figure 4). The "Saffir – Simpson Scale" is now used universally in the Western Hemisphere to describe hurricanes. Originally it was based on wind speed only but more recently it has been adapted to take into account the effect of storm surge levels, the Saffir-Simpson scale provides an indication of the potential damage to man-made structures and flooding which will result when a hurricane makes landfall.

There has been some discussion about adding additional categories for hurricanes with maximum sustained winds significantly higher than a category 5 hurricane (over 156 miles/ hour). Other updates which have been considered include representing the overall impact of the hurricane on populations, including flood risk, location of settlements and building practices. However, for clarity of understanding and all practical purposes there is no value in a classification in excess of "catastrophic'.

Category	Wind speed mph (kph)	Storm surge (height above normal) ft (m)	Atmospheric pressure (mb)	Damage
1	74–95 (119–153)	4–5 (1.2–1.5)	>979	**Minimal:** No real damage to buildings. Damage to unanchored mobile homes. Some damage to poorly constructed signs. Some coastal flooding and minor pier damage.
2	96–110 (154–177)	6–8 (1.8–2.4)	965–979	**Moderate:** Some damage to building roofs, doors, and windows. Considerable damage to mobile homes. Damage to piers from flooding. Small craft in unprotected moorings may break their moorings. Some trees blown down. Evacuation of some shoreline residences and low-lying areas required.
3	111–130 (178–209)	9–12 (3–4)	945–964	**Extensive:** Some structural damage to small residences and utility buildings. Large trees blown down. Mobile homes and poorly built signs destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland. Evacuation of low-lying residences within several blocks of the shoreline may be required.
4	131–155 (210–249)	13–18 (4–5.5)	920–944	**Extreme:** More extensive failure on non-bearing, exterior walls with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. Massive evacuation of residential areas as far inland as 6 mi (10 km) may be required.
5	>155 (249)	>18 ft (5.5)	<920	**Catastrophic:** Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas on low ground within 5 to10 mi (8 to 16 km) of the shoreline may be required.

Figure 4: The Saffir – Simpson Scale

Hurricane impacts

Although storm surge is the most dangerous and destructive part of a hurricane, accounting statistically for 90% of all hurricane related deaths, high winds and heavy rains will cause considerable damage and may be accompanied by tornadoes.

Storm Surge: Refers to the rapid rise in the level of water that comes ashore as the hurricane hits land. The greatest storm surge will occur where the eye of the storm makes landfall and the effect will be most severe when it approaches perpendicular to land and around inlets and bays. Storm surge is the most dangerous aspect of any hurricane (https://www.nhc.noaa.gov/surge/)

Strong Winds: The overall effect of a hurricane depends on the speed of the wind which determines the force of the hurricane, storm surge, and the likely damage. Wind is responsible for much of the structural damage associated with hurricanes. Tornados within hurricanes and gusting winds can be considerably stronger than the sustained wind speed and cause significantly more damage.

Rainfall: Flooding typically causes more deaths than the actual hurricane with 5-10 inches of rainfall common. Rainfall is typically heaviest six hours before and six hours after landfall. [Rainfall (in inches) can be estimated by dividing 100 by the speed of the hurricane in miles per hour]

Rip tides and surf: Strong sea currents and rip tides may be one of the first indications of a hurricane.

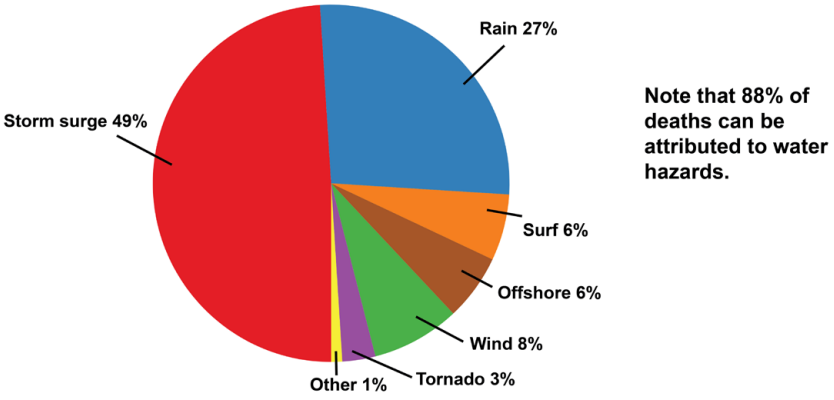


Figure 5: Causes of direct fatalities from Atlantic tropical cyclones 1963-2012
https://www.noaa.gov/education/resource-collections/weather-atmosphere/hurricanes

Hazards

Hurricanes are classified according to sustained wind speed. Table 2 below provides an indication of the expected damage which can be expected in the wake of a tropical cyclone:

Table 2: Expected damage from tropical cyclones

Hurricane category	Expect	Property	Natural environment
1	Very dangerous winds	Damage to roofs, shingles, sidings and gutters. Power lines will down.	Large tree branches may snap, shallow rooted trees may topple.
2	Extremely dangerous winds and extensive damage	Major damage to roofs and sidings. Roads will be blocked. Power outages.	Many shallow rooted trees will be uprooted or snapped.
3	Devastating damage	Major damage to well built homes including loss of roofs and decking. Electricity and water outages.	Trees will be snapped and uprooted.
4	Catastrophic damage	Severe damage to well built homes, loss of most or all of the roof structure, damage to exterior walls. Island may be uninhabitable.	Most trees will be snapped or uprooted blocking roads and trails.
5	Catastrophic damage	High percentage of well built homes will be destroyed, with total roof failure and wall collapse. Island will be uninhabitable for weeks or months.	Large areas of trees snapped and uprooted.

Disaster Management: island level

All islands have their own disaster management plans which include outreach and information for local residents and businesses. Bonaire, Saba and St Maarten have downloadable applications with information, instructions and advice.

Applications

APPs for mobile phones are available on some islands (Table 3), examples of the information available on the APPs are provided in Figure 6 and Figure 7.

Table 3: APPs for disaster preparation

Island	App name
Aruba	
Bonaire	Disasterprep Bonaire
Curaçao	
Saba	Disasterprep Saba
St Eustatius	
St Maarten	Disasterprep Sint Maarten

Figure 6: Example from the Saba hurricane preparation APP

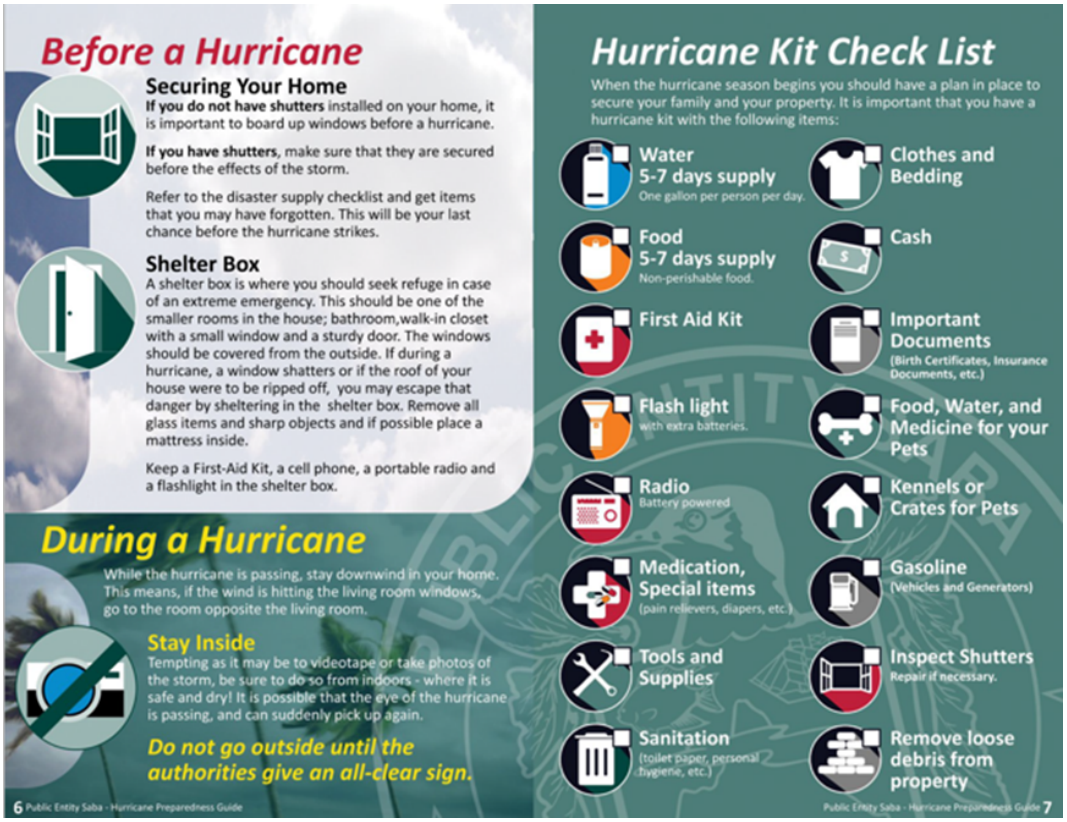


Figure 7: Example from the Saba hurricane preparation APP

Island Emergency Response Framework: Generic

Each island will have their own Emergency Response Framework. In generic terms most probable disasters are considered to be:

- Tropical storm / extreme weather event
- Airplane crash
- Civil disorder
- Fire on an oil tanker / Cruise ship incident
- Public health emergency
- Emergency shelter of asylum seekers

The response co-ordination will generally be organised as shown in Table 4:

Table 4: generic response co-ordination

Command level	Team	Scope	Authorized person
1	Incident site command (CoPI)	On site	CoPI Leader
2	Island policy team	On island	Governor
3	National Government disaster staff	External	National Government representative

In general, Disaster planning includes direct roles and responsibilities for:

- Fire brigade
- Police / Royal Military Policy)
- Health care
- Population welfare (water, telecommunication, transport, governance, evacuation / shelter, information)

Incident Site Command (CoPI) is in charge of disaster management on site and includes:

- CoPI Leader – person in overall charge of the incident/disaster
- Fire brigade representative
- Health care representative
- Police representatives
- Population welfare representative
- Communication advisor
- Information manager

Additional support can include:

- Harbour Master
- Airport manager
- Rijkswaterstaat liaison
- Company liaison
- Nature organisations

Role of Protected Area Managers and staff

Parks typically have a supporting role and may be called upon to give advice and/or to provide support services including search and rescue and beach clean-ups.

It is essential that Park staff receive the necessary training to perform these tasks, including post event coaching and mental health support.

Additionally, training and resources are needed to deal with incidents which include damage to corals including:

- Recovering and relocating damaged corals
- Capacity, tools and materials
- Coral nurseries and relocation sites

Planning

Planning is perhaps the most critical step in terms of disaster management and should take place well before the hurricane season starts.

Disaster Manual and Response Plans:

- Make sure everyone has access to Disaster manual and Response Plans
- Laminated sheets with checklists and protocols
- Display poster with flow chart and essential information
- Provide individualized plans
- Organise hurricane and curfew passes as soon as possible with relevant authorities

Planning and preparation will include the following:

1. Organisational structure
2. Funding (Emergency funds, grants, donations)
3. Information (including maps, resources)
4. Partnerships (funding, expertise and resources)
5. Prepare materials, tools and equipment
6. Training
7. Insurance (for first responders)
8. Communication
9. Threat and risk reduction
10. Response Plans

Organisational structure

Having an approved organisational structure and protocols in place will significantly improve efficiency and will provide clarity for everyone involved in the disaster management.

Everyone needs to know who is in charge as well as what their own role and their responsibilities are, and be familiar with the Disaster Manual (Response Plan) and protocols. See Table 5 and Appendix for full explanation of roles and responsibilities.

Table 5: Organisational structure for the Dutch Caribbean

Name	Group	Main responsibilities
Disaster Management Committee	Dutch Caribbean Nature Alliance	Planning, liaison, central coordination, funding, training, networking, media, communication
Disaster Managers	Park Directors/ Managers	On site point contact responsible for organising, Rapid Assessment, response and recovery, reporting and communication
Operations Team(s)	Park admin staff + volunteers	On site communication hub, record keeping, logistics, supplies, transportation, funding
Responder Teams	Park field staff + volunteers	On site preparation, Rapid Assessments, clean up, First Aid and recovery operations
Partners / volunteers		

Funding

You will need ready money to buy materials, tools, fuel, rent gear, boats and vehicles (if necessary), food, drink and reimbursements to volunteers as well as funding for response and long term recover operations.

Parks should create an onsite 'slush fund' and make sure you have petty cash on hand.

The Disaster Management Committee should mobilize funds quickly from the Emergency Funds and organise to pay as much as possible direct to vendors.

Table 6: Possible funding sources

Emergency funds (DCNA)	Short term
Contributions and in-kind support from local businesses/tourism	Short term
International and funding agency disaster relief funds such as WWF NL	Short – mid term
Government relief funds	Long term
Disaster insurance coverage	Long term

Disaster Management Committee preparation includes:

- Have protocols in place to rapidly provide Emergency Fund support to parks
- Assist with applications to national disaster fund relief
- Secure grants
- Organise collection of (online) donations and promote giving

NOTE*: It is important to ensure sound financial management of disaster relief funds. This can be facilitated through the DCNA Secretariat.*

Information

It is important to get familiar with local agencies which monitor the weather and issue official weather bulletins as well as national weather institutions and metrological services at the National and island level. A number of sources of information are available:

Local Apps

Make sure all staff and volunteers download local apps:

Island	App name
Aruba	
Bonaire	Disasterprep Bonaire
Curaçao	
Saba	Disasterprep Saba
St Eustatius	
St Maarten	Disasterprep Sint Maarten

Weather forecasts and updates

Know where to get the most up-to-date and accurate weather forecasts as well as official weather bulletins and warnings and be sure to stay tuned to local weather bulletins from local Met station.

Name	Aim	Link
Storm carib	The official Caribbean Hurricane Network	https://stormcarib.com
Wind Guru	Check WindGuru and other pertinent weather websites regularly	http://www.windguru.cz
NOAA	NOAA weather warnings	https://www.nhc.noaa.gov
KNMI Royal Netherland Metrological Institute	Weather warnings for the Caribbean Netherlands	https://www.knmidc.org
RCN	Hurricane season updates	https://english.rijksdienstcn.com/infrastructure-and-water-management/hurricane-season
Metrological Department St Maarten	The Met service for St Maarten provides weather updates for the windward islands	https://www.meteosxm.com
Metrological Department Curaçao (Met Service)	The Met service on Curacao provides weather updates for Aruba, Bonaire and Curaçao	https://www.meteo.cw

Warning systems

Metrological services for the Dutch Caribbean (KNMI)

Color Coded Warning System

The KNMI warning system consists of six (6) color coded warning phases indicating the severity of the conditions and time left before a (potential) storm reaches the community.

Phase	Definition:
	No threat
Information *--- Be Alert! ---*	**A Storm or Tropical Cyclone might threaten the community within 48 to 72 hours**
Watch *--- Prepare Yourself! ---*	**Storm or Tropical Cyclone conditions might threaten the community within 48 hours**
Warning *--- Protect Yourself! ---*	**Storm or Tropical Cyclone conditions expected within the next 36 hours**
Strike *--- Seek Cover! ---*	**Storm or Tropical Cyclone conditions expected within 6 to 9 hours**
Advisory *--- Carefull! ---*	**Heavy rainfall and or rough sea conditions are expected. No Tropical Storm or hurricane is expected**

Guideline: might means ≥ 10% chance, expected means ≥ 50% chance

During the Information phase (Yellow Phase) KNMI will provide 2 times per day a *Tropical Cyclone Bulletin (TCB)*. During the phases from "Watch" to "Strike" (Orange to Purple) this number increases to 4 times per day to provide the latest available information. These phases and the TCB will be initiated by KNMI in coordination with the National Hurricane Center (NHC). A *TCB* describes the warning, expected Wind, Rainfall and Maritime conditions. The TCB will be in the English language. See the example on the next pages.

Figure 8: KNMI warning system

Meteorological Department Curaçao Hurricanes and Tropical Storms

Table 7: Meteorological Department Curaçao warning system

Tropical storm watch	An announcement for a specific area that a tropical storm or incipient tropical storm conditions poses a possible threat within 48 hours.
Tropical storm warning	A warning for tropical storm conditions, including possible sustained winds within the range 63-117 km/h (39-73 mph) (34-63 knots) are expected in specified areas in 36 hours or less
Hurricane watch	An announcement for a specific area that a hurricane or incipient hurricane conditions pose a possible threat within 48 hours.
Hurricane warning	A warning that one or both of the following dangerous effects of a hurricane are expected in a specific area in 36 hours or less: (a) average winds 118 km/h (74 mph) (64 knots) or higher; (b) dangerously high water or a combination of dangerously high water and exceptionally high waves.
Strike warning	A Strike Warning will be issued when the effects of Tropical Storm or Hurricane force winds are imminent, generally within 6-9 hours. It is part of the Warning Phase.

When the hurricane warning is issued, all precautions should be taken immediately. Hurricane warnings are seldom issued more than 36 hours in advance. If the hurricane's path is unusual or erratic, the warnings may be issued only a few hours before the beginning of hurricane conditions.

Tornadoes spawned by hurricanes are among the storms' worst killers. When a hurricane approaches, listen for tornado watches and warnings. A tornado watch means tornadoes are expected to develop. A tornado warning means a tornado has actually been sighted. When your area receives a tornado warning, seek inside shelter immediately.

Partnerships

A network of partner organisation is important so as to be able to obtain the resources park staff need to successfully respond. Key partners will include:

- Government agencies
- Private sector (tourism sector)
- Emergency services (local and national)
- Universities
- Fishermen
- Aid organisations
- Funders
- Regional Disaster Management Organizations (CEDEMA F.E)

The scope of partnership activities could include:

- Provision and transportation of emergency supplies (Dutch Military)
- Loan of boats and/or vehicles
- Supply of aerial / satellite images (Red Cross)
- Expertise

Partners should be aware of the Disaster Management Plan and the Response Plan so that they can identify where they can collaborate.

Table 8: International partners

Contact	Web / email	Phone	Social	Person
The Netherlands Red Cross	www.rodekruis.nl/en/ contactcenter@redcross.nl	T: 070 44 55 678 M: 06 5781 3499	FB TW WhatsApp	
Ministry of Infrastructure and Water Management	https://english.rijksdienstcn.com/infrastructure-and-water-management/hurricane-season			
CDEMA	https://www.cdema.org			
WWF Environment and Disaster Management Programme	1250 24th Street NW, Washington DC 20037 envirodm@wwfus.org			Anita van Breda - Director
WWF-NL	agroene@wwf.nl	T: +31 (0)30 69 37 333 M: +31 (0) 6 46272075		Arjan de Groene – Caribbean Netherlands

Prepare materials, tools and equipment

Response Teams will need special material, tools and equipment to do their work. These should be stored in special Hurricane boxes. Tools and equipment which need to be put together and checked include:

- Toolboxes
- Hurricane boxes
- First Aid kit including appropriate Trauma Kit\

Toolboxes must be resistant, durable and portable (wheeled) with an airtight seal to ensure they are waterproof. The content of toolboxes needs to be well organised and include:

- Inventory
- Labelled
- Complete and in good condition
- Accessible at all times in a known safe location (cache)

First Aid

In addition to standard First Aid kits, diving activities will require diver rescue equipment and oxygen kits.

Shutter systems also need to be checked. The Response Leader has the responsibility to check, prepare and keep the necessary Toolboxes and First Aid kits.

Mapping

Make sure you have detailed maps of your protected areas which identify:

- **High risk areas:** landslides, cliff collapse, gulleys, areas liable to flooding, landslides, cliff collapse, underwater landslides and unstable bottom etc. which should be approached with extreme caution
- **Infrastructure:** roads, trails which will need to be surveyed
- **Red flag areas:** areas of high or vulnerable biodiversity, including threatened, endangered, endemic of flagship species
- **Nurseries:** coral nurseries, native and botanical gardens

Capacity to respond

Regularly assess your capacity to respond to a natural disaster. Include what you need in order to be able to conduct rapid assessments, respond and recover under different scenarios in terms of:

- Trained staff and volunteers
- Equipment and supplies

[see Training on the next page]

Training

Disaster Management Committee should ensure that training is available to all Disaster Managers and Responders (staff and volunteers), ideally including theory and practice and encompassing the following topics:

- Basic biology (especially important for marine Response Teams)
- Rapid Assessment methodologies
- Use of specialized equipment including lift bags, pneumatic drills, chain saws etc
- First aid activities including:
  - Lopping branches
  - Removing trees
  - Stabilizing trails
  - Reattaching corals and coral fragments
  - Removing buried corals, stabilizing rubble
  - Coral nurseries
- Simulation drills (where Responder Teams can work together)
- Disaster response training (designed to help responders cope with psychological stress)
- Oil spill response training
- Rappelling and rope skills

It's important to look for training gaps, to strengthen co-ordination and teamwork and build leadership skills.

Insurance (for first responders)

Have insurance cover for everyone involved in disaster management (staff and volunteers). For anyone diving this should include professional diving insurance (Note: Divers Alert Network – DAN will not cover search and rescue or work).

Check out: Insuring natural resources

Communications

On site the Operations Team Leader will be responsible for setting up a communication network and ensuring the smooth flow of information.

Have a plan and procedures in place for both internal and external communication which includes:

- What to communicate
- When to communicate
- How to communicate (hardware, software, protocols)
- Who is responsible at each stage

Plans should include how to communicate effectively with/without WiFi coverage

NOTE: Post event mobile providers may have different response times. Determine ahead of time which are the most reliable service providers and be prepared to switch if necessary.

Table 9: Information to prepare about communications providers

Company	Phone – fax - email	Contact person	Alternate contact
Satel NV	+599 416 3211 +599 416 3200 info@satelnv.com www.facebook.com/satelnv	***Assistant Director/ Technical Manager:*** Tim van Oosteren tvanoosteren@satelnv.com ***Technical Team:*** Lucio Levenstone llevenstone@satelnv.com Carl Hassell Chassell@satelnv.com Steve Hughes Email: shughes@satelnv.com	Mathew Levenstone Street # 6 The Bottom Saba, Dutch Caribbean
UTS / Chippie	+1721588 1010 +1721 588 1010 infosxm@uts.sx http://uts-ec.com/		

Ensure that up to date contact information for all emergency services is readily available including:

- Police
- Hospital
- Fire brigade
- Hyperbaric Chamber
- Red Cross

NOTE: it is extremely important that all diving work is done within safe 'no stop' times as access to recompression facilities – for example on Saba – will be almost impossible

Print and laminate this information and have it available at the Operations Centre and meeting areas.

Keep a detailed list of everyone involved from the Disaster Response Committee to the individual members of the Response Teams. List should include at least:

- Full name
- Organisation
- Emergency contact (next of kin)
- Telephone (cell/land line)
- Email
- Messenger/SkyPE
- Broadband radio channel (if applicable)
- Satellite phone number (if applicable)

Innovation

Serval Project

Check out Serval Project which was developed as a result of the Haiti earthquake and allows mobile phones to connect directly with each other even if there is no network coverage using Serval App and Serval Mesh.
http://www.servalproject.org/
NOTE: currently only available for Android

Red Cross Emergency App

Allows survivors to access weather updates and get safety tips as well as preparedness information. This app is credited with having save thousands of lives in the USA.
https://www.redcross.org/get-help/how-to-prepare-for-emergencies/mobile-apps.html

NOAA Super Res Radar

This iOS app is aimed at weather enthusiasts and boasts high resolution graphics four times more detailed than other apps as well as full text warnings from the National Weather Service. Multiple map styles and different view options make this app a good one for serious trackers. This third-party app is not an official platform of the National Oceanic and Atmospheric Administration or the National Weather Service. As with any app that relies on mapping software, these hurricane trackers should be used sparingly as maps can drain battery power quickly, which could be catastrophic in an emergency situation. Turn off when not in use.
https://itunes.apple.com/us/app/hurricane-tracker/id327193945?mt=8

Hurricane Tracker by EZ Apps

Using four simple categories at launch, this iOS app lets you see detailed threat level and radar maps, National Hurricane Center updates, video forecast updates, and real-time alerts for hurricanes, tropical storms, tropical depressions, and invests. There are free and paid (ad-free) versions of this app, which has more than 65 maps including animated maps and images.
http://www.hurrtracker.com/Main/home.html

Insuring natural assets

Refer to: The Nature Conservancy "Guide on How to Insure Natural Assets"

Threat and Risk reduction

Personal safety always comes first.

Before going out in the field consider safety:

- Infrastructure stability (don't enter buildings unless you are sure it is safe to do so)
- Pollution (sewerage, garbage dumps and landfill material)
- Large debris
- Unstable cliffs, paths, landslides
- Potential for underwater landslides
- Entangling, HAZMAT diving in fuel/ battery acid…

Ensure weather conditions are safe before heading out into the field to conduct Rapid Assessments. Map potential threats

Legal issues

Consider getting legal advice on possible legal considerations including:

- Salvage
- Search and recovery
- Indemnity

Preparation

The purpose of preparation is to reduce the threat to people, property and the natural environment.

Some examples include:

- Repair/removal of anything in poor condition such as piers, roofs, buildings
- Address any sources of pollution that could overflow or drain/wash into the sea
- Clean roofs, drains, vacant lots, garbage dumps
- Trim trees and shrubs
- Secure objects that could fly away in high winds

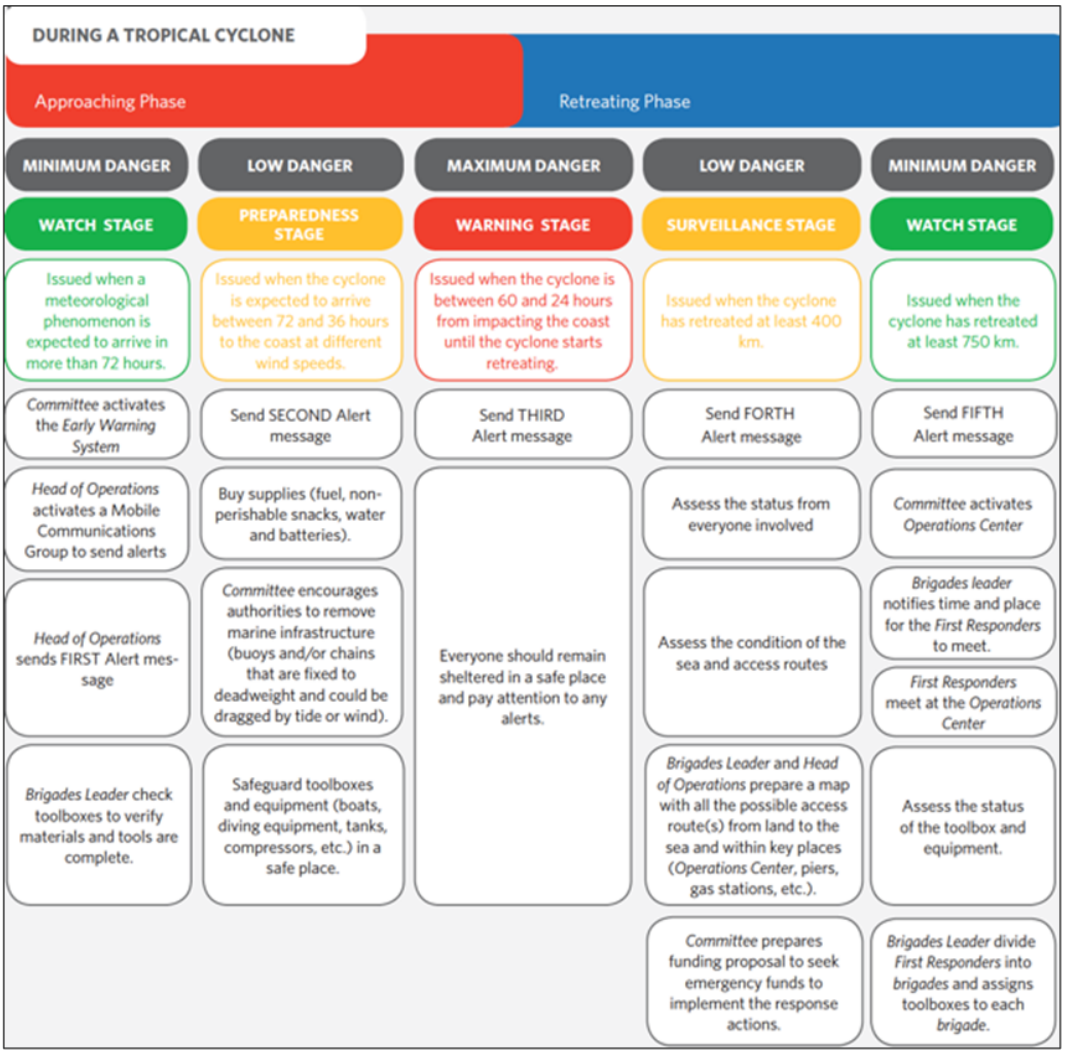


Figure 9: Framework for disaster preparation
www.nature.org

Table 5: Organisational structure

Name	Group	Main responsibilities
Disaster Management Committee	Dutch Caribbean Nature Alliance	Planning, liaison, central coordination, funding, training, networking, media, communication
Disaster Managers	Park Directors/ Managers	On site point contact responsible for organising, Rapid Assessment, response and recovery, reporting and communication
Operations Team(s)	Park admin staff + volunteers	On site communication hub, record keeping, logistics, supplies, transportation, funding
Responder Teams	Park field staff + volunteers	On site preparation, Rapid Assessments, clean up, First Aid and recovery operations
Partners / volunteers		

Table 10: Preparation - Ahead of the hurricane season

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Ahead of the hurricane season			Back up files, ensure all critical documents including insurance papers are scanned and place in a safe, file documents away	Trim trees, hurricane cut palm trees, clear drains, check roofs, remove garbage, tidy up and remove anything that could be blown around
		Customize first aid and trauma kits as necessary		
		Shutter system review: ensure appropriate shutter system in place	Check all first aid boxes and verify contents	Check all shutters and repair if necessary
				Check and run generator
	Check communications and protocols (include sat phones, handheld VHF if available)	Check communications and protocols (include sat phones, handheld VHF if available)	Test communications	Test communications
		Follow best practices e.g. vehicle policy throughout		

Disaster Response Plan

BEFORE severe weather event: "Approaching phase"

Table 11: Approaching phase - Watch

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Watch	Continuously monitor local weather forecasts	Continuously monitor local weather forecasts	Set up WhatsApp group and/ or mobile communications group	Check hurricane boxes, emergency supplies, plywood and verify contents
	Track location and intensity of hurricane	Track location and intensity of hurricane	Send out alert messages	Purchase any missing materials/supplies
			Check all first aid boxes and verify contents	Check all shutters and repair if necessary
				Check boat trailers and jacks
				Make sure vehicles and boats are fuelled and fill jerry cans
				Check and run generator
				Check the container for leaks and fix, move everything up off the floor and ensure container edges are secured to the ground
				Check and service all chain saws and store them at strategic locations with adequate fuel, oil and parts
	Check communications and protocols (include sat phones, handheld VHF if available)	Check communications and protocols (include sat phones, handheld VHF if available)	Test communications	Test communications
				Remove planking from piers; remove mooring buoys
				Fences/green houses: remove shade cloth

Table 12: Approaching phase - Preparedness

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Prepared-ness		Liaise with emergency services and government agencies	Buy supplies (fuel, non perishable snacks, water, batteries)	Buy supplies (fuel, non perishable snacks, water, batteries)
		Secure emergency passes if necessary	Secure cash	Safeguard hurricane boxes, toolboxes first aid kits
				Remove and secure signage, bird feeders and similar
				Remove planking from piers; remove mooring buoys
		Mobilize Operations Team to prepare office	Move everything off the floor and away from windows, plastic wrap and bag	Boats: remove boats, kayaks and dinghys; if boats cannot be secured locally take to a remote location (take 2 anchors and chains)
		Mobilize Responders and allocate tasks: buildings, boats, vehicles, office, trail shop, equipment	Remove all electronic / sensitive items; shut down UPS and breakers	Boat preparation: cover console and engines with tarpaulins, remove electronic navigation equipment and VHF; secure boats to trailers with concrete blocks, docklines/straps
			Unplug remove, bag and store electronics in safe locations	Walk round buildings, secure all loose objects, remove furniture from balconies etc
		Check cameras, batteries (keep them charged)	Put all souvenir items into plastic boxes and secure	Store tools securely including machetes anvil loppers, buck saws, bow rakes, fan rakes and gloves
			Take in signs	Office: Board up windows/put shutters in place and secure buildings
			Secure offices	Secure emergency generator and lockers (including fuel locker)
				Fences/green houses: remove shade cloth
		Go home and prepare	Go home and prepare	Go home and prepare

Table 13: Warning

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Warning		Shelter in place	Shelter in place	Shelter in place
			Monitor WhatsApp for advice and instructions: don't return to workplace before clearance is given	Monitor WhatsApp for advice and instructions: don't return to workplace before clearance is given

AFTER the severe weather event: "Retreating phase"

Table 14: Retreating Phase - Surveillance

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Surveill-ance	Continuously monitor local weather forecasts	Continuously monitor local weather forecasts	Check and report damage	Check and report damage
	Establish contact with Disaster Managers and ascertain status	Assess status of organisation: staff, buildings vehicles, boats, equipment		
	Establish contact with funding and aid agencies	Assess conditions on island		
	Prepare funding requests	Assess sea conditions		
	Mobilize emergency funds	Determine where to locate Operation Centre		
	Draft press and social media notices based on Disaster Manager reports	Prepare Responder Teams so they are ready to be deployed		
		Provide daily updates for Disaster Management Committee, staff and public		
		Contact volunteers		
		Prepare maps for Responder Teams		

Table 15: Retreating Phase - Watch

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Watch	Request satellite images of effected areas	Determine areas most effected	Activate Operational Centre	Initiate Rapid Damage Assessment protocols to determine amount and type of debris and damage
	Draft press and social media notices based on Disaster Manager reports	Call first meeting with Responders	Set up computers	Marine surveys: manta tow snorkel / dive
		Close trails as necessary		Check trails
		Confirm Responder Teams and allocate areas to cover for marine and terrestrial rapid assessments	Set up and test communication (sat phone, mobile phone, WhatsApp) and agree protocols	Terrestrial surveys: drone ground truthing
		Ensure Operational Centre is staffed and operational	Organise logistics: transportation, food, water and supplies for Responder Teams	
		Determine amount and type of debris and level and type of damage	File daily: Activity reports Costs	Submit daily: Activity report RAP results

Table 16: Retreating Phase - Recovery

STAGE	Disaster Management Committee	Disaster Managers	Operations Team	Responders
Recovery		Draw up a plan of action: establish priorities and allocate staff and volunteers	Organise logistics: transportation, food, water and supplies for Responder Teams	
		Cleanup: determine areas, equipment and personnel needs and priorotize areas		
		First Aid: determine personnel, equipment and supply needs, prioritize areas and activities		

Rapid Assessment

Once the severe weather event has passed and conditions are considered safe, the first task facing Disaster Managers is to get a clear picture of the condition of the park's resources (extent of the damage and the amount of debris). This is done using standard rapid assessment protocols.
Rapid assessments help to identify the most affected areas and the type of damage and provide the information necessary for Disaster Managers to prioritize site by site response activities (clean-up efforts and first aid) and formulate a recovery plan.

There are two overriding principles for rapid damage assessment:
safety first and 'do no harm'.

1. Conduct rapid assessments to determine the extent and intensity of damage and debris

2. Prioritize sites for response

3. Formulate a recovery plan

Rapid Assessment protocols can be developed for both habitats and, where appropriate, vulnerable species.

Rapid Assessment: survey methods

NOTE: on site rapid assessments can only be conducted once safety and weather conditions permit

Satellite images

To determine the extent of the damage and to ensure that remote sites are included in the rapid assessment, acquire satellite images (preferably pre and post event). Refer to Red Cross.

NOTE: this may be difficult until electricity and communications have been restored.

Marine: trawl survey / manta tow

This method involves a snorkeler being dragged slowly behind a boat while holding onto a floating device or a rope, allowing the snorkeler to record information on an acrylic slate and/or camera for photos or videos. Information can also be recorded from the boat by other members of the Team (including GPS points). In this case, Team members should agree on a signal code that allows the snorkeler to transmit information on what it is observed on the bottom.

Coastal / Terrestrial: drones

Aerial data can estimate the amount of disaster debris dragged into the sea in shallow water areas, reefs, and along the coastline, especially in areas where access is restricted. Drones can be used to capture aerial data for damage assessment and obtain high resolution and georeferenced videos and images.

This can provide a greater detail than satellite imagery at substantially lower cost, but for marine environments the detail of the images will depend on the conditions of the water. Turbidity and movement can affect the interpretation of the images.

NOTE: Appropriate training is needed in equipment and software if surveys are to be conducted using drones.

Infrared imagery

It may be necessary to acquire infrared imagery to locate missing persons during a disaster.

What to expect ...

Coral reefs are most vulnerable to the direction the hurricane approaches (exposure) as well as the extent, intensity and duration of the storm surge. Mechanical damage will range from tissue loss and abrasion to breakage with corals snapped, overturned and/or fragmented. Some corals, particularly on the reef slope and in deeper water may be covered in very fine sediment. In extreme cases the reefs may be completely removed (destroyed) exposing the underlying reef matrix. Additionally, heavy rainfall and run off will affect salinity and increase sediment and nutrient loads. Expect to see coral reefs and shallow marine areas littered with (household) debris.

Seagrass beds may be disturbed or destroyed.

Mangrove forests may be impacted in the same way as terrestrial forests. In Florida, after the category 5 hurricane Andrew made landfall entire mangrove forests were stripped of their foliage and look dead, only to bounce back weeks later. NOTE: Birds are likely to be particularly hard hit.

Beaches may be damaged, destroyed or displace due to storm surge and/or changed wave patterns and will most likely have considerable amounts of debris deposited on them. Clean ups should only be organised once beaches have been surveyed for hazards including contamination by oil, sewerage or other discharges. Cleaning beaches may have high priority for local government and businesses intent on re-opening for tourism. Those cleaning beaches should beware of nails and other sharp objects.

Types of damage to marine and terrestrial environments

Table 17: Types of damage from hurricanes to marine and terrestrial environments

Ecosystem	Damage
Coral reefs	• Mechanical (physical) damage • Smothering, related to silt or sand • Impeding of light, due to silt or sand • Fish kill due to releases of toxic material (dead fish or macro invertebrates) • Debris
Seagrass beds	• Uprooting, which can result from storm surges. • Smothering, related to silt or sand • Impeding of light, due to silt or sand • Fish kill due to releases of toxic material (dead fish or macro invertebrates) • Debris
Fishing grounds	• Mechanical (physical) damage • Smothering, related to silt or sand • Impeding of light, due to silt or sand • Fish kill due to releases of toxic material (dead fish or macro invertebrates) • Debris (including trees and branches which may snag nets and lines).
Beaches	• Loss of beach, due to surges or changed wave patterns. • Sand migration, and particularly the movement of sand from the beach further inland (may also result in loss of beach width, or changed composition). • Scouring across the beach, due to flood runoff. • Changed composition, due either to washout of fine particles (leaving gravel, • cobbles and boulders) or blanketing of the beach with mud • Contamination (of sand or water) due to oil, sewage, industrial and agrochemical discharges • Debris and littering of the beach
Salt ponds	• Breached berm removing the separation of the pond from the sea. • Washing-out of the pond • Filling up due to silt, sand, mud • Contamination due to oil, sewage, industrial and agro-chemical discharges. • Littering of the pond with solid debris. **NOTE:** hydrogen sulphide may be released into the surrounding environment if the sediment of a salt pond is disturbed.
Mangroves and wetlands	• Defoliation: loss of leaves due to strong winds or salt inundation • Broken limbs, due to strong winds, heavy rains or physical impact • Tree fall or clearing, due to heavy rainfall, strong winds, or physical impact • Impaired drainage, which prevents efficient flushing of the wetland • Filling up due to silt, sand, mud • Contamination due to oil, sewage, industrial and agro-chemical discharges. • Littering of the wetland with solid debris.

Table 17: continued

Ecosystem	Damage
Forests	• Defoliation: loss of leaves due to strong winds, salt inundation or 0 airborne toxicants • Broken limbs, due to strong winds, heavy rains or physical impact • Tree fall or clearing, due to heavy rainfall, strong winds, or physical impact • Landslide / Mudslide • Fire Damage from lightning strikes
Historical and Archaeological sites	• Physical and structural damage • Landslides • Burial

Rapid Assessment Protocols

Rapid assessment protocols will need to be as simple as possible and implementable even at very low staff capacity for both terrestrial and marine environments. Protocols will be developed by DCNA's monitoring working group.

Coral reefs

Rapid assessment of coral reefs after a severe weather event should record three parameters:

- Spatial extent of damage
- Damage intensity
- Amount of debris

Spatial extent of damage can be recorded using standard estimates as:

- Less than 10%
- 10-25%
- 25-50%
- More than 50%

Damage intensity can be recorded as:

Minor – few effected / limited effect
Medium – marked effect / moderate effect
Major – extensive / irreversible

Damage rating

Information collected in the filed on the damage intensity and spatial extent of the damage can be used to provide a Damage 'rating' from Low to Extreme:

Table 18: Proposed damage rating scale

	Area damaged			
Intensity	**Less than 10%**	**10-25%**	**25-50%**	**Over 50%**
Minor	Low	Low	Moderate	High
Medium	Low	Moderate	High	High
Major	Low	Moderate	High	Extreme

A more refined version would look like this:

DAMAGE LEVELS

Damage Level	Category	Observed Characteristics
0	No damage	Undamaged reef
1	Minor damage	Branched corals with broken edges and tips (1 - 30%) and/or branches (1 - 10%).
2	Moderate damage	Branched and massive corals with damaged tissue and broken *fragments* (31 - 75%).
3	Major damage	Detached *coral colonies* (11 - 30%), *fragments* of various sizes of massive and branched coral loose in the bottom and among the *rubble* (31 - 50%).
4	Severe damage	Detached large *coral colonies* (31 - 50%), *fragments* buried among the *rubble* (51 - 100%). Portions of the substrate totally eroded.
5	Extreme damage	Surface of the seabed without sessile organisms, large colonies of massive and branched corals detached (51 - 100%). Seabed totally removed and with evidence of structural damage.

Figure 10: Example damage rating scale

www.nature.org

Team:	Date:		

Impact	Intensity	Spatial extent	Damage rating
Mechanical (physical) damage			
Smothering			
Impeding light (low viz)			
Fish kill			

Effective assessment			
Value of coral reefs (before event)			$
Damage factor • Quick assessment = x 0 - 0.25 • Moderate assessment = x 0.25 - 0.6 • High assessment = x 0.6 - 1			
Full economic loss (value of coral x damage factor)			$

Response actions:			

Restriction of use:			

Long term measures:			

Remediation cost:			$

Figure 11: Sample data sheet

Response

Having recorded the level and extent of damage and debris at survey sites, terrestrial and marine, the next step is to determine which sites need immediate attention to prevent more damage and prioritize next steps.

Response should be quick, scalable, adaptable and flexible and will fall into one of the following categories, generally in this order of priority:

1. Clean up: remove debris
2. First aid: stabilize in situ
3. Rescue
4. Nurseries and rehab work

Prioritization: coral reefs

Use these guidelines in your decision making:

Level	Prioritize	Rational
1	Clean up: removing debris	Debris will cause further damage to the reef if not removed
2	First Aid: Sites with large, whole, detached and/or overturned coral heads	Most likely to recover
3	First Aid: Sites with small and medium size corals	These can be stabilized
4	Sites with large fragments or boulders buried in sediment or rubble	

Figure 12: Sample coral reef prioritisation guidelines

Speed is essential !
In coral reef environments, the longer it takes to clean up and provide first aid, the lower the chances that corals will recover.

Clean up: removing debris

A hurricane has the potential to generate a tremendous amount of debris both wind bourn and associated with storm surge and flooding. This will range from construction material, household and garden items, appliances, garbage, plastics and furniture to tree trunks, branches and organic material.

Coral Reefs

Cleaning up in coral reef environments is generally a high priority and should be done urgently because debris will continue to move around with wave action causing harm to corals and other sea life.

- Clean ups can be organised with Responders in groups of divers and snorkelers
- Boat cover is useful for diver safety, to collect debris and to mark and retrieve large/ heavy objects
- Divers: work underwater to collect and remove debris in sacks
- Snorkelers: work at the surface to receive sacks, organise buoying of large objects and ferry sacks to the shore or boats
- Responders must work in buddy pairs and must use a surface marker buoy whenever possible
- Woven, jute or bulk sacks are best to collect debris and can be easily sent to the surface
- Lift bags should be used to lift heavy objects (never personal buoyancy devices)

Clean ups will need to be repeated as often as necessary to ensure the area is debris free. Debris will need to be transported from shore to a municipal dump or other designated site.

Beaches

Cleaning up beaches can be done with well briefed groups of volunteers.
Survey the beach beforehand to ensure that there are no hazardous or toxic objects.

- Responders should work in pairs
- Always wear gloves and good footwear (no bare feet)
- Take care particular care with buried/semi buried and sharp objects
- Woven, jute or bulk sacks are best to collect debris
- Mark heavy objects for later removal

Lagoons and salt ponds

- Macro-debris (vessels)
- Household debris
- Fish kills

Forests, woodlands and trails

- Clearing trails
- Felling trees, removing branches
- Use of tools especially chain saws

First Aid: coral reefs

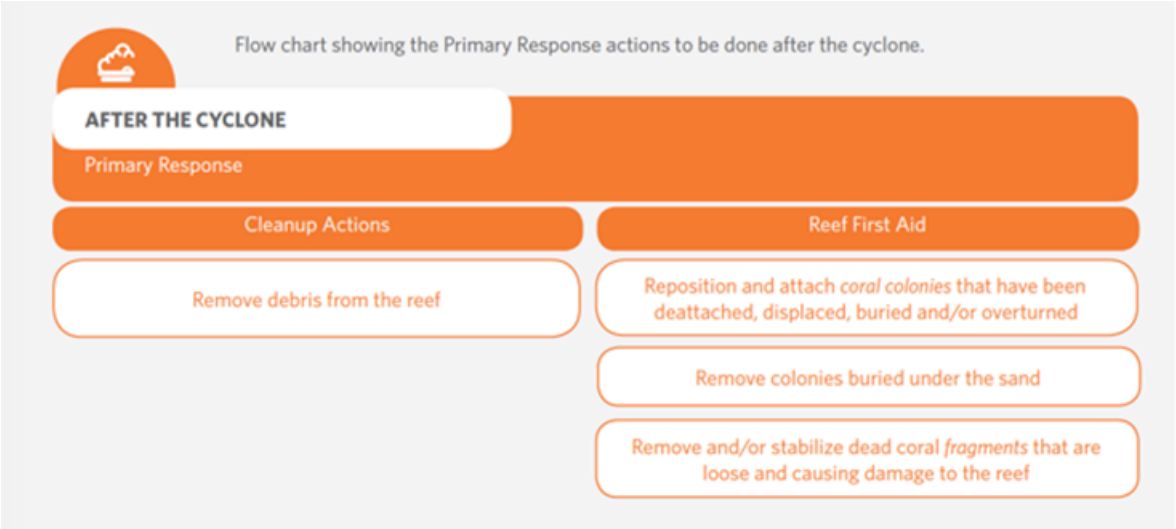


Figure 13: Sample Coral Reef First Aid actions
www.nature.org

Each Responder will need the following equipment:

- Galvanised tying wire
- Cement
- Epoxy and epoxy putty
- Gloves

Additional equipment

- Lift bags
- Ropes
- Drilling equipment, drill bit ½" - 5/8"
- Metal rods (galvanised or stainless steel)

Reef First Aid includes the following:

Reposition or re-attach displaced, dislodged, broken or overturned massive coral heads or fragments

- Coral fragments should have over 50% live tissue for rescue/reattachment
- Large fragments and coral heads with little living tissue or with a lot of damage should be left

General

- Try to locate where the coral came from for reattachment
- Find another suitable point if necessary: a firm surface free of loose material
- Clean the attachment surface with a wire brush before cementing
- Small fragments can be wedged into holes and/or secured with plastic straps or tarred yarn
- Whole coral heads and large fragments can be anchored using cement
- Orientate corals so that the highest proportion of living tissue is receiving sunlight
- Smaller fragments or fragments with low percentage coral tissue should be collected for later use in coral nurseries

Drilling

- Corals can be reattached by drilling through the coral head and 4-6” into the substrate and then a metal rod is inserted into the drilled hole to secure the coral head in place.

Fixation techniques:

- Galvanised tying wire
- Epoxy
- Cement
- Drilling and inserting a metal rod

Remove colonies buried under sediment or sand

Corals can survive for 24 hours, or depending on the species, up to 4 weeks under high sediment load regimes. Corals will try to remove sediment but this costs considerable energy.

When trying to unbury corals it is important not to touch them.

Responders should attempt to dig out and clean buried corals. Techniques include:

- Blow sediment away using a low pressure air source (e.g. spare tank and regulator) at a distance of 6-10 inches
- Waft water across the coral head to remove low levels of sediment

Remove and/or stabilize loose dead coral rubble and sediment

Loose dead material should either be removed or stabilized to prevent it rolling around damaging adjacent corals. Avoid gluing or cementing live coral onto unconsolidated coral rubble

Stabilize:

- Group coral in mounds
- Consolidate using plastic straps, yarn, cement, wire, biodegradable nets

Recovery

Recovery encompasses both short-term and long-term efforts. Recovery planning should take into account restoration, building sustainability and resiliency.

Include:

- Annual review of the Disaster Manual
- Evaluation of outcomes: successes, failures and lessons learnt
- Update protocols annually
- Establish nurseries (corals, trees etc)
- Prepare restoration plans for the affected areas (flora and fauna)
- Remove fast growing invasive species

Appendices

Organisational Structure

Disaster Management Committee (Dutch Caribbean Nature Alliance - DCNA)

The Disaster Management Committee will need a Memorandum of Understanding and appointed members to direct the planning, liaison, co-ordination, funding flow, training provision and communication needs surrounding Disaster Management.

The Disaster Management Committee should take responsibility for planning, directing and coordinates activities, including:

- Developing the Natural Disaster Management Manual ('Disaster Manual')
- Providing a central hub for communication (internal and external)
- Providing access to resources (volunteers, experts, information)
- Organising training for Disaster Managers and Responders
- Managing funds and resources including in house Emergency Fund, national disaster relief funds, grants and donations
- Coordinating with partner institutions and securing assistance from Ministries, local government, CDEMA, Red Cross and others
- Ensuring the Disaster Manual and on-site Response Plans are reviewed and updated annually

The Disaster Management Committee:

- Will need protocols in place to rapidly activate access to Emergency Funds and should prepare and co-ordinate funding proposals and agreements as well as taking on the administration of funding relief to parks.
- Should seek to establish partnerships with National and regional (government) agencies and international relief agencies (with or without formal agreements) for the provision of funding, access to expertise and resources (materials and equipment) as well as transportation to deliver them on island.
- Liaise with organisations to provide expertise and training in all relevant aspects of disaster management
- Become the 'go to' for information and produce regular updates for media and social media
- Promote and accept donations (hotlines, database, o- line donations liaison) and pass the funds along
- Vet and secure suitably qualified volunteers able to provide on site support & expertise

Disaster Managers (Park Director/Manager)

Disaster Managers will be the people responsible for the protected area, normally the Park Director, Manager or other senior member of staff. Disaster Managers will:

- Be the point contact for nature conservation disaster management on their island
- Set up, organise and direct the Operations Team (and Operations Team Leader)
- Set up, organise and direct Responder Teams (and Responder Team Leaders)
- Preparing and coordinating the implementation of Response Plans
- Ensure adequate funding, equipment, supplies

Operations Teams

The Operations Team works from an Operations Centre (ideally Park Headquarters), which must be safe, accessible and have space to securely store materials and kit.

The Operations Team/s should ideally consist of 2-4 people with one Team Leader who is responsible for co-ordinating their team's efforts and reporting to the Disaster Manager on activities and progress. The Operations team is responsible for the communication, co-ordination, logistics and record keeping including:

- Setting up and running an Operations Centre
- External communication between DCNA and Managers, Government and Disaster Response
- Internal communication between Managers and Responders (staff, volunteers)
- Co-ordinating partner and volunteer efforts
- Monitoring activities and progress of all Responder Teams
- Organising logistics: transportation, supplies (fuel, food, beverages) and equipment for Responder teams
- Mobilizing toolboxes, gear, equipment, boats, vehicles etc
- Collection and disposal of debris

You will need to secure emergency funding as soon as possible.

Make sure you are able to document costs associated with all aspects of the disaster response, personnel and volunteer time, equipment used/expended, purchases, supplies, food and drinks. You will need to have appropriate protocols and templates in place to ensure the smooth and efficient administration of your disaster response. There are plenty of reasons for keeping good records including creating a historical record, aiding cost recovery, meeting insurance requirements and learning for the future.

Documentation should include:

- Contact details for everyone involved
- rapid assessments logs
- field work logs
- volunteer hours and remuneration
- expense sheets

Daily field work logs need to capture:

- actions taken
- resources used
- persons involved and hours worked
- volunteer services (name, hours, work performed, compensation)
- next steps
- lessons learned

Organise:

- Safety surveys for buildings
- Repairs to buildings and utility supply
- Repairs/replacement for vehicles
- Repairs/replacement of equipment (inventory)
- Submit relevant insurance claims

Logistics:

- Transportation for Responders (staff and volunteers) and equipment
- Delivery of food and beverages
- Equipment (inventory)
- Toolkits (inventory)
- First Aid kits (inventory)
- Removal of debris to municipal dump or other sanctioned location
- Resupplying

Responder Teams

Responder teams will be primarily responsible for preparation and for field operations after the severe weather event has passed.

Safety first: Responders must have appropriate protective equipment including gloves, chaps etc. Responders should always work in buddy pairs

Responder teams can be made up of staff members, volunteers or others who have special skills and/or have had specialized training in Disaster Response and the use of rapid assessment protocols.

Teams should ideally consist of 4 – 6 persons (excluding boat personnel) with one Team Leader who is responsible for forming and co-ordinating their team's efforts and reporting to the Disaster Manager on activities and progress.

Responder Teams carry out:

- Maintaining and safeguarding toolboxes, first aid boxes and other equipment and supplies
- Preparation
- Rapid damage assessments (terrestrial and marine)
- Clean-up efforts and removal of debris
- 'First aid' including:
  - Marine: reattaching displaced broken corals, or overturned coral colonies, removing colonies buried under sediment/sand, removing dead coral
  - Terrestrial: removing damaged branches, trimming, replacing, reattaching, replanting

Partner/Volunteer network

It's important to have a network of partners and volunteers who can assist and provide (access to) additional support. Partners will include government agencies, private sector (dive operators, tour operators), NGOs, fishermen and others who are willing and able to contribute to the response efforts.

Timing of events

Severe weather event approaching
www.nature.org

Severe weather event retreating
www.nature.org

Tropical Storm and Hurricane check lists

Saba Conservation Foundation

Tropical Storm Alert:

If named storm - especially passing to the south of the island:

- ☐ Pull boats out of water and secure on high ground (stone crusher). For insurance purposes, it is mandatory to remove the boats from the water when an official storm warning has been issued for Saba.
- ☐ Walk around buildings and secure any loose objects i.e. move Golf Cart to higher ground, pile kayaks in new store room (old fishermen's shed).
- ☐ Decision to be made ad hoc whether to shutter Hyperbaric Facility doors and main building.

Hurricane Procedures

Fort Bay

Secure boats

- ☐ Check trailers and pull boats, place boats in secure on high ground (check with Gary for location).
- ☐ As soon as storm threat confirmed and if ***no trailer available***, transfer Queen B. II to Simpson Bay Lagoon (arrangements to be made by management). Prepare 2 anchors, including chain.
- ☐ On Lady Rebecca cover console and engines with tarpaulin.
- ☐ Remove electronic navigational equipment and VHF from Lady Rebecca.
- ☐ Secure navigational and stereo equipment on Queen Beatrix I.
- ☐ Secure boats to trailers with concrete blocks, dock lines and/or straps.

Secure Main Building:

- ☐ Walk around buildings and secure any loose objects as for Tropical Storm Alert.
- ☐ Remove all chairs etc. from balcony and close all upstairs shutters and back door shutter.
- ☐ Inside media room remove all electrical/sensitive items away from north wall (in case of falling rocks) shut down UPS and shut down breakers located on far wall in media room, just before locking main office.
- ☐ Secure fuel locker under entrance steps, lock and secure container (any loose objects to be secured inside).

Compressor room (old fishermen's shed)

- ☐ Secure all items inside, lift any sensitive or electrical items from floor.
- ☐ Sand bag the double door and close shutters.
- ☐ Protect compressor intake vent.
- ☐ Block sink drain.

Hyperbaric chamber

- ☐ Remove shutters from chamber room and crossbeams and bolts stored in coffee can (toolbox on wheels).
- ☐ Put all loose objects in new storage or chamber, move golf cart into new store room (old fishermen's shed).
- ☐ Close main doors and sand bag inside the doors remove ladder and toolbox.
- ☐ Shut down breakers on panel above sink.
- ☐ Shutter Dive Room (decide whether to remove and store dive equipment upstairs), main double doors and finally oxygen room (expandable foam under all these shutters).
- ☐ Close and secure main steel door put ladder and one toolbox upstairs before closing and shuttering main door upstairs.

Store Room (behind new fishermen's sheds)

- ☐ Secure all items inside, lift any sensitive or electrical items from floor.
- ☐ Sand bag the doors and close shutters.

Container

- ☐ Check and fix potential water leaks.
- ☐ Secure electronics and turn off electricity.
- ☐ Move seawater sensitive- or items that easily corrode off the floor.
- ☐ Check that container edges are tied to the ground.

Trail Shop

- ☐ Walk around building and secure any loose objects.
- ☐ Take down bird feeders and store in Trail Shop bathroom.
- ☐ Put all tee shirts and stock in plastic containers or plastic bags.
- ☐ Put covers over computer equipment and switch off all breakers just before leaving Trail Shop.
- ☐ Close shutters and install crossbeams (stored on shelf above bathroom door).
- ☐ Label crossbeams starting with #1 from Sea Saba roadside.
- ☐ Take down big signs at Mt. Scenery Trail Head.

Practice self-preparedness at home

Follow the guidelines issued by Island Government on their Facebook page: https://www.facebook.com/PublicEntitySaba and stock up supplies for at least 3 days. Emergency rations are available for free from the Disaster Preparedness Office in The Bottom (at the government building).

There is usually enough time to take care of your home and family after we finished the preparations in the harbor and closed off the Trail Shop.

Emergency box contents

Basic Disaster Supplies Kit

A basic emergency supply kit could include the following recommended items in a sturdy box:

- Water (one gallon per person per day for at least three days, for drinking and sanitation)
- Food (at least a three-day supply of non-perishable food)
- Battery-powered or hand crank radio and a NOAA Weather Radio with tone alert
- Flashlight
- First aid kit
- Extra batteries
- Whistle (to signal for help)
- Dust mask (to help filter contaminated air)
- Plastic sheeting and duct tape (to shelter in place)
- Moist towelettes, garbage bags and plastic ties (for personal sanitation)
- Wrench or pliers (to turn off utilities)
- Manual can opener
- Local maps
- Cell phone with chargers and a backup battery
- Fuel

Additional Emergency Supplies

- Cloth face coverings soap, hand sanitizer, disinfecting wipes to disinfect surfaces
- Non-prescription medications such as pain relievers, anti-diarrhoea medication, ant acids or laxatives
- Cash
- Prescription medicines
- Important documents such as copies of insurance policies, identification and bank account records saved electronically or in a waterproof, portable container
- Sleeping bag or warm blanket for each person
- Complete change of clothing appropriate for your climate and sturdy shoes
- Fire extinguisher
- Matches in a waterproof container
- Feminine supplies and personal hygiene items
- Mess kits, paper cups, plates, paper towels and plastic utensils
- Paper and pencil
- Books, games, puzzles or other activities for children

Maintaining Kit

- Keep canned food in a cool, dry place.
- Store boxed food in tightly closed plastic or metal containers.
- Replace expired items as needed.
- Re-think needs every year and update kit as needs change.

Kit Storage Locations

- Home: Keep this kit in a designated place and have it ready in case you have to leave quickly. Make sure all staff members know where the kit is kept.
- Work: Be prepared to shelter at work for at least 24 hours. A work kit should include food, water and other necessities like medicines, as well as comfortable walking shoes, stored in a “grab and go” case.
- Car: Keep a kit of emergency supplies in the car.

Saba Disaster Prep App

Hurricane or Disaster Response Kits and Tools - Tool kit

Saba Conservation Foundation

Tool box		
Item	**Amount**	**Amount needed**
Tools		
Ball peen hammer	1	1
Steel brush	1	2
Flat head screwdriver	1	1
3/4 inch wrench	2	2
17mm wrench	1	2
Foam can	1	4
11/16-25/32 wrench	1	1
Small socket wrench	1	2
5/8-11/16 wrench	1	1
Big file	1	1
Sockets		
3/4 inch short socket	1	1
3/4 inch long socket	2	2
11/16 inch long socket	1	1
16mm short socket	1	1
Nuts, Washers, Bolts, Screws		
3/4 inch nuts	48	22
3/4 inch washers	38	22
3/4 inch lock washers	23	22
Long screws	5	5
Long screw washers	8	5
Short screws	8	7
Short screw washers	7	7
Short screw nuts	9	7
Miscellaneous		
1/2 inch, 4 ft paracord	1	1
Medium tie straps	30	1
7oz plumbers putty	1	1

Hurricane or Disaster Response Kits and Tools - Hurricane Box

Template

Tool box		
Item	**Amount**	**Amount needed**
Medic First Aid Bag	1	
Plastic Gloves	10	
High Visibility Jackets & Helmets	1	
Headlamp	2	
GPS Unit	2	
Island Maps	5	
Whistles	5	
Walkie Talkie	2	
Duct tape	1	
Pencil & Pens	Several	
Waterproof Paper	Several	
1/2 inch vinyl rope	20 yards	
Flagging Tape	1 roll	
Garbage Bags	1 roll	
AA & AAA Batteries	10	
Tie Wraps	Several	

Personnel sign up sheet

Template

Full name	
Affiliation	
Home address	
Mobile	
Land line	

Driving license	
Boat handling	
Snorkelling	
Diver certification	
Certification agency	
Certification #	

Accident insurance	
Company	
Policy #	

Life insurance	
Diving insurance	

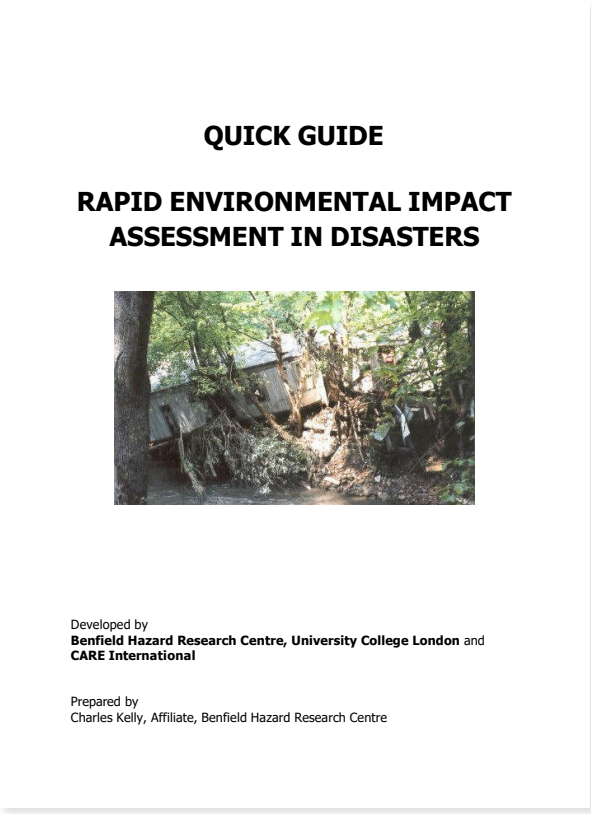
Blood type	
Medical form	
Medicine	

Emergency contact:	
Name	
Home address	
Mobile	
Landline	

Training: [*list all appropriate training]*	

Multi-hazard early warning systems: checklist

Quick Guide: rapid environmental impact assessment in disasters

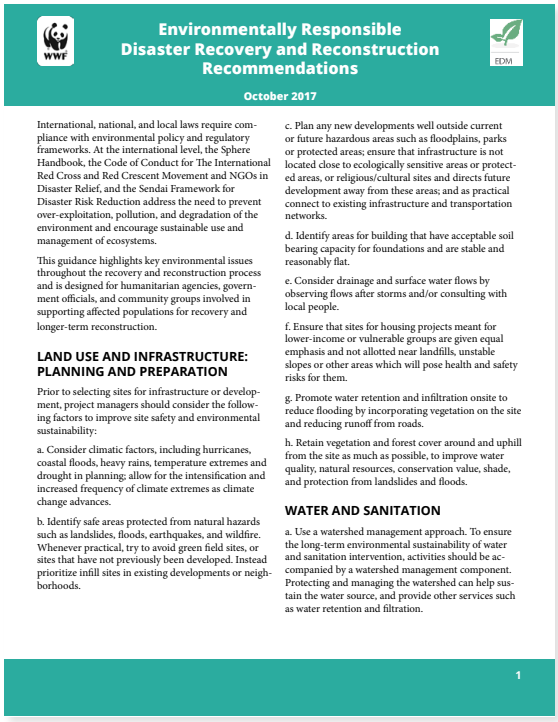

QUICK GUIDE

RAPID ENVIRONMENTAL IMPACT ASSESSMENT IN DISASTERS

Developed by
Benfield Hazard Research Centre, University College London and **CARE International**

Prepared by
Charles Kelly, Affiliate, Benfield Hazard Research Centre

WWF recovery and rebuilding recommendations and principles



Environmentally Responsible Disaster Recovery and Reconstruction Recommendations

October 2017

International, national, and local laws require compliance with environmental policy and regulatory frameworks. At the international level, the Sphere Handbook, the Code of Conduct for The International Red Cross and Red Crescent Movement and NGOs in Disaster Relief, and the Sendai Framework for Disaster Risk Reduction address the need to prevent over-exploitation, pollution, and degradation of the environment and encourage sustainable use and management of ecosystems.

This guidance highlights key environmental issues throughout the recovery and reconstruction process and is designed for humanitarian agencies, government officials, and community groups involved in supporting affected populations for recovery and longer-term reconstruction.

LAND USE AND INFRASTRUCTURE: PLANNING AND PREPARATION

Prior to selecting sites for infrastructure or development, project managers should consider the following factors to improve site safety and environmental sustainability:

a. Consider climatic factors, including hurricanes, coastal floods, heavy rains, temperature extremes and drought in planning; allow for the intensification and increased frequency of climate extremes as climate change advances.

b. Identify safe areas protected from natural hazards such as landslides, floods, earthquakes, and wildfire. Whenever practical, try to avoid green field sites, or sites that have not previously been developed. Instead prioritize infill sites in existing developments or neighborhoods.

c. Plan any new developments well outside current or future hazardous areas such as floodplains, parks or protected areas; ensure that infrastructure is not located close to ecologically sensitive areas or protected areas, or religious/cultural sites and directs future development away from these areas; and as practical connect to existing infrastructure and transportation networks.

d. Identify areas for building that have acceptable soil bearing capacity for foundations and are stable and reasonably flat.

e. Consider drainage and surface water flows by observing flows after storms and/or consulting with local people.

f. Ensure that sites for housing projects meant for lower-income or vulnerable groups are given equal emphasis and not allotted near landfills, unstable slopes or other areas which will pose health and safety risks for them.

g. Promote water retention and infiltration onsite to reduce flooding by incorporating vegetation on the site and reducing runoff from roads.

h. Retain vegetation and forest cover around and uphill from the site as much as possible, to improve water quality, natural resources, conservation value, shade, and protection from landslides and floods.

WATER AND SANITATION

a. Use a watershed management approach. To ensure the long-term environmental sustainability of water and sanitation intervention, activities should be accompanied by a watershed management component. Protecting and managing the watershed can help sustain the water source, and provide other services such as water retention and filtration.

1

Disaster Rebuilding:
Environmentally Responsible Design Principles

October 2017

When planning, designing, and implementing disaster recovery and reconstruction programs, it is important for agencies to consider the environment to build back safer.

Design principles include:

"Do No Harm" to the environment and communities

The "do no harm" principle aims to get humanitarian practitioners to examine their programs to ensure that no unintentional negative impacts occur because of an intervention. This principle means that all programs should be examined for unintentional negative impacts on the environment or communities.

Multiple benefits of addressing the environment

With the demands placed on staff responding to disasters environmental issues may seem like a lower priority, but considering environmental issues has multiple benefits. These can include:

- Recognizing and addressing the underlying environmental issues that may have contributed to causing the disaster risk in the first place.
- Improving the affected population's health, safety, and well-being through reduction of air and water pollution (management of debris, liquid and solid wastes).
- Protecting and managing natural assets that support fisheries, tourism, shelter, and water-related needs and employment opportunities.
- Protect people and the natural resources upon which they depend, from future risk.

Environmental issues cannot always be subcontracted — they require action on everyone's part

Humanitarians must recognize that environmental issues are integral to solutions to mitigate the effect of future risk. This is not an area that can be considered outside the remit of, for example, a water engineer or a health worker. Everyone must take a part in understanding how a program may affect the environment and ensuring that programs build back safer and do no harm.

Build back safer and greener

The post-disaster situation allows humanitarian actors and communities an opportunity to undertake projects that have an integrated environmental component to build back safer. This may be, for example, rebuilding with clean energy systems, or reducing development in flood-prone areas.

Be solution-oriented

Examples of reconstruction and development degrading the environment are easy to find, but it is important that we look to solutions to ensure that this trend is changed. Cities and urban areas around the world are becoming leaders in innovative approaches to stormwater management, green building, and resilient infrastructure. A learning approach to rebuilding can support a more durable and resilient future for the communities recovering from disaster.

Emphasize the use of local knowledge and problem solving

Community leadership and active participation in program design and development is essential. This is to ensure that we are meeting the real needs of communities and individuals, and not those perceived by us, as well as to ensure that local capacity is utilized fully. Particularly in urban areas, community groups may be diverse and include homeowners, renters, business owners, and civic organizations.

ENVIRONMENT & DISASTER MANAGEMENT
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