

# Rapid Health Assessment of Coral Bay Mangrove Forests; Post-Irma and Maria condition

January, 2018





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## Introduction

The tandem hurricanes of Irma and Marie combined to create the most damaging natural disaster in the US Virgin Islands in 30 years or more. Coral Bay was in the eye wall of hurricane force winds in Irma and experienced winds in the mangrove area of over 200mph. Addressing the damage to infrastructure, and personal property became the first priority after the storms. Assessing the damages to natural resources can be more nuanced and requires observation and analysis. Mangrove forests are widely recognized as important natural resources due to their high productivity and their role in protecting coastlines from storm surges and flooding. The mangrove forest of Coral Bay, St John bore the evidence of widespread damage after the storms. Their resiliency after such a large natural disaster was unknown.

The goal of this project is to quickly capture the conditions of the coastal forests across Coral Bay. This study utilizes traditional scientific measurements used in ecology, combined with observations and descriptions by the experienced ecologists at Geographic Consulting. The result is a descriptive snapshot of the area at a single point in time. The study can be repeated in the future because the sampling points are spatially explicit.

Finally, we make recommendations based on our findings and experience. The purpose of the recommendations is to preserve, protect and improve the health of the mangrove forests. We hope that the resiliency of these forests combined with thoughtful land management will result in the recovery of Coral Bays' mangrove forests.

## Method

The first step in a Rapid Assessment is to gauge the condition of the habitat across the entire study site. The proposed study area includes the mangrove habitat on the northern portion of Coral Bay, approximately 2 linear miles. Figure 1 indicates mangrove forest locations, as identified by previous land cover classification projects, each using unique methods. We merged the results from these studies into a single, all-inclusive polygon using the mapping software ArcGIS 10.2. Sample plots were then overlaid on the map. The locations for points 1-10



**Figure 1. Spherical densitometer used to measure canopy coverage**

were chosen by Sean Richardson for a wetland plant inventory he conducted in April 2017. We revisited these points, to the best of our ability, using the final report Mr. Richardson created. We created additional set of randomly generated points to ensure complete coverage of the site and to remove possible bias.

On January 29, 30, and 31, Brian Daley and Jennifer Valiulis of Geographic Consulting used GPS units to navigate to each of the 19 points. We measured a circular sampling plot with a 10 foot radius around the center point. Canopy coverage was measured at the center point using a spherical densitometer and expressed as a percentage. The variables; Canopy height, dbh, forest health, storm damage, regeneration and soil description were all based on the entire 314 Sq. ft. plot.

Plants were identified to the species level in each plot and general observations of forest health recorded. Ground cover, forest health, storm damage and regeneration are expressed as a percentage between 0-100 percent.

Birds, invertebrates and other wildlife were identified to the species level when possible and noted.

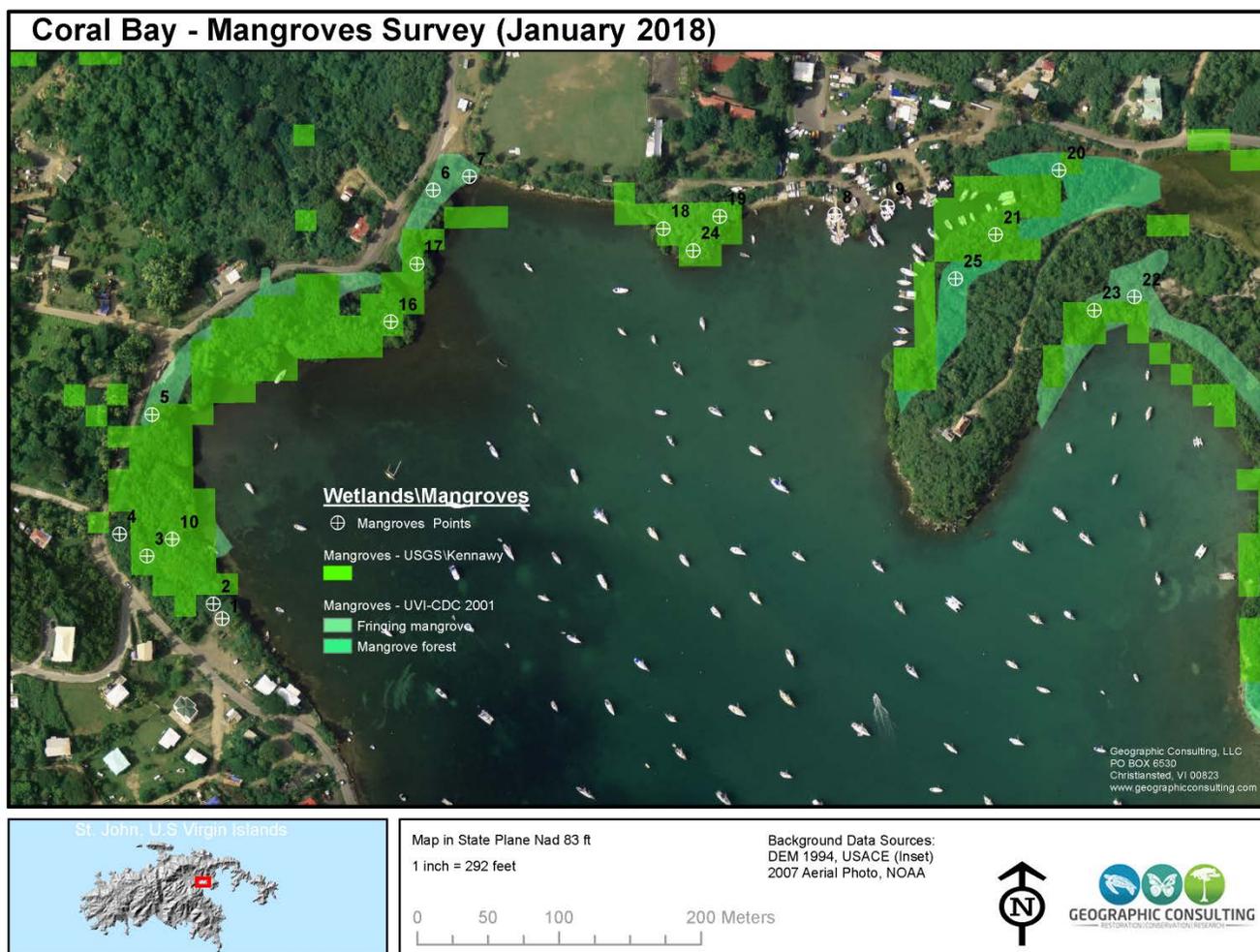


Figure 2 Mangrove forest locations, as identified by previous studies, are shown with enumerated sampling plot locations

## Summary of Findings and Recommendations

Overall we found the damage to the mangrove system to be significant, but to vary depending on location and initial site condition. The most severely impacted sites have nearly 100% damage with trees knocked over or broken in half. Remaining trees were standing dead or leaning and showed little sign of refoliation. Other sites,



particularly to those forests of small stature and protected by rocky coasts, were only minimally damaged. In most plots, there are already young mangrove propagules growing in the understory. In three or four of the sample plots, it appears damaged trees are dead and will not recover. However, the vast majority of the plots have some damaged but living mangrove trees that are in the process of producing new leaves.

High winds and incredible wave energy from two category 5 hurricanes caused wide spread damage to the coastal forest. Mangrove species have adapted to this type of disturbance over millennia, but this was also an extreme event and the recovery will take time. This reforestation process will most likely be driven by two simultaneous phenomena: damaged trees producing new leaves to form a new, lower forest canopy, and propagules and seedlings in the understory of the forests growing up to become the new, younger components of the forest canopy. We do not believe a large scale reforestation/tree planting effort is required at this point in time.

In a few sites, including point 10, we observed large volumes of sediment that were moved by storm water. There was very little regrowth in these sites and storm damage was severe. The deposition of mud, sand and gravel has partially clogged some culverts and may have altered the hydrology of some sites. The area around Point 3, 4 and 10 should be monitored on an ongoing basis to ensure that forest regeneration occurs. These sites may require additional intervention (tree planting) if the forest does not recover on its own.

Rubber vine existed in Coral Bay prior to the storm, but the population has exploded since then. The purple flowered plant is considered an undesirable [exotic invasive plant in the US Virgin Islands](#). It thrives in moist coastal areas, prefers bright sunlight and tolerates lower levels of salt. The hurricanes provided ideal conditions for rubber vine by defoliating and knocking down the native trees in the landscape and dumping steady rain for weeks after the storm. We only observed rubber vine in two plots, but it forms dense, almost impenetrable clumps on roadsides and fields around Coral Bay. We recommend that rubber vine be eradicated from target areas and the overall population controlled before the problem gets much worse. The task will not be easy

Finally, there is a large amount of storm debris and trash throughout the mangrove forest. Pulling masts and sailboat hulls out of the mangrove forest will be logistically challenging, but may be easier if done from boats in the water. Removing large storm debris like roof sections will also be challenging, but facilitated by cutting it in to smaller pieces that people can more easily carry. We recommend coordinating teams of workers on the sea and land to find the best solutions. Regardless of the level of care used by clean-up workers and volunteers, some damage to the forest is inevitable when removing the debris. We recommend focusing human activity in places with dead trees rather than areas with young and more fragile propagules and other seedlings.

## Point Data (Beginning in the south west and continuing around the coast to the east)

### Point 1 & 2 (West Side of the Harbor)

(These two points were combined because the original points were within 10 ft. of each other, which created overlapping plots. Canopy coverage measure and GPS point is for #2)

<b>Date</b>	1/31/18	<b>Latitude</b>	18.34479	<b>Longitude</b>	-64.71595
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<b>Canopy Height</b>	18	<b>Canopy Coverage</b>	9%	<b>dbh</b>	6.1"
<b>Forest Health</b>	40-60%	<b>Storm Damage</b>	40-60%	<b>Regeneration</b>	

Site Description – This plot is on the coastal edge of a site with a parking lot where truck, machinery and other storm recovery equipment are being stored. There is evidence of it being backfilled to maximize the flat parking area. There is a single black mangrove tree that has been knocked over in the storm. The understory is 30% covered in grass and other herbaceous broadleaf plants. These are the same species of plants recorded by Sean Richardson.

Tree Species – Black mangrove tree, *Thespesia populnea*, *Cordia ricksekeri*, *Quadralla jamaicensis*, *Capparis flexuosa*, *Solanum bahamense*, *Pluchea odorata*, *Hippomane mancinella* and *Jatropha gossypifolia*.

Soil – Rocky fill with larger boulders and sand along the beach.

Storm Damage and Regeneration Description – A black mangrove and other large *C. ricksekeri* have been blown over.

On-going threats – The adjacent land use of the parking lot is impacting the forest health of the site. Rocks and low quality fill are being dumped to create an even parking surface, but are burying the bases of living trees.

Management Recommendations – The rocks and fill used for the parking lot should be pulled inland to allow for vegetation to reestablish along the coastline.

### Point 3

<b>Date</b>	1/31/18	<b>Latitude</b>	18.34468	<b>Longitude</b>	-64.71624
<b>Canopy Height</b>	35'	<b>Canopy Coverage</b>	0	<b>dbh</b>	4.1 (dead)
<b>Forest Health</b>	10%	<b>Storm Damage</b>	80-100%	<b>Regeneration</b>	none

Site Description – This is among the most heavily damaged points in all of Coral Bay. All trees in and around the plot are damaged or dead. The tree canopy was likely 35 feet before the storm, but no live trees were observed. Sean Richardson noted the understory was open and easy to walk through. He also noted the presence of white mangroves trees, and pneumatophores from black mangroves. These were not identifiable in January, 2018.

Tree Species – Black and white mangroves

Soil – The soil onsite is storm deposited sediment and gravel at the surface. Below this layer is saturated clay. We sank through this soil almost to our knees. Whatever soil was on site previously is now buried by storm sediment.

Storm Damage and Regeneration Description – There are trees knocked over, some are topped and broken and others are leaning over, dead. No new leaf growth was observed on trees in or around the plot. No regeneration was observed in the understory

On-going threats – There may have been changes to the hydrology of this site due to sediment deposited during the storms.

Management Recommendations – Culverts are clogged and need to be cleaned out. This plot and plot 10 should be monitored on an on-going basis. They are the only plots where regeneration was not recorded and a management intervention, such as tree planting or restoring the healthy hydrology may be required.

#### Point 4

<b>Date</b>	1/31/18	<b>Latitude</b>	18.34496	<b>Longitude</b>	-64.71633
<b>Canopy Height</b>	20'	<b>Canopy Coverage</b>	16%	<b>Dbh (Inches)</b>	9.5, 8.8, 5.8
<b>Forest Health</b>	Average	<b>Storm Damage</b>	High	<b>Regeneration</b>	Average

**Site Description** – This is a roadside plot set back from the sea. Sean Richardson described it as dominated by large red mangrove trees. We found no mangroves of any species at the location in the report, making us question the accuracy of the point. We describe this point as dominated by many large pond apple trees (*Annona glabra*) which were all damaged by high winds. The under story is 50% covered with hurricane grass and guinea grass.

**Tree Species** – Pond Apple in the overstory and *Solanum bahamense* in the understory. No mangrove tree species were observed inside the plot.

**Soil** – Brown silty clay. Dry

**Storm Damage and regeneration Description** – Tree canopy is severely damaged with large limbs snapped off and many are hanging. There does not appear to be any mortality, as all the severely damaged trees are producing new leaves.

**Wildlife** – Multiple iguanas, blue land crab (*Cardisoma guanhumi*), thrush, *Anolis cristatellus*

**On-going threats** – none

**Management Recommendations** – Minor roadside trash removal

#### Point 10

<b>Date</b>	1/31/18	<b>Latitude</b>	18.34506	<b>Longitude</b>	-64.71603
<b>Canopy Height</b>	NA	<b>Canopy Coverage</b>	0	<b>dbh</b>	1.5"
<b>Forest Health</b>	20%	<b>Storm Damage</b>	90%	<b>Regeneration</b>	0%

**Site Description** – Severely impacted site where all large trees either fell or died. It was difficult to accurately identify the dead trees and we could not compare this site to Sean Richardson's description.

**Tree Species** – White mangrove and Jamaican caper (*Quadrella jamaicensis*)

**Soil** – Sediment and gravel deposited in a thick layer on top of heavy clay. The soils seems to have poor drainage and percolation.

**Storm Damage and Regeneration Description** – All large trees were damaged or knocked down. Some trees were large (with dbh up to 9.9") and were uprooted entirely. There is a single white mangrove tree living and a single Jamaican caper.

**Wildlife** – Pearly eyed thrasher. Calls from white lipped frogs were heard, but the animal was not observed.

**On-going threats** – Clogged culverts and heavy deposits of sediment appear to have altered either the local soil conditions or the entire hydrology of the site.

**Management Recommendations** – More than any other point, this site needs to be monitored during the recovery period. If no natural regeneration occurs, this site is the lead candidate for human assisted regeneration. This could be through a combination of earth moving to improve the flow and drainage of fresh water and subsequent tree planting.

**Point 5 (Near the Dumpster Site)**

<b>Date</b>	1/31/18	<b>Latitude</b>	18.34558	<b>Longitude</b>	-64.71627
<b>Canopy Height</b>	15'	<b>Canopy Coverage</b>	0	<b>dbh</b>	13.6
<b>Forest Health</b>	20-40%	<b>Storm Damage</b>	80%	<b>Regeneration</b>	

Site Description – This is a nearly mono-specific stand of Black mangroves along the roadside. The canopy was likely 40 feet tall prior to the hurricanes. This is one of Sean Richardson’s selected sites. Today, it is near to the overflowing dumpsters and covered with every manner of overflowing trash and storm debris. The understory is comprised of *Pluchea odorata* and there are no mangrove propagules.

Tree Species – Dominated by black mangrove (*Avicennia germinans*), with a few Red mangrove trees and *Thespesia populnea* . The understory has red mangrove propagules and *Pluchea odorata*

Soil – Saturated organic clay. Brown.

Wildlife – Iguana, *Anolis cristatelles*, and not many Blue crab holes (*C. guanhumi*)

Storm Damage and Regeneration Description – Trees are topped and blown over. The 40 foot canopy now stands at 15 feet. Nearly bare stems with few new leaves. Sean Richardson noted that coconut trees (*Cocos nucifera*) were present, but these were all killed in the storms.

On-going threats – The dumpsters are not covered and there is every manner of trash scattered across the site. The clean up will be laborious.

Management Recommendations – There is a guide wire from a WAPA pole that was intentionally tied around the trunk of a large mangrove tree. The WAPA pole has fallen down and the wire will severely damage the tree in not removed. A large trash clean up will be required to restore this site to any sort of pre-storm normalcy .

**Point 16 (Near Pickles Deli)**

<b>Date</b>	1/30/18	<b>Latitude</b>	18.3461	<b>Longitude</b>	-64.714515
<b>Canopy Height</b>	20'	<b>Canopy Coverage</b>	40%	<b>dbh</b>	4+
<b>Forest Health</b>	10%	<b>Storm Damage</b>	80-100%	<b>Regeneration</b>	10%

Site Description –This patch is a seaside edge of a once lush red mangrove forest. The canopy was likely 35 or 40 feet. There are now some branches extending as high as 20’ that have new leaf growth. There is a man-made clearing in the mangroves, like a channel, just to the north of this point. Hurricane damage is severe and includes toppled trees and snapped trunks and branches.

Tree Species – Red mangrove.

Soil – Open water in many places with a combination of black organic material on top of white sand.

Storm Damage and Regeneration Description – Many standing dead, topped and toppled trees. Mortality may be near 80%, but there is still a chance that some of the damaged trees will grow new leaves. Regeneration of leaves has begun on only very few branches. There are many red propagules already established in the wetland understory.

On-going threats – It is still not clear of the largest standing trees will survive. The majority of the woody stems appear to be damaged and likely dead.

Management Recommendations – Preserve and protect. Continue to observe this site to track the regeneration of the red mangrove propagules. This site may require replanting in order to restore the mangrove forest. This site also needs normal trash removal.

### Point 17

<b>Date</b>	1/30/18	<b>Latitude</b>	18.34650	<b>Longitude</b>	-64.71447
<b>Canopy Height</b>	15'	<b>Canopy Coverage</b>	30%	<b>dbh</b>	3.8
<b>Forest Health</b>	10%	<b>Storm Damage</b>	80-100%	<b>Regeneration</b>	10%

**Site Description** – Originally a monospecific patch of red mangroves with a 35' canopy. The patch is 100' wide between the road and the sea. Mortality is greatest on the sea side and the road side. There are hundreds and hundreds of propagules in the understory providing as much as 40% understory coverage. Many of these have been defoliated by small herbivores that were not observed (could be caterpillars) and are now regrowing.

**Tree Species** – Red mangrove only.

**Soil** – Saturated sand covered in black organic material

**Storm Damage and Regeneration Description** – Many standing dead, topped and toppled trees. Mortality appears to be over 80%. Regeneration of leaves has begun on only very few branches.

**On-going threats** – Humans have been cutting and removing branches here. It is also possible that the hydrology has changed somewhat and what regrows will not be the same as what was here originally.

**Management Recommendations** – Stop cutting trees and removing branches. Preserve and protect. Continue to observe this site to track the regeneration of the red mangrove propagules. Consider planting black mangroves in the upland portions of this site as a defense against the altered drainage regime. This site also needs normal trash removal.

### Point 6 (Near Triangle)

<b>Date</b>	1/30/18	<b>Latitude</b>	18.34672	<b>Longitude</b>	-64.71432
<b>Canopy Height</b>	35	<b>Canopy Coverage</b>	0	<b>dbh</b>	4.9, 4.1"
<b>Forest Health</b>	20-40%	<b>Storm Damage</b>	80%	<b>Regeneration</b>	10%

**Site Description** – Prior to the storms this site appears to have been a mix of red and black mangroves (*Avicennia germinans*), with a canopy to 35' high and reaching back 50' from the water's edge. They were among the largest mangrove trees in Coral Bay. The hurricane damage was severe, with mortality around 75% and almost all branches and stems damaged in some way. Sean Richardson noted there were large red mangrove trees in the area and some coconut (*Cocos nucifera*) were present. In January of 2018, this was no longer the case.

**Tree Species** – Black and red mangroves with some *Thespesia populnea* mixed among them in drier places

**Soil** – Saturated mixture of black organic matter atop sand. An upland wetland flows into the sea across this point, so there is also some transported sediment.

**Storm Damage and Regeneration Description** – Severely damaged forest experienced roughly 75% mortality. Living trees are also topped, damaged and leaning. There is minimal regeneration of leaves on the stems at this point. The ground cover is less than 5% in the plot, comprised of less than a dozen red mangrove propagules

**On-going threats** – It is possible there has been a change to the hydrology of this site from the sediment moved by the storm. Large storm debris, including a keeled hull, is in the mangrove. Another boat is in the water up against the mangroves.

**Wildlife** – Yellow warbler, *Anolis cristatellus*, bannanaquit, fiddler crabs, pearly eyed thrasher, iguana.

Management Recommendations – Remove the vessels and large items from the sea side and the smaller trash from the landside access. There is no need to prune trees or remove the dead wood on this site, as those downed branches continue to provide wildlife habitat and are part of the nutrient cycle.

**Point 7**

1/29/18

Rejected

Utility poles and porta-potty dominate the site

**Point 18 (Behind the Ballfield)**

<b>Date</b>	1/30/18	<b>Latitude</b>	18.34669	<b>Longitude</b>	-64.71252
<b>Canopy Height</b>	5'	<b>Canopy Coverage</b>	0	<b>dbh</b>	4.1
<b>Forest Health</b>	10%	<b>Storm Damage</b>	80-100%	<b>Regeneration</b>	10%

Site Description – This site is located on the rocky coast and includes upland forest species as well as a few mangrove trees. There are less than dozen red mangroves, growing in open water as an interwoven patch of branches and roots. It was severely impacted by the storm. Tree heights were roughly 18-20 feet prior to the storm but are now only 5'. There are several damaged vessels, including a kayak and two dinghies that are broken apart and sunken.

Tree Species – Red mangrove, *Agave missionum*, *Pilocerus royenii*, *capparis flexuosa*, *Pithocellobium unguicati*, *L. leucocephals*, *T. populnea*, *Croton flavum*, *C. astriodes*, *Melochia tomentosa*, Coral vine

Soil – Hard rocky outcroppings with pockets of clay soil perched in depressions. The mangroves are growing on sand in open water.

Storm Damage and Regeneration Description – The red mangroves were all but destroyed. Every branch and stem is broken and the tangles patch of wood has only a few leaves on it. Regeneration is minimal on a few trees, while others are dead. The upland forest species, which are growing at higher elevation and set back slightly from the sea, are only slightly damaged.

Wildlife- Iguanas, kingbirds

On-going threats – Multiple derelict vessels are partially sunk along the rocky shore. One has been tied off to a damaged mangrove tree. Stacks of relatively new lumber have either washed up on the shore or are being salvaged here.

Management Recommendations – Remove derelict vessels from the seaward side and large storm debris from the landward side

**Point 24**

<b>Date</b>	1/30/18	<b>Latitude</b>	18.34669	<b>Longitude</b>	-64.71252
<b>Canopy Height</b>	6'	<b>Canopy Coverage</b>	16%	<b>dbh</b>	<2"
<b>Forest Health</b>	90%	<b>Storm Damage</b>	10%	<b>Regeneration</b>	NA

Site Description – This plot is a rugged rocky shore with vegetation mixed in with exposed rocks. The trees are widely dispersed, so do not form a true canopy and the tree heights are up to 6'. There is surprisingly little storm damage.



Tree Species – Black mangroves, *Acacia macracantha*, *Leucaena leucocephala*, *Agave missionum*, *Pilocerus royenii*, *Randia aculeata*, *Croton. astriodes*, *C. flavens*, *Cassine xylocarpa*, *Opuntia dilleniana*, *M. tomentosa*, *Ipomea eggersiana*, *Tilandsia utriculata*, *Plumeria alba*, *Comocladia dodonaea* (Christmas bush).

Soil -

Storm Damage and Regeneration Description – The small black mangrove trees are healthy, with only a few broken branches. The upland species also fared very well. This is among the least damaged forest plots that we observed during the study.

On-going threats – none other than minor trash.

Management Recommendations – normal coastal clean up.

### Point 19

1/29/18

Rejected

No Mangroves

### Point 8 (Dock Area)

<b>Date</b>	1/29/18	<b>Latitude</b>	18.34707	<b>Longitude</b>	-64.71148
<b>Canopy Height (ft)</b>	8	<b>Canopy Coverage</b>	0	<b>dbh</b>	NA
<b>Forest Health</b>	70%	<b>Storm Damage</b>	30%	<b>Regeneration</b>	30%

Site Description The near shore and shallow waters around the dinghy dock. Ringed by black mangroves and a single red mangrove. The trees are spread out and don't form a continuous canopy in most of the area.

Tree Species - Black, red and a single buttonwood mangrove. Inside the plot were also tan-tan (*Leucaena leucocephala*), rubber vine, Seaside mahoe (*Thespesia populnea*).

Soil - Saturated sandy soil with patches of black pneumatophores protruding.

Storm Damage Description – Mostly branch tip burn/die-back. New leaf growth regeneration is visible.

On-going threats – In the case where mangrove trees grow in close proximity to boating activity, there is always the risk that trees, boats or boaters can be harmed by actions taken when people are not paying attention. Storm debris and trash was brought by the storm.

Management Recommendations – Dead branches should be removed from the eye level of boaters and boaters should not tie-off to mangrove trees. The dock extension was destroyed in storm, making the current docking area more crowded. This is most likely a temporary condition, but extra care should be used for the safety of plants and people. Installing cleats and additional docking facilities is recommended for various reasons. Manual trash removal is recommended. The single dead buttonwood mangrove tree should be removed for boater safety.

### Point 9

REJECTED. There are only a few individual mangrove trees in a small patch and surrounded by boats and storm debris. This point was most likely damaged by the storms, but no longer resembles the description by Sean Richardson.

### Point 25 (The Creek by Usher Bay)

<b>Date</b>	1/29/18	<b>Latitude</b>	18.34650	<b>Longitude</b>	-64.71083
<b>Canopy Height</b>	18	<b>Canopy Coverage</b>	7%	<b>dbh</b>	4.5



<b>Forest Health</b>	20-40%	<b>Storm Damage</b>	80-100%	<b>Regeneration</b>	
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**Site Description** – This point is dominated by a single red mangrove tree with extensive prop roots and almost no leaves. It has been topped and was taller. There is also a single white mangrove tree.

**Tree Species** – Red mangrove. Also, *Citharexylum fruticosum*, *Solanum bahamense*, *Croton xylocarpa*, *Pilocerus royenii*, and *Thespesia populnea*

**Soil** – Variable within the plot, from saturated wetland silt to rocky upland soil. Extensive decomposing leaf litter.

**Storm Damage and Regeneration Description** – The single large red mangrove has been toppled, has no regrowth and appears dead. The two largest black mangrove trees have been sheared below 10 feet. A large *Pilocerus royenii* cactus is also toppled. Red mangrove propagules and saplings dominate the understory and there are dry forest shrubs above them. Over 200 propagules were counted.

**On-going threats** – Extensive storm debris and trash.

**Management Recommendations** – Manual removal of trash. There is a large sailboat mast and rigging and lines toppled into the plot and is resting atop dead branches and trees. Removal of the large mast from the seaside of the plot. This work should be done soon, as future forest regeneration will surely be damaged by its removal

**Wildlife** – Yellow warbler, green hummingbird, iguanas, termites and pearly eyed thrasher. Kingbirds are known to nest here. We observed kingbirds in the area, outside of the plot, but observed none inside the plot and saw no nesting/mating activity.

### Point 21

<b>Date</b>	1/29/18	<b>Latitude</b>	18.34672	<b>Longitude</b>	-64.7105
<b>Canopy Height</b>	25	<b>Canopy Coverage</b>	42%	<b>dbh</b>	1.8 inches
<b>Forest Health</b>	3	<b>Storm Damage</b>	3	<b>Regeneration</b>	

**Site Description.** - Coastal fringing mangrove forest, mixed canopy of red and black mangroves close to the shore. More secondary forest species present away from the coast. The forest patch is roughly 100 ft wide in this area. Closer to the sea (outside the plot) are standing dead trees, 35' tall and no regeneration below them at this time.

**Tree Species** Red and Black mangrove within the plot. Just outside the plot are *Cassine xylocarpa*, *Randia aculeate*, rubber vine, *Tabebuia heterophylla*, *tillandsia utriculata*, *Leucaena leucocephala*.

**Soil** – Saturated wetland mud with large crab holes.

**Storm Damage and Regeneration Description** – Primarily large broken branches. Multi-stem mangrove trees lost several branches and 2 younger blacks have been broken in half and died. The damaged black mangrove trees are regenerating with vigor. There are black mangroves of various sizes regenerating in the understory and one red sapling. 20% ground cover.

**On-going threats** – None. Minimal storm trash/debris in the area.

**Management Recommendations** – Preserve and protect

**Wildlife** - Scaly nape pigeon.

### Point 20

<b>Date</b>	1/30/18	<b>Latitude</b>	18.34706	<b>Longitude</b>	-64.71015
<b>Canopy Height</b>	25	<b>Canopy Coverage</b>	32%	<b>dbh</b>	2.1
<b>Forest Health</b>	40-60%	<b>Storm Damage</b>	20-40%	<b>Regeneration</b>	40-60%

**Site Description** – The two largest trees in the plot are black mangroves, are multi-stemmed and have multiple branches around 2” dbh. There are many other black mangrove trees of similar or smaller size.

**Tree Species** – Red and black mangroves.

**Soil** – Saturated wetland mud. Hundreds of fiddler crab holes and black pneumatophores.

**Storm Damage and Regeneration Description** – Roughly 25% damaged. Two large reds are dead, small trees are partially or fully blown down and topped. In the southern portion of the plot there is a large (40’ tall) red mangrove blown over. Black mangroves are broken but standing, alive and regenerating vigorously. This trend continues outside of the plot and along the coast. There is about 10% ground cover comprised of mostly black mangrove seedlings.

**On-going threats** – Trash is an ongoing threat on this plot and many others

**Management Recommendations** – Although there is abundant dead wood (Both branches and some trees) in this plot, it should not be removed, so that it can continue to provide habitat for decomposers and wildlife. Plywood and other trash should be removal. It would be helpful to have battery powered saws or other tools to break down the debris and get it out more easily. Although there is abundant dead wood in and around this plot, it is better to leave it in place. Allow the regenerating seedling and saplings to continue to grow.

**Wildlife** – Iguanas, bananaquits, green heron, chickens, small crab holes (fiddlers) and abundant golden orb spiders. This site is known to be a bird rookery and is described in a December, 2017 report from the Audubon Society. Only one heron was observed during our field work.

### Point 23 (Usher Bay, near Carolina Corral)

<b>Date</b>	1/29/18	<b>Latitude</b>	18.34622	<b>Longitude</b>	-64.70994
<b>Canopy Height</b>	28’	<b>Canopy Coverage</b>	17%	<b>dbh</b>	6”
<b>Forest Health</b>		<b>Storm Damage</b>		<b>Regeneration</b>	

**Site Description** – Coastal forest where mangrove forest meets with secondary dry forest species in rocky coastal upland. The mangroves grow on a south facing coastal mudflat.

**Tree Species** – Red, white and black mangroves inside the plot. *Cassine xylocarpa*, *Thespesia populnea* and abundant *Tilandsia utriculata* (Large air plant) of all sizes and ages. Two of these have flower spikes. This has been observed in other plots also. Is this a response to the storm?

**Soil** – Open water 1-6 inches deep in the mangrove area and transition into rocky coastline

**Storm Damage and Regeneration Description** – Red mangroves inside the plot and in the surrounding area have either been severely damaged or killed in the storm. However, nearby upland forest seems to have been protected and is relatively healthy, with no dead trees. The understory is 20% ground cover. There are over 100 red mangrove propagules, and *T. populnea*, *C. fruticosum*.

**On-going threats** – The storm destabilized the upland rocky soil and there have been a few small rockslides. Storm debris and trash.



Management Recommendations – Manual cleanup of the trash and debris. Significant construction debris (plywood) has washed up. Seaside access would be helpful.

**Point 22**

<b>Date</b>	1/29/18	<b>Latitude</b>	18.34632	<b>Longitude</b>	-64.70961
<b>Canopy Height</b>	20'	<b>Canopy Coverage</b>	6%	<b>Dbh</b>	2.2 (many stems)
<b>Forest Health</b>	40-60%	<b>Storm Damage</b>	60-80%	<b>Regeneration</b>	60-80%

Site Description – The sample site is dominated by *T. populnea*, rather than mangrove species.

Tree Species – Red and black mangroves but dominated by seaside mahoe

Soil – Saturated sandy soil with decomposing organic layer.

Storm Damage and Regeneration Description – Red mangroves and mahoe are blown over and have significant branch breakage, but vigorously regenerating leaves. The understory is dominated by red mangrove seedlings (20% cover) and a few saplings. Outside of the plot are abundant red mangrove saplings.

On-going threats – Trash.

Management Recommendations – Manual trash clean up. The residential debris is small to medium sized and includes a mattress and maybe a sailboat mast. We recommend having one trash removal team on the ground and one on a boat.

## One Page Summary of Recommendations for Distribution to the Public



### CORAL BAY COMMUNITY COUNCIL

Mail: 9901 Estate Emmaus, St. John, VI 00830  
8-1 Estate Emmaus, Coral Bay, St. John, U.S. Virgin Islands  
CBCC@CoralBayCommunityCouncil.org Phone 340-776-2099  
www.CoralBayCommunityCouncil.org

#### Mangrove Debris Removal Guidelines for Volunteers – *Thank you!*

**What to wear:** THICK-SOLED CLOSED-TOED SHOES, light long sleeves and pants, gloves, sun screen, sunglasses and hats. – It is buggy, sunny and muddy!

**Caution:** Be prepared to balance on old mangrove roots and uneven ground. Wet mud can be so soft, you can sink in 12 inches or more. There could be sharp debris, metal, glass, etc. hidden in the mud. Avoid these areas or protect yourself in advance with proper footwear – like old hiking boots. BRING DRINKING WATER!

We are only removing trash and debris. In general, we will not cut, trim or remove dead mangrove trees. They are natural wildlife habitat and their roots continue to protect the shoreline.

Do not step on new green shoots coming up, choose a path to step on old “dead” red mangrove roots, or rocks and soil only.

**Safety First:** Avoid using sharp tools. Have a safety volunteer keep people 25 feet away or further when chainsaws or other sharp tools are in active use by professionals.

Hand-carrying debris with no dynamic change to the natural habitat is best!

*Thank you so much for helping to clean up Coral Bay's Beautiful Nature!*

Please let us know what creatures you see during the clean up too.

Volunteer name: \_\_\_\_\_

Mailing address: \_\_\_\_\_

Email address: \_\_\_\_\_

Date and hours of cleanup: \_\_\_\_\_

Notes on what you saw, recommended next debris removal steps:

*CBCC is a 501(c)(3) nonprofit public charitable organization and welcomes your tax-deductible donations.  
PayPal available on our website*



## Mangrove Post Hurricane Biological Assessment

In September 2017, the mangrove forests in Coral Bay and across the Virgin Islands were severely impacted by the tandem effects of Hurricanes Irma and Maria. Combined high winds and intense wave energy damaged, uprooted and killed mangroves and other trees along our coasts. The Coral Bay Community Council (CBCC) contracted Geographic Consulting, LLC (a natural resources management and consulting company) to conduct a mangrove forest health assessment in Coral Bay in January 2018. The analysis documented the extent and severity of this damage using traditional forestry measurements, GPS mapping and photographs. The work was funded by a grant to CBCC from the Friends of the Virgin Islands National Park. Here are highlights from the report

### Findings

- Uprooted, dead and damaged trees were found along the entire coastline. However, many of the damaged trees are regenerating vigorously.
- Red mangroves which grow in the deepest water, bore the brunt of the wind and wave action. Thereby, they were the species most severely affected.
- Red mangrove propagules or seedlings were abundant and growing vigorously in many places where the forest canopy was lost. The mangrove system has already begun “healing itself” just months after the storms.
- Wildlife continues to use the mangrove habitat, including dead snags.
- Mangrove hydrology is the movement of fresh and salt water through the system and is the single most important factor in determining where mangrove trees grow and how healthy they are. The hydrology of Coral Bay’s mangroves may have been altered in some areas by erosion and sediment deposition.

### Recommendations for Trees

- Dead and damaged trees still provide ecological benefits and should not be cut or removed. Red mangrove tree roots continue to provide protection for fish and other small creatures. The roots and trees, although dead, are still protecting the coast and trapping sediment and soil.
- Standing dead trees (or snags) in mangrove forests provide great terrestrial habitat. Birds use the broken branches as perches. Insects use the wood to make their homes and to produce their next generation. Removing dead trees would result in the displacement of wildlife that uses the physical structure of the trees. Changes in temperature and soil saturation could also occur due to the removal of dead trees, thereby affecting the many fiddler and land crabs that reside in the wetlands.
- Dead red mangroves, in particular, continue to stabilize the site where they once lived. The young propagules and saplings growing below them still benefit from this stabilization.
- Together, the dead trees combine to form a large volume of biomass. The organic material should be left onsite and remain part of the nutrient cycle.

### Recommendations for Debris Removal

- When removing storm debris, consider the damage that extraction will cause and how to minimize it. It is better to damage dead trees than live trees and seedlings.
- In some locations it would be helpful to have a land-side team and a sea-side team on a boat working in tandem. This will permit trash and debris to be removed along the path of least resistance

Large pieces of roof and plywood are difficult to drag through the dense forest while still intact. Consider having professionals use battery powered saws to reduce the size and make removal easier and less impactful to the forest.

