UWI
CAVE HILL CAMPUS
BARBADOS, WEST INDIES

3rd Sargassum Symposium

CERMES

SargAdapt
Adapting to a new reality: Managing responses to influxes of sargassum seaweed in the Eastern Caribbean as ecosystem hazards and opportunities

Sargassum Monitoring Protocol Using Drones

Dr. Kim Baldwin
Hazel A. Oxenford, Joseph Weekes, Micaela Small & Jeanelle Irvine

MARINE SPATIAL INFORMATION SOLUTIONS

CARIBBEAN BIODIVERSITY FUND

Supported by:
Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection
based on a decision of the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

KFW

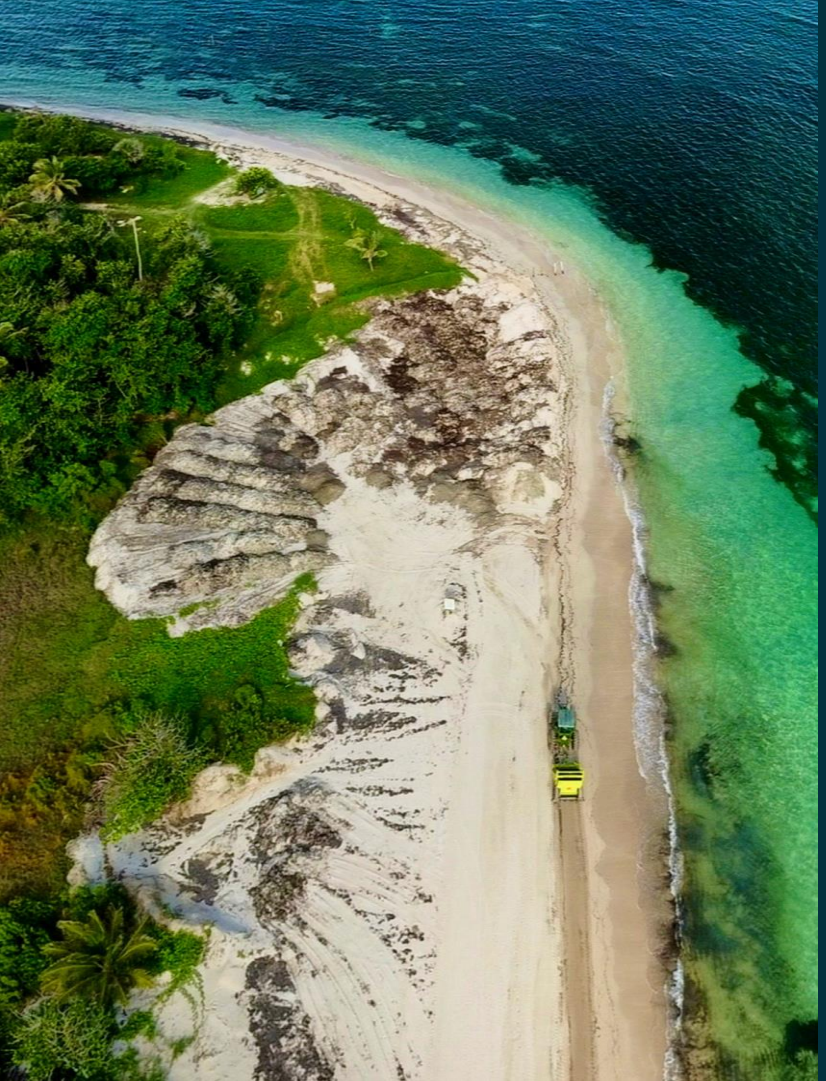
dr. Kim Baldwin
CONNECTING PEOPLE, TECHNOLOGY & INFORMATION

Courtyard Marriott
Barbados
March 9-10, 2023

ENVIRONMENTAL MANAGEMENT CHALLENGES IN THE CARIBBEAN

- **Extreme Environments**
  - Wind, Rain, Heat, Humidity, Rugged Terrain
  - Lack of Cell Data, No Signal (Offline) & Power
- **Inadequate Resources**
  - Limited Money, Personnel, Time, Training
  - Existing Equipment, Data, Computers, Storage
- **Multiple Scales & Levels**
  - Local, National & Regional Extent
  - Audiences: Communities, Field Workers, Managers, Decision-Makers & Public
- **Limited Capacity**
  - Technology: Computers & Software
  - GIS Data & Spatial Analysis Skills


How can drone technology be used to support regional sargassum management?



SargAdapt (2018)

Identified Applications

Monitoring Abundance

Simple, rapid method of measuring the amount of sargassum stranding along shorelines

Issues, Impacts & Mitigation

Mapping of local knowledge, socio-economic & development of potential management scenarios

Collaboration & Education

Visual understanding & aiding discussions

Data sharing, access & participation in data collection

1

Identify Applications Initial testing drones, flight surveys, data, spatial analysis & software

2

Resarch in GIS/UAS analysis workflows, & automated tools, ground-truthing data (drone & beach field-surveys)

3

Developing the SMP-Drones Protocol + methods for regional data collection & access

4

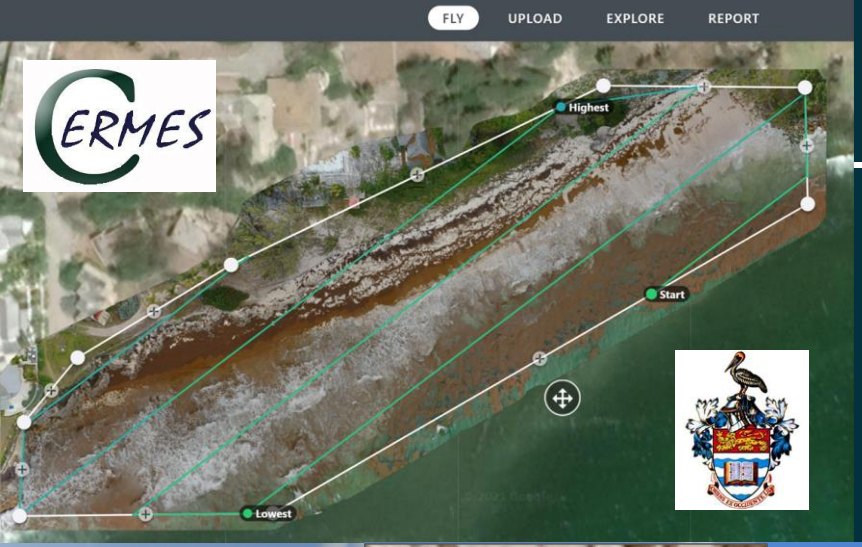
Roll-out & Training SMP-Drones + Course developed to guide teams in implementation & anlaysis of beach monitoring data

5

Applying Participatory Mapping Approaches + creation & sharing of information for national sargassum strategies and management efforts

SARGASSUM MONITORING PROTOCOL USING DRONES

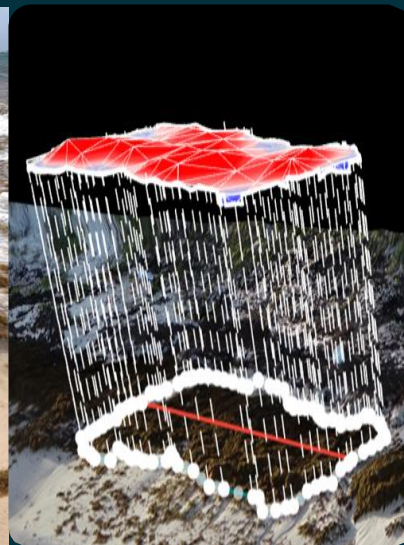
Estimatimg the abundance of beached sargassum



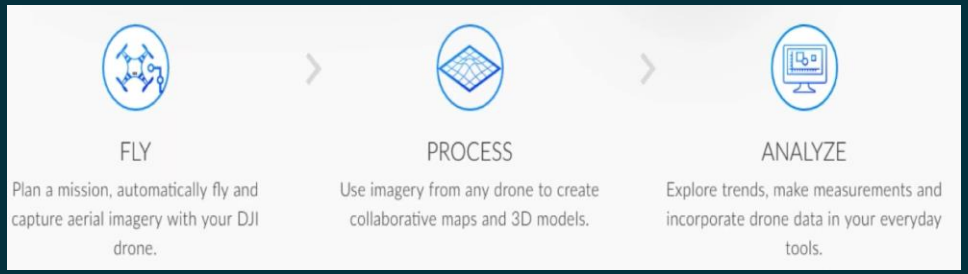
SMP Drones (2019-21)

SARGASSUM MONITORING DRONE RESEARCH

- Drone flight plans & mapping surveys, videos, pictures
- Conventional field survey data: abundance, class, species
- Testing GIS analysis, automated dashboards & tools
- Regional data collection, management & web-platforms



DJI + DRONE DEPLOY



EXTREMELY ACCURATE
Precise & Reliable Data

NON-TECHNICAL & AFFORDABLE
Easy to Use & Offline Functionality

CLOUD-BASED RESOURCES
Processing, Storage & Analysis Tools

REGIONAL GIS CAPACITY
Converstion, Mapping & Analysis Tools

DATA ACCESS & REACH
Reporting, Apps & Integrations

SMP Using Drones
Required Resources

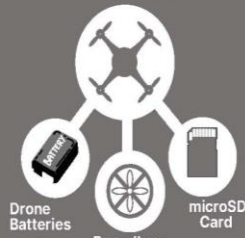
Manpower / Time

- Drone Pilot
- Observer
- Field assistant *for ground measurements of sargassum*

The entire beach survey is designed to take less than one hour, regardless of the severity of the sargassum influx

UAS Components

1. Drone Components
2. Remote Controller
3. System Software

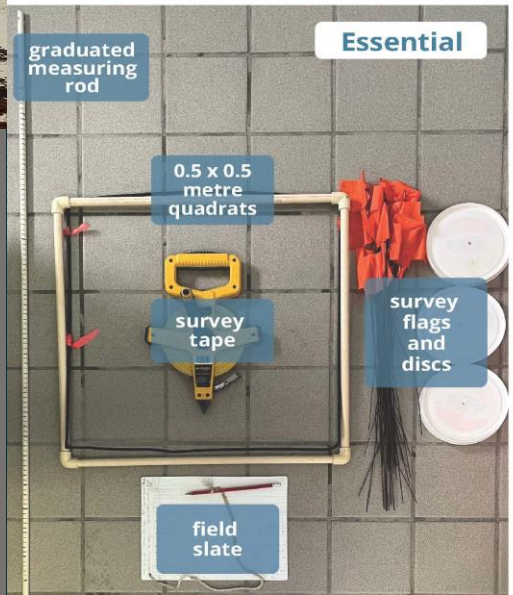


Mapping-Grade Drone

Data Processing & Analysis

1. A DroneDeploy user account *(Any subscription level)*
2. A laptop or desktop personal computer *(Windows 10, 64 bit with 8 GB RAM Intel Core i7 Processor)*
3. An internet connection *(ideally high-speed)*
4. Microsoft© Office Excel application

Ground Measurement Equipment



Pagua Bay, Dominica

Sargassum Monitoring Protocol
Drone Training Course

Mission Planning

Site Selection
Data Needs
Survey Extent
Flight Parameters
Mobile Apps
Data Collection &
Team Logistics

Drone Surveys

Feasibility & Safety
Site Assessment
Baseline Mapping
Flight Plans
Beach Surveys
Data Sheets
& Flight Logs

Data & Information

Data Management
Processing &
Viewing Results,
Quality Assessment
Mapping & Analysis
Tools, Reports
Exporting & Sharing

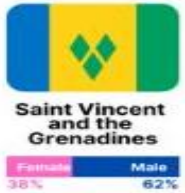

Step1
#DRONESURVEY

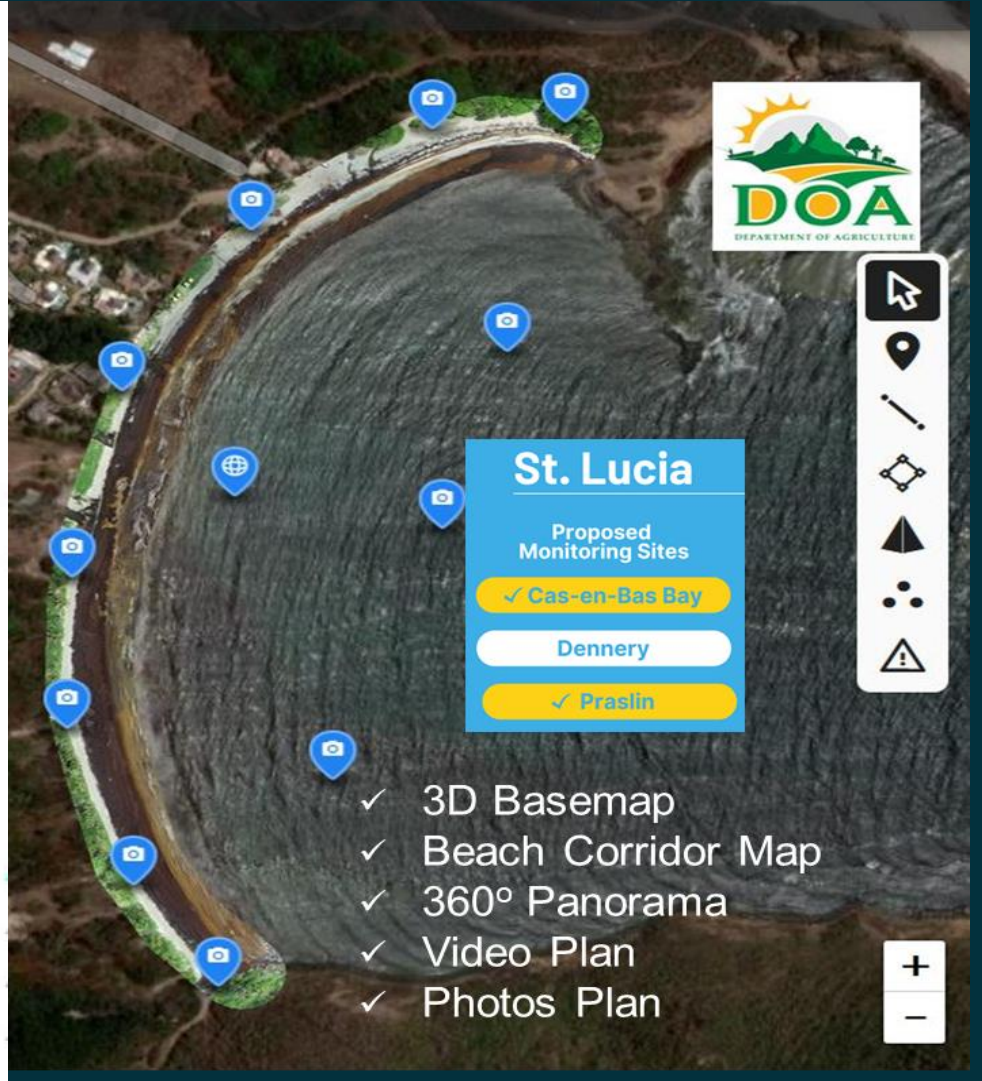

Barbados
Female
Male
55%
45%


Dominica
Female
Male
30%
70%


Grenada
Female
Male
17%
83%


Saint Lucia
Female
Male
50%
50%


Saint Vincent and the Grenadines
Female
Male
38%
62%


DOA
DEPARTMENT OF AGRICULTURE
St. Lucia
Proposed Monitoring Sites
✓ Cas-en-Bas Bay
Dennery
✓ Praslin
✓ 3D Basemap
✓ Beach Corridor Map
✓ 360° Panorama
✓ Video Plan
✓ Photos Plan

The Sargassum Monitoring Protocol comprises four drone flight plans, each serving its own purpose.

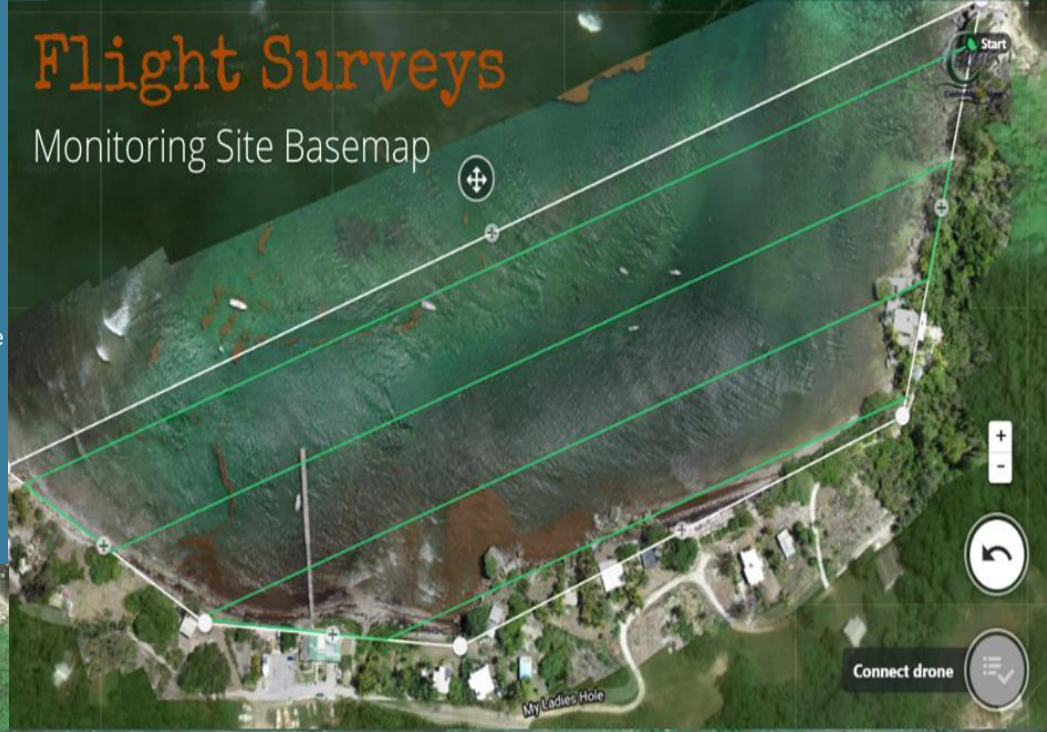
Corridor: used for sargassum beach monitoring survey

Panorama: generates an interactive spherical 360° view

Photo: used for lower altitude landscape perspective of site

Video: used to capture lower altitude footage of site

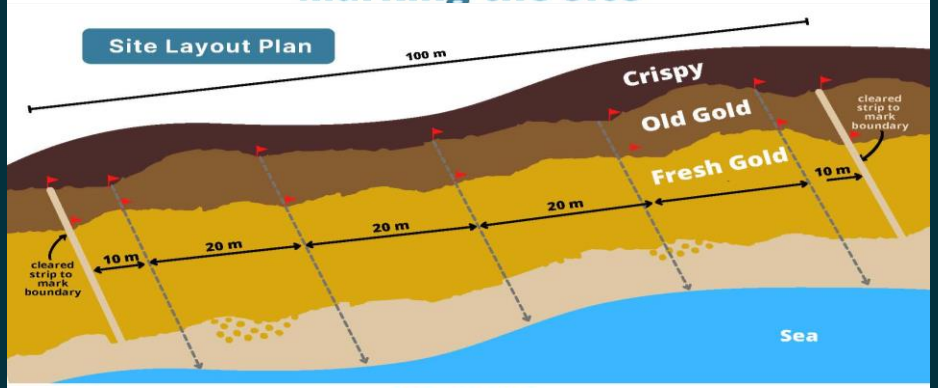
All four flight survey plans can be 'queued' and flown consecutively, in less than 15 minutes, using a single drone battery.



Using this protocol will give you a sargassum stranding rate per high tide.

Using a standard volume unit of m^3/100 m shoreline as recommended will allow easy comparison across other studies using this SMP.

STEP #1
Marking the Site

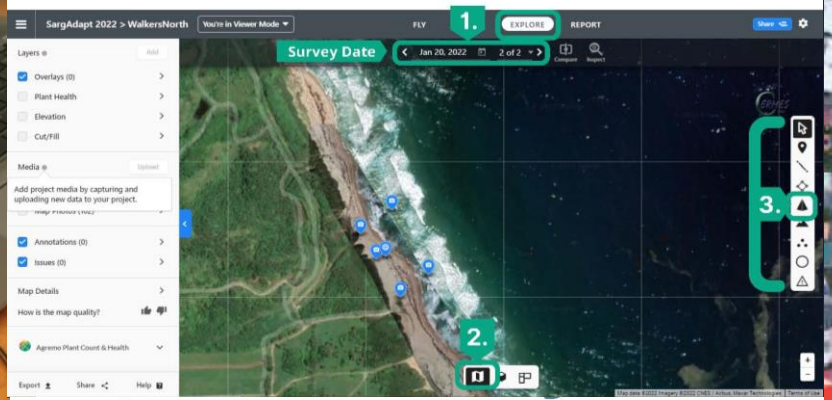


STEP #2
Depth Transects

The average depth of beached sargassum can be adequately estimated by measuring the depth along your fixed grid pattern (straight-line transects).

Data Analysis

Analysis of drone data using the DroneDeploy Dashboard



Analysis of ground measurements using MS Excel

Your field data can provide estimates of sargassum abundance as surface area of the beach covered and as volume of beached sargassum.

A. Surface Area

A good estimate of surface area covered by Fresh Gold and/or Old Gold sargassum can be easily obtained from the mean length of the transects running across the sargassum.

B. Volume

An estimate of the sargassum volume (for each class) can also be obtained using the same MS Excel data sheet and the same PivotTable selections, **with one minor change**, as follows:

C. Volume to Weight Conversion

- PDF Map
- GeoTIFF Map
- JPG Map
- Point Cloud
- Elevation
- Digital Terrain Model
- 3D Model
- Plant Health

SargAdapt Training Cohort

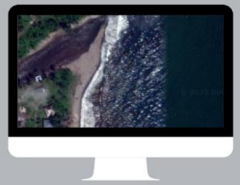
51 students enrolled

21 organizations

5 countries

7 monitoring sites

19 mapping surveys



SMP Site Assessment

Rosalie Bay, Dominica

Site Type: Beach | **Site Location / Coast**: South East | **Beach Wave Exposure**: Full

Predominant Wind Direction: Longshore | **Coastal Infrastructure:** Hotels | **Beach Width:** Wide

Uses: Conservation, Fishing, Tourism, Recreation | **Coastal Vegetation:** Coastal Strand

Sargassum Management: Undisturbed | **Beach Slope**: Gradual / Sloping | **Shoreline Type**: Sandy

Assessment guided by previous knowledge and observation of existing aerial imagery
(e.g. Google Earth)

Grenada

Proposed Monitoring Sites

- Bathway
- La Sagesse
- Soubise
- ✓ Marquis Beach

St. Vincent & the Grenadines

Proposed Monitoring Sites

- Macaroni Beach
- ✓ Diamond Beach
- Richmond Bay
- Indian Bay Beach
- Brighton Beach

Barbados

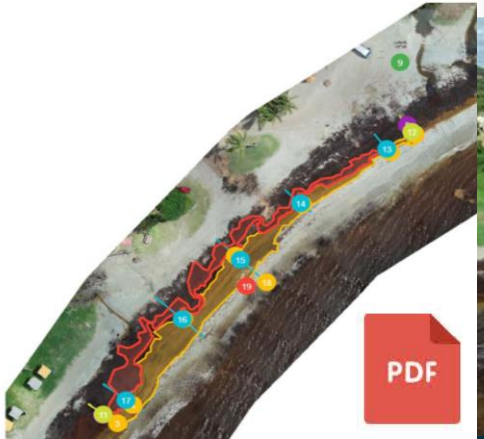
Proposed Monitoring Sites

- Foul Bay Beach
- ✓ Consett Bay
- Accra Beach
- Dover Beach
- Bath Beach

Cas-en-Bas, Sargassum Monitoring Annotation Report

Created on August 21, 2022

Captured on August 14, 2022



Panorama

Generate a spherical panorama for 360 degree views

Next Steps

SUSTAINABLE SARGASSUM MANAGEMENT
IN THE OVERSEAS TERRITORIES

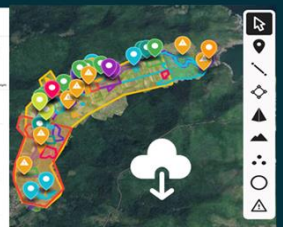
DARWIN PLUS

CANARI

Participatory UAS Approach

INCORPORATING SOCIO-ECONOMIC INFORMATION

- SITE ASSESSMENT, & EVALUATION OF MONITORING STRATEGIES
- MAPPING OF LOCAL KNOWLEDGE OF RESOURCES, USES, IMPACTS & SOLUTIONS
- COLLABORATIVE DATA CREATION, INFORMATION INTEGRATION & SPATIAL ANALYSIS
- STANDARDISED REPORTING & WIDESPREAD INFORMATION SHARING

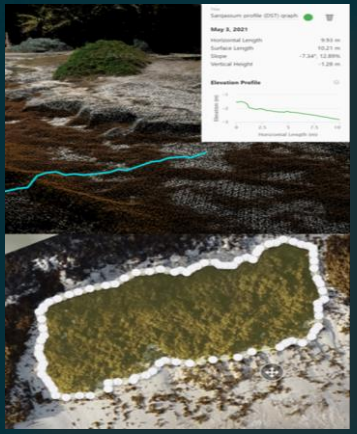


ANGUILLA

MONTSERRAT

BRITISH VIRGIN ISLANDS

Data Access, Analysis Dashboard & Workflow Automation



PROVIDING ACTIONABLE INFORMATION THROUGH THE

SARGASSUM INFORMATION HUB

SARGASSUM IMPACTS

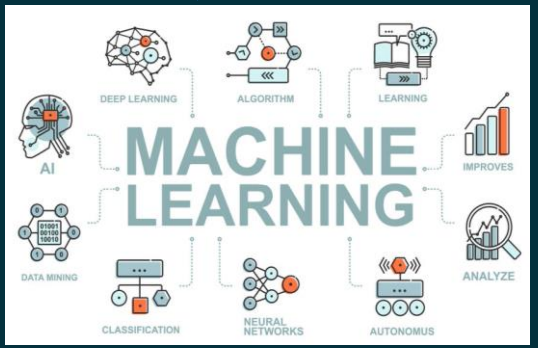
IN-SITU
- Database
- Dashboard
- Data collection app

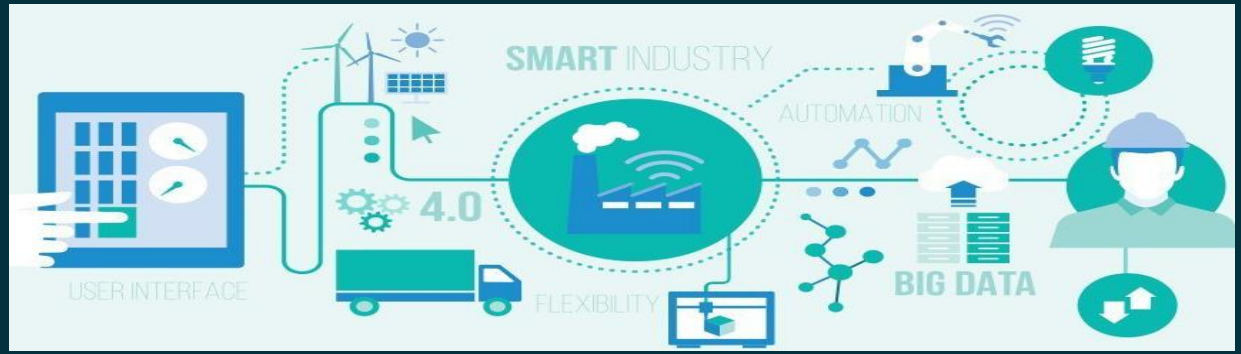
REMOTE SENSING
- Alternative Floating Algae Index
- Maximum Chlorophyll Index
- MultiSpectral Instrument-Modified Floating Algae Index

FORECASTING
- Drift experiments
- Local inundation reports
- Basin-wide forecasting system

SCIENCE
- Growth
- Sources
- Use

MANAGEMENT
- Challenges
- Collaboration
- Best Practices





Special Thanks For Support Provided





DroneDeploy

NC STATE UNIVERSITY

esri

MARINE SPATIAL INFORMATION SOLUTIONS

www.marsis.us

Drones Or Bust

Dr Kim Baldwin

dr. Kim Baldwin

CONNECTING PEOPLE, TECHNOLOGY & INFORMATION

www.drkimbaldwin.com

CERMES

This research is part of the SargAdapt Project, and supported by:

CARIBBEAN BIODIVERSITY FUND

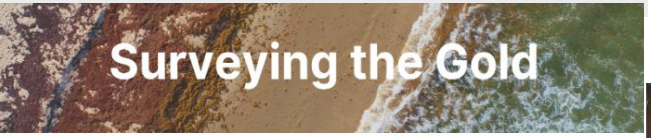
KFW

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

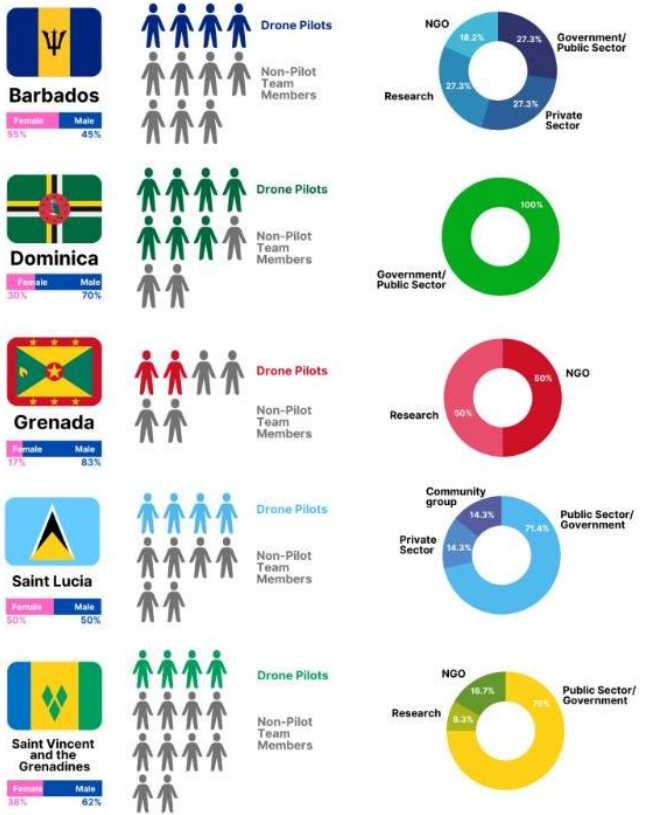
CANARI

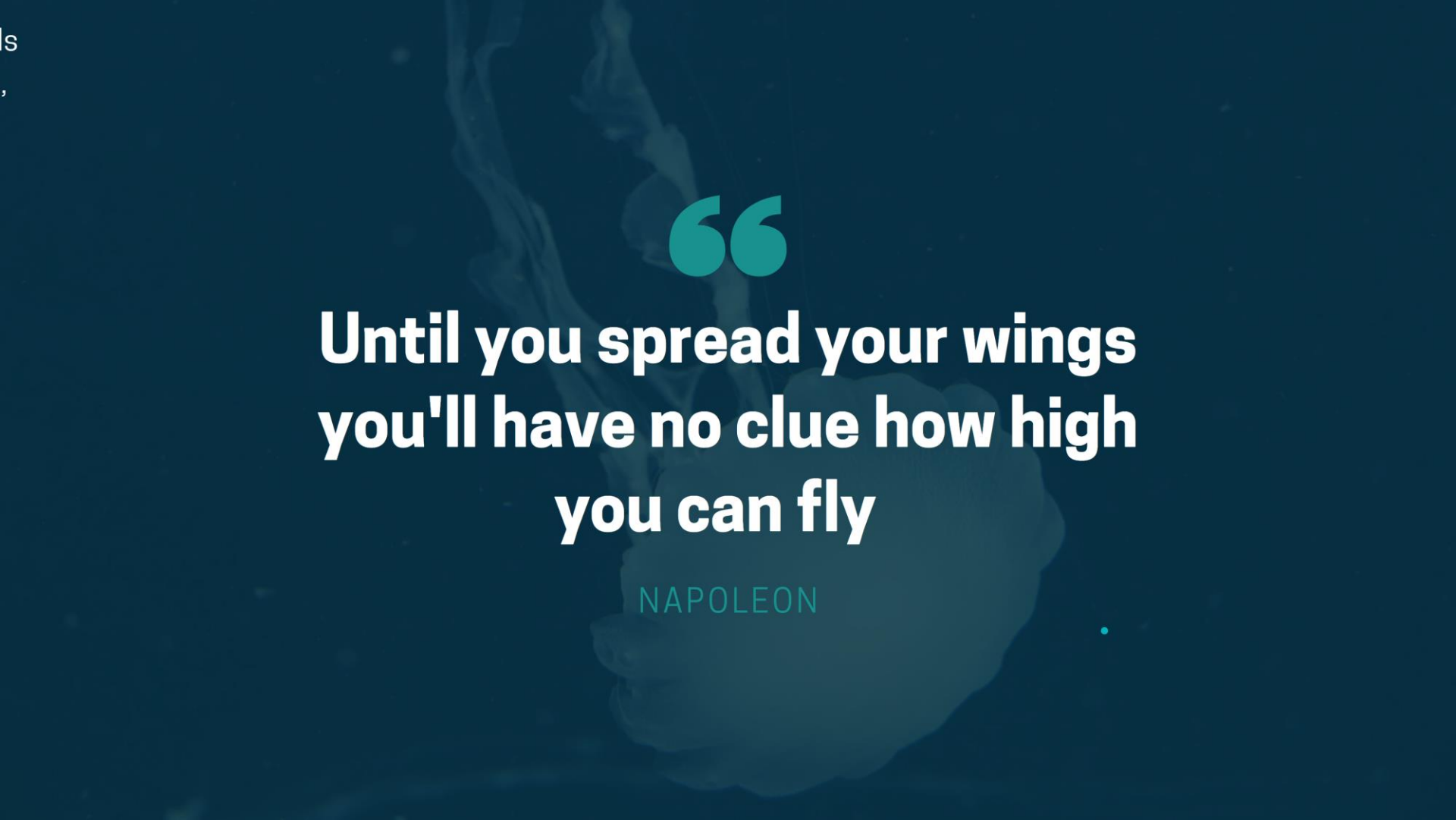
Additional Sargassum Resources

ArcGIS Story Maps



www.cavehill.uwi.edu/cermes/projects/sargassum/story-maps




Until you spread your wings you'll have no clue how high you can fly
NAPOLEON