Sargassum Monitoring Protocol with Drones: methods for rapidly estimating beached sargassum

Protocolo de Monitoreo de Sargazo con Drones: métodos para estimar rápidamente sargazo varado

Protocole de Surveillance des Sargasses avec des Drones: méthodes pour estimer rapidement les sargasses échouées

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EXTENDED ABSTRACT

Massive sargassum influx events have continued to plague the Caribbean over the last decade, yet there are very few examples of sustained monitoring of beached sargassum anywhere. This information is needed to advise management efforts, to validate sargassum forecasts, and to inform entrepreneurs looking to use the seaweed. To address the dearth of monitoring programmes, we have developed a simple, rapid sargassum monitoring protocol using drones (SMP-Drones) to encourage widespread, standardized monitoring of beached sargassum and the estimation of volume across the region. The SMP-Drones uses rapid field survey measurements combined with 'off-the-shelf' drones and the cloud-based drone photogrammetry and geospatial analysis software platform from DroneDeploy© which does not require users to have any GIS expertise or specialized computer power to provide both an accurate and non-technical, standardized workflow to easily capture aerial imagery and allow users to process data to visualize and estimate the abundance of freshly beached sargassum. Furthermore, we also developed a variety of easy-to-follow, illustrated guides and multi-media resources for applying this SMP-Drones, as well as a more basic one for use without drones (SMP-Beaches). We have also developed and implemented an online training course under the CERMES SargAdapt Project (2019-2022). Our easy-to-implement SMP-Drones requires limited time, labour, and technical expertise, thus making it accessible for a broad range of stakeholders across the Caribbean to participate in regional sargassum management efforts easily and effectively.

Here, we briefly review t our research activities from 2018-2021 in which we tested and cross-validated several identified drone technologies, geospatial techniques, field survey methods and spatial analysis tools to develop our easy to use and rapid standardised SMP-Drones. Additionally, we showcase the results of our corresponding virtual training course held from July-August 2022 in which teams were incrementally guided through the protocol's methodology, to quickly learn how to plan, set-up and implement the SMP-Drones to estimate the abundance of sargassum washing up on their beaches (Figure 1). Under the SargAdapt Project, our first cohort to receive training comprised 51 participants, across 21 organisations within the 5 participating countries of Barbados, Dominica, Grenada, Saint Lucia, and Saint Vincent and the Grenadines in the newly refined SMP-Drones (Table 1). Over the course of four weeks, drone teams were virtually guided using a blended format consisting of self-paced lessons, live webinars and coaching calls in the protocol's methodology. Participants identified and classified a total of 18 beaches impacted by sargassum within the five Project countries. The SargAdapt SMP-Drone teams ultimately set up a total of seven monitoring sites in which 19 drone surveys were conducted, data were processed and analysed to quickly estimate the abundance of sargassum washing up on their monitoring beaches. Teams were trained in the use of reporting and information sharing tools to allow for the widespread use and sharing of generated information through the gracious support of DroneDeploy.org. This contribution has allowed Caribbean drone teams to utilise the DroneDeploy platform free of cost to process, analyse and freely share their spatial data and multi-media.

Moving forward we anticipate that the five regional drone teams will continue to collect sargassum beaching data to create geospatial abundance data as well as standardised drone multi-media (pictures, videos) at the 7 established sites across the Eastern Caribbean. Moreover, under the Sustainable Sargassum Management Project implemented in conjunction with Caribbean Natural Resources Institute (CANARI) and funded by a Darwin Plus grant (2021-24), three additional country drone teams in the Overseas Territories of Anguilla, Montserrat and the British Virgin Islands have been established and trained in the SMP-Drones. Moreover, further development of the drone protocol with participatory mapping methodol-

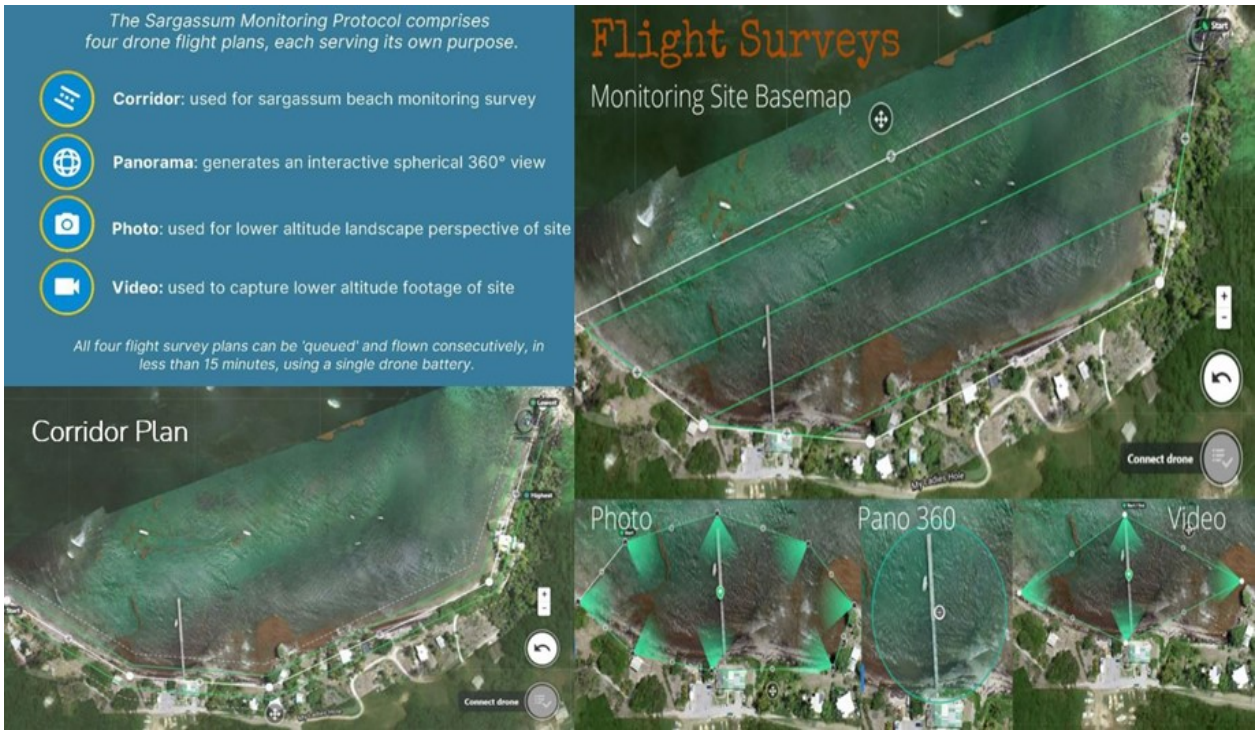

Figure 1. Sargassum Monitoring Protocol Using Drones comprises five drone flight survey plans so that the collected data can be used for multiple applications and audiences .

ogies (P-UAS) aimed at understanding social and economic impacts as well as management and mitigation efforts is underway and will be released in early 2023.

Recommendations for further work includes the development of a strategy to allow public access to the standardised SMP-Drone data and information to enable widespread use for management and education. Further research into ways in which our regional sargassum monitoring data can be integrated into a web-based centralised knowledge platform (such as the established SargNet Sargassum Hub) should be explored to enable regional drone and geospatial data to be freely accessible for download. Moreover, further research and funding to automate our identified geospatial analysis workflow using machine learning and ultimately the development of a 'SMP-Drones' Application Programming Interface (API) to enable the collection, processing and analysis of drone sargassum monitoring data to be processed and shared in real-time is recommended and could allow for scaling-up across the Caribbean and amongst various levels of stakeholders working to manage sargassum.

It is our hope that this research and the developed SMP-Drones methodology and corresponding Good Practice Guides and training course will provide another tool for Caribbean coastal stakeholders coping with sargassum events.

KEYWORD: Ssargassum, monitoring, drone mapping, geospatial technology, participatory approach.

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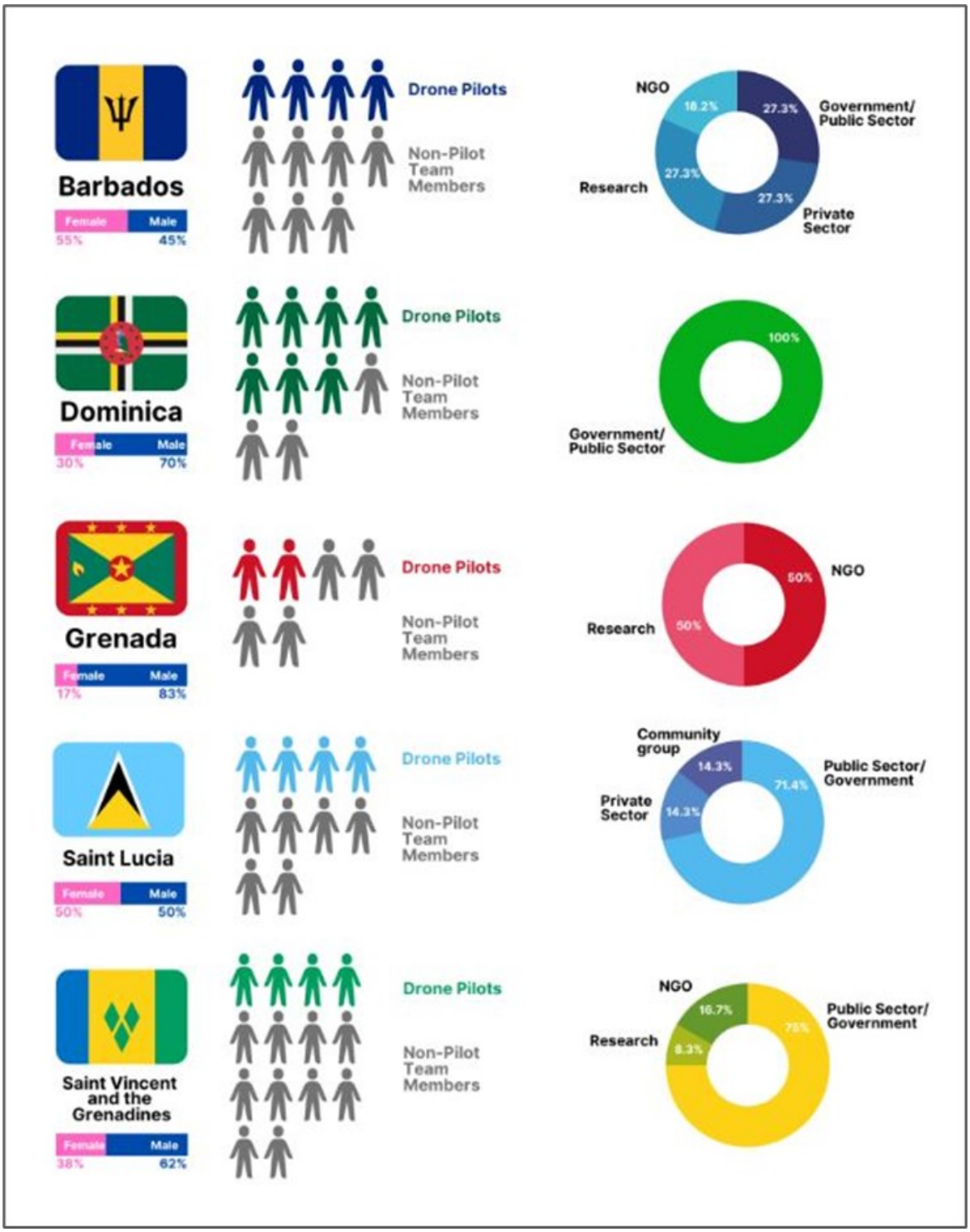

Figure 2. Infographic of the breakdown of the first cohort of the SargAdapt SMP-Drone training course participants (September 2022).