

# Tourism from Nature Dependent Beaches

Dominica, Grenada, Saint Lucia, St. Kitts & Nevis,  
and St. Vincent & the Grenadines

Mapping Ocean Wealth (MOW) and Caribbean  
Regional Oceanscape Project (CROP)





## ABOUT THIS PROJECT

The Global Environment Facility (GEF) and the Organisation of Eastern Caribbean States (OECS) Commission, in partnership with the World Bank, is implementing the Caribbean Regional Oceanscape Project (CROP) to improve systems and put relevant structures in place in an effort to foster a Blue Economy and to promote greater consideration of the ecosystem functions and services which the ocean provides for member states. The project timeline was October 2017 - December 2021. Under this project, The Nature Conservancy used the Mapping Ocean Wealth approach to develop ecosystem service models and maps for the five CROP countries in the Eastern Caribbean.



**CROP Project Overview:**

<https://oecs.org/en/crop>



**Map Viewer:**

[maps.oceanwealth.org/oecs](https://maps.oceanwealth.org/oecs)



# Introduction and Summary of Methodology

## Overview

The Caribbean is highly dependent on coastal and marine tourism activities. While beach tourism forms a bedrock for tourism in most countries, the role of nature in supporting and sustaining beach tourism has not been widely considered. This work rectifies this and, for the first time, estimates and maps the contribution of nature to beach values. Data for this work were derived from large volume image recognition of online photos, beach habitat maps, tourism arrival and expenditures, cruise arrival and expenditures and other cruise activities. Maps and methodologies were further refined through stakeholder engagement activities.

Maps of paddle sport activities (e.g., kayaking, stand-up paddleboarding) also provide supplementary information about the influence of coastal habitats on tourism activities in the region.

This is the first time that these components of nature-dependent tourism values associated with beaches have been so extensively mapped and analysed at these resolutions. We believe that the results are of considerable use for understanding the role of natural ecosystems in underpinning beach tourism at local scales, applicable to management, that they will enable a broad range of users from the public to industry to government to better plan and manage both the tourism industry and any other active sectors within the blue economy.

## Purpose of the Guide

We have developed this guide for individuals who are interested in downloading, analyzing, and applying the data for projects within the five countries covered by this project (Dominica, Grenada, Saint Lucia, St. Kitts and Nevis, and St. Vincent and the Grenadines). While these datasets were originally developed to complement the marine spatial planning processes undertaken under the Caribbean Regional Oceanscape Project (CROP), we describe a range of possible applications across multiple sectors, along with practical advice on the methodology, interpretation and caveats surrounding these datasets. More details about the model including links to technical reports can be found at <https://oceanwealth.org/project-areas/caribbean/crop/nature-dependent-beach-tourism/>.



**This is the first time that these components of nature-dependent tourism values associated with beaches have been so extensively mapped and analysed at these resolutions.**

**This work furnishes stakeholders with detailed data and maps for two of the most important social and economic sectors in these countries.**

## Regional Policy Relevance

In 2013, the OECS Heads of Government endorsed the Eastern Caribbean Regional Ocean Policy (ECROP). In 2019, the ECROP was revised to align with the UN Agenda 2030 for Sustainable Development – SDG 2030. The CROP is designed in alignment with ECROP (2013) and has an overall objective to develop and implement integrated ocean governance policies to leverage sustainable public and private investment in the waters of OECS member states and other participating Caribbean countries. The first component of the CROP project is to strengthen ocean governance through the development of National Ocean Policies (NOPs) and Coastal and Marine Spatial Planning (MSP). The work described in this project falls under the subcomponent 2.1 of the CROP: Strengthening knowledge and capacity building.

The ecosystem service modelling work was undertaken in parallel with the development of the coastal and marine spatial plans under CROP, meaning that the ecosystem service model results were not available during their planning process. Nevertheless, this work furnishes stakeholders with detailed data and maps for two of the most important social and economic sectors in these countries – tourism and coastal fishing. Such data can now be incorporated into the MSP process and this should be a priority as part of the finalization of these, or indeed any future, plans.

At the simplest level these models and maps enable the discernment of critical areas of current use of natural resources and form a core background for stakeholder discussion and debate in the context of MSP. The same information can also be used in the projection of future use options, including the potential costs and benefits of different uses and activities in coastal and marine waters. A key element of MSP is that such planning needs to be cyclical and ongoing, rather than a static, one-off, process. This means that information can be continually added or updated to future planning cycles, along with knowledge of new opportunities or risks.

## Methodology and Definitions

The multi-step approach to mapping the value of nature-dependent beach tourism involved two broad tracks. The first was the development of a map showing the distribution of these activities using the locations of photos (from Flickr and TripAdvisor) that depicted natural elements of beaches (e.g., white sand, clear, turquoise water, vegetation), or from text reviews (from TripAdvisor) which described natural elements of beaches or beach-associated activities (clear water, turtles, fish, reefs, swimming, kayaking, paddleboarding). These locations were assigned variable weighting depending on density of overlapping photos or reviews from different contributors. The second step after mapping intensity was to estimate a reasonable proportion of total tourism value that could be attributed to the natural values of beaches.

This was accomplished using proxy indicators to develop a metric characterizing the relative importance of nature to beach tourism at the national level. These indicators were 1) estimate of overall beach utilisation for the region based on exit surveys<sup>1</sup>; 2) estimate of the relative contribution of natural values to beach tourism based on Schuhmann

<sup>1</sup> Spalding, M. D., K. Longley-Wood, M. Acosta-Morel, A. Cole, S. Wood, C. Haberland, and Z. Ferdana. 2018. Estimating Reef-Adjacent Tourism Value in the Caribbean. The Nature Conservancy.

et al (2019)<sup>2</sup>; 3) national modifiers to indicate the variance of the importance of nature to beaches across the five CROP countries. These modifiers were based on the ratios of nature-dependent PAMs, PUDs and reviews to the total number of PAMs, PUDs and reviews for each country.

These three proxy metrics were then applied as a multiplier for the national tourism statistics to generate final value scores which were then distributed across beaches utilising the use intensity maps.

## Input Datasets

A summary of datasets used in the analysis is provided below. Users are encouraged to reference the technical report for additional details on sources and geoprocessing steps.

Data input	Source(s)
<b>PUDs (Nature-Dependent Beach Photos)<sup>3</sup></b>	Flickr
<b>PAMs (Nature-Dependent Beach Photos)<sup>4</sup></b>	TripAdvisor
<b>Beach Habitat</b>	TNC
<b>Beach Locations and Attractions</b>	TripAdvisor
<b>Tourism Arrivals &amp; Expenditures</b>	Eastern Caribbean Central Bank (ECCB) <sup>5</sup> ; Averaged values for the five years up to and including 2019.
<b>Cruise Arrivals &amp; Expenditures</b>	Florida-Caribbean Cruise Association (FCCA) and Business Research and Economic Advisors (BREA); A Survey Based Analysis of the Impacts of Passengers, Crew and Cruise Line Spending. Volumes I & II. 2018 <sup>6</sup>
<b>Cruise Activities</b>	Port guides and other web-based cruise guides
<b>Paddle sport locations</b>	TripAdvisor

*Unless otherwise noted, all data sources were accessed in 2019.*

2 Schuhmann, P., R. Skeete, R. Waite, P. Bangwayo-Skeete, J. Casey, H. A. Oxenford, and D. A. Gill. 2019a. Coastal and Marine Quality and Tourists' Stated Intention to Return to Barbados. *Water* 11:1265.  
Schuhmann, P. W., R. Skeete, R. Waite, T. Lorde, P. Bangwayo-Skeete, H. A. Oxenford, D. Gill, W. Moore, and F. Spencer. 2019b. Visitors' willingness to pay marine conservation fees in Barbados. *Tourism Management* 71:315-326.

3 Photo User Days (PUDs) are underwater photos were then standardized such that only one image per user per day can be counted across a 500m resolution grid spread across the region.

4 Photo by Attraction by Member (PAMs) are underwater photos from TripAdvisor standardized such that only one image per attraction per TripAdvisor member can be counted

5 ECCB. 2020. Real Sector Statistics - Selected Tourism Statistics. Eastern Caribbean Central Bank, Basseterre, St Kitts and Nevis.

6 FCCA, and BREA. 2018a. Economic Contribution of Cruise Tourism to the Destination Economies. A Survey-based Analysis of the Impacts of Passenger, Crew and Cruise Line Spending. Volume I: Aggregate Analysis. Florida-Caribbean Cruise Association (FCCA) and Business Research and Economic Advisors (BREA), Miami.  
FCCA, and BREA. 2018b. Economic Contribution of Cruise Tourism to the Destination Economies. A Survey-based Analysis of the Impacts of passenger, Crew and Cruise Line Spending. Volume II: Destination Reports. Florida-Caribbean Cruise Association (FCCA) and Business Research and Economic Advisors (BREA), Miami.

Image recognition software was trained to pick out natural values in beach photos uploaded by users, generating over 3500 data points.

## Definitions

**Tourism**, in this work, is focused on international visitors. We recognise that local tourism and recreation add significant additional value to on-reef tourism. We believe that our distribution model of use-intensity will largely include these local tourism and recreational components, however the values we have spread are limited to the international arrivals statistics.

Our work separates overnight tourism from cruise tourism as represent very different patterns in terms of activities, spending, and spatial distribution.

*Overnight tourism*, in our models, includes both land-based stays and yacht-based stays, with the former making up the vast majority of all statistics. Overnight tourists spend an average of 8-13 days in a country, and will be spread to all places where there is accommodation, access, and attractions.

*Cruise tourism* also includes a small number of “excursionists.” Cruise tourists, while representing very large numbers of visitors, typically only visit an island for a day, and do not use local accommodation. Their daily expenditure is extremely low, limited to single excursions (often planned by the cruise company), and geographically-constrained

(Excursionists have most of the same characteristics as cruise passengers, while yacht visitors are closer to overnight visitors, remaining several days in a country and often renting their boats from local companies.)

**Nature-Dependent Beach Tourism Value** is a term we have developed to cover the proportion of beach tourism value that can be attributed solely to the presence and enjoyment of natural elements (e.g., white sand, clear waters, natural vegetation). In other words, this is not meant to describe all tourism on beaches, but instead, tries to isolate the degree to which nature influences tourism expenditure and intensity. For this model the values represent the likely loss of return visits (in terms of both people and expenditure) that might be expected from a moderate degradation of the natural values of beaches

**Geo-located photos** were taken from Flickr and TripAdvisor. Training images of natural beach scenes (those dominated by key natural features of water, beach and vegetation, see Technical Report) were selected and used to train image recognition models. The resulting images were counted in a 500m grid. To avoid the undue influence of multiple images from the same location by the same photographer on the same day we applied the Photo User Day (PUD) approach where only one image per person per upload day can be counted in any grid cell. Each grid cell then has a score of the total number of PUDs which provide not only location, but also a metric of use intensity (more photos implying greater value). A similar approach was taken with TripAdvisor photos, which have lower spatial accuracy, as the coordinates are tied to the location of the attraction associated with the photo. Here, we take a similar approach by standardizing photos as Photo by Attraction by Member (PAMs), where only one photo, per person per attraction is counted towards the score. In total over 3500 PAMs and PUDs of nature dependent beaches were found.

**Attractions** – TripAdvisor provided a list of attractions (e.g., hotels, restaurants, points of interest), most of which had a locational data attached. Each photo and review provided by TripAdvisor could be linked to an attraction, and therefore plotted on a map.

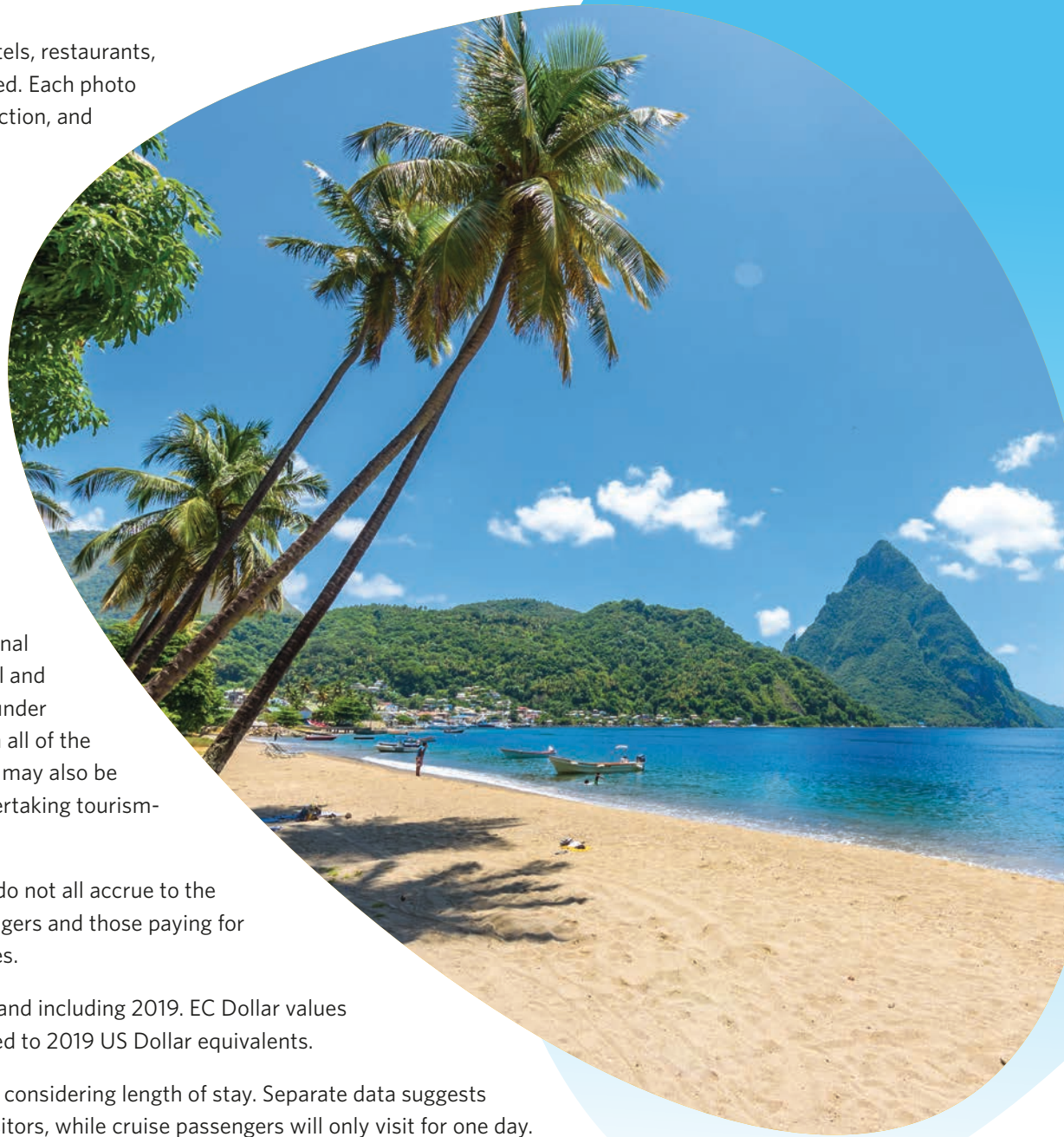
**Beaches** – describe sandy shorelines typically between high and low tidal marks. The original beach layer was digitized as polygons by TNC based on a variety of satellite imagery sources (typically ~2m resolution) between 2007 - 2009. These were enhanced and where available annotated with beach names from TripAdvisor where possible. This layer was then gridded to a 100m resolution which has the effect of greatly increasing total beach area but represents the broader area around which nature-dependent beach activities are likely to take place.

**Expenditure and arrivals** – Expenditure and arrivals statistics are collated annually by the Eastern Caribbean Central Bank. The definition of expenditure includes all expenditure within the destination country, as well as travel fares for all international visitors. Arrivals, or visitors, include business, student, medical and family visitors. It was considered relevant to keep all of these under our model, not only because tourists dominate the statistics in all of the CROP countries, but further because all of these other classes may also be influenced in their destination choice by the possibility of undertaking tourism-related activities and their expenditure.

**Expenditure** – It is important to note that expenditure receipts do not all accrue to the CROP countries—this may be especially true for cruise passengers and those paying for accommodation to international or externally-based companies.

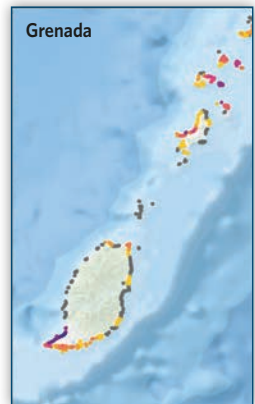
For this work we used averaged values for the five years up to and including 2019. EC Dollar values were converted to USD\$ and using a currency deflator averaged to 2019 US Dollar equivalents.

**Arrivals** – These numbers represent individual visitors, without considering length of stay. Separate data suggests overnight visitors average stays of 8-13 nights for overnight visitors, while cruise passengers will only visit for one day. Thus, for the region as a whole cruise tourists represent 72% of arrivals, but 21% of visitor days.





# Nature-Dependent Beach Tourism Modelling and Mapping Process



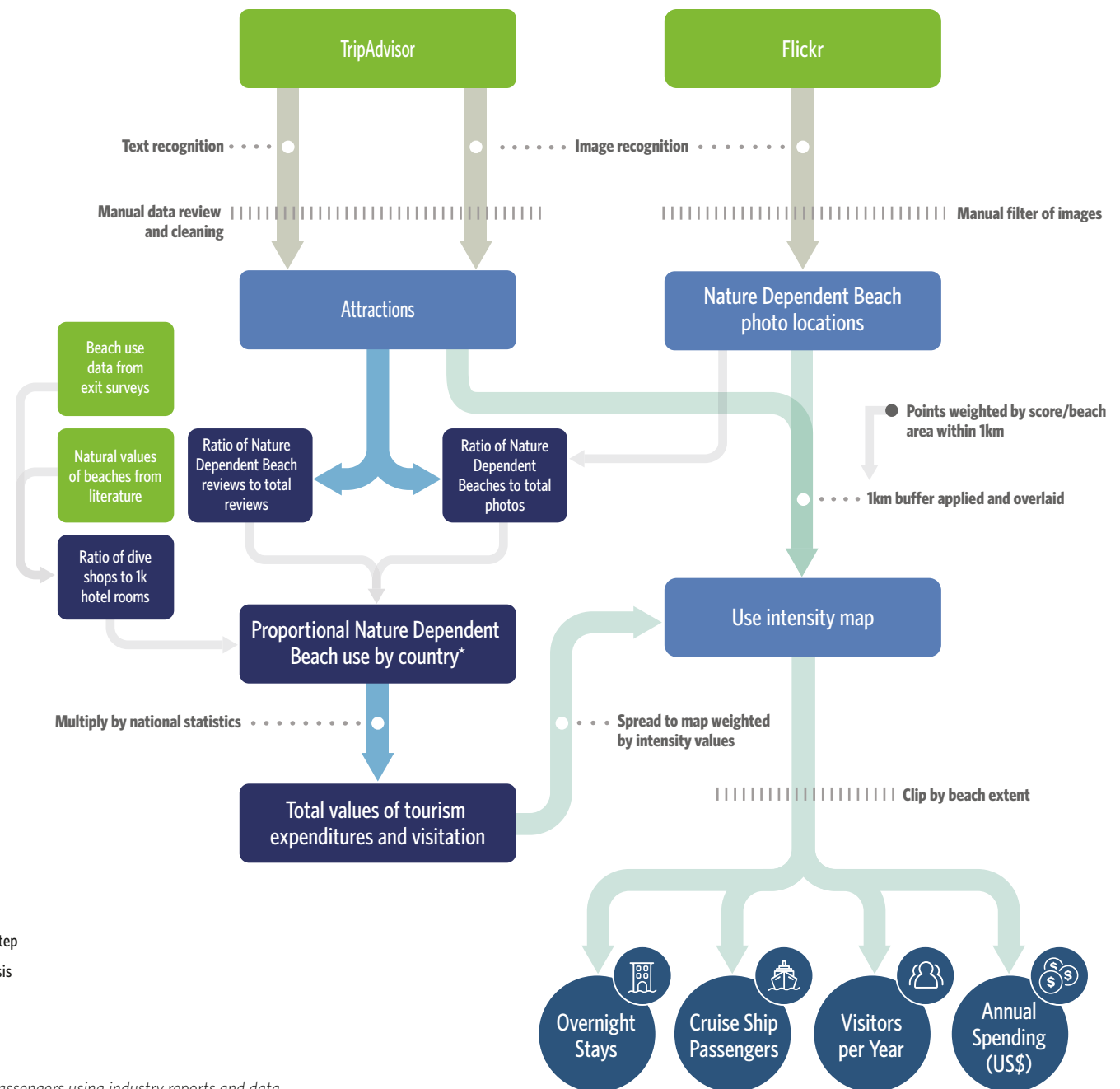
Mapped nature-dependent beach tourism expenditures in Grenada

## Data

- Input data source
- Intermediate data product
- Calculated statistic
- Map product

## Data Processing

- Geoprocessing Step
- Statistical Analysis
- AI/ML
- Data input



\*Separate proportions and extents derived for cruise passengers using industry reports and data.



# Findings

The map outputs, and associated statistics, reveal the very high overall value of nature-dependent beach tourism. The patterns of natural value broadly follow the overall patterns of beach tourism because, in these countries, all beaches have at least some important natural attributes. At the same time, the relative importance of nature varies between locations: natural values for popular beaches in more urban settings may be proportionally far lower than those for less crowded beaches in more natural settings.

Dollar values reported represent tourist expenditure that can be attributed specifically to the natural values of beaches. These numbers are derived from an assessment of both relative importance of nature-dependent beaches and from a wider information set on known expenditure from similar countries in the region. The numbers would include not only direct spending on these activities, but also the influence of a beach's natural elements in destination choice, with the assumption that, without the "draw" of these natural features, visitors would have chosen alternative destinations.

## Exploring the data

**Tourism expenditure directly linked to nature-dependent beach tourism is estimated at US\$318 million annually.**

This can also be expressed in terms of visitor numbers, with 215,000 overnight visitors and 348,000 cruise visitors choosing these islands for their on-reef activities. Such numbers, whether summed across the CROP countries or for each country individually, are very large, representing **over 14% of visitors and over 23% of all expenditure**.

## Zooming in

At least as important as these summary statistics are the statistics for individual beaches. The values here have been linked to individual beach cells of 1 hectare (100x100m). Some 50% of the region's beaches don't register a value in our models. Many of these beaches are on the windward (eastern) shores of most islands which are often inaccessible and waveswept. In a few cases, however, it is possible that beaches may have been excluded due to insufficient input data and/or a lack of natural elements driving these values. By contrast in areas where there are intensive activities, particularly where there are few beaches or beaches are small, individual beaches are generating very high expenditure values. **The top 10% of reefs are generating nearly \$3 Million per hectare per year.**

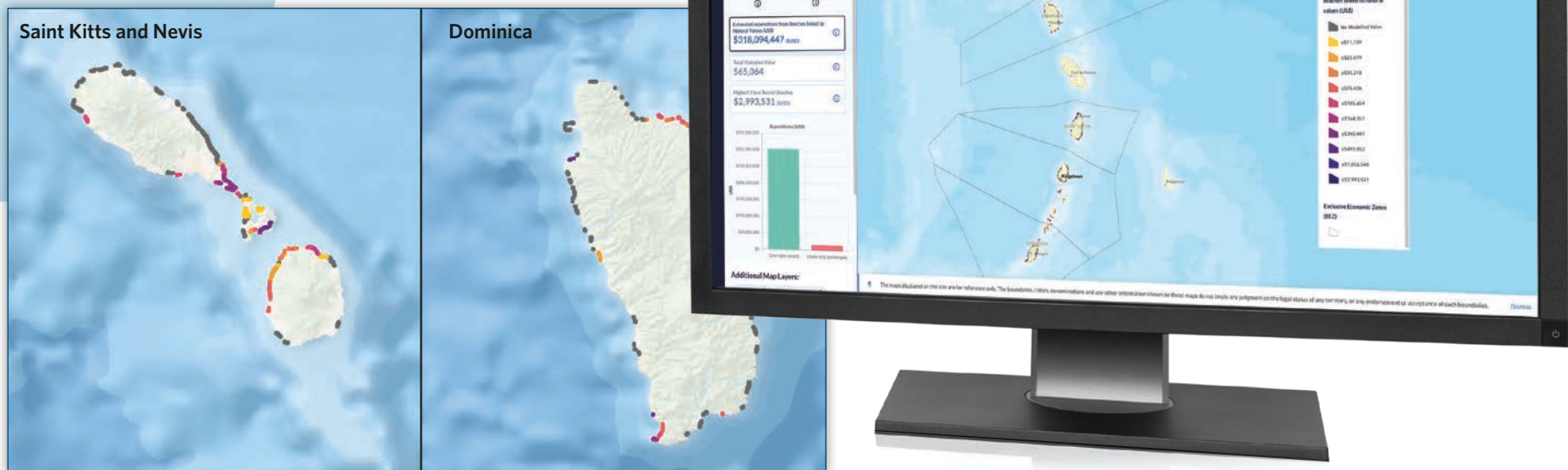
## Paddle sports

*A number of activities in coastal waters also have a degree of nature dependency. Two of these are kayaking and stand-up paddleboarding, which are popular in areas of clean, clear and sheltered waters, notably those with natural features such as reefs and mangrove forests. In addition to being highly nature dependent, these activities were selected for further exploration because of their ease of identification in our search process. In total some 407 paddle sporting attractions were found across all the CROP countries, with the highest concentration of activity on the leeward coast of Saint Lucia. While the data do not permit the quantification of monetary value or use, they do give a valuable indication of the popularity of these paddle-sports and a further indication of the need to manage marine and coastal resources in a manner that does not threaten such activities in future.*

# Data Access and Specifications

Outputs of this project included spatial datasets (File Geodatabase Raster Datasets) that can be imported, viewed, and analysed within Geographic Information Systems (GIS) such as Esri ArcMap, ArcPro, or QGIS. Data can be downloaded from the map viewer at [maps.oceanwealth.org/oecs](https://maps.oceanwealth.org/oecs) or at <https://oceanwealth.org/project-areas/caribbean/crop/nature-dependent-beach-tourism/>. The downloaded file contains a geodatabase and a metadata document. Within the geodatabase, files starting with NDB describe nature-dependent tourism datasets (the other files, beginning with CRT describe coral reef tourism described within the same technical report). Data are broken out so that users can view data for all CROP countries or by individual countries, or with the data broken out into overnight tourists, cruise tourists, or combined tourism values. Expenditure and visitation data, described below, are also broken out into separate datasets.

Map viewer and output samples of the Mapping Ocean Wealth Platform



## Applications

Maps and data such as these have an immediate and important role in drawing attention to a value that was perhaps already known by some, but which had never been clearly elucidated. Clearly beaches have always had a central role in tourism in the region, but explicitly calling out the role of nature in driving a significant proportion of this value is new and illuminating: these are values that are placed at risk with even low levels of environmental degradation. Raising public awareness of such value can help to foster support for conservation and rehabilitation for these natural spaces, accounting especially for water quality, development, and beach trash. Such knowledge needs to be factored in to planning and scenario-building.

By having a common currency, it is possible to place these values alongside others. In particular, high-value beaches can be seen as key economic drivers at the national scale, to be protected against risks that might arise from such activities as pollution, coastal dredging, land reclamation and other coastal development. These values may become “opportunity costs” or the lost earnings that might be associated with otherwise apparently high value coastal developments. They can also be viewed as indicative values that may be achieved from other locations through a combination of improved management and sustainable development.

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### Public interest

While coastal residents of the Eastern Caribbean are well-aware of the importance of nature for livelihoods and economies, public perception of the monetary value of nature can be low or vague. While it is not to be expected that individual public users will want or need direct access to the detailed results of our work, the work itself can be used to generate information of high public interest.

Community groups and NGOs should feel empowered to use this work, in support of their own campaigns or outreach. They may, for example, wish to make the case to restore degraded areas; or to argue against the expansion of coastal development which might threaten these values; or to help steer the tourism sector to more sustainable approaches. Armed with maps and statistics their arguments will be both stronger and more balanced.



### Business sector

One of the core businesses for nature-dependent beach tourism is of course beachfront hotels and restaurants. While our maps and statistics may be of interest to anyone working in this sector to understand a static situation, it is perhaps more relevant to consider their value in the face of any projected change. By understanding the value of particular beaches, it is possible to frame stronger arguments for ensuring and maintaining sustainable practices such as appropriate waste disposal and other water quality measures, which in some cases may arise from activities upstream or along the coast from particular beaches. It may further support arguments to constrain construction or development activities that may degrade beaches, or even just tourist perceptions of the natural values of beaches.





### **Building data into planning**

The CROP countries have made a commitment to develop their Blue Economy. Within this framework they are proposing to develop their coastal resources in a manner that is sustainable and that enhances natural value and human benefits.

Marine Spatial Planning is a key component of developing the Blue Economy. Central to MSP is the integration of all relevant sectors; inclusivity, with the engagement of all stakeholders, including minority groups; and the utilisation of all available information to inform planning processes.

In many settings, data on natural resource values for MSP is weak or lacking, however the current work provides a remarkable tool, available in only a very few countries. These data can be used alongside other data sources, ecosystem service values, and stakeholder opinions to guide decision-making and to inform equitable resolutions where there are differing interests. For example, these could be used during participatory mapping exercises, especially when used as a backdrop to structure conversations with stakeholders who bring their own knowledge regarding the values and impacts of nature-dependent tourism to the table.



### **Scale limitations**

As described earlier, the data-inputs give us some ideas of the scope and limitations for these datasets. The beach base-maps have a high degree of accuracy. These were gridded to a 100m grid (one hectare cells). By contrast, the input data for locating beach importance is of variable, and often poorly defined, accuracy. To avoid risks of geographic errors generating false accuracy, all of our locations (from Flickr and TripAdvisor sources) were buffered to a circle of 1km radius before being used to weight the reefs. Thus, although the beaches have approximately 100m resolution, we recommend that the maps be used at an assumed resolution of no less than 1:25,000 and in generating statistics we advise not attempting to summarise information for any areas smaller than 4x4km.



### **Time-frames**

All of the data used and presented represent tourism up to end 2019. The influence of Covid-19 on tourism has been enormous and we cannot assume that eventual recovery will include a return to the pre-pandemic patterns. As described earlier, tourism statistics have been averaged over a 5-year period up to and including 2019. Such an approach helps to remove annual fluctuations, however it may also mask trends or step changes that may arise (for example the building of a new cruise port or a rapid and large-scale expansion of overnight infrastructure). We recommend that users who are aware of such influences bear these in mind when examining our maps and make allowances for such change.



### Other caveats and limitations

These are modelled data products based on a series of assumptions, including the motivations and activity patterns of tourists. Model assumptions have been vetted by experts, stakeholders, and data where possible. The model is also heavily based on crowd-sourced data points, which may be subject to bias. As such, interpretation of statistics, especially for very small areas, should be treated with caution. Estimates will be more robust when based on larger areas. Pixels with no values don't necessarily lack tourism values, as not all values will be captured in the modelling approach used.



### Update and revise

A key advantage of our approach has been to build transparent models that are relatively simple to understand. Technical users are encouraged to explore the approaches we used – this may raise awareness of weakness or inspire questions which, at the simplest level, may enable those users to objectively comment on findings and suggest likely biases or even potential scenarios.

It is, of course, possible to re-run the models with different input layers or weightings. Detailed geoprocessing steps can be found in the technical report, and the project team can be contacted to share additional datasets and advise on how this might be done; however, it would of course require key technical and mapping skills to do this.



### Post-Covid

The final outcome of the Covid pandemic remains hard to foresee. The grave social and economic impacts from the decline of tourism receipts will have had other consequences which remain poorly understood, but could include positive and negative environmental impacts (for example changes in fishing efforts, or agriculture, coastal development or pollution). The return of tourism may not follow pre-pandemic models. It seems likely that open-air, nature-centric tourism may recover faster than travel which places tourists in more crowded settings such as large-volume hotels and cruise ships.

There may be opportunities to use the pre-Covid models presented here to better understand the different components of tourism across the CROP countries and to begin to inform possible recovery scenarios. Beaches will always form a core of tourism experiences in the Eastern Caribbean, but by considering and promoting natural values there may be opportunities to aid a more secure and sustainable recovery.



Stakeholders explore Mapping Ocean Wealth data at a 2019 workshop in Saint Lucia.

## FIND OUT MORE

For access to the high-quality maps and the full technical report, please visit the Mapping Ocean Wealth platform <https://oceanwealth.org/project-areas/caribbean/crop/nature-dependent-beach-tourism/>

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# Closing Words

For many visitors to the CROP countries, beaches are iconic, a key pull in destination choice and a key location for much of their time in the islands. The use of beach imagery to “sell” these destinations is widespread, and for many, both in the sector and among the visitors, the dominant images include nature – clear, turquoise waters, dappled by coral reefs, light sand beaches and mountainous forested hillsides. Prior to this work, the importance of nature to this most important part of the industry was unquantified, and possibly in some places overlooked. These maps and the associated numbers change that. Calling on prior research that has shown the very high concerns that many tourists have for healthy beaches, and using their own reviews and imagery to enumerate and locate these values, we have created a unique set of maps.

As countries move towards more ordered and holistic planning in the coastal and marine space such knowledge is critical. The importance of beaches was already well known, but the importance of nature to those beaches was overlooked. These new datasets should support a better assessment and evaluation of growing or changing demands on the use of coastal and marine spaces, enabling informed consideration of both conflicts and synergies with other demands.

We encourage users to explore the data online, but also to consider its validity and utility in different contexts. Deeper engagement with the data will enable wider uses, including opportunities to project and predict outcomes beyond the maps themselves. We hope that future users may also be able update and improve the maps, using similar approaches, and informed by the details we have provided underpinning our methods and our findings.



A vibrant coastal scene featuring clear turquoise water in the foreground, rocky shores with green algae, and a backdrop of lush green mountains under a bright blue sky with scattered white clouds. A dark blue circular graphic overlay is positioned in the upper right corner, containing white text.

As countries move towards more ordered and holistic planning in the coastal and marine space such knowledge is critical, enabling demands on coastal space to be properly assessed and enabling informed consideration of both conflicts and synergies with other demands.





Organisation of  
Eastern Caribbean States



WORLD BANK GROUP



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MAPPING  
OCEAN WEALTH



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<https://oceanwealth.org/project-areas/caribbean/crop/>



Photo: ©Shane Gross