

## **Darwin Plus: Overseas Territories Environment and Climate Fund**

### **Final Report**

#### **Darwin Project Information**

Project reference	DPLUS081
Project title	Mapping for evidence-based policy, recovery and environmental resilience
Territory(ies)	British Virgin Islands and Turks and Caicos Islands
Lead organisation	Environment Systems Ltd.
Partner institutions	DECR, TCI; National Parks Trust of the Virgin Islands, BVI; JNCC
Grant value	£210,920.00
Start/end date of project	01/04/2018 – 31/03/2020
Project leader name	Johanna Breyer and Katie Medcalf
Project website/Twitter/blog etc.	None
Report author(s) and date	Johanna Breyer, Katie Medcalf, Tom Marshall, Eric Salamanca Nancy Pascoe and Gwawr Jones

## **1 Project Overview**

### **Background**

Ecosystem goods and services, including those derived from biodiversity, are essential drivers for the TCI and BVI economies, supporting tourism, food provision and mitigating the effects of extreme weather events. The natural environment is susceptible to damage from human activities resulting in significant loss of value to the economies of the Territories and an increased risk from natural disaster such as hurricane-generated storm surges and flooding. The recent hurricane damage to the islands highlight the importance of protecting these natural assets.

This project brought together experts from two overseas territories; British Virgin Islands (BVI) and Turks and Caicos Islands (TCI), together with experts in environmental modelling, mapping and monitoring, Environment System Ltd and JNCC, to help model recovery from hurricanes Irma and Maria. Natural features such as mangroves and dry forest can provide a degree of protection for properties which are sheltered by them. However, they are susceptible to damage from human activities resulting in significant loss of value to the economies of the Territories and an increased risk from natural disasters such as hurricane-generated storm surges and its associated flooding. This project considered GIS and Remote Sensing techniques of understanding natural resources (natural capital), biodiversity, and ecosystem services, that staff on island could use to investigate recovery and feed into policy-making.

### **Project Location**

The project covered the terrestrial and marine areas of the British Virgin Islands and the Turks and Caicos Islands (see Figure 1 and 2).

There was a particular focus on natural ecosystems in the terrestrial and coastal environments where the impacts of the storm events were felt most strongly, and where there is potential for restoration and enhancing the impact of the natural resources.

Figure 1: BVI study area

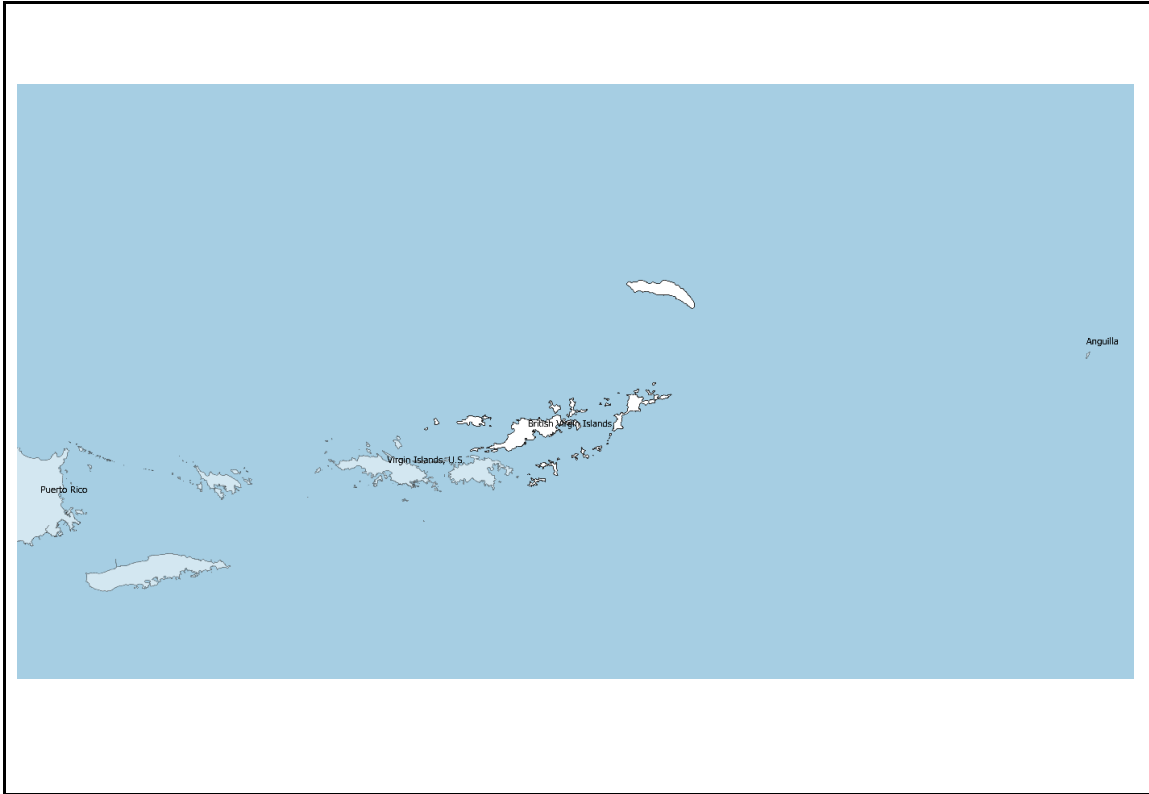
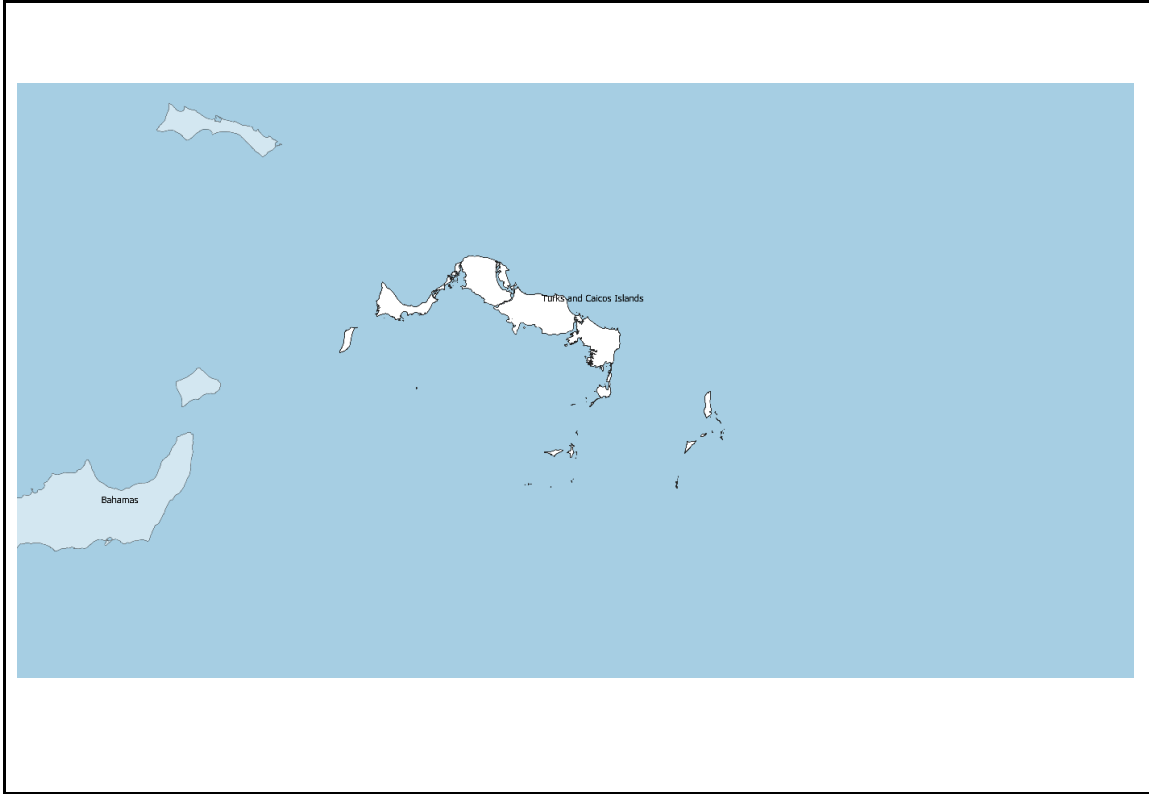


Figure 2: TCI study area



## Issues being addressed

- Hurricanes Irma and Maria had a devastating effect on the natural ecosystem of the islands.
- Natural resources contribute to protection of key assets especially in the coastal zone, these need to be mapped, monitored, explained and described to policy makers and local community stakeholders.
- Natural environment management lacks 'hard' evidence such as graphs, maps and statistics to quantify and monitor resources (natural capital) which can be presented to policy makers for social and economic recovery planning and influence policy decision making.

This project set out to strengthen the evidence base into sustainable management, recovery and mitigation of future storm events, by making available evidence from satellite imagery on recovery and risk to ecosystems, and natural capital. A key element of the project was to train six 'core' participants from across the two islands so that they are confident in using satellite imagery and geographic information systems (GIS) to report scientifically robust evidence using maps, graphs and statistics to help strengthen the knowledge and appreciation of the natural resources in the islands.

The environmental and climate change challenge this project was designed to meet, was that of providing robust, repeatable evidence that could be available to the island throughout the project, and afterwards, to help monitor the natural resources, judge the effectiveness of action, and report on it to key policy makers.

## How was the project expected to address these challenges?

The project provides evidence to develop policy to aid post-hurricane environmental recovery and enhance future resilience to natural disasters. It used satellite data and GIS systems to map and model the marine and terrestrial environment in the Turks and Caicos Islands (TCI) and the British Virgin Islands (BVI), pre- and post the 2017 hurricanes Maria and Irma.

The project further focuses on sharing experience and learning to develop both islands' expertise in relevant techniques, and is integrated closely with other UK Government supported projects in the BVI and TCI.

The project supports territory priorities to protect and enhance critical goods/services and biodiversity values, addressing these issues through:

- building capacity to use remote sensing technologies/methods;
- undertake detailed mapping of the marine and terrestrial environments for monitoring change;
- evaluating hurricane impacts on the natural environment;
- mapping opportunities for habitat restoration;
- providing firm evidence for policy development and planning.

## 2 Project Stakeholders/Partners

The project team have been working closely with primary project partners from the TCI Department of Environment and Coastal resources, and the BVI National Parks Trust, as well as JNCC. All project partners have been involved in project planning and decision making relevant to their role, and helping to ensure that the overall project stayed on track and delivered the intended outcomes for the partners within the territories.

The engagement of the primary project partners was strong through the project duration and considerably shaped the outcomes and eventual focus of the project on increased training of key individuals to improve capacity and the required techniques within the territories in alignment with their stated priorities.

We have further involved stakeholders from eight other departments and organisations within the two territories into decision-making and planning events, so that the final project outputs and training imparted can have the maximum impact on the islands.

The project has also liaised with DPlus073 (Project lead: Louise Soanes) project on BVI, based on Jost van Dyke.

Help has also been given to stakeholders on BVI from the Department of Disaster Management (DDM) who wanted interpretation of geological survey results and how they can use these within their GIS systems.

### 3 Project Achievements

#### 3.1 Outputs

The project has achieved the outputs identified in the log-frame, as follows.

**Output 1: Participants in the project are trained to develop the knowledge and skills necessary to effectively use the tools required**

**Output fully achieved.** Project beneficiaries were trained to use GIS and remote sensing techniques to make management and policy decisions concerning the natural environment. This is evidenced by surveys carried out after the workshops. Participants' improved knowledge and skills of remote sensing were captured *via* a self-assessment questionnaire. Of the 11 participants in BVI, 10 (91%) reported that their remote sensing knowledge and skills have increased as a result of the training. Of the 10 survey respondents in TCI, 9 (90%) reported that they better understood how to apply remote sensing techniques to their work in TCI after the workshop. Qualitative data collected during the end line evaluation shows that the six 'core' participants are confident that their remote sensing knowledge and skills have increased significantly as a result of participation in the project.

Please see the attached baseline analysis and the final project evaluation report for more detail on this: DPlus081\_Final\_Report\_Evidence\_Supplements\Annex\_2\_M&E\_Reports.

The project has gone further than initially anticipated in this area, training six 'key participants' to produce maps using GIS and remote sensing.

**Output 2: Participants have access to the data required for on-going mapping and monitoring of the islands**

**Output fully achieved.** Currently, the islands have access to high resolution satellite imagery from before and immediately after Hurricane's Irma and Maria through previous CSSF funded projects (Williams et al., 2018 and 2019, Using radar-based terrain mapping to model the vulnerability of 5 UK OTs and validation of the modelling).

This project therefore concentrated on sourcing and preparing a time series of Sentinel 2 images for each island group. In total by the end of Year 2, several thousand Sentinel 2 image tiles, as well as temporal composite Sentinel-1 scenes, are available to the project partners, captured throughout 2017, 2018 and 2019, processed to analysis ready status and including derived indices such as NDVI, TSS and MNDWI. Cloud free images are rare in the Caribbean which tend to have small cumulus clouds across different parts of the image. Capturing such a dense time series enables the stakeholders to find imagery suitable for a variety of mapping needs on their islands.

This addresses indicators 2.1-2.3 in the log frame.

(DPlus081\_Final\_Report\_Evidence\_Supplements\Annex\_5\_Data\_and\_Equipment\Satellite\_Imagery)

Indicator 2.4 addresses the need for on-going access (beyond end of the project) to Sentinel-2 data for continuing mapping and monitoring of the islands. The training provided under Output 1 would enable participants to source image data directly from the Sentinel Data Portal or to explore relationships with providers that offer data products tailored to the data needs of the islands. Currently the project has set up a data-services platform, meaning that project beneficiaries can continue to access analysis ready data for a small fee going forward.

Image data provided under the current project was provided on hard drives as the internet capacity available on island was not sufficient to download such large data volumes remotely and this is a potential capacity issue that needs to be addressed going forward to ensure the ability to access data as required for on-island analysis.

### **Output 3: Participants have access to the equipment required for on-going mapping and monitoring of the islands**

#### **Output fully achieved.**

New equipment and high-end processing laptops were delivered to each island together with equipment to collect ground truth data for monitoring of the marine environment and training given. As evidenced by the invoices and shipping lists included in annex five of this report, participants have ongoing access to the equipment required for on-going mapping and monitoring of the islands. This is suitable equipment for the task, with laptops deemed the most suitable way of delivering this equipment as they can be moved easily and are therefore resilient in the face of events such as hurricanes.

(DPlus081\_Final\_Report\_Evidence\_Supplements\Annex\_5\_Data\_and\_Equipment\Physical\_Equipment)

### **3.2 Outcome**

At the end of the project, the project has largely achieved its overall anticipated outcome: “partners now routinely use tools and data to generate knowledge on spatial attributes of biodiversity and natural capital, improving the evidence base for planning and policy decisions on the islands.” There is, however, the potential for this outcome to be strengthened in the future, by further training relevant stakeholders in BVI and TCI in GIS and remote sensing techniques, and embedding project-centred learning firmly in work routines of stakeholders as well as dissemination of skills to colleagues on an on-going basis.

There is evidence that providing training has increased the use of remote sensing techniques within partner organisations. In line with outcome indicator 0.5, it appears that the majority of ‘core’ workshop participants have undertaken RS/GIS analysis to support evidence-based decision making within the territories (Annex 2 and 4 provide examples of this.). When interviewed during the end line evaluation, four of five workshop participants interviewed reported that they are now producing more evidence than they had been able to do before receiving training (N.B. *one ‘core’ workshop participant was unable to participate in evaluation interviews due to work commitments*). What is more, this evidence is being used to better inform internal and external decisions made by the organisations.

There are diverse examples of how additional mapping (relating to outcome 0.2) has been used to inform policy decisions (relating to outcome 0.1), articulated in greater detail in the case studies attached to this report as an appendix. These outcomes include:

- The National Parks Trust of The Virgin Islands (NPT) mapping the effects of the invasive Australian Pine (*Casuarina equisetifolia*) on Anegada in BVI. Using images made available through the project of the 2016 picture before the hurricane, the 2017 hurricane damage and the situation in 2019 when vegetation had grown back, it has been possible to use NDVI analysis to map endemic and invasive species in terrestrial park areas and map them using GIS techniques. This allows NPT to make evidence-based decisions to support indigenous species on the island.
- NPT using NDVI analysis to map forestry in BVI. This has been particularly important after hurricane Irma, when many trees in the forests lost significant amounts of vegetation. Complementing and potentially replacing much of the fieldwork that NPT was doing, the NDVI map provides NPT with significant information about forests’ recovery since the hurricane, and can be fed to staff involved in the management of the forests.
- The Ministry of Natural Resources and Labour (MNRL) on BVI has used the increased skills and knowledge of remote sensing to map mangrove habitats in BVI. Mangroves have an important function in shoreline protection and are an important habitat, but have been devastated by the hurricanes. Applying the new techniques and making use of remote sensing data, MNRL has worked towards quantifying the damage done. The

detailed data analysis is also expected to identify appropriate areas to replant mangroves, feeding into a project to restore mangrove banks currently being delivered by the Department of Disaster Management with support from the Caribbean Development Bank.

- MNRL has also applied the learning and access to satellite images to an analysis of the scale and location of sargassum influx on the islands after extreme weather events. As well as smothering seagrasses and coral reefs, sargassum is malodorous and potentially has negative impacts for tourism on the island. Being able to quantify the damage done, both in terms of volume and the area affected, means that the Ministry can now develop a much clearer understanding of the clean-up costs involved and get more accurate, cost-effective quotes for its removal.
- The Department of Environment and Coastal Resources (DECR) in TCI has used the skills and capacity to identify, and add to the IUCN Red List of Threatened species, an orchid indigenous to the islands. Neither the team nor other ecologists had ever visited the area where it grows. The coastal dunes, which are the natural habitat for this type of orchid on the islands, is highly vulnerable to environmental change, through hurricanes and sea level rise. These habitats compete with humans for use of construction, much of it privately owned. Continuing to use the methodology within DECR's work will lead to a better grasp of habitat change and allow a consistent application of red listing criteria across TCI and the expectation is that the knowledge gained will make a lasting impact on the way the endemic species can be protected.

Notably, in changing the project focus from undertaking mapping for beneficiaries, to upskilling them to allow them to do mapping themselves, the project has potentially resulted in a greater number of maps being produced, although this is likely to take place over a longer period of time.

Of the five 'core' workshop participants who took part in stakeholder interviews as part of the evaluation, four (80%) reported an increased use of GIS and remote sensing in decision-making within their departments. This is because increased technical capacity has made tasks simpler and allowed evidence to be considered when developing policy. In the longer-term, these have the potential to facilitate more evidence-based policy making, and increase the resource and time-efficiency of certain tasks for project beneficiaries. One of the reasons for this is that beneficiaries will no longer have to outsource analysis, resulting in quicker and cheaper decision-making.

*“The process of mapping key aspects for decision-making is now quicker. While previously, the team could have gone to the survey and mapping department to get certain maps produced, this would have been associated with a lengthy process of requesting and waiting for the final maps.”*

-Project beneficiary

*“In the past our team would have had to use external consultants to produce much of what they are now able to produce themselves using the new skills. Without the proprietary software being renewed, in the past, consultants would have provided a product, but the team would not have been able to use it very effectively, because they weren't able to manipulate the imagery.”*

-Project beneficiary

Other impacts reported by project beneficiaries during the final project evaluation include:

- a belief that they will be better able to influence and persuade external parties with a more robust evidence base;
- a belief that they will be better able to deliver higher-quality outputs as a result of the increased expertise; and

- a desire to undertake new projects in the future, expanding on their experience with GIS and Earth observation (EO) in this project.

As will be discussed in the following section, whether these emerging outcomes translate into long-term strategic outcomes and a legacy of the project will depend on the extent to which participants are able to reinforce the skills they have learned through this project.

### **3.3 Long-term strategic outcome(s)**

There is evidence to suggest that the project has the potential to help deliver long-term strategic outcomes for the natural environment in the British Virgin Islands and the Turks and Caicos Islands. As a result, key departments in both territories have increased capacity to use GIS and EO to make environmental management and policy decisions. If these emerging outcomes discussed above become more routine, and GIS and remote sensing data are regularly used in decision-making, then there is the potential that these will have long-term strategic outcomes for the natural environment in BVI and TCI.

By upskilling key staff within key government departments, the project has enabled these staff to use GIS and remote sensing techniques to improve the evidence-base upon which policy and management decisions concerning the natural environment are made. By embedding GIS and remote sensing into departments, there is the potential for more evidence-based decision-making in the future, something which is anticipated to improve the strategic management of the islands in the future.

Rather than creating a set of maps for the project, by training the users on BVI and TCI to create maps for themselves, the project has increased the likelihood of the intervention having a long-term legacy, and therefore increasing the project's value-of-money. The intervention is likely to result in more maps, and more evidence-based decision-making than would have been achieved had the project persisted with the original delivery model.

However, as noted below, the sustainability of these outcomes will depend on how effectively these skills are passed on internally within departments, how much time those trained have to build on and utilise these skills and how effectively they are at communicating the information to others within their departments.

There are a number of projects in progress in both territories that build on the outcome from this work.

## **4 Sustainability and Legacy**

By delivering the project through training rather than undertaking mapping for project beneficiaries, the project has increased the likelihood of the project having a lasting legacy. Once trained, beneficiaries can potentially use the skillset on a variety of projects across related areas, as well as ensuring that maps are updated- giving the investment a longer legacy than the original delivery model. The project has set up a data-services platform, meaning that project beneficiaries can continue to access data for a small fee, and hardware continues to be available for project beneficiaries.

While these factors all encourage sustainability, the extent to which this will happen depends on whether beneficiaries continue to receive the time and resources to reinforce these skills and- potentially- pass them on to others within their organisations. Staff turnover—with beneficiaries leaving organisations or moving into different roles—could also potentially be a barrier to sustainability. While this is beyond the control of the project, if participating departments want to maximise the legacy of the project, they should consider:

- a. Ensuring that project participants have the time to reinforce their GIS and EO expertise gained during the project, potentially expanding the experience; and
- b. Facilitating internal skill-share to ensure that the skills are more widely shared within the departments.

While it is recognised that for the departments who have received support, resource can be scarce and it is not necessarily easy to allocate it for these purposes, doing so would likely have considerable benefits, building on the investment that has already been made here.

There are ongoing support needs for beneficiaries, and meeting these in some way will help to ensure there is a sustainable legacy of this investment. For example, when interviewed, most workshop participants reported wanting some form of ongoing support now that they have finished their training in order to reinforce the learning and help deal with technical challenges.

*“To ensure that there is a legacy, ongoing technical support, having people to ask when encountering a problem, will be key. Yes, Googling things helps to some extent, but for EO there aren’t many good explanations of specific aspects available. Repetition will now be the most important thing though – ‘the more you do it, the more you know what you want’.”*

-Project beneficiary

This was a challenge also recognised by project delivery staff, who identified that while there have been outcomes for project beneficiaries, there may have to be a reinforcement of the learning to prevent it being lost.

*“There has been considerable learning for beneficiaries, but without proper reinforcement, I worry that some of it will be lost. Further support, maybe as peer-support would be helpful, and I think that’s already happening on BVI.”*

-Project delivery staff

To a certain extent, this is already happening, with project participants on BVI setting up a peer-support group, aimed at sharing learning and helping each other with ongoing GIS and EO tasks. There does not appear to be a similar group in TCI, however, and there is the potentially greater risk of skills being lost here than in BVI. Future efforts should focus on fostering peer-to-peer support in both territories.

In addition to existing learning, three of the five project beneficiaries reported that they want more training in additional areas of GIS and EO that were not covered in the original training. There are potentially legacies of the project in terms of inspiring other capacity building activities, and future learning about other aspects of EO and GIS.

*“The government is now also exploring the use of lidar images provided by the UK Hydrographic Office. We’d like more training on that and how different data and methods can be combined might be needed in future. It’s important that we do get training in this area as if the government pays for imagery, you want to be able to use it”*

-Project beneficiary

*“The team have previously submitted a proposal for a soil mapping project, which was not successful. This remains a priority in order to gain a better understanding of how land should be zoned. We are keen to ‘repackage’ this to include some capacity building and resubmit the project.”*

-Project beneficiary

Given the resource constraints on project beneficiaries, the availability of future grant funding opportunities will be important if these longer-term ambitions are to be achieved.



## 5 Lessons learned

In stakeholder interviews carried out at the end of the project, the workshop format was identified as a key strength of the delivery model by both beneficiaries and project delivery staff. During evaluation interviews, beneficiaries reported valuing the face-to-face delivery model, broken up into sessions held in the three locations.

*“The structure and timing of the workshops [was a strength of the project], with part delivered in BVI, TCI and in Aberystwyth. The pacing was also good, with sufficient time to think and talk as well as receiving instruction.”*

-Project beneficiary

The workshop format allowed for a range of issues to be addressed, specific to the challenges that individual workshop participants were facing. Using specific—rather than generic—data was important for engaging workshop participants.

*“A number of specific issues were identified and assigned to participants as part of the initial training workshop. One colleague tracked erosion, another looked at sargassum, one worked to refresh habitat map developed in 2010 with JNCC support, which was desperately needed after two hurricanes”*

-Project beneficiary

Beneficiaries reported that—if anything—there could have been more of a focus on specific data relevant to their work, although this potentially creates other challenges in terms of standardising workshop materials. There were also lessons learned around providing beneficiaries with examples that are of an appropriate level of technical complexity: providing examples without cloud cover is likely to be sufficient for the proficient but non-specialist audience the intervention was training.

A key learning point around workshop delivery has been the importance of taking an iterative approach to deliver training. During interviews undertaken during the final evaluation, delivery staff reported that it was important to tailor workshops to be relevant and ‘pitched at the right level’ for participants. To do this, they had to be ‘light on their feet’, ask regular questions of beneficiaries and respond in real-time to the topics and activities that participants were finding particularly challenging or particularly easy, rather than relying on a ‘plan’ for the workshops.

*“The key learning point for me was that when you’re delivering workshops, you have to be reactive, and think on your feet, to ensure that the remainder of the workshop builds on the things that participants find most relevant or most challenging.”*

-Project delivery staff

Another learning point reported by project delivery staff was the importance of ensuring that beneficiaries can dedicate the time to participate in training. One of the key challenges faced throughout the project was ensuring that beneficiaries—all of whom were busy people, facing significant demands on their time within their professional roles—had the time to focus on the training. An online training format, while potentially being more flexible, is also likely to have been swamped by participants’ other commitments and—ultimately—would have been less efficient in increasing beneficiaries’ capacity.

Significantly, participation seemed to be strongest, and beneficiaries most able to focus on the workshops, when they were not on their own island. Bringing beneficiaries to Aberystwyth (or BVI beneficiaries to TCI and vice versa) for training was particularly effective in this regard, as beneficiaries’ time was clearly demarcated for this purpose and they were not being asked to carry out other tasks.

## 5.1 Monitoring and evaluation

The main change to the project since inception has been the move from producing maps for project beneficiaries to undertaking a capacity-building intervention. This change was implemented with the full agreement of all project stakeholders and was initiated following feedback collected as part of the on-going M&E process during the first two project workshops in 2018/2019 to form a baseline analysis which also assessed the increasing confidence of workshop participants before and after the training events:

(DPlus081\_Final\_Report\_Evidence\_Supplements\Annex\_2\_M&E\_Reports\DPlus081\_Baseline\_Analysis.pdf).

Carrying out a sustained and parallel M&E process throughout the duration of the project was very helpful as a mechanism to review the success and contribution of project activities to the project outcomes and overall progress on an on-going basis and enabled the project to react with adaptive management to developments throughout. The project team greatly valued this as a helpful source of objective feedback.

An independent external evaluation of the project was carried out by Wavehill Ltd. This was carried out at the end of the project and comprised of:

- A review of monitoring data and training reports;
- Telephone interviews with project delivery staff x 5;
- Skype interviews with key project beneficiaries x 5.

The evaluation focused on outcomes and impacts resulting from the support as well as the effectiveness of project delivery mechanisms to support the aims of the project and lessons learned from delivery. The key findings of the evaluation have been presented in the 'Project Achievements' and 'Sustainability and Legacy' and 'Lessons Learned' sections of the report, above. For the sake of brevity, these will not be repeated again here. The evaluation also produced four case studies, highlighting outcomes resulting from increased capacity. These have been included as an annex to this report:

(DPlus081\_Final\_Report\_Evidence\_Supplements\Annex\_2\_M&E\_Reports\DPlus081\_Monitoring and Evaluation\_Report.pdf).

## 5.2 Actions taken in response to annual report reviews

The annual report review was shared with all project partners and discussions were held to refine and agree the final objectives of the project which resulted in the submission of a revised log frame for the project.

## 6 Darwin Identity

All project documents, e.g., workshop presentations, agenda, attendance certificates referenced in Section 3 included the Darwin logo as well as those of the project partners.

All project partners used Twitter to publicise project activities. The following addresses either tweeted or were tagged in tweets related to the project: Darwin Plus (@Darwin\_Defra), Environment Systems (@envsystems), JNCC (@JNCC\_UK), BVI government (@BVIgovernment), TCI government (@TCI\_Press).

<https://www.facebook.com/NPTVI> contains project-related posts.

During on-island workshop local press were invited to report on the events and this resulted in a number of news items both in the printed press (<https://bvinews.com/govt-now-has-access-to-satellite-imagery-remote-sensing-technology/>) as well a short report on local television in TCI following the final workshop.

The project has a distinct identity but is building on other projects that have been carried out in the Caribbean OTs prior to this and it forms part of a wider effort of capacity building and

hopefully as a stepping stone to further strategic Darwin bids. There are other projects underway in the territories that have synergies with the current one (e.g., DPlus043 and DPlus073) and previous ones to which the learning from this project can be correlated to (e.g., DPlus030 on BVI and DPlus016 on TCI).

There is a very good understanding of the Darwin Initiative within the BVI and TCI and a number of project partners have been and are currently involved in other Darwin projects and are planning to apply for future ones. The initiative funding is appreciated as a useful funding source for specific projects with a targeted focus but also considered within strategic efforts to build capacity for environmental protection within the territories.

On the 31st of May 2019 a webinar was hosted jointly by the CIEEM UK Overseas Territory Special Interest Group with the UK Overseas Territories Conservation Forum [<https://www.ukotcf.org.uk/>]. The webinar included talks from the partner organisations in the British Virgin island and Turks and Caicos Islands:

<http://events.cieem.net/Events/EventPages/31052019000000ProvidinganEvidenceBaseforConservationintheUKsOverseasTerritories.aspx>

## 7 Finance and administration

### 7.1 Project expenditure

**Project expenditure 2019/2020, Year 2 of the project.**

Project spend (indicative) since last annual report	2019/20 Grant (£)	2019/20 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others				
<b>TOTAL</b>				

Staff employed (Name and position)	Cost (£)
Dr Katie Medcalf - Environment Director	
Dr Johanna Breyer - Senior Remote Sensing Consultant	
Samuel Pike - Remote Sensing Consultant	
Matthew Yandell-Thomas - Senior GIS Analyst	
Nancy Woodfield Pascoe – Project Co-ordinator	
Keith Grant – Field Staff	
Finfun Peters – Field Staff	
<b>TOTAL</b>	

Consultancy – description and breakdown of costs	Other items – cost (£)
Wavehill Limited	
<b>TOTAL</b>	

Other items – description	Other items – cost (£)
M&E costs - data collection support on island	
<b>TOTAL</b>	

### Cumulative project expenditure 2018/2020.

Cumulative Project spend over total project period	2018/20 Grant (£)	2018/20 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others				
<b>TOTAL</b>				

Staff employed (Name and position)	Cost (£)
Dr Katie Medcalf - Environment Director	
Dr Johanna Breyer - Senior Remote Sensing Consultant	
Samuel Pike - Remote Sensing Consultant	
Matthew Yandell-Thomas - Senior GIS Analyst	
Nancy Woodfield Pascoe – Project Co-ordinator	
Keith Grant – Field Staff	
Finfun Peters – Field Staff	
<b>TOTAL</b>	

Consultancy – description and breakdown of costs	Other items – cost (£)
Wavehill Limited	
<b>TOTAL</b>	

<b>Capital items – description</b>	<b>Capital items – cost (£)</b>
Pro Book 450 Laptops and associated peripherals Buffalo and WD Red External storage devices Ulefone Armor Rugged data tablet Deeper PRO Plus Feature Sonar	
<b>TOTAL</b>	

<b>Other items – description</b>	<b>Other items – cost (£)</b>
M&E costs - data collection support on island	
<b>TOTAL</b>	

## 7.2 Additional funds or in-kind contributions secured

<b>Source of funding for project lifetime</b>	<b>Total (£)</b>
Joint Nature Conservation Committee	
Department of Environment and Coastal Resources, Turks and Caicos Islands	
Environment Systems Limited	

<b>Source of funding for additional work after project lifetime</b>	<b>Total (£)</b>
Not applicable	
<b>TOTAL</b>	

### 7.3 Value for Money

- The project initially aimed to train only four staff members from partner organisations during the masterclass in Aberystwyth in May 2019. However, due to efficient use of the travel and subsistence budgets it was possible to have six individuals in attendance, representing a 50% increase on the initial target.
- The final M&E report highlights the importance of the face-to-face time the project partners were able to spend together during the project to establish, maintain and deepen relationships. This helped to deliver on the learning outcomes of the project and it was felt that the project budget was used very efficiently to deliver four weeks of workshop time in total both on TCI and BVI as well as in Aberystwyth.  
(DPlus081\_Final\_Report\_Evidence\_Supplements\Annex\_2\_M&E\_Reports)
- The organisation of the workshops was a considerable logistical challenge, considering the number of participants required to travel etc. and it was felt that the efficient cooperation of all partners delivered these events at a good value for money for the project.
- The project employed an external consultant to undertake monitoring and evaluation of the project outcomes from the beginning. This strengthened the ability of the project team to respond to collected feedback from participants during the project and to provide a more extensive and objective evaluation of the outcomes of the completed project than otherwise might have been possible.
- To deepen learning outcomes achieved during the project workshops, regular monthly Skype surgeries were held during the second and final year of the project to address specific technical questions by key staff as they applied the learning in their work. Skype provided an efficient means of communication during these conversations with partners located in different time zones.

## Annex 1 Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p><b>Impact:</b> <i>The role biodiversity and ecosystem services play in mitigating natural disasters, are further integrated and strengthened in planning and development activities in marine and terrestrial areas of BVI and TCI</i></p> <p>(Max 30 words)</p>			
<p><b>Main Outcome:</b></p> <p>(Max 30 words) Partners now routinely use tools and data to generate knowledge on spatial attributes of biodiversity and natural capital, improving the evidence base for planning and policy decisions on the islands.</p>	<p>0.1 Plans developed to integrate this new type of spatial mapping into policy decisions to help improve marine and terrestrial conservation, protection of key resources and integrated planning on both BVI and TCI.</p> <p>0.2 Key ecosystem services identified and mapped for each island's priority to allow sustainable use of terrestrial and marine environments by the end of the project.</p> <p>0.3 Monitoring plan agreed for both islands to use remote sensing (RS) to update maps both systemically and after future extreme events by the end of the project.</p> <p>0.4 TCI set up a GIS working group or similar support mechanism for inter-departmental collaboration (BVI already have one) by the end of the project.</p> <p>0.5 Workshop participants report increase in use of RS within their organisation against baseline data collected at the initial workshop. Target: 80% of participants report an increased use of RS/GIS since the first training event.</p>	<p>1.1 Policy decisions evidenced by official material (report, meeting minutes, etc.).</p> <p>1.2 Key services identified and maps produced (Project outputs).</p> <p>1.3 Monitoring plan documents produced for each island.</p> <p>1.4 Minutes from initial meeting of support group/GIS working group</p> <p>1.5 Collection of use-case studies showing new application of RS &amp; GIS techniques</p>	<ul style="list-style-type: none"> <li>● Staff turn-over remains low</li> <li>● Staff have time to put learning into practice and integrate it into their day-to-day tasks, as well as commitment to on-going training to keep skills current</li> <li>● Internal knowledge sharing is sustained and tools and data are made accessible to wider and new staff</li> <li>● Key staff are trained and there is a plan on each island to continue integrating the RS data and techniques into working routines</li> <li>● The hardware/software required remains in place and operational</li> </ul>

<p>Output 1: Participants in the project are trained to develop the knowledge and skills necessary to effectively use the tools required</p>	<p>1.1 Staff trained via 3 workshops and 1 UK training event. Six core participants attending all four workshop sessions by the end of the project and a total of 20 people attending at least one workshop sessions.</p> <p>1.2 Training in ground control data methods to support remote sensing mapping delivered during the first two on-island workshops to a total of 20 people.</p> <p>1.3 Mapping methods to inform sustainable development policies and practices using RS data are developed and implemented by the end of the project.</p> <p>1.4 Participants' RS knowledge and skills increase. Baseline data was collected at the initial workshop via a knowledge test. Target: 80% demonstrate an improvement in score following workshop attendance as well as self-reporting of increased skill.</p>	<p>1.1 Workshop materials and attendance lists (disaggregated by gender), Questionnaire at end of training comes back with 100% of six core participants that attended all workshops and at least 75% of other attendees feeling confident they can use the tools and data.</p> <p>1.2 Ground control data for the marine and terrestrial environment used in subsequent analysis. Workshop materials and attendance lists (disaggregated by gender). Questionnaire? Check!</p> <p>1.3 Workbooks developed following December 2018 and February 2019 workshops and distributed to participants.</p> <p>Examples where mapping methods have been applied in real world scenario at least once on each island (reference in internal report or similar).</p> <p>1.4 Participants' report increased RS knowledge and skills in post-training surveys and personal testimony supplied with final report.</p>	<ul style="list-style-type: none"> <li>● Staff time made available to participate in training</li> <li>● Weather does not prevent ground-truth data collection during workshops</li> <li>● Training is provided at an appropriate level for participants</li> <li>● The right staff have been invited and are able to attend the workshops</li> </ul>



<p>Output 2: Participants have access to the data required for on-going mapping and monitoring of the islands</p>	<p>2.1 BVI and TCI supplied by December 2018 with every usable (cloud-dependant) Sentinel 2 scene over terrestrial and marine environments on BVI and TCI from 2017 and 2018 processed to analysis ready status.</p> <p>2.2 BVI and TCI have on-going access (beyond end of the project) to Sentinel-2 data for continuing mapping and monitoring of the islands.</p>	<p>2.1 Inventory lists of data hard drives provided.</p> <p>2.2 Evidence of on-going access to RS going forward (e.g., data services contract or alternative plan) by the end of the project.</p>	<ul style="list-style-type: none"> <li>• The data provided are appropriate for the needs of participants and the challenges they face</li> <li>• Sentinel-2 data remains accessible to participants</li> </ul>
<p>Output 3: Participants have access to the equipment required for on-going mapping and monitoring of the islands</p>	<p>3.1 Capital items listed under project application purchased and delivered successfully by December 2018.</p>	<p>3.1 Invoices and shipping lists.</p>	<ul style="list-style-type: none"> <li>• Capital items are appropriate to the needs of participating institutions</li> </ul>
<p><b>Activities</b> (each activity is numbered according to the Output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)</p> <p>Output 1: Participants in the project take part in training to develop the knowledge and skills necessary to effectively use the tools required</p> <p>1.1 Workshop 1; Use of remote sensing and modelling in Arc GIS and open-sourced software including shallow water marine, training in ground truth data collection</p> <p>1.2 Workshop 2; Training in monitoring methods, design of monitoring strategies</p> <p>1.3 UK training; Detailed training (Masterclass) for two key individuals from each island to enhance their skill base in the UK at Environment Systems offices</p> <p>1.4 Workshop 3: Training in modelling for opportunity mapping and ecosystem service resilience, stakeholder awareness event in policy.</p> <p>Output 2: Participants have access to the tools / data / equipment required</p> <p>2.1 Satellite imagery sourced and processed and supplied to BVI and TCI; mapping produced for multiple dates supported by existing and new data</p> <p>2.2 Purchase of hardware to allow TCI and BVI to plan for using Sentinel data</p> <p>2.4 Produce timeseries of maps for before and after hurricane Irma and Maria showing diversity maps of terrestrial areas and key shallow water marine features</p> <p>2.5 Develop and trial monitoring methods, write monitoring plan</p> <p>2.6 Create ecosystem service and opportunities maps to identify priority areas/habitats</p>			

for restoration post hurricane to maximise natural protection  
2.7 Write methodology reports and workbooks to allow the ecosystem service and opportunity maps to be re-created as part of future monitoring

Output 3: Participants have access to the equipment required for on-going mapping and monitoring of the islands

3.1 Capital items listed under project application purchased and delivered successfully by December 2018.

## Annex 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
<p><b>Impact:</b></p> <p><i>The role biodiversity and ecosystem services play in mitigating natural disasters, are further integrated and strengthened in planning and development activities in marine and terrestrial areas of BVI and TCI.</i></p>		<p>The project has successfully upskilled staff within relevant government departments in BVI and TCI to use remote sensing and GIS to take an evidence-based approach to making environmental management decisions. There is evidence of beneficiaries using these techniques to make evidence-based environmental management and policy decisions, including planning and development activities in BCI and TCI. As would be expected, this kind of behaviour change takes time, and these are still emerging outcomes. There is still work to be done to embed these as routine parts of decision-making in BVI and TCI, and ensure that remote sensing and GIS methods are being used to the fullest possible extent.</p>
<p><b>Outcome:</b></p> <p><i>Partners now routinely use tools and data to generate knowledge on spatial attributes of biodiversity and natural capital, improving the evidence base for planning and policy decisions on the islands.</i></p>	<p>0.1 Plans developed to integrate this new type of spatial mapping into policy decisions to help improve marine and terrestrial conservation, protection of key resources and integrated planning on both BVI and TCI.</p> <p>0.2 Key ecosystem services identified and mapped for each island's priority to allow sustainable use of terrestrial and marine environments by the end of the project.</p> <p>0.3 Monitoring plan agreed for both islands to use remote sensing (RS) to update maps both systemically and after future extreme events by the end of the project.</p> <p>0.4 TCI set up a GIS working group or similar support mechanism for inter-departmental collaboration (BVI already have one) by the end of the project.</p>	<p>There is ample evidence to show that the outcome has been achieved across the indicators for the main project outcome. As noted in the assumptions in the logframe, the extent to which these outcomes will lead to long-term change in the way that evidence is used to make management and policy decisions about biodiversity and natural capital on the islands will depend on staff turnover remaining low, staff within organisations passing on knowledge and expertise to colleagues and having the time to reinforce, apply and take further their expertise.</p> <p>As a result of upskilling, key ecosystem services have been identified and mapped (indicator 0.2) by project beneficiaries, as part of case studies carried out during the project, and through subsequent, post-project activities. Further evidence is presented in section 3.2 of this report and annex two and four.</p> <p>All of the 'key participants' interviewed during the final evaluation identified that they are now using more remote sensing and GIS techniques in their work than they had been previously (indicator 0.5). Details of these uses have been included in the case studies included in the final evaluation report in Annex 2. At the same time, it was acknowledged that more could be done to share this information more widely within departments.</p> <p>There is ample evidence that these spatial mapping approaches have been used to improve marine and terrestrial conservation, protecting key resources and taking into account environmental sensitivity in planning processes in BVI and TCI (indicator 0.1). Evidence of decisions that have already been taken with the support of data derived from remote sensing and GIS have been provided in section 3.2 and in the case studies that have been included in Annex 2 and 4.</p>

	<p>0.5 Workshop participants report increase in use of RS within their organisation against baseline data collected at the initial workshop. Target: 80% of participants report an increased use of RS/GIS since the first training event.</p>	<p>A detailed technical monitoring plan (indicator 0.3) was produced for BVI under this project and is attached in Annex 3 of the supplementary evidence.</p> <p>For TCI a detailed 'living' terrestrial habitat map was produced by JNCC as a project partner. This will be used to support conservation monitoring and provide firm evidence for policy development and planning. The 'living maps' concept allows for the habitat map to be refined using ecological knowledge over time, so that misclassifications can be corrected, and any changes to the landscape recorded. The most recent version of the map has been made available to the TCI Department of Environment and Coastal Resources (DECR) and the process of creating and updating the map has been documented in a full report published by JNCC</p> <p><a href="https://hub.jncc.gov.uk/assets/ba26b0c2-f7e6-40ee-a0f3-fb6eabed60e9">https://hub.jncc.gov.uk/assets/ba26b0c2-f7e6-40ee-a0f3-fb6eabed60e9</a></p> <p>By the end of the project there does not appear to be a GIS/EO working group set up in TCI and there is the potentially greater risk of skills being lost here than in BVI. Future efforts should focus on fostering peer-to-peer support in both territories (Indicator 0.4).</p>
<p><b>Output 1:</b> <i>Participants in the project are trained to develop the knowledge and skills necessary to effectively use the tools required</i></p>	<p>1.1 Staff trained via 3 workshops and 1 UK training event. Six core participants attending all four workshop sessions by the end of the project and a total of 20 people attending at least one workshop sessions.</p> <p>1.2 Training in ground control data methods to support remote sensing mapping delivered during the first two on-island workshops to a total of 20 people.</p> <p>1.3 Mapping methods to inform sustainable development policies and practices using RS data are developed and implemented by the end of the project.</p>	<p>Attendance data indicates that 23 people in total attended at least one workshop session and six core participants attended all four workshops (indicator 1.1 and indicator 1.2, see baseline and final evaluation in Annex 2).</p> <p>The workshops were identified as a successful way of upskilling project beneficiaries, with in excess of 90% of participants in each of the initial TCI and BVI workshops reporting that their knowledge and skills at remote sensing and GIS have improved as a result of the workshop. All of the 'key participants' (who attended all workshops) interviewed during the final evaluation reported that they were both better able to use these techniques in their own work at the end of the project (indicator 1.4) as a result of this upskilling.</p> <p>As a result of the upskilling, mapping has been carried out which can be used to inform sustainable development activities across the two islands (indicator 1.3). The nature of some of these outputs has been outlined in section 3.2 and the final evaluation report in Annex 2.</p>

	1.4 Participants' RS knowledge and skills increase. Baseline data was collected at the initial workshop via a knowledge test. Target: 80% demonstrate an improvement in score following workshop attendance as well as self-reporting of increased skill.	
Activity 1.1: Workshop 1; Use of remote sensing and modelling in Arc GIS and open-sourced software including shallow water marine, training in ground truth data collection		Supplementary evidence of the workshop is located here: DPlus081_Final_Report_Evidence_Supplements\Annex_1_Workshops_Masterclasses\First_Woprkshop_BVI_December_2018
Activity 1.2: Workshop 2; Training in monitoring methods, design of monitoring strategies		Supplementary evidence of the workshop is located here: DPlus081_Final_Report_Evidence_Supplements\Annex_1_Workshops_Masterclasses\Second_Workshop_TCI_March_2019
Activity 1.3: UK training; Detailed training (Masterclass) for two key individuals from each island to enhance their skill base in the UK at Environment Systems offices		The project initially aimed to train only four staff members from partner organisations during the masterclass in Aberystwyth in May 2019. However, due to efficient use of the travel budgets it was possible to have six individuals in attendance, representing a 50% increase on the initial target.  Supplementary evidence of the workshop is located here: DPlus081_Final_Report_Evidence_Supplements\Annex_1_Workshops_Masterclasses\GIS_Masterclass_Aberystwyth_May_2019
1.4 Workshop 3: Training in modelling for opportunity mapping and ecosystem service resilience, stakeholder awareness event in policy.		Supplementary evidence of the workshop is located here: DPlus081_Final_Report_Evidence_Supplements\Annex_1_Workshops_Masterclasses\Final_Workshop_February_2020
<b>Output 2:</b> <b><i>Participants have access to the data required for on-going mapping and monitoring of the islands</i></b>	2.1 BVI and TCI supplied by December 2018 with every usable (cloud-dependant) Sentinel 2 scene over terrestrial and marine environments on BVI and TCI from 2017 and 2018 processed to analysis ready status.	Indicator 2.1: DPlus081_Final_Report_Evidence_Supplements\Annex_5_Data_and_Equipment\Satellite_Imagery  Indicator 2.2.: See section 3.1 of this report.

	<p>2.2 BVI and TCI have on-going access (beyond end of the project) to Sentinel-2 data for continuing mapping and monitoring of the islands.</p>	
<p><b>Output 3.</b>  <i>Participants have access to the equipment required for on-going mapping and monitoring of the islands</i></p>		<p>Please see section 3.1 of this report as well as evidence of purchases in Annex 5 of the supplementary evidence.</p>

## Annex 3 Standard Measures

Code	Description	Totals (plus additional detail as required)
<b>Training Measures</b>		
1	Number of (i) students from the UKOTs; and (ii) other students to receive training (including PhD, masters and other training and receiving a qualification or certificate)	N/A
2	Number of (i) people in UKOTs; and (ii) other people receiving other forms of long-term (>1yr) training not leading to formal qualification	6
3a	Number of (i) people in UKOTs; and (ii) other people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	23
3b	Number of training weeks (i) in UKOTs; (ii) outside UKOTs not leading to formal qualification	In UKOTs: 3 Outside UKOTs: 1
4	Number of types of training materials produced. Were these materials made available for use by UKOTs?	Four sets of workshop slides and accompanying manuals were provided to UKOT partners.
5	Number of UKOT citizens who have increased capacity to manage natural resources as a result of the project	23
<b>Research Measures</b>		
9	Number of species/habitat management plans/ strategies (or action plans) produced for/by Governments, public authorities or other implementing agencies in the UKOTs	1 "Preliminary Status Analysis for Likely New Endemic Orchid Taxon in Turks and Caicos Islands" (Annex_4_Partner_Work_Examples\BNManco)
10	Number of formal documents produced to assist work in UKOTs related to species identification, classification and recording.	0
11a	Number of papers published or accepted for publication in peer reviewed journals written by (i) UKOT authors; and (ii) other authors	0
11b	Number of papers published or accepted for publication elsewhere written by (i) UKOT authors; and (ii) other authors	0
12b	Number of computer-based databases enhanced (containing species/genetic information). Were these databases made available for use by UKOTs?	0

13a	Number of species reference collections established. Were these collections handed over to UKOTs?	0
13b	Number of species reference collections enhanced. Were these collections handed over to UKOTs?	0
<b>Dissemination Measures</b>		
14a	Number of conferences/seminars/workshops/stakeholder meetings organised to present/disseminate findings from UKOT's Darwin project work	1 <a href="http://events.cieem.net/Events/EventPages/31052019000000ProvidinganEvidenceBaseforConservationintheUKsOverseasTerritories.aspx">http://events.cieem.net/Events/EventPages/31052019000000ProvidinganEvidenceBaseforConservationintheUKsOverseasTerritories.aspx</a>
14b	Number of conferences/seminars/workshops/stakeholder meetings attended at which findings from the Darwin Plus project work will be presented/ disseminated	1 <a href="http://events.cieem.net/Events/EventPages/31052019000000ProvidinganEvidenceBaseforConservationintheUKsOverseasTerritories.aspx">http://events.cieem.net/Events/EventPages/31052019000000ProvidinganEvidenceBaseforConservationintheUKsOverseasTerritories.aspx</a>
<b>Physical Measures</b>		
20	Estimated value (£s) of physical assets handed over to UKOT(s)	
21	Number of permanent educational/training/research facilities or organisation established in UKOTs	N/A
22	Number of permanent field plots established in UKOTs	N/A
23	Value of resources raised from other sources (e.g., in addition to Darwin funding) for project work	N/A



## Annex 4 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. weblink, contact address, annex etc)
Report	JNCC Report No. 664, Darwin Plus 081 Project "Using Earth Observation to map terrestrial habitats of the Turks and Caicos Islands", Jones, G. and Lightfoot, P., July 2020	British	British	Female	JNCC, Peterborough	<a href="https://hub.jncc.gov.uk/assets/ba26b0c2-f7e6-40ee-a0f3-fb6eabed60e9">https://hub.jncc.gov.uk/assets/ba26b0c2-f7e6-40ee-a0f3-fb6eabed60e9</a>

## Annex 5 Darwin Contacts

<b>Ref No</b>	DPLUS 081
<b>Project Title</b>	Mapping for evidence-based policy, recovery and environmental resilience
<b>Project Leader Details</b>	
Name	Dr Johanna Breyer
Role within Darwin Project	Lead organisation project manager
Address	[REDACTED]
Phone	[REDACTED]
Email	[REDACTED]
<b>Partner 1</b>	
Name	Lormeka Williams
Organisation	Department of Environment and Coastal Resources (TCI)
Role within Darwin Project	Co-investigator
Address	[REDACTED]
Skype	
Email	[REDACTED]
<b>Partner 2</b>	
Name	Nancy Pascoe
Organisation	National Parks Trust of the Virgin Islands (BVI)
Role within Darwin Project	Co-investigator
Address	[REDACTED]
Email	[REDACTED]
<b>Partner 3</b>	
Name	Dr Gwawr Jones
Organisation	JNCC
Role within Darwin Project	Co-investigator
Address	[REDACTED]
Email	[REDACTED]