



Darwin Plus (DPLUS 065) Mapping the Falklands & South Georgia coastal margins for spatial planning (Coastal Mapping)

Darwin Plus: 2019 Annual Report



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Cover image top: *View across Yorke Bay minefield, Cape Pembroke, East Falkland. Photo Credit: Neil Golding © SAERI, 2018*

Cover image bottom: *Bird Island, South Georgia, as mapped by the DPLUS065 Coastal Habitat Mapping project. © SAERI, 2019*

Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

Important note *To be completed with reference to the Reporting Guidance Notes for Project Leaders:
it is expected that this report will be about 10 pages in length, excluding annexes*

Submission Deadline: 30th April 2019

Darwin Plus Project Information

Project reference	DPLUS065
Project title	Mapping Falklands and South Georgia coastal margins for spatial planning
Territory(ies)	Falkland Islands, South Georgia
Contract holder institution	SAERI
Partner institutions	Oregon State University, Joint Nature Conservation Committee, Shallow Marine Surveys Group Ltd, Falkland Islands Government, Government of South Georgia & the South Sandwich Islands.
Grant value	£278,696
Start/end date of project	April 2017 – March 2020
Reporting period (e.g., Apr 2018-Mar 2019) and number (e.g., AR 1,2)	AR2 1 st April 2018 - 31 st March 2019
Project leader name	Dr Paul Brickle
Project website/blog/Twitter	http://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/ #SouthAtlanticCoastalMapping @SAERI_FI (Twitter) @S4ERI (Facebook)
Report author(s) and date	Neil Golding & Bran Black

2. Project overview

The coastal and inshore marine ecosystems and resources of the Falkland Islands and South Georgia (**Figure 1.1**) play an important role in these two United Kingdom Overseas Territories (UKOTs). From their historical role as a safe harbour, source of food, and forage for livestock, to their present importance for fishing and wildlife-based tourism revenues, the diverse range of ecosystem services provided by the coast and the sea defines these islands. Knowledge of these coastal environments is essential for their effective conservation and management, and yet they have been subject to little regional study. In summary, comprehensive island wide broad scale and fine scale coastal habitat maps, which would form an important baseline (from which to measure future change for example), are lacking. This project aims to fill this critical gap in coastal knowledge.

This project seeks to use freely available Earth Observation (EO) data (primarily in the form of Sentinel-2 medium resolution satellite imagery) along with other relevant data layers to develop broad-scale (Stage 1) coastal habitat (land cover) models/maps, using machine-learning techniques on the Google Earth Engine platform. Where there are significant uncertainties in habitat classifications, or where stakeholders deem it a priority (from a spatial and/or temporal perspective), fine-scale (Stage 2) coastal habitat models/maps will be developed. These will be based on very high-resolution satellite imagery (e.g. World View 2-4) or very high resolution aerial imagery gathered using drone technology. The resultant ‘satellite-derived’ coastal habitat maps, a ‘first’ for both the Falkland Islands and South Georgia, will form an effective baseline against which to monitor change, providing a sound basis for planning, decision making and future monitoring.

A key part of the project, over and above the coastal habitat modelling/mapping, is the establishment of methods and systems for the Islands to allow these maps to be updated in the years to come. This latter part (the projects legacy) will be critical to ensure that future monitoring of the Falklands (**Figure 1.2**) and South Georgia (**Figure 1.3**) coastal habitats can continue after this project has ended.



Figure 1.1: Location of the Falkland Islands and South Georgia in the South Atlantic. Map projection World Robinson

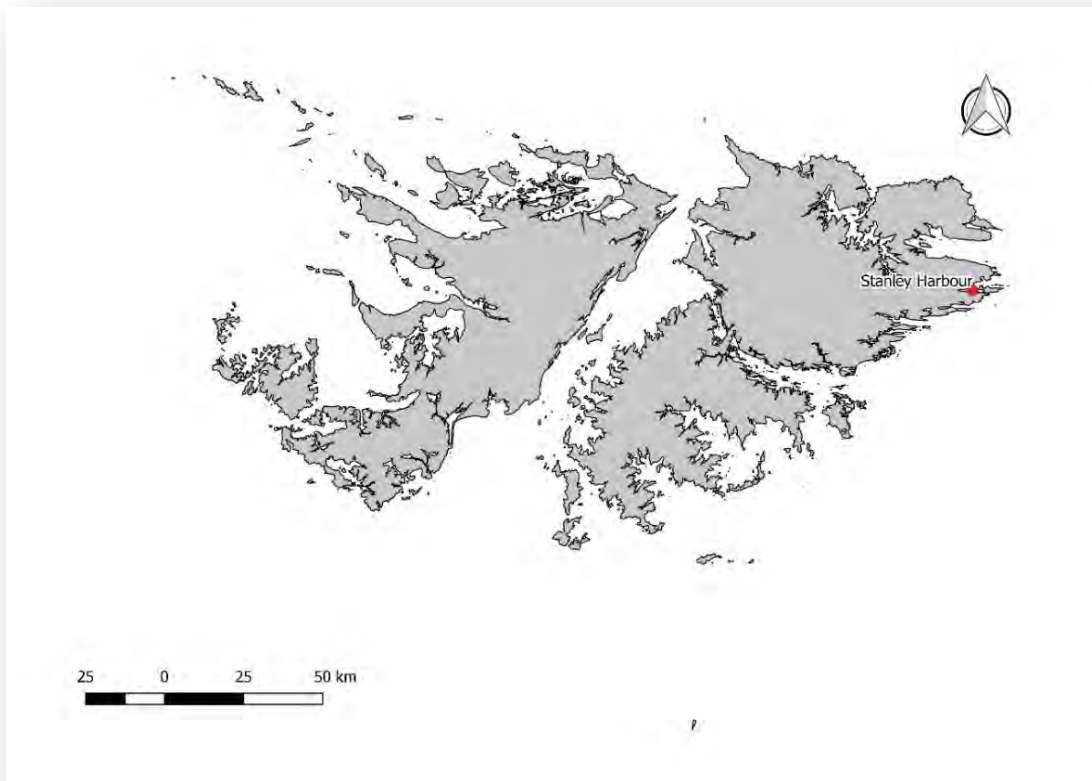


Figure 1.2: Falkland Islands, South Atlantic. The location of Stanley is indicated with a red dot. Map projection WGS84 UTM 21S

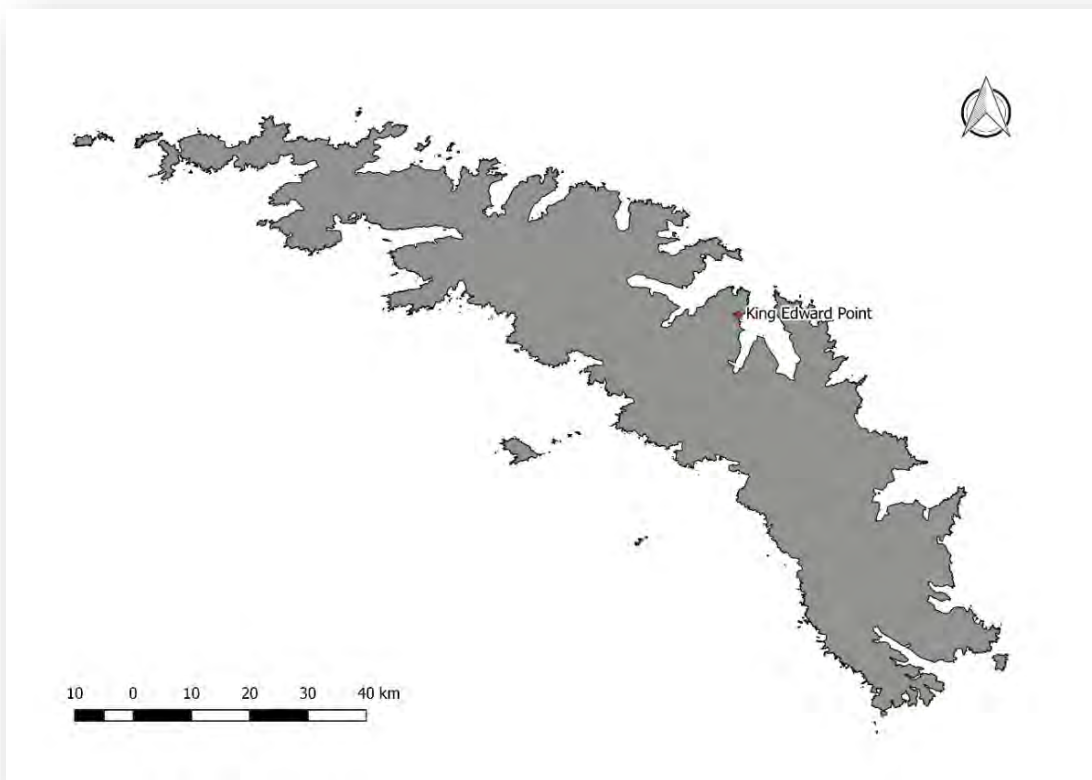


Figure 1.3: South Georgia, South Atlantic. The location of King Edward Point research station is indicated with a red dot. Map projection WGS84 South Georgia Lambert

3. Project stakeholders/partners

The project partners (**SAERI, Oregon State University (OSU), Falkland Islands Government (FIG), Government of South Georgia & the South Sandwich Islands (GSGSSI), Shallow Marine Surveys Group (SMSG) and Joint Nature Conservation Committee (JNCC)**) form the Project Management Group (PMG). The PMG meets quarterly to monitor and steer the project, ensuring it aligns with the project proposal document, and to ensure it delivers its outputs on time, and on budget. In this reporting year, there have been four PMG meetings. The PMG Terms of Reference and Approved Minutes are available from the Coastal Habitat Mapping project webpage, under the Document Download Area (<https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>). Note that due to the month-long South Georgia Coastal Habitat Mapping expedition in February/March 2019, the FY18/19 Q4 PMG meeting was pushed back until 5th April 2019. However, this has now been held and the minutes from the meeting are in the process of being finalised; they will be made available on the project website in due course.

The 2018/19 reporting year has been an exceptional year for the project from a stakeholder engagement perspective, and this has resulted in a significant amount of stakeholder support, as well as opportunities to discuss and implement unique collaborations (for example, the minefield mapping collaboration with SafeLane Global and the UK Foreign & Commonwealth Office). This year, **Falkland Islands Government (FIG)** and the **Government of South Georgia & the South Sandwich Islands (GSGSSI)**, both primary stakeholders who will utilise the project outputs as well as project partners, have remained heavily involved in the project. The project has received financial support through the FIG Environmental Studies Budget. GSGSSI supported the project through the planning process for the 2019 South Georgia field expedition, including facilitating with the permitting process to enable drones to be used on South Georgia to collect very high-resolution aerial imagery in non-visitor sites and waiving visitor landing fees for the project participants during the expedition.

Biannual Project Stakeholder Group (PSG) meetings have been held; minutes and presentations are available on the project website¹. One of these meetings took the form of a workshop. Two workshops were held, one for each Territory (Falkland Islands & South Georgia), and these formed a valuable mechanism by which Stakeholders could direct progress with the fine-scale mapping element of the project, through highlighting their priorities at the workshop. These workshops are discussed in more detail in Section 3.1.

Further details of notable engagement with stakeholders is provided below, with evidence where relevant.

Falklands Conservation (FC)

FC is a key project stakeholder, who provided a letter of support during the project proposal stage. There are clear synergies between Falkland Conservation's priorities and those of the project. **Katherine (Frin) Ross**, who runs the Habitat Restoration project at FC, has a seat on the PSG, and participated in the stakeholder prioritisation workshop. The project has actively engaged the Falklands Watch Group. The Watch Group is a youth group based in Stanley, run by the Falklands Conservation Community Outreach Officer. The Watch Group undertook a coastal habitat mapping exercise organised by the DPLUS065 Project Manager (PM) on Sat 24th November 2018 (**Figure 2.1**), and a second follow up exercise with Nicole Durfee (Shackleton Scholar) and the PM on Sat 1st December 2018.

The project was also involved in collecting a baseline aerial imagery dataset for the Port Howard Nature Area (PHNA) in West Falkland. This is a new area which has been fenced off from livestock and will be subject to habitat restoration as part of the FC project. The PM flew a drone mapping mission over the PHNA at an elevation of 50m (**Figure 2.2**) which resulted in the

¹ <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>

production of a 3D model and a high resolution orthomosaic of the PHNA. This latter dataset has been shared with FC, and will provide an essential baseline for FC to detect future change in vegetation cover. The data will also be fed into the fine-scale habitat mapping workflow to develop a fine-scale habitat model for the area.



Figure 2.1: The DPLUS065 team getting the Falklands Conservation Watch Group involved in some habitat mapping ground validation.

British Antarctic Survey (BAS)

BAS are a relevant stakeholder, particularly with respect to the South Georgia element. **Adrian Fox, Head of Mapping and Geographic Information Centre** has a seat on the PSG, and has contributed to various PSG meetings as well as the South Georgia fine-scale mapping prioritisation workshop on 9th August 2018. Adrian Fox has a wealth of knowledge, particularly around aerial imagery, and was able to contribute to discussions around the Falklands 1956

aerial imagery geo-referencing in particular. The PM also liaised with Adrian to facilitate the input of the South Georgia broad-scale habitat map into the SG GIS system.

The PM has also liaised with **Susie Grant** from BAS, who leads the DPLUS069 project ([Building data resources for managing the SGSSI Marine Protected Area](#)), which led to the PM giving a presentation about the DPLUS065 Coastal Habitat Mapping project at a DPLUS069 workshop in Cambridge, UK in December 2018 (**Figure 2.3**). The workshop was titled *Developing a Research and Monitoring Plan for the South Georgia and South Sandwich Islands Marine Protected Area* (**Figure 2.3**).



Figure 2.2: Baseline mapping at the Port Howard Nature Area with project stakeholder, Falklands Conservation.



Figure 2.3: Presenting an update on the DPLUS065 project at the DPLUS069 workshop: *Developing a Research and Monitoring Plan for the South Georgia and South Sandwich Islands Marine Protected Area*

International Association of Antarctica Tour Operators (IAATO)

The project has engaged with **IAATO**, specifically its **Executive Director, Damon Stanwell-Smith**. Damon participated in the South Georgia Stakeholder Prioritisation Workshop held on

9th August 2018. All commercial tourist vessels, which visit South Georgia, are required to be members of IAATO to ensure the highest standards of visitor management and compliance are followed, and transparency in decision-making is essential to the relationship between GSGSSI and IAATO. As a key stakeholder in South Georgia's natural environment and involved in South Georgia's rapidly expanding cruise tourism industry, receiving IAATOs input into the prioritisation process was of critical importance to the project. Additionally, GSGSSI does not permit tourists to fly drones at South Georgia, therefore engagement with IAATO vessels during fieldwork was essential to explain why this project was allowed to use drones under strict permitting conditions when other visitors to the islands are not able to do so.

UN Environment World Conservation Monitoring Centre (WCMC)

The PM has continued to liaise with **Edward Lewis** from the WCMC this reporting year. WCMC were contract by project partner GSGSSI to develop a suite of Terrestrial Protected Areas for South Georgia. The data needs of the WCMC in light of this work are closely aligned to that data being generated through the DPLUS065 project. For this reason, WCMC were invited to participate in the South Georgia fine-scale stakeholder prioritisation workshop in August 2018, where Edward Lewis made a valuable contribution to proceedings. Once again, developing these relationships with stakeholders really highlights the impact that the DPLUS065 project outputs will have upon completion.

UK Foreign & Commonwealth Office (FCO) and SafeLane Global

It became apparent during the Falklands fine-scale mapping stakeholder prioritisation workshop held in August 2018 that there was significant interest among stakeholders in the habitat recovery of the minefields from the 1982 conflict following the demining process. These minefields had lain almost untouched for 35 years. The Darwin + Coastal Habitat Mapping project provided an opportunity to map these areas prior to the demining process, allowing the project to capture a baseline of what these pristine habitats looked like, so that future change could be monitored. The PM realised that there was an opportunity to work with the Falklands Demining Programme (SafeLane Global and the UK FCO) to create a better product with wider utility through collaborating with these stakeholders. As part of this collaboration, prior to a drone-mapping mission being flown, SafeLane Global deployed markers (known as Ground Control Points) actually within the minefields and then took their positions and heights using specialist survey equipment. The PM could then use this information during the processing of the drone imagery to create highly accurate digital terrain models of the minefields. The digital terrain models (DTMs) have proved to be a useful addition to the work already undertaken by SafeLane as part of the demining process. This high resolution drone imagery will also be fed into the fine-scale habitat modelling process in order to develop fine-scale habitat maps for the coastal margins of the Falkland Islands (see **Annex 9**). **John Hare, Technical Director at SafeLane Global** stated that "this supplementary piece of work provides really good corroborative, and in some cases additional, data and a bench mark for the remediation of the minefield sites". The collaboration has also involved **Ross Chaloner** from the **Falkland Islands Government Public Works Department (PWD)** who provided survey and technical support.

Falkland Island landowners/farm managers

Farmers Week, a weeklong series of events and meetings held in Stanley each year in July, was an ideal opportunity to update the Falklands landowners on progress with the Coastal Habitat Mapping project. Many landowners and farmers from East and West Falkland come into Stanley for this week. There was an opportunity for the PM to make a formal presentation during this week (**Figure 2.4**) about the project. In addition, a Farmers Week Expo is also held the weekend preceding Farmers Week. This event attracts a wide-ranging audience, both young and old, and allowed the PM to explain a bit about the project in a more relaxed atmosphere, chat to landowners about how the project could benefit them, and demonstrate some of the equipment being used by the project (**Figure 2.5**). The drone simulator proved to be very popular.



Figure 2.4: Presentation by DPLUS0665 Project Manager, Neil Golding, at Farmers Week.



Figure 2.5: Getting people excited about the DPLUS065 Coastal Habitat Mapping project at the Farmers Week Expo.

A specific priority emerging from the Falklands Stakeholder prioritisation workshop was a better understanding about the distribution of invasive non-native species such as calafate. The PM has been working with the FIG Department of Agriculture (**Adam Dawes & James Bryant**) and the farm owners at Port Sussex farm to collect very high-resolution aerial imagery from drone mapping missions. Through using a drone equipped with a multispectral camera as well as a standard RGB camera, it may be possible to identify reflectance characteristics of vegetation (such as calafate) to enable it to be more accurately modelled (**Figure 2.6**). During this fieldwork, the PM was joined by the Shackleton Scholar, **Nicole Durfee** from Oregon State University (also a project partner). Nicole has considerable experience using multispectral cameras on drones, and was able to share the wealth of experience she has gained undertaking her research on rangeland habitats on the western US.



Figure 2.6: Completing drone mapping missions with a multispectral camera, focussing on calafate at Port Sussex farm.

During this reporting year, the PM has had the opportunity to meet and discuss the DPLUS065 project with a range of Falklands landowners. **Lewis Clifton**, owner of Weddell Island, participated in the Falklands fine-scale mapping stakeholder prioritisation workshop alongside other landowners such as **Mike & Phyl Rendell**, owners of Bleaker Island.

Wildlife Conservation Society (WCS)

WCS² own some of the Jason Islands to the far west of the Falklands, and are the location of globally important populations of seabirds such as the Black-Browed Albatross. The PM has continued to liaise with **Graham Harris** the WCS representative for the Falklands this reporting year, particularly around working with WCS to undertake fieldwork on Steeple and Grand Jason. While in the end, logistics meant that it was not possible for the PM to join Graham when WCS visited the Jason's to undertake fieldwork, WCS have agreed to share drone imagery from Steeple Jason, and these orthomosaics will form an important dataset for the fine-scale habitat mapping of this priority area.

Springcreek Conservation

Springcreek Conservation³ are already working with DPLUS065 project stakeholders such as Falklands Conservation and Elephant Beach Farm. The PM had the opportunity to work with

² <https://www.wcs.org/>

³ <http://www.springcreekconservation.com/>

Gifford Hickey, one of the co-founders of Springcreek during the South Georgia Coastal Habitat Mapping expedition in February/March 2019. Gifford assisted the PM to collect ground validation information on South Georgia to train the broad-scale and fine-scale habitat models being developed by the project. In addition, Gifford was the designated visual observer during the various drone mapping missions flown on South Georgia during the expedition.

South Georgia Association (SGA) and Cambridge University: Cambridge Archaeological Unit (CAU)

The SGA have been an important stakeholder this reporting year from a South Georgia perspective. As plans for the South Georgia expedition developed, the PM met with **Robert Burton** (SGA) and **Marcus Brittain** (CAU) in Cambridge on Monday 10th December 2018 to finalise the expedition planning. Further details of the South Georgia expedition are included in **Section 3.1**.

South Georgia Heritage Trust

A collaboration with SGHT this reporting year added significant value to the project. The SGHT led expedition to South Georgia, for the purposes of archaeology, provided an opportunity for crucial data to be gathered for the DPLUS065 project. Through a relatively small contribution, the PM was able to join the expedition and support the archaeological project through the collection of aerial drone imagery, while at the same time collect both ground validation information and high resolution aerial imagery in areas identified through the South Georgia stakeholder prioritisation workshop. This information is of great value to the project partners, such as GSGSSI, and will allow highly accurate fine-scale habitat models to be developed for specific areas of stakeholder interest on South Georgia (see **Annex 13** for a letter of thanks from SGHT). The PM has been instrumental in ensuring that a significant amount of outreach and awareness was generated through social media from during and after this expedition. A summary of the projects top tweets can be seen in **Table 8.1** in **Section 8**.

Iridium Communications

The PM made initial contact with Iridium Communications regarding provided satellite data support for the South Georgia expedition, in order for online drone mission planning to be undertaken whilst in extremely remote locations. From this, the PM was able to develop a strong relationship with Iridium Communications, and generate strong support for the project. This support (in the form of 4GB of satellite data, valued at over \$4,800 / £3,600) proved invaluable for ensuring that the highest quality drone imagery data could be collected at the various locations around South Georgia. In addition, Iridium provided three handsets (with complimentary calls) and three trackers for the expedition to use whilst on South Georgia.

Engagement with the wider public in the Falkland Islands

This reporting year, there has been the opportunity for the project to engage effectively with the wider public in the Falklands in a number of ways:

- **Shackleton Scholar programme of events** – The PM was successful in his application to the Shackleton Scholarship Fund application to get a drone expert down to the Falklands. The intention was to work with the community to promote how drones, when used safely, can really benefit science, education and more. The resulting series of events run by Nicole Durfee and the PM jointly was well received and well attended by the wider public. Further information can be found in **Annex 11**.
- **Falkland Girl Guides** – The PM wrote a letter of support to the **Falkland Islands Government** in support of their Environmental Studies Budget application to visit Bleaker Island to undertake some conservation orientated activities. As part of this visit, the Girl Guides collected ground validation data from Bleaker Island for inclusion in the Falklands broad-scale habitat model/map.

- **Infant & Junior School (IJS), Stanley** – The PM visited IJS in July 2018 as part of their Science Week and with his colleague, made an informative presentation on marine forests (kelp forests) which are a vitally important marine habitat around the Falklands coastline, and one of the habitats being mapped as part of DPLUS065. As part of this session, the PM was able to provide some background to the Darwin + Coastal Habitat Mapping project (see **Figure 2.7**)
- **Chamber of Commerce public talk** – The PM gave a public talk about the DPLUS065 project at the Chamber of Commerce on 27th November 2018, and there was very good attendance, despite it being a warm, sunny evening, which usually leads to reduced participation in such events. (**Figure 2.8**)



Figure 2.7: Getting involved with Science Week at Stanley Infant & Junior School.



Figure 2.8: Public Talk - presenting an update on the DPLUS065 Coastal Habitat Mapping project at the Chamber of Commerce.

Links with other Darwin projects (and other work)

The PM has fostered links with a number of other Darwin Initiative funded projects (and other relevant projects), both within and outside the Falkland Islands and South Georgia in order to share ideas, experience and data. These include:

- **DPLUS071 - Fine scaling the design of Falkland Islands Marine Management Areas.** There are a number of areas of spatial/geographic overlap with this project and DPLUS065, and the PM has been exploring efficiencies with the DPLUS071 PM regarding data collection and delivering maximum value for money. This has included sharing data for areas of overlap. In addition, the DPLUS071 project team participated in the sidescan processing workshop run during a visit by **Chris Goldfinger** from Oregon State University.
- **DPLUS069 - Building data resources for managing the SGSSI Marine Protected Area.** The PM has liaised with the DPLUS069 project regarding data sources of relevance to the Coastal Habitat Mapping project. This resulted in the PM being invited by **Susie Grant** to give a presentation about the DPLUS065 Coastal Habitat Mapping project at a DPLUS069 workshop in Cambridge, UK in December 2018 (**Figure 2.3**). The workshop was titled “*Developing a Research and Monitoring Plan for the South Georgia and South Sandwich Islands Marine Protected Area*”.
- **DPLUS083 - Soil map and online database as climate change mitigation tools.** While out on fieldwork in the Falklands, the Soils project team have also been collecting ground validation information at their sampling points using the DPLUS065 field recording pro-forma. This will be valuable information to feed into the wider habitat modelling work being undertaken. There are also clear synergies between the Soils project (focussing on below ground) and the Coastal Mapping (focussing on vegetation cover above ground). We have been discussing ways that the final outputs could be linked into the future.
- **DPLUS068 - Building foundations to monitor and conserve Falklands marine forest habitats.** The PM has been discussing options with the DPLUS068 project team to better understand how drone imagery being collected by the Coastal Mapping project may be utilised by DPLUS068, and where synergies lie.
- **DPLUS080 - Securing South Georgia's native habitats following invasive species control.** Ahead of the 2019 South Georgia field expedition, the PM contacted **Rosemary Newton** and **Colin Clubbe** at the Royal Botanic Gardens, Kew. During a skype conference, they discussed both projects, terrestrial habitat classifications in use in South Georgia and how and where drone technologies may benefit invasive species mapping. They identified synergies that could be explored in future. Data collected during the 2019 SG expedition will be of immense value to DPLUS080.
- **Global *Macrocystis* model - Alejandra Mora Soto (PhD student) – University of Oxford.** The PM has been in contact with Alejandra from University of Oxford following her enquiry about the project. Alejandra is developing a global *Macrocystis* (giant kelp) model. SAERI have shared data (kelp layer from Falklands) generated through the DPLUS065 project and are exploring ways that other information being collected (such as drone imagery) can assist Alejandra with her research, as well as exploring future collaboration ideas.

In summary, this reporting year has been extremely busy from a stakeholder engagement perspective, with plenty of interest being generated. This clearly demonstrates the relevance and impact that the DPLUS065 Coastal Habitat Mapping project is having across the Territories and beyond.

Evidence that some of the above meetings took place is in the form of written correspondence (emails etc). In order to keep this report of a manageable size, these can be provided on request.

4. Project Progress

It was noted in the last Annual Report (AR1) that due to delays in recruiting a Project Manager (PM), the project was running up to 3 months behind schedule. However, following key changes to the timings of deliverables across Work Packages and a change in spend across financial years (this was approved through the change request process - approved by Defra on 9th March 2018), the PMG can report that the project is now on track delivering on time and on budget.

4.1 Progress in carrying out project Activities

Output 1: Project Management structure and communications tools established

Summary: ALL activities planned for this reporting year have been completed.

The Memorandum of Understanding (MoU) was signed by all project partners during Q1 of FY 18/19 (**Activity 1.2**). A copy of the MoU is available on the project website (https://www.south-atlantic-research.org/wp-content/uploads/2019/04/MoU_DPLUS065_CoastalMapping_Final.pdf). In addition, a copy of the signatories to the MoU is included in **Annex 3** of this report.

Quarterly Project Management Group (PMG) meetings have been held in June 2018, September 2018 and December 2018 (**Activity 1.3**). Approved minutes can be found on the project website (<https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>). Note that due to the month-long South Georgia Coastal Habitat Mapping expedition in February/March 2019, the FY18/19 Q4 PMG meeting was delayed until 5th April 2019. However, this has now been held and the minutes from the meeting are in the process of being finalised; they will be made available on the project website in due course.

Bi-annual Project Stakeholder Group (PSG) meetings were run in April 2018, August 2018 and February 2019 (**Activity 1.4**). Approved minutes from these meetings and presentations made are available on the project website (<https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>). Note that the August PSG meeting doubled as a fine-scale habitat mapping stakeholder prioritisation workshop. Two workshops were held on the 8th August 2018 and 9th August 2018 for the [Falklands](#) and [South Georgia](#) respectively. These workshops were extremely successful, providing a clear steer for which areas the project should focus its fine-scale modelling/mapping efforts on. Presentations and reports from these workshops are available on the project website.

Regular updates have been made to the DPLUS065 Coastal Habitat Mapping project webpage, hosted by SAERI. <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/> (**Activity 1.5**). Of particular interest on the project website is the 'Latest News' section, which highlights key achievements/outputs that have been generated through the project, as well as details of project outreach. You can see the 'Latest News' section here: <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-latest-news/>

During the day to day running of the project, various project management tools are used to ensure that project outputs are achieved and assessed against measurable indicators, and delivered on budget (**Activity 1.6**). These include the use of **TRELLO**, an online (cloud-based) project management tool to ensure all members of the PMG have secure access to relevant documents, irrespective of their location. In addition, other mechanisms such as an **Issues Log** keeps track

of various issues that may arise during the project, and which may impact delivery. The latest version of the **Issues Log** is available in **Annex 6**.

Output 2: Work Package 1: Digitised 50 year old aerial imagery (FI only) - COMPLETE

Summary: ALL planned activities for this year have been completed.

In AR1, we highlighted the fact that due to the considerable number of aerial images requiring geo-referencing in this Work Package (approx. 3,688 images), and assuming it takes 5 minutes to manually geo-reference an image, it would take 8.5 weeks (assuming a 36 hour working week) to complete this task, without completing any other project work. This was not feasible, so a revised plan was required in order to deliver this output.

Through collaborative working between SAERI, its IMS-GIS data centre and Oregon State University, we have been able to deliver a digital map of 1956 aerial imagery for the Falkland Islands. The digital map can be seen on the DPLUS065 Coastal Habitat Mapping webGIS https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fj_coastal_hab_map_wu_rem (ensure the 1956 Aerial Imagery box is checked) (**Activity 2.2, 2.3 & 2.4**). On the webGIS, you can see the extent of every 1956 black and white aerial image. An example can be seen in **Annex 7**. This output was achieved by using innovative techniques developed by the SAERI IMS data centre, who wrote a script to automate the image geo-referencing process; the script will be run for each aerial image (loaded on the WebGIS) when requested by an end user.

This Work Package can now be considered complete.

Output 3: Work Package 2 - Object based image analysis and habitat modelling of the coastal margin (FI and SG) - COMPLETE

Summary: ALL planned activities for this year have been completed.

The work undertaken for Work Package 2 in this reporting period primarily involved Oregon State University (OSU) and SAERI. Following on from the successful testing of the broad-scale habitat mapping using a cloud-based system (Google Earth Engine) for South Georgia (reported in AR1), the classification was further developed, through the testing of other variables and data layers, before agreeing on a final suite of classification inputs (**Activity 3.3**). Further evidence of the broad-scale (Stage 1) habitat classification development process is detailed in **Annex 8**. A final broad-scale habitat map (with terrestrial and shallow coastal water components) was delivered to the project partner - Government of South Georgia & the South Sandwich (GSGSSI) - at the end of July 2018 (**Activity 3.4**) (see **Figure 3.1.1**). Further example maps can be seen in **Annex 8**. These broad-scale mapping outputs were well-received by GSGSSI, and were subsequently presented by them at the annual South Georgia Government's Stakeholder Event, hosted by the Foreign & Commonwealth Office in London (**Figure 3.1.2**). The South Georgia broad-scale habitat maps are also now available online to the wider public via the South Georgia Geographical Information System website (<https://www.sggis.gov.gs/>) (**Activity 3.5**) (**Figure 3.1.3**).

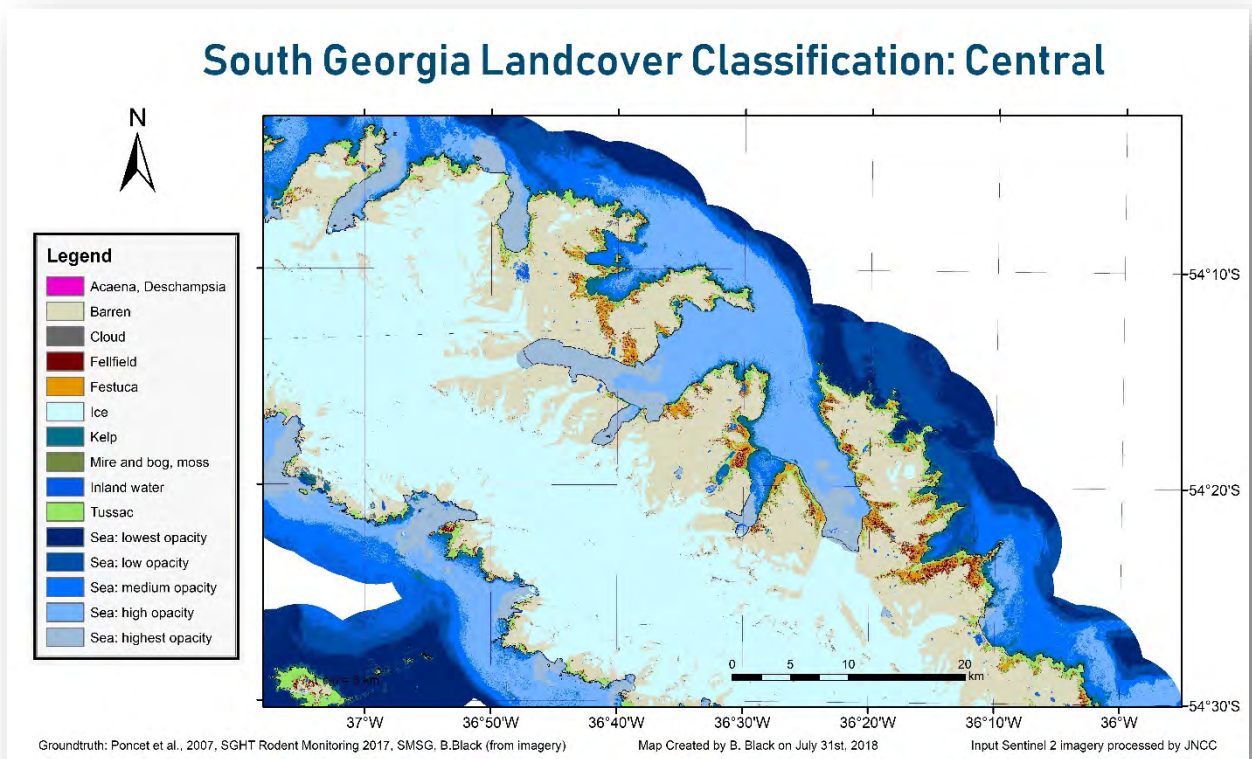


Figure 3.1.1 – The broad-scale (Stage 1) habitat model/map showing the central area of South Georgia. Further maps can be seen in **Annex 8**.



Figure 3.1.2 – showcasing of the new South Georgia broad-scale habitat model/map at the Foreign & Commonwealth Office hosted South Georgia Stakeholder workshop.

A final broad-scale (Stage 1) habitat model/map was also delivered to the Falkland Islands Government in October 2018 (**Activity 3.4**). This final output was then made available to the wider public on a bespoke DPLUS065 Coastal Habitat Mapping project webGIS hosted by the SAERI IMS-GIS data centre (**Activity 3.5**)(**Figure 3.1.4**).

(https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fi_coastal_hab_map_wu_rem).

It is important to highlight here that the project was able to deliver ‘added value’ with the Falklands broad-scale habitat map. Rather than just focussing on the coastal margin, in light of the available data, it seemed feasible and appropriate to create a broad-scale habitat map for the entire Falkland Islands. This was for two reasons; firstly, extensive ground validation data was available from previous projects (including the JNCC’s CSSF-funded Natural Capital Assessment project), which could be utilised. Secondly, it was more efficient for JNCC to process the Sentinel satellite imagery for the entire extent of the Falklands, rather than just the coastal margin.

Following the production of these outputs for the Falklands and South Georgia, this Work Package is now considered complete.

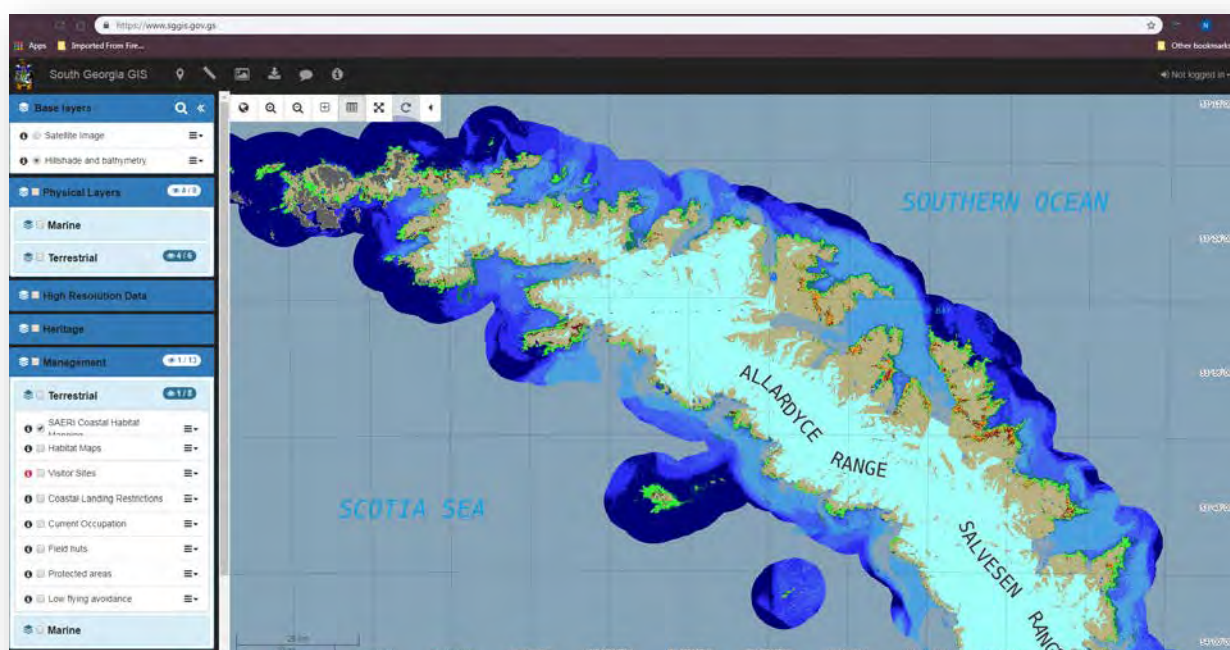


Figure 3.1.3 – The broad-scale (Stage 1) South Georgia habitat maps on the South Georgia web online mapping system.

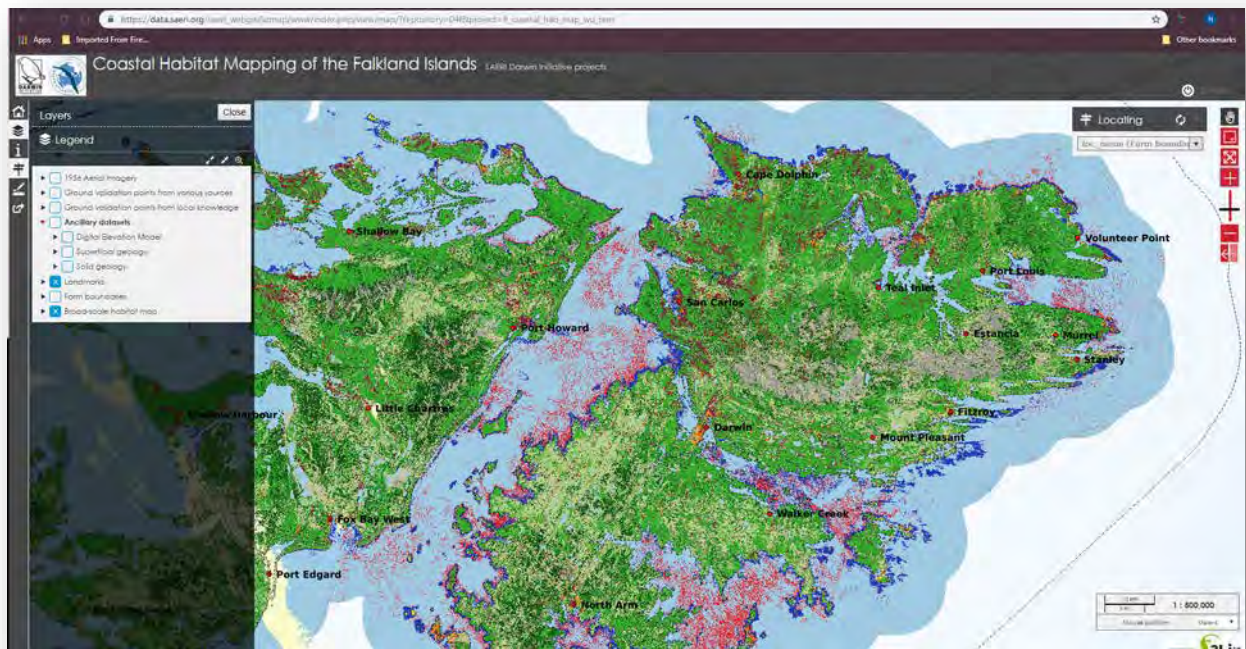


Figure 3.1.4 – The broad-scale (Stage 1) Falkland Islands habitat maps on the DPLUS065 Coastal Habitat Mapping project webGIS.

Output 4: Work Package 3 - Identification, prioritisation and fulfilment of information data needs for the systematic conservation and planning of the coastal margin for the FI and for SG

Summary: ALL planned activities for this year have been completed.

The work undertaken for Work Package 3 this year primarily involved Oregon State University (OSU), Falkland Islands Government, Government of South Georgia & the South Sandwich Islands, Joint Nature Conservation Committee (JNCC) and SAERI. Following completion of the broad-scale (Stage 1) habitat models/maps, it was important to understand where there was stakeholder demand for fine-scale habitat models, through dedicated stakeholder prioritisation workshops (**Activity 4.1 & 4.2**). In addition, these fine-scale models will also address areas of uncertainty in the broad-scale habitat maps. As stated in the previous annual report (AR1), it was agreed that different approaches should be employed for the Falklands and South Georgia stakeholder workshops. A traditional one-day workshop with ‘stakeholders round the table’ was held for Falkland Islands stakeholders on 8th August 2018 (**Activity 4.3**). However, with South Georgia stakeholders being widely distributed across many different countries, a different model was needed; material was circulated beforehand and a dedicated Skype conference at GSGSSI offices was held for views to be fed back on 9th August 2018 (**Activity 4.3**). The workshops were extremely successful, and stakeholders provided a clear mandate on their priorities. Reports from the [Falkland Islands](#) and [South Georgia](#) stakeholder prioritisation workshops are available on the project website (**Activity 4.5**), and detail workshop attendees etc.

Following a successful bid by project partner Oregon State University to the Digital Globe Foundation, high-resolution WorldView satellite imagery was made available to the project in April 2018 (**Activity 4.5**). **This initiative has added significant value to this project, as the purchase of this imagery (c. £200,000) was out of scope for the original project. With the full range of very high-resolution imagery now available through the Digital Globe grant for the Falkland Islands and South Georgia, it is envisaged that the project outputs will be even more robust.** Evidence of the Digital Globe Foundation data can be seen on the various outputs produced by the project, including the stakeholder prioritisation reports and project outreach material (**Figure 3.1.5**).



Figure 3.1.5: An example dataset provided by the Digital Globe Foundation following a successful grant application.

In light of this successful Digital Globe Foundation grant, Darwin funding originally allocated to the “*acquisition of remote sensing data and associated costs*” was put to other uses to enhance the project further and provide excellent added value. These included the acquisition of aerial/subtidal remote sensing data and the training and certification in drone-flying for the PM. This was submitted to Darwin as a change request on 11th May 2018 and approved by Darwin on 21st May 2018.

Throughout this reporting period, a significant amount of aerial drone imagery data has been collected from within the Falkland Islands. This was from priority locations selected by stakeholders during the Falklands stakeholder prioritisation workshop (**Activity 4.5**). During this time, the project has worked collaboratively with other local stakeholders and organisations, such as Falklands Conservation (**Figure 2.2**) and the Falklands Demining Programme (SafeLane Global and UK Foreign & Commonwealth Office) (**Figure 3.1.6 & Annex 9**). This very high-resolution drone imagery has been processed to create three-dimensional models, digital elevation models and orthomosaics (**Activity 4.6 & 4.7**) (as shown in **Annex 9**), the latter will be fed into the fine-scale habitat modelling workflow. Other areas that have been a priority include the mapping and modelling the invasive plant calafate, where the project has been working with the Falkland Islands Government Department of Agriculture.



Figure 3.1.6: Collaborating with SafeLane Global and the UK Foreign & Commonwealth Office: Falklands Demining Programme

A significant amount of ground validation data has been collected for the Falklands this reporting year (see **Figure 3.1.7**). This is in addition to those ground validation points that have been created through the use of WorldView and other satellite imagery available on platforms such as Google Earth. To aid the collection of high quality and robust ground validation data, SAERI has developed a bespoke field recording form as an Android smartphone app, based on Open Data Kit (ODK) app available for Android smartphones (**Figure 3.1.8**). This has significantly improved the efficiency and accuracy of the ground validation phase of the project (**Activity 4.8**).

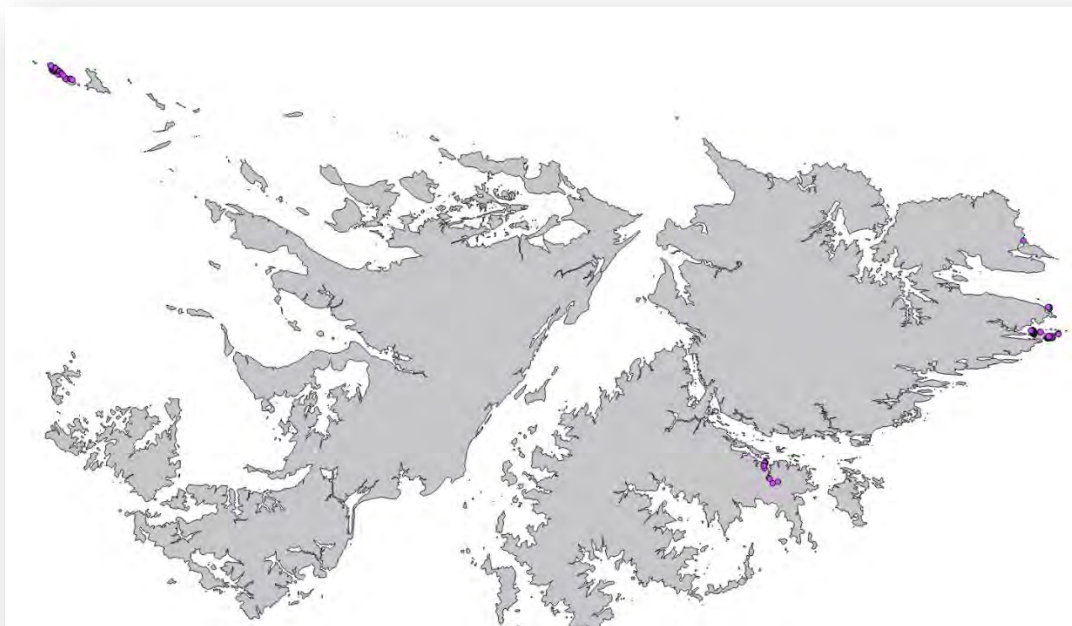


Figure 3.1.7: Ground validation points on the Falkland Islands collected using the SAERI developed ODK smartphone field recording app.



Figure 3.1.8: The SAERI ODK field recording app

SAERI collaborated with the South Georgia Heritage Trust and Cambridge University Archaeological Unit and others on an expedition to South Georgia, which departed Stanley on 23rd February 2019. While the primary reason for the month long expedition was the South Georgia Archaeological Project, the SAERI Coastal Mapping PM joined the expedition in order to collect ground validation information and very high resolution aerial imagery from drone surveys of South Georgia (**Activity 4.5, 4.6, 4.7 & 4.8**). The Coastal Habitat Mapping element of this expedition collected 241 sample points across South Georgia (**Figure 3.1.9**) – these will be used to verify the ground cover/habitats at each of these locations, and will supplement information used to train and validate the computer models being used to create coastal habitat maps for South Georgia. A South Georgia variant of the smartphone recording app was used to collect the ground validation data during the South Georgia expedition. In addition, high-resolution drone mapping surveys were carried out in 8 locations, including Bird Island, Elsehul, Koppen Point, Jason Harbour, Start Point (Salisbury Plain), Fortuna Bay, Albatross Cove (Cooper Bay) and Gold Harbour (An example of the drone imagery collected is shown in **Figure 3.1.10 & 3.1.11**).

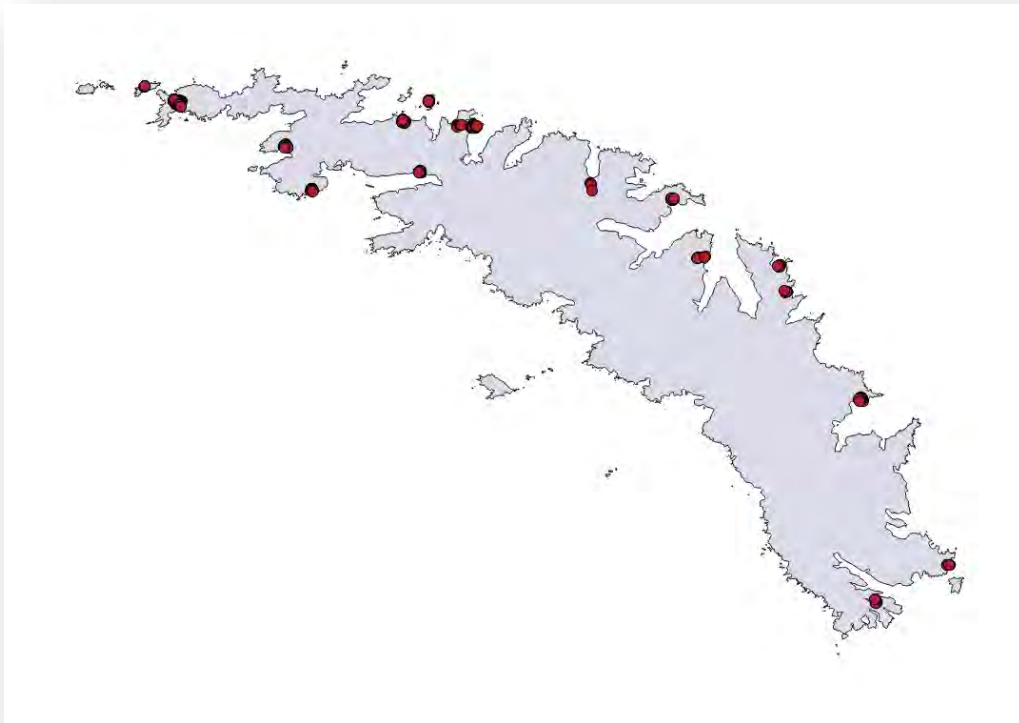


Figure 3.1.9: 241 ground validation points collected on the 2019 South Georgia expedition.

The expedition was a success. Sponsorship from Iridium Communications (in the form of satellite data as well as use of satellite handsets) was secured by the PM to allow the project to maintain a high level of social media outreach. This sponsorship from Iridium was essential for the drone mission planning, which utilised novel technology in the form of a drone mapping application, which altered the height of the drone in real time during the mapping mission with the terrain to ensure a near constant elevation above ground level, despite the mountainous terrain of South Georgia.

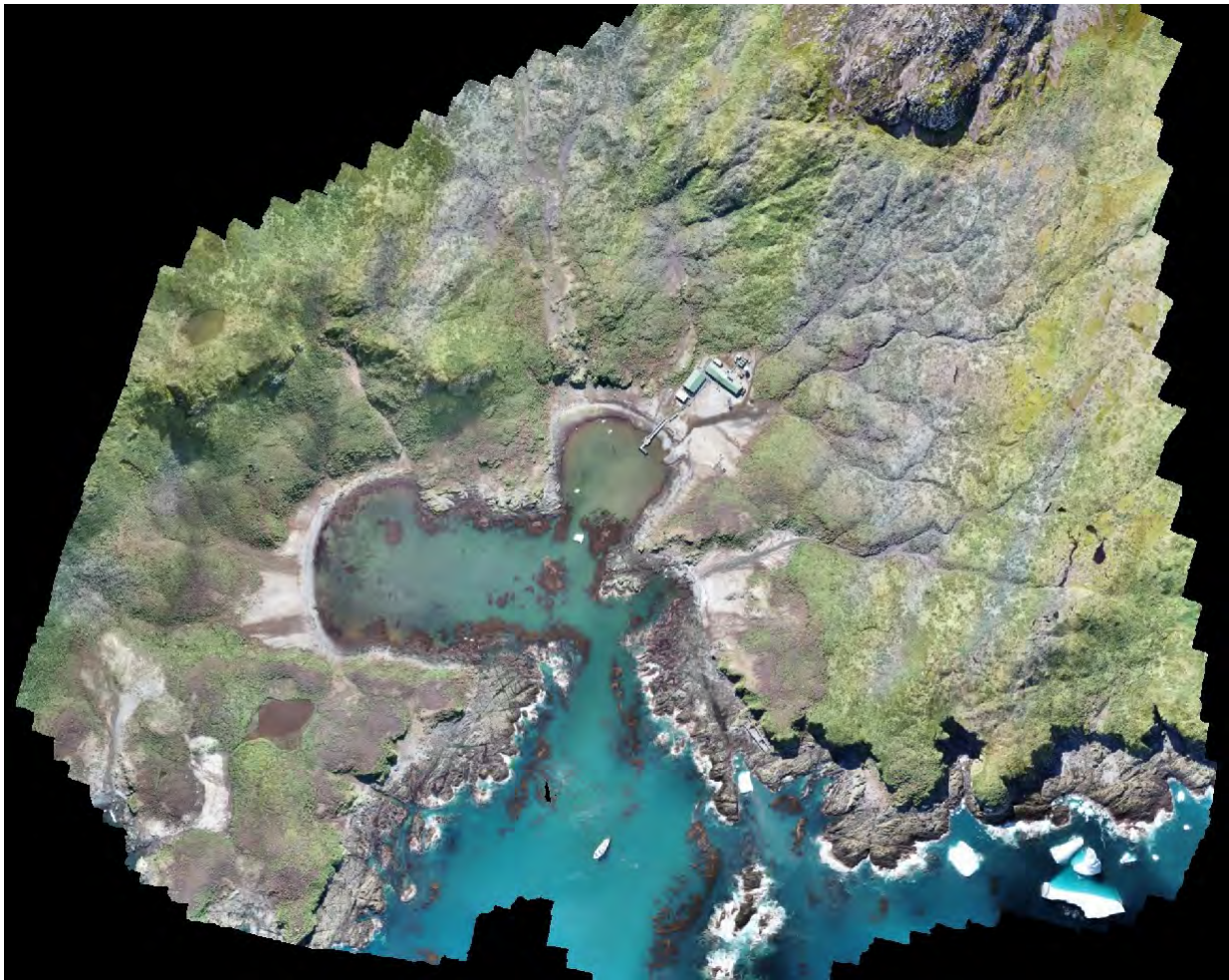


Figure 3.1.10: Bird Island mapping on the 2019 South Georgia expedition

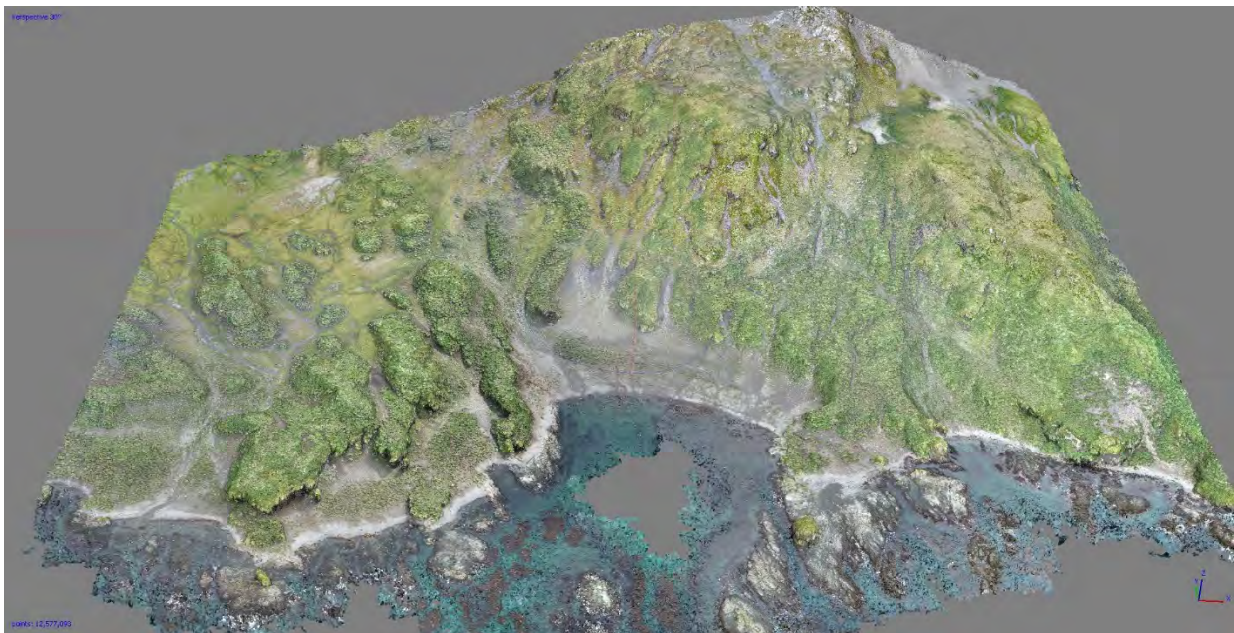


Figure 3.1.11: Albatross Cove, Cooper Bay, 3D view, from the 2019 South Georgia expedition

With respect to the subtidal mapping element, building on progress reported in AR1, several dedicated subtidal survey expeditions were completed this reporting year; a collaboration between SAERI, Shallow Marine Surveys Group (SMSG) and Oregon State University (OSU). These included side-scan sonar surveys of areas around Port William, Kidney Island (**Figure 3.1.12**) & Cochon Island and drop-camera ground validation surveys (**Activity 4.5, 4.6 & 4.7**). Dr Chris Goldfinger from OSU visited the Falklands to take part in some of these subtidal surveys, sharing his extensive knowledge of collecting side-scan imagery. In addition to the collection of survey data, Dr Chris Goldfinger ran a side-scan processing workshop for SAERI (cross-Darwin project working with DPLUS065 and DPLUS071 staff) and SMSG staff (**Figure 3.1.13**). The data collected through these sublittoral surveys will be invaluable for the sub-tidal aspects of the habitat models being developed through the project.

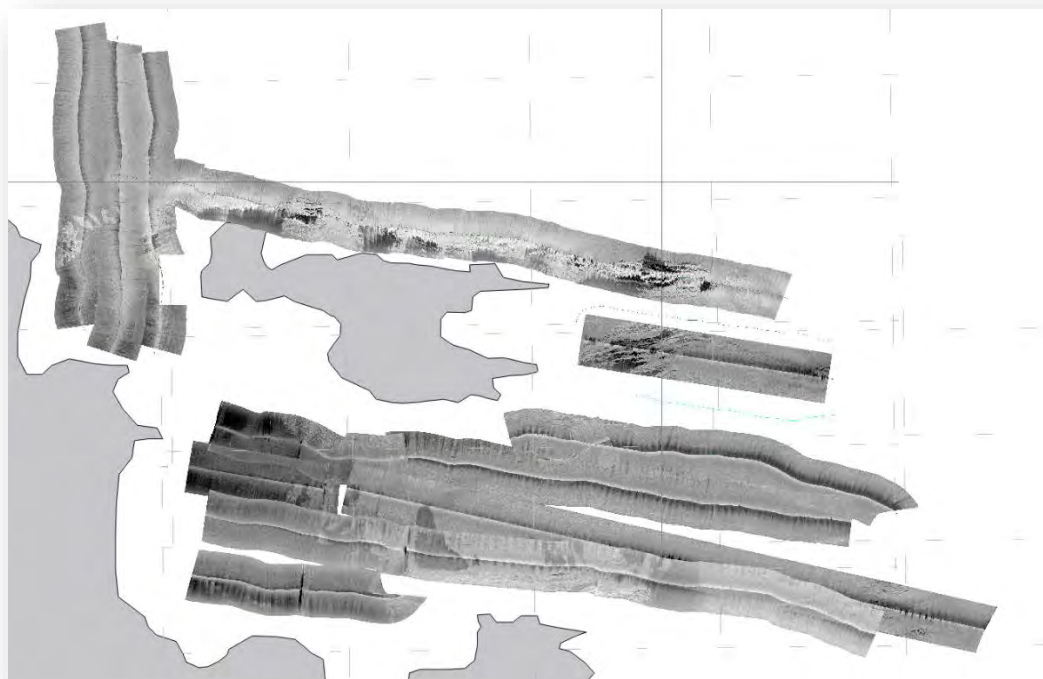


Figure 3.1.12: Side-scan survey of Kidney Island



Figure 3.1.13: Side-scan training

4.2 Progress towards project Outputs

There has been excellent progress towards achieving the project outputs. Despite earlier delays highlighted in AR1 getting a project manager in post, appropriate re-planning ensured the project got back on track. **Rigorous project controls have ensured the project remains on track and on budget to deliver its Outputs.**

Output 1 involves establishing the project management structure and communication tools. Overall progress of this Output is excellent. The baseline reported in AR1, and at the start of the second reporting year was that all work (and associated **Indicators 1.1, 1.3, 1.4 & 1.5**) was complete with the exception of a final, signed MoU (**Indicator 1.2**). This year, all relevant work has been completed as planned, including signing the MoU off by project partners (measured by **Indicator 1.2, 1.3, 1.4 & 1.5**). The indicators in use for Output 1 remain appropriate, and are measured according to the M & E plan. All (non-confidential) indicator means of verification (**1.2, 1.3, 1.4 & 1.5**) are available on the project website⁴.

Output 2 deals with the geo-referencing of 1956 aerial imagery for the Falklands – the baseline at the start of this reporting year was that a workflow had been devised to take this work forward in Year 2 but no further work has been undertaken. At the end of this reporting year, the project has delivered a digital map of 1956 aerial imagery for the Falkland Islands, thereby achieving **Indicator 2.2**. This output was achieved by using innovative techniques developed by the SAERI IMS data centre, who wrote a script to automate the image geo-referencing process; the script will be run for each aerial image (loaded on the WebGIS) when requested by an end user. Evidence of completion of this output can be seen on the Coastal Habitat Mapping webGIS (**Annex 7** & https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fj_coastal_hab_map_wu_rem - ensure the 1956 Aerial Imagery box is checked). The indicators remain appropriate, and are measured according to the M & E plan. This output can be considered complete.

Output 3 considers the development of broad-scale (Stage 1) coastal habitat maps for the Falklands and South Georgia. The baseline from the end of reporting year one (AR1) was that the first iteration broad-scale habitat map for South Georgia had been delivered. This year, a revised broad-scale ‘satellite-derived’ habitat map was delivered for South Georgia (**Figure 3.1.3**). A broad-scale ‘satellite-derived’ habitat map was also delivered for the Falkland Islands (**Figure 3.1.4**). It is important to note the added value delivered through the project; a Falklands-wide habitat map was delivered, not just a habitat map of the Falklands coastal margin. **Indicator 3.1, 3.2 & 3.3** has been achieved this year. Evidence of these outputs can be seen in **Figure 3.1.3 & 3.1.4**, and the detail is reported in **Annex 8**. The indicators in use for Output 3 remain appropriate, and are measured according to the M & E plan. This output can now be considered complete.

Output 4 deals with the identification, prioritisation and fulfilment of information data needs for the systematic conservation and planning of the coastal margin for the Falkland Islands and for South Georgia. The baseline from the end of the last reporting year was largely around the collection of ground validation. Excellent progress has been made this reporting year delivering this Output, and is on track to deliver by the end of the project. **Indicator 4.1** has been achieved: a set of successful stakeholder workshops were held (workshop reports available on the project website evidence this⁵). **Indicator 4.2** has been achieved; ground validation information has been collected from both Territories (evidenced in **Section 3.1 & Figure 3.1.7, 3.1.8 & 3.1.9**). **Indicator 4.3** has been partially achieved this year – as far as could be expected. This is outlined in Annex 8. The indicators in use for Output 4 remain appropriate, and are measured according to the M & E plan.

⁴ <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>

⁵ <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>

Output 5 involves the prioritisation of ongoing planning, protection and monitoring of the coastal margin. This output focusses on knowledge sharing and training; no work was planned under this Output in Year 2 although a draft schedule has been agreed for the training workshop (**Indicator 5.3**). The indicators proposed for Output 5 remain appropriate, and will be measured according to the M & E plan.

Output 6 deals with the integration of project outputs with existing and emerging initiatives. The baseline from the end of the last reporting year was largely around the commencement of a data initiatives review. This review (**Indicator 6.1**) was completed this reporting year. The remaining indicators relate to the final reporting year. The indicators in use for Output 6 remain appropriate, and are measured according to the M & E plan.

Output 7 considers the monitoring and evaluation of the project. The baseline at the end of the first reporting year was the achievement of **Indicator 7.1**. Progress for this Output this reporting year has been good, with **Indicator 7.2** being achieved, as evidenced through the PMG meeting minutes available from the project website¹. The indicators in use for Output 7 remain appropriate, and are measured according to the M & E plan.

4.3 Progress towards the project Outcome

This year, the project has made excellent progress to achieve the project Outcome “mapping generated from this cost-effective and innovative remote-sensing will underpin and enhance spatial and conservation planning in the remote Falkland Islands and South Georgia and allow for efficient, effective monitoring”. Considering the baseline with neither Territory having an island-wide coastal habitat map, excellent progress has been made, with a broad scale ‘satellite-derived’ habitat map being completed for both South Georgia and the Falkland Islands (see Section 3.1 – Output 3). Work is now progressing to deliver fine-scale habitat models/maps in line with stakeholder priorities by the end of the project. Following recommendations from the reviewer of AR1, the two indicators for the project Outcome have been revised (see **Annex 1**). Both indicators (**Indicator 0.1 & 0.2**) are deemed adequate for measuring project success. It is envisaged that the project will achieve its Outcome by the end of March 2020.

4.4 Monitoring of assumptions

Overall, the stated risks and assumptions identified at the start of the project (**Annex 2**) are still relevant.

An important assumption identified, and still relevant, under the broader project Outcome was that SAERI continues to “retain relevant skilled staff”. This has been essential for the delivery of the project mapping outputs via a bespoke project webGIS delivery system, as well as progressing **Output 2** as outlined below.

When considering the risks/assumptions for **Output 2**, we identified in AR1 that the planned workflow would need some consideration in order to deliver this Output, in light of the significant resource required. Having access to skilled staff within the SAERI IMS-GIS data centre ensured that a solution could be “coded” programmatically, thereby automating the geo-referencing process and expediting the process significantly. **Output 2** has now been delivered.

Regarding **Output 3**, the maps produced for South Georgia & the Falkland Islands demonstrate that this Output is achievable, and that the methodology proposed is feasible.

The assumptions for **Output 4** are relevant, for example, landowner permission has been required for access to survey locations (this has generally been forthcoming). From a satellite imagery perspective, cloud cover is an important factor to consider as the project progressed the fine-scale modelling/mapping. In addition, collection of very high-resolution drone imagery is extremely weather dependent – and this has been factored in when considering the number of areas and the number of available days when drone aerial imagery could be collected to feed into the fine-scale modelling/mapping.

The assumptions for **Output 5 & 6** are still considered to be realistic.

These assumptions have been incorporated into a project risk register and are being monitored as part of the monitoring and evaluation process.

4.5 Project support to environmental and/or climate outcomes in the UKOTs

Both Territories have plans and policies in place where the implementation will be enhanced by the increased coastal knowledge provided by this project

In the Falklands, the Islands Plan (2018 – 2022) contains a number of targets where the Outputs of this project could significantly advance knowledge and provide baseline conditions from which to detect future change and trends. They include:

- The implementation of the 2030 Biodiversity Framework to preserve our natural environment;
- Implement control of invasive species, biosecurity and eradication plans;
- Encourage natural habitat restoration and preservation;

This year, the project has worked towards delivering the Outputs tailored to stakeholder priorities (following the successful stakeholder prioritisation workshops). For example, specifically, the project has focussed efforts on looking at habitat restoration following the Falklands Demining Programme (see **Annex 9**), through collection of a baseline very high-resolution drone imagery dataset. The project has also focussed on the collection of data from around Port Sussex farm, an area where Falkland Islands Government is tackling the spread of a non-native invasive plant called calafate. This data will facilitate Falkland Islands Government to be able to monitor and track the spread of this invasive plant (**Figure 3.5.1**).



Figure 3.5.1: 3D dense point cloud (from processed drone imagery) from a calafate mapping mission at Port Sussex, East Falkland.

For South Georgia, the 2016-2020 Biodiversity Action Plan (BAP) published by GSGSSI, a key project partner for that Territory, includes a target to “*Enhance knowledge of the biodiversity and habitats of GSGSSI [...], including the establishment of scientific baselines from which to monitor environmental change*”. There are clear links between this BAP target and the mapped scientific baselines this project has been delivering. For example, the South Georgia Coastal Habitat Mapping expedition successfully completed by the project this year has collected important aerial baseline datasets and ground validation data for a variety of visitor landing sites – these datasets

will provide GSGSSI with a useful tool to help better inform their management. In addition, the detailed imagery and consequent mapping will also provide a valuable baseline into how habitats and the island's vegetation are changing and developing in the wake of the successful eradication of rodents and reindeer from South Georgia (**Annex 10**).

5. Monitoring and evaluation

A **Monitoring and Evaluation plan (Activity 7.1)** is available on the project website⁶, and has been an instrumental tool to allow the **Project Management Group (PMG)** to effectively govern the project (the latter was established in **Activity 1.3**); all project partners (SAERI, GSGSSI, FIG, OSU, JNCC and SMSG) sit on the PMG and actively participate. There is also a separate **Memorandum of Understanding (MoU) (Activity 1.2)**, signed by all partners, which underpins the partnership. The Project Manager (PM) has responsibilities to present a quarterly report on progress against deliverables, M&E and quarterly financial reports to the PMG (**Activity 7.2**). The PM also has responsibilities to maintain an **Issues Log** and project **Risk Register** which are also presented to the PMG at quarterly intervals (evidenced in the finalised minutes of each quarterly PMG meeting on the project website⁷). The PMG is tasked with ensuring that the project delivers its outputs on time and on budget. The PMG also has a responsibility to review and monitor the quality of the outputs.

Trello⁸, an online (cloud-based) project management tool is being utilised to ensure all members of the PMG have secure access to relevant documents, irrespective of their location.

Through a **Project Stakeholder Group (PSG) (Activity 1.4)**, there is the ability to check the relevance of planned products with a suite of potential end users. This is formalised through the biannual stakeholder meetings (evidenced by minutes and presentations from biannual PSG meetings on the the project website). Through a dedicated workshop for each Territory, the project was able to elicit priorities from the stakeholder network to determine priorities for fine-scale habitat mapping across both Territories (**Activity 4.1, 4.2, 4.3 & 4.4**).

6. Lessons learnt

The project has found that allocating sufficient time to project promotion and outreach within the community has paid dividends, and is worthy of note. This has really elevated the knowledge of the project, and the Darwin Initiative, within the Territories. Outreach has taken place through social media (Facebook & Twitter posts) as well as local radio station interviews, public presentations at the Chamber of Commerce, running special sessions at the local infant and junior school as well as attendance at local events such as the Rural Business Association show. Promotion of the project through the successful award of a Shackleton Scholarship Fund focussing on drone technologies with the Falklands allowed the Project Manager (PM) to share knowledge and experience of the technology being used by DPLUS065 to undertake the fine-scale mapping (**Annex 11**). The power of social media in small island territories which often use social media platform such as Facebook as a key method of communication should not be underestimated.

The project has built many new partnerships, which have meaningfully enhanced the opportunities and support for the project. In addition, the value of stakeholder engagement cannot be underestimated, opening up opportunities in terms of other complimentary activities and projects taking place. For example, collaborating with SGHT on the South Georgia Archaeological expedition, and building a partnership with Iridium Communications. This

⁶ https://www.south-atlantic-research.org/wp-content/uploads/2019/04/DPLUS065_ME_Plan_Final_Updated.pdf

⁷ <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/>

⁸ <https://trello.com/b/ISipUNL0/dplus065-coastal-mapping-project-management>

shows the importance of working with other organisations to find out about these types of projects and then how integration and cooperation can benefit both parties.

The project has benefitted from both the lead organisation (SAERI) and the PM being based in-territory, this is of value as it results in strong local partnerships with stakeholders, as well as helping to understand the local issues “on the ground” and ensure that any outputs are tailored to local stakeholder needs as a far as possible.

7. Actions taken in response to previous reviews (if applicable)

The reviewer made a number of comments when reviewing the DPLUS065 AR1. Reviewer comments and responses are provided below:

1. **Reviewer comment:** *The website link for the M&E was not active and so it could not be reviewed*

Response: *the web link to the DPLUS Coastal Habitat Mapping project webpage has now been repaired - <https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/>*

2. **Reviewer comment:** *Please provide suitable evidence upfront on future reports*

Response: *suitable evidence is available either via a working website link or within this report.*

3. **Reviewer comment:** *Consider splitting the Outcome indicator into multiple SMART indicators to better measure progress. If not split, the indicator should be amended to be more clearly measurable and SMART.*

Response: *the Outcome Indicator has both been split, to make it easier to measure progress, as well as being made SMARTer. The revised Outcome Indicator is shown in Annex 2 (highlighted yellow)*

8. Other comments on progress not covered elsewhere

The project has a clearly defined and developed exit strategy, ensuring that consideration is given to what happens after the project ends; in-project training being considered a key part of this. The training of local stakeholders and personnel, scheduled for the third (final) year, will ensure that the local community has the skills to take forward habitat modelling and mapping in the Falklands and South Georgia after the project has completed, through using the tools developed by the Coastal Habitat Mapping project.

Towards the end of the year, the project experienced some problems from a subtidal fieldwork perspective with both weather windows and mechanical failure of vessel assets being used by the project. Both are unpredictable, and it was possible to mitigate this through sourcing alternative vessels which may be used. This highlights the importance of considering contingencies during the project planning phase. When planning projects such as this in remote locations, the malfunctioning of key assets/survey platforms could have a profound effect on project delivery.

When working in remote locations with extreme weather conditions, it is important to consider the risks of weather disrupting field work (i.e. drone flying) and building in enough time and flexibility to get out in the field and deliver results when conditions are appropriate.

The project commissioned a study looking to develop a Satellite-Derived Bathymetry layer for the shallow coastal waters of the Falkland Islands. This layer will be a useful input into the subtidal habitat modelling work. However, it would also be an extremely useful dataset in its own right for the Falklands community. There were difficulties with the approach, and these are reporting on in **Annex 14**. The work was undertaken by Environment Systems Ltd.

9. Sustainability and legacy

During this reporting year, the profile of the project has increased significantly. An increase in the frequency of posts on social media by the PM have resulted in a demonstrable increase in post sharing and retweeting, including from the Darwin Initiative, Iridium Communications and wider project partners. Consistent use of the project #SouthAtlanticCoastalMapping has helped elevate project visibility and identity. A summary of the top tweets with impressions and total engagements are provided in **Table 8.1**.

Regular project management group meetings, and the project stakeholder group meetings remain as important platforms for engagement, promotion and awareness of the work with key stakeholders on the islands.

Dedicated blog posts by visiting researchers such as Bran Black from Oregon State University have helped raise the profile of the project outside the two territories of the Falklands and South Georgia⁹.

There have been numerous examples of project (and Darwin Initiative) promotion throughout this reporting year, including press releases, radio interviews, television interviews and newspaper articles. These are listed (and evidenced) in **Section 9** below.

The *aide memoire* (a single side A4 PDF) prepared last year for all project related communications (included with AR1 – Annex 7) has worked exceptionally well, ensuring that all project partners are mentioned in the correct way. The success of this single sided PDF was demonstrated when South Georgia Heritage Trust requested a similar document for the 2019 South Georgia field expedition. For this trip, it was important that expedition sponsors such as Iridium Communications and National Geographic received recognition in all social media outreach (**see Annex 12**)

The exit strategy is still valid, with this forthcoming final year being very important; during Year 3, a training workshop will be held (draft schedule is shown in **Annex 4**). This workshop will enable the outputs from the project to be revised in later years even after the project has finished, using tools developed by the project.

Data generated through the project will be made available for future initiatives, through the IMS-GIS Database. In addition, data from South Georgia has been made available by the British Antarctic Survey through the South Georgia GIS.

With the Project Manager (PM) based in the Falkland Islands, working for SAERI – a Falklands-based research institution, there is a strong local connectivity for the full duration of the project.

Engaging the local community, through visiting schools and planning activities for the Watch Group has been a great way to get people enthusing about the project, which can only help with the future sustainability and legacy of coastal habitat mapping.

⁹ <https://www.south-atlantic-research.org/bran-blacks-basic-rules-for-geo-referencing-drone-imagery/>

Table 8.1: A summary of the DPLUS065 project top tweets, with impressions and total engagements.

Date	Tweet	Impressions	Total Engagements
24 th July 2018	Look who's hiding in the tussac at Cape Dolphin! ☐ Stands of tussac form an important coastal habitat for the southern #sealion around the #Falklands - one that we're modelling and mapping as part of the @Darwin_Defra #SouthAtlanticCoastalMapping project #TussacTuesday pic.twitter.com/1VYS17z1dJ	8,279	118
15 th August 2018	An important part of #Falklands history, viewed from space! Pan-sharpened WorldView image of Stanley courtesy of @DigitalGlobeFDN . The @Darwin_Defra #SouthAtlanticCoastalMapping project is using this data to help map #Falklands coastal habitats #FalklandsDay #WednesdayWisdom pic.twitter.com/SEDG5XXwS2	5,997	181
6 th November 2018	Last week, the #SouthAtlanticCoastalMapping project went to sea, joined by @goldfinger300 from @OSUCEOAS . Chris specialises in seabed mapping, with sidescan sonar the tool of choice. Even our local charismatic megafauna couldn't resist the towfish! #Dolphins #TuesdayMotivation pic.twitter.com/jjwCQVJ51o	5,139	79
8 th February 2019	15 days until @SG_Archaeology expedition departs for SG on Hans Hansson (@Quixote Exped), and some more drone imagery courtesy of @GovSGSSI & Geometria from around Grytviken. The @Darwin_Defra #SouthAtlanticCoastalMapping project will be collecting more like this #FridayFeeling pic.twitter.com/DURnHuazpj	8,338	172
7 th March 2019	An #albatross view of Bird Island - the #CoastalMappingTeam had stunning weather & completed a 100 ha high resolution aerial imagery of the island. Thank you @IridiumComm @mailasail #IridiumNEXT for their support, allowing us to plan our drone missions in the most remote places! pic.twitter.com/hlPHwxOmem	4,376	134

10. Darwin identity

Over the last reporting year, significant effort has been made to publicise the project, and the Darwin Initiative funding for the project. The project has followed Clause 21 of the Darwin Terms and Conditions¹⁰, and has used the Darwin logo where possible.

Table 9.1 below lists the outreach activity, which was undertaken to raise the profile of both the project and the Darwin Initiative.

Table 9.1: Outreach activity for the DPLUS065 Coastal Habitat Mapping project

Date	Details	Link to evidence
20 th April 2018	Interview on Falkland Islands Radio introducing the Coastal Habitat Mapping project given by the project manager Neil Golding	https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-latest-news/
4 th Sept 2018	This poster, presented at the 2018 UK National Earth Observation Conference, won first prize. It features the DPLUS065 broad scale habitat mapping work completed for South Georgia as one of the case studies	https://www.south-atlantic-research.org/wp-content/uploads/2018/10/The-Living-Maps-Method-Poster-V2.pdf
1 st August 2018	Bran Black, a grad student from Oregon State University recently visited the Falklands and joined project manager Neil Golding to finish island-wide maps based on satellite imagery for both the Falklands and South Georgia, as well as to help create the more detailed maps of localized areas of interest. Bran wrote a blog sharing her experience on the islands and working with SAERI	https://www.south-atlantic-research.org/brans-black-basics-for-geo-referencing-drone-imagery/
21 st Nov 2018	The article 'Drones as a tool for our future – drone expert to visit the Falkland Islands' was circulated on the SAERI network on 21st November 2018	https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-latest-news/
24 th Nov 2018	The visit of the Shackleton Scholar "drone expert" to the Falkland Islands that will be running junction with DPLUS065 Coastal Mapping project was broadcast on the local radio station.	https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-latest-news/
24 th Nov 2018	Shackleton Drone week video produced by FITV	https://www.youtube.com/watch?v=d5JAJhEOJCo&feature=youtu.be
15 th Feb 2019	The article 'Using drones to create fine scale models of minefields' was published on the Penguin News on 15th February 2019	https://www.south-atlantic-research.org/wp-content/uploads/2019/02/20190215-11.pdf
20 th Feb 2019	The presentation 'Mapping the coastal margins of the Falklands & South Georgia' given to the Environment Committee was held on the 20th February 2019	https://www.south-atlantic-research.org/wp-content/uploads/2019/04/2019_02_20_CoastalHabitatMapping_EnvCommittee_Presentation.pdf
29 th March 2019	The article 'South Georgia Archaeological Expedition 2019: collection of news from the field' published by South Georgia Heritage Trust, includes the contribution to the expedition made by the DPLUS065 Coastal Habitat Mapping project.	http://www.sght.org/news/south-georgia-archaeological-expedition-2019-collection-of-news-from-the-field/
5 th April 2019	Project manager, Neil Golding, and the DPLUS065 Coastal Habitat Mapping project provided aerial mapping support to the South Georgia Archaeological Project expedition in February/March 2019. This is described on the article 'Tracing the birth of a global economy' published on the Penguin News on the 5th April 2019.	https://www.south-atlantic-research.org/wp-content/uploads/2019/04/pncentre.pdf
5 th April 2019	The article 'Using drones to map South Georgia's coastal habitats' was published on the Penguin News on the 5th April 2019	https://www.south-atlantic-research.org/wp-content/uploads/2019/04/pn11.pdf

Samples of the social media outreach produced by the project have been used throughout this report. Both Facebook and Twitter posts tagged the Darwin Initiative. SAERI has 1655 followers.

¹⁰ Schedule of Terms and conditions for Darwin Plus awards 2017-2018.

11. Project Expenditure

This reporting year, in light of a successful Digital Globe Foundation grant, Darwin funding originally allocated to the “*acquisition of remote sensing data and associated costs*” was put to other uses to enhance the project further and provide excellent added value. These included the acquisition of aerial/subtidal remote sensing data and the training and certification in drone-flying for the Project Manager (PM). This was submitted to Darwin as a change request on 11th May 2018 and approved by Darwin on 21st May 2018.

Project expenditure for this reporting year can be seen below in **Table 10.1**.

Table 10.1: Project expenditure during the reporting period (1 April 2018 – 31 March 2019)

Project spend (indicative) in this financial year	2018/19 D+ Grant (£)	2018/19 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs	£77,186.33	£76,870.01	▼ -0.41%	
Consultancy costs	£3,000.00	£3,000.00	0.00%	
Overhead Costs	£5,413.91	£5,413.91	0.00%	
Travel and subsistence	£19,169.50	£19,458.30	▲ 1.51%	
Operating Costs	£6,300.00	£6,340.00	▲ 0.63%	
Capital items	-	-	0.00%	
Others (Please specify)	£4,774.44	£4,774.44	0.00%	
TOTAL	£115,844.18	£115,856.66		

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2018-2019 – if appropriate

Note that the green highlighted section under Measurable Indicators was revised following feedback from the AR1 reviewer.

Also note that Measurable Indicators completed and reported in AR1 (April 2017 – March 2018) have not been included in this report of progress below.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>Impact</p> <p>Environmental evidence-base for decision-making on the FI and SG is significantly enhanced by the provision of baseline data in a thematic area that is a current gap i.e. coastal margin.</p>		<p><i>With the production of broad-scale (Stage 1) habitat models/maps for both the Falklands and South Georgia now complete, these have effectively plugged this data/knowledge gap for both territories. This has then allowed stakeholders to prioritise the location of fine-scale modelling/mapping (Stage 2). Fieldwork has been undertaken in both territories to support Stage 2.</i></p>	
<p>Outcome</p> <p>The mapping generated from this cost-effective and innovative remote-sensing will underpin and enhance spatial and conservation planning in the remote FI and SG and allow for efficient, effective monitoring.</p>	<p>0.1 The coastal habitats of the Falkland Islands are broadly classified and visualized via digital outputs (e.g. maps, GIS layers) at a spatial and temporal scale sufficient for spatial planning and decision making, by the end of March 2020.</p> <p>0.2 The coastal habitats of South Georgia are broadly classified and visualized via digital outputs (e.g. maps, GIS layers) at a spatial and temporal scale sufficient for spatial planning and decision making, by the end of March 2020.</p>	<p><i>In this second year, excellent progress was made achieving this projects outcome. In addition, opportunities to add value to this project were sought and have delivered significant gains. Following successful delivery of broad-scale habitat models/maps for the Falklands (Figure 3.1.4) and South Georgia (Figure 3.1.3), these have been rolled out to the wider public through bespoke and existing spatial data delivery mechanisms. Work has now commenced developing and delivering fine-scale maps for the Falklands and South Georgia at a resolution and location driven by stakeholder demand.</i></p>	<ul style="list-style-type: none"> • <i>Further collection of ground validation information for fine-scale habitat modelling.</i> • <i>Completion of fine-scale (Stage 2) coastal habitat models/maps for the Falklands and South Georgia.</i> • <i>Monitoring manual for the long-term monitoring of the coastal margin of the Falklands and South Georgia (final project report).</i> • <i>Training workshop for knowledge transfer</i> • <i>End of project synthesis workshop</i>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>Output 1. Project Management structure, and communications tools established</p>	<p>1.2 An MoU agreed and signed by all partners by end Quarter 4 FY 17/18.</p> <p>1.3 A Project Management Group (PMG) meeting held every 3 months starting October 2017.</p> <p>1.4 A Project Stakeholders group (PSG) meeting held every 6 months starting Quarter 4 FY 17/18.</p> <p>1.5 At least 1 project webpage created by end Quarter 4 FY 17/18, and at least 1 update to the page made every month.</p> <p>1.6 Final project report produced by March 2020</p>	<p>1.2 <i>The MoU was approved and signed by project partners in Q1 of FY 18/19. The text of the MoU is available on the project website https://www.south-atlantic-research.org/wp-content/uploads/2019/04/MoU_DPLUS065_CoastalMapping_Final.pdf. A copy of the signatories to this MoU is shown in Annex 3 of this report. Indicator is appropriate.</i></p> <p>1.3 <i>On track – quarterly PMG meetings held & approved minutes available here: https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/ Indicator is appropriate. Due to the February/March 2019 month-long South Georgia fieldwork expedition, the FY 18/19 Q4 PMG meeting was delayed until 5th April 2019. However, this has now been held and the minutes are in the process of being finalised.</i></p> <p>1.4 <i>On track – Bi-annual stakeholder meetings have been held, and approved minutes and presentations available here: https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/. The August 2018 stakeholder meeting was also a very successful Stakeholder prioritisation workshop. Two workshops were held, one for the Falklands and one for South Georgia. Reports are available at the same web link above. Indicator is appropriate.</i></p> <p>1.5 <i>On track – Project website is running well, and has been updated regularly https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/. Note the 'Latest News' section which is regularly updated. Indicator is appropriate.</i></p> <p>1.6 <i>N/A in this reporting period. This will be completed next year (Year 3). Indicator is appropriate.</i></p>	
Activity 1.2: Draft and sign Project Partners MoU		Completed	
Activity 1.3: Quarterly PMG meetings		Completed	Further PMG meetings planned for next period
Activity 1.4: 6 monthly PSG meetings		Completed	Further PSG meetings planned for next period

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 1.5: Monthly Webpage updates		<i>Completed</i>	<i>Further website updates planned for next period</i>
Activity 1.6: Complete various project management activities		<i>Completed</i>	<i>These will be completed as required next period</i>
Activity 1.7: Final project report and publicity		<i>Not planned for this reporting period</i>	<i>Planned for completion next reporting period.</i>
Output 2. Work Package 1 (WP1): Digitised 50 year old aerial imagery (FI only)	2.2 Complete geo-referencing of 1954 aerial imagery to create a digital map by end Quarter 2 FY 18/19	2.2 <i>This was completed in this reporting period. Using innovative techniques, the SAERI IMS data centre developed a script to automate the image geo-referencing process. A digital map of the Falklands 1956 aerial imagery is now available on the DPLUS065 Coastal Habitat Mapping webGIS: https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fi_coastal_hab_map_wu_rem (Please tick the 1956 Aerial Imagery box)</i>	
Activity 2.2: Complete the geo-referencing of 1956 aerial imagery along the coastal margin		<i>Completed</i>	
Activity 2.3: Produce a digital map of the 1956 aerial imagery showing the coastal margin		<i>Completed</i>	
Activity 2.4: Upload the 1950's coastal margin (aerial imagery) map onto the MSP GIS portal and a copy of the associated metadata onto the South Atlantic metadata catalogue		<i>Completed</i>	
Output 3. Work package 2 (WP2): Object based image analysis and habitat modelling of the coastal margin (FI and SG)	3.1 Stage I habitat modelling and classification complete for the Falklands by September 2018. 3.3 Stage I habitat modelling and classification (subtidal) complete for South Georgia, and integration with terrestrial and intertidal habitat maps by end July 2018	3.1 <i>This was completed this reporting period; the resulting broad-scale habitat map for the Falklands can be seen in Figure 3.1.4 as well as being available on the webGIS. Value was added to this output through creation of a Falklands wide habitat model, not just focussed on the coastal margin. (https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fi_coastal_hab_map_wu_rem). (Please tick the Broad-scale habitat map box). Indicator is appropriate</i> 3.3 <i>This was completed this reporting period; the resulting broad-scale habitat map for South Georgia can be seen in Figure 3.1.3 as well as being available on the South Georgia GIS: https://www.sggis.gov.gs/ (On the left hand side,</i>	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
		<i>please expand 'Management', 'Terrestrial' and then tick the SAERI Coastal Habitat Mapping box). Indicator is appropriate</i>	
Activity 3.3: Undertake Analysis of the satellite imagery and habitat modelling		<i>Completed</i>	
Activity 3.4: Produce a Coastal Margin habitat map for South Georgia and the Falklands		<i>Completed</i>	
Activity 3.5: Upload the Coastal Margin habitat map onto the MSP GIS portal (for the Falklands) and supply SG map to GSGSSI (for upload to GSGSSI web portal); upload a copy of the associated metadata onto the South Atlantic metadata catalogue.		<i>Completed</i>	
Output 4. Work Package 3 (WP3): Identification, prioritisation and fulfilment of information data needs for the systematic conservation and planning of the coastal margin for the FI and for SG.	<p>4.1 At least 1 FI (Q3 FY 18/19) and 1 SG (Q3 FY 18/19) stakeholder workshop held to identify and prioritise data needs for the coastal margin</p> <p>4.2 Ground truthing of satellite imagery analysis on SG (Quarter 3 FY 17/18 & Quarter 4 FY 18/19) and the FI (Quarter 1 – Quarter 4 FY 18/19)</p> <p>4.3 Stage II geospatial data products reflecting prioritized information needs utilizing high res imagery to reduce uncertainty in habitat models/classifications and address spatial and temporal data priority needs expressed by stakeholders – for both the FI and SG by Quarter 1 FY 19/20</p>	<p>4.1 <i>Two successful fine-scale mapping stakeholder prioritisation workshops were held on the 8th & 9th August 2018 for the Falkland Islands and South Georgia respectively. Workshop presentations and reports can be found here: https://www.south-atlantic-research.org/research/terrestrial-science/coastal-mapping-project/coastal-mapping-project-download-area/. Indicator is appropriate</i></p> <p>4.2 <i>Successful ground validation campaigns were completed on South Georgia in Q4 FY 18/19 (see Penguin News article: https://www.south-atlantic-research.org/wp-content/uploads/2019/04/pn11.pdf, Section 3.1 and Figure 3.1.9) and the Falklands right through FY 18/19. See Section 3.1 & Figure 3.1.17 . Indicator is appropriate</i></p> <p>4.3: <i>Good progress has been made developing the fine-scale habitat modelling/mapping framework, which will address stakeholder priorities, by Oregon State University, the partner leading on this work package. Progress to date is reported in Section 3.1 and Annex 8. This work is scheduled for completion in Year 3. Indicator is appropriate</i></p>	
Activity 4.1: Confirm Stakeholder workshop (to identify and prioritise spatial and temporal data priority needs expressed by Stakeholders) date, venue, and participants for the Falklands and South Georgia		<i>Completed</i>	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 4.2: Confirm Stakeholder workshop programme, speakers and facilitators through consultations via the PMG and PSG for the Falklands and South Georgia		<i>Completed</i>	
Activity 4.3: Host the Stakeholder workshop for the Falklands and South Georgia		<i>Completed</i>	
Activity 4.4: Produce the Stakeholder workshop report for the Falklands and South Georgia and upload onto the project webpage		<i>Completed</i>	
Activity 4.5: Acquire very high resolution satellite imagery (e.g. WorldView) and/or undertake drone missions to acquire high resolution imagery for priority areas requiring fine-scale mapping in South Georgia and the Falklands		<i>Completed for South Georgia. The bulk of drone surveys have now been completed for the Falkland Islands.</i>	<i>Anticipated that further drone surveys will be completed within the Falkland Islands in the next reporting period.</i>
Activity 4.6: Pre-process the imagery to prepare for analysis		<i>Completed for imagery collected in this reporting period.</i>	<i>Further image processing will be anticipated for drone surveys undertaken in the next reporting period.</i>
Activity 4.7: Undertake analysis of the imagery.		<i>Analysis of imagery commenced in this reporting period.</i>	<i>This analysis will continue into the next reporting period, when it will be completed.</i>
Activity 4.8: Undertake ground-validation of analysed data on the Falklands and South Georgia		<i>The collection of ground validation information has been completed for South Georgia, following the successful completion of the 2019 South Georgia Coastal Habitat Mapping expedition. The collection of ground validation has been largely completed for the Falkland Islands, but will continue into the next reporting period</i>	<i>Collection of Falklands ground validation information will continue into the next reporting period.</i>
Activity 4.9: Produce detailed (Stage II) Coastal Margin habitat maps for priority areas for South Georgia and for the Falklands		<i>Work has commenced on the fine-scale (Stage 2) habitat models/maps, led by Oregon State University.</i>	<i>To be completed in next reporting period.</i>
Activity 4.10: Upload the detailed (Stage II) Coastal Margin habitat map onto the MSP GIS portal (for the Falklands) and supply to GSGSSI for upload onto the			<i>To be completed in next reporting period.</i>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
GSGSSI web portal. Upload a copy of the associated metadata onto the South Atlantic metadata catalogue.			
Output 5. Work Package 4 (WP4): Prioritisation of ongoing planning, protection and monitoring of the coastal margin	<p>5.1 A monitoring manual produced for long-term monitoring of coastal margin for the Falklands by end Quarter 3 FY 19/20</p> <p>5.2 A monitoring manual produced for long-term monitoring of coastal margin for South Georgia by end Quarter 3 FY 19/20</p> <p>5.3 At least 1 face-to-face training workshop in implementing monitoring undertaken by end Quarter 2 FY 19/20</p>	<p>5.1 For completion in Year 3 - Indicator is appropriate</p> <p>5.2 For completion in Year 3 - Indicator is appropriate</p> <p>5.3 For completion in Year 3 - Indicator is appropriate</p>	
Activity 5.1: Draft a long-term coastal mapping/monitoring manual for the Falklands and South Georgia and upload onto the project webpage			<i>For completion in final reporting period</i>
Activity 5.2: Confirm date, venue, and participants for the Falklands and South Georgia coastal mapping/monitoring training workshop		<i>Training workshop schedule was discussed in the Q4 PMG meeting, with the date of 9th – 11th July reserved for workshop. A draft training workshop schedule is shown in Annex 4.</i>	<i>For completion in final reporting period</i>
Activity 5.3: Undertake coastal mapping/monitoring training workshop			<i>For completion in final reporting period</i>
Activity 5.4: Record videos of training sessions and upload online onto the project webpage			<i>For completion in final reporting period</i>
Output 6. Work Package 5 (WP 5) All outputs integrated with existing and emerging initiatives	<p>6.1 New geospatial products maximally informed and integrated with existing FI and SG geo-spatial data initiatives</p> <p>6.2 End of project synthesis workshop for FI and SG held by end Quarter 3 FY 19/20 to discuss and consider how</p>	<i>6.1 Review of stakeholder and data initiatives within the Falklands and South Georgia was completed this year. The short report from which can be seen in Annex 5, and has been uploaded onto the project website for wider dissemination¹¹.</i>	

¹¹ https://www.south-atlantic-research.org/wp-content/uploads/2019/04/19_03_A_review_of_existing_data_management_initiatives_in_Falklands_SouthGeorgia_FINAL.pdf

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
	findings will contribute to systematic conservation planning	6.2 For completion in Year 3 – Planned for October/November 2019. Indicator is appropriate	
Activity 6.1: Review all of the existing (relevant) stakeholder groups and data creation and management initiatives and protocols.		Completed	
Activity 6.2: Produce a report on the review demonstrating how this initiative links to and builds on the existing and emerging work, and publish on the project webpage.		Completed	
Activity 6.3: Prepare for and host 'end of project' synthesis workshop to decide how outputs will be fed into planning			For completion in final reporting period
Output 7. Monitoring & evaluation	7.2 6-monthly updates on implementation of M&E Plan provided to PMG	7.2 Regular updates on implementation of the M&E plan have been given to PMG. Trello online project management tool continued to be used to share PMG documentation. Review of the M&E plan has been a standing agenda item on the quarterly PMG meetings. M&E plan can be seen here: https://www.south-atlantic-research.org/wp-content/uploads/2019/04/DPLUS065_ME_Plan_Final_Updated.pdf . Indicator is appropriate	
Activity 7.2: Prepare and present 6 monthly M and E updates		Completed	Further updates planned for next reporting period
Activity 7.3: Upload M and E plan and updates onto webpages		Completed	Any further changes will be reflected in the version available on the project website

Annex 2: Project’s full current logframe as presented in the application form (unless changes have been agreed) - if appropriate

N.B. if your application’s logframe is presented in a different format in your application, please transpose into the below template. Please feel free to contact Darwin-Projects@itsi.co.uk if you have any questions regarding this.

Note that the yellow highlighted section under Measurable Indicators, revised following feedback from the AR1 reviewer.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Environmental evidence-base for decision-making on the FI and SG is significantly enhanced by the provision of baseline data in a thematic area that is a current gap i.e. coastal margin.			
Outcome: The mapping generated from this cost-effective and innovative remote-sensing will underpin and enhance spatial and conservation planning in the remote FI and SG and allow for efficient, effective monitoring.	0.1 The coastal habitats of the Falkland Islands are broadly classified and visualized via digital outputs (e.g. maps, GIS layers) at a spatial and temporal scale sufficient for spatial planning and decision making, by the end of March 2020. 0.2 The coastal habitats of South Georgia are broadly classified and visualized via digital outputs (e.g. maps, GIS layers) at a spatial and temporal scale sufficient for spatial planning and decision making, by the end of March 2020.	0.1 FI MSP Web GIS portal 0.2 SG webGIS portal 0.3 SAERI project webpages.	SAERI’s IMS-GIS Centre continues to retain relevant skilled staff
Outputs: 1. Project Management structure, and communications tools established	1.1 Project Manager recruited by end Quarter 3 FY 17/18. 1.2 An MoU agreed and signed by all partners by end Quarter 4 FY 17/18. 1.3 A Project Management Group (PMG) meeting held every 3 months starting October 2017. 1.4 A Project Stakeholders group (PSG) meeting held every 6 months starting Quarter 4 FY 17/18.	1.1 Project Manager employment contract signed 1.2 MOU signed by all parties 1.3 PMG meeting notes available online 1.4 PSG meeting notes available online.	PM with the relevant skills can be recruited.

	<p>1.5 At least 1 project webpage created by end Quarter 4 FY 17/18, and at least 1 update to the page made every month.</p> <p>1.6 Final project report produced by March 2020.</p>	1.5 Project webpage available for viewing online	
2. Work Package 1 WP1: Digitised 50 year old aerial imagery (FI only)	<p>2.1 1 Commence geo-referencing of 1954 aerial imagery by Quarter 4 FY 17/18.</p> <p>2.2 Complete geo-referencing of 1954 aerial imagery to create a digital map by end Quarter 2 FY 18/19</p>	2.1 1954 FI aerial imagery digital map available via MSP GIS portal	Aerial imagery is of sufficient quality to be able to be digitised. Preliminary checks suggest this is the case.
3. Work package 2 (WP2): Object based image analysis and habitat modelling of the coastal margin (FI and SG)	<p>3.1 Stage I habitat modelling and classification complete for the Falklands by September 2018.</p> <p>3.2 Stage I habitat modelling and classification (terrestrial and intertidal) complete for South Georgia by end March 2018.</p> <p>3.3 Stage I habitat modelling and classification (subtidal) complete for South Georgia, and integration with terrestrial and intertidal habitat maps (3.2) by end July 2018</p>	<p>3.1 FI coastal margin (Stage I) habitat map available online via MSP GIS portal</p> <p>3.2 SG coastal margin (Stage I) habitat map available online via South Georgia GIS portal</p>	<p>Satellite imagery at useful resolution and without cloud cover is obtainable.</p> <p>Preliminary checks suggest several options and suitable imagery will be available.</p> <p>Satellite imagery and derived products are open access.</p> <p>Preliminary enquiries and expert opinion suggest this is feasible.</p>
4. Work Package 3 (WP3): Identification, prioritisation and fulfilment of information data needs for the systematic conservation and planning of the coastal margin for the FI and for SG	<p>4.1 At least 1 FI (Q3 FY 18/19) and 1 SG (Q3 FY 18/19) stakeholder workshop held to identify and prioritise data needs for the coastal margin</p> <p>4.2 Ground truthing of satellite imagery analysis on SG (Quarter 3 FY 17/18 & Quarter 4 FY 18/19) and the FI (Quarter 1 – Quarter 4 FY 18/19)</p>	<p>4.1 FI and SG stakeholder workshop report on the project page website</p> <p>4.2 FI coastal margin fine scale (Stage II) maps available online via FI MSP GIS portal.</p>	<p>Satellite imagery at useful resolution and without cloud cover is obtainable.</p> <p>Preliminary checks suggest several options and suitable imagery will be available.</p> <p>Permissions to access study areas approved by landowners (where required).</p>

	4.3 Stage II geospatial data products reflecting prioritized information needs utilizing high res imagery to reduce uncertainty in habitat models/classifications and address spatial and temporal data priority needs expressed by stakeholders – for both the FI and SG by Quarter 1 FY 19/20	4.3 SG coastal margin fine scale (Stage II) maps available online via SG GIS portal	
5. Work Package 4 (WP4): Prioritisation of ongoing planning, protection and monitoring of the coastal margin	5.1 A monitoring manual produced for long-term monitoring of coastal margin for the Falklands by end Quarter 3 FY 19/20 5.2 A monitoring manual produced for long-term monitoring of coastal margin for South Georgia by end Quarter 3 FY 19/20 5.3 At least 1 face-to-face training workshop in implementing monitoring undertaken by end Quarter 2 FY 19/20	5.1 FI monitoring manual available on the project page website 5.2 SG monitoring manual available on the project page website. 5.3 Training workshop report available on project page website 5.4 Televised training available online on project page website.	There are in-territory staff who are well-positioned to undertake the training. Discussions to identify where the future long-term monitoring role would sit for both islands are underway.
6. Work Package 5 (WP 5) All outputs integrated with existing and emerging initiatives	6.1 New geospatial products maximally informed and integrated with existing FI and SG geo-spatial data initiatives 6.2 End of project synthesis workshop for FI and SG held by end Synthesis workshop held by end Quarter 3 FY 19/20 to decide how findings will contribute to systematic conservation planning	6.1 Report on integration with other initiatives on the FI published on the project webpage. 6.2 Report on integration with other initiatives on the SG published on the project webpage.	Owners and co-ordinators of existing initiatives are willing to collaborate and explore these opportunities as well. The support of the project partnership brings on board key leaders in these areas.
7. Monitoring and evaluation	7.1 Detailed Monitoring and evaluation plan produced by end Quarter 4 FY 17/18 7.2 6-monthly updates on implementation of M&E Plan provided to PMG	7.1 Detailed M&E Plan available on project webpage 7.2 M&E updates available on project webpage	PM has skills to deliver M&E plan This will be built into the Job description of the PM and

Activities (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)

- 1.1 Advertise, interview and recruit PM
 - 1.2 Draft and sign Project Partners MoU
 - 1.3 Quarterly PMG meetings
 - 1.4 6 monthly PSG meetings
 - 1.5 Monthly Webpage updates
 - 1.6 Complete various project management activities
 - 1.7 Final project report and publicity
-
- 2.1 Explore development of a workflow to aid the geo-referencing 1954 aerial imagery
 - 2.2 Complete the geo-referencing of 1954 aerial imagery along the coastal margin
 - 2.3 Produce a digital map of the 1954 aerial imagery showing the coastal margin
 - 2.4 Upload the 1950's coastal margin (aerial imagery) map onto the MSP GIS portal and a copy of the associated metadata onto the South Atlantic metadata catalogue
-
- 3.1 Source the Satellite imagery for the Falklands and South Georgia
 - 3.2 Pre-processing of satellite imagery to prepare for analysis
 - 3.3 Undertake Analysis of the satellite imagery and habitat modelling
 - 3.4 Produce a Coastal Margin habitat map for South Georgia and the Falklands
 - 3.5 Upload the Coastal Margin habitat map onto the MSP GIS portal (for the Falklands) and supply SG map to GSGSSI (for upload to GSGSSI web portal); upload a copy of the associated metadata onto the South Atlantic metadata catalogue.
-
- 4.1 Confirm Stakeholder workshop (to identify and prioritise spatial and temporal data priority needs expressed by Stakeholders) date, venue, and participants for the Falklands and South Georgia
 - 4.2 Confirm Stakeholder workshop programme, speakers and facilitators through consultations via the PMG and PSG for the Falklands and South Georgia
 - 4.3 Host the Stakeholder workshop for the Falklands and South Georgia
 - 4.4 Produce the Stakeholder workshop report for the Falklands and South Georgia and upload onto the project webpage
 - 4.5 Acquire very high resolution satellite imagery (e.g. WorldView) and/or undertake drone missions to acquire high resolution imagery for priority areas requiring fine-scale mapping in South Georgia and the Falklands
 - 4.6 Pre-process the imagery to prepare for analysis
 - 4.7 Undertake analysis of the imagery.
 - 4.8 Undertake ground-validation of analysed data on the Falklands and South Georgia
 - 4.9 Produce detailed (Stage II) Coastal Margin habitat maps for priority areas for South Georgia and for the Falklands
 - 4.10 Upload the detailed (Stage II) Coastal Margin habitat map onto the MSP GIS portal (for the Falklands) and supply to GSGSSI for upload onto the GSGSSI web portal. Upload a copy of the associated metadata onto the South Atlantic metadata catalogue.

- 5.1 Draft a long-term coastal mapping/monitoring manual for the Falklands and South Georgia and upload onto the project webpage
- 5.2 Confirm date, venue, and participants for the Falklands and South Georgia coastal mapping/monitoring training workshop
- 5.3 Undertake coastal mapping/monitoring training workshop
- 5.4 Record videos of training sessions and upload online onto the project webpage

- 6.1 Review all of the existing (relevant) stakeholder groups and data creation and management initiatives and protocols.
- 6.2 Produce a report on the review demonstrating how this initiative links to and builds on the existing and emerging work, and publish on the project webpage.
- 6.3 Prepare for and host 'end of project' synthesis workshop to decide how outputs will be fed into planning

- 7.1 Prepare monitoring and evaluation (M and E) plan
- 7.2 Prepare and present 6 monthly M and E updates
- 7.3 Upload M and E plan and updates onto webpages

Annex 3: DPLUS065 MoU

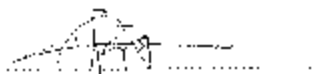
Signature panels from DPLUS065 Project Partner Memorandum of Understanding – **Please double click on the embedded PDF below to open.**

Paragraph 11
Amendments

This Memorandum may be amended at any time by written consent of all the participants.

Signed in two originals in ... [add location where signed] on ... [add date] in the English language.

Signature of Participant (please also add relevant details in Appendix A)



Annex 4: Draft schedule for Training workshop planned for July 2019.

Please double click on the embedded PDF below to open.



Darwin Plus (DPLUS 065) Coastal Habitat Mapping project

Training Workshop (Draft Schedule)

8th – 10th July 2019

Day 1 – Monday 8th July 2019

Time	Details	Responsible person
AM	Welcome & introduction to the Coastal Habitat Mapping project	NG
	Introduction to Earth Observation (EO) <ol style="list-style-type: none"> 1. What is EO 2. Tour of the technology – satellite to drone (focus on optical but mention radar/LIDAR etc) 3. What it can and cannot do 	GJ
Lunch		
PM	Practical session: Intro to spatial resolution <ol style="list-style-type: none"> 1. Drawing pixels (can do this outside if weather is favourable) Practical session: Intro to spectral resolution <ol style="list-style-type: none"> 2. Visualising different bands in greyscale and analysing what is visible in the bands 3. Calculating an index and interpretation 	GJ
	Fly drone mapping mission if good weather	NG

Annex 5: Review of existing data initiatives for Falklands and South Georgia.

Please double click on the embedded PDF below to open.

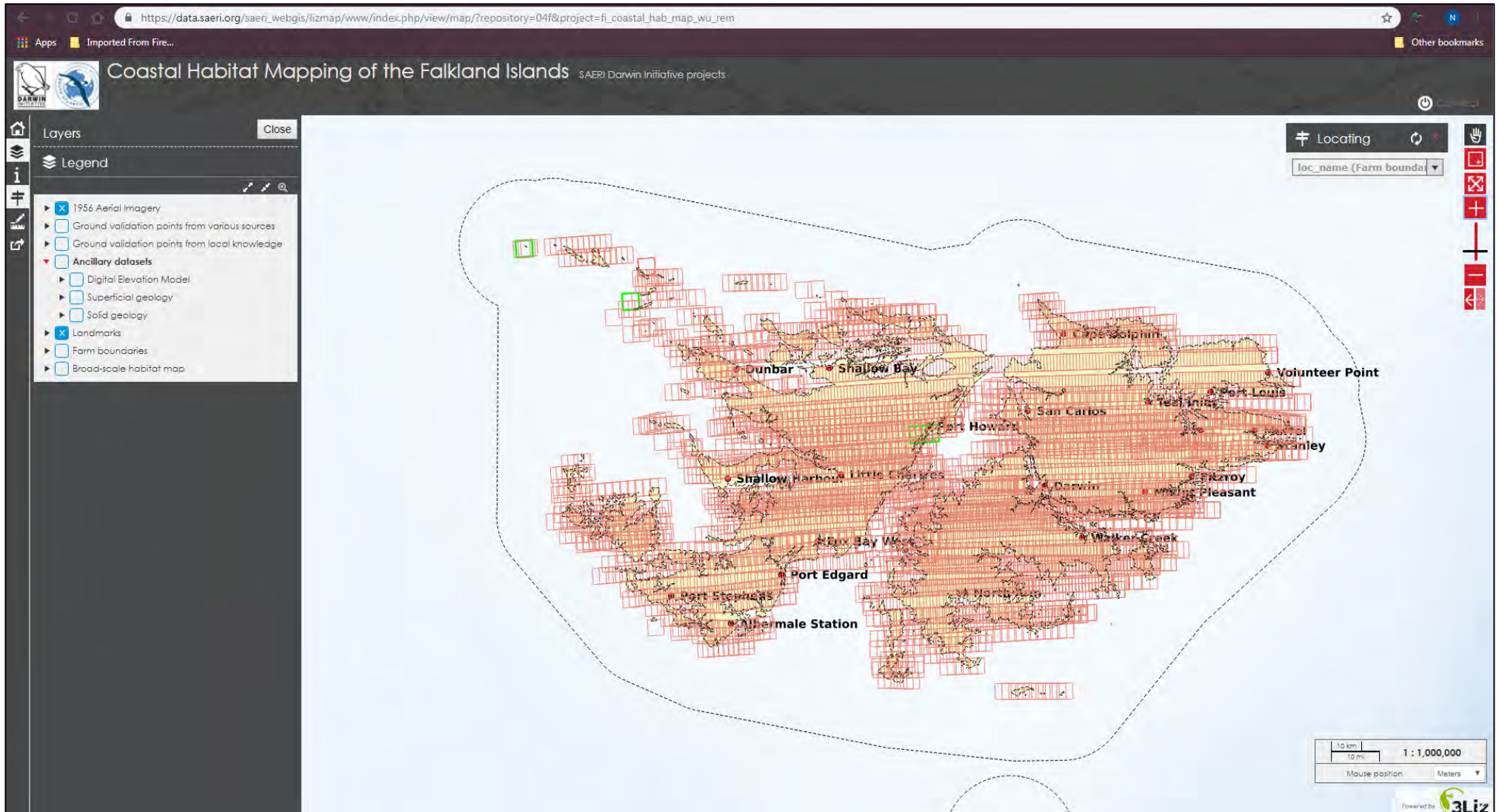


Annex 6: Issues Log (current version)

Please double click on the embedded PDF below to open.

ID	Issue	Description	Impact	Priority	Owner	Start Date	Due Date	Status	Resolution/Comments
11	No appropriate backup for Project Manager available at start of project	During hours around starting of software, the new PM laptop was not available when they started to work. NZC provided a good laptop for temporary use but which allowed the PM to access SARS and other systems, but there was no access to COVID-19 data from the Project Manager. The laptop was also to be delivered to the PM on Wed 23rd Dec, but was lost by the courier. Since Wed 23rd Dec, PM has had access to TVU use laptop, which does have the COVID-19 data. The laptop will be used for the Project Manager until the PM's original laptop is replaced. Backup should be available by the time he returns on 27th January 2020.	This issue has impacted what the PM has been able to achieve during his first month to date.	High	Paul G	18/12/2019	27/12/2019	Resolved	New laptop purchased following loss of original laptop by UPS courier. Cost of original laptop not added to project.
12	PM could purchase satellite	Project Manager has explored if new imagery is purchased a round working. Current proposal document suggests that "satellite imagery purchase negotiations will be ahead of ensuring that all imagery and derived products are available". This will not be possible as all purchased data will have license restrictions. However a group license can be purchased (and should be purchased), which will allow all partners to access and use imagery.	Issues on which is prohibited for use imagery data purchased through NZC.	High	Paul G	18/12/2019	27/12/2019	Resolved	CEU (Gibson) has purchased the Digital Globe license for use on the project (NZC 2019). If there is a wish to purchase Digital Globe imagery for other research, approval could be sought via CEU (Gibson) (not relevant) for this year project. This deal cannot be used for any commercial purposes.
13	Project later starting delays to PM requirements impacting available as notified in Darwin Plus proposal and budget	Due to delays in the procurement of the PM, this has effectively impacted the timeline back by several three months. Requiring a temporary and a change request will be submitted regarding budget, but there is a risk that required budgets will be inflated as requested.	Impact to project timeline if budget cannot be reallocated following reallocation of Project Manager.	High	Paul G	18/12/2019	27/12/2019	Resolved	Change request and reallocation approved by Darwin Plus - small amount.
14	Four state of data coming from South Sea 2017 South Georgia field work	The data (Images and coordinates) received by researchers on the South Georgia field survey was in a poor state. Issues with sample reallocation and being followed (many sample locations where field data was not being collected), correct logging of locations (some sample locations images have no associated spatial reference information whereas others are the other way), & data management - currently allocated each set of photos to their respective site ID (this can be used for validating the results) has been extremely time consuming.	Has allowed down from other tasks such as developing various plans and NZC plan.	High	Paul G	18/12/2019	27/12/2019	Resolved	Data sorted/validated by Project Manager and Data Manager.
15	GDPR unable to not available to add new content for project website	The GDPR website has moved to a new host, and has not been available to the Project Manager to update information on the website.	Publicity via the website is a challenge under the long framework for completion by end of 2019 (end of 2019/2020).	High	Paul G	18/12/2019	27/12/2019	Resolved	New website more operational from 18/12/2019.
16	CEU assigned to satellite imagery	This special was not required following purchase of Digital Globe Permanent Use. Special in FY 2019/2020.	Unapproved spend in FY 2019/2020.	High	Paul G	10/04/2020	27/12/2019	Resolved	Special approved.
17	Current budget	Current budget is around £1.4M. 400P necessary for the project, as there is a Research Agreement in place between CEU and NZC.	Could result in higher than anticipated costs for CEU, thereby potentially impacting co-funding from CEU.	High	Michael Hulse	02/02/2020	27/12/2019	Resolved	Terms Review completed. Darwin Plus regarding this in relation to shared grant prepared from Darwin Plus (NZC).
18	Final Oregon field collection	The CEU required computer equipment was not for delivery until proceeding.	Could impact delivery of equipment collection date previously agreed for before Christmas 2019, thus having a knock on effect to completion of a field collection of photos, external field work (done in North coast) and delivery of these to NZC.	High	Michael Hulse	03/12/2019	27/12/2019	Resolved	Deliveries progressed (end of Feb '20 - although 400P needed with CEU as some the equipment) - Current collection points provided by Darwin Plus. Equipment delivery to NZC delivery.
19	Coverage of sites on South Georgia field collection	A significant number of sites were identified by stakeholders through the field mapping and subsequent ground truthing. However, as the Council Mapping project was being funded on a 50/50 basis, with the main cost of the sites which were not possible to visit at 2019/2020. In addition, increased weather impacted availability of some sites, which was outside the control of the project team.	Some locations of interest to stakeholders could not be visited, resulting in data gaps and some commitments from stakeholders.	High	Paul G	02/02/2020	27/12/2019	Resolved	This needs to be communicated to project partners and stakeholders as the final three weeks (which is being delivered) is likely to appear gaps in the data. However, this has been brought to the attention of the project partners, although there may be impacts in the range of data collection available on these sites due to weather.
20	Methodical problems with 2019/2020	Some delays in collection of satellite data for field mapping at the end of 2019.	Some delays in collection of satellite data for field mapping at the end of 2019.	High	Paul G	02/02/2020	27/12/2019	Resolved	Some delays in collection of satellite data for field mapping at the end of 2019.

Annex 7: Example of the 1956 aerial imagery digital map – available on the [DPLUS065 Coastal Habitat Mapping webGIS](https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fi_coastal_hab_map_wu_rem)




https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=04f&project=fi_coastal_hab_map_wu_rem

Apps Imported From Fire... Other bookmarks

Coastal Habitat Mapping of the Falkland Islands SAERI Darwin Initiative projects

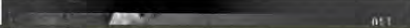
Close

Field	Value
id	2891
name	F_1_36_0141
present	1
photos	

georef_photos Request the photo to be georeferenced at datamanager@saeri.org

status non georeferenced

1956 Aerial Imagery

Field	Value
id	2890
name	F_1_36_0140
present	1
photos	

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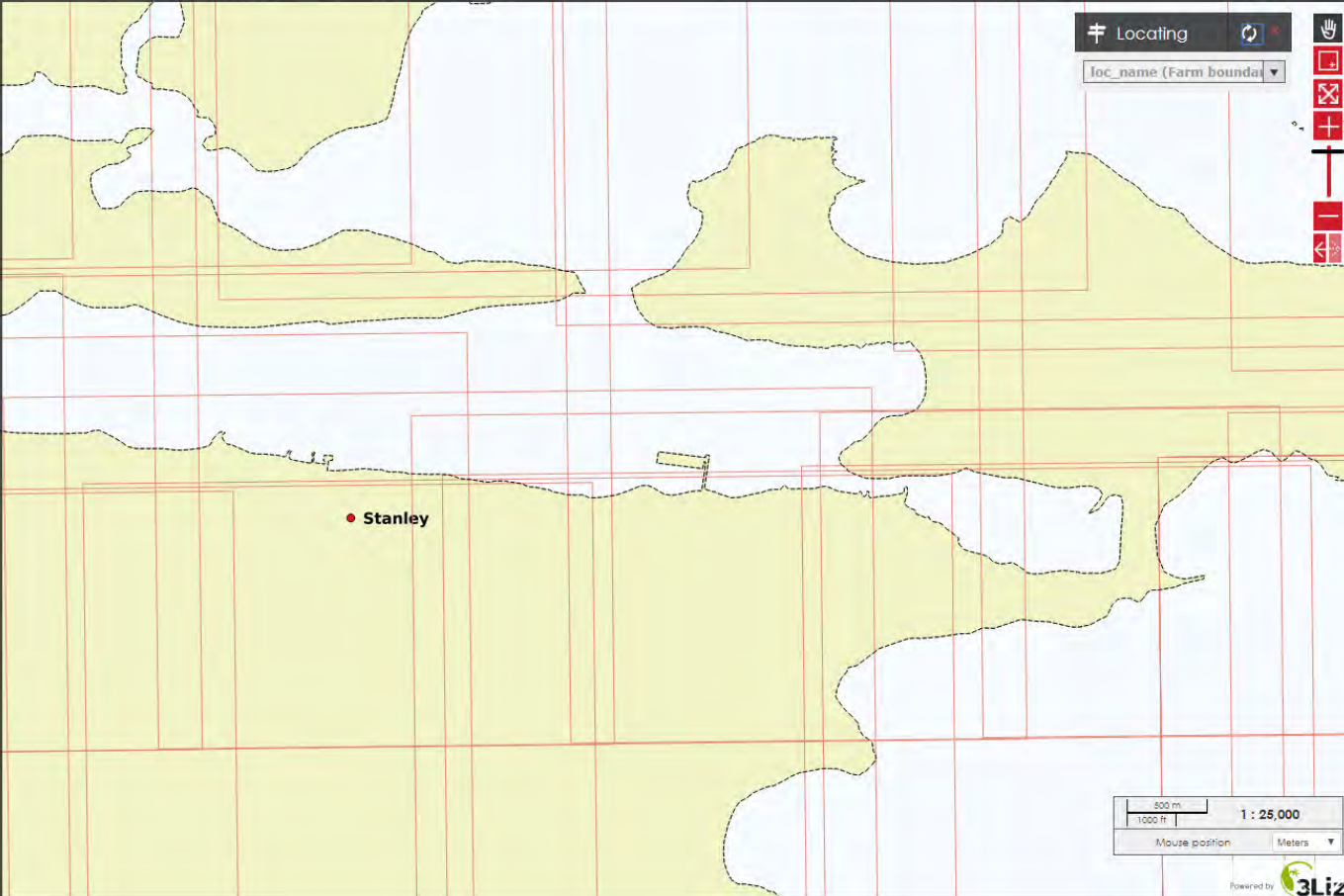
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Annex 8: Details of the broad-scale and fine-scale habitat mapping/modelling workflows

Falklands and South Georgia broad-scale habitat maps/models

We created a Google Earth Engine (GEE) land cover classification method for mapping both South Georgia Island and the Falklands on an island-wide scale. 10m Sentinel 1 and 2 imagery served as this method's primary imagery inputs (alongside Landsat 8 (band 1 only), SRTM (Shuttle Radar Topography Mission) and related DEM products (slope, aspect, etc.). Processed Sentinel imagery was provided by the JNCC (Joint Nature Conservation Committee). Additional metrics, such as EVI, NDVI, and NDWI (quantifications of vegetation density) and Geary's C (spatial autocorrelation algorithm) were also calculated from both islands' imagery. Over 15,000 groundtruth points were compiled for the Falkland Islands, with ~7,500 for South Georgia (well over half of were tussac grass points provided by researcher Sally Poncet from her work surveying seabirds on the island – some tussac points were decimated from the final map product input dataset due to apparent over-training of the classifier to the tussac class having a diluting effect on the classifier's capability to map non-tussac vegetated classes). General groundtruth QA/QC was performed on input data prior to use in the final maps. Much emphasis was also given to determining which land cover (particularly vegetated) classes were, indeed, mappable with current available ground truth and imagery data sources. Decisions for final map classes were derived primarily through an iterative process of including or excluding various ground truth types within mapped land cover classes and assessing uncertainty in the resultant maps via confusion matrices.

GEE's cloud-based platform permits access to many datasets and analysis tools of great use in the creation of the island-wide maps. We constructed a GEE script that handles the entire classification process from start to finish – including terrain (cosine based) and cloud correction, metric (NDVI etc.) calculations, data extraction for ground truth points, and the application of a pixel-based, supervised, random forest classifier and model validation, followed by map creation alongside the production and export of confusion matrices (**Figure 8.1**).

Much of the refinement of the broad-scale maps occurred during a two-week visit by OSU principle investigator Michael Harte and a six-week visit by team member Bran Black during the summer of 2018. During this time, the original broad-scale methodology was refined to better suit the internet bandwidth requirements of the Falkland Islands (a factor that required consideration when running a script through GEE), as well as to assist in the fine-scale Falkland Island and South Georgia stakeholder prioritisation workshops held in August 2018. A series of in-person meetings and discussions between various OSU and SAERI team members also helped direct and fine-tune the future direction of project research.

Integration of subtidal, intertidal, and terrestrial environs began in 2018 in its incipient stages; ongoing work will further develop this project component over the course of the next year. Work in 2018 and to date into 2019 centred on the integration of Shallow Marine Surveys Group (SMSG) data, in the form of *Macrocystis* ground truth points. *Lessonia* and harder substrate points were incorporated at early stages of map production but were later dropped due to lack of classification success in relatively deeper waters within the mapping area. Kelp ground truth points were extracted from Sentinel 2 and Worldview 2 and 3 imagery. Current subtidal work continues with the integration of drop camera and side-scan survey (field techniques developed by project members Neil Golding and Dr. Chris Goldfinger) progressing throughout the 2019 field season. Experimental side-scan derived object-based classification/segmentation of basic substrate type (hard, mixed, soft) derived from side-scan surveys is now being

investigated and will be incorporated into the final broad-scale map product if found to contribute meaningfully. Sentinel-based Satellite Derived Bathymetry (SDB) for shallow marine (estimated $\leq 14\text{m}$ range, approximately two meter vertical resolution) is currently being produced for the Falkland Islands by Environment Systems Ltd. This analysis process is experimental both at this site and with this data source, but if the resultant dataset is found to describe bathymetry with reasonable success and with minimal apparent processing artefacts, these data will be incorporated into the final broad scale subtidal classification.

The Open Data Kit (ODK) smartphone application created and managed by the SAERI IMS data centre fostered the ease and practicality of furnishing additional project ground truth points to the existing ground truth library. Further drone survey and ground truthing, with emphasis on non-tussac vegetated classes, was collected by Neil Golding at South Georgia during March of 2019. This will likely prove highly impactful to the improvement of map accuracy for the South Georgia broad scale maps.

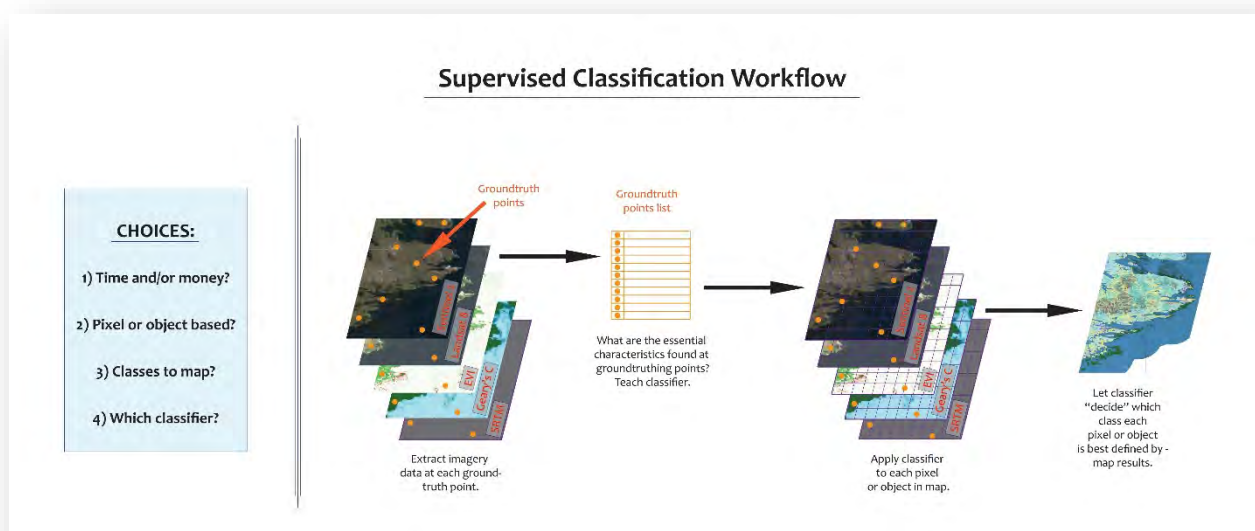


Figure 8.1: Supervised classification workflow

Falklands and South Georgia fine-scale habitat maps/models

Areas and questions of interest compiled at the Falkland Islands and South Georgia fine-scale mapping stakeholder prioritisation workshops in August 2018 indicated a significant user interest in maps with finer spatial scale and more tightly constrained research questions driving their production than those that drove the general island-wide land cover classification maps created in the broad scale map series. Discussed research questions revolved around the mapping of features that were often too fine to discern in the medium resolution (10m) public access Sentinel imagery that the broad scale maps had been constructed from (for example, the mapping of invasive weed calafate at sensitive sites in the Falkland Islands). This shift in focus for the second half of the project drove us to bring finer scale input data, namely drone imagery collected by Neil Golding and Worldview 2 and 3 data supplied through the Digital Globe Foundation grant for both Falklands and South Georgia, into much more prominent roles within our classification process. The substantially finer spatial resolution of both imagery types rendered the use of GEE impractical due to data upload and storage

limitations. These limitations led us to explore alternative classification methods to create our fine-scale habitat maps/models.

We are currently developing an open source classification method (**Figure 8.2**) that employs Python’s machine learning library Sci-Kit Learn to run object-based classification capable of accepting drone and Worldview imagery as principle data sources and ground truthing. Object creation is currently achieved through the FIJI (open source, Java-based image classification software) Segmentation plugin. Future work will focus on the scaling-up of already existing scripts to improve the handling of the data volume required for full scale modelling and the efficient export of model results. Currently, completed scripts centred on the raster data production component of the project workflow will be adapted once the final format for full-scale model results is better known.

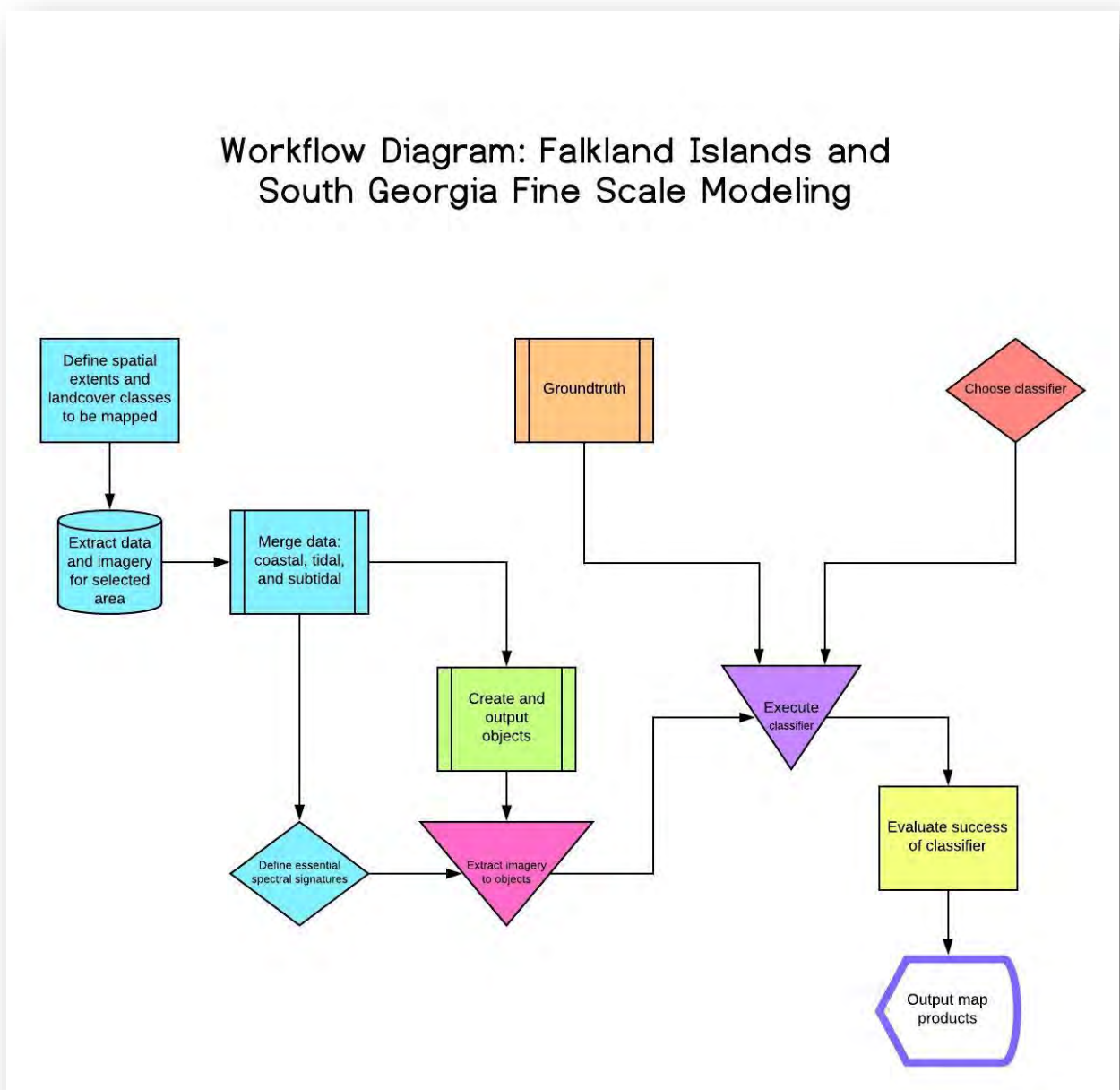


Figure 8.2: Fine-scale habitat mapping/modelling workflow

Please double click on the embedded PDF below to open.

Penguin News, February 15, 2019

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Using drones to create fine scale models of minefields



View across Yorke Bay minefield from drone (SAERI)

MOST people wouldn't associate minefields with drones, unless you're unlucky enough to lose your drone in one (which we hear has happened here). However, drones are proving increasingly useful in providing imagery of inaccessible minefields.

THE minefields around Stanley, dating back to the Falklands war, have remained largely untouched for nearly 35 years, due to the restrictions in place around access to the minefields. Over this time, they have become a haven for Falkland's wildlife.

The fact that following the demining process, these areas will be opened to the public by Falkland Island Government, albeit allowing for suitable habitat recovery, generated interest amongst stakeholders involved in the Darwin + Coastal Habitat Mapping project currently underway within the Falklands and South Georgia.

They saw an opportunity to map these areas prior to the demining process, allowing the project to capture a baseline of what these pristine habitats looked like, so that future change could be monitored.

Since October 2018, Neil Golding, the Coastal Habitat Mapping

Project Manager at the South Atlantic Environmental Research Institute (SAERI), has been out to Yorke Bay and the surrounding area with SafeLane Global personnel, capturing imagery with drones to create state of the art maps of these minefields.

Neil realised there was an opportunity to create a better product with wider utility through collaborating with the UK Government Falkland Islands Demining Programme, led by Guy Marot of Fenix Insight, and SafeLane Global who undertake the clearance work.

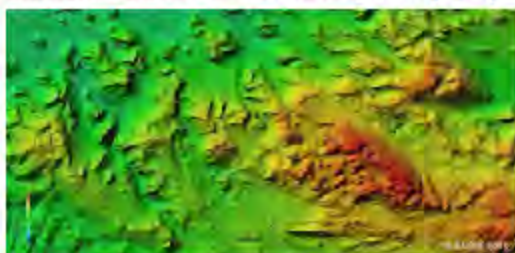
As part of this collaboration, SafeLane Global deployed markers (known as Ground Control Points) actually within the minefields and then took their positions and heights using specialist survey equipment.

Neil then used this information during the processing of the drone imagery to create highly accurate digital terrain models of the minefields. The models are a useful addition to the work already undertaken by SafeLane as part of the demining process.

The Coastal Habitat Mapping project is currently working to feed this high resolution drone imagery into a habitat modelling



Top: an ortho-mosaic (many hundred images merged together) of Yorke Bay minefield (you can spot the blue SAERI vehicle at the bottom). Below: A digital terrain model created with the help of SafeLane Global for the same area as the image above. (SAERI)



process in order to develop fine-scale habitat maps for the coastal margins of the Falkland Islands. These fine-scale habitat models/maps are scheduled for completion by the end of June 2019.

Neil said: "Being able to work with the Falklands Demining Programme has been a fantastic opportunity, and the project is grateful for the support Dave Clark and the SafeLane Global survey team has been able to provide, not forgetting Ross Chaloner from the Public Works Department.

The resulting aerial maps not only provide an excellent baseline to monitor change after the project and land has been handed back, but have also hopefully provided SafeLane with valuable additional information for their work". John Hare, Technical Director at SafeLane Global said "this supplementary piece of work provides really good corroborative, and in some cases additional, data and a bench mark for the remediation of the minefield sites".

Historically, and to this day, the coastal and inshore marine ecosystems and resources have played an important role in the

Falkland Islands, both from a social and economic perspective. Knowledge of these coastal environments is essential for their management, yet comprehensive island-wide broad-scale and fine-scale coastal habitat maps are lacking. Such maps would form an important baseline from which to measure future change. The DPLUS065 Coastal Habitat Mapping project aims to fill this critical gap in coastal knowledge.

This three-year project, grant aided by the Darwin Initiative through UK Government funding, and with a financial contribution made by FIG through the Environmental Studies Budget, brings together many organisations.

These comprise SAERI, Oregon State University, the UK Joint Nature Conservation Committee, Shallow Marine Surveys Group, Falkland Islands Government and Government of South Georgia & the South Sandwich Islands, representing the leading edge in remote sensing, ecological knowledge and field expertise.

The Coastal Habitat Mapping project is due to conclude in March 2020. SAERI

One of the drones being used to map Stanley's minefields (SAERI)



Please double click on the embedded PDF below to open.

Penguin News, April 5, 2019

Page 11



The view across Gold Harbour. Copyright: SAERI 2019



A composite image of Bird Island. Copyright: SAERI 2019

Using drones to map South Georgia's coastal habitats

THE recent South Georgia Archaeological Project expedition to South Georgia (see centre spread) included Neil Golding of the South Atlantic Environmental Research Institute (SAERI), project manager for the Institute's ongoing Darwin Plus Coastal Habitat Mapping.

The aim of the trip for this project, Neil told Penguin News, was to reach areas identified by the project's stakeholders as priority areas, that is to say, areas where the stakeholders wanted "much more detailed information than they got from the broad-scale maps originally developed through the project for South Georgia."

Those areas include popular visitor sites, which will provide a useful tool to help better inform their management, he said.

But the detailed imagery and consequent mapping will also provide a valuable baseline into how habitats and the island's vegetation are changing and develop-

The drone used in the project.



Pic: N Golding Copyright: SAERI 2019

ing in the wake of the successful eradication of rodents and reindeer from South Georgia.

The trip allowed the project to add 241 points of ground validation data into the model, in other words, checking the broad-scale habitat model predictions against the reality on the island's surface.

The use of a drone further allowed Neil to obtain detailed imagery of eight locations within South Georgia: Bird Island, Elsehul, Koppen Point, Jason Harbour, Start Point (Salisbury Plain), Fortuna Bay, Albatross Cove (Cooper Bay) and Gold Harbour. From this imagery, he says, we can then interrogate to compare with what is predicted on the broad-scale maps, but also it gives us that much higher level of resolution about what's on the ground; [and helps with] species counts, so we've got a really good data-set from Fortuna Bay, which has a large colony of king penguins.

The drone imagery, together

with high res World View satellite imagery from the Digital Globe Foundation will result in "more robust fine-scale habitat maps" as well. The project was grateful for the support they received from Iridium Communications.

Neil also supported the archaeological project, providing invaluable aerial footage of dig sites, allowing "archaeologists to put those sites in the context of the wider environment."

The Coastal Habitat Mapping Project aims to develop the first

island-wide broad-scale and fine-scale habitat maps of the coastal margin for South Georgia and the Falklands.

The project is led by SAERI with the Government of South Georgia and South Sandwich Islands as an integral partner, and further partner support from the Falkland Islands' Government, Oregon State University, the UK Joint Nature Conservation Committee (JNCC), and the Shallow Marine Surveys Group.



Falkland Islands Obesity Awareness Day - 2019

To observe World Health Day held annually on 07th April,

KEMH is organising a

"Falkland Islands Obesity Awareness Day"

Everyone is invited to attend to have their Body Mass Index (BMI), Blood Pressure (BP) and Blood Sugar checked.

When? - Monday 08th April 2019 between 10:00am and 12:00 noon

and 1:00pm and 4:00pm

Where? - Book in at KEMH Reception and you will be called through to see the Practice Nurse

Annex 11: Shackleton Scholar summary report



Shackleton Scholar Report Drones as a “tool” for our future Nicole Durfee, Oregon State University



Technological developments have made Unmanned Aerial Vehicles (UAVs, also called drones) more accessible and affordable. Additionally, the portability and ease of operation of many commercially available drones make them a tool that can be adapted for a number of objectives. Drones are now being utilized for a myriad of purposes, from recreation to ecological research. For example, drones can provide agricultural producers a tool that decreases time requirements for data collection while providing improved monitoring of large pastures or rangelands. The high spatial resolution of drone-based imagery also improves the ability to monitor important issues relevant to the Falkland Islands, such as invasive species establishment, coastal erosion, or livestock movement.

Nicole Durfee visited the Falklands for two weeks in November and December of 2018 as a Shackleton Scholar and ran a series of events around theme of drones. Nicole was joined by Neil DPLUS065 Coastal Habitat Mapping project, grant aided by the Darwin Initiative through UK Government funding. The South Atlantic Environmental Research Institute (SAERI) organized and hosted the trip. During her time in the Falkland Islands, she engaged with members of the community in a variety of drone-focused workshops and seminars. Each event provided the community exposure to different aspects of drones, to include basic flight skills and safety, mission planning, and potential applications. As Nicole’s work with UAVs has largely focused on monitoring vegetation (particularly western juniper) in rangeland environments, several events also addressed the potential for using drones for monitoring vegetation characteristics specifically.

A drone theory workshop was held at the Lighthouse at Seaman’s Mission in Stanley during the first week of the visit. Participants expressed interest in using drones for a number of purposes, to include local news reporting and surveying of construction sites. Information regarding basic drone rules and regulations as well as safety guidelines was provided. Various aspects associated with drone use, such as sensors and flight planning were also addressed. During this event, participants also received experience working with image processing software and were provided with step-by-step instructions for creating an orthomosaic using imagery collected using drones.

A public presentation addressing drone applications was held at the Falkland Islands Chamber of Commerce. An overview of safety and regulation considerations was provided in addition to information regarding a number of drone-related projects. Topics included monitoring of wildlife and vegetation, agricultural health and productivity analysis, and wildfire tracking. A case study examining the use of drones for vegetation identification was also profiled. This was followed by a presentation on the DPLUS065 Coastal Habitat Mapping Project from Neil Golding. Following the presentations, audience members discussed a variety of topics with the presenters, to include the use of drones for mine identification and minefield mapping as well as methods of image data analysis.

Several events focused on working with local school-age children. A classroom presentation was held with year 6 students from the Falkland Islands Infant Junior School, in which students learned about uses of drones and participated in a classroom

event in which they “designed” their own drones. Students were later provided the opportunity to fly a drone in a safe, controlled environment with supervision. An additional event was held in coordination with the Falklands Conservation Watch Group, in which students practiced basic flying skills and learned about drone-related research conducted by SAERI.

A field workshop was conducted in Surf Bay during the first week. Participants in this event had a variety of experience levels with drones and indicated interest in using drones for both recreational and commercial purposes. Community members were able to learn about flight mission operations, such as the tools used for flight planning (e.g., flight controls and mission planning software, weather forecasting resources), and georeferencing. The discussion also emphasized the importance of safety, regulation, and weather considerations. Following an overview of the drone and flight objectives, participants observed a drone-mapping mission. Considerations regarding other drone applications, such as performing building inspections or recording sporting events, were also discussed throughout the course of this event.

An additional workshop was held at the Stanley Leisure Centre Sports Hall in order to provide community members the opportunity to fly a drone in a controlled, indoor environment. Each participant received an explanation of basic flight controls and techniques, and was able to practice these skills. This workshop also gave participants an opportunity to ask questions and learn more about drone applications in an informal environment. In particular, several participants were interested in the general capabilities of drones and associated cameras (such as tracking moving objects) as well as limitations (e.g., cost or battery life).

During the second week, Nicole and Neil travelled across to West Falkland. Presentations were given at the Hill Cove Social Club and at the Fox Bay East Social Club. Both presentations focused on the wide variety of drone applications available, as well as the use of drones for agricultural purposes. In particular, participants expressed interest in the use of drones to monitor vegetation production, invasive species, and potentially livestock movements. A flight demonstration was held in Hill Cove in order to allow participants an opportunity to observe basic drone-mapping procedures. Regulations and safety concerns were also addressed during this demonstration, to include interactions with birds and weather limitations. Weather conditions did not permit a demonstration in Fox Bay East.

Upon returning to East Falkland, a meeting was held with the Department of Agriculture to discuss some of the uses of drones specific to production and vegetation management. Of particular interest during this meeting was the use of high-resolution, drone-based imagery to identify and monitor invasive species (such as calafate) among other ecological applications.

Nicole’s trip to the Falkland Islands concluded with habitat mapping fieldwork in Port Sussex, led by Neil Golding from SAERI. Two missions were flown over areas with varying terrain characteristics. Imagery was captured using the MicaSense RedEdge multispectral camera mounted on a DJI Phantom 4 Professional drone. Orthomosaics created from this imagery may potentially be used to identify reflectance characteristics of vegetation (such as calafate), as well as to track trends in vegetation over different temporal and spatial scales.

As drone technology continues to evolve, the potential uses of drones are rapidly expanding. Through outreach programs, safe drone operations are reinforced while simultaneously informing the public about the many possibilities for drone use.

Associated Publicity

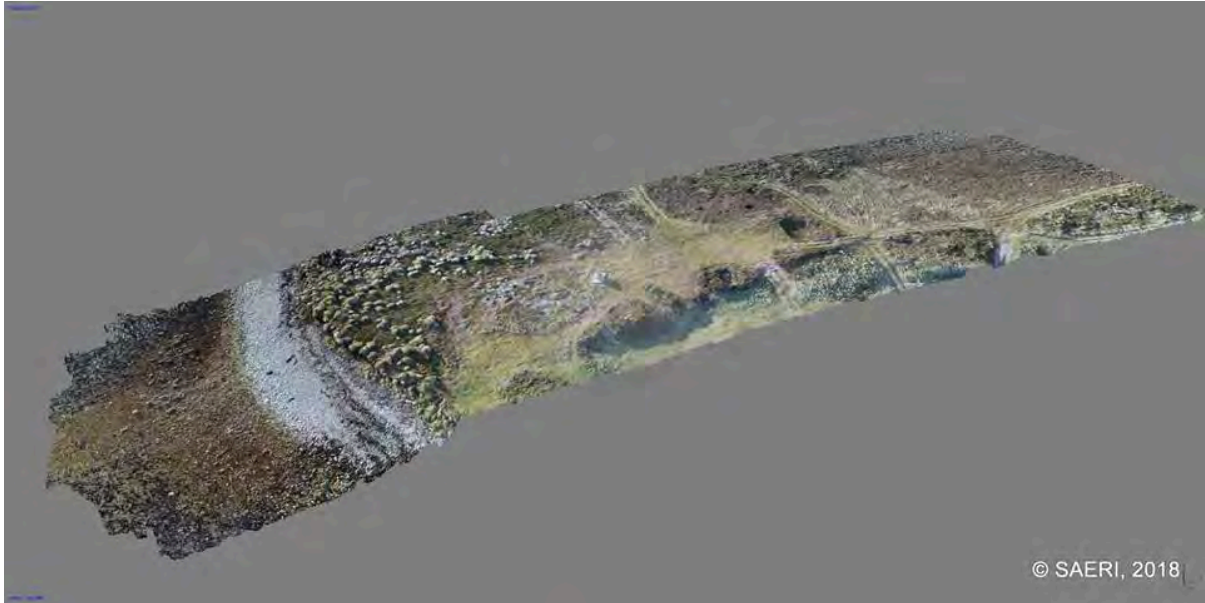
- Article in Penguin News
- Interview for Falkland Island Radio Service (FIRS) and Falkland Islands Television (FITV)
- Announcement through SAERI social media sites
- Announcement through Oregon State University Department of Animal and Rangeland Science



Drone workshop (26th Nov 2018). Photo credit: Neil Golding, SAERI

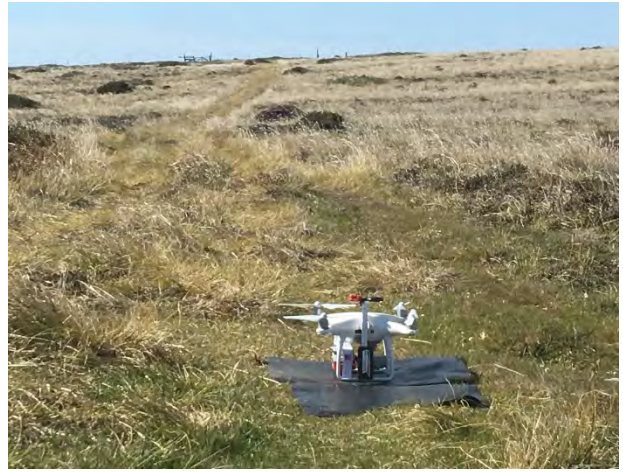


Surf Bay Field Workshop. Photo credit: Neil Golding, SAERI



© SAERI, 2018

Orthomosaic created from Surf Bay workshop – Image courtesy of SAERI



View from Port Sussex (L), DJI Phantom 4 Professional with RedEdge multispectral camera attached (R). Photo credit: Nicole Durfee



© SAERI, 2018

Teaching the Falklands Conservation Watch Group about drones. Photo Credit: Neil Golding, SAERI

Annex 12: South Georgia expedition outreach *Aide Memoire*

Please double click on the embedded PDF below to open.

South Georgia Archaeological Expedition outreach: Facebook & Twitter handles - *Project hashtag: #SGArchExpedition*

South Georgia Heritage Trust (SGHT)

@SGHTcharitysite (Twitter)

@SouthGeorgiaHeritageTrust (Facebook)

Cambridge Archaeological Unit (CAU)

@ucamarchaeology (Twitter)

@archaeologyCambridge (Facebook)

@cambridge_archaeology (Instagram)

South Georgia Archaeological Project

@SouthGeorgiaArchaeologicalProject (Facebook)

@SG_Archaeology (Twitter)

@sg.archaeologicalproject (Instagram)

Friends of South Georgia Island (FOSGI)

@FOSGI_News (Twitter)

SAERI

@SAERI_FI (Twitter)

@S4ERI (Facebook)

Darwin Initiative

@DarwinInitiative (Facebook)

@Darwin_Defra (Twitter)

National Geographic

@NatGeo (Twitter, Facebook & Instagram)

Iridium

@IridiumComm (Twitter handle)

@DanMERC.AIR (Dan's own Twitter handle)

Hashtags to use:

#iridium

#iridiumNEXT

Government of South Georgia and the South Sandwich Islands

@GovSGSSI (Twitter)

@GovSGSSI (Facebook)

Annex 13: Letter of thanks from South Georgia Heritage Trust

Please double click on the embedded PDF below to open.



*Registered Scottish Charity No. SC036819
South Georgia Heritage Trust,
Verdant Works, West Henderson's Wynd, Dundee DD1 5BT
Patron HRH The Princess Royal
Hon. President: Baroness Young of Old Scote*

Neil Golding
SAERI
Stanley Cottage, Ross Road
FIQQ 1ZZ Stanley,
Falkland Islands

10 April 2019

Dear Neil,

The South Georgia Heritage Trust would like to thank you for the excellent contribution that you made to the recent South Georgia Archaeological Expedition.

SAERI's financial contribution to pay for your place on the expedition helped us to make it possible. The Coastal Habitat Mapping work that you undertook during the expedition also provided the archaeologists with useful imagery taken by aerial drones, helping the archaeologists to identify sites and items of interest. We appreciated the excellent communications you maintained with the expedition's stakeholders and sponsors throughout, and the visibility that your updates gave to all those who supported SAERI's Coastal Habitat Mapping work and the South Georgia Archaeological Project.

We wish you all the best with the completion of the Coastal Habitat Mapping work and thank you again on behalf of all at the South Georgia Heritage Trust.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Alison Neil'.

Alison Neil
Chief Executive, South Georgia Heritage Trust

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Annex 14: Satellite-Derived Bathymetry report

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Kelp & Bathymetry Modelling in the Falkland Islands

Technical report



March 2019

Version No. 1.00



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