Darwin Plus:
Overseas Territories Environment and Climate Fund
Final Report

*To be completed with reference to the "Writing a Darwin Report" guidance: (http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)*

Darwin Project Information

Project reference	DPLUS083
Project title	Soil map and online database as climate change mitigation tools
Territory(ies)	Falkland Islands
Lead organisation	South Atlantic Environmental Research Institute (SAERI)
Partner institution (s)	UK Centre for Ecology and Hydrology (UKCEH), Falkland Island Government (FIG), James Hutton Institute (JHI), Natural History Museum (NHM), UK Falkland Island Trust (UK FIT) and University of Magallanes (UMAG)
Darwin Plus Grant value	£265,612
Start/end date of project	1st April 2018 to 31st October 2020
Project leader name	Tara Pelembe
Project website/Twitter/blog etc.	Website: https://www.south-atlantic-research.org/research/terrestrial-science/soil-map-and-online-database-as-climate-change-mitigation-tools/ Blog: https://www.south-atlantic-research.org/news/ Twitter: @SAERI_FI Facebook: https://www.facebook.com/S4ERI/ #FalklandSoils
Report author(s) and date	Dr Stefanie Carter (Project Manager), Prof. Jim McAdam (Project Partner), proof-reading by the whole Project Management Group and SAERI Senior Management Team 30 November 2020

1 Project Summary

Soil erosion due to dry and windy conditions, past uncontrolled grazing and sporadic fires is a widespread, unevenly distributed and dynamic process on the Falklands. Climate change predictions show a rise in temperature and an increased soil moisture deficit through increased seasonal evapotranspiration which could alter soil organic matter content with knock-on effects on soil biological, physical and chemical properties. This would further increase the risk of erosion and some of the shallow soils with high organic matter could change from carbon sinks to carbon sources. The Falklands had neither a soil map nor an accurate understanding of the extent and the state of the peatlands.

This DPLUS083 Soil Mapping Project follows on from the EU BEST funded project 'Terrestrial Ecosystems of the Falklands – a Climate Change Risk Assessment' (TEFRA, 2013-2017). The TEFRA project identified climate change predictions for the Falkland Islands and their potential impact for plants and soil. In order to address these climate change challenges, more baseline information on soil properties and distribution was required and the Darwin Plus 083 Soil Mapping Project was developed to fill these gaps in knowledge.

This DLUS083 Soil Mapping Project developed a national soil map for the Falkland Islands (location in Figure 1, left) and interactive tools for local stakeholders. These tools made data such as soil type, chemical properties, pH and bulk density available at farm level at a resolution of 30

m, which can now be utilised by farmers as well as agricultural advisors, conservation and research organisations for improved land management. Microbiological properties of soil samples were determined and their differing communities were assessed and related to the chemical and physical properties. The project also established a baseline for peat extent, carbon stock and erosion extent, which puts the Falkland Islands' peat and carbon resource into a global context.

These deliverables were achieved through extensive soil surveys across the Falkland Islands (Figure 1, right). For each location where soil was surveyed, soil was measured across a range of soil properties (such as pH, bulk density, soil moisture, electric conductivity and several chemical properties). In addition, erosion extent and peat depth were recorded. The mapping was carried out using digital soil mapping with spatial covariates (e.g. topography, geology, habitat classification, Sentinel-2 imagery) and linked with the aforementioned field observations using a trained machine learning model.

The outcomes of this project are highly relevant to local stakeholders – mainly landowners and land managers – but also conservation organisations and agricultural advisors. Stakeholder engagement and consultation were therefore a particular focus for the project as were the stakeholders' requirements for the delivery of the final interactive tool.

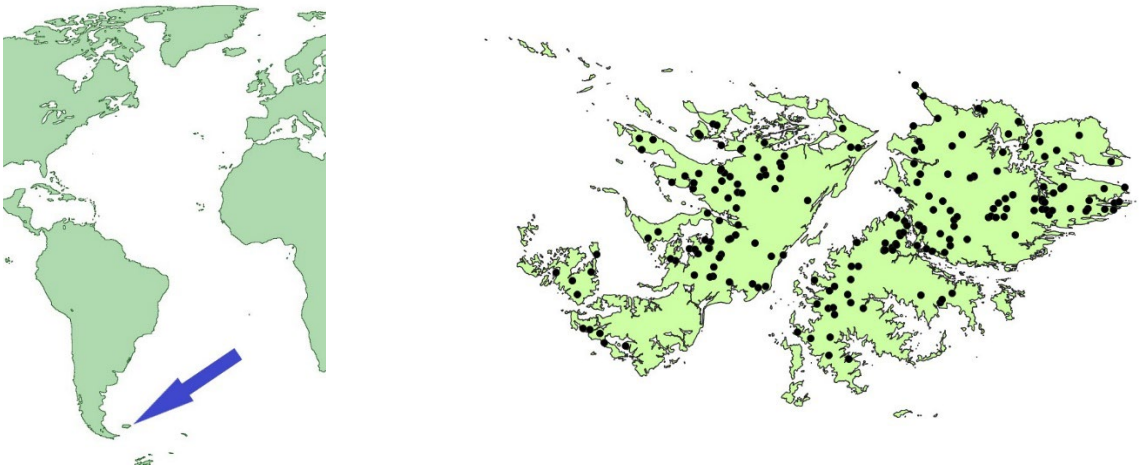


Figure 1: Location of the Falkland Islands (left). Location of soil survey points within the Falkland Islands (right).

2 Project Stakeholders/Partners

2.1 Project partners

The project partners formed the Project Management Group (PMG) and met regularly to guide the project, decided on the methodologies applied and discussed any issues that arose. They also had a Monitoring and Evaluation (M&E) function. Nine PMG meetings were held throughout the project, the notes for which are available here.
The project partners were directly involved in supporting the project as follows:

- SAERI was the lead organisation. SAERI's main office is in the host territory from which the Project Manager (PM) Stefanie Carter ran the project administration (e.g. PMG and stakeholder meetings, purchasing equipment, managing the budget), maintained contact with stakeholders, planned the fieldwork and carried out the fieldwork alongside the soil surveyor. She was supported by SAERI's Deputy Director (Innovation) Tara Pelembe and Deputy Director (Science) Dr Alastair Baylis with the overall project management, by SAERI's Deputy Director (Business & Programmes) Teresa Bowers with project finances and by SAERI's office staff with general administration and logistics.
- FIG was the lead host-territory partner organisation and was involved in stakeholder engagement and soil lab analyses but also advised on general fieldwork planning and methodology. James Bryan and Matthew McNee from the Department of Agriculture (DoA) were involved in contacting landowners to update them on the progression of the project, for permission to carry out the soil surveys and assisted in planning and running the stakeholder workshops. Gordon Lennie (DoA) processed all soil samples collected in the field and analysed ca. 60% of them for chemical and physical properties.

- JHI was the lead for the soil modelling. Project partner Dr Matt Aitkenhead selected the satellite maps, compiled all available environmental data, which formed the baseline of the model, selected the soil sample points, and created all maps.
- UKCEH in Bangor advised on general fieldwork methodology and planning and more particularly on recording peat and erosion extent through project partner Prof. Chris Evans. He also instigated an additional deliverable to the project (soil CO_2 flux monitoring) and assisted in organising the relevant equipment and planning the experimental design. Chris also joined the fieldwork through a self-funded trip and provided a weather station on a permanent loan basis.
- NHM was the lead on soil microbiology. Project partner Dr Anne D. Jungblut visited the Falkland Islands in the beginning of 2019 to collect soil samples and carried out the DNA extraction and sequencing. Anne also interpreted the results on soil microbial communities and put these in a wider context.
- UK FIT was the lead on stakeholder engagement in the project. Project partner Prof. Jim McAdam was involved in organising and running the stakeholder workshops and met with many farmers individually who were unable to join the workshops.
- UMAG advised on fieldwork methodology, assisted with fieldwork and advised on the interpretation of the soil properties through project partner Dr Sergio Radic Schilling. He also recruited the soil surveyor, Roberto Jara Langhaus, for the fieldwork.

One particular partner relationship strengthened by on-going collaboration is that between SAERI and UKCEH. A gas flux experiment initiated by the Soil Mapping Project was only made possible through close collaboration with the UKCEH project partner, who made the required equipment available in order for the PM to ship it down to the Falkland Islands. Additionally, project partner Prof. Chris Evans joined the gas flux fieldwork and soil survey fieldwork at his own expense and encouraged the PM to collaborate with his research project on water chemistry from lakes, ponds and estuaries in the Falklands. Furthermore, UKCEH have provided a weather station on a permanent loan basis to SAERI to initiate the gathering of long-term climatic data. Monthly summary data are made publicly available on the project website, whilst the raw data will be stored for future analyses. These and other collaborations led to the signing of a Memorandum of Understanding between SAERI and UKCEH in May 2020 for future research partnerships beyond the Soil Mapping Project.

2.2 Acknowledgements

The project had amazing support from many individuals without whom it could have not been successful. For a full list of acknowledgements, please see Annex 6.1.

2.3 Project stakeholders

2.3.1 Host territory

Stakeholder engagement was a key component of the project as the final maps and interactive tool produced by the project will directly benefit local stakeholders and stakeholders in the wider peatland community. Stakeholders who were engaged in the project included: farmers, representatives of rural associations, FIG, Department of Agriculture (DoA) officials, Falklands Landholdings (FLH), Relevant Members of the Legislative Assembly (MLAs), NGO Falklands Conservation (FC) and Independent Research Institute SAERI, IUCN and other organisations outside the Falklands engaged in sustainable peatland management.

At the planning stage of the project, there was engagement with

a. Those involved in the previous EU-BEST project, *Potential impact of climate change on terrestrial ecosystems in the Falkland Islands*
b. FIG-DoA and Environmental Policy
c. SAERI
d. Other relevant experts, e.g. qualified soil surveyors with Falkland Islands experience

Workshops

A key component of local stakeholder involvement throughout the project were workshops held in project years one (February 2019) and two (February 2020). The workshops were advertised on Falklands Radio, in the Penguin News (local newspaper), Wool Press (bi-monthly magazine for farmers) and Facebook (Figure 2) and they were held in Stanley, East Falkland and Fox Bay, West Falkland to give as many landowners as possible the opportunity to attend. In the first year, the workshops focussed on informing landowners about the project, what it hoped to achieve and how the project would go about it. Landowners were also asked to feed back their ideas on the delivery of the final outcomes to ensure that all the maps would be relevant and accessible to them.

In the second year, landowners received an update on the project process and the opportunity to explore preliminary maps to better understand what the project will deliver. They were also encouraged to present ideas on map delivery that would suit them. Each year workshops were followed up by the UK FIT Project Partner with individual farm visits, presentations and one-to-one discussions with interested landowners who were not able to attend the workshops. The workshop reports are available here and a full list of landowner engagement is available in Annex 6.2.

Further outreach was delivered by a stall and presentation at the Expo during Farmer's Week in July 2019 (Figures 3 and 4). The stall provided the opportunity to engage with the general public on the project and the presentation was directed at members of the Rural Business Association. Farmer's Week was unfortunately not held in 2020 due to Covid-19, otherwise this engagement would have been repeated.

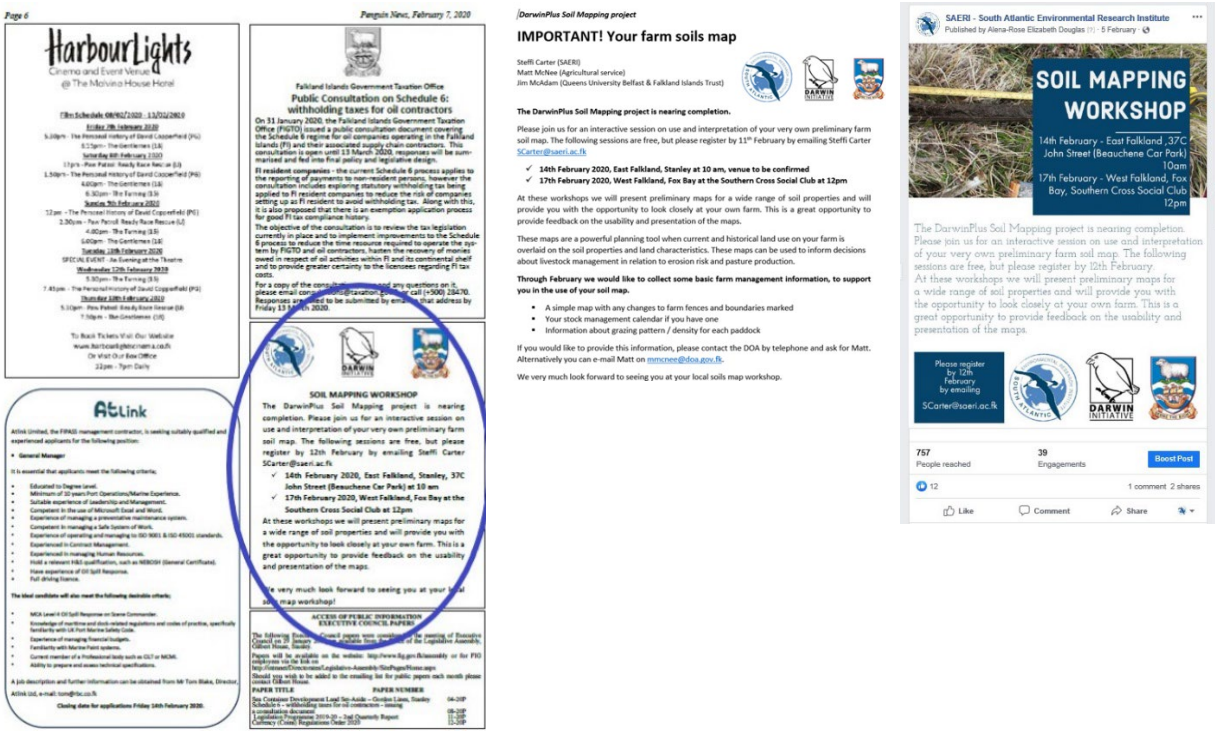


Figure 2: Adverts for Farmer's workshops in the Penguin News (left), Wool Press (middle), Facebook (right).

Figure 3: General public stall with poster presentation, soil profile activity for children and preliminary maps at Farmer's Week.


Figure 4: Presentation held at Farmers' Week.

The furthest-reaching stakeholder involvement was made possible by the map delivery itself. Every landowner received all map layers for their farm on a memory stick in the mail accompanied by a Falkland Islands Soil Map Interpretation Guide. This ensured that all landowners in the Falklands are now aware of the project but also have access to the maps irrespective of internet connections which are slow and expensive in the Falklands.

Additionally, to engagement with landowners, The UKFIT Project Partner also met with and briefed the following people on the progress of the Soil Mapping Project:

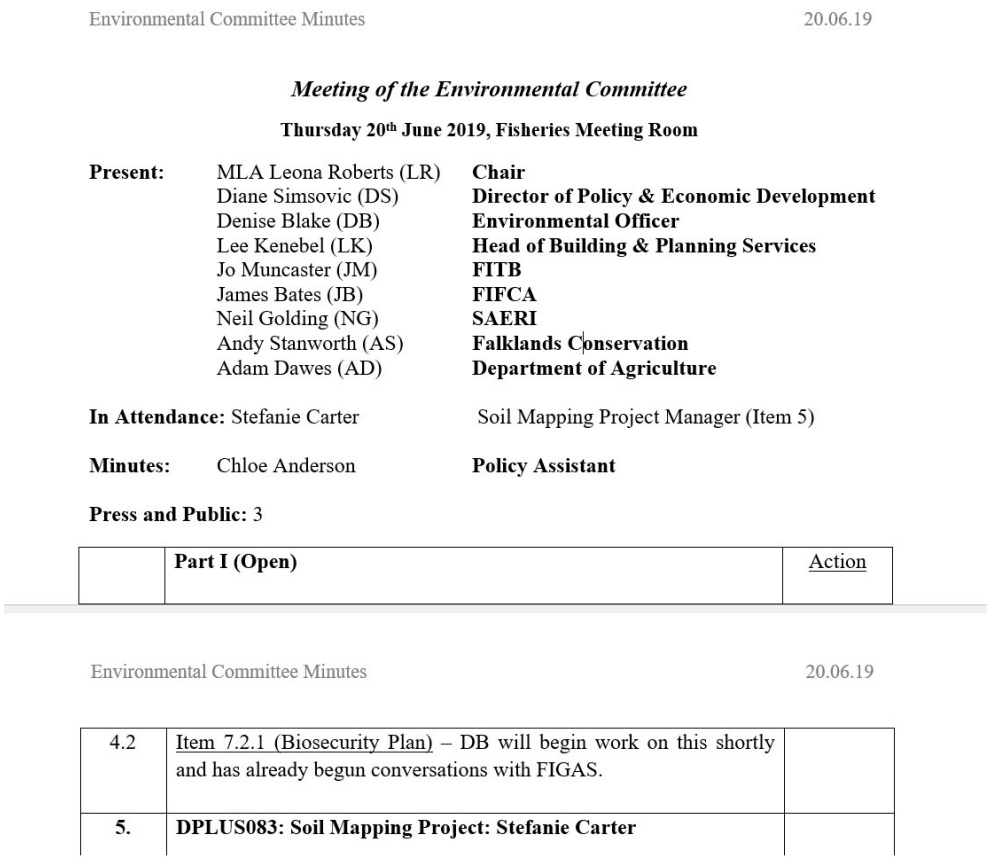
Project Year 1

- Governor Nigel Phillips to brief him on the project
- MLAs Ian Hansen (FLH & Deputy Portfolio Holder-Natural Resources), Teslyn Barkman (Portfolio Holder-Natural Resources and Deputy Portfolio Holder-Environment and Public Protection) and Leona Roberts (Portfolio Holder-Environment and Public Protection)
- Head of Policy and Environment, FIG Diane Simsovic and Environment Officer and Policy Adviser, Denise Blake

Project year 2

- FIG Director of Natural Resources, Dr Andrea Clausen
- FIG Senior Agricultural Adviser, Department of Agriculture, Tom McIntosh
- Assistant Director and the Habitats Restoration Officer of FC, Drs Andy Stanworth and Katherine Ross, respectively

The PM also attended FIG's Environment Committee in June 2019 and delivered a presentation on the Soil Mapping Project to the committee; attendees are listed in Figure 5.



Environmental Committee Minutes 20.06.19

Meeting of the Environmental Committee

Thursday 20th June 2019, Fisheries Meeting Room

Present:	MLA Leona Roberts (LR)	**Chair**
	Diane Simsovic (DS)	**Director of Policy & Economic Development**
	Denise Blake (DB)	**Environmental Officer**
	Lee Kenebel (LK)	**Head of Building & Planning Services**
	Jo Muncaster (JM)	**FITB**
	James Bates (JB)	**FIFCA**
	Neil Golding (NG)	**SAERI**
	Andy Stanworth (AS)	**Falklands Conservation**
	Adam Dawes (AD)	**Department of Agriculture**
In Attendance:	Stefanie Carter	Soil Mapping Project Manager (Item 5)
Minutes:	Chloe Anderson	**Policy Assistant**

Press and Public: 3

	Part I (Open)	Action

Environmental Committee Minutes 20.06.19

4.2	Item 7.2.1 (Biosecurity Plan) – DB will begin work on this shortly and has already begun conversations with FIGAS.	
5.	**DPLUS083: Soil Mapping Project: Stefanie Carter**	

Figure 5: FIG's Environment Committee meeting notes excerpt from 20th June 2019.

2.3.2 Project stakeholders – global

Project Year 1
The project was also discussed by the PM in a Foreign & Commonwealth Office visit to the Falkland Islands with Rossa Commane (British Embassy, Montevideo, Uruguay); Emily Ford, Felix Roberts and Liz Green (British Embassy, Buenos Aires, Argentina).

Project Year 2

The PM presented the project on 24 February 2020 to a delegation from the Foreign & Commonwealth Office (FCO) visiting the Falkland Islands and the PM and the UK FIT Project Partner discussed the project in further detail during a subsequent informal lunch. The following people attended: Ben Cooper (FCO Overseas Territory Directorate), Sarah Cowley (Vice Consul, British Embassy, Montevideo, Uruguay), Robin Smith (Defence Attaché, British Embassy, Buenos Aires, Argentina), Emily Hourmouzios (Head of Programs, British Embassy, Buenos Aires, Argentina), Michael Dunlop (Second Secretary, British Embassy, Buenos Aires, Argentina), Harriet Beach (Second Secretary, British Embassy, Buenos Aires, Argentina), Christopher Wright (Political Consular, British Embassy, Brasilia, Brazil), Daniel Matthews (Argentina Desk Officer, FCO), Edward Strudwick (Brazil and Southern Cone Desk Officer, FCO) (Figure 6).

Figure 6: FCO visit to SAERI.

At the IUCN UK Peatlands Conference – 'Peatlands: Investing in the Future' – held in Belfast in October 2019, the UKFIT Project Partner gave a poster presentation highlighting the project: Mapping the Peatland Resource in the Falkland Islands (UKOT) (Figure 7). He also attended and contributed information about the project to sessions at this conference on:

- Peatlands: climate change & greenhouse gas accounting
- Peatland progress - UK Strategy in action
- Peatland restoration: emerging ideas & current challenges
- Engaging with key stakeholders at a practical & policy level

As a UK Oversees Territory (OT), the significant contribution the Falklands' peatlands make to the UK total peatland and carbon stocks was highlighted and came as a surprise to most delegates. This heightened interest in the project at a wider level.

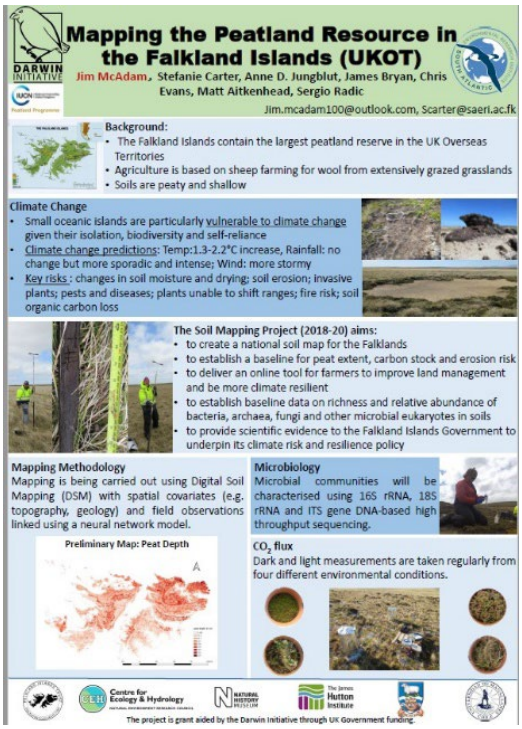


Figure 7: Poster presentation at the IUCN UK Peatland Conference in Belfast, Northern Ireland.

The UKFIT Project Partner also helped organise a one-day seminar at the Agri-Food and Biosciences Institute (AFBI) and Queen's University Belfast in October 2019 on 'Climate Change in the UK Overseas Territories'. At this seminar Tara Pelembe (Deputy Director, SAERI) gave an overview presentation 'Climate change in the South Atlantic' which set the scene for the Soil Mapping Project. Subsequently, the UKFIT Project Partner held a presentation on 'Climate

change predictions, predicted risk to terrestrial ecosystems and mitigation strategies for the Falkland Islands', which described the operation and potential outcomes of the Soil Mapping Project (Figure 8).

Figure 8: UK FIT Project Partners presents the Soil Mapping Project at an AFBI seminar.

The Chartered Institute of Ecology and Environmental Management (CIEEM) in the UK has a Special Interest Group (SIG) on Overseas Territories (OTs), which hosted an Autumn Conference in November 2019 through Zoom videoconferencing. The PM participated with a pre-recorded conference on 'The significance of understanding and protecting soil in the Falkland Islands'. The presentation was subsequently made available via YouTube and the project website and promoted through Facebook and Twitter (Figure 9).

Figure 9: Promotion of CIEEM SIG OTs Autumn Conference presentation on Facebook (left) and Twitter (right).

The JHI Project Partner also attended the Soil Organic Matter conference in Adelaide, Australia, in October 2019, where he promoted the project to ca. 300 soil science researchers and representatives from farming groups, regulatory bodies and policy engagement groups. The conference report is available on the project website.

Project Year 2

The PM further extended the project's publicity by presenting a talk at Uruguay's largest agricultural gathering – the Expo Prado in Montevideo – as part of a seminar of agricultural matters relating to the Falkland Islands in September 2020 (Figure 10). The presentation was given as a Zoom presentation to a live audience at the grounds as well as a virtual audience and was translated into Spanish by a translator to make it more accessible to the audience.

CONFERENCIA: Agro en las Islas Falkland.

Viernes 19 de Setiembre – 15hs

PROGRAMA

15hs	**Apertura**
15:10hs	***"Desafíos técnicos del rubro ovino en Las Islas Falkland"*** Dr. Daniel Pereira Machín /Ex Asesor Ovino del Departamento de Agricultura de las Islas Falkland • Veterinario uruguayo con formación y experiencia en Producción ovina.
15:35hs	***"Una visión de las pasturas"*** Ing. Ag. Marcelo Pereira/Plan Agropecuario • Especialista en manejo y conservación de sistemas pastoriles. • Presidente de la Mesa de Ganadería sobre Campo Natural. • Visitó las islas invitado por el gobierno de las mismas en 2019.
15:50hs	***"La aplicación de herramientas digitales para el modelado de suelos y el monitoreo remoto en la agricultura de las islas Falkland"*** PHD Stefanie Carter/Project Manager del South Atlantic Research Institute (SAERI) • Licenciada en Conservación Rural y Master en Gestión del Medio Ambiente de la Universidad de Aberberystwyth de Gales. • Las principales áreas de investigación DE SAERI (https://www.south-atlantic-research.org/research) abarcan ciencias naturales y físicas en dimensiones marinas, terrestres y data science. Actualmente, tienen en curso investigaciones y proyectos vinculados al sector agropecuario en las Islas.
16:10hs	***Preguntas***
16:30hs	**Cierre**

NOTA: La presentación de Stefanie Carter será en inglés con traducción secuencial.

Figure 10: Programme for the session on the Falkland Islands at the Expo Prado in Uruguay in September 2020.

The UK FIT Project partner also presented the project at the virtual *1st International Symposium on Climate-Resilient Agri-Environmental Systems* (ISCRAES 2020) with a pre-recorded presentation on *A science-based policy response to predicted climate change in the Falkland Islands (52°S)* (Book of Abstracts, page 35). He has also submitted a presentation to this year's virtual IUCN UK Peatland Conference taking place in December 2020.

2.4 Collaborations with DPLUS065 Coastal Mapping

The Soil Mapping Project worked closely with the DPLUS065 Coastal Mapping Project collecting ground validation information, which was integrated into the Coastal Mapping database. The Coastal Mapping PM also flew drone-mapping missions using the multispectral camera over the gas-flux study site delivering a key baseline dataset for the Soil Mapping Project (Figure 11).

Figure 11: DPLUS065 Coastal Mapping completing a multispectral drone survey for the Soil Mapping Project.

3 Project Achievements[1]

3.1 Outputs

Output 1 – Project Management Structure.
The purpose of **Output 1** was to establish the project management structure to ensure a smooth administration of the project. This process largely worked very well and resulted in efficient management throughout the project; all indicators were completed. All seven parties signed the MoU; signed versions are available on the project website. (**Indicator 1.1**). The PM resumed her post as envisaged in August 2018 (**Indicator 1.2**). Quarterly PMG meetings were held throughout the project; the meeting minutes are available on the project website (**Indicator 1.3**). The 6-monthly stakeholder contact was maintained with workshops in February 2019 and February 2020 as outlined in section 2.3.1; the workshop reports and presentations are available on the project website. A stall and a presentation were held at Farmer's Week in 2019. Due to Covid-19 Farmer's Week 2020 did not take place and it was not possible to repeat this outreach. A further workshop was held in June 2020, focussing on project legacy with selected stakeholders; the report is also available on the project website (**Indicator 1.4**). The project website was updated regularly throughout the project; the project's timeline was updated with the latest news and all relevant report were uploaded here and here (**Indicator 1.5**). The monitoring and evaluation plan was created by October 2018 and is available on the project website (**Indicator 1.6**). The project ended in October 2020 and the final report was submitted soon after (**Indicator 1.7**).

Output 2 – WP1: National Soil Map, peatland distribution and soil erosion extent/risk
Output 2 focussed on producing a national soil map and creating a baseline for peat extent, soil erosion extent and soil erosion risk against which future data can be measured. This was achieved through intensive fieldwork campaign and several reiterations of the soil model. The output was fully completed and the maps are available on the project webGIS. The project started out with a Skype, during which project partners met and discussed the strategies for the project (**Indicator 2.1**). The desk study was carried out and the methodology for the digital soil mapping is available here and for the determination of sampling points here (**Indicator 2.2**). As scheduled, the first soil maps were created by October 2018; these were made available on the project website and the process of soil map creation is outlined here (**Indicator 2.3**). A first set of preliminary maps was issued in April 2019 with physical data from the first field season at a 100 m per pixel resolution, which were made available to project partners as GIS layers. These were also explained and presented to local stakeholders during Farmer's Week in July (Figure 12). The first set of maps were refined by the addition of chemical data and field descriptions from the second half of the first field season and new maps were issued in January 2020. A full report on progress with soil modelling and map production by project partner Dr. Matt Aitkenhead is available on the project website (**Indicators 2.4 and 2.8**). Determination of the soil survey methodology was completed in October 2018 and is available on the project website (**Indicator 2.5**). The soil surveyor was identified and contracted in good time before the start of the field season. He worked full-time on all fieldwork campaigns, completed the data entry after the 2018/19 field season and is the first author on two of the fieldwork reports (**Indicator 2.6**). The soil campaigns were conducted as scheduled. The first campaign ran for four weeks from 25 November to 21 December 2018; the report is available here. The second campaign ran for six weeks and five days (27 January to 8 March and 18 March to 22 March 2019); the report is available here. The final fieldwork campaign ran from 3 November to 20 December 2020 with additional points visited in January and February 2020; the fieldwork report is available here (**Indicator 2.7**). All fieldwork and lab data were submitted to project partner Dr. Matt Aitkenhead at the end of March 2020 as agreed in a previous project management group meeting. All maps except for the soil class map were created by 2020 June. Soil classification took longer than anticipated and required the involvement of an independent consultant. The soil class map was created in September 2020. All maps are available on the project webGIS (**Indicator 2.9**).

[1] See also Annex 2

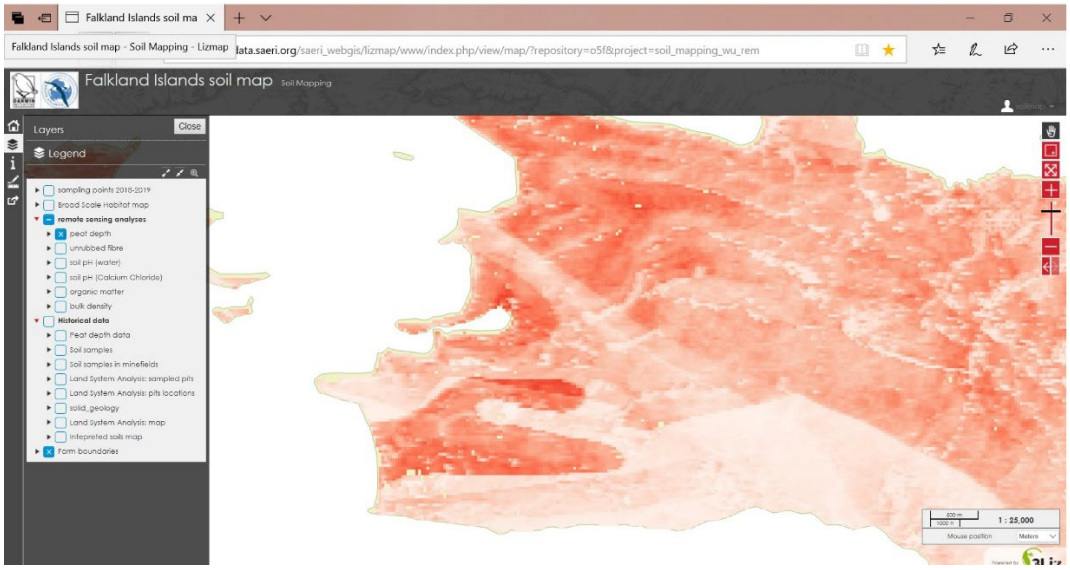


Figure 12: Example of a preliminary map for peat depth created in April 2019.

Output 3 – WP2: Assessment of the sustainability of soil management practices and of soils physical, chemical and microbiological properties

Soil sample analyses for physical, chemical and microbiological properties was the focus of **Output 3**. Soil sample collection was carried out as anticipated, all analyses were completed and the data were integrated into the soil modelling carried out as part of Output 2. The lab analyses of the soil samples were carried out after each fieldwork season and completed by March 2020 (Figure 13; **Indicator 3.1**). The DNA sequencing was completed and the data were related to the physical and chemical soil properties; the report is available here (**Indicators 3.2 and 3.3**). The long-term monitoring programme was prepared by project partners and is available here. It was also submitted to FIG's Environment Department (Figure 14) (**Indicator 3.4**).


Figure 13: PM preparing soil samples for the pH testing (left), lab assistant Kate Stenning weighing samples for organic matter (centre), PM carrying out analysis for chloride content (right).

Figure 14: Submission of long-term soil monitoring recommendations to FIG's Head of Environment.

Output 4 – WP3: Development of soil spatial database and interactive tool for interpreting and describing soils properties and health, displaying soil erosion risk on selected farms.

The purpose of **Output 4** was to ensure that the all data were shared between project partners in order to allow an efficient work flow, to ensure that all data would be stored appropriately so that they can be accessed by future projects and to ensure that the final maps and tools would

be freely accessible in the appropriate formats. This was achieved and all indicators were completed. The delivery of the online data tool for local farmers was discussed during stakeholder workshops. Additionally, to the online webGIS, it was also suggested to deliver offline PDF maps to landowners so that the maps could be accessed irrespective of the internet, which is expensive and slow in the Falklands. At follow-up workshops it was ensured that stakeholders were aware of this and agreed with the intended online and offline map delivery (**Indicator 4.1**). Data was shared between project partners through a Google Drive platform to which everyone had access and editing rights (Figure 15). Data sharing was also specified in the MoU (paragraph 6) (**Indicator 4.2**). The SAERI server was set up and two internal hard drives (4TB each) were purchased to allow the server to deal with the data generated by the project (Figure 16, **Indicator 4.3**). The interactive webGIS with all the soil maps including soil class, chemical and physical properties, peat depth, erosion and erosion risk is available online and accessible to everybody. The link assesses the user's IP address and redirects the user to either a server in the Falklands or a server in Europe depending on their location. This ensures that map speed is maximised (**Indicators 4.4 and 4.6**). The database was updated and all data are now integrated into PostgreSQL (Figure 17, **Indicator 4.5**).

Figure 15: All fieldwork and lab data were shared with project partners via Google Drive.

Figure 16: Screenshot of the SAERI server with the soil mapping set-up.

Figure 17: Screenshot of the Soil Mapping Project's PostgreSQL database.

Output 5 – WP 4: Knowledge transfer workshops and training courses

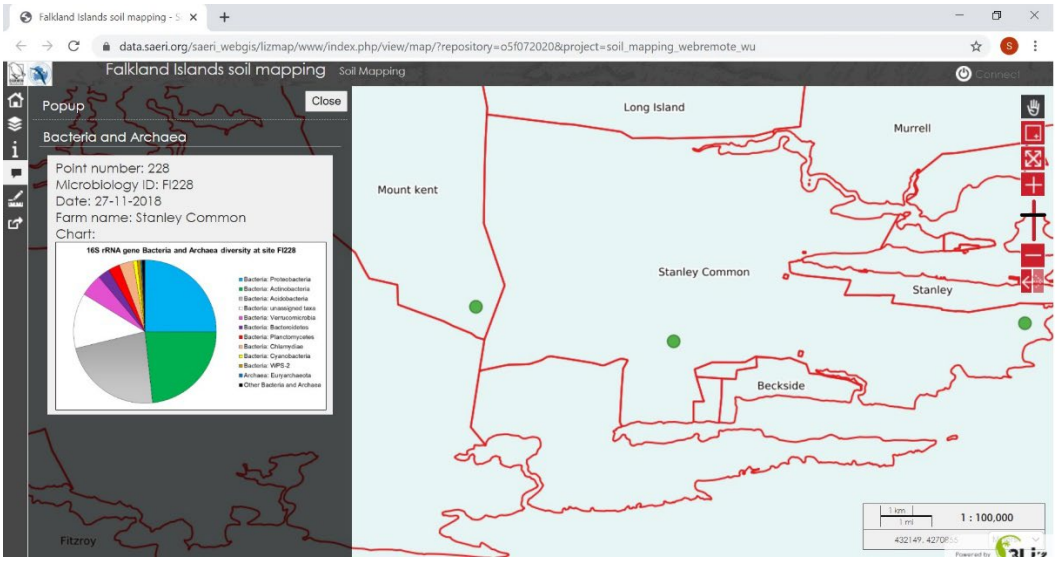
The intention of **Output 5** was to ensure that some of the knowledge and skills involved in the project would remain in the Islands so that the soil assessments and map interpretation can be made beyond the project's life span. This was achieved and the indicators were fulfilled. During the workshops in February 2020 the project's background of soil modelling and field work were explained, a case study illustrated how the final maps can be utilised for land management and the opportunity to explore preliminary interactive maps was offered to participants (see workshop report). Further assistance on soil map application for land management was provided by the Department of Agriculture in 1-1 farm visits, which started in July 2020 in West Falkland (see section 6.1) and will continue beyond the project and include farms on East Falkland (**Indicator 5.1**). Two stakeholders (Tony Heathman, Estancia farm and Ben Berntsen, Elephant Beach and Cape Dolphin) also joined the fieldwork. The soil team explained the details of the soil survey and the overall importance of the soil maps, see fieldwork reports and Figure 18 (**Indicator 5.2**). The knowledge for gas flux monitoring work will also be maintained in the Islands: the PM of the Soil Mapping Project will be managing the new DPLUS113 project on wetlands and aquatic habitats on the Falkland Islands. She will therefore be able to take the gas flux work further with current and new project partners, examples include involvement in a bid for a new Darwin-funded project and a proposal for a PhD project (**Indicator 5.3**).

Figure 18: Examples of stakeholder involvement in the fieldwork. Left: Ben Berntsen (owner Elephant Beach farm, manager Cape Dolphin farm), third from left and the fieldwork team in tussac grass at Cape Dolphin. Right: Tony Heathman (owner Estancia farm) at Johnsons Harbour with the fieldwork team.

3.2 Outcome

The project's main outcome was an improved evidence-base for mitigating climate change through new decision-support tools: online maps and database of soil types, peatlands and erosion extent/risk integrated with physical, chemical and micro-biological analysis of soils. This was fully achieved. Soil maps including distribution maps for soil class, peatland and erosion extent as well as erosion risk are available on the project's webGIS (**Indicator 0.1**). The webGIS also includes maps for the chemical and physical soil properties as well as information on the microbiological communities (Figure 19). The information provided is accompanied with interpretation aides to assist with practical land management application (Figure 20). Additionally, all landowners received their individual farm maps as a layered PDF file (Figures 21, 22 and 23) on a memory stick accompanied by a printed soil map interpretation guide; landowners therefore do not rely on the internet to access the maps (**Indicator 0.2**).

a)



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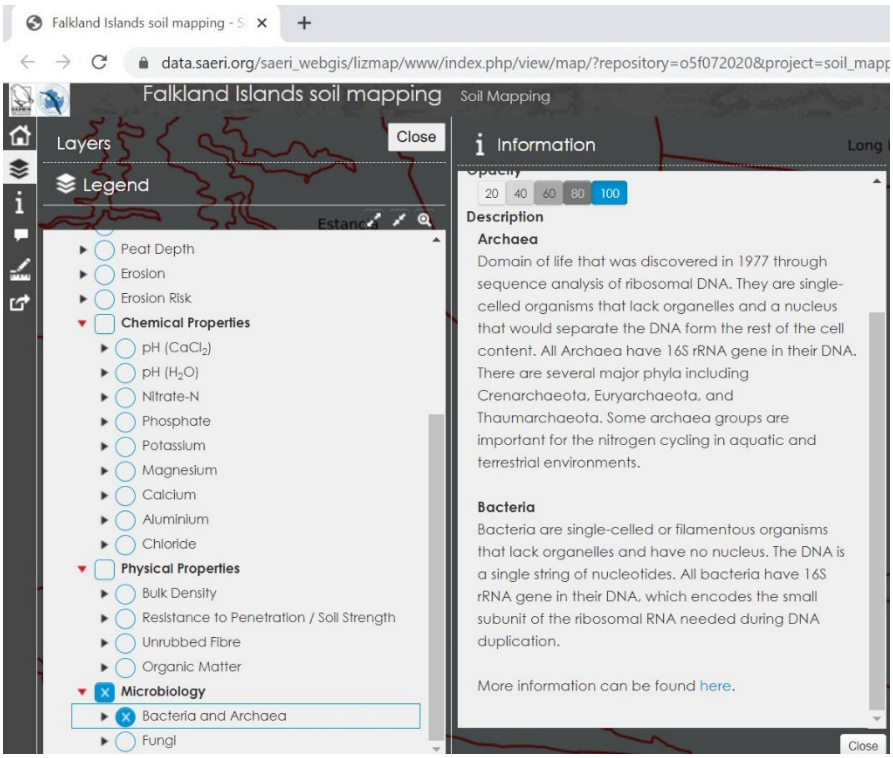

Figure 19: Example of the microbiological information available on the webGIS: example of a survey point (a) and example of the background information for each layer (b).

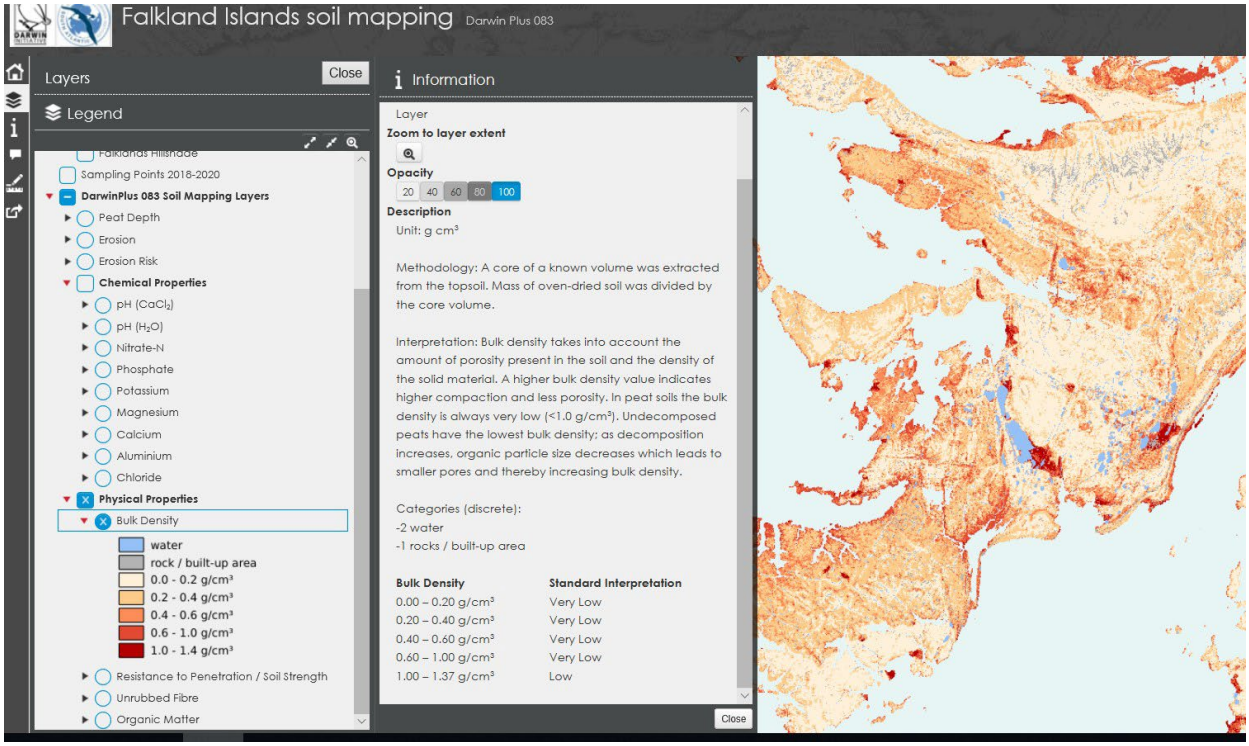

Figure 20: Example of the presentation of a map layer (bulk density); each layer is divided into meaningful categories and an interpretation for the overall soil property as well as each category is provided. All information is tailored specifically to Falkland Island soils.

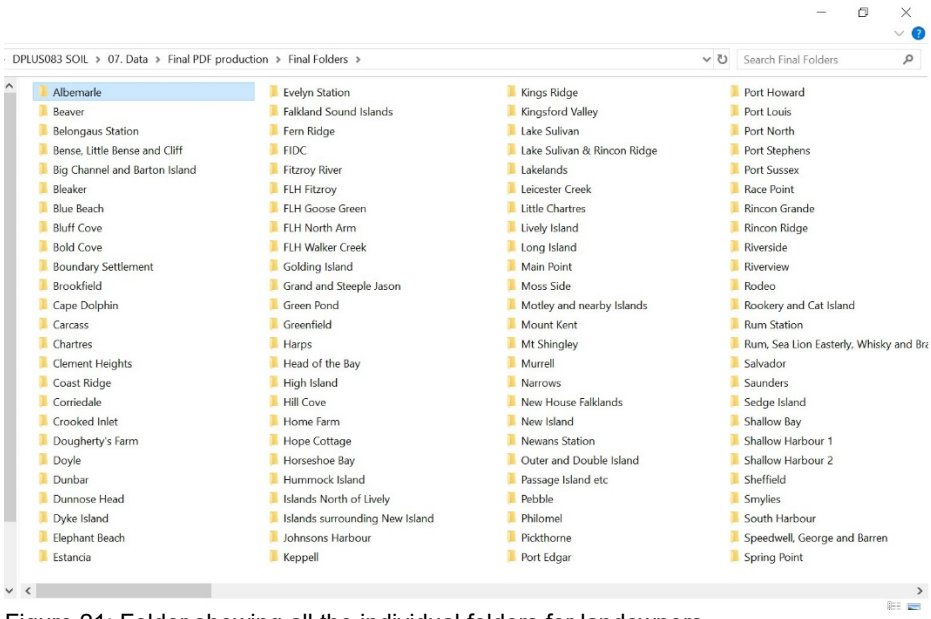

Figure 21: Folder showing all the individual folders for landowners.

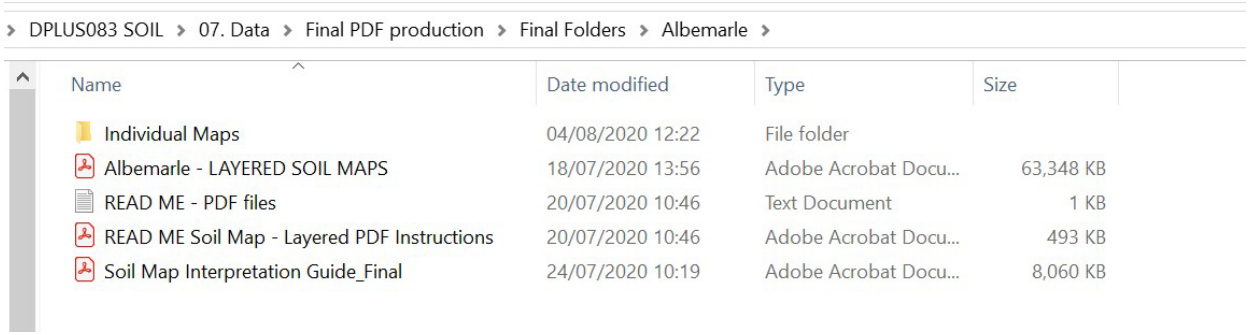

Figure 22: Example of each of the folders sent to landowners.

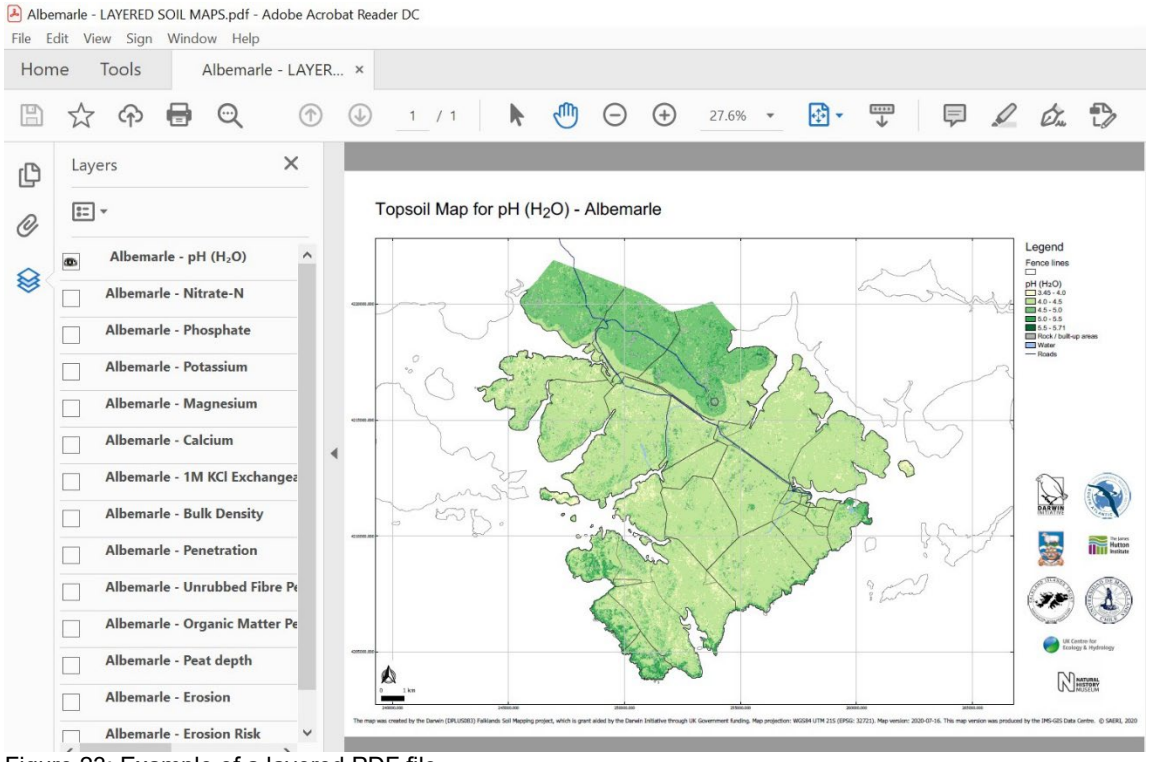

Figure 23: Example of a layered PDF file.

3.3 Monitoring of assumptions

The PMG met regularly and discussed any issues that arose and jointly found solutions; this process worked very well and monitored the assumptions. Most assumptions were inconsequential and the outputs could be completed without any necessary adjustments. Here we are reporting the exceptions:

Assumption 1.1 suggested that the MoU could only be signed if all project partners agree to sign the document. All partners were willing to sign; however, lengthy administrative hurdles resulted in one partner organisation not signing until almost the end of the project. Whilst this did not pose a problem for the project itself, it did put an additional workload on the PM and the relevant project partner because the progress of the signing had to be followed up continuously. Any new projects should not only consider the partner's willingness to sign but should also anticipate the administrative hurdles each organisation might add.

Assumption 2.7 refers to the necessity of good weather conditions to be able to complete the fieldwork. The project was very lucky that this assumption was almost inconsequential. Some extreme weather caused minor delays, such as strong winds preventing the ferry between East and West Falkland from operating and therefore delaying travel; strong winds delaying the Islands' plane schedules and heavy rain making access to field sites impossible. Overall, the frequency of extremely bad weather was low and the fieldwork programme could be completed with minor adjustments. Nonetheless, all future projects in the Falkland Islands with a large fieldwork component need to monitor this assumption closely and allow for flexibility in the overall fieldwork schedule.

A new assumption was added for the overall project delivery in the second annual report in 2020 in the form of COVID-19 related delays. The outbreak of a global pandemic and closure of offices and laboratories was not anticipated. Working from home and remotely connecting with the servers at JHI presented a time-consuming challenge for project partner Dr. Matt Aitkenhead, which he was able to work around and managed to deliver the maps within the project's timeline. Lab closure also added delays to the completion of the microbiology work at NHM. Fortunately, NHM granted special access to project partner Anne D. Jungblut and additional lab services resumed in time for this part of the project to be completed within the project.

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

4.1 Pre-project baseline

Climate change has been highlighted as the greatest long-term threat facing UKOTs. Although the Falkland Islands were not included in early knowledge gap analyses to identify the impacts of global climate change on the UKOTs (Sear *et al.,* 2001[2]), the need to understand Climate Change Adaptation, Mitigation and Ecosystem Services in all the UK Overseas Territories had been highlighted by Defra since 2008 (Brown, 2008[3]).

The current project follows on from an EU BEST funded project (2013-2017) – Terrestrial Ecosystems of the Falklands – a Climate Change Risk Assessment (TEFRA). The overall aim of TEFRA was to inform FIG policy development by providing an assessment of the current evidence base relating to the potential impacts of climate change on plants and soils of the Falkland Islands and the services they provide. Following climate change predictions for the Falklands Islands, stakeholder consultation and a thorough review of all the available science from the Falklands and equivalent regions and habitats, the key risks identified from TEFRA were:

- Changes in soil moisture deficits and drying
- Changes in soil organic carbon

[2] Sear, C.; Hulme, M.; Adger, N. and Brown K. (2001) *The Impacts of Global Climate Change on the UKOT: Issues and Recommendations*. Tyndall Centre for Climate Change Research. Natural Resources Institute.

[3] Brown, N. (2008) Climate change in the UK Overseas Territories: an overview of the Science, Policy and You. Defra.

- Changes to invasive plant species and plant pests and diseases
- Habitat disturbance by extreme events – increased fire risk
- Changes in range, yield and quality of crop/ forage varieties/ species grown

The underlying feature to all of these impacts was the importance of the peatland resource in the Falklands. Two of the key impacts were:

1. Changes in soil moisture deficits and drying out

Climate change is predicted to increase soil moisture deficits with potentially large knock-on effects on soil health. In the Falkland Islands evapotranspiration during spring and summer is predicted to increase, with a swing towards a greater increase in the spring soil deficit rather than later in the growing season.

2. Changes in soil organic carbon

Total soil organic carbon estimates for the Falkland Islands are weak and based on soil type coverage estimates for individual geological mapping units. Based largely on proxy research on similar northern hemisphere peaty soils, predicted climate change is likely to lead to Falkland peatlands as a whole becoming a carbon source rather than sink.

Hence, from a sound evidence base, the strategic long-term requirements identified to manage Falklands' natural environment was developing a climate change mitigation strategy that focused on sustainable management of the fragile soil resource. To achieve this, the TEFRA project highlighted the need for a soil type and depth distribution map and a more accurate assessment of the soil carbon stocks to plan land use strategies, which will help ameliorate the risk from climate change and promote sustainable use of Falkland's peatlands.
Most countries in the developed world have a soil map; it is seen as an essential tool for sustainable land management. Up until the completion of this project, despite the fragility of their soils and the substantial risk of erosion, particularly around some prevalent land use practices and predicted climate change, the Falklands had no soil map.

4.2 Achievements of the project

The project has successfully delivered a series of soil maps created through a combination of digital soil mapping, fieldwork over two summers and lab analyses of soil samples from these locations. Soil physical and chemical maps have been generated for pH, Nitrate, Phosphate, Potassium, Magnesium, Calcium, Aluminium, Bulk Density, Soil Depth, Resistance to Penetration and Organic Matter. Thresholds have been applied to each individual layer to act as an interpretation guide and can be used to underpin decisions on sustainable soil management and erosion remediation. An interpretation guide to accompany the maps has been produced and distributed to all stakeholders through an appropriate user platform.

4.2.1 Changes as a result of the project.

This project fills a huge gap in the armoury of resources available to land managers and planners responsible for future policy in the islands. Given the perceived threat of predicted climate change in the Falklands, the islands are now at a significant advantage in moving ahead to develop sustainable soil management strategies.

The project has delivered a product, which will be a valuable tool for farmers as the main stakeholders. This was clearly evidenced at the stakeholder fora held in the final stages of the project and subsequent farmer engagement. Already, the local Agricultural Adviser for Agronomy has received positive feedback from farmers on how they will be able to use their own farm soil maps to make informed decisions on cropping and grazing strategies which will lead to more sustainable soil use and health and, overall, more resilience of their farms in the light of already experienced climate change. Such a resource has not been previously available so its value –

as a) an awareness and educational resource and b) a strategic land management tool – is indicative of a clear change in attitude and capability as a result of the project.

The local conservation NGO FC is already planning to use outputs from the project to overlay plant species distribution maps with soil characteristics to propose and deliver habitat restoration strategies.

For further details please also see section 6 – sustainability and legacy.

4.2.2 Contribution to key Government priorities and themes

As evidenced from the previous TEFRA project and their engagement with this Darwin project, FIG takes its climate change obligations and commitments seriously. It has shown willingness to underpin these commitments with the appropriate science base and has indicated that it will utilise the outcomes from the project in policy formulation, which will feed into the Island's climate change mitigation action plan and contribute to the further development and implementation of the FI Biodiversity framework.

From a Government perspective, the FIG now has a much better estimate than previously of total carbon stocks across the islands. This will help them make more accurate returns in light of their territorial and international obligations and to formulate policy on climate resilience and climate change mitigation.

The project has interacted with and been discussed at all levels within FIG:

- Governor Nigel Phillips
- Members of the Legislative Assembly (MLAs): Ian Hansen (FLH & Deputy Portfolio Holder – Natural Resources), Teslyn Barkman (Portfolio Holder – Natural Resources and Deputy Portfolio Holder – Environment and Public Protection) and Leona Roberts (Portfolio Holder – Environment and Public Protection)
- Environment Officer and Policy Adviser, Denise Blake
- Director of Natural Resources, Dr Andrea Clausen
- Department of Agriculture staff, specifically Senior Agricultural Advisor, Tom McIntosh and project Soil Mapping Project team member and Senior Agronomist, Matt McNee

The Soil Mapping PM was also invited to attend an Environment Committee (FIG) meeting and briefed the committee on the project (see section 2.3.1 and Figure 5). The interest and involvement by this key government department has gradually grown as the project has developed. Staff have increasingly realised the potential value of the project outputs to assist them with future work schedules and projects, which extends well beyond the duration of the Soil Mapping Project.

Denise Blake, Environmental Policy Officer, states "In a predominantly agricultural landscape, knowledge of our soils underpins sustainable management. From an environmental point of view, mapping our soils ensures that we can work towards maintaining their health, not just for carbon storage, but for the life they support on our islands."

4.2.3 Supporting the host Territory in multi-lateral UKOT agreements

The UK has ratified the Convention on Biological Diversity (CBD) on behalf of the Falkland Islands and this project has supported Aichi target 19 "By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied." The project has also supported the UN's Sustainable Development Goals (SDGs) by contributing to goal 15 "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss".

Before the project, the awareness of the Falklands as a significant peatland resource within the UKOT was very limited. The project has gone some way towards correcting this deficit. At the IUCN UK Peatlands Conference, 2019 – 'Peatlands, Investing in the Future' a poster presentation 'Mapping the Peatland Resource in the Falkland Islands (UKOT)' highlighting the project was given (see section 2.3.2 and Figure 7). In addition, the project was represented in sessions at this conference on:

- Peatlands: climate change & greenhouse gas accounting
- Peatland progress - UK Strategy in action
- Peatland restoration: emerging ideas & current challenges
- Engaging with key stakeholders at a practical & policy level

As a UK Oversees Territory (OT), the significant contribution the Falklands' peatlands make to the UK total peatland and carbon stocks was highlighted and came as a surprise to most delegates. This heightened interest in the project at a wider level.

The UKFIT Project Partner also helped organise a one-day seminar at AFBI and Queen's University Belfast in October 2019 on 'Climate Change in the UK Overseas Territories' (see section 2.3.2 and Figure 8). At this seminar Tara Pelembe (Deputy Director, SAERI) gave an overview presentation 'Climate change in the South Atlantic' which set the scene for the Soil Mapping Project. Subsequently, the UKFIT Project Partner gave a presentation on 'Climate change predictions, predicted risk to terrestrial ecosystems and mitigation strategies for the Falkland Islands', which described the operation and potential outcomes of the Soil Mapping Project.

CIEEM in the UK has a Special Interest Group (SIG) on Overseas Territories (OTs), which hosted an Autumn Conference in November 2019 through Zoom videoconferencing. The PM participated with a pre-recorded conference on 'The significance of understanding and protecting soil in the Falkland Islands' (see section 2.3.2 and Figure 9).

The project also feeds into UK Government targets for climate change and greenhouse gas (GHG) emissions through the UKCEH project partner. The UK Government has been requested to improve its reporting of land-use related GHG emissions and removals for the UKOTs, and the Falklands has been identified as a particular priority given its large land area and peat extent. Key requirements for land-use emissions reporting are spatial data on soils and land-cover, and measurements of GHG fluxes, all of which were produced during the project. The UK's need to include the Falkland Islands in its GHG emission reporting has now become more urgent. On 21 September 2020 FIG reported:

"At the end of August, the Falkland Islands Government received official confirmation from the UK Government that the Foreign Secretary had agreed the extension of the Doha Amendment to the Falkland Islands. The Doha Amendment establishes the Kyoto Protocol's second commitment period and forms part of the United Nations Framework Convention on Climate Change (UNFCC), which was adopted by the UK in 1992 and seeks to 'stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.' This development means that the Falkland Islands will form part of UK efforts to reduce greenhouse gases further."

The baselines established through the project on peat extent, peat depth, carbon stock and erosion extent will be able to feed directly into any future assessments.

4.2.4 Project influence on wider decision making.

Project Partner UKCEH, along with the Green Alliance, has undertaken a scoping study for FC and the Royal Society for the Protection of Birds (RSPB) on the potential to develop a land-use carbon offsetting scheme for the Falklands, with a focus on peatland management and restoration. This work is being informed by the results of the DarwinPlus083 Soil Mapping Project, with input from project participants Pro. Chris Evans, Prof. Jim McAdam and Dr. Stefanie Carter. If the scoping study does lead to the future development of an offsetting scheme, this will be highly reliant on the soil maps produced during the project, and could support the implementation of climate change mitigation in the Falklands, as well as developing new potential sources of income for the conservation and farming sectors.

The project has helped farmers see the significance of soil, not just from a farming perspective but also as a fragile ecological resource, which will require careful future management to remain sustainable. Throughout the project and in recent interactions they have shown a willingness to

adopt soil maps into their decision making process. This will ensure widespread project adoption across the islands.
The outcomes from the project will be readily transferrable to other OTs where soil moisture deficits and soil sustainability are major climate change challenges.

5 OPTIONAL: Gender equality

In the SAERI office, the current staff cohort is 60% female and 40% male, and SAERI has an equal opportunities policy as part of its internal policy framework. The project leader and PM of the Soil Mapping Project are both female.
Most of the farms on the Falkland Islands are family owned or family managed, with both the men and women within the households making an active contribution to the maintenance and development of the farm and the farm business. While it might generally be the male members of the household who will be using the maps in the field, any positive impact on the farm business as a result of the increased evidence provided will benefit the family as a whole. Attendance at the February 2020 stakeholder workshops was 47% females vs. 53% males (see workshop report for attendees), which illustrates how evenly balanced interest in the project is.
The real importance is that the project maps will be made available to everyone and that gender will not be a barrier to access the outputs.

6 Sustainability and Legacy

6.1 Enduring project achievements and legacy

SAERI has its main office on the Falkland Islands and hosts and maintains all webGIS projects and the data portal for the long-term as a service to FIG and the wider community. Through this long term on-island role, SAERI can ensure that the project outputs will be maintained and SAERI will through its good relationships with government and stakeholders be able to continuously make the information available to everyone.

The availability of national and individual farm soil maps beyond the life of the project are the most enduring achievements of the project. We have ensured a sustained legacy by training local staff in the Department of Agriculture how to use the soil map in conjunction with their customers i.e. the end users. Staff in SAERI and in the DoA have been made fully conversant with the project methodology and outcomes. This enables continued maintenance of the online mapping tool beyond the life of the project.
Project Partner Dr Matt McNee and his colleague Andrew Bendall (Sheep Management Adviser) went to West Falkland for three weeks in July 2020 carrying out one-to-one farm visits as part of their roles at the DoA. During these visits Matt reported:

“Andrew and I have been blown away by the correlation between the map information and current land use patterns e.g. the correlation between ‘more fertile’ land and lambing camps. … Importantly, farmers have expressed an interest in taking action. A number want to confirm the baseline map information so that they can improve on their current plans (e.g. changes to grazing rotations, fencing strategy, pasture improvement).”

In his post-trip report Matt wrote:

“The Falkland Islands Soil Map was the most useful for generating insightful and meaningful discussion. In many of the discussions we found ourselves referring to the soil maps for clarification, validation and to discuss opportunities for different types of management on farms. The forage production possibilities also highlighted the importance of soil health.
Follow on from West visits: f) Soil mapping: There was much interest in the soil maps. We will continue to work with farmers to familiarise themselves with the tools and demonstrate the utility in farm planning and management.”

This highlights how the maps are used already jointly by the landowners and the DoA and demonstrates that they will continue to be applied and referred to for the foreseeable future.

Three of the project partners also wrote a long-term soil monitoring report with recommendations for a monitoring programme, which was submitted to FIG's Head of Environment (within Directorate of Policy and Economic Development). The report recommends a 5-year monitoring cycle and will hopefully encourage FIG to implement it, ensuring long-lasting legacy.
Local capacity for future environmental management has been increased through the inclusion of local volunteers, work experience students, assistants and stakeholders in the practical project work. This will have enhanced knowledge on environmental matters and taught practical skills in aspects of environmental management to local participants.
FIG's Director of Natural Resources, Dr Andrea Clausen, has confirmed the support of her department for the project, particularly in relation to follow-up and legacy issues. The interest and involvement by this key government department has gradually grown as the project has developed. Staff have increasingly realised the potential value of the project outputs to assist them with future work schedules and projects, which extends well beyond the duration of the Soil Mapping Project.
The Falkland Islands Emergency Services, including the Chief Fire Officer, have confirmed that information on peat depth obtained from the project overlayed with information on vegetation from the DPLUS065 Coastal Mapping Project will identify high-risk fire areas (see Annex 6.3). Peatland fires are a significant environmental threat in the Falklands. Climate change predictions are for warmer, drier conditions in summer when the risk of vegetation fires-which can burn into the peat soils-is greatest.
The Veterinary Department plan to use information on peat depth deriving from this project. It will help deliver their 'Foot and Mouth' Strategy (burying of deceased animals in deep peat).

Legacy outside of the Falklands within UK Government planning will be achieved through the work pursued by the UKCEH project partner as described in sections 4.23 and 4.2.4. This will have a significant, long-term bearing on total UK peatland and carbon stock estimates.

6.2 Future projects and actions following directly on from this one.

SAERI is fully aware of the project and has added substantial capacity to the outcomes by involving outputs from other, related projects they are involved with. SAERI's senior staff have, have been fully engaged with it and are committed to be actively involved in its legacy.

A funding bid involving SAERI and the Department of Agriculture has been developed: '*Using geospatial and remote sensing approaches to support ranching in the Falkland Islands – The Ranching Productivity Toolkit.'* This projects aims to bring a suite of tools, including the soil maps and resulting data layers together, to enable landowners to make evidence-based decisions for optimising land use and stocking densities, with the aim of improving productivity and increasing yields.

At the completion of the project a project stakeholder workshop to conceptualize project ideas to follow on from the Soil Mapping Project linked to local stakeholder interests was carried out in the Falklands and by Zoom with overseas project partners. A wide range of practical and applied research projects were identified.
Attendees saw the next stage for future projects as using the soil maps as a resource to help manage Falklands soils to maintain vegetation cover by planning grazing strategies, to reduce fire and erosion risk, to introduce more productive forages to select areas, to optimise land management, to target niche markets-including carbon counting and offsetting and to focus on erosion control, carbon accounting and habitat restoration, soil nutrient quality, plant nutritional value, soil health, productivity and nutrient turnover.

This workshop and the project as a whole highlighted the paucity of knowledge of and research on soils in the Falklands. It also highlighted how the Soil Mapping project had gone a very long

way to addressing this deficit in knowledge and has laid a firm foundation for more sustainable management and care for soils in the Falkland Islands. The full report can be accessed here.

Furthermore, this project has assisted with and led to two funding bids – one to Darwin Plus and one to BEST 2.0+ –, which are currently under assessment to carry on with research on Falkland Islands peatlands to inform policy and encourage sustainable management.

6.3 Project staff and resources beyond the project

The Soil Mapping PM Stefanie Carter will remain in the Falkland Islands and lead the DPLUS116 Wetlands Project; this ensures that all knowledge gained during the Soil Mapping Project can be directly applied to the Wetlands project and will offer a smooth initiation of the new project. The Soil Mapping Project also leaves legacy equipment behind in the form of a vehicle – an important resource for future fieldwork – as well as a weather station and microloggers monitoring soil moisture and soil temperature. The PM will be able to carry on with this important long-term monitoring of climate variables. The Soil Mapping Project also created strong ties between SAERI and UKCEH, who are also a project partner for the Wetlands Project, collaborations will therefore continue. The UKCEH project partner has put together a PhD project proposal involving SAERI and the PM to carry on with the GHG flux measurements initiated by the Soil Mapping Project. All of this will ensure that vital soil monitoring and research work continues.

7 Lessons learned

The Soil Mapping Project was a success and all outcomes and outputs were achieved, there are lessons that can be learned and will be applicable for future projects. These are outlined here.

SAERI is an in-territory organisation, and therefore has an in depth understanding of the natural and stakeholder landscapes of the Falkland Islands. Territory-led projects minimise the perception of the imposition of ideas/actions by external organisations. Having the PM based in the Falkland Islands for the duration of the project was vital for project success. The stakeholder engagement side in particular hugely benefitted from her continued presence. Landowners and land managers have busy schedules, which do not conform to regular office hours and working days. Therefore, engagement needs to take that into consideration and be carried out on stakeholders' terms in order to be successful. Examples include the managers at Fitzroy Farm who were unable to attend any of the stakeholder engagement events, yet wanted to be involved in the project. The PM therefore visited them on the farm and presented the project at a time suitable for them. Another landowner was very interested in the project and wanted to join the fieldwork but only had time outside of the main fieldwork campaigns. The PM therefore completed the four points on his farm in October 2019 with the help of a volunteer. By being present in the Falklands Islands for the duration of the project the PM was also able to maximise the skills and experience available in the SAERI office, through discussing experiences with other Darwin Plus project managers and enhancing her own GIS skills with the help of her colleagues. It is vital for projects to have an 'in country/in territory' full time presence to enable support, buy-in, ownership and sustainability.

A further positive lesson is the projects legacy, which was achieved through continuous stakeholder engagement as outlined in section 6.1.

Receiving the signature of all project partners for the project's MoU has proved very difficult in this project with one partner organisation not signing until almost the end of the project due to administrational challenges (as discussed in section 3.3). Nonetheless, the project partners worked well together without a signed MoU and it has not impeded project delivery. As the MoU is not a legally binding document, it may therefore not be a requirement for successful projects.

The PM took up the post with only two and a half months available to acquire all the equipment and plan the fieldwork. This was completed successfully but only just within the time frame. All

projects operating in remote locations where the acquisition of equipment is a lengthy process should allow sufficient time for this to be carried out. During the current COVID-19 pandemic sourcing of equipment takes even longer so more time should be set aside for this step in the project.

In the beginning of the project, it was difficult to predict how long the fieldwork element would take. Although all required survey points were completed, this was only just within the timeframe of the project. Fieldwork took longer than first anticipated because off-road driving across long-distances was required to reach most of the survey points. More specifically delays occurred for several reasons: lack of an established track often meant that the driving speed had to be reduced considerably, unfamiliarity with the land meant that it took time to find the best access route, frequently bridges had to be built to cross ditches and the car getting bogged and one flat tyre further delayed travelling. All projects with fieldwork in remote locations should anticipate that fieldwork completion is likely to take longer than anticipated and should allocate additional time for this.

One of the most important lesson from this project in terms of project management and timeline planning is that all projects using novel approaches should allow for a considerable trialling time of these approaches in order to assure that the final run goes ahead smoothly. This aspect has worked particularly well in this project. The first maps were produced in April 2019 and it took most of 2019 including three PMG meetings and another map re-iteration to mitigate all issues that had arisen. Running the modelling with all of the project data for the final map production was therefore a smooth process apart from COVID-19 related challenges.

Attendance at the second stakeholder workshops had much improved compared to the first round of workshops. In the first year, the Soil Project was not as well-known across the Islands and it is likely that a small community in a remote place such as the Falkland Islands might need time to embrace a large-scale externally funded project. On-going engagement by the PM, UK FIT Project Partner and FIG DoA project partners increased awareness of the project but more importantly highlighted how the final outcome – soil maps – can be applied for improved and sustainable land management; this generated increased interest in the project. A strong stakeholder engagement side has therefore proven vital for the success of this project and should be seen as a fundamental requirement for all territory-based projects.

7.1 Monitoring and evaluation

A Monitoring and Evaluation (M&E) plan was developed for the project and is available on the project website; no changes were made to it during the project. The project was governed through an established PMG, which was formed by all project partners. The project partners worked well together and regularly met to discuss and steer the project. The project manager updated the PMG in these quarterly meetings on the deliverables in the log frame, the M&E, and budget. The PMG used Google Drive to share documents and all project partners had editing rights (Figure 15). It was the PMG's responsibility to facilitate project delivery on time and within budget and to review the quality of the outputs. Engagement and involvement of stakeholders ensured that the outcome delivered through the product actually met stakeholder requirements. Completion of indicators and full project delivery highlights how this process worked very well.

7.2 Actions taken in response to annual report reviews

In the AR1 review it was suggested to communicate indicator changes with Darwin. This was subsequently dealt with and approved through change request #3. This involved changing two indicators in the logframe:
Indicator 1.4 was changed from 'project stakeholder group (PSG) meeting held every 6 months starting May 2018' to '6-monthly stakeholder engagement will be maintained through workshops

and 1-1 contact during the summer and through a presentation and 1-1 meetings during the annual Farmer's Week in July'.
Indicator 5.3 was changed from 'A training course to be delivered by microbiology specialists to local scientists, interested stakeholders and to the DoA laboratory technician. The training course will take place indicatively in the last quarter of year' to 'Training on gas flux measurements for local scientists and interested stakeholders so that monitoring work can be continued.'

8 Darwin Identity

The Darwin Initiative funding was recognised in every communication and public engagement event. The logo was displayed in presentations and advertisements; the Darwin Initiative was recognised in press articles and the funding through the UK government was explained in presentations and meetings with stakeholders.
The Soil Mapping Project was always presented as a distinct project with a clear identity attached to the Darwin Initiative as the funding donor. The Darwin Initiative funding programme was known to some people as there have been previous Darwin Projects on the Falklands; however, the project's outreach work has increased public awareness of the Darwin Initiative, particularly with the farming and land-owning community. This is supported by section 2.3.1 (local stakeholders) and section 6 (sustainability and legacy).

The logo was displayed in the following outreach:

- The fieldwork vehicle has the Darwin logo displayed on both sides of the car (Figure 24)
- All above-mentioned presentations and posters (section 2) displayed the Darwin logo; examples are shown in Figures 3, 4, 7, 8; see also CIEEM presentation and stakeholder workshop reports
- Advertisement for stakeholder events included the logos (Figure 2)
- Blogs from project partners on the SAERI website (Blogs 1 and 2)

The Darwin Initiative was mentioned in the following outreach:

- Several Facebook posts and tweets in which the Darwin Initiative was tagged, examples are presented in Figures 25 and 26. SAERI currently have over 2,000 followers on Twitter; the Facebook posts reached up to 1,600 people
- Radio interview on the project's gas flux study (17 July 2019) and a radio piece on World Soil Day (5 December 2019, see latest news)

SAERI now have a member of staff with direct responsibility for communication and social media. This has enhanced SAERI's outreach considerably over the last 12 months and therefore also benefitted promotion of the Darwin Initiative. A full overview of project publicity is available in Annex 6.4.

Figure 24: Photos taken during the 2018/19 fieldwork season (left) and the 2019/20 fieldwork season (right) showing the display of the Darwin logo on both sides of the car.

Figure 25: Examples of tweets, which show how the Darwin Initiative was tagged throughout the project.

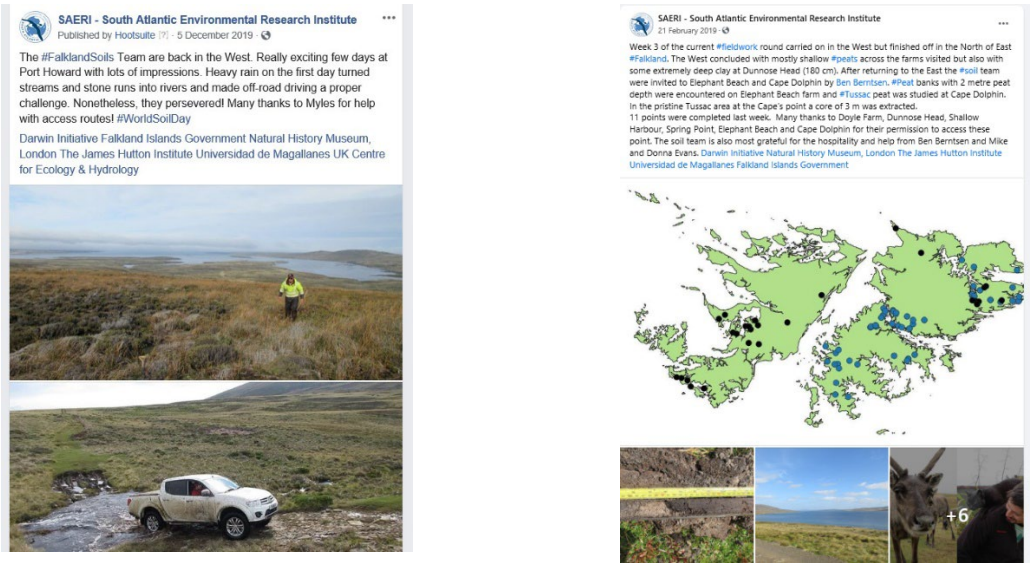

Figure 26: Examples of Facebook posts, which show how the Darwin Initiative was tagged throughout the project.

9 Finance and administration

9.1 Project expenditure

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

Project spend (indicative) since last annual report	2019/20 Grant (£)	2019/20 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Others				
TOTAL				

Staff employed (Name and position)	Cost (£)
Project Manager – Stefanie Carter	
SAERI Business and Programme Manager – Teresa Bowers	
SAERI Scientific Supervisor – Paul Brickle	
SAERI IMS-GIS data centre	
JHI Specialist Digital Soil Mapping – Matthew Aitkenhead	
UKFIT Agricultural Advisor – Jim McAdam	
TOTAL	

Consultancy – description and breakdown of costs	Other items – cost (£)
Rodney Burton – Soil Classification	
TOTAL	

Capital items – description	Capital items – cost (£)
Microloggers for soil moisture, soil temperature, air temperature	
TOTAL	

Other items – description	Other items – cost (£)
Stanley Services - Gas bottle USB2U - Memory Sticks for map delivery FIC - notebook FIC - labels FIC - envelopes Print Shop - Soil Map Guides Adobe Trial Subscription FPS - Postage FPS - Postage FPS - Postage FPS - Postage FPS - Postage Stanley Services - Fuel June and July 2020 Amazon - Rechargeable battery for keyboard FPS - Extra Postage Satlan Amazon – Consumables for setting up peat cameras Satlan Battery Station – batteries for peat cameras Satlan RS – consumables for peat cameras Satlan Farnell – consumables for peat cameras	
TOTAL	

9.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
In-kind time SAERI	
In-kind time JHI	
In-kind time NHM	
In-kind time UK FIT	
In-kind time UMAG	
In-kind time FIG	
In-kind time UK CEH	
Equipment provided by UK CEH (Automatic weather station, collars for gas flux measurement)	
T&S funds provided by UK CEH to join project fieldwork	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
FIG's Environmental Studies Budget to purchase satellite imagery to investigate soil erosion rates in the Falkland Islands, carried out from September 2020 to September 2021 by a Masters by Research Student	
TOTAL	

9.3 Value for Money

The project and the PM were based in the host territory, which meant that no international travel budget was required for the PM and most of the travel funds could be used for fieldwork travel.

The project greatly benefitted from in-kind time provided by project partners and SAERI staff as outlined in section 9.2. The work provided by the NHM project partner, which included fieldwork, lab work for DNA extraction and sequencing and data analysis and report writing was entirely covered by in-kind time contribution.

Volunteers dedicating their time to assist with fieldwork enabled the project to cover additional soil survey points, which subsequently made the soil modelling more robust.

Value for money was also added by the great collaboration between SAERI and UK CEH. This has led to the set-up of a study site for greenhouse gas flux measurements with first measurements being taken during the Soil Mapping Project. Additionally, UK CEH gave SAERI an automatic weather station on permanent loan basis, which was set up in Stanley to fill a gap in weather recording. The UK CEH project partner also funded his trip to the Falklands himself, which added value to the fieldwork aspect of the project.

The project was able to secure additional funding for a study into soil erosion rates in the Falkland Islands as outlined in section 9.2. Whilst this Soil Mapping Project established a map for soil erosion occurrence, which acts as a baseline, we do not have any information on past soil erosion rates which could be used as a proxy to estimate future erosion rates. The funding was obtained from FIG's Environmental Studies Budget to purchase satellite imagery. The study is now being carried out by a Masters by Research student, who is resident in the Falkland Islands and registered with Bangor University in the UK.

Overall, the project was excellent value for money because it not only completed its initial objectives and outcomes but also additional ones such as the greenhouse gas flux work. Project partners went above and beyond to ensure that the projects and its outputs are well-known and appreciated on Island as well as in the international communities. The project also enabled soil monitoring work (microloggers for soil properties) and research (soil erosion) to take place beyond the project.

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

Please insert your project's logframe (if your project has a logframe), including indicators, means of verification and assumptions. 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@ltsi.co.uk if you have any questions regarding this.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Science-based evidence on soils, peatlands and erosion extent/risk will allow policy makers, conservationists and land managers/owners to implement priority actions mentioned in the national climate change mitigation action plan.			
Outcome: Improved evidence-base for mitigating climate change through new decision support tools: online maps and database of soil types, peatlands and erosion extent/risk integrated with physical, chemical and microbiological analyses of soils.	0.1 A distribution map of soils, peatlands and erosion extent for the Falkland Islands to fill a knowledge gap and provide information on a fundamental natural resource which needs sustainable management. 0.2 An online tool for interpreting the chemical and microbiological aspects of the soils to help habitat restoration and land managers to more effectively mitigate against erosion, soil degradation and carbon loss.	0.1. A tailored WebGIS portal for accessing the distribution map and all project data will be designed and published online. The metadata catalogue (Falkland Islands IMS-GIS data centre) will host the metadata of the data gathered throughout the project. 0.2 The tool for interpreting the national soils, their characteristics and the erosion risk will be published on FIG Department of Agriculture (DoA) webpage.	0.1 SAERI continue to retain relevant skilled staff and the Falkland Islands IMS-GIS data centre will be sustained by the government in the future years 0.2 The tool for monitoring erosion risk will be simple enough to be maintained in the long term by the stakeholders
Outputs: **1**. Project Management structure, monitoring, evaluation and communications tools established	1.1 A Memorandum of Understanding (MoU) agreed and signed by all partners by May 2018 1.2 Project Manager recruited by August 2018 1.3 A Project Management Group (PMG) meeting held every 3 months starting May 2018 1.4 6-monthly stakeholder engagement will be maintained through workshops and 1-1 contact during the summer and through a presentation and 1-1	1.1 MoU signed by all parties 1.2 Project Manager employment contract signed 1.3 PMG meeting notes available online 1.4 Workshop meeting notes available online, evidence for Farmer's Week presentation submitted through Darwin Annual Report 1.5 Project webpage available for viewing online 1.6 Monitoring and evaluation plan available online 1.7 Final project report available online.	1.1 Project partners agree to sign the MoU 1.2 PM with the relevant skills is able to be recruited. 1.3 and 1.4 PMG can meet without delays; stakeholder are willing and able to participate in workshops and meetings. 1.5 PM will be trained on how to use and update the project webpage on SAERI website 1.6 The monitoring and evaluation plan has been written and implemented

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	meetings during the annual Farmer's Week in July 1.5 At least 1 project webpage created by April 2018, and at least 1 update to the page made every 3 months. 1.6 Monitoring and evaluation plan created by October 2018 1.7 Final project report produced by July 2020		1.7 PM to be on time with his/her tasks and able to write the final report
2. WP1: National Soil Map, peatland distribution and soil erosion extent/risk (scale 1:250,000)	2.1 Meeting in the UK (Cambridge – British Antarctic Survey - BAS) amongst overseas partners (UMAG via Skype) to define the strategy for the soil survey by May 2018 2.2 Desk study for assessing Satellite imagery availability and identification of digital soil mapping methods by June 2018 2.3 Remote Sensing analyses and first soil map by October 2018 to be used by surveyors 2.4 Iteration of Remote Sensing analyses using data from soil campaign to originate new soil, peatlands and soil erosion (extent/risk) maps by April 2019 2.5 Soil survey methodology ready by October 2018 2.6 Soil surveyor is identified and will participate to the meeting in Cambridge (2.1) to plan the soil campaign methodology 2.7 Soil Campaign to be conducted in November 2018, February and November 2019. 2.8 Desk-based analysis of soil data collected in the Falklands following each soil sampling campaign	2.1 Meeting notes and survey strategy design available online. Data Management Plan initialised 2.2 Desk study report available online 2.3 Processed satellite imagery available online through the project specific webGIS service and by November 2018. Soil map given to the surveyors for ground truthing. 2.4 First validated soil, peatlands and erosion extent/risk maps available to other project participants and stakeholders by April 2019. Remote sensing interpretation methods documented and shared amongst project partners to allow evaluation of derived maps 2.5 Publication online of the soil survey methodology 2.6 Soil surveyor contract of employment 2.7 Brief soil survey reports generated at the end of each soil campaign 2.8 Soil type descriptions available as GIS layer and tables (excel or comma delimited files) at the beginning of each new campaign 2.9 Maps of soil, peatlands and erosion extent/risk published online through the	2.1 All overseas project partners available for the meeting and BAS agreeing to provide a meeting room 2.2 Availability of cloud-free Sentinel 2 imagery across multiple years (from 2015) and for more than one season. If Sentinel 2 is not available, then Landsat will be the substitute for analyses 2.3 Images will have been processed and the model shown to be successful 2.4 Soil surveyors were able to provide ground truthing points and soil descriptions for remote sensing analyses. Digital Soil model is proving good. 2.5 There is good collaboration between project partners and the PM is already in post 2.6 Experienced soil surveyor is available to take the job 2.7. Good weather to allow fieldwork during the various soil campaigns in order to provide ground truthing points for remote sensing analyses. It is assumed that there will not be problems with the logistics (e.g. flight disruptions and lack of accommodations in rural locations) All soil surveyors will be fit

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	2.9 Remote sensing analyses consisting in iterations of soil/peatlands and erosion risk maps on the basis of the data coming from soil campaigns and laboratory analyses (completion the first quarter of year 3)	webGIS service and stored on the Falkland Islands data centre repository. All datasets will have been documented with standard metadata form and metadata logged in IMS-GIS data centre metadata catalogue online by July2020	and healthy enough to carry out fieldwork for the planned periods 2.8 At the end of each soil campaign the majority of the data are already in digital form to allow time for soil descriptions between consecutive campaigns 2.9 Soil survey campaigns feed the model used by the remote sensing analyses with useful data. No assumption on the data centre as it exists already and provides the type of services needed to publishing data.
3. WP2: Assessment of the sustainability of soil management practices and of soils physical, chemical and microbiological properties	3.1 Chemical analyses of soil sampled during the fieldwork (November 2018, February and November 2019) 3.2 DNA sequencing of soil samples collected at locations chosen by stakeholders and agricultural advisors 3.3 Map the results against other data collected or used by the project to identify patterns in the soil physical, chemical and biological properties across the islands 3.4 Identify a sustainable and long term manageable monitoring programme for assessing soil health by the end of July 2020	3.1 Report on methods, types and results from the chemical properties are analysed and published on a pdf and csv file. 3.2 Report on methods, and results from DNA sequencing analyses will be available as pdf file and on a csv file 3.3 Interpretation of the results (physical, chemical and biological) for each sampled location and Extrapolation to the entire islands. Data to be added to the interactive soil properties and erosion risk tool and scientific evaluation published in open access international journal. 3.4 Documentation of approaches used for sample analysis, for comparison/standardisation and to facilitate project reporting and publication development	3.1 Soil samples are collected according to standards and received by the laboratory technician in a well preserved way. 3.2 No delays in shipping equipment for laboratory analyses 3.3 The laboratory tests were successful and the interactive tool is ready 3.4 The results obtained from the laboratory analyses will be available for publication
4. WP3: Development of soil spatial database and interactive tool for interpreting and describing soils properties and health, displaying soil	4.1 Meeting with stakeholders to present examples of designs of the online data system tool and obtain feedback on which format works better.	4.1 Summary document from meeting with stakeholders to decide how the interactive tool should look and what it should contain in order to be useful and usable. To be updated after every	4.1 All stakeholders are available for the meeting and show interest in helping in outlining and testing the interactive tool 4.2 and 4.3 no assumption as the data manager has been working for the last

Project summary	Measurable Indicators	Means of verification	Important Assumptions
erosion risk on selected farms. The tool supports stakeholders' actions for mitigating with climate change effects	Updates on the development of the tool will be provided at each PSG meeting. 4.2 Data sharing procedures to allow access to the data for all project participants. By June 2018 4.3 SAERI server to be set up in order to store database in PostgreSQL and datasets collected throughout the project by June 2018 4.4 Online interactive soil database on soil properties and erosion risk by July 2020 4.5 Database of the national soils, peatlands and eroded areas and erosion risk in PostgreSQL (open source database engine) accessible by Stakeholders and project partners. Continuous work from November 2018 until July 2020 4.6 Preparation and publication of webGIS services to make results available to the wider public by July 2020	meeting (at least every 6 months) by reporting on interactions with stakeholders throughout online tool development, to provide evidence of feedback and tool design adjustments 4.2 Report on data sharing agreement Published online 4.3 Ensure that the server in SAERI has prepared for the new database. 4.4 Delivery of the tool and publication online. Additionally, a step by step guide on how the interactive tool works and instruction on its long term maintenance will be provided. 4.5 Data on national soils/peatland distribution, carbon storage, soil erosion extent and risk layers which populate the database are made available to the stakeholders and project partners 4.6 Publication of the maps through Project specific webGIS service	4 years at SAERI using the server and creating databases. 4.4 Free or low charge internet connection for the interactive soil properties and erosion risk tool (to be negotiated with SURE, the local telecommunication provider) 4.5 the server used for storing the database is accessible to authorised users (stakeholders and project partners) 4.6 the webGIS service will be ready by the last quarter of year 2
5. WP4: Knowledge transfer workshops and training courses	5.1 At maximum of 8 workshops (split into 4 in West and 4 in East Falkland) will be run on farms and in Stanley to landowners and to the public to describe and explain in simple words the use of the tools employed throughout the project and to ensure the people are informed and can appreciate their practical applications to land management. The workshops will be running in the last quarter of year 2 5.2 At least two local stakeholders trained in fieldwork to learn what the soil survey is about and how a better	5.1 Workshop reports will be available online and the workshop will be followed up by articles in the local newspaper 5.2 Stakeholder feedback forms completed. 5.3 Manual for gas flux measurements available online	5.1, 5.2, 5.3, 5.4 Interest from stakeholders, above all landowners 5.1 Venues for hosting the workshops in rural areas will be available and people can travel to them without disruptions 5.2 Local stakeholders' available time and scheduled fieldwork coincide 5.3 Weather conditions allow gas flux measurements to be taken.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	knowledge of the soils and their properties helps in managing this natural resource in relation to farm business and conservation plans. Monthly fieldwork campaigns will occur 3 times in spring and summer 2018/2019 and in spring 2019 5.3 Training on gas flux measurements for local scientists and interested stakeholders so that monitoring work can be continued.		

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)

Output 1 - Project Management Structure

1.1 Write the MoU, circulate it among the project partners and have it signed
1.2 Prepare the contract for the PM role, advertise the job, recruit and have the contract signed by August 2018
1.3 Arrange quarterly PMG meetings
1.4 Arrange annual workshops and an annual presentation and offer the opportunity for 6-monthly 1-1 meetings every six months
1.5 Set up the project webpage at the main SAERI website and keep it updated once every three months
1.6 Write the monitoring and evaluation plan by October 2018
1.7 Write and submit the final project report by July 2020 and prepare scientific papers by July 2020

Output 2 - WP 1: National Soil Map, peatland distribution and soil erosion extent/risk

2.1 Recruit the soil surveyor and define the date and meet in Cambridge to draw an action plan for the desk-based data analyses, the soil campaign and laboratory works (in London and Falklands)
2.2 Acquire necessary field equipment and ship it to the Falklands if not bought on the islands
2.3 Plan soil campaign in the Falkland Islands and liaise with SAERI logistics officer for the preparation of the fieldwork on farms and in Stanley
2.4 Identify suitable satellite imagery (Sentinel 2) across years and seasons and source other datasets and data sources (Google Earth) which can contribute to the identification of soils, peatlands and areas affected by erosion. Investigate and decide which Digital Soil Mapping methods are the most appropriate for the Falkland Islands. Prepare a report
2.5 Carry out the pre-processing and processing of the identified satellite imagery and incorporate the other ancillary data. Issue the first soil map by the end of October 2018
as it will be used by surveyors in the soil campaign
2.6 Prepare new versions of the maps (soil/peatlands/erosion) on the basis of the ground-truthed points collected by the soil surveyors. Make the maps available to the stakeholders by end of April 2019

Project summary	Measurable Indicators	Means of verification	Important Assumptions
2.7 Write the soil survey methodology to be followed during the soil campaign and make it available online 2.8 Carry out the soil campaign in the Falkland Islands and write a short fieldwork report at the end of each campaign 2.9 Process and analyse the data collected during the soil campaign and make them available to the other project partners. The activity will take place between each campaign. 2.10 Combine ancillary data (elevation, habitat and weather) and soil physical properties to estimate erosion risk and generate a map 2.11 Remote sensing analyses continue to be updated and iterated in order to include data coming from then soil campaign. The final maps of soil, peatlands, erosion extent and risk are delivered to the stakeholders by June 2020 <u>Output 3 - WP2: Assessment of the sustainability of soil management practices and of soils physical, chemical and microbiological properties</u> 3.1 Check which equipment is needed to carry out laboratory analyses in the Falklands and subsequently buy and ship what is missing 3.2 Identify with stakeholders, soil surveyors and agricultural advisors how many soil samples should be collected for DNA sequencing and from which areas 3.3 Adopt current accepted metrics and standards to measure soil health and DNA sequencing. Write a report and make it available online 3.4 Define with the soil surveyors and the laboratory technician the standard methods of soil collection and storage. If necessary run a training course 3.5 Assess the sustainability of soil management practices by sequencing analysis for soil microorganisms carried out at the Life Sciences Department, NHM, London 3.6 Provide interpretation of the results from analyses so that they can be explained in a way that is accessible to local stakeholders and all users of the interpretative soil database tool 3.7 Carry out the chemical analyses of soils sampled during the campaigns. The lab analyses will take place in the Falklands. 3.8 Identify and document which laboratory analyses approaches, used throughout the project, can support a long term monitoring program for quantifying chemical and biological soil properties and for assessing soil health 3.9 Pull out the main outcomes from the laboratory analyses (chemical and biological) and plan for publishing them on a scientific paper <u>Output 4 - WP3: Development of soil spatial database and interactive tool</u> 4.1 Liaise with other project participant to ensure that the data management plan is adopted, filled in and kept up-to-date. Include the data management plan to the report to be submitted to the funding organisation 4.2 Talk to project partners to understand and define how they need to access and share the data collected and analysed and in which form. Write the methodology and make it available online. 4.3 Design the spatial database for the national soil map and the interpretative tool on soil properties, carbon storage and erosion risk in PostgreSQL and link it to QGIS and a to the project based webGIS service 4.4 Check that data are documented, open access, quality checked, stored and backed-up in the secure server at the local data centre in the Falkland Islands and on a cloud server for the overseas project partners 4.5 Engage the stakeholders to identify which information requirements are needed for the online and freely available interpretative soil and erosion risk tool. Write a short report to describe the outcomes of the stakeholders engagement 4.6 Use stakeholders' feedbacks to ensure that the interpretative tool can be simply accessed and understandable by them and easily managed by SAERI data manager. Write a short report to describe the various steps made to generate the interactive tool 4.7 Test and assess the interactive tool on farmer attitude and economic performance of the farms. Use the results in a feedback loop to modify the tool and make it more efficient and valuable and more able to be adopted into policy decisions 4.8 Publish the final maps online through webGIS service 4.9 Publish the interactive tool online at the Department of Agriculture webpage			

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Output 5 – WP 4: Knowledge transfer workshops and training courses 5.1 Run 2 workshops on farms and in Stanley (one each) on soil health and training agricultural advisors and habitat restoration officer on how to collect soil samples for future chemical/biological analyses and for soil properties monitoring 5.2 Prepare 2 workshops on farms and in Stanley (one each) on what the Earth Observation techniques can tell about soils, erosion and peatlands. 5.3 Deliver 2 workshops on farms and in Stanley on how to use the interactive tool, how to keep it up-to-date and how to monitor soil health/erosion/greenhouse gases emission in the long term 5.4 Deliver 2 workshops on farms and in Stanley (one each) to describe the soils of the Falklands and how the soil campaign took place 5.5 Present the results at the annual winter meeting for rural landowners - Farmers' Week 5.6 Promote the project by allowing volunteers, including interested high school students, to join the PM and the project partners on fieldwork and laboratory analyses (in the Falklands) 5.7 Promote the Falkland Islands soil work to other UKOTs			

Annex 2 Report of progress and achievements against final project logframe for the life of the project (if your project has a logframe)

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
Impact: Science-based evidence on soils, peatlands and erosion extent/risk will allow policy makers, conservationists and land managers/owners to implement priority actions mentioned in the national climate change mitigation action plan.		The impact of the soil maps will be determined by future implementation into policy and land management decisions. In order to achieve this, all relevant stakeholders – from landowners to environmental policy makers – need to be aware of their existence and potential. Sections 2.3 and 4.2.2 highlight how the project has gone above and beyond to engage with stakeholders at all levels. Section 6 demonstrates how the path for the soil maps' practical application has been set and how they are being applied by landowners as well as the Department of Agriculture.
Outcome Improved evidence-base for mitigating climate change through new decision support tools: online maps and database of soil types, peatlands and erosion extent/risk integrated with physical, chemical and microbiological analyses of soils.	0.1 A distribution map of soils, peatlands and erosion extent for the Falkland Islands to fill a knowledge gap and provide information on a fundamental natural resource which needs sustainable management. 0.2 An online tool for interpreting the chemical and microbiological aspects of the soils to help habitat restoration and land managers to more effectively mitigate against erosion, soil degradation and carbon loss.	0.1 Soil maps including distribution maps for soil class, peatland and erosion extent as well as erosion risk are available on the project's webGIS. 0.2 The webGIS also includes maps for the chemical and physical soil properties as well as information on the microbiological communities (Figure 19). The information provided is accompanied with interpretation aides to assist with practical land management application (Figure 20). Additionally, all landowners received their individual farm maps as a layered PDF file (Figures 21, 22 and 23) on a memory stick accompanied by a printed soil map interpretation guide; landowners therefore do not rely on the internet to access the maps.
Output 1. **Project Management structure, monitoring, evaluation and communications tools established**	1.1 A Memorandum of Understanding (MoU) agreed and signed by all partners by May 2018 1.2 Project Manager recruited by August 2018 1.3 A Project Management Group (PMG) meeting held every 3 months starting May 2018 1.4 6-monthly stakeholder engagement will be maintained through workshops	1.1 Six out of seven parties have signed the MoU; signed version are available on the project website. Indicator is appropriate. 1.2 The Project Manager resumed her post on 20 August 2018. Indicator is appropriate. 1.3 Quarterly PMG meetings were held throughout the project; the meeting minutes are available on the project website. Indicator is appropriate. 1.4 The 6-monthly stakeholder contact was maintained through workshop 1 in January 2019, presentation at Farmer's Week in July 2019, workshop 2 in February

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
	and 1-1 contact during the summer and through a presentation and 1-1 meetings during the annual Farmer's Week in July 1.5 At least 1 project webpage created by April 2018, and at least 1 update to the page made every 3 months. 1.6 Monitoring and evaluation plan created by October 2018 1.7 Final project report produced by October 2020	2020 and workshop 3 in June 2020. See section 2.3.1 – local stakeholders – and the workshop reports. Indicator is appropriate. 1.5 The project website was updated regularly through the latest news and the document download area. Indicator is appropriate. 1.6 The monitoring and evaluation plan was created by October 2018 and is available on the project website. Indicator is appropriate. 1.7 The final report was produced by October 2020. Indicator is appropriate.
Activity 1.1 Write the MoU, circulate it among the project partners and have it signed		Completed.
Activity 1.2 Prepare the contract for the PM role, advertise the job, recruit and have the contract signed by August 2018		Completed.
Activity 1.3 Arrange quarterly PMG meetings		Completed.
Activity 1.4 Arrange annual workshops and an annual presentation and offer the opportunity for 6-monthly 1-1 meetings every six months		Completed.
Activity 1.5 Set up the project webpage at the main SAERI website and keep it updated once every three months		Completed.
Activity 1.6 Write the monitoring and evaluation plan by October 2018		Completed.
Activity 1.7 Write and submit the final project report by October 2020 and prepare scientific papers by October 2020.		Completed.
Output 2. WP1: National Soil Map, peatland distribution and soil erosion extent/risk (scale 1:250,000)	2.1 Meeting in the UK (Cambridge – British Antarctic Survey - BAS) amongst overseas partners (UMAG via Skype) to define the strategy for the soil survey by May 2018 2.2 Desk study for assessing Satellite imagery availability and identification of digital soil mapping methods by June 2018	2.1 The meeting was held through Skype instead of a partner meeting in Cambridge. The strategy for the soil survey was discussed. The meeting minutes are available on the project website. Indicator is appropriate. 2.2 The desk study was carried out and the methodology for the digital soil mapping is available here and for the determination of sampling points here. Indicator is appropriate.

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
	2.3 Remote Sensing analyses and first soil map by October 2018 to be used by surveyors	2.3 First soil maps were created by October 2018. These are available on the project website, the process of soil map creation is outlined here. Indicator is appropriate.
	2.4 Iteration of Remote Sensing analyses using data from soil campaign to originate new soil, peatlands and soil erosion (extent/risk) maps by April 2019	2.4 A first set of maps was issued in April 2019, made available to project partners and added to the project webGIS (Figure 12). These were refined by the addition of chemical data and field descriptions from the second half of the first field season and new maps were issued in January 2020. The project partner's progress report is available here. Indicator is appropriate.
	2.5 Soil survey methodology ready by October 2018	2.5 Determination of the soil survey methodology was completed in October 2018 and is available on the project website. Indicator is appropriate.
	2.6 Soil surveyor is identified and will participate to the meeting in Cambridge (2.1) to plan the soil campaign methodology	2.6 The soil surveyor was identified and contracted in good time before the start of the field season. He worked full-time on all fieldwork campaigns, completed the data entry after the 2018/19 field season and is the first author on two of the fieldwork reports. Indicator is appropriate.
	2.7 Soil Campaign to be conducted in November 2018, February and November 2019.	2.7 The soil campaigns were conducted as scheduled. The first campaign ran for four weeks from 25 November to 21 December 2018; the report is available here. The second campaign ran for six weeks and five days (27 January to 8 March and 18 March to 22 March 2019); the report is available here. The final fieldwork campaign ran from 3 November to 20 December 2020 with additional points visited in January and February 2020; the fieldwork report is available here. Indicator is appropriate.
	2.8 Desk-based analysis of soil data collected in the Falklands following each soil sampling campaign	2.8 See indicator 2.4. Indicator is appropriate.
	2.9 Remote sensing analyses consisting in iterations of soil/peatlands and erosion risk maps on the basis of the data coming from soil campaigns and laboratory analyses (completion the first quarter of year 3)	2.9 All fieldwork and lab data were submitted to project partner Dr. Matt Aitkenhead at the end of March 2020 as agreed in a previous project management group meeting. All maps except for the soil class map were created by 2020 June. Soil classification took longer than anticipated and required the involvement of an independent consultant. The soil class map was created in September 2020. The erosion extent map was also reiterated in September 2020. All maps are available on the project webGIS. Indicator is appropriate.

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
Activity 2.1 Recruit the soil surveyor and define the date and meet in Cambridge to draw an action plan for the desk-based data analyses, the soil campaign and laboratory works (in London and Falklands)		Completed.
Activity 2.2 Acquire necessary field equipment and ship it to the Falklands if not bought on the islands		Completed.
Activity 2.3 Plan soil campaign in the Falkland Islands and liaise with SAERI logistics officer for the preparation of the fieldwork on farms and in Stanley		Completed.
Activity 2.4 Identify suitable satellite imagery (Sentinel 2) across years and seasons and source other datasets and data sources (Google Earth) which can contribute to the identification of soils, peatlands and areas affected by erosion. Investigate and decide which Digital Soil Mapping methods are the most appropriate for the Falkland Islands. Prepare a report.		Completed.
Activity 2.5 Carry out the pre-processing and processing of the identified satellite imagery and incorporate the other ancillary data. Issue the first soil map by the end of October 2018 as it will be used by surveyors in the soil campaign		Completed.
Activity 2.6 Prepare new versions of the maps (soil/peatlands/erosion) on the basis of the ground-truthed points collected by the soil surveyors. Make the maps available to the stakeholders by end of April 2019		Completed.
Activity 2.7 Write the soil survey methodology to be followed during the soil campaign and make it available online		Completed.
Activity 2.8 Carry out the soil campaign in the Falkland Islands and write a short fieldwork report at the end of each campaign		Completed.
Activity 2.9 Process and analyse the data collected during the soil campaign and make them available to the other project partners. The activity will take place between each campaign.		Completed.
Activity 2.10 Combine ancillary data (elevation, habitat and weather) and soil physical properties to estimate erosion risk and generate a map		Completed.
Activity 2.11 Remote sensing analyses continue to be updated and iterated in order to include data coming from the soil campaign. The final maps of soil, peatlands, erosion extent and risk are delivered to the stakeholders by June 2020		Completed. The final maps were delivered in July 2020.
Output 3. WP2: Assessment of the sustainability of soil management practices and of soils physical, chemical and microbiological properties	3.1 Chemical analyses of soil sampled during the fieldwork (November 2018, February and November 2019) 3.2 DNA sequencing of soil samples collected at locations chosen by stakeholders and agricultural advisors	3.1 The lab analyses of the soil samples were carried out after each fieldwork season and completed by March 2020 (Figure 13). Indicator is appropriate. 3.2 The DNA sequencing was completed and the report is available here. Indicator is appropriate.

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
	3.3 Map the results against other data collected or used by the project to identify patterns in the soil physical, chemical and biological properties across the islands 3.4 Identify a sustainable and long-term manageable monitoring programme for assessing soil health by the end of July 2020	3.3 The patterns were assessed and the report is available here. Indicator is appropriate. 3.4 The long-term monitoring programme has been prepared by project partner Prof. Jim McAdam and is available here. Indicator is appropriate.
Activity 3.1 Check which equipment is needed to carry out laboratory analyses in the Falklands and subsequently buy and ship what is missing		Completed.
Activity 3.2 Identify with stakeholders, soil surveyors and agricultural advisors how many soil samples should be collected for DNA sequencing and from which areas		Completed.
Activity 3.3 Adopt current accepted metrics and standards to measure soil health and DNA sequencing. Write a report and make it available online		Completed.
Activity 3.4 Define with the soil surveyors and the laboratory technician the standard methods of soil collection and storage. If necessary run a training course		Completed.
Activity 3.5 Assess the sustainability of soil management practices by sequencing analysis for soil microorganisms carried out at the Life Sciences Department, NHM, London		Completed.
Activity 3.6 Provide interpretation of the results from analyses so that they can be explained in a way that is accessible to local stakeholders and all users of the interpretative soil database tool		Completed.
Activity 3.7 Carry out the chemical analyses of soils sampled during the campaigns. The lab analyses will take place in the Falklands.		Completed.
Activity 3.8 Identify and document which laboratory analyses approaches, used throughout the project, can support a long-term monitoring program for quantifying chemical and biological soil properties and for assessing soil health.		Completed.
Activity 3.9 Pull out the main outcomes from the laboratory analyses (chemical and biological) and plan for publishing them on a scientific paper.		Completed.
Output 4 WP3: Development of soil spatial database and interactive tool for interpreting and describing soils	4.1 Meeting with stakeholders to present examples of designs of the online data system tool and obtain feedback on which format works better.	4.1 The interactive tool delivered to local stakeholders was discussed during stakeholder workshops, offline pdf maps were suggested additionally to the online webGIS and this idea was promoted in the follow-up stakeholder engagement (workshop report).

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
properties and health, displaying soil erosion risk on selected farms. The tool supports stakeholders' actions for mitigating with climate change effects	Updates on the development of the tool will be provided at each PSG meeting 4.2 Data sharing procedures to allow access to the data for all project participants. By June 2018 4.3 SAERI server to be set up in order to store database in PostgreSQL and datasets collected throughout the project by June 2018 4.4 Online interactive soil database on soil properties and erosion risk by July 2020 4.5 Database of the national soils, peatlands and eroded areas and erosion risk in PostgreSQL (open source database engine) accessible by Stakeholders and project partners. Continuous work from November 2018 until July 2020 4.6 Preparation and publication of webGIS services to make results available to the wider public by July 2020	 4.2 Data is shared between project partners through a google drive platform to which everyone has access and editing rights (Figure 15). Data sharing is also specified in the MoU (paragraph 6). Indicator is appropriate. 4.3 The SAERI server was set up and two internal hard drives (4TB each) were purchased to allow the server to deal with the data generated by the project (Figure 16). Indicator is appropriate. 4.4 The interactive webGIS with all the soil maps including soil class, chemical and physical properties, peat depth, erosion and erosion risk is available online and accessible to everybody. Indicator is appropriate. 4.5 The spatial database in PostgreSQL was created after the first field season and has been updated with the entire dataset (Figure 17). Indicator is appropriate. 4.6 The interactive webGIS with all the soil maps including soil class, chemical and physical properties, peat depth, erosion and erosion risk is available online and accessible to everybody. Indicator is appropriate.
4.1 Liaise with other project participant to ensure that the data management plan is adopted, filled in and kept up-to-date. Include the data management plan to the report to be submitted to the funding organisation		Completed.
4.2 Talk to project partners to understand and define how they need to access and share the data collected and analysed and in which form. Write the methodology and make it available online.		Completed.
4.3 Design the spatial database for the national soil map and the interpretative tool on soil properties, carbon storage and erosion risk in PostgreSQL and link it to QGIS and a to the project based webGIS service		Completed.

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
4.4 Check that data are documented, open access, quality checked, stored and backed-up in the secure server at the local data centre in the Falkland Islands and on a cloud server for the overseas project partners		Completed.
4.5 Engage the stakeholders to identify which information requirements are needed for the online and freely available interpretative soil and erosion risk tool. Write a short report to describe the outcomes of the stakeholders engagement		Completed.
4.6 Use stakeholders' feedbacks to ensure that the interpretative tool can be simply accessed and understandable by them and easily managed by SAERI data manager. Write a short report to describe the various steps made to generate the interactive tool		Completed.
4.7 Test and assess the interactive tool on farmer attitude and economic performance of the farms. Use the results in a feedback loop to modify the tool and make it more efficient and valuable and more able to be adopted into policy decisions		Completed.
4.8 Publish the final maps online through webGIS service		Completed.
4.9 Publish the interactive tool online at the Department of Agriculture webpage		Completed.
Output 5 Knowledge transfer workshops and training courses	5.1 At maximum of 8 workshops (split into 4 in West and 4 in East Falkland) will be run on farms and in Stanley to landowners and to the public to describe and explain in simple words the use of the tools employed throughout the project and to ensure the people are informed and can appreciate their practical applications to land management. The workshops will be running in the last quarter of year 2 5.2 At least two local stakeholders trained in fieldwork to learn what the soil survey is about and how a better knowledge of the soils and their properties helps in managing this natural resource in relation to farm business and conservation plans. Monthly fieldwork campaigns will occur	5.1 Two workshops were held in February 2019 that explained the project's background of soil modelling and field work, illustrated with a case study how the final maps can be utilised for land management and offered the opportunity to explore preliminary interactive maps (see workshop report and slides examples in Annex 4). Indicator is appropriate. 5.2 Two stakeholders (Tony Heathman, Estancia farm and Ben Berntsen, Elephant Beach and Cape Dolphin) joined the field work. The soil team explained the details of the soil survey and the overall importance of the soil maps. (See fieldwork reports and Figure 18. Indicator is appropriate.

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
	3 times in spring and summer 2018/2019 and in spring 2019 5.3 Training on gas flux measurements for local scientists and interested stakeholders so that monitoring work can be continued.	 5.3 The knowledge for gas flux monitoring work will be maintained in the Islands: the PM of the Soil Mapping Project will be managing the new DPLUS113 project on wetlands and aquatic habitats on the Falkland Islands. She will therefore be able to take the gas flux work further with current and new project partners, examples include involvement in a bid for a new Darwin-funded project and a proposal for a PhD project.
5.1 Run 2 workshops on farms and in Stanley (one each) on soil health and training agricultural advisors and habitat restoration officer on how to collect soil samples for future chemical/biological analyses and for soil properties monitoring		Completed.
5.2 Prepare 2 workshops on farms and in Stanley (one each) on what the Earth Observation techniques can tell about soils, erosion and peatlands.		Completed.
5.3 Deliver 2 workshops on farms and in Stanley on how to use the interactive tool, how to keep it up-to-date and how to monitor soil health/erosion/greenhouse gases emission in the long term		Completed.
5.4 Deliver 2 workshops on farms and in Stanley (one each) to describe the soils of the Falklands and how the soil campaign took place		Completed.
5.5 Present the results at the annual winter meeting for rural landowners - Farmers' Week		Completed.
5.6 Promote the project by allowing volunteers, including interested high school students, to join the PM and the project partners on fieldwork and laboratory analyses (in the Falklands)		Completed.
5.7 Promote the Falkland Islands soil work to other UKOTs		Completed.

Annex 3 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1	Number of (i) students from the UKOTs; and (ii) other students to receive training (including PhD, masters and other training and receiving a qualification or certificate)	(i) 0 (ii) 0
2	Number of (i) people in UKOTs; and (ii) other people receiving other forms of long-term (>1yr) training not leading to formal qualification	(i) 0 (ii) 0
3a	Number of (i) people in UKOTs; and (ii) other people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	(i) 2 x male, 4 x female (ii) 0
3b	Number of training weeks (i) in UKOTs; (ii) outside UKOTs not leading to formal qualification	(i) 0 (ii) 0
4	Number of types of training materials produced. Were these materials made available for use by UKOTs?	0
5	Number of UKOT citizens who have increased capacity to manage natural resources as a result of the project	400
Research Measures		
9	Number of species/habitat management plans/ strategies (or action plans) produced for/by Governments, public authorities or other implementing agencies in the UKOTs	1 (Sustainable long-term soil monitoring programme)
10	Number of formal documents produced to assist work in UKOTs related to species identification, classification and recording.	0
11a	Number of papers published or accepted for publication in peer reviewed journals written by (i) UKOT authors; and (ii) other authors	(i) 0 (ii) 0
11b	Number of papers published or accepted for publication elsewhere written by (i) UKOT authors; and (ii) other authors	(i) 0 (ii) 0
12b	Number of computer-based databases enhanced (containing species/genetic information). Were these databases made available for use by UKOTs?	1 Soil Map webGIS Yes.
13a	Number of species reference collections established. Were these collections handed over to UKOTs?	0
13b	Number of species reference collections enhanced. Were these collections handed over to UKOTs?	0
Dissemination Measures		
14a	Number of conferences/seminars/workshops/stakeholder meetings organised to present/disseminate findings from UKOT's Darwin project work	A total of 5, all in UKOT: Stakeholder Workshops x 5
14b	Number of conferences/seminars/ workshops/stakeholder meetings attended at	A total of 7

Code	Description	Totals (plus additional detail as required)
	which findings from the Darwin Plus project work will be presented/ disseminated	In UKOT: Public talk x1 Outside of UKOT: Conference talks x4 Conference poster presentation x1 Presentation to FCO delegation x1
Physical Measures		
20	Estimated value (£s) of physical assets handed over to UKOT(s)	
21	Number of permanent educational/training/research facilities or organisation established in UKOTs	0
22	Number of permanent field plots established in UKOTs	1
23	Value of resources raised from other sources (e.g., in addition to Darwin funding) for project work	

Annex 4 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. weblink, contact address, annex etc)
Journal (in prep)	Development and testing of a digital map of soil properties in the Falkland Islands Matthew Aitkenhead, Stefanie Carter, Christopher Evans, Roberto Jara Langhaus 2021	British	British	Male	TBC	In preparation
Report	Falkland Islands Soil Map Interpretation Guide Stefanie Carter, Matt Aitkenhead, Chris Evans, Anne D. Jungblut, Gordon Lennie, Jim McAdam, Matthew McNee, Sergio Radic Schilling 2020	German	Falkland Islands	Female	SAERI, Falkland Islands	https://www.south-atlantic-research.org/wp-content/uploads/2020/07/Soil-Map-Interpretation-Guide_Final.pdf
Report	A scoping study for potential community-based carbon offsetting schemes in the Falkland Islands Chris Evans, Jonathan Ritson, Jim McAdam, Stefanie Carter, Andrew Stanworth and Katherine Ross 2020	British	British	Male	Falkland Conservation, Falkland Islands	https://falklandsconservation.com/wp-content/uploads/2020/09/Evans_et_al_2020_Carbon_offsetting_schemes_Falklands_FC_revised_sept_2020.pdf

Report	Sustainable long-term monitoring programme Jim McAdam, Anne D. Jungblut, Stefanie Carter	British	Falkland Islands	Male	SAERI, Falkland Islands	https://www.south-atlantic-research.org/wp-content/uploads/2020/11/Long-term-soil-monitoring-programme_Final.pdf
Report	Characterisation of soil microbial communities on the Falkland Islands using 16S rRNA and 18S rRNA gene high throughput sequencing Anne D. Jungblut 2020	German	British	Female	NHM, London	https://www.south-atlantic-research.org/wp-content/uploads/2020/11/Report-Falkland-Island-soil-microbiology_final.pdf
Newspaper Article	Soils in the Falkland Islands Jim McAdam, Matthew McNee, Sergio Radic 2020	British	Falkland Islands	Male	Woolpress, Falkland Islands	https://www.south-atlantic-research.org/wp-content/uploads/2020/07/Woolpress-May-June-2020-Soils-in-the-Falklands.pdf
Newspaper Article	Soil-acidity and aluminium toxicity Sergio Radic, Jim McAdam, Matthew McNee 2020	British	Falkland Islands	Male	Woolpress, Falkland Islands	https://www.south-atlantic-research.org/wp-content/uploads/2020/12/Woolpress-May-June-2020-Soil-acidity-and-aluminium-toxicity.pdf
Newspaper Article	Falkland soils under the spotlight iLaria Marengo 2020	Italian	Falkland Islands	Female	Penguin News, Falkland Islands	https://www.south-atlantic-research.org/wp-content/uploads/2020/07/Penguin-News-Article_2018_03_23.pdf

Annex 5 Darwin Contacts

Ref No	DPLUS083
Project Title	Soil map and online database as climate change mitigation tools
Project Leader Details	
Name	Tara Pelembe
Role within Darwin Project	Leadership, oversight, connection with project partners
Address	
Phone	
Skype	
Email	
Partner 1	
Name	Dr. Matt McNee
Organisation	Falkland Islands Government – Department of Agriculture
Role within Darwin Project	Stakeholder Engagement & Agronomy Adviser
Address	
Skype	
Email	
Partner 2	
Name	Prof. Jim McAdam
Organisation	UK Falkland Islands Trust
Role within Darwin Project	Stakeholder Engagement and Agronomy Adviser
Address	
Skype	
Email	
Partner 3	
Name	Dr. Matt Aitkenhead
Organisation	James Hutton Institute
Role within Darwin Project	Soil Modeller
Address	
Skype	
Email	
Partner 4	
Name	Prof. Chris Evans
Organisation	UK Centre for Ecology and Hydrology
Role within Darwin Project	Adviser on peatlands, carbon stock, erosion, biogeochemistry
Address	
Skype	
Email	
Partner 5	
Name	Dr. Anne D. Jungblut
Organisation	Natural History Museum
Role within Darwin Project	Microbiology analyses
Address	
Skype	
Email	
Partner 6	
Name	Dr. Sergio Radic
Organisation	University of Magallanes
Role within Darwin Project	Adviser on soil properties and functioning
Address	
Skype	
Email	

Annex 6 Supplementary material (optional but encouraged as evidence of project achievement)

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	Yes
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	No
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	Yes
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	No
Have you involved your partners in preparation of the report and named the main contributors	Yes
Have you completed the Project Expenditure table fully?	Yes
Do not include claim forms or other communications with this report.	