Darwin Plus:
Overseas Territories Environment and Climate Fund
Annual Report

Important note *To be completed with reference to the Reporting Guidance Notes for Project Leaders:*

it is expected that this report will be about 10 pages in length, excluding annexes

Submission Deadline: 30th April 2019

Darwin Plus Project Information

Project reference	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 institutions	Centre for Ecology and Hydrology (CEH), Falkland Island Government (FIG), James Hutton Institute (JHI), Natural History Museum (NHM), UK Falkland Island Trust (UK FIT) and University of Magallanes (UMAG)
Grant value	£265,612
Start/end date of project	1st April 2018 to 31st July 2020
Reporting period (e.g., Apr 2018-Mar 2019) and number (e.g., AR 1,2)	April 2018 to March 2019 AR 1
Project leader name	Tara Pelembe
Project website/blog/Twitter	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/
Report author(s) and date	Stefanie Carter (Project Manager), Jim McAdam (Project Partner). Editing and proof-reading by the whole Project management Group. 30 April 2019

1. Project overview

The soil mapping project aims to create a national soil map of the Falkland Islands (Figure 1). Additionally, the project also aims to develop an online tool for local stakeholders. This tool will make data such as soil type, chemical properties, pH and bulk density available at farm level at a resolution of 10 m which can then be utilised by farmers as well as conservation and research organisations for improved land management. In order to address challenges faced through climate change, the project also aims to establish a baseline for peat extend, carbon stock and erosion.

This will be achieved through extensive soil surveys across the Falkland Islands (Figure 1). For each point the soil classification is determined, a range of soil properties (such as pH, bulk density, soil moisture, electric conductivity and several chemical properties) are determined, erosion extent and peat depth are recorded. Soil health is also considered by the project: additional soil samples at selected locations will be analysed for microbiological properties.

The outcome of this project is highly relevant to local stakeholders – mainly land owners and land managers but also conservation organisations. Stakeholder engagement and consultation are therefore a particular focus for the project and the stakeholders' requirements for the delivery of the final online tool will be determined.

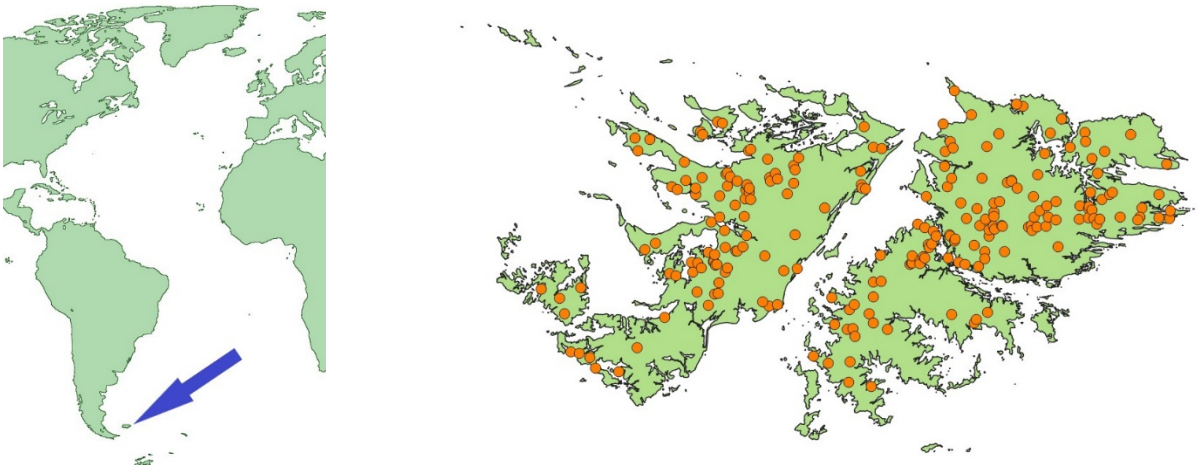

Figure 1: Location of the Falkland Islands (left). Location of soil survey points within the Falkland Islands (right).

2. Project stakeholders/partners

Project partners

The project partners form the project management group (PMG) and have met regularly to steer the project along, decide on the methodologies applied and discuss any issues that have arisen. Three PMG meetings were held in this reporting period, the notes for which are available here.

The project partners are directly involved in supporting the project as follows:

- SAERI is the lead organisation. Project Manager Stefanie Carter runs the project administration (e.g. PMG and stakeholder meetings, purchasing equipment, managing the budget), maintains contact with stakeholders, plans the fieldwork and carries out the fieldwork alongside the soil surveyor. She is supported by SAERI's Deputy Director (Innovation) Tara Pelembe with the overall project management, by SAERI's Deputy Director (Business & Programmes) Teresa Bowers with project finances and by SAERI's office staff (Traighana Smith, Matías Torres Torres and Zoë James) with general administration and logistics.
- Matt Aitkenhead from the James Hutton Institute, UK, is the lead for the soil modelling. He selected the satellite maps, compiled all available environmental data which form the baseline of the model, selected the soil sample points, and will create all maps. He will also carry out the soil classification based on field descriptions and lab analyses.
- Falkland Island Government (FIG) is involved in stakeholder engagement and soil lab analyses but has also advised on general fieldwork planning and methodology. James Bryan from the Department of Agriculture (DoA) has been 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) analyses the soil samples collected in the field for chemical properties.

- Chris Evans from the CEH in Bangor, UK, has advised on general fieldwork methodology and planning and more particularly on recording peat and erosion extent. He has 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.
- Anne D. Jungblut from the Natural History Museum, UK, is the lead on soil microbiology. She visited the Falkland Islands in the beginning of 2019 to collect soil samples and will carry out the DNA extraction and sequencing. Anne will also interpret the results on soil microbial communities and put these in a wider context.
- Jim McAdam (UK FIT) has the lead on stakeholder engagement in the project. He was involved in organising and running the stakeholder workshops and contacted numerous farmers directly regarding the workshops. Several farmers had expressed an interest in the project but were unable to attend the workshops, therefore Jim met with many individually during his visit in the Falkland Islands.
- Sergio Radic Schilling from the University of Magallanes (UMAG), Chile, has advised on fieldwork methodology, assisted with fieldwork and will advise on the interpretation of the soil properties. He also recruited the soil surveyor, Roberto Jara Langhaus, for the field work.

Project Stakeholders

Stakeholder engagement is a key component of the project as the final maps and online tool produced by the project will directly benefit the local stakeholders. Stakeholders to be 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 and Independent Research Institute SAERI.
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 Falklands experience

Soon after the project commenced, articles were placed in the local farming magazine in the Falklands-Wool Press and the Penguin News (Annex 3). Furthermore, two radio interviews on Falkland Radio were given to update the listeners on the soil mapping project. There first one was given by iLaria Marengo – SAERI's GIS specialist – on 17 April 2018 and a second one was given by the project manager on 21 November 2018. This would have reached all potential stakeholders.

Fundamental to stakeholder involvement has been the holding of two Stakeholder workshops (on both East and West Falkland) followed up by individual farmer/landowner presentations and one-to-one discussions for those who were not able to attend. The agenda for and invitation to the stakeholder workshops was discussed and agreed with the project partners. The invitation was sent by email to all farmers, Falklands Conservation (FC), SAERI, FLH. The workshops were advertised on Falklands Radio and in the local newspaper, Penguin News (Figure 12).

A public lecture advertised on local radio, in the Penguin News and on the local Facebook community page on "The Risk to Falkland Soils from Climate Change" was given by the UKFIT Project Partner prior to the workshops (Figure 2). This lecture covered the background to and relevance of the project. The talk attracted an audience (21 people) from the wider public beyond the specific, targeted stakeholders.

Although numbers attending the East Falkland workshop were small there was representation across all sectors and the project partner responsible for stakeholder engagement was able to follow up with several individual farm owner visits. An additional stakeholder forum was held on West Falkland to facilitate those farmers and stakeholders who might not have found it easy or

convenient to travel to East Falkland. There was good attendance at this event. Please see the workshop report for details.

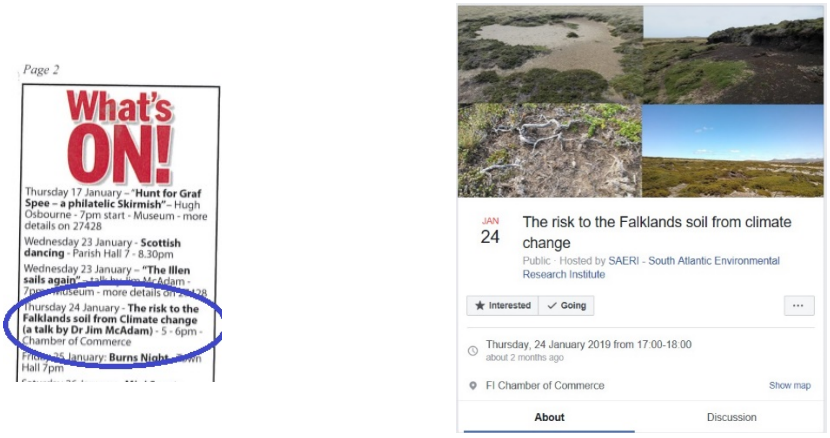

Figure 2: Advert for Jim McAdam's talk in the Penguin News (left) and on Facebook (right).

Engaging with local government officials and with local public representatives is a key element of the project. The UKFIT Project Partner met with

i. Governor Nigel Phillips to brief him on the project.
ii. Gave a presentation on the project to 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).
iii. Briefed Head of Policy and Environment, FIG Diane Simsovic and Environment Officer and Policy Adviser, Denise Blake on the project.

Additionally, the project was discussed by the project manager 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).

All farmers and stakeholders in addition to the aforementioned policymakers that the project has been discussed with and / or presentations were made to are listed in Annex 4. The group of farmers agreeing to work with the project (highlighted in Annex 4) to refine and test the map on a pilot basis before general release have had a follow up contact from the Project Manager. Given the small numbers of farmers in the Falklands, their seasonal workload and the difficulty and expense of travel, every effort was made by the project partners to engage with stakeholders. A good cross section of farmers and landowners were engaged with and recruitment targets for numbers of farmers to pilot test the maps were exceeded.

Collaborations

The project has collaborated with Darwin Plus Project 065 'Mapping Falklands and South Georgia coastal margins for spatial planning'. The coastal mapping project requires ground validation for the habitat map at two different levels. At each of the soil survey points Level 1 (10 m radius) habitat data was recorded and will feed into the coastal mapping project.

3. Project Progress

3.1 Progress in carrying out project Activities

Output 1 - Project Management Structure

Summary: The majority of planned activities for this reporting year have been completed.

The project Memorandum of Understanding (MoU) was drafted in April 2018 and circulated amongst project partners. Several comments were received and amendments were requested by various project partners, which then had to be re-circulated between all partners. This prolonged the signing process substantially until a final version was drafted in November 2018. Four project partners (SAERI, JHI, UK FIT and CEH) have now signed the MoU, with a further imminent (FIG and NHM). UMAG require a translation into Spanish which has been requested. Once the translation is received, they will also sign the MoU. The signing of the MoU is anticipated to be completed in May 2019 and the final version will be uploaded to the project website. The partially signed document is available upon request. Even though three project partners have not signed the MoU, this has not impeded their participation in the project (**Activity 1.1**). The PM was in post on 20 August 2018 and has been recruited for a two-year period. Their contract is available upon request (**Activity 1.2**). The Terms of Reference (ToR) for the PMG meetings have been approved by the PMG and are available on the project website. Quarterly PMG meetings were held in May, September 2018 and January 2019. The meeting minutes are available on the project website (**Activity 1.3**).

One project stakeholder meeting was held on 25 January in 2019 in Stanley (East Falkland) and the same event was repeated on 5 February 2019 in Fox Bay (West Falkland) in order to give all land managers across the Falklands the chance to attend. The workshop report is available on the project website. This was the earliest opportunity to hold a stakeholder event. As the fieldwork was organised, contact with land owners and land managers was established which was important in enabling active participation in the project. The turnout at the events was lower than originally anticipated and was probably due to the busy schedule of farmers and long driving distances in the Falkland Islands. The Stakeholder engagement for this project has therefore been adapted accordingly and there have been a relatively high number of 1-1 meetings by the PM during fieldwork and by project partner Jim McAdam who actively sought out farmers to engage them in the project (please see section 2 for details). The anticipated 6-monthly project stakeholder group (PSG) meeting schedule has been revisited and instead we propose to engage with stakeholders once a year during the annual farmer's week (July 2019 and 2020) and with at least one further 1-1 meeting with the farmers that have agreed to actively participate in the project (highlighted in Annex 4). (**Activity 1.4**).

The project website was set up in April 2018 and is updated regularly (**Activity 1.5**). The monitoring and evaluation plan was written and approved by the PMG in October 2018 and is available on the project website (**Activity 1.6**).

Output 2 – WP1: National Soil Map, peatland distribution and soil erosion extent / risk

Summary: The majority of the activities planned for this reporting year have been completed.

The first PMG meeting was held through skype instead of an actual meeting in Cambridge as this was easier to organise due to everyone's commitments. The soil surveyor was identified by June 2018; a contract was in place in November 2018, which is available upon request (**Activity 2.1**). Field equipment was ordered in September 2018 and arrived in November 2018 (Figure 3) (**Activity 2.2**). The fieldwork scheduled was planned, accommodation was organised and permission from land owners was obtained prior to the beginning of each soil campaign. The fieldwork schedule is presented in the fieldwork reports 1 and 2, all land owners received an email (example presented in Annex 5) which asked for permission to carry out the work and explained the specifics of the soil surveys (**Activity 2.3**). Several types of imagery were explored and the digital soil mapping approach was determined, which is summarised in this report (**Activity 2.4**). Soil maps were created which are available on the project website; the process of soil map creation is outlined here (**Activity 2.5**).

The soil survey methodology was written up by October 2018 and is available on the project website (**Activity 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 (**Activity 2.8**). Data processing and analysis will take place between field seasons instead of field campaigns. There was very limited time between the two field campaigns (five weeks including the Christmas holidays) which made it impossible to enter,

process and analyse the data at the same time as planning the next round of fieldwork. Instead, this process will take place in year 2 where there is a longer gap between field seasons (**Activity 2.9**). A preliminary erosion map was created and is available here. The final map will be produced at the end of the project (**Activity 2.10**).

Figure 3: First lot of equipment arrived in October 2018 (left), the remainder arrived in November 2018 (right).

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

Summary: All of the activities planned for this reporting year have been completed.

All equipment and consumables sourced from the UK were ordered in September and arrived by November 2018. All equipment and consumables sourced in Stanley were purchased in November 2018 (Figure 3, **Activity 3.1**). The selection of sites for the microbiological analyses was mainly determined by the logistical practicalities of the fieldwork; however, a range of areas across the Falkland Islands were visited and additional areas were covered to incorporate stakeholder's requirements (please see second fieldwork report). Through stakeholder engagement in the workshops and during 1-1 interactions it became clear that successful tussac grass *Poa flabellata* establishment is of concern to stakeholders. Therefore, various tussac sites (restored and pristine) were visited (Figure 4) in order to determine chemical and microbiological properties required for healthy tussac establishment. Advantage was also taken to consult and engage in the field with a visiting expert on tussac grass planting, Enrique Frers (**Activity 3.2**). The methodology for the sampling of soil for microbiological analyses and DNA extraction as well as sequencing has been written and is available on the project website (**Activity 3.3**). Soil is collected from the upper 20 cm for chemical analyses and in agreement with the laboratory technician soil samples are kept cool after collection up until the point of lab analyses in cool bags, fridges and electrical cool boxes (**Activity 3.4**). Chemical analyses started as soon as the first soil samples were collected in November 2018 and the analyses have been on-going since. It is anticipated that all samples from the first and second campaign will be completed by May 2019 (Figure 5) (**Activity 3.7**).

Figure 4: Left image: (from left) Anne D. Jungblut (project partner), Roberto Jara Langhaus (soil surveyor), Ben Berntsen (farm manager at Cape Dolphin) and Stefanie Carter (project manager) at Cape Dolphin. Right image:

Anne D. Jungblut and Stefanie Carter collecting soil samples for microbiological and chemical analyses amongst tussac grass.

	A	B	C	D	E	F	G	H	I	J	K	L	M
13	Farm	Estancia											
14	Point No	% O.M	% unrubbed Fibre	pH water	pH Ca Cl2	Bulk Density	mg /L N	mg/L P	mg/L K	mg/L Ca	mg/L Mg	mg/L Al	mg/L Cl
15	189	84.58	68.29	3.85	3.09	0.292/0.294	2.4	25	100	500	310	40	250
16	192	82.84	41.2	3.95	3.18	0.150/0.158	1.7	17	155	750	200	22	1000
17	193	95.94	94	3.47	2.9	0.181/0.145	1.6	21	100	500	285	0	250
18	197	88.85	71	3.83	3.1	0.180/0/132	2.2	10	115	250	390	25	250
19	191	92.96	75.86	4.03	3.38	0.1/0.090	1.7	52	170	500	185	2	375
20													
21													
22													
23	Farm	Horseshoe Bay											
24	Point No	% O.M	% unrubbed Fibre	pH water	pH Ca Cl2	Bulk Density	mg /L N	mg/L P	mg/L K	mg/L Ca	mg/L Mg	mg/L Al	mg/L Cl
25	214	93.32	47.06	3.81	3.01	0.189/0.186	1.8	23	160	1000	275	20.6	<125
26													
27													
28	Farm	Belongaus station											
29	Point No	% O.M	% unrubbed Fibre	pH water	pH Ca Cl2	Bulk Density	mg /L N	mg/L P	mg/L K	mg/L Ca	mg/L Mg	mg/L Al	mg/L Cl
30	212	20.81	50.51	5.21	4.32	0.336/0.375	1.6	25	365	1250	425	54	
31													
32													

Sheet1 Sheet2 Sheet3

Figure 5: Example of the results from the chemical analyses.

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 tool supports stakeholders' actions for mitigating with climate change effects

Summary: All of the activities planned for this reporting year have been completed.

A data management plan was created, accepted by the PMG and made available online (**Activity 4.1**). Data is shared between project partners through a Google Drive platform to which everyone has access and editing rights (Figure 6). Data sharing is also specified in the MoU (paragraph 6). A report to formalise this was not deemed necessary (**Activity 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 7) (**Activity 4.3**). **Activity 4.4** started with the set-up of the SAERI server (Activity 4.3) and is on-going. Stakeholders were asked as part of the workshop what the final tool produced by the project should look like. The discussions are available in the stakeholder workshop report (**Activity 4.5**).

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

Summary: This output is mostly relevant for project years 2 and 3.

The majority of activities will take place in years 2 and 3. Two activities are on-going and therefore partially relevant for this reporting period. Two land owners volunteered to assist with fieldwork (see fieldwork reports 1 and 2 and Figures 4 and 13) and one further volunteer was recruited for the fieldwork week on Saunders Island (see fieldwork report 2 and Figure 8) (**Activity 5.6**). The project is promoted to other UKOTs through SAERI's Facebook and twitter posts and newsletters (example Figure 9). (**Activity 5.7**).

Figure 8: Project manager Steffi Carter and volunteer Gwawr Jones on Saunders Island.

Soil Mapping Project

Exciting news: The first fieldwork campaign will commence very soon! Our project partner Matt Aitkenhead from the James Hutton Institute in Scotland selected a total of 226 survey points for the entire Falklands. With landowners' permission, the project manager and a soil surveyor from the University of Magallanes will visit a selection of these from 24th November onwards to describe soil horizons, record soil erosion and take soil samples for chemical analyses at the Department of Agriculture.

Figure 9: Excerpt from the SAERI Newsletter, November 2018.

Summary:

3.2 Progress towards project Outputs

Output 1 – Project Management Structure.

Output 1 involves the establishment of the project management structure and communication tools as well as stakeholder engagement. The overall progress is good. Most indicators are completed (**Indicators 1.2, 1.3, 1.5 and 1.6,** evidence available in the activity summary 3.1). The signing of the MoU (**Indicator 1.1**) is still outstanding; the delay is due to language translations and a complete signed version will be achieved in due course. This is considered only a formality. Holding formal and regular PSG meetings (**Indicator 1.4**) is not a practical approach for the stakeholders involved in this project – farmers with busy schedules and long travelling distances from their farms to any settlements in the Falklands. Contact with stakeholders is better maintained through the annual Farmer's week, which takes place in July every year and through 1-1 contact during fieldwork and via emails.

Output 2 – WP1: National Soil Map, peatland distribution and soil erosion extent/risk

Output 2 involves the actual soil mapping through field work and modelling; the overall progress is very good; most indicators are completed. The notes for the first PMG meeting and the data management plan are available on the project website (**Indicator 2.1**). The desk study report for the digital soil mapping is available here (**Indicator 2.2**). The first maps were created and are available on the project website (**Indicator 2.3**). The soil survey methodology is available on the project website (**Indicator 2.5**). The soil surveyor did not attend the first PMG meeting but was contracted before the start of the first field campaign. The contract is available on request (**Indicator 2.6**). The field campaigns were conducted as scheduled, the fieldwork reports are available on the project website (**Indicator 2.7**). There was limited time available between each field campaign to analyse the data. This process will take place between field seasons in the austral autumn and winter (**Indicator 2.8**).

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

The progress of this output is excellent, both indicators relevant in this reporting period have been completed. The analyses for chemical and physical soil properties commenced as soon as the first soil samples were collected in November 2018 and the analyses have been on-going since (Example in Figure 5). It is anticipated that all samples from the first and second campaign will be analysed by May 2019. Below (**Indicator 3.1**). Soil samples for the microbiological analyses were collected between 25 January and 19 February 2019 when project partner Anne D. Jungblut visited the Falkland Islands. Soil sample points from across the Falkland Islands with a range of

characteristics and additional sites for stakeholder engagement were visited (please see second fieldwork report; **Indicator 3.2**).

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 progress for output 4 is excellent. **Indicators 4.1, 4.2 and 4.3** are completed. Stakeholders were asked about the format of the final online tool during the workshops and this engagement will continue throughout the project (**Indicator 4.1**). Project partners agreed on data sharing procedures and the database for the project was set up (**Indicators 4.2 and 4.3).** The data base will be updated regularly when new data becomes available (**Indicator 4.5**).

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

There is only one indicator relevant for this reporting period which is completed. 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 Figures 4 and 13) (**Indicator 5.2**).

3.3 Progress towards the project Outcome

The progress towards the project outcomes is excellent. In the first and second fieldwork campaign data and soil samples from 112 general soil survey points were collected and all the soil sampling for microbiological analyses has been completed. Peat depth was recorded at each survey point and additional peat depth records were recorded from a further 100 waypoints. This information will feed into a detailed peatland distribution map. Soil erosion was recorded at each soil survey point and additional erosion areas were logged during travel between points which will feed into a map for erosion extent. The basic webGIS frame that will host the maps that the project is generating has been created (Figure 10) and the SAERI server is set-up to store the data (Figure 7). All of these activities have contributed to **Outcome 0.1** which aims to construct 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. The indicator is appropriate. The progress for **Outcome 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 – is also excellent. Outcome 0.1 will form the baseline for the online tool. In-depth stakeholder consultation has revealed what the local stakeholders want from this online tool and how it needs to be presented in order to be of use (Workshop report). On-going stakeholder engagement will ensure that the online tool is designed appropriately. The indicator is appropriate.

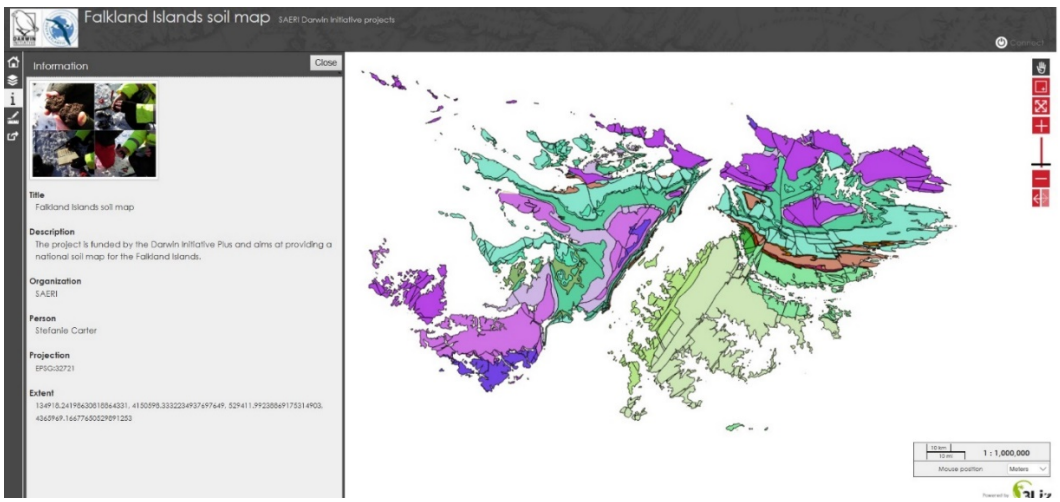

Figure 10: Example of the project's webGIS with the geology layer turned on.

3.4 Monitoring of assumptions

Monitoring of critical conditions (risks and assumptions) is crucial to project success. Report on whether the identified risks still hold true. If there have been changes in assumptions, how is the project meeting or managing these? Please substantiate comments with evidence.

It is important to monitor the risks and assumptions initially identified in the project's log frame. The project has also produced a risk register which is available to all project partners. At the start of the project a list of overall risks has been created but these have not occurred and additional risks have not been logged because the project is progressing well. The PMG meets regularly and discusses any issue that arise and jointly finds a solution.

Risks that are still relevant for **Output 1** is the willingness and ability for project stakeholders to meet (**Assumption 1.4**). As mentioned previously, farmers in the Falkland Island have busy schedules and are scattered across larger distances, which makes arranging meetings at central points a challenge. However, the established stakeholder group is very interested in the project and if central meetings are not possible, contact will be maintained through 1-1 meetings. **Assumption 1.1** still holds true because not all partners have signed the MoU. The project is currently on schedule which means the project manager should complete the final project report on time (**Assumption 1.7**). All other assumptions have become negligible.

The most important risk for **Output 2** is still highly relevant: good weather and problem-free logistics are required to complete the fieldwork (**Assumption 2.7**). In the first season, the weather did not delay any fieldwork but car problems (flat tyre and bogging) caused minor delays. This is still a high risk for the upcoming fieldwork season. The availability of cloud-free satellite imagery still poses a small risk because the current preliminary maps have small areas without any data due to cloud cover. Better imagery needs to be identified (**Assumption 2.2**). All other assumptions are negligible. The project partners work well together, chemical lab analyses commenced as soon as the first samples had been collected, data entry was completed immediately after the field campaigns and preliminary maps have tested the modelling process.

The assumptions for **Output 3** are mostly negligible. Soil sample collection has been appropriate, the chemical lab analyses are progressing without any problems and the results are shared between project partners. The sampling for microbiological sequencing has been completed on schedule. The risk of insufficient DNA or lack of amplification of sequencing templates by PCR (polymerase chain reaction) is mitigated by the collection of sufficient amount of soil material, and we will use established soil DNA extraction protocols such as Qiagen DNA Power extraction kit which includes a purification step to remove PCR inhibitors. The risk is therefore negligible. Other risks which could delay the sequencing of the soil microbiology include the timely delivery of molecular biology reagents and technical problems with the sequencing machine. We will order reagents well in advance to mitigate the risk of a delayed delivery. The selected sequencing approach is a standard protocol and therefore sequencing of the samples could also be carried out at an external sequencing company which mitigates this risk further.

For **Output 4** the ability for the project to consult with stakeholders is still a risk. As previously mentioned this risk can be mitigated by offering 1-1 consultations with individual stakeholders (**Assumption 4.1**). The availability of free or low charge internet costs has not been resolved and may be an issue in order to deliver the online tool to the stakeholders. To counteract this the possibility of an offline app is being explored (**Assumption 4.4**). All remaining risks are negligible; SAERI's data management and data centre are well-established.
The main risk for **Output 5** still holds true. Interest from stakeholders and their ability to travel to venues is crucial for the successful delivery of training workshops (**Assumptions 5.1, 5.2, 5.3, 5.4**).

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

Potential climate change has been highlighted as the greatest long-term threat facing UK Overseas territories (UKOT). Although the Falkland Islands were not included in early knowledge

gap analyses to identify the impacts of global climate change on the UKOT (Sear *et al.,* 2001[1]), the need to understand Climate Change Adaptation, Mitigation and Ecosystem Services in all the UK Overseas Territories has been highlighted by Defra since 2008 (Brown, 2008[2]).

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 Falkland Islands Government 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
- 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:

- 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.

- 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 outcomes for the natural environment in the Falklands were, developing a climate change mitigation strategy, which focuses 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 the peatlands.

The current project is a direct follow-on from the TEFRA project and will address the main strategic long-term outcomes for the natural environment in the Falklands. Skill in application and usage of the outcomes and tools from the current soil mapping project will be transferred to the stakeholders – mainly farmers and habitat restoration and agricultural extension workers – ensuring that the programme will improve capacity to manage environmental assets in the Falklands. The outcomes from the project will be readily transferrable to other OTs where soil moisture deficits and soil sustainability are major climate change challenges.

[1] 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.

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

Progress.
1. A soil sampling strategy based on existing natural resource maps has been devised and implemented in the field. At least half of the sampling programme is complete.
2. Samples have been successfully collected for soil chemical and physical analyses in the Falklands and soil microbiological analyses in the UK.
3. Stakeholder engagement is on target. At least 11 land owners covering a range of soil types and management practices have agreed to participate in the pilot stages of the project to test and refine the digital soil maps.
4. Preliminary data is available to produce draft maps for initial trialling.

4. Monitoring and evaluation

A Monitoring and Evaluation (M&E) plan was developed for the project and is available on the project website; no changes have been made to it during the reporting period. The project is governed through an establish PMG which is formed by all project partners. The project partners work well together and regularly meet to discuss and steer the project. The project manager updates the PMG in these quarterly meetings on the deliverables in the log frame and the M&E as well as on the budget. The project manager also set up and maintains the risk register. The PMG uses Google Drive to share documents and all project partners have editing rights (Figure 6).

It is the PMG's responsibility to deliver the project on time and within budget and to also review the quality of the outputs. Engagement and involvement of stakeholders ensures that the outcome delivered through the product actually meets stakeholder requirements. The indicators of achievements is the evidence produced by each activity (e.g. reports, maps, methodologies). Section 3 outlines how the activities feed into the project outputs and outcomes.

5. Lessons learnt

A difficult task has been to produce a Memorandum of Understanding (MoU) that all project partners are happy to sign. The project partners all work for large organisations that have their own legal teams. It is therefore up to the legal advisers to agree to the MoU and not the project partner itself. Once one legal adviser requests changes to the document, the revised version has to be re-circulated to all project partners again. If not careful, this process can carry on for quite some time. As the MoU is not a legally binding document, it may be a better idea for the lead organisation to produce a letter that summarises the spirit of collaboration and to circulate this amongst project partners without the need to sign the document.

The project manager 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.

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

Not applicable.

7. Other comments on progress not covered elsewhere

Previously not covered in the report is the addition of an extra deliverable within the project's budget. A change request re-aligned the budget and made funds available to buy equipment for a study on soil CO_2 flux. This study will provide novel data on the condition of the Falkland's peatlands and deliver additional data for the climate change mitigation aspect of the project.

The mapping of peat depth is a crucial part of the project. As highlighted in the first fieldwork report, the fieldwork methodology was refined after the first fieldwork campaign in order to gather additional data for peat depth.

8. Sustainability and legacy

The profile of the project has been promoted and discussed at several levels within the Territory.

At the highest level in Government.

1. Governor, Governor Nigel Phillips.
2. 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)
3. Head of Policy and Environment, FIG Diane Simsovic and Environment Officer and Policy Adviser, Denise Blake

Within relevant government departments and relevant institutions and NGOs

1. The Department of Agriculture staff engage fully with the project. This interest and involvement has gradually grown as the project has developed. Staff have increasingly realised the potential value of the project to assist them in delivering their roles in the Falklands.
2. The local NGO, Falklands Conservation, has been briefed on the project and is fully aware of its value for nature conservation in the islands.
3. 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.

With eventual end users and other stakeholders

In addition to the above stakeholders, farmers and other land-owners will be the direct beneficiaries of the project. They have been made aware of the project through: the local farmers' magazine, Wool Press; their regular interaction with the department's extension agronomist and project partner James Bryan; 2 stakeholder events; individual farm owner visits and one-to-one presentation and discussion.

With the general public in the Falklands

A public lecture was presented covering the background to and relevance of the project. This was advertised in the local weekly newspaper Penguin News and on the Facebook community forum.

Although the project has only completed one year of field sampling, due to the above interactions, it is widely known and its profile has steadily increased over the year. The number of farmers coming forward expressing an interest in participating in the project and engaging with the Agricultural advisory officer indicates increased capacity and interest in the project.
The planned exit strategy is still valid. We will ensure 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. The GIS officer post in SAERI will be fully conversant with the project methodology and outcomes. This will enable continued maintenance of the online mapping tool beyond the life of the project.

9. Darwin identity

The Darwin Initiative funding was recognised in every communication and public engagement opportunity. 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 public awareness of the Darwin Initiative, particularly with the farming and land-owning community. This is supported by section 2 (stakeholder engagement) and section 8 (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 11)
- Presentations at two stakeholder events (25 January 2019 in Stanley, Falkland Islands and 5 February 2019 in Fox Bay, Falkland Islands), presentation title slides are presented in Figure 12.
- Advertisement for stakeholder events in Penguin News on 11 and 18 January 2019. (Figure 12)

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 13 and 14. SAERI currently has 1,640 followers on Twitter, the Facebook posts reached up to 1,000 people.
- Two press articles at the start of the project: Penguin News on 23 March 2018 and WoolPress in the March / April edition (Annex 3).

Figure 11: The Darwin logo on both sides of the fieldwork car.

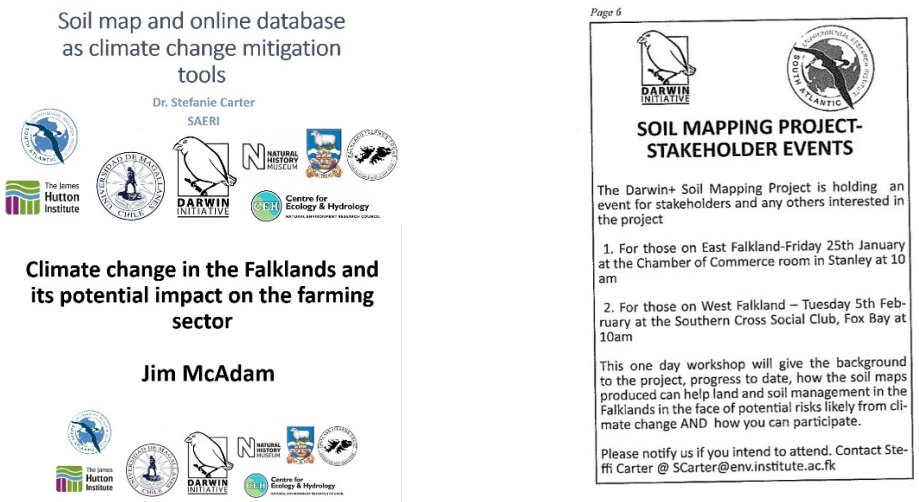

Figure 12: Examples of the presentation of the Darwin logo in presentations to project stakeholders (left) and an advert in the Penguin News (right).

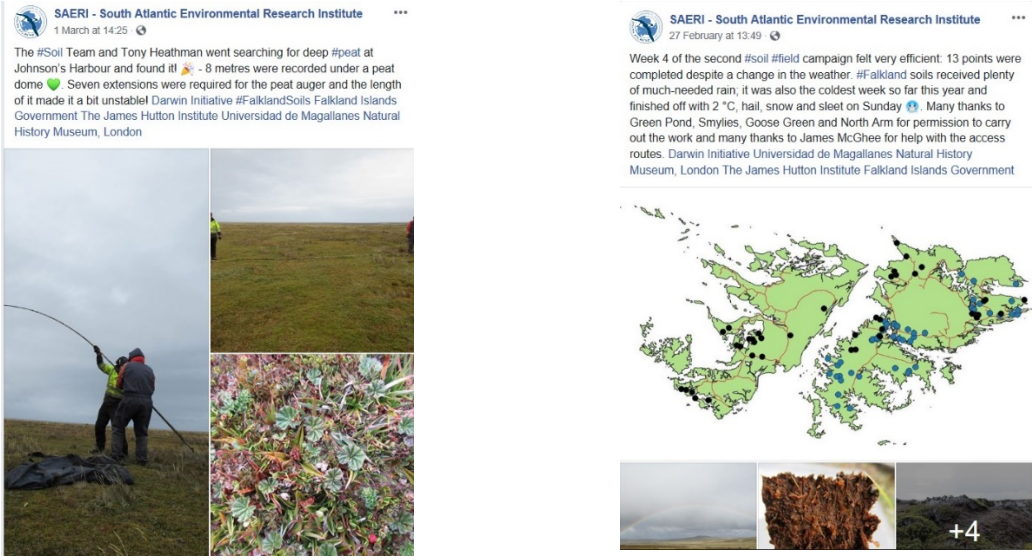

Figure 13: Examples of Facebook posts, which show how the Darwin Initiative is tagged.

Figure 14: Examples of and tweets, which show how the Darwin Initiative is tagged.

10. Project Expenditure

The budget was adjusted with two change requests. The first change request realigned the budget to match the specific needs of the project after the project manager took over the project. The second change request redistributed overheads which were released when two researchers where contracted by SAERI directly instead of through the University of Magallanes. This was the result of a delay in a contracting process. The budget presented below (Table 1) is the latest version after the two change requests.

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

Project spend (indicative) in this financial year	**2018/19 D+ Grant (£)**	**2018/19 Total actual D+ Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				

Operating Costs				
Capital items				
Others (Please specify)				
TOTAL				

Highlight any agreed changes to the budget and **fully** explain any variation in expenditure where this is +/- 10% of the budget. Have these changes been discussed with and approved by Darwin?

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

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Impact Insert agreed project Impact statement		(Report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity e.g. steps towards sustainable use or equitable sharing of costs or benefits)	
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.	The first and second fieldwork campaign have been completed, 112 out of 226 points were visited. Soil samples for the chemical analyses, which are underway, have been collected from these. The collection of soil samples for microbiological analyses is complete. Preliminary maps were created to test the modelling process and to demonstrate the kind of maps we will create.	• Complete the remaining soil survey points in the next fieldwork season • Complete the analyses for chemical properties • Carry out DNA extraction and sequencing to determine the microbiological communities • Create final 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	1.1 An MoU has been signed by four out of the seven parties. Two further partners have agreed to sign but have not provided a signed copy. One partner's signing is delayed by translation of the document into Spanish. MoU available on request. The final signed version will be made available on the project website. Indicator is appropriate. 1.2 The PM took up the position in August 2018 and will be in place until August 2020, one month after the project is completed. Indicator is appropriate. 1.3 On track – three meetings were held in this reporting period. Indicator is appropriate. 1.4 Two PSG meetings (for East and West Falkland) were held in the beginning of 2019. Earlier meetings were not possible because of fieldwork (preparations	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
	1.4 A Project Stakeholders group (PSG) meeting held every 6 months starting May 2018 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	and carrying out fieldwork). Formal meetings every 6 month will not be possible because of stakeholders' time commitments and the impracticality of meeting in particular locations because of long travel distances. Stakeholder engagement will be maintained through the annual farmer's week and through 1-1 contact either via email or in direct meetings during the fieldwork season. Indicator is not appropriate. 1.5 The project webpage was created by April 2018 and has been regularly updated with meeting notes, methodologies, maps and reports. 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 n/a in this reporting period. Will be carried out in year 3 - indicator is appropriate.	
Activity 1.1 Write the MoU, circulate it among the project partners and have it signed		MoU drafted, circulated amongst project partners, signed by 4 partners, agreed to be signed by a further two. Last partner will sign when translation is complete – anticipated for May 2019.	Sign-off by the remaining project partners
Activity 1.2 Prepare the contract for the PM role, advertise the job, recruit and have the contract signed by August 2018		Completed	n/a
Activity 1.3 Arrange quarterly PMG meetings		Completed	Quarterly meeting schedule will be maintained.
Activity 1.4 Arrange PSG meetings every six months		PSG has been formed, two meetings (for East and West Falkland) have been held and other forms of engagement have been carried out (see section 2. Project stakeholders).	Stakeholder engagement during farmers' week in July 2019. Further engagement on 1-1 basis either via email or in person during fieldwork season.
Activity 1.5 Set up the project webpage at the main SAERI website and keep it updated once every three months		Completed	Regular updates will be made.
Activity 1.6 Write the monitoring and evaluation plan by October 2018		Completed	n/a

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 1.7 Write and submit the final project report by July 2020 and prepare scientific papers by July 2020		Planned for completion in year 3	n/a
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 2.3 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 2.9 Remote sensing analyses consisting in iterations of soil/peatlands	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. 2.3 Soil maps were created. These are available on the project website, the process of soil map creation is outlined here. Indicator is appropriate. 2.4 n/a in this reporting period. Will be carried out in year 2 - indicator is appropriate. 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 The soil surveyor was identified but was not able to attend the skype meeting. The soil surveyor worked full-time on both fieldwork campaigns, completed the data entry and is the first author of the fieldwork reports. Indicator is appropriate. 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. Indicator is appropriate. 2.8 The desk-based analysis of the field data will be carried out during the austral autumn and winter 2019. Initial data entry was completed on 31 March 2019; data entry will undergo quality control and will then be released for the desk-based analysis, release of data to project partners is anticipated for the end of April 2019. Indicator is appropriate. 2.9 n/a in this reporting period. Will be carried out in year 2 - indicator is appropriate.	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
	and erosion risk maps on the basis of the data coming from soil campaigns and laboratory analyses (completion the first quarter of year 3)		
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	n/a
Activity 2.2 Acquire necessary field equipment and ship it to the Falklands if not bought on the islands		Completed	n/a
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	n/a
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	n/a
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	n/a
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		In progress – completion in year 2	Create preliminary maps and make them available to stakeholders.
Activity 2.7 Write the soil survey methodology to be followed during the soil campaign and make it available online		Completed	n/a
Activity 2.8 Carry out the soil campaign in the Falkland Islands and write a short fieldwork report at the end of each campaign		In progress – completion in year 2	Complete fieldwork season in (austral) summer 2019/20.
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.		In progress – completion in year 2	All fieldwork and lab data will be made available to project partners in year 2
Activity 2.10 Combine ancillary data (elevation, habitat and weather) and soil physical properties to estimate erosion risk and generate a map		Preliminary erosion map completed, available here.	Final erosion map to be created by year 3.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 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		Planned for completion in year 3	Final maps to be created in year 3.
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 3.3 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 Chemical analyses started as soon as the first soil samples were collected in November 2018 and the analyses have been on-going since (Figure 5). It is anticipated that all samples from the first and second campaign will be completed by May 2019. Indicator is appropriate 3.2 Soil samples for microbiology were collected between 25 January and 19 February 2019 when project partner Anne D. Jungblut visited the Falkland Islands. Details are in the fieldwork report. Soil sample points with a range of characteristics were covered and additional areas of stakeholder interest were also included. Indicator is appropriate. 3.3 n/a in this reporting period, maps have not been created yet. Will be carried out in years 2 and 3 - indicator is appropriate. 3.4 n/a in this reporting period. Will be carried out in year 3 - indicator is appropriate.	
3.1 Check which equipment is needed to carry out laboratory analyses in the Falklands and subsequently buy and ship what is missing		Completed	n/a
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	n/a
3.3 Adopt current accepted metrics and standards to measure soil health and DNA sequencing. Write a report and make it available online		Completed	n/a
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	n/a
3.5 Assess the sustainability of soil management practices by sequencing analysis for soil microorganisms carried out at the Life Sciences Department, NHM, London		Planned for completion in years 2 and 3	DNA extraction from soil samples and sequencing (year 2) and assessing microbial community (year 3)

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
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		Planned for completion in years 2 and 3	Workshops to explain results either in year 2 or year 3.
3.7 Carry out the chemical analyses of soils sampled during the campaigns. The lab analyses will take place in the Falklands.		In progress – completion in year 2	Complete analyses from all fieldwork campaigns in year 2
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		Planned for completion in year 3	Write report in year 3
3.9 Pull out the main outcomes from the laboratory analyses (chemical and biological) and plan for publishing them on a scientific paper		Planned for completion in year 3	Write scientific paper in year 3
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 tool supports stakeholders' actions for mitigating with climate change effects	4.1 Meeting with stakeholders to present examples of designs of the online data system tool and obtain feedback on which format works better. 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	4.1 Stakeholders were presented with design examples during the PSG workshops and during 1-1 meetings (please see PSG workshop report and section 2). Indicator is appropriate. 4.2 Data is shared between project partners through a google drive platform to which everyone has access and editing rights (Figure 6). 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 7). Indicator is appropriate. 4.4 n/a in this reporting period. Will be carried out in year 3 - indicator is appropriate. 4.5 This is on-going work and started with the set-up of the SAERI server 4.3. The data from the first fieldwork season will be added as soon as it is available. Indicator is appropriate. 4.6 n/a in this reporting period. Will be carried out in year 3 - indicator is appropriate.	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
	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		
4.1 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		Complete	Update the data management plan if necessary.
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.		Complete	
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		Complete	
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		Ongoing.	Continue with data quality and storage checks
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		In progress – completion in year 3	Continue with stakeholder 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		Planned for completion in year 3	Write report on interactive tool generation
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		Planned for completion in year 3	Stakeholder engagement with early version of the online tool.
4.8 Publish the final maps online through webGIS service		Planned for completion in year 3	Publish maps at the end of the project

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
4.9 Publish the interactive tool online at the Department of Agriculture webpage		Planned for completion in year 3	Publish interactive tool at the end of the project
Output 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 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 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 2	5.1 n/a in this reporting period. Will be carried out in year 2. It is unlikely that 8 workshops in total will be delivered. The turnout for the project stakeholder workshops gave a good indication of what the interest in the end of project workshops is likely to be. It is anticipated that two workshops – one in East Falkland and one in West Falkland – will be held. 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 Figures 4 and 13. Indicator is appropriate. 5.3 n/a in this reporting period. This indicator will not be completed. The PMG discussed this indicator and decided that such specialised training will not be applied in the Falklands. It was intended to provide training for DNA extraction from soil samples. However, all further steps such as sequencing would have had to be carried out outside of the Falkland Island because such expensive equipment would not be available in the Falklands. It was therefore concluded that there would not be any purpose to just execute the first step in a series of processes. Indicator is not appropriate.	
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		Planned for completion in year 2	Two workshops in total will be held when the all the data has been analysed.
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.		Planned for completion in year 2	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
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		Planned for completion in year 2	
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		Planned for completion in year 2	
5.5 Present the results at the annual winter meeting for rural landowners - Farmers' Week		Planned for completion in years 2 and 3	Present the project at the Farmer's Week in July 2019 and 2020.
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)		Ongoing	Promote the project to volunteers.
5.7 Promote the Falkland Islands soil work to other UKOTs		Ongoing	Promote the project to UKOTs.

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

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 A Project Stakeholders group (PSG) meeting held every 6 months starting May 2018 1.5 At least 1 project webpage created by April 2018, and at least 1 update to the page made every 3 months.	1.1 MoU signed by all parties 1.2 Project Manager employment contract signed 1.3 PMG meeting notes available online 1.4 PSG meeting notes available online. 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 and PSG can meet without delays 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 1.7 PM to be on time with his/her tasks and able to write the final report

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	1.6 Monitoring and evaluation plan created by October 2018 1.7 Final project report produced by July 2020		
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 2.9 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)	2.1 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 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	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 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

Project summary	Measurable Indicators	Means of verification	Important Assumptions
		centre metadata catalogue online by July2020	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 erosion risk on selected farms. The tool supports stakeholders' actions for mitigating with climate change effects	4.1 Meeting with stakeholders to present examples of designs of the online data system tool and obtain feedback on which format works better. 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	4.1 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 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	4.1 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 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)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	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	4.3 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	4.5 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 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 A training course to be delivered by microbiology specialists to local scientists, interested stakeholders and to the DoA laboratory technician. The	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: Training course material available online; training participant feedback forms completed.	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 Overseas project partners can reach the Falklands without travel disruptions and local participants are on the islands and available for training

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	training course will take place indicatively in the last quarter of year 2		

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 PSG 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
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

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

3.1 Check which equipment is needed to carry out laboratory analyses in the Falklands and subsequently buy and ship what is missing

Project summary	Measurable Indicators	Means of verification	Important Assumptions
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 <u>Output 5 – WP 4: Knowledge transfer workshops and training courses</u> 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)			

Project summary	Measurable Indicators	Means of verification	Important Assumptions
5.7 Promote the Falkland Islands soil work to other UKOTs			

Annex 3: Press articles which promoted the soil mapping project and the Darwin Initiative

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.	**X**
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.	X
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.	**X**
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.	n/a
Have you involved your partners in preparation of the report and named the main contributors	**X**
Have you completed the Project Expenditure table fully?	**X**
Do not include claim forms or other communications with this report.	