

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	DPLUS080
Project title	Securing South Georgia's native habitats following invasive species control
Territory(ies)	South Georgia
Lead organisation	Royal Botanic Gardens, Kew (Kew)
Partner institutions	Indigena Biosecurity International (Indigena) and Durham University
Grant value	£256,544 (Y1 = £101,666)
Start/end date of project	01 April 2018 – 31 March 2021
Reporting period (e.g., Apr 2018-Mar 2019) and number (e.g., AR 1,2)	April 2018 – March 2019 AR 1
Project leader name	Rosemary Newton
Project website/blog/Twitter	Kew project website: https://www.kew.org/science/our-science/projects/south-georgias-native-habitats Twitter: Follow @KewUKOTs; Search #KewSouthGeorgia
Report author(s) and date	Rosemary Newton & Colin Clubbe 3 May 2019

1. Project overview

The project is focussed on securing native habitats and their constituent native species on South Georgia following non-native species control. South Georgia is an isolated UK Overseas Territory in the Southern Atlantic Ocean. The island is 165 km long and 35 km wide and located around 1300 km south-east of the Falkland Islands (Figure 1).

Invasive non-native species are one of the most important drivers of biodiversity loss, and this impact is particularly severe on islands. South Georgia is a wildlife haven which has, until recently, been significantly impacted by introduced reindeer and rodents. Reindeer have been successfully removed and the island was declared rodent free in May 2018 (DPLUS031; <http://www.sght.org/news/south-georgia-declared-rodent-free/>).

In response to the predicted grazing pressure release following mammal eradication, a Non-Native Plant Management Strategy was developed by the Government of South Georgia & the South Sandwich Islands (GSGSSI; DPLUS015) and is now being implemented, to manage to zero density 33 of the 41 non-native plant species on the island and to control the more widespread invasive plant species (Annex 3). Eradication of non-native plant species is exceedingly difficult because of the formation of a soil seed bank from which plants can regenerate, often for many years.

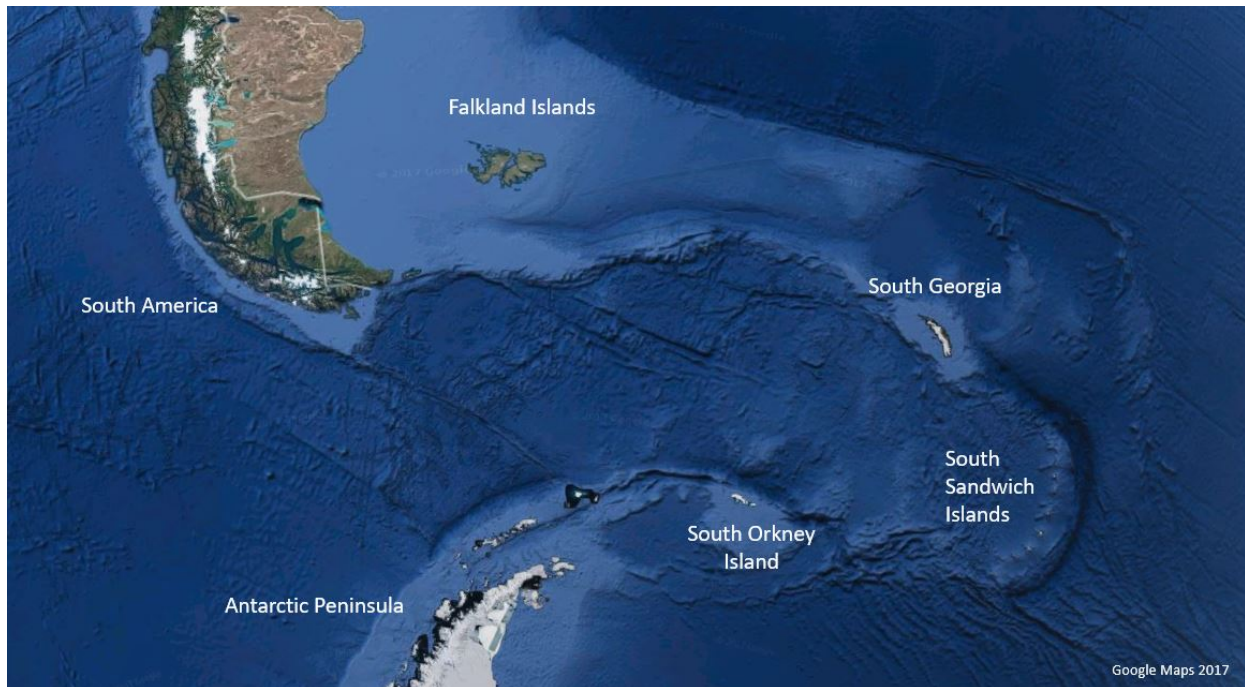


Figure 1: Location of the UK Overseas Territory of South Georgia and the South Sandwich Islands.

This project aims to safeguard South Georgia’s native habitats by monitoring and assessing vegetation changes following invasive non-native species control; estimating from soil seed bank and seed viability studies the risk of non-native plant species persisting beyond 2020 (the end date for the current Non-Native Plant Management Strategy) to inform future management strategy; quantifying the potential for non-native plant species to disperse into new areas following glacial retreat due to climate change; and, securing seed and fern spore collections of native plant species for long-term conservation at Kew’s Millennium Seed Bank (MSB).

The outcomes of the project will inform future management strategies by GSGSSI of non-native plant control and of terrestrial communities in the face of predicted climate change (Needs Assessment: South Georgia and South Sandwich Islands, DFID, July 2012).

2. Project stakeholders/partners

The main stakeholder is the Government of South Georgia & the South Sandwich Islands (GSGSSI). The primary contact person at GSGSSI has been the Environment Officer, Jennifer Lee. Regular email and phone conversations are held between Kew (Rosemary Newton, Colin Clubbe, Marcella Corcoran), Indigena (Bradley Myer), Durham University (Wayne Dawson) and GSGSSI (Jennifer Lee) to discuss project activities. All partners were fully engaged in developing the project and writing the original proposal.

GSGSSI’s advice and recommendations on field sites and activities have been invaluable in developing protocols for sample and data collection that minimise the impact of project activities on South Georgian wildlife. This enabled the development of a robust Regulated Activity Permit (RAP) Application (Annex 4), the outcome of which was the issue of the Permit 2018/036 for the first field season (Annex 5).

The formal project launch and workshop were held in Stanley in the Falkland Islands 16 – 22 December 2018. During this week meetings were held with project partners (Indigena, Durham University and Kew) and key stakeholders, including GSGSSI and Falklands Conservation (FC), to ensure that they were fully briefed about the project and had an opportunity to contribute to project planning and decision making (Annex 6).

GSGSSI offices were visited on the morning of 20 December 2018 and a half-day meeting held with partners and stakeholders (Annex 7). This was particularly important since several key staff, including the GSGSSI Chief Executive, were new in post since the project was developed and the proposal written and submitted to Darwin. This meeting provided the new staff with the context to the project and its close relationship with the development and implementation of the Non-Native Plant Management Strategy (Annex 3) which Kew had been a partner in developing. GSGSSI remain very engaged and supportive of the project.

3. Project Progress

3.1 Progress in carrying out project Activities

Output 1 activities

The South Georgia DPLUS080 project was formally launched at the workshop held in Stanley in the Falkland Islands in December 2018. This was a unique and valuable opportunity to bring the project team, field team and stakeholders together to meet ahead of the first field season on South Georgia. Although the methodologies and protocols were collaboratively prepared in the months prior to the workshop, the meeting enabled final discussions to take place to ensure that everyone was clear on and in agreement about the activities to be completed on South Georgia during the field season (December 2018 – March 2019) and the methods being employed (Annex 8). In spite of a day of the workshop being lost due to the unexpected flight cancellation from Punta Arenas to Mt Pleasant because of rotary winds over the Falkland Islands, we were able to fully discuss and clarify all aspects of the project amongst the partners and with the field team and so the workshop was a great success (Figure 2).



Figure 2: Rosemary Newton (Kew and project leader), Wayne Dawson (Durham University), Kelvin Floyd (Indigena field team leader), Bradley Myer (Indigena managing director), Pamela Quilodr n, Ken Passfield and Sally Poncet (Indigena field team members) and Colin Clubbe (Kew) discussing activities of the South Georgia DPLUS080 project.

Dissemination activities were undertaken whilst in Stanley to ensure maximum exposure to the project scope and activities. The full team undertook a radio interview at the Falkland Islands Radio Station (Annex 9). This was recorded on 18 December 2019 (Annex 6) and broken down into three separate segments which were broadcast on several occasions over the subsequent weeks. The project team was also interviewed by Penguin News, the weekly newspaper of the Falkland Islands. A double-spread feature with colour images was published on 18 January 2019 (Annex 10). Plans for a public lecture got caught up in cross-competing activities approaching Christmas and had to be cancelled.

The Memorandum of Collaboration (MoC) was discussed at the meeting held at the offices of the Government of South Georgia & the South Sandwich Islands (GSGSSI) and agreed in principle. However, as legal teams from each of the partners needed to review the document, the MoC could not be signed off at this meeting. The MoC has now been approved by all legal teams and signed by all parties (Annex 11).

The field team spent a total of 12 weeks on South Georgia completing activities related to both the DPLUS080 project as well as the Non-Native Plant Management Strategy project. They kept weekly accounts of their activities, including details on the occurrence of non-native plant species at field sites (Annex 12).

Output 2 activities

The soil sampling protocols were developed following a review of field sampling methods and the methodology was finalised at the Falkland Islands workshop. Five soil samples from 26 sites were collected over the 2018-2019 field season (Annex 13). Prior to sending the soil samples to the UK, a Standard Operating Procedure (Annex 14) was written to safely process soil samples from South Georgia at the Millennium Seed Bank (MSB) to identify and quantify viable seeds in the samples while ensuring that risks to the UK environment from organisms in the soil are minimised. This was submitted to Defra and a Licence to import, move and keep prohibited soil was issued to the MSB in March 2019 (Annex 15). Transporting living (i.e. non-autoclaved) soil samples from South Georgia via the Falkland Islands to the UK involved significant logistical organisation and authorisation. The Falkland Islands biosecurity officer was key in this and helped ensure that all the correct approvals and paperwork were put in place so that not only were we able to import the soil samples from year 1 activities, but we now have a clear workflow to ensure smooth transfer of future soil samples.

Kaitalin White, a Kew MSc student, selected the South Georgia project as part of her training, and started at the MSB in late March. Following training in seed processing techniques and researching different seed extraction methods, she has been testing the feasibility of these methods on UK soil. Once confident with the method she will start processing the South Georgia soil samples.

Output 3 activities

Following email discussions between project partners, the seed trap design that was selected for use on South Georgia was a modified version of the bucket trap (after Morris et al., 2011, J Veg Sci 22:807-801, Annex 16). Thirty traps were installed at six localities on South Georgia, five per site, and retrieved prior to the field team leaving South Georgia (Annex 17). Trap contents have been received at the MSB and processing of the contents will commence in June.

Output 4 activities

Suitable pairs of congeneric native and non-native plant species were selected to determine the impact of climate change on seed germination. Native *Poa flabellata* will be paired with either non-native *P. annua* or *P. pratensis*; native *Festuca contracta* with non-native *F. rubra*; and native *Deschampsia antactica* with non-native *D. parvula* or *D. cespitosa*. Thermal gradient plate germination (Annex 18) is virtually complete for native *P. flabellata*. As well as yielding interesting results this has validated the methodology which will now be employed over the coming year for the species combinations listed above. Seeds of these species have been collected by the field team (Annex 19) and thermal gradient plate tests on the remaining species will commence as soon as the collections have been accessioned by the Seed Collections Team at the MSB.

Output 5 activities

In the first field season from December 2018 - March 2019, 29 collections of 18 species in total were collected, consisting of 11 seed collections from 6 native plant species; 7 seed collections of 5 non-native plant species and 11 spore collections of 7 native fern species (Annex 19). All the required paperwork for importing the seeds (Annex 20, 21) was in place prior to their transport to the MSB. The collections arrived on 3 April 2019.

Germination tests have commenced for all native and most non-native plant species on South Georgia to determine germination requirements. Germinated seeds are being grown on to produce seedlings for imaging.

3.2 Progress towards project Outputs

The first year of the project has been primarily focussed on setting up and preparing for the first field season and putting into place protocols for the work to be accomplished. Significant time was also needed to ensure all the correct authorisations and approvals were in place to ensure legal and safe transfer of plant and soil samples from South Georgia via the Falkland Islands to the UK. These are all now in place for the duration of the project. Good progress has been made towards the Outputs as far as this preparation is concerned and a highly productive field season suggests that we are on track to achieve them at the end of the project. The Output indicators remain suitable indicators by which progress towards the project Outputs can be determined.

Data have been collected to enable vegetation changes and consequently the success of the non-native plant control to be determined following the 2018-2019 field season (Output 1).

The risk of non-native plant species persisting past 2020 (Output 2) will be addressed by determining whether any seeds of non-native plant species are present in soil sampled from areas where non-native plant species are being controlled. Progress towards this output has been achieved by the collection of 130 soil samples for analysis.

The potential for non-native species to spread (Output 3) will be determined by examining seed trap contents which were collected in bucket traps from sites around the island during the 2018-2019 field season.

The impact of climate change on selected native and non-native plant species in South Georgia (Output 4) will be addressed by comparing thermal gradient plate germination results from paired native and non-native plant species to determine differences in germination responses. The germination response of one species has been determined and seeds for the remaining species have been collected during the 2018-2019 field season.

The collection efforts of the field team in the 2018-2019 field season (Annex 19) have ensured that we are making good progress to ensuring that the native plant and fern species of South Georgia are conserved *ex-situ* at the Millennium Seed Bank (Output 5).

3.3 Progress towards the project Outcome

At the end of the first year of the project we are all confident that what we have achieved so far means that the project has started well and is on track, partnerships have been consolidated, especially with the new Government of South Georgia & the South Sandwich Islands administration, and the project Outcome remains relevant and achievable by the end of the project. We feel that there are no interventions needed at this stage.

The project indicators seem to be adequate at this stage of the project, but we will be monitoring these carefully during year 2 to ensure that the project remains on target to achieve its desired Outcome.

3.4 Monitoring of assumptions

- Weather conditions and transport problems did not significantly hamper project activities in the first field season. The field team received full support from on-island support teams of the British Antarctic Survey (BAS) and the Government of South Georgia & the South Sandwich Islands enabling them to get to all the field sites we identified for year one activities. Severe weather or issues with boat transport to and around South Georgia could, however, hamper field work activities in the second season (2019-2020), so this remains a risk and will continue to be monitored closely (Assumptions 0.1, 1.1, 1.2).
- Seeds or spores from all target species have been collected (Annex 19); however, as these collections have not yet been processed, it is not possible to ascertain whether collection numbers, quality and viability is sufficient to count towards the target as safely stored for conservation at the Millennium Seed Bank (MSB). In addition, it is also not yet possible to assess whether adequate seed has been collected for germination experiments and whether good germination will occur under test conditions (Activity 4.1). Some risk therefore remains for these targets and these continue to be monitored (Assumptions 0.2; 4.1, 4.2, 5.1).
- The success of the non-native plant control programme remains at risk from new non-native species being discovered or introduced to South Georgia. The field team collected a new species of *Rumex*, possibly *R. acetosa* or *R. alpinum*, in Husvik. Herbarium specimens were collected for identification at Kew. Biosecurity measures are strong and well implemented on South Georgia, so these occasional new discoveries are more likely to represent overlooked species rather than genuine new introductions to South Georgia. However, appearance of new non-native plant species remains a threat to native South Georgia plant species and this is being carefully monitored during the field season.
- Soil samples from 26 sites (5 replicates resulting in 130 samples in total) were collected in the first field season. However, as samples have not yet been processed, the risk of insufficient seeds in samples remains a risk (Assumption 2.1).
- Although seed and seedling imaging of native and non-native plant species that occur on South Georgia is well underway, it is still not clear whether these species are easily identifiable at these life stages. Therefore Assumptions 2.2 and 3.3 remain a risk.
- Dispersal traps were robust and were not disturbed whilst they were *in-situ*. We have no reason to think that the same will not be the case in the next field season, although weather conditions can vary significantly on South Georgia from season to season so we will continue to monitor the situation but consider Assumption 3.1 as no longer significant.
- Contents from dispersal traps were collected and have arrived at the MSB. These have not yet been analysed; however, the field teams indicated that dispersal traps had to be removed from the field before seed dispersal from some plant species had finished, so the risk remains that a representative sample of seed dispersing over the summer months on South Georgia was not collected (Assumption 3.2). The field team considered leaving the seed traps out all year but evaluated a greater risk of losing the traps and their contents during the winter's more severe weather and so collected them as late as possible, just prior to their departure from South Georgia.

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

The core concept of this project evolved from Kew's partnership with the Government of South Georgia & the South Sandwich Islands (GSGSSI) on an earlier Darwin Plus project (DPLUS015), a key output of which was developing and publishing the South Georgia Non-Native Plant Management Strategy (2016-2020) which is currently being implemented (Annex 3). The outputs of this project contribute directly to the implementation of this strategy and will help to ensure a better outlook for native plants and habitats on South Georgia following non-native mammal eradication. The outputs will also inform the development of a strategy for post-2020. As this is the first year of the project and we are only just beginning to analyse those data and specimens collected during the first field season on South Georgia (December 2018 – March 2019), it is too early to say how effective this will be in supporting environmental and climate outcomes on South Georgia, but we are confident that we are well on our way to achieving these outcomes.

4. Monitoring and evaluation

Day to day monitoring of project planning and preparations is undertaken by the project leader and regular contact maintained with partner leads. This is mostly via regular email, occasional phone calls. Scheduled Skype and face-to-face meetings, where there is time for reflection on progress rather than focussing on activities and planning, including the following:

4 July 2018: Skype meeting (Rosemary Newton, Colin Clubbe, Wayne Dawson)

23 August 2018: Skype meeting (Rosemary Newton, Colin Clubbe, Bradley Myer)

19 October 2018: Meeting at the Millennium Seed Bank (Rosemary Newton, Wayne Dawson, Colin Clubbe, Marcella Corcoran)

15 November 2018: Skype meeting (Rosemary Newton, Bradley Myer)

16-21 December 2018: Falkland Islands workshop (Rosemary Newton, Colin Clubbe, Wayne Dawson, Bradley Myer, Kelvin Floyd, Sally Poncet, Ken Passfield, Pamela Quilodrán)

7 March 2019: Meeting at the Millennium Seed Bank (Rosemary Newton, Wayne Dawson)

The Monitoring and Evaluation plan remains as written for the original proposal and is largely co-ordinated by the lead partner and the project leader. We envisage in year 2 more regular discussions as we move into the phase of the project where we are analysing the results from the year 1 specimen and data collection. These analyses will inform plans for the year 2 field activities and we will employ a more adaptive management approach as we complete our analyses and feed them into planning and any modifications required of the field methodology to ensure that those data we collect will enable us to achieve the project outputs and the overall project outcome. Discussions have also started with the Government of South Georgia & the South Sandwich Islands regarding the nature of the Strategy that will be developed to follow on from the management of non-native species post-2020 and how the project outputs inform the new Strategy.

5. Lessons learnt

The work has been progressing well so far and no major issues have been encountered.

Co-operation between partners has been key to the project running smoothly so far and is instrumental to the success of the project. Even though the Government of South Georgia & the South Sandwich Islands are not full partners, they have been fully supportive of the project by providing logistical support for the field team.

The remoteness of South Georgia coupled with the changeable and harsh climatic conditions makes the logistics of field work in the environment difficult to manage, yet despite these challenges the field team have had an incredibly successful 2018-2019 season, overachieving on the targets for the first year.

There are specific challenges in moving living soil samples from South Georgia to the UK with a transit stop in the Falkland Islands. It has taken us longer to secure this successfully and we had conflicting advice during the process. A lesson learnt is that we cannot assume anything and need to both double check advice and confirm it with the local authorities at every step in the process. It was also important that we had knowledgeable and experienced local partners to navigate local authorities on behalf of the project to ensure that the samples reached the UK successfully and legally and weren't autoclaved/incinerated en route or just turned back at a border.

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

N/A.

7. Other comments on progress not covered elsewhere

None.

8. Sustainability and legacy

South Georgia is uninhabited apart from research scientists and visiting tourists, so there are relatively few opportunities to promote the work in South Georgia. Hence most of the promotion has been done in the Falkland Islands; for example, during the workshop (see section 3.1) and online (see section 9).

Colin Clubbe was invited by the Commissioner of South Georgia and the South Sandwich Islands to join his annual stakeholder trip to South Georgia (24 February – 16 March 2019). This provided an opportunity to publicise the project during discussions on board the *Pharos SG* and through presentations given on board (e.g. Annex 22) as well during a 2-day stop at King Edward Point, the British Antarctic Survey research station on South Georgia, and 4-day stop in Stanley, Falkland Islands.

We have reviewed the exit plan at the end of this first year of the project and feel that it remains adequate. As the project progresses, we will be reviewing the appropriateness of this regularly.

9. Darwin identity

The Darwin Initiative has been identified as the funder of the project in all communications, including in presentations (e.g. Colin Clubbe's presentation on the *Pharos SG* en route to South Georgia, Annex 22), on the Kew website (<https://www.kew.org/science/our-science/projects/south-georgias-native-habitats>) and frequently on our Twitter feed (by using the @Darwin_Defra tag; search: #KewSouthGeorgia).

Local radio interviews (Annex 9) and the article in the Penguin News (see section 3.1, Annex 10) completed during the workshop on the Falkland Islands clearly identified the project as a Darwin project and the Darwin Initiative as the project funder.

10. Project Expenditure

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				

In the half year report, it was indicated that there would be an overspend in Travel and Subsistence and an underspend in Operating Costs related to the Falkland Islands workshop held in December 2018. Travel and subsistence were more expensive than anticipated due to

the workshop being held so close to the Christmas peak period. This timing was necessary, however, because the only feasible time to bring the whole team together was prior to the departure of the *Pharos SG* (GSGSSI fisheries patrol vessel) from Stanley to South Georgia. The timing of this departure was solely the decision of GSGSSI and was subject to many, sometimes competing, requirements of science. Operating costs for the workshop less than estimated mainly because we did not need to hire a venue for the workshop, as we were provided various spaces to hold meetings at the GSGSSI offices, at Falklands Conservation and at our accommodation at no charge. In combination, these in country costs totalled £ (grant) and £ (actual spend), respectively, a combined variance of -7.7% accounting for our overall underspend.

All figures indicated in the table are actual, excepting the “Others” category. In this category, the exact figure for the Defra soil permit plus inspection has been estimated as the invoice had not been received at the time of financial reconciliation. The value for the equipment costs incurred by Indigena has also been estimated as the invoice from Indigena is in New Zealand dollars and the Great Britain pound value for the payment will vary depending on the exchange rate on the day the payment is made.

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

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>Impact</p> <p>South Georgia's native habitats and plant species diversity are protected through the eradication of non-native species, conservation of native species, rehabilitation and maintenance of native habitats and improved biosecurity [29 words]</p>		<p>Eradication efforts on South Georgia proceeded well during the 11 weeks spent in South Georgia 2018-2019 field season. Signs of native plant species recovery were noted by the field team (Annex 12).</p>	
<p>Outcome</p> <p>South Georgia's native habitats protected by identifying non-native species most likely to persist, determining potential climate change effects on native and non-native species survival and banking seeds of native species [30 words]</p>	<p>0.1 The number of non-native species predicted to persist post-2020 determined</p> <p>0.2 Native and non-native species likely to colonise new habitats identified</p> <p>0.3 Spores of at least three fern species and all native seed plants of South Georgia securely banked at the MSB</p>	<p>0.1 – 0.2 N/A for this reporting year as data not yet analysed.</p> <p>0.3 Eleven spore collections of seven native fern species were collected in the 2018-2019 field season and are currently being processed at the MSB (Annex 19).</p>	<p>Data and samples collected during the 2018-2019 field season will be analysed to enable progress towards indicators 0.1 and 0.2 in support of the project outcome.</p>
<p>Output 1.</p> <p>Vegetation changes following reindeer removal from established vegetation monitoring plots quantified and success of the control programme of non-native plants on South Georgia evaluated</p>	<p>1.1 Data from 2 established vegetation monitoring plots analysed in year 1 and year 2 and across the monitoring period to demonstrate change in numbers and frequency of native and non-native plant species</p> <p>1.2 Data from at least 2 invaded sites (4 plots per site) analysed in year 1 and year 2 and across the monitoring period to demonstrate change in numbers and frequency of native and non-native plant species</p>	<p>1.1 – 1.2 The database from vegetation monitoring plots across South Georgia was obtained from Indigena in late 2018 and is due to be updated with data collected from the 2018-2019 season. Once this has been obtained from Indigena (expected in May 2019), this will be analysed.</p>	
<p>Activities 1.</p> <p>1.1 Agree a Memorandum of Collaboration with GSGSSI, Indigena, Durham University and Kew</p>		<p>1.1 Memorandum of Collaboration (Annex 11) agreed and signed by all</p>	<p>A third season of data to be collected by the field team during the 2019-</p>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>1.2 Review and finalise current methodology, including sites and plots for sampling, in light of planned South Georgia activities and data analyses</p> <p>1.3 Project launch and workshop in the Falkland Islands</p> <p>1.4 Discuss and finalise field data protocols at Falkland Islands workshop</p> <p>1.5 Collect data on non-native species distribution at field sites visited in year 1 and year 2</p> <p>1.6 Analyse data to quantify the success of control methods in year 1 and year 2</p> <p>1.7 Update excel database and produce a summary report on non-native species distribution</p> <p>1.8 Upload summary report onto GSGSSI and Kew websites and Research Gate</p> <p>1.9 Prepare scientific paper for open access publication in an international peer-reviewed journal</p>		<p>parties.</p> <p>1.2 Methodology, sites and plots agreed at Falkland Islands workshop.</p> <p>1.3 Project launched and successful workshop held in the Falkland Islands in December 2018.</p> <p>1.4 Field data protocols finalised (Annex 8).</p> <p>1.5 Data collected by field team during 2018-2019 field season.</p> <p>1.6 - 1.9 N/A for this reporting year.</p>	<p>2020 field season and analysed in relation to data from previous years.</p>
<p>Output 2.</p> <p>The risk of non-native plant species persisting past 2020 estimated</p>	<p>2.1 Viability of seeds from at least 20 invaded sites with a minimum of 5 soil samples of 200 cm³ per site determined</p>	<p>Soil samples (5 replicates from 26 sites) collected on South Georgia and transported to the MSB are currently being processed.</p>	
<p>Activities 2.</p> <p>2.1 Develop soil sampling protocols</p> <p>2.2 Discuss and finalise field data protocols at Falkland Islands workshop</p> <p>2.3 Collect soil samples from field sites in South Georgia</p> <p>2.4 Transport samples to the MSB for analysis</p> <p>2.5 Process samples in the laboratory by sieving soil and removing seeds</p> <p>2.6 Identify species where possible from seeds</p> <p>2.7 Seed germination and tetrazolium tests to quantify seed viability</p> <p>2.8 Grow on seedlings in a glasshouse at Kew for plant species identification</p> <p>2.9 Analyse data to estimate the proportion of viable non-native seeds in soil</p>		<p>2.1 - 2.2 Soil sampling protocols finalised and agreed at the Falkland Islands workshop. Laboratory Standard Operating Procedure developed and agreed by Defra enabling a soil licence to be obtained for the work to be conducted at the MSB (Annex 14, 15).</p> <p>2.3 Five reps from 26 sites (130 soil samples in total) collected from South Georgia field sites.</p> <p>2.4 Samples arrived at the MSB on 3 April 2019 and processing will start in</p>	<p>Soil samples to be processed, seeds removed, identified where possible, and seed viability determined by germination and tetrazolium tests. If plant species identity cannot be confirmed from seed then they will be grown on to be identified from seedlings.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>samples</p> <p>2.10 Update excel database and produce a summary report on soil sample analysis and the risk of non-native plant species persisting past 2020</p> <p>2.11 Upload summary report onto GSGSSI and Kew websites and Research Gate</p>		<p>May 2019.</p> <p>2.5 - 2.11 N/A for this reporting year.</p>	
<p>Output 3.</p> <p>The potential for non-native species to spread quantified</p>	<p>3.1 The number of species and number of seeds per species dispersed into at least 5 traps per site each placed in a minimum of 2 invaded sites, 2 native sites and 2 sites recently exposed by retreating glaciers identified</p> <p>3.2 Likelihood of new areas recently exposed by retreating glaciers being colonised by non-native species, over native species, quantified</p>	<p>Seed trap contents (5 replicates from 6 sites) collected on South Georgia and transported to the MSB are currently being processed.</p>	
<p>Activities 3.</p> <p>3.1 Develop and test seed trap design</p> <p>3.2 Agree seed trap sites and set-up protocols at Falkland Islands workshop</p> <p>3.3 Set seed traps at the beginning of the field season to catch dispersed seeds</p> <p>3.4 Collect seed from seed traps before the end of the field season</p> <p>3.5 Transport samples to the Millennium Seed Bank (MSB) for analysis</p> <p>3.6 Identify species where possible from seeds</p> <p>3.7 Seed germination and tetrazolium tests to quantify seed viability</p> <p>3.8 Grow on seedlings in a glasshouse at Kew for plant species identification</p> <p>3.9 Analyse data to quantify potential native and non-native species spread</p> <p>3.10 Update excel database and produce a summary report on the potential for non-native species to spread</p> <p>3.11 Upload summary report onto GSGSSI and Kew websites and Research</p>		<p>3.1 - 3.2 Seed trap design researched and developed and seed trap sites agreed at the Falkland Islands workshop.</p> <p>3.3 - 3.4 Thirty seed traps installed at six different locations on South Georgia at the beginning and retrieved at the end of the field season (Annex 13).</p> <p>3.5 Seed traps arrived at the MSB on 3 April 2019 and have started being processed.</p> <p>3.6-3.11 N/A for this reporting year.</p>	<p>Seed trap contents will be documented, and seeds removed and identified where possible. Seed viability will be determined by germination and tetrazolium tests. If plant species could not be identified from seeds alone then they will be grown on to be identified from seedlings/plants.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Gate			
<p>Output 4. Impact of climate change on selected native and non-native plant species in South Georgia estimated</p>	<p>4.1 Germination characteristics of 3 native and 3 non-native plant species at current and warmer temperatures of seeds determined (as a proxy of establishment success)</p> <p>4.2 Likelihood of non-native success over native species under climate change quantified</p>	<p>Germination characteristics of native <i>Poa flabellata</i> seeds from a South Georgia collection banked at the MSB have been determined using the thermal gradient plate.</p> <p>Germination characteristics of non-native <i>Poa annua</i> / <i>Poa pratensis</i>, <i>Festuca rubra</i>, <i>Deschampsia parvula</i> / <i>Deschampsia cespitosa</i> and native <i>Festuca contracta</i> and <i>Deschampsia antactica</i> will be determined using seeds collected in the 2018-2019 field season.</p> <p>Likelihood of non-native success over native plant species will be determined when all thermal gradient plate results have been collected and analysed.</p>	
<p>Activities 4.</p> <p>4.1 Identify non-native and closely-related native species to research the impact of climate change on seed germination and subsequent recruitment in South Georgia</p> <p>4.2 Determine germination requirements for paired native and non-native plant species from SBD or the literature</p> <p>4.3 Collect target non-native seed from populations in South Georgia or the Falklands if not available from MSB collections</p> <p>4.4 Seed germination tests on a thermal gradient plate at the MSB on three closely related species pairs, where one species is native and the other is non-native</p> <p>4.5 Analyse data to determine germination characteristics (e.g. temperature thresholds)</p> <p>4.6 Prepare scientific paper for open access publication in an international peer-reviewed journal</p>		<p>4.1 - 4.2 Suitable pairs of native and non-native congeneric plant species were selected and germination requirements checked on SBD.</p> <p>4.3 Seed from both native and non-native target species were collected in field season 2018-2019 (Annex 19).</p> <p>4.4 Thermal gradient plate germination is virtually complete for native <i>Poa flabellata</i>.</p> <p>4.5 - 4.6 N/A for this reporting year.</p>	<p>Thermal gradient plate germination tests to be completed on non-native <i>Poa annua</i> or <i>Poa pratensis</i>, non-native <i>Festuca rubra</i> and native <i>Festuca contracta</i>.</p>
<p>Output 5. Seeds and fern spores of native plant species of South Georgia collected and stored at the Millennium Seed Bank for ex-situ conservation and seed</p>	<p>5.1 Spores of at least three fern species and all native seed plants of South Georgia securely banked and at least two thirds (i.e. 17 species) with multiple collections for genetic diversity at the Millennium Seed Bank</p>	<p>In the first field season from December 2018 – March 2019, 29 collections of 18 species in total were collected, consisting of 11 seed collections from 6 native plant species; 7 seed collections of 5 non-native plant species and 11 spore collections of 7 native fern species (Annex 19). These collections arrived at the MSB on 3 April 2019.</p> <p>Germination tests have commenced for all native plant species on South</p>	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
germination protocols determined	<p>5.2 Seed dispersal and dormancy syndromes identified and seed germination protocols determined for all native species</p> <p>5.3 Seedling images captured for all native plant species</p>	<p>Georgia to determine germination requirements and confirm collection viability.</p> <p>Germinated seeds are being grown on to produce seedlings for imaging.</p>	
<p>Activities 5.</p> <p>5.1 Identify suitable populations for seed and fern spore collection</p> <p>5.2 Collect seeds and fern spores of native plant species of South Georgia for ex-situ conservation at the MSB</p> <p>5.3 Transport collections to the MSB for processing and banking</p> <p>5.4 Produce blog on South Georgia collecting trip for GSGSSI and Kew websites</p> <p>5.5 Process seed and fern spore collections and produce germination protocols</p> <p>5.6 Identify seed dispersal and dormancy syndromes</p> <p>5.7 Photograph seedlings from germination tests and make images available online</p> <p>5.8 Upload germination protocols onto the Seed Information Database (SID)</p> <p>5.9 Publish a Guide to Seeds and Seedlings of the Plants of South Georgia</p>		<p>5.1 - 5.2 Suitable populations were identified, and seed and fern spores collected during the 2018-2019 field season (Annex 19).</p> <p>5.3 Seed and fern spore collections arrived at the MSB on 3 April 2019.</p> <p>5.4 - 5.9 N/A for this reporting year.</p>	<p>A blog on the successful field trip to South Georgia will be published on GSGSSI and Kew websites; germination protocols will be produced for collected seed and fern spores to determine dormancy syndromes for the Seed Information Database (SID). Seeds and seedlings will be photographed for the Guide to Seeds and Seedlings of the Plants of South Georgia.</p>

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

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

Impact: (30 words max)

South Georgia’s native habitats and plant species diversity are protected through the eradication of non-native species, conservation of native species, rehabilitation and maintenance of native habitats and improved biosecurity [29 words]

Project Summary	Measurable Indicators	Means of Verification	Important Assumptions
<p>Outcome: (30 words max) South Georgia’s native habitats protected by identifying non-native species most likely to persist, determining potential climate change effects on native and non-native species survival and banking seeds of native species [30 words]</p>	<p>0.1 The number of non-native species predicted to persist post-2020 determined</p> <p>0.2 Native and non-native species likely to colonise new habitats identified</p> <p>0.3 Spores of at least three fern species and all native seed plants of South Georgia securely banked at the Millennium Seed Bank</p>	<p>0.1 Summary report published on GSGSSI and Kew websites and Research Gate</p> <p>0.2 Seed Bank Database (SBD) for seed collected and excel database of results</p>	<p>0.1 Weather conditions allow boats to access South Georgia and field work to be completed</p> <p>0.2 All target species produce sufficient seeds or spores during the lifetime of the project to allow safe collection for storage and not impact the future of native populations</p>
<p>Output 1: Vegetation changes following reindeer removal from established vegetation monitoring plots quantified and success of the control programme of non-native plants on South Georgia evaluated</p>	<p>1.1 Data from 2 established vegetation monitoring plots analysed in year 1 and year 2 and across the monitoring period to demonstrate change in numbers and frequency of native and non-native plant species</p> <p>1.2 Data from at least 2 invaded sites (4 plots per site) analysed in year 1 and year 2 and across the monitoring period to demonstrate change in</p>	<p>1.1 Excel database and report on vegetation changes in established monitoring plots and in non-native species distribution in invaded sites where control is taking place</p> <p>1.2 Summary report published on GSGSSI and Kew websites and Research Gate</p> <p>1.3 Scientific paper on vegetation</p>	<p>1.1 Team able to visit all sites every year to collect data unhampered by weather conditions</p> <p>1.2 GSGSSI boat operational and able to transport team from the Falkland Islands to South Georgia and to field sites</p>

	numbers and frequency of native and non-native plant species	changes following non-native species control submitted to open access journal for publication end of year 3	1.3 No new non-native species introduced to South Georgia
Output 2: The risk of non-native plant species persisting past 2020 estimated	2.1 Viability of seeds from at least 20 invaded sites with a minimum of 5 soil samples of 200 cm ³ per site determined	2.1 Excel database on seeds found in soil seed bank 2.2 Summary report on potential for non-native species to spread into new areas published on GSGSSI and Kew websites and Research Gate	2.1 Soil samples contain sufficient seeds 2.2 Reliable identification of species is possible from seeds or young plants
Output 3: The potential for non-native species to spread quantified	3.1 The number of species and number of seeds per species dispersed into at least 5 traps per site each placed in a minimum of 2 invaded sites, 2 native sites and 2 sites recently exposed by retreating glaciers identified 3.2 Likelihood of new areas recently exposed by retreating glaciers being colonised by non-native species, over native species, quantified	3.1 Excel database on seeds caught in dispersal traps 3.2 Summary report on potential for non-native species to spread into new areas published on GSGSSI and Kew websites and Research Gate	3.1 Dispersal traps are robust enough to survive the field season and are not disturbed 3.2 Dispersal traps collect sufficient seeds 3.3 Reliable identification of species is possible from seeds or young plants
Output 4: Impact of climate change on selected native and non-native plant species in South Georgia estimated	4.1 Germination characteristics of 3 native and 3 non-native plant species at current and warmer temperatures of seeds determined (as a proxy of establishment success) 4.2 Likelihood of non-native success over native species under climate change quantified	4.1 Scientific paper on the thermal germination niche of three closely related pairs of native and non-native species and associated predictions of a changing climate on seed germination behaviour submitted to open access journal for publication by the end of year 3	4.1 Adequate seed can be sourced for germination experiments 4.2 Seeds germinate under tested conditions

<p>Output 5: Seeds and fern spores of native plant species of South Georgia collected and stored at the Millennium Seed Bank for <i>ex-situ</i> conservation and seed germination protocols determined</p>	<p>5.1 Spores of at least three fern species and all native seed plants of South Georgia securely banked and at least two thirds (i.e. 17 species) with multiple collections for genetic diversity at the Millennium Seed Bank</p> <p>5.2 Seed dispersal and dormancy syndromes identified and seed germination protocols determined for all native species</p> <p>5.3 Seedling images captured for all native plant species</p>	<p>5.1 Kew's internal Seed Bank Database at the Millennium Seed Bank</p> <p>5.2 Blog detailing seeds banked at end of year 3 on GSGSSI and Kew websites</p> <p>5.3 Germination protocols on Kew's open access Seed Information Database: http://data.kew.org/sid/</p> <p>5.4 Seedling images for native plant species to South Georgia available online</p> <p>5.5 Publish a Guide to Seeds and Seedlings of the Plants of South Georgia</p>	<p>5.1 Populations of target native plant species produce seeds which are mature and in sufficient quantities for collection (no more than 20% of available seed to be collected to ensure native populations are not harmed) at the time the sites are visited</p>
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Annex 3 Onwards – supplementary material (optional but encouraged as evidence of project achievement)