Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

Submission Deadline: 30th April 2021

Darwin Plus Project Information

Project reference	DPLUS102
Project title	Saving Tristan's only native tree and its associated unique buntings
Territory(ies)	Tristan da Cunha
Lead organisation	Royal Society for the Protection of Birds (RSPB)
Partner institutions	Conservation Department, Tristan Government Centre for Agriculture and Bioscience International (CABI) Fera Science Ltd
Grant value	£306,653
Start/end dates of project	July 2020 – March 2024
Reporting period (e.g. Apr 2020-Mar 2021) and number (e.g. Annual Report 1, 2)	July 2020 – March 2021 Annual Report 1
Project Leader name	Andy Schofield
Project website/blog/social media	
Report author(s) and date	Ashleigh Atkinson and Andy Schofield (RSPB); Norbert Maczey (CABI); Chris Malumphy (Fera)

1. Project summary

This project is an urgent intervention to prevent the collapse of the *Phylica* forest ecosystem, and the global extinction of unique bunting species in Tristan da Cunha. Invasive alien species are one of the greatest threats to the archipelago's biodiversity. Over the course of the past decade, an invasive scale insect (*Coccus hesperidum*) has infested Tristan's only native tree species, *Phylica arborea*, smothering and killing many on Tristan, Nightingale and Inaccessible Island World Heritage Site (WHS), (Figure 2). Endemic large-billed *Nesospiza* buntings, evolved to specialise on the fruit of *Phylica* trees, are running towards the possibility of extinction due to insufficient availability of habitat and food. Invasive New Zealand flax (*Phormium tenax*) presents a further pressure to the Phylica habitat on Inaccessible WHS, and has the ability to outcompete the island's native species.

In close collaboration with international experts and Tristan's Conservation Department, we will select, safely test, and release at least two biocontrol agents in heavily infested *Phylica* stands on the three northern islands (see map, Figure 1) to sustainably manage invasive scale numbers. We will also control invasive flax on Inaccessible Island and build local capacity in specialist rope access skills. These actions will, in the long-term, deliver significant biodiversity benefits, facilitate the restoration of the *Phylica* forest ecosystem - making it more resilient in a changing climate - and safeguard threatened bunting species.

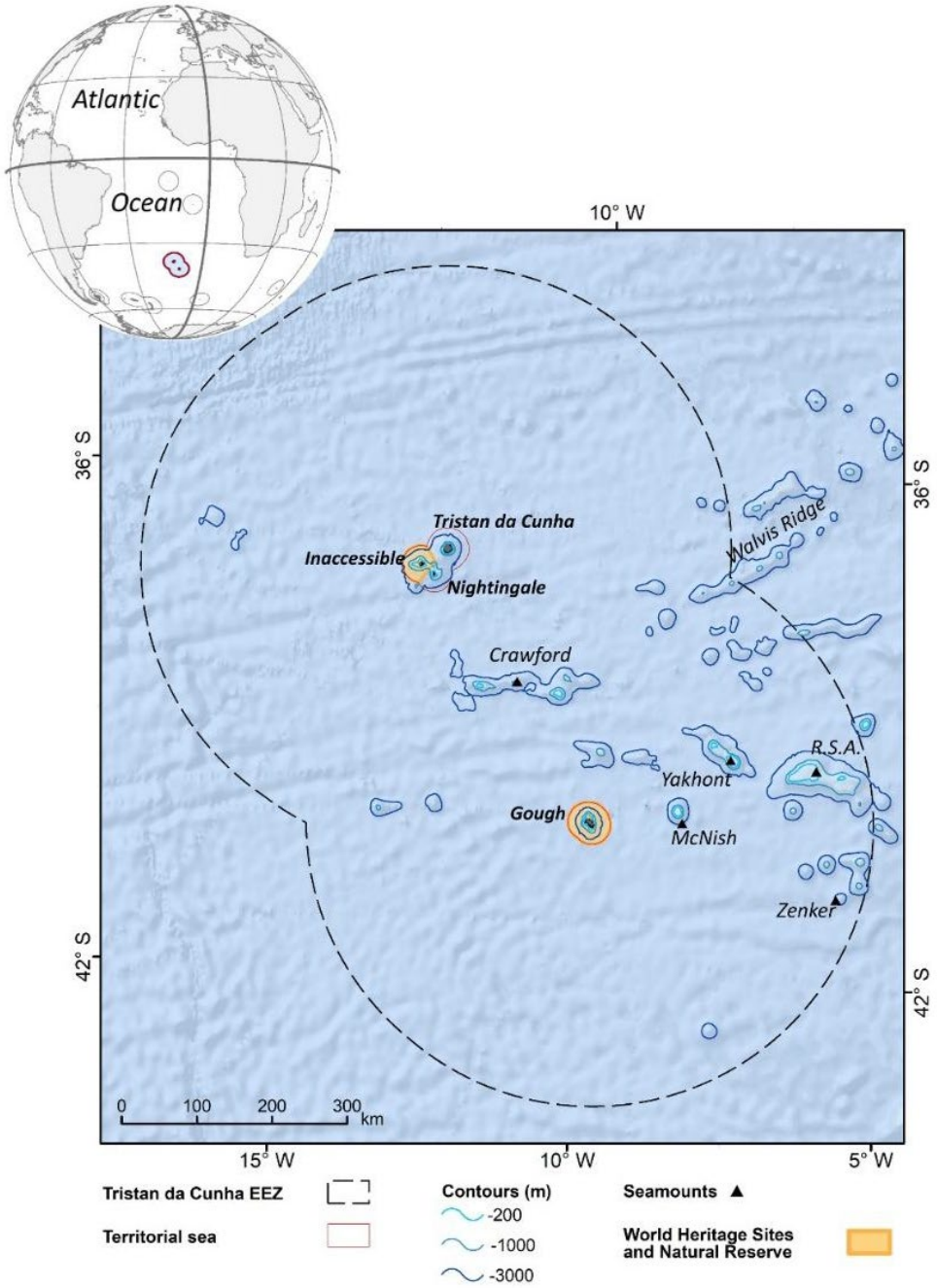

Figure 1. (left) Tristan da Cunha archipelago is the world's most remote inhabited island group, located almost half-way between South America and South Africa. The project will work on the three main northern islands: Inaccessible, Nightingale and Tristan.

Figure 2. (above) The devastation on Nightingale from invasive scale insects and the two storms in 2019.

2. Project stakeholders/partners

The partnership is made up of the Conservation Department within the Tristan da Cunha Government, the Centre for Agriculture and Bioscience International (CABI), Fera science, and the Royal Society for the Protection of Birds (RSPB). Each partner brings unique knowledge and experience to the project; made up of technical skills, expert knowledge in biocontrol agents and invasive species, experience of working with Territories and on-the-ground conservation knowhow. The partnership was formed as a result of a request from Tristan to tackle the threats to the endangered bunting species, and partners with the appropriate expertise were brought together.

Although it is the primary responsibility of the RSPB to monitor and evaluate the project, the partners regularly meet to discuss project progress, make decisions together, and feed into planning. Several partnership meetings have taken place throughout the year, and since the biocontrol agents landed on Tristan we've been meeting multiple times a week.

The partners have pulled together this year in these challenging circumstances, and have been able to successfully select, rear, transport and plan the release of biocontrol agents in the first year of the project. This is a remarkable achievement considering that it wasn't possible to provide much needed in-person support and capacity to the Conservation Department. It has also been an opportunity to learn from one another with one partner saying, "I have learnt a great deal from the partners".

Project progress

3.1 Progress in carrying out project Activities

The activities which have not commenced to date, as per the project timeline, have not been reported on below.

Output 1. Suitable biological control agents for *C. hesperidum* on Tristan selected, risk assessed and tested

1.1 Identification of scale insect from samples collected on Tristan; use of molecular methods to identify the strain/subspecies present on Tristan

Permanent slide mounts have been made of the adult female scale insect samples received from Tristan. These keyed out as *Coccus hesperidum* using standard published morphological keys. The specimens were then critically compared with specimens of *C. hesperidum* deposited in the Fera reference collections and found to be morphological consistent. Several specimens were sequenced but the only organism identified was *Wolbachia*, a genus of intracellular parasitic bacteria that is commonly found in scale insects. It is not clear why the sequencing failed, and this is being investigated. Fresh specimens from the culture of scales obtained from Tristan and reared at CABI will be sequenced. *C. hesperidum* feeds on upper and lower leaf surfaces but the majority of specimens are usually found on the lower leaf surface, enabling the egested honeydew to fall away from the colony and reduce the risk of contamination. The majority of *C. hesperidum* in the Tristan samples were found on the upper surface of the *Phylica arborea* leaves, which is likely to be due to the dense hairs on the lower surface being unsuitable for the first instars (main dispersal stage) to settle to feed. The samples of Phylica and the scale insects were covered in a dense matt of sooty mould (Figure 3).

Figure 3. *Phylica arborea* twig smothered in sooty mould growing on honeydew egested by *Coccus hesperidum*. (right) Two adult female *Coccus hesperidum,* indicated by the arrows, completely hidden beneath a crust of sooty mould.

1.2 Analysis of pre-project survey and literature survey to match agents to scale taxon present on Tristan; this includes climate matching of previous successful control projects of C. hesperidum with the conditions present on Tristan

A review of previous classical biological control (CBC) efforts for *C. hesperidum* under outdoor conditions has been made at the start of the project. Most previous attempts using biological control agents have been focusing on citrus orchards and all have been conducted several decades ago. The lack of previous CBC projects for this species is most likely due to the fact that *C. hesperidium* is normally well controlled by natural enemies under outdoor conditions. As there seems to be no precedence of other CBC attempts for this species under climatic conditions similar to Tristan da Cunha, testing of potential biological control agents (BCA) for their climate suitability will remain a major focus of the project.

1.3 Selection of suitable and readily available agents, including use of agents commercially available and agents currently used in other research institutes

The literature review conducted at the start of the project revealed a significant list of potentially suitable BCA. Approximately 170 parasitoid wasps assigned to 11 families have been recorded in association with *C. hesperidum*. The majority of parasitoids belong to the families Aphelinidae (60 spp.) and Encyrtidae (76 spp.). The three genera with the largest number of parasitoids associated with *C. hesperidum* are *Coccophagus, Metaphycus* and *Microterys*. It was decided to start testing with a commercially available hymenopteran parasitoid with a good track record of efficiently controlling *C. hesperidum*. In order to setup a first culture of the BCA, as a first step suitable hosts plants had to be grown to support a scale insect population large enough to provide sufficient host specimens to keep a culture of parasitoids permanently going. Therefore, the first weeks of the project focused on growing ivy (*Hedera helix*) cuttings as this species is easy to obtain and is a well-known host of *C. hesperidum*. However, it turned out that, under artificial light conditions, ivy is slow growing and prone to infestation by the two-spotted spider-mite. Development of scales on ivy under artificial light conditions also turned out not to be ideal. We therefore switched host plants production to Malabar spinach (*Basella alba*) in August. Malabar spinach proved to be a much better suited host plant to support a healthy brown scale population. Not to delay the establishment of a parasitoid culture whilst waiting for scales to arrive from Tristan a scale culture using *C. hesperidum* specimens from infested *Fatsia* plants in a local greenhouse was setup instead. This culture was established under temperature-controlled conditions inside a CT-room. Only after sufficient scale insects were produced by late July a contingent of *Microterys nietneri*, a soft scale specialist widely used for brown scale control in greenhouses, was acquired from a commercial seller. As this species is not licensed for release in the UK (although the species is established outdoors in the UK) a culture was setup in quarantine. The culture of this BCA is now well established and initial temperature assessments showed that the species remains active at 16°C and is still actively attacking brown scales and developing inside them under such a low temperature. A

more detailed climate testing running at a range of different temperatures has started in March 2021 and is currently ongoing.

The culture of this BCA at Egham is now well established. The species attacks *C. hesperidum* even under the low temperature as described above to a degree that under laboratory conditions host populations rapidly collapse after infection. Rearing of *M. nietneri* under controlled conditions on Tristan using the local population of *C. hesperidum* on *Phylica arborea* plants indicate an equally efficient degree of infestation.

1.4 Shipment of living scale insects from Tristan to quarantine at CABI to test agents on the correct target taxon

Despite very limited expectations to be able to ship brown scales from Tristan during the ongoing pandemic, we were successful in shipping living scale insects from Tristan via a month-long journey through South Africa; the shipment arrived mid-August at CABI's quarantine facilities in Egham, UK.

1.5 Culturing of C. hesperidum from Tristan at CABI for testing and mass rearing of agents

Only few scales survived the long journey from Tristan, but these have been successfully transferred onto Malabar spinach and are now, after a slow start, increasing in numbers. A solid culture of the Tristan scale population has now been established at the quarantine facilities at Egham and these scales are currently used for ongoing efficacy testing of *M. nietneri*.

1.7 Risk assessment for selected agents with a focus on published host specificity records

A detailed risk assessment (RA) for *M. nietneri* has been conducted by Fera with the support of CABI (Annex 3.1).

The assessment clearly demonstrated that:

- The biology and host range of the species are very well understood. *M. nietneri* develops oligophagously inside a relative wide range of Coccidae. There are few additional records from Diaspididae (Armoured scales) and a single record from Pseudococcidae (Mealybugs), however these remain doubtful.
- None of the three families with host records for *M. nietneri* have native/endemic representatives on Tristan.
- *M. nietneri* is already present in South Africa, the only country with a direct transport link to Tristan, where it has previously been used for control of *C. hesperidum* in *Citrus* plantations. This demonstrates that a release of the agents on Tristan does not pose any risks for other countries/geographical regions.
- There were no anticipated side or non-target effects predicted for a release on Tristan.
- No additional host range testing was required for its use on Tristan.

1.8 Efficacy testing of agents in quarantine at Egham UK looking into infestation rates and rates of encapsulation by the target species

Population levels of *C. hesperidum* (UK populations) and the primary BCA (*M. nietneri*) are now high enough to start with a first series of efficacy tests for this control agents during the coming months. Despite the delayed start of the project this activity is on track to deliver its objective.

Output 2. Tristan Council and community understand and approve of selected control agent release

2.1 Tristan Conservation Department screen educational video and share publicity materials to Council and with community. Community engagement lead visits Tristan in Q2 of Years 2 and 3 to engage Council, school children and community members via public meetings, informal discussions, classroom teaching and film screening.

The educational video has been produced by Fera (Annex 3.2) and shared with Island Council.

2.2 The PRA is submitted to APHA for independent scrutiny, and their feedback then provide direct to Tristan Council both in writing and via a phone explanation.

APHA, a subsidiary of DEFRA, provided an independent opinion on the PRA (Annex 3.3).

2.3 Tristan Council meeting discusses PRA and approves issue of an environmental permit by the 'Administrator in Council'.

Island Council have discussed the release of a biocontrol agent and have issued an environmental permit for the release of *M. nietneri* (**awaiting documentary evidence**).

2.4 Visiting expert conducts pest assessments on potato crops of at least 8 growers, as well as the Agriculture Department vegetable production polytunnel, providing immediate verbal feedback and a follow-up report.

It was not possible for a visiting expert to travel to the Tristan archipelago in Year 1, this activity will be carried out in Year 2.

Output 3. Selected control agent reared under controlled conditions on Tristan

3.1 Rearing of agents for release at CABI

Adult *M. nietneri* destined for Tristan were produced at the CABI facilities in Egham, UK, during December and in particularly over Christmas 2020; 300+ individuals were handed over by CABI to the RSPB on 5 of January 2021 when they started their journey to Tristan.

3.2 Development of training material and rearing protocols for Tristan

Instructions how to handle the BCA during transport and after they had arrived on Tristan were developed (Annex 3.4). This was accompanied by frequent online meetings to supervised setup and maintenance of the culture on Tristan. This supervision and frequent update of instructions started in December, and is continuing.

3.3 First shipment of approved agent(s) on Tristan

A shipment of 300+ adult *M. nietneri* wasps reached Tristan in January after a challenging three-week journey; they then changed hands several times before reaching Tristan on 26 January. The parasitoids were housed inside standard specimen tubes and transported in a small cool box packed according to international quarantine standards and accompanied with the required licences and documentation. Only a small number of wasps survived the journey, during which they endured exposure to both very high and freezing temperatures alike.

3.4 Training of biosecurity staff on Tristan how to rear control agents

In-person training of the project team on Tristan, as originally planned, was not possible due to the ongoing Covid-related travel-restrictions. Instructions how to handle the BCA during transport and after they had arrived on Tristan were sent by e-mail messages. This was accompanied by frequent online meetings to supervise setup and maintenance of the culture on Tristan as tightly as possible. This supervision and frequent update of instructions started in December and is continuing.

3.5 Culturing of agents on Tristan

A makeshift setup on Tristan (due to Covid restrictions and Covid-related shipping difficulties a polytunnel could not as quickly installed as initially planned) using four pop-up cages allowed the conservation team on Tristan, with regular remote supervision, to slowly increase numbers of the control agent (Figure 4). Because of the low numbers of parasitoids surviving the long journey to Tristan it took longer than initially anticipated to build up numbers sufficient for a first release. The BCA is cultured using both the target host (*C. hesperidum*) and the target host plant (*P. arborea*).

Figure 4. Temporary facilities on Tristan to rear the control agent, *M. nietneri*, with the target host *C. hesperidium* on *P. arborea*.

Output 4. Control agents released and successfully established on Tristan da Cunha, Inaccessible & Nightingale Islands

4.1 Training of biosecurity staff on Tristan how to release control agents

A release and monitoring protocol have been developed (Annex 3.5) and training of the team involved in this activity on Tristan is currently being delivered remotely via Zoom.

4.2 First release of agent(s) on Tristan

The now well-established culture on Tristan has the capacity to produce sufficient numbers of the BCA for a planned first release on Nightingale Island in April. This is only slightly delayed compared with our initial best-case scenario. A release site on Nightingale, close to East Landing, in a sheltered newly planted Phylica copse has been identified.

4.5 Monitoring of impact (infestation rates of C. hesperidum)

Baseline data will be collected during the first release, which is imminent. A protocol has been developed for this (Annex 3.5) and training is currently ongoing.

Output 5. Invasive New Zealand flax closest to Phylica habitat controlled on Inaccessible Island World Heritage Site, with an increased local capacity to undertake control activities

5.1 Experienced flax control team visit Inaccessible island in year one to complete island plateau flax mapping and update the 2019 cliff flax map baseline

The flax team were on Inaccessible island from January to March 2021, and produced updated maps (Annex 3.6).

5.2 All island plateau flax, and the top 50m of invaded cliff beneath the plateau, is cleared of flax in year one

Due to logistical issues, outlined in further detail in Annex 3.6, it was not possible to clear the plateau or top 50m of flax invaded cliff face in Year 1. Flax plants that were accessible to the team was removed in the 3 weeks that the team were on island; approximately, 119 flax plants were removed from the lower cliff face.

5.4 One Tristanian resident accompanies the experienced flax team on each visit to Inaccessible island and receives on-the-job training

Christiaan Gerber accompanied the experienced flax team in Year 1 for the full duration of the trip; he received refresher training for rope access skills, gained experience in gear inspection and abseiling, and received on-the-job-training for flax removal. Additionally, whilst on Tristan Christiaan was responsible for gear management. During this time, Christiaan gained 50 hours of experience that can go towards gained an IRATA level 2 qualification. A detailed report of the training activities can be found in Annex 3.7.

3.2 Progress towards project Outputs

Output 1. Suitable biological control agents for *C. hesperidum* on Tristan selected, risk assessed and tested

See section 3.1, Output 1. Output 1 one as evaluated by the indicators have largely been achieved and is on track in Year 1.

A number of potentially suitable BCAs for brown scale control on Tristan have been selected, amongst others: *Metaphycus flavus, Coccophagus scutellaris, Coccophagus pulvinariae* and *Metaphycus stanleyi*. Based on a known high efficacy controlling the target species in combination with a tolerance of relatively low temperatures and an already established presence in South Africa *Microterys nietneri* was selected for testing as the most promising candidate, and the team started working with this species (Indicator 1.2).

Testing of efficacy against the Tristan brown scale population is slightly delayed compared with the initial plan, which again was based on a decision to focus on rearing the species for shipment to maintain the chance for an early release once the species was risk assessed. Efficacy testing is also still ongoing because of the delayed start of the project and difficulties in obtaining scales from Tristan due to severe Covid restrictions on shipment from South Africa. First results from rearing of the selected first BCA on Tristan indicate that the species is effectively developing and reproducing on the target population with no indication of a reduced efficacy.

A risk assessment has been conducted for *M. nietneri*, which has allowed the successful shipment to Tristan and the setup of a culture on the island (Annex 3.1).

Output 2. Tristan Council and community understand and approve of selected control agent release

See section 3.1, Output 2. Output 2 is largely on track, with the exception of Indicator 2.4, and will be achieved by the end of the project.

Publicity materials have been produced (Indicator 2.1; Annex 3.2), and shared with Tristan Council. The first PRA has been produced, and APHA have provided their independent opinion that has been provided to Tristan (Indicator 2.2; Annex 3.3); Tristan have approved the introduction of the first BCA, *M. nietneri* (Indicator 2.3; **awaiting documentary evidence**). It was not possible to carry out a potato crop pest assessment due to Covid travel restrictions (Indicator 2.4).

Output 3. Selected control agent reared under controlled conditions on Tristan

See section 3.1, Output 3. Output 3 is largely in track, with the exception on Indicator 3.4, and will be delivered by the end of the project.

Issues with transport, procurement and equipment availability has resulted in the delayed arrival of some of the equipment required to setup the rearing facilities on Tristan. The majority of the equipment is now on-island, including the polytunnel, and will be set up in the coming months. Despite of this delay, the team has managed to successfully setup temporary facilities using the equipment available (Indicator 3.1; Figure 4) and have established a culture of *M. nietneri* on Tristan, maintained by the conservation department and remotely trained by the

entomologists from CABI and Fera (Indicator 3.2); the training materials have been developed and delivered to the Tristan Conservation Department staff (Kirsty Green, Julian Repetto, Trevor Glass; 1 female / 2 male), and will continue into Year 2 (Indicator 3.3; Annex 3.4 and 3.5). Numbers have increased to the degree that specimens are collected for an imminent release on Nightingale before the onset of winter; although this is slightly delayed, we consider Indicator 3.5 to be largely on track.

It has not been possible for the activities with the school children to go ahead in Year 1 due to the delayed timeline and reduced capacity of the Conservation Department (Indicator 3.4). A steady supply of hosts was required to maintain the BCA culture, and we found that propagation times would not realistically be able to provide this; we instead opted for scale-infested Phylica cuttings which were more readily available and provided sufficient resources for one generation of the BCA.

Output 4. Control agents released and successfully established on Tristan da Cunha, Inaccessible & Nightingale Islands

See section 3.1, Output 4. Output 4 is currently on track to be delivered by the end of the project.

As described in section 3.2, Output 3, the first release has been slightly delayed from Q4 of Year one into Q1 of Year two; the release site has been identified on Nightingale, and a release will take place once sufficient numbers have been reached (Indicator 4.1)

Output 5. Invasive New Zealand flax closest to Phylica habitat controlled on Inaccessible Island World Heritage Site, with an increased local capacity to undertake control activities

See section 3.1, Output 5.

In the 2021 field season, the flax team mapped the plateau and the top 50m of invaded cliff beneath the cliff (Indicator 5.1 and 5.3; Annex 3.6). However, due to the logistical issues and weather conditions, flax removal on the plateau did not proceed as planned (Indicator 5.1). A full removal on the plateau and the top 50m of invaded cliff is still possible in Year 2.

A baseline has been set for local trainee, Christiaan Gerber's, rope access skills (Indicator 5.4; Annex 3.7).

3.3 Progress towards the project Outcome

Outcome: Sustainable community-supported control of Coccus hesperidum successfully established and invasive flax buffer created that enables recovery of Phylica trees, restoration of seed-setting and ultimately increased food availability for Nesospiza buntings.

Despite some minor delays and methodological adjustments as to the introduction of the BCAs, the project is on track to achieve the Outcome by the end of the project and the indicators outlined remain adequate for measuring achievement of the project Outcome.

Indicator 0.1 In year four at least one control agent successfully established on each of the three northern islands in compliance with Tristan legislation and Council permissions

Island Council have permitted the release of one control agent, *M. nietneri*, on Nightingale (**awaiting documentary evidence**). A monitoring protocol has been set up which will determine whether the control agent has established (Annex 3.5); we are not expecting to see results from the first establishment until the end of the year.

Indicator 0.2 In year four, lower densities of *C. hesperidum* and 10% reduction in sooty mould cover of foliage recorded on *Phylica* compared to 2020 baseline

A baseline condition assessment will be undertaken by the Conservation Department at the time of releasing the biocontrol agent.

Indicator 0.3 No New Zealand flax is recorded on the plateau of Inaccessible Island or top 50m of surrounding cliff by end of year 2

The 2021 field season mapped the distribution of flax on Inaccessible, removed 119 invasive flax plants, and made progress with logistics for next field season (Annex 3.6). It is still possible to achieve this indicator, but due to the issues outlined in further detail in Section 3 Output 5 and Section 2.4, the next field season needs to be closely managed.

Indicator 0.4 3 Tristan Conservation Department staff (2 male / 1 female) trained and able to successfully rear, release and monitor a biological control agent

CABI have delivered remote training with the Conservation Department (2 male / 1 female) who have been rearing the biocontrol agent on Tristan since January (Figure 4); numbers have been built to the hundreds, a release planned and a monitoring protocol developed. In person training in Years 2-4 will increase the Conservation Departments capacity further.

Indicator 0.5 Within 3-5 years of project start, increased number of seeds/fruits recorded on Phylica compared to 2021 baseline, and population density of buntings stabilised.

Ongoing assessments of the bunting populations will be used to determine whether there is a stable population in years 3-5; this year it was reported that the population of Wilkins' buntings had decreased further. A baseline for Phylica fruits/seeds will be obtained in 2021.

3.4 Monitoring of assumptions

All key assumptions are outlined in the log frame (**Annex 2**). The majority of the identified assumptions that have been tested have held true, with the following exceptions:

Assumption: Unmapped first-hand reports from February 2019 team on flax presence on the island plateau suggest that full removal is possible.

Comments: During the flax teams visit to Inaccessible Island in Year 1, a significant mapping exercise was undertaken. This revealed more invasive flax plants than were originally reported, and coupled with the logistical and weather issues in Year 1 there is additional pressure on delivering a successful field season in Year 2. Full removal on the plateau and a 50-metre buffer remains possible if there are no further disruptions and needs to be managed closely.

Assumption: Suitable weather conditions enable timely team drop-off and pick-up, plus working conditions on the island plateau.

Comments: Weather significantly impacted the progress the flax team were able to make in the 2021 field season. Firstly, due to sea conditions the team landed at Waterfall Beach rather than the preferred landing point of Blenden Hall which resulted in a delayed timeline. Weather further impacted the retrieval of project gear, delivery of equipment from Tristan, and mobility of the team on island which resulted in delayed access to the plateau to begin removal work. The groundwork carried out this year will boost efficiency in the next field season, however Inaccessible Island has a decidedly inhospitable terrain and unpredictable weather that is challenging to manage.

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

The project is making good progress on a key environmental issue for the Territories. Invasive species were identified as a core biodiversity challenge by 57% of the respondents to Defra's recent Call for Evidence on 'Safeguarding the Environment in British Overseas Territories' (second only to the threat from economic development as an issue). Invasive scale insects and flax are identified as a threat in Tristan's Biodiversity Action Plan, and the project is delivering against this plan under Objective 4: The impact of invasive species is reduced or eliminated the project is contributing.

The work undertaken which is leading towards the release of the first biocontrol agent will, if established, result in the effective control of the invasive scale insect population and reduce the associated sooty mould, giving the Phylica the opportunity to recovery which will in turn provide

food and habitat for the endangered bunting species. Furthermore, reducing two pressures (invasive flax and scale insect) from the habitat will allow for the recovery of the Phylica forest and will, in turn, improve the climate resilience.

5 OPTIONAL: Consideration of gender equality issues

The project is achieving the gender-based indicator of training 2 male / 1 female members of staff at the Conservation Department in rearing, releasing and monitoring BCAs. Kirsty Green is primarily responsible for the financial and administrative running of the Conservation Department, and this year has taken on substantial new responsibilities in rearing the BCAs.

6 Monitoring and evaluation

Monitoring and evaluation is primarily lead by the RSPB with partners feeding into the process. The log frame and project timetable are continually referenced to monitor project progress and identify delays, and partners self-evaluate and feed into the overall project monitoring during more formal partner meetings (e.g. Annex 3.7) and regular informal catch ups. As this project is identified as a high-priority and high value project, the RSPB requested an operational plan to manage risk, which is currently in draft (Annex 3.9).

The primary indicators of achievement are the establishment of at least one biocontrol agent on three of the northern islands and the removal of flax; both are being measured quantitatively via monitoring protocols (Annex 3.5) or mapping activities. The community support is being managed by the Conservation Department and Tristan community lead, and is shown through Island Council approving the release biocontrol agent but will largely be understood through informal conversations with the community.

7 Lessons learnt

- The partnership has been very successful in collaboratively delivering a set of ambitious targets, sharing the complementary skills and experiences of the different organisations and adapting the approach to remote training. Selecting a suitable biological control agent, breeding them successfully in captivity, rearing them on Tristan and planning for a release at the start of the second year has been a remarkable achievement - particularly with Covid-19 restrictions. This process would normally take years (it has taken about 4 years to obtain a license to release a parasitoid in the UK). Furthermore, we were incredibly fortunate that multiple projects within our network were taking place and we were able to coordinate the delivery of the wasps to Tristan: the journey took 3 weeks and changed hands five times before reaching Tristan, and only 16 survived the epic journey.

- We were able to rapidly respond to Covid-19 by adapting the workplan and revising the objectives in Year 1 to what could realistically be delivered in a reduced timeline, and took into consideration travel and shipment delays. Focusing our efforts and reprioritising in this first year has been a key contributing factor to the progress we've made.

- Working on Tristan, particularly with the unpredictability of the weather, you need to be ready at a moments notice and opportunities can easily be lost if this preparation isn't put in well in advance. We're keen to maintain the good progress made during this year and will be undertaking more detailed planning and risk management with partners.

- There was a delayed start to the project resulting in a cost neutral one-year extension, which although essential has meant that project resources have been stretched, resulting in additional sources of funding being sought.

- The partners have requested that in-person meetings resume as soon as it's safe to do so, and would provide a good opportunity to learn from the success of rearing BCAs at CABI's facilities.

- A contractual issue arose with one of the partners resulting in delays to the contract and budget changes; at the development stage of future projects, the RSPB should ensure that the contract and Darwin's Terms of Reference are agreed to in writing and passed through the legal teams of partner organisations to mitigate this financial/contractual risk.

8 Actions taken in response to previous reviews (if applicable)

N/A – this is the first Annual Report.

Clarifications were provided by Jonathan Hall on 29/05/2020 in response to questions posed by Darwin when the project was funded.

9 Other comments on progress not covered elsewhere

- The RSPB has supported Tristan Conservation Department in submitting a funding bid to BEST 2.0+ to provide further resources for the flax removal in Year 2, and add an additional year of effort to remove more invasive flax from the cliff. The outcome of the funding bid will be known in May 2021. This will also mitigate the risk, as outlined in section 2.4, ensuring that all flax is removed and controlled on the plateau and surrounding 50m on the cliff.
- The scale insect infestation has spread quicker than expected, and is a much greater threat to the Phylica forest and associated buntings that originally anticipated. This threat is compounded by an increased frequency of storms. It is now even more essential that the project is a success, and we've been working on complementary project activities including more intensive bunting monitoring, increased Phylica propagation and planting, and we have investigated captive breeding options for worse-case scenarios.
- The project leader on Tristan, Trevor Glass, has been unavailable due to health concerns. It was therefore not possible to involve the Trevor in the annual report writing this year.

10 Sustainability and legacy

The project is a very welcomed and urgently needed intervention to prevent the collapse of the *Phylica* forest ecosystem and associated buntings. Good communications with Tristan have been key to delivering the workplan with minimal delays and getting community buy-in; this project is recognised as a priority by Island Council, the joint Administrators, and the community. For example, the Administrators have both visited Inaccessible Island to assist the flax team.

Through training, the Conservation Department have gone from having no experience of rearing parasitoids to building expertise and raising sufficient numbers for a release. This capacity will be built on further in the coming years, and will provide a sustainable skills base on Tristan for this type of work. It is intended that the BCAs will sustainably manage the *C. hesperidium* population which will allow for sustainable ecological benefits such as the recovery of the Phylica forest ecosystem and associated biodiversity.

Aside from the project being extended by one year, the exit strategy remains unchanged. Monitoring the establishment of the BCAs and identifying further BCAs for release will inform whether any further changes are needed.

11 Darwin identity

The Darwin Initiative is positively regarded within the community on Tristan da Cunha, and there is a good understanding of Darwin particularly within the Fisheries and Conservation Departments. Approximately 10% of the community have worked directly on a Darwin project, and project updates are given at the fortnightly Government Department meetings.

The project, alongside the Darwin handle or hashtag, has been promoted on Twitter by both Tristan Admin and Tristan Nature: accounts both run by Tristan Government with a combined audience of over 14,000. Some example tweets posted during a trip to Inaccessible by the Administrators and community members, and in connection with #WomeninScience day:

https://twitter.com/NatureTristan/status/1364225544817045516 = 829 impressions

https://twitter.com/NatureTristan/status/1362068281037905922 = 5,011 impressions

https://twitter.com/NatureTristan/status/1359832338960646144 = 9,527 impressions

At the start of the project, the partnership published press releases on the CABI and RSPB website, alongside an article in the UK press and a complementary blog written by RSPB's director of Global Conservation which all publicise the Darwin Initiative.

As part of the wider dissemination work, the partnership decided to submit a poster (Annex 3.10) to the Second International Congress of Biological Control (ICBC2); the poster has been accepted and CABI will virtually represent the project and the Darwin Initiative in April 2021.

12 Impact of COVID-19 on project delivery

Covid-19 has impacted the project work plan significantly with an initial delay of 3 months to the project start date, all international travel restricted, and members of the project team on furlough resulting in reduced capacity. As a result, we have extended the project by a year, moved all travel to Tristan and the survey in South Africa to Year 2 and provided remote support to Tristan in the rearing and culturing of the parasitic wasps.

Furthermore, in the past year access to the propagation and quarantine facilities were restricted due to social distancing measures, shipments between Tristan and the UK were significantly extended and at a much greater expense. Remarkably, we have managed to make great progress towards the project Outputs, and have demonstrated that it is possible to adapt our approach and continue to deliver activities under challenging circumstances:

- Using our network, we coordinated in-person transportation of agents in temperature controlled cool boxes resulting in reduced transit times and the successful delivery of parasitoids to Tristan.
- Regular remote meetings have taken place with partners to closely monitor the parasitoid on Tristan and deliver training.
- It was decided to focus work on one BCA species during Year one and to use the available capacities to produce sufficient specimens of this species for an early release on Nightingale, and not to miss a chance for a first release before the onset of winter to manage Covid-related project delays.

At this time, the unpredictability around Covid-19 in South Africa poses the most substantial risk to the project due to its potential impact on travel. We may be able to go ahead with some activities with further remote support, but travel to Tristan and South Africa is essential to provide much-needed additional capacity, to deliver intensive practical training and to carry out monitoring and surveying activities. The one-year project extension mitigates the potential for long-term delays, but it's worth acknowledging that if we are unable to travel to Tristan for a further year then there is an increased risk of project delays.

In Year 1, travel between South Africa and Tristan da Cunha went ahead for a team of three flax removal technicians. The team followed the protocols outlined by the Tristan da Cunha

Government; having received a negative Covid-19 test, stayed in an approved Covid-safe hotel, and were isolated for 26 days before coming into contact with the Tristan community.

13 Safeguarding

Please tick this box if any safeguarding violations have occurred during this financial year. ☐

If you have ticked the box, please ensure these are reported to ODA.safeguarding@defra.gov.uk as indicated in the T&Cs.

The RSPB's Safeguarding policy was updated in 2019 which adheres to Darwin's terms and conditions. RSPB staff on the project have completed the safeguarding training, and our policy has been shared downstream with partners.

14 Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2020 – 31 March 2021)

The project expenditure for 2020/21 is currently unavailable. Due to Covid, there has been a delay in the end of year processes, e.g. staff being on furlough and adapted financial processes. We expect to be able to give a financial update towards the end of May, and do not anticipate any underspend.

Project spend (indicative) in this financial year	**2020/21 D+ Grant (£)**	**2020/21 Total actual D+ Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others (Please specify)				
TOTAL				

- **Annex 1:Report of progress and achievements against Logical Framework for Financial Year 2020-2021 – <u>if applicable</u>**

Project summary	Measurable Indicators	Progress and Achievements April 2020 - March 2021	Actions required/planned for next period
Impact Healthy Phylica forests cover their available habitat niche on the northern islands of Tristan da Cunha and sustain their maximum possible populations of endemic Nesospiza buntings for long-term resilience		One biological control agent (BCA) selected, tested and assessed for risks, transported to Tristan and reared for release.	
Outcome Sustainable community-supported control of *Coccus hesperidum* successfully established and invasive flax buffer created that enables recovery of *Phylica* trees, restoration of seed-setting and ultimately increased food availability for *Nesospiza* buntings.	0.1 In year four at least one control agent successfully established on each of the three northern islands in compliance with Tristan legislation and Council permissions 0.2 In year four, lower densities of C. hesperidum and 10% reduction in sooty mould cover of foliage recorded on Phylica compared to 2020 baseline 0.3 No New Zealand flax is recorded on the plateau of Inaccessible Island or top 50m of surrounding cliff by end of year 2 0.4 3 Tristan Conservation Department staff (2 male / 1 female) trained and able to successfully rear, release and monitor a biological control agent 0.5 Within 3-5 years of project start, increased number of seeds/fruits recorded on Phylica compared to 2021 baseline, and population density of buntings stabilised.	See section 3.3. Island Council have permitted the release of one control agent, *M. nietneri* that is currently on Tristan in sufficient numbers for a release to take place on Nightingale. A monitoring protocol has been set up which to measure establishment (Annex 3.5) The 2021 field season mapped the distribution of flax on Inaccessible, removed 119 invasive flax plants, and made progress with logistics for next field season (Annex 3.6). CABI have delivered remote training with the Conservation Department (2 male / 1 female) who have been rearing the biocontrol agent on Tristan since January (Figure 4).	Release of first BCA on Nightingale. A baseline condition assessment of *Phylica* and *C. hesperidium infestation* will be undertaken by the Conservation Department at the time of releasing the biocontrol agent. Testing and rearing of further BCAs. In-person training delivered on Tristan by CABI. Ongoing assessment of bunting populations. Planning and delivery of second field season of flax removal.
Output 1. Suitable biological control agents for C. hesperidum on Tristan selected, risk assessed and tested	*1.1 At least three suitable control agents identified and selected from commercial, research and wild South African sources by end of Q4 in year two*	See section 3.2, Output 1. 1.1 A number of potentially suitable BCAs for brown scale control on Tristan have been selected. 1.2 *Microterys nietneri* was selected for testing as the most promising candidate, and the team started working with this species.	

	1.2 One control agent tested through standardised methods and under controlled conditions in Q3 of year one, and at least one further agent by Q2 of year two *1.3 At least one control agent demonstrated to be highly effective against the C. hesperidum strain present on Tristan by end of Q2 of year two* *1.4 PRA on one tested and recommended control agent completed by end of Q3 in year one, and of all tested and recommended agents by Q3 of year two*	1.3 Efficacy testing is ongoing because of the delayed start of the project. First results from rearing of the selected first BCA on Tristan indicate that the species is effectively developing and reproducing on the target population with no indication of a reduced efficacy. 1.4 A risk assessment has been produced for *M. nietneri* (Annex 3.1).	
1.1 Identification of scale insect from samples collected on Tristan; use of molecular methods to identify the strain/subspecies present on Tristan		Scale insects from Tristan have been confirmed as *C. hesperidium* through morphological observations. Sequencing results inconclusive.	Sequence further scale specimens from Tristan.
1.2 Analysis of pre-project survey and literature survey to match agents to scale taxon present on Tristan; this includes climate matching of previous successful control projects of C. hesperidum with the conditions present on Tristan		Literature reviewed.	Continued testing of BCAs for climatic suitability.
1.3 Selection of suitable and readily available agents, including use of agents commercially available and agents currently used in other research institutes		Suitable agent, *M. nietneri*, selected.	Further most suitable agents selected.
1.4 Shipment of living scale insects from Tristan to quarantine at CABI to test agents on the correct target taxon		Complete.	N/A
1.5 Culturing of C. hesperidum from Tristan at CABI for testing and mass rearing of agents		Complete.	Culture of C. hesperidium will be maintained.
1.6 Survey in SA for additional agents; the survey will focus on areas with significant citrus growing where C. hesperidum is widespread		Not started as per project timeline.	Survey in South Africa.
1.7 Risk assessment for selected agents with a focus on published host specificity records		Complete for *M. nietneri*.	Further risk assessments of suitable agents.
1.8 Efficacy testing of agents in quarantine at Egham UK looking into infestation rates and rates of encapsulation by the target species		Numbers have reached suitable levels for testing with *M. nietneri*.	Testing of *M. nietneri* and other agents.
Output 2. Tristan Council and community understand and approve of selected control agent release	*2.1 Publicity materials and video are submitted to Tristan Council and screened for public viewing by Tristan*	See section 3.2, Output 2.	

	Conservation Department in Q2 of Yr1. At least 75% of Tristan Council members, at least 75% of Tristan school classes, and at least 50 Tristanians have face-to-face discussions with community engagement lead in Q2 of years two and three *2.2 Independent opinion on first PRA produced by APHA and explained to Tristan Council via phone, by end of Q3 in year one, and subsequent PRAs by Q3 of year two* *2.3 Tristan Council and community approval granted for introduction, rearing and release of one tested and recommended control agent by end of year one and of all tested and recommended agents by Q3 of year two* *2.4 Potato crop pest assessments completed for at least 8 growers (4 male / 4 female), as well as the Agriculture Department vegetable production polytunnel, and potential for benefits from biocontrol evaluated, by end of year one*	2.1 Publicity materials have been produced (Annex 3.2), and shared with Tristan Council. 2.2 The first PRA has been produced, and APHA have provided their independent opinion that which been provided to Tristan (Annex 3.3) 2.3 Tristan have approved the introduction of the first BCA, M. nietneri. 2.4 It was not possible to carry out a potato crop pest assessment due to Covid travel restrictions.	
2.1 Tristan Conservation Department screen educational video and share publicity materials to Council and with community. Community engagement lead visits Tristan in Q2 of Years 2 and 3 to engage Council, school children and community members via public meetings, informal discussions, classroom teaching and film screening.		Educational video shared with Island Council	Community lead visits Tristan and undertakes engagement activities.
2.2 The PRA is submitted to APHA for independent scrutiny, and their feedback then provide direct to Tristan Council both in writing and via a phone explanation.		APHA has provided an independent opinion on the PRA for *M. nietneri* (Annex 3.3)	Further PRAs submitted for an opinion for selected control agents.
2.3 Tristan Council meeting discusses PRA and approves issue of an environmental permit by the 'Administrator in Council'.		Permit for *M. nietneri* approved.	Further permits issued for selected control agents.

2.4 Visiting expert conducts pest assessments on potato crops of at least 8 growers, as well as the Agriculture Department vegetable production polytunnel, providing immediate verbal feedback and a follow-up report.		Not started.	Assessment conducted by visiting experts.
Output 3. Selected control agent reared under controlled conditions on Tristan	*3.1 Rearing facilities established on Tristan to allow repeated releases without long-distance imports by the end of year one* *3.2 At least one well suited control agent brought into permanent culture under controlled rearing conditions on Tristan by end of year one* *3.3 Three Tristan Conservation Department staff (2 male / 1 female) trained in rearing control agents by the end of year one* *3.4 At least 14 school children (7 female / 7 male) involved in propagating/growing plants for the control agents by the end of year one, and subsequent rearing by Q3 of year two* *3.5 Production of at least 300 female control agents for release by the end of year one and 500 females in years two, three and four*	See section 3.2, Output 3. 3.1 After some delays equipment is on island and temporary facilities set up (Figure 4). 3.2 Culture of *M. nietneri* established on island. 3.3 Remote training has been delivered to three Tristan Conservation staff (2 male / 1 female): Annex 3.4 and 3.5 3.4 No progress has been made towards this indicator as a result of capacity and resources needed. 3.5 Sufficient numbers have been produced for a release on Nightingale.	
3.1 Rearing of agents for release at CABI quarantine facilities using several chambers to keep individual agents separated and supply population of scales uninfected		300+ BCAs were produced at CABI's quarantine facilities	Continued rearing of *M. nietneri* and further BCAs.
3.2 Development of training material and rearing protocols for Tristan, including photographic identification guide for the species involved in word format and as PowerPoint presentation		Materials have been developed.	Training materials developed for further BCAs.
3.3 Establishment of polytunnel rearing facilities on Tristan		Polytunnel equipment is on Tristan.	Build of polytunnel.
3.4 First shipment of approved agent(s) on Tristan and establishment in prepared rearing facilities on the island		*M. nietneri* shipped to Tristan and established in temporary rearing facilities	Further shipments of selected BCAs.
3.5 Training of biosecurity staff on Tristan how to rear control agents followed by remote supervision after the training		Remote training delivered.	In-person training delivered by CABI on Tristan.

3.6 Culturing of agents on Tristan in person and under remote supervision by FERA and CABI		*M. nietneri* successfully cultured on Tristan.	Culturing of *M. nietneri* continues, and for further BCAs.
Output 4. Control agents released and successfully established on Tristan da Cunha, Inaccessible & Nightingale Islands	*4.1 At least one well suited control agent released in at least two sites with heavy infestations of C. hesperidum on one of the islands in Q4 of year one and in each of the three islands by the end of year two and again in year three and year four* *4.2 Annual Q4 monitoring of infestation rates of C. hesperidum at release sites shows at least one control agent established in at least one site by end of year two, and on all three islands by end of year four*	See section 3.2, Output 4. 4.1 The release of the first BCA will go ahead in Q1 of Year 2, and release sites have been identified. 4.2 No progress to date, as per project timeline.	
4.1 Training of biosecurity staff on Tristan how to culture, release and monitor control agents		Remote training delivered.	In-person training delivered by CABI on Tristan in Q3.
4.2 First release of agent(s) on at least two sites on one of the target islands		Release sites identified.	Release of first BCA in Q1 Year 2 on Nightingale.
4.3 Follow on shipments and releases of agent(s) to cover all three target islands		Not started – as per project timeline.	Further releases of M. nietneri on all three islands, and shipment of further selected BCAs
4.4 Monitoring of establishment by local staff once every year in late summer/early autumn		Not started – as per project timeline.	Monitoring activities begin in Q3 Year 2.
4.5 Monitoring of impact (infestation rates of C. hesperidum) by local staff once every year in late summer/early autumn		Not started – as per project timeline.	Baseline data collected in Q1 Year 2, followed by annual monitoring.
Output 5. Invasive New Zealand flax closest to Phylica habitat controlled on Inaccessible Island World Heritage Site, with an increased local capacity to undertake control activities	*5.1 All flax plants present on island plateau are mapped and removed in Q4 of year one* *5.2 The 2019 baseline map of cliff flax presence is updated and the top 50m of invaded cliff beneath plateau is cleared of flax in Q4 of year one* *5.3 All year one plateau and cliff clearings re-checked and re-controlled where necessary in Q4 of year two*	See section 3.2, Output 5. 5.1 and 5.2 All flax plants were mapped (Annex 3.6). Logistical and weather issues precluded the removal of flax plants in the target areas. 5.3 Full removal still possible in Year 2. 5.4 Baseline set and rope access training delivered on Inaccessible (Annex 3.7).	

	5.4 Local trainee demonstrates year on year improvement in rope access skills		
5.1 Experienced flax control team visit Inaccessible island in year one to complete island plateau flax mapping and update the 2019 cliff flax map baseline		Complete.	N/A
5.2 All island plateau flax, and the top 50m of invaded cliff beneath the plateau, is cleared of flax in year one		Delayed.	To be completed in January 2022.
5.3 Experienced flax control team revisit Inaccessible in year two to re-check and re-control year one clearings where necessary		Not started.	Flax team return in January 2022.
5.4 One Tristanian resident accompanies the experienced flax team on each visit to Inaccessible island and receives on-the-job training		Complete for first field season.	Trainee returns in January 2022.

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

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: **Healthy *Phylica* forests cover their available habitat niche on the northern islands of Tristan da Cunha and sustain their maximum possible populations of endemic *Nesospiza* buntings for long-term resilience**			
Outcome: Sustainable community-supported control of *Coccus hesperidum* successfully established and invasive flax buffer created that enables recovery of *Phylica* trees, restoration of seed-setting and ultimately increased food availability for *Nesospiza* buntings.	0.1 In year four at least one control agent successfully established on each of the three northern islands in compliance with Tristan legislation and Council permissions 0.2 In year four, lower densities of *C. hesperidum* and 10% reduction in sooty mould cover of foliage recorded on *Phylica* compared to 2020 baseline 0.3 No New Zealand flax is recorded on the plateau of Inaccessible Island or top 50m of surrounding cliff by end of year 2 0.4 3 Tristan Conservation Department staff (2 male / 1 female) trained and able to successfully rear, release and monitor a biological control agent 0.5 Within 3-5 years of project start, increased number of seeds/fruits recorded on *Phylica* compared to 2021 baseline, and population density of buntings stabilised.	0.1 Environmental permits. Rearing and release reports. Assessment report of control agent population establishment. 0.2 Assessment report of sooty mould cover on *Phylica* trees. Photographic evidence. 0.3 Flax assessment report. Photographic evidence 0.4 Biological control agent Training, Release & Monitoring reports verified by CABI and Fera. Feedback forms. Photographic evidence. 0.5 Assessment report of fruit yield and seed setting (recruitment). Bird population monitoring data.	By the end of the project a decline of the pest species and tree coverage by sooty mould should start to be reflected in the recorded data. Recovery of *Phylica* trees and bird populations can only be measured and verified several years after the termination of project however as part of long-term monitoring activities. Assumption: Tristan Conservation Department and the RSPB continue monitoring beyond the life of the project. This holds true as RSPB and Tristan Conservation have a long-term monitoring work programme which is not dependent on further project-funding, so will be able to deliver on this. We also commit to reporting the results to Darwin Plus / DEFRA post grant.
Outputs: **1.** Suitable biological control agents for *C. hesperidum* on Tristan selected, risk assessed and tested	1.1 At least three suitable control agents identified and selected from commercial, research and wild South African sources by end of Q4 in year two	1.1 Literature Review. South African survey report. 1.2 Efficacy testing results report 1.3 Efficacy testing results report	Assumption: Suitable control agents matching the target pest can be identified. This is highly likely as the different strains of *C. hesperidum* have been successfully controlled under a wide range of environmental conditions. Indeed, *C. hesperidum* is one of the

	1.2 One control agent tested through standardised methods and under controlled conditions in Q3 of year one, and at least one further agent by Q2 of year two 1.3 At least one control agent demonstrated to be highly effective against the *C. hesperidum* strain present on Tristan by end of Q2 of year two 1.4 PRA on one tested and recommended control agent completed by end of Q3 in year one, and of all tested and recommended agents by Q3 of year two	1.4 Pest Risk Assessments.	best assessed pest species in the world regarding associated parasitoids and other natural enemies. The CABI Invasive Species Compendium alone lists more than 40 parasitoids and predators for this target pest. Suitable control agents can be obtained from existing cultures or through field surveys. This is highly likely as some agents are commercially available and more are in use in agricultural research institutes with which CABI has long-established contacts. Additional species can relatively easily be sourced during field surveys in particular from citrus growing areas, where *C. hesperidum* can be frequently found. The methodology for required surveys is already established at CABI and will draw on substantial past experiences in controlling this species.
2. Tristan Council and community understand and approve of selected control agent release	2.1 Publicity materials and video are submitted to Tristan Council and screened for public viewing by Tristan Conservation Department in Q2 of Yr1. At least 75% of Tristan Council members, at least 75% of Tristan school classes, and at least 50 Tristanians have face-to-face discussions with community engagement lead in Q2 of years two and three 2.2 Independent opinion on first PRA produced by APHA and explained to Tristan Council via phone, by end of Q3 in year one, and subsequent PRAs by Q3 of year two	2.1 Photographs from public meetings and school talks. Publicity materials demonstrating biocontrol agents. Educational pack for school. Short educational video. Trip report. 2.2 APHA Opinion document. Tristan Council meeting minutes 2.3 Environmental Permits 2.4 Potato crop & Agriculture Department polytunnel pests report. Potential biocontrol report	Possible community fears about the introduction of a parasitoid wasp can be allayed. This is highly likely as Tristan Council has already formally approved this project application, Tristan Conservation Department is a core partner, the RSPB has excellent long-term community links and thus understanding of local concerns, and clear communications will demonstrate that the (likely) agents are c.2mm long and harmless to humans and the wider environment. The potato crop is largely all grown close together at the ‘patches’, so assessments conducted with 8 growers will be sufficient to provide insights and lessons for all growers of this staple crop.

	2.3 Tristan Council and community approval granted for introduction, rearing and release of one tested and recommended control agent by end of year one and of all tested and recommended agents by Q3 of year two 2.4 Potato crop pest assessments completed for at least 8 growers (4 male / 4 female), as well as the Agriculture Department vegetable production polytunnel, and potential for benefits from biocontrol evaluated, by end of year one		
3. Selected control agent reared under controlled conditions on Tristan	3.1 Rearing facilities established on Tristan to allow repeated releases without long-distance imports by the end of year one 3.2 At least one well suited control agent brought into permanent culture under controlled rearing conditions on Tristan by end of year one 3.3 Three Tristan Conservation Department staff (2 male / 1 female) trained in rearing control agents by the end of year one 3.4 At least 14 school children (7 female / 7 male) involved in propagating/growing plants for the control agents by the end of year one, and subsequent rearing by Q3 of year two	3.1 Photographic evidence of rearing facilities 3.2 Rearing protocols. Photographic evidence 3.3 Training protocol provided as annex to second annual project report 3.4 Teacher feedback in second annual project report. 3.5 Results from rearing protocols provided in second annual project report	Pest Risk Assessment ensures that no native species are harmed by the control agent. To date, no native scale insects have ever been recorded for the Tristan group, but further surveys by a world-leading entomologist, and rigorous testing as part of the PRA process, will provide extremely high levels of confidence in this assumption. Control agents can be reared and cultured under controlled conditions. This is highly likely as standardised rearing protocols for both parasitoid and predatory control agents of *C. hesperidum* exist. Tristan Conservation Department able to work closely with the Island school. This is highly likely as occurs frequently already.

	3.5 Production of at least 300 female control agents for release by the end of year one and 500 females in years two, three and four		
4. Control agents released and successfully established on Tristan da Cunha, Inaccessible & Nightingale Islands	4.1 At least one well suited control agent released in at least two sites with heavy infestations of *C. hesperidum* on one of the islands in Q4 of year one and in each of the three islands by the end of year two and again in year three and year four 4.2 Annual Q4 monitoring of infestation rates of *C. hesperidum* at release sites shows at least one control agent established in at least one site by end of year two, and on all three islands by end of year four	4.1 Release reports. Photographic evidence. 4.2 Annual monitoring reports. Final report includes post-release evaluation.	Suitable weather conditions allow field releases. Environmental conditions allow establishment of agents (which is highly likely as testing will have aimed to replicate conditions on Tristan as much as possible)
5. Invasive New Zealand flax closest to *Phylica* habitat controlled on Inaccessible Island World Heritage Site, with an increased local capacity to undertake control activities	5.1 All flax plants present on island plateau are mapped and removed in Q4 of year one 5.2 The 2019 baseline map of cliff flax presence is updated and the top 50m of invaded cliff beneath plateau is cleared of flax in Q4 of year one 5.3 All year one plateau and cliff clearings re-checked and re-controlled where necessary in Q4 of year two 5.4 Local trainee demonstrates year on year improvement in rope access skills	5.1 Plateau flax presence map. Control team report. Photographic evidence. 5.2 Updated cliff flax map. Control team report. Photographic evidence. 5.3 Monitoring trip report. Updated plateau and cliff flax presence maps. Photographic evidence. 5.4 Baseline skills assessment on rigging techniques, gear inspection and rope management. Trainers report.	Tristan Government retains this as a key priority. Highly likely as included in the project at Tristan's specific request and a key action of the World Heritage Site management plan. Suitable weather conditions enable timely team drop-off and pick-up, plus working conditions on the island plateau. Control therefore to be conducted in the Tristan summer (Jan-March) to maximise good weather. Unmapped first-hand reports from February 2019 team on flax presence on the island plateau suggest that full removal is possible. COVID-19 travel restrictions allow for the flax team to travel to Tristan in Q4 of Yr1. This will be a direct voyage from South Africa to Inaccessible Island, with the potential not to stop at Tristan da

			Cunha entirely, so is less likely to be affected by global travel restrictions.

Activities (each activity is numbered according to the Output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

1.1 Identification of scale insect from samples collected on Tristan; use of molecular methods to identify the strain/subspecies present on Tristan

1.2 Analysis of pre-project survey and literature survey to match agents to scale taxon present on Tristan; this includes climate matching of previous successful control projects of *C. hesperidum* with the conditions present on Tristan

1.3 Selection of suitable and readily available agents, including use of agents commercially available and agents currently used in other research institutes

1.4 Shipment of living scale insects from Tristan to quarantine at CABI to test agents on the correct target taxon

1.5 Culturing of *C. hesperidum* from Tristan at CABI for testing and mass rearing of agents

1.6 Survey in SA for additional agents; the survey will focus on areas with significant citrus growing where *C. hesperidum* is widespread

1.7 Risk assessment for selected agents with a focus on published host specificity records

1.8 Efficacy testing of agents in quarantine at Egham UK looking into infestation rates and rates of encapsulation by the target species

2.1 Tristan Conservation Department screen educational video and share publicity materials to Council and with community. Community engagement lead visits Tristan in Q2 of Years 2 and 3 to engage Council, school children and community members via public meetings, informal discussions, classroom teaching and film screening.

2.2 The PRA is submitted to APHA for independent scrutiny, and their feedback then provide direct to Tristan Council both in writing and via a phone explanation.

2.3 Tristan Council meeting discusses PRA and approves issue of an environmental permit by the 'Administrator in Council'.

2.4 Visiting expert conducts pest assessments on potato crops of at least 8 growers, as well as the Agriculture Department vegetable production polytunnel, providing immediate verbal feedback and a follow-up report.

3.1 Rearing of agents for release at CABI quarantine facilities using several chambers to keep individual agents separated and supply population of scales uninfected

3.2 Development of training material and rearing protocols for Tristan, including photographic identification guide for the species involved in word format and as PowerPoint presentation

3.3 Establishment of polytunnel rearing facilities on Tristan

3.4 First shipment of approved agent(s) on Tristan and establishment in prepared rearing facilities on the island

3.5 Training of biosecurity staff on Tristan how to rear control agents followed by remote supervision after the training

3.6 Culturing of agents on Tristan in person and under remote supervision by FERA and CABI

4.1 Training of biosecurity staff on Tristan how to culture, release and monitor control agents

4.2 First release of agent(s) on at least two sites on one of the target islands

4.3 Follow on shipments and releases of agent(s) to cover all three target islands

4.4 Monitoring of establishment by local staff once every year in late summer/early autumn

4.5 Monitoring of impact (infestation rates of *C. hesperidum*) by local staff once every year in late summer/early autumn

5.1	Experienced flax control team visit Inaccessible island in year one to complete island plateau flax mapping and update the 2019 cliff flax map baseline
5.2	All island plateau flax, and the top 50m of invaded cliff beneath the plateau, is cleared of flax in year one
5.3	Experienced flax control team revisit Inaccessible in year two to re-check and re-control year one clearings where necessary
5.4	One Tristanian resident accompanies the experienced flax team on each visit to Inaccessible island and receives on-the-job training

- **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.	
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.	✓
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	✓
Do you have hard copies of material you need 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.	
Have you involved your partners in preparation of the report and named the main contributors	✓
Have you completed the Project Expenditure table fully?	
Do not include claim forms or other communications with this report.	