Darwin Plus:
Overseas Territories Environment and Climate Fund
Annual Report

To be completed with reference to the "Project Reporting Information Note" (https://dplus.darwininitiative.org.uk/resources/information-notes/).

It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Submission Deadline: 30th April 2022

Darwin Plus Project Information

Project reference	DPLUS113
Project title	CRACAB: Climate Resilience and Conservation of Ascension's Biodiversity
Territory(ies)	Ascension Island
Lead partner	Ascension Island Government Conservation & Fisheries Directorate (AIGCFD)
Project partner(s)	University of Exeter French Institute for Agricultural Research (INRA)
Darwin Plus grant value	£261,894
Start/end dates of project	1st September 2020 – 31st March 2023
Reporting period (e.g. Apr 2021-Mar 2022) and number (e.g. Annual Report 1, 2)	Apr 2021 – Mar 2022 (Annual Report 2)
Project Leader name	Dr Diane Baum
Project website/blog/social media	www.ascension-climate.org
Report author(s) and date	Sam Weber, Phil Lambdon, James McGurk, Liliana Colman & Diane Baum (April 2022)

1. Project summary

The Earth's climate is changing at an unprecedented rate, threatening biodiversity and human well-being alike. Small oceanic islands are predicted to be highly vulnerable to climate change because of their size, isolation and relatively simple ecosystems. However, those same attributes also make small islands ideal microcosms in which to understand and manage its effects.

On Ascension Island, climate change is regarded as one of the principal threats to biodiversity, cutting across marine and terrestrial ecosystems. All but one of the 16 Species and Habitat Actions Plans prepared for the Island's Biodiversity Action Plan recognise climate change as a substantial threat; it is listed the Marine Protected Area (MPA) Management Plan as one of the few impacts that will continue to affect Ascension's marine environment following the designation of a large-scale MPA in September 2019; and it is identified as posing a significant risk of extinction in the island's Endemic Plant Restoration Plan. Yet, the likely impacts are rarely quantified.

Climate change is not an existential threat but a real and current problem facing Ascension's biodiversity, and managers need to treat it with the same impact assessment approach as other pressures. This project will enable such a paradigm shift by providing outputs that allow quantitative measures of risk and impact that can be incorporated into Ascension's strategies and management plans, as well as

exploring adaptation strategies to mitigate the most serious threats. This locally-specific information is vital to capture the attention of policy makers and galvanise action both on-island and globally. The adaptations trialled during the project will provide direct benefit to the species and ecosystems concerned and also benefit the AIGCFD staff and volunteers involved as they are able to take positive action to address climate change.

2. Project stakeholders/partners

The project is led by the Ascension Island Government Conservation & Fisheries Directorate (AIGCFD) and was developed in response to priorities identified in conservation plans and strategies contributed to by numerous subject specialists over the past decade. The Project partnership builds on a long-term collaboration between AIGCFD and the University of Exeter (UoE) and this relationship has continued to be productive over Y2 of the project. In addition to leading research outputs on marine turtles, the UoE is providing project management support (including drafting of reports, change requests etc. and the maintenance of Project website) and the Project Manager at UoE and Project Leader in AIG meet at least monthly to coordinate activities. Both the AIG Project Leader and UoE Project Manager co-authored the marine climate change assessment produced by consultants at Plymouth Marine Lab during Y2 and were closely involved in its design and reporting. The project has also developed a new collaboration with the French Institute for Agricultural Research (INRA) to support research on drought impacts affecting endemic plants. Unfortunately, the COVID-19 pandemic has continued to frustrate planned visits by INRA to Ascension Island during Y2. Nevertheless AIG has worked closely with the INRA team to develop contingency plans to ensure that at least some of the planned work can proceed remotely (see Activity 2.1). Engagement with the Ascension Island community has increased in Y2, including holding of the first public meeting. However, the majority of the outreach and dissemination activities will take place in Y3 once the necessary research and modelling outputs are completed.

3. Project progress

3.1 Progress in carrying out project Activities

Progress is summarised below for all activities that were scheduled for Y2 according the agreed implementation timetable, as well as activities planned for subsequent years for which there is early progress to report.

Output 1.

***1.1** Creation of climate model for Ascension capable of predicting temperature and rainfall changes with measured degree of certainty*

The long-term climate time series for Ascension Island compiled by University of East Anglia during Y1 of the project has now been published in the peer-reviewed literature (https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.7314; **Annex 4**) and imported into the Climate Research Unit's global gridded dataset (CRU TS). This is a necessary step as CRU TS provides the input to the tool that generates future climate projections (called ClimGen). Importing the new version of CRU TS into the ClimGen tool is now underway. The final analytical stage, which will commence shortly, will be to use ClimGen to generate future projections for the Ascension location, combining observations and predicted climate changes together for a range of different emissions scenarios.

***1.2** Production of map showing climatic zones on Ascension based on altitude, aspect and distance from sea*

Although Activity 1.1 was able to successfully compile a long-term climate series for low-elevation sites on the west of the Island, the geographic coverage of temporally-matched meteorological data for other areas has proved insufficient to generate a comprehensive map of climatic zonation. This assumption regarding data availability was identified in the project logframe and the scope of this activity will therefore be reduced to work with the available information. Given that climate and vegetation zones on Ascension are primarily structured by altitude, one option we are exploring is to

generate altitude-specific climate projections using data from the few mid- and high-altitude meteorological stations that temporally overlap with the lowland series. Although this approach will not generate fine-scale predictions, it will provide an assessment of how climate change will manifest in Ascension's major terrestrial biomes.

***1.3** Creation of oceanographic model for Ascension EEZ produced predicting future changes in current and upwelling systems.*

Consultants at Plymouth Marine Laboratory appointed in Y1 have now completed the oceanographic modelling of the Ascension EEZ and submitted their final report to the Ascension Island Government (**Annex 5** and project website). The team used the state-of-the-art CMIP6 model ensemble (used in the most recent Intergovernmental Panel on Climate Change sixth assessment report) to generate Ascension-specific projections for a range of ocean biophysical variables for the period 2015–2100 under 4 different emission scenarios and over a range of depth strata. They also conducted a more detailed analysis of the evolution of the Atlantic equatorial undercurrent (AEU) system, which plays a key role in regulating the oceanography of this region. Headline results indicate a weakening of the AEU under all emissions scenarios, accompanied by a trend towards warmer, more acidic, less nutrient rich and less productive surface waters. In addition to the summary figures included in the report, raw datasets from the CMIP6 projections have also been transferred to AIG and will inputs for modelling responses of marine species and processes to future climate change.

Output 2.

***2.1** Production of response curves relating temperature to green turtle sex ratios, and soil moisture content to stress levels in an endemic plant species (Euphorbia origanoides) from experimental data*

Turtles: Modelling of the temperature response curve for green turtle offspring sex ratio at Ascension Island is now complete (**Annex 3.1**). The analysis used data from 60 artificially incubated green turtle clutches and 72 in situ nests to model changes in sex ratio over range of different incubation temperatures. The fitted curve shows the expected pattern of increasingly female-biased sex ratios at higher temperatures, with a pivotal temperature (equal sex ratio) of 29.7 ^{o}C and a thermal transitional range of 27.7 – 31.5 ^{o}C. Once local temperature projections for Ascension Island are completed (Output 1.1), these will be merged with thermal response curves to generate long-term predictions of green turtle demographic rates.

***Euphorbia origanoides*:** Eight soil moisture monitoring sites have now been established in key population areas for *E. origanoides* and have been monitored weekly over a nine-month period (project website: https://ascension-climate.org/2022/04/25/pastures-new-assisted-migration-of-ascension-island-spurge-as-a-climate-mitigation-strategy/). Rain gauges have also been deployed at three of the sites. This has enabled us to build a detailed picture of soil moisture regimes according to season, location and precipitation. We are now clear that although deep soil moisture is fairly stable, surface soils can be extremely dry except for a short window during the rainy season. This likely imposes severe limitations on seedling survival: the moist period must be long enough for seedlings to germinate and grow sufficiently long roots to tap into the deeper layers. However, to understand fully how these patterns affect spurge recruitment, we need more data on the physiology of the plants; in particular the critical cut-off point when drought causes them to die. Unfortunately, continued access issues caused by the COVID-19 pandemic have required us to delay further a planned visit of partners from INRA to Ascension Island to quantify the drought stress experienced by *E. origanoides* in a field setting. A partial solution has been found using measurements on *ex situ* plants under laboratory conditions. The Conservatoire Botanique National de Brest, situated close to INRA, are currently growing Ascension spurge plants under controlled conditions for experimental trials, which should allow us to obtain results by the end of 2022 (Q3 Y3). However, it is impossible to truly mimic the natural environment in an artificial setting and we are continuing to work towards a field visit by INRA partners during Y3 of the project.

2.2 *Production of digital terrain maps of turtle nesting beaches*

Creation of digital elevation models (DEMs) of nesting beaches was largely completed ahead of schedule within Y1 of the project (see project website and Annual Report 1). Further cleaning and refinement of these models has taken place in Y2 in preparation for formal analysis of nesting habitat loss under different sea level rise scenarios in Y3 (Activity 2.3)

2.4 *Analysis of correlation between seabird productivity and ocean state variables completed and used to assess feasibility of using seabirds as indicators of ocean health.*

Limited progress has been made on this activity in Y2, primarily due to a change in the employment status of the University of Exeter researcher, Dr Sam Weber, who was responsible for leading the analysis (see Section 9). A replacement was appointed in March 2022 (Y2Q4) and will be employed at a higher percentage FTE for the remainder project, helping to make up for the delays encountered.

Output 3.

3.1 *Trials of turtle nest shading, endemic plant shading and fog-catching irrigation systems carried out*

Nest shading**:** Green turtle nest shading trials were initiated in January 2022 (Y2 Q4) at the start of the 2021-22 nesting season. Shaded and unshaded exclosures have been constructed on two nesting beaches (**Annex 3.2**) and 48 nests have so far been relocated into them, out of a planned 80 over the whole season. Clutches are randomly assigned to either the shaded or unshaded control plots and are reburied with temperature loggers which will allow the impact of shading to be assessed once hatchlings have emerged.

Endemic plant shading: This activity has not been pursued in great detail. Soil moisture monitoring data coming from Activity 2.1 suggest that low precipitation input rather than surface evaporation is the principle hydrological constraint on Ascension spurge survival. As a result, artificial shading is not expected to be an effective or sustainable approach for preserving the population. Conversely, the assisted migration trial (Activity 3.3) into areas with naturally higher soil moisture content has yielded promising early results, and more effort has consequently been invested in this.

Fog-catching irrigation systems: Several irrigation trials are currently being conducted on Green Mountain. Two fog catchers have been constructed at the Windy Ridge endemic plant site which feed precipitated water via a gutter into storage tanks (**Annex 3.3**). This is distributed via a series of pipes, where drip technology allows it to slowly trickle onto the most important banks. At present, 20 areas (each 1-3 metres long) are served by the system, with scope to expand the network. The catchers supply up to 130 L per day whilst there is regular fog and can supply much beyond the current needs, but it is not yet clear how well they will perform during drought periods. A series of quadrats have been established in order to assess how vegetation communities respond to the increased watering relative to control quadrats that are not watered (**Annex 3.3**), although these differences will take time to materialize. As a further trial, a third fog catcher has been constructed at a more isolated location, where it would be less practical to construct a full irrigation system. The catcher lacks a tank or piping, but the net simply drips water directly on to the bank. It cannot supply water during dry periods, but amplifies the natural levels of precipitation received during fog days.

3.3 *Sites on Ascension that have suitable climate conditions for Euphorbia origanoides identified. Transplant nursery grown stock to these areas and monitor success.*

Most of the project duration will be needed in order to collect sufficient information to parameterise a formal Habitat Suitability Model. However, from the initial results of soil moisture monitoring (Activity 2.1), we have been able to make informed guesses about the best locations. We have selected three test sites at different altitudes designed to trial the appropriate methodologies (**Annex 3.4**). The first (Cross Hill, 40 m) is a lowland site where a spurge population became extinct in the 1980s. It is designed to be a

control, mimicking conditions where the species is currently struggling. We do not expect plants to succeed here, but it will form a baseline to compare the performance at the other sites. We will also trial other interventions: (1) setting up sprinkler systems to increase surface soil moisture; (2) to conduct annual periods of short but intense hand watering, to examine whether the moisture persists for long enough to allows seedlings to establish.

The second and third sites (which will not involve the enhanced watering experiments) are situated on suitable soils at medium (280 m) and high (500 m) elevations respectively. Each site is fenced to exclude sheep and rabbits, and baited to reduce rat numbers (**Annex 3.4**). Introducing plants grown in cultivation to wild situations in very dry, harsh environments can be extremely challenging, and a number of measures have been taken to ensure success. Seed only matures sporadically, and collecting sufficient quantities for the trial has taken some time. For acclimatisation purposes, the plants have been grown in soil from the wild sites which is sterilised to eliminate pests. Once large enough, they are transferred to a hardening bench that has been constructed outside the nursery where they are gradually exposed to increasing periods of daily sun and reduced watering.

It takes at least 5 months from sowing to produce a batch ready for planting, but, even then, the plants are unlikely to survive in the extremely harsh and dry wild conditions without regular watering until they are fully established. To achieve this, we have installed timer-controlled irrigation systems fed by harvested rainwater stored in a tank. The irrigation is not intended to be a long-term measure, but will keep the mother plants healthy while they produce seed to build up a large natural seedbank. It is only with this seedbank that natural recruitment can take-over, to form an established population not requiring ongoing maintenance. Progress has been slower than anticipated, mainly because of delays in delivery of fencing and irrigation materials. However, only the Cross Hill site remains to be finished. The two higher altitude sites are now populated with plants, which are surviving well.

Output 4.

4.1 *Creation of project website setting out scope of project and updated with project outputs*

Completed publications, reports and updates on work conducted during Y2 have continued to be uploaded to the CRACAB website (www.ascension-climate.org) which will act as a repository for sharing and publicising project outputs and activities.

4.2 *Public meetings held on Ascension to initially outline the objectives of the project and later to showcase results of the project and illustrate climate scenarios for the island*

A public meeting was held in October 2021 (Y2 Q3), attended by 40 Ascension residents. The initial presentation was divided into two parts. The first outlined the threats posed by climate change internationally, and then discussed how the various issues are likely to affect the island. The second showcased the activities we have been conducting as part of the project, and summarised some of the results to date. A range of questions were taken at the end, which were used to explore public ideas and concerns.

3.2 Progress towards project Outputs

Output 1. *Ascension-specific predictions of future climate and ocean conditions produced and published.*

This output is at an advanced stage of completion and will be achieved in full by the end of the project. A comprehensive climatic baseline for Ascension Island has now been published in the peer reviewed literature, incorporating more than 100 years of temperature and rainfall data (**Annex 4**). This observational series has been imported into the University of East Anglia's *ClimGen* climate projection software which will be used to generate long-term projections of air temperature and precipitation under a range of emission scenarios. A comprehensive marine climate change assessment for the Ascension Island EEZ has also been completed, incorporating long-term projections for a range of key ocean biophysical variables (**Annex 5**). The report is available on the project website and the team at

Plymouth Marine Laboratory who led the analysis intend to develop the key findings into a peer-reviewed publication during Y3.

Output 2. *Quantitative relationships between key habitats/species and climate variables established to allow greater detail on predicted impact of climate change on biodiversity.*

Although the majority of deliverables for Output 2 are not due to be completed until Y3, significant progress has already been made in several key areas. The thermal response curve linking temperature and offspring sex ratio in Ascension Island green turtles has now been robustly modelled, incorporating data collated in Y1 (**Output 2.1; Annex 3.1**). Digital elevation models (DEMs) of Ascension's turtle nesting beaches (created ahead of schedule in Y1) have also been further refined and overlaid with green turtle nesting locations which will enable quantitative assessments of habitat loss under different projections of sea level rise (**Output 2.2**). Although the raw datasets used in both of these outputs were available prior to the project, analyses were at a preliminary stage. Through soil moisture monitoring, we now have a detailed understanding of the hydrological constraints on the survival of the endemic Ascension spurge, which was lacking prior to the project (see Project Website). We already have enough information to develop a basic model of how surface moisture in spurge habitats will respond to future changes in rainfall patterns. Our ability to make quantitative predictions regarding the impact of these changes on spurge recruitment will depend largely on experimental work planned for Y3 (see Activity 1.1). This work has been delayed several times due to COVID-related travel issues, but we have developed a contingency plan using laboratory analysis of *ex situ* plants to ensure that this output is partially achieved, even if planned fieldwork by INRA cannot be arranged. Progress on some activities contributing to this Output (e.g. Activity 2.4) stalled in Y2 due to a change in employment status of the Project Manager (see Section 9). However, a full time replacement has been appointed and we remain confident that the necessary analyses can be completed by the end of Y3. Given these staff changes, it may not be possible to publish all research findings in the peer-reviewed literature by the end of the project, as originally proposed, but pre-publication results will be made available to AIG in the form technical reports and draft manuscripts.

Output 3. *Evidence-based adaptation actions trialled and those demonstrated to be successful are implemented through core AIGCFD workplans*

Significant progress has been made on this output during Y2 following COVID-related delays in Y1 caused by disruptions to shipping and international travel. Experimental nest shading trials aimed at reducing temperatures in clutches have been initiated on two of Ascension's principle green turtle nesting beaches (**Annex 3.2**). Data from the trials will be analyzed by the University of Exeter team to assess the impact that shading has on incubation temperatures, hatching success and sex ratios. Low-maintenance irrigation systems have also been established at key endemic plant sites in Green Mountain national park and monitoring initiated to assess how vegetation communities respond (**Annex 3.3**). The time required for differences to emerge as a result of irrigation is likely to be considerable, but work undertaken to date has provided proof of concept and monitoring of the benefits for native and endemic flora has been initiated. Despite a few initial technical problems, we now have healthy Ascension spurge populations growing and seeding well at two novel locations, representing a rare test of "assisted migration" as a climate change mitigation tool (**Annex 3.4**). Simply achieving this phase is a major milestone, given the historical difficulties in reintroducing spurge plants to the wild. However, our measure of success will ultimately be based on the recruitment of new seedlings from the seedbank, and survival of the recruits without human intervention. Monitoring of the number and size of recruits will occur on a 6-monthly basis and, given seasonal recruitment, may take 1-2 years to before success can be adequately evaluated. The use of these trials will help to assess suitable approaches to roll-out on a larger scale in the longer term.

Output 4. *Results of project and knowledge gained are widely shared to galvanise action on Ascension and encourage similar projects on other OTs and small islands*

3.3 Progress towards the project Outcome

Progress towards the intended outcome of informing and empowering Ascension's response to climate change is broadly on track at this midpoint in the project and we remain confident that it can be achieved by the end of the funding period. We have completed the first long-term climate change projection for Ascension's marine environment (**Annex 5**) and are close to completing a similar exercise for the terrestrial environment (**Annex 4**; Project Website), both of which are essential for preparing evidence-based impact assessments. Continued progress has also been made with predicting and mitigating the impacts of climate change for a range of Biodiversity Action Plan priority species, including green turtles and *E. origanoides* (see **Annex 3** & project website). Quantifiable measures of the threat posed by climate change and the effectiveness of available adaptation measures were lacking previously and are necessary to guide responses. The indicators proposed for monitoring progress against the intended Outcome are based on inclusion of final projections and management recommendations in relevant strategies, action plans and policy presentations, which makes it hard to directly measure progress at this stage. Nevertheless, the Output level indicators are adequate for monitoring the progress of individual workstreams that will ultimately contribute to this Outcome.

3.4 Monitoring of assumptions

Assumption 1: There is sufficient existing and available data to input into models

Comments: This assumption has largely held, with the exception of Activity 1.2 (mapping of climatic zones). As detailed in Section 3.1, the spatial coverage of available meteorological data for Ascension Island has proven to be too limited to comprehensively map fine-scale climatic variation. We are therefore exploring alternative outputs that make use of the available data. In addition, monitoring has identified a number of data gaps relating to thermal variation among nesting beaches on Ascension Island which will affect our ability to generate island-wide projections for green turtle reproductive output. Work is now underway to collect the necessary data within the current turtle nesting season.

Assumption 2: Observed relationships between climate variables and biological indicators are sufficiently robust to allow meaningful predictions

Comments: In the case of green turtles, the modelled relationship between temperature and sex ratio is robust and suitable for generating long-term predictions (**Annex 3.1**). Analyses for other biological indicators are at an earlier stage and more data is needed to evaluate this assumption. Thus far, data on soil moisture seems to broadly agree with observed patterns in the condition of Ascension Island spurge: sub-populations that are performing badly are located in areas where the soil is dry for the longest part of the year. However, we need more data on the physiology of the plants in order predict how future rainfall regimes will affect survival rates.

Assumption 3. At least some potential adaptation actions are shown to be effective and deliverable within available resources

Comments: Although a range of climate change adaptation trials have been initiated during Y2, these are generally at too early a stage to assess their effectiveness. We have been able to demonstrate that the artificial irrigation infrastructure works, but it is not yet possible to tell whether these initiatives will be effective at improving the survival of endemic plant populations because it will take some time for healthy communities to develop. Similarly, while nest shading trials have established that it is possible to maintain shaded exclosures on key nesting beaches, we do not yet have data with which to evaluate the conservation benefits of this practice.

Assumption 4. Outputs from the models and adaptation trials are sufficiently robust to warrant public interest

Comments: Most public engagement and outreach activities are planned for Y3 of the project so it is currently too early to test this assumption. However, participation in a public climate change meeting held in Y2 (ca. 40 people) was above average for Ascension Island, demonstrating that there is local interest in learning more about this global issue.

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

The project is still at too early a stage to demonstrate clear, positive outcomes for biodiversity on Ascension Island. Nevertheless, sustained progress has been made in Y2 towards the intended impact of "demonstrating leadership in tackling climate change by treating it as a current, quantifiable pressure". As a result of work already completed, Ascension is perhaps the first UKOT to have access to detailed, locally-specific climate projections spanning both the marine and terrestrial environments, which is critical for predicting long-term outcomes for biodiversity. We are closer to understanding how rainfall and soil moisture regimes constrain the population dynamics of the critically-endangered Ascension Island spurge, and have developed quantitative models to describe how temperature affects green turtle sex ratios. Through experimental shading, irrigation and assisted migration trials initiated in Year 2 we are also actively testing a range of management options for mitigating the effects of climate change on these species. These outputs will help to inform future management on Ascension Island and contribute directly towards commitments under the United Nations Framework Convention on Climate Change, including 4.1e ("Cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management…") and 4.1f ("Take climate change considerations into account in … social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally").

5. OPTIONAL: Consideration of gender equality issues

The project does not raise or address any specific gender equality issues.

6. Monitoring and evaluation

The M&E plan remains unchanged from Y1, involving at least quarterly meetings between project partners to monitor progress, identify risks and adapt accordingly. The COVID-19 pandemic has continued to disrupt planned fieldwork by overseas partners, but this risk was anticipated and several proactive steps have been taken to ensure that planned activities can continue in Y2 (Section 11). A number of non-COVID related adaptations were also introduced as a result of M&E in Y2. Continuous evaluation of soil moisture monitoring data from Activity 1.2 informed a decision to abandon artificial shading of endemic plant populations and invest more effort and project resource into assisted migration trials that stand a greater chance of success. A review of meteorological data collected for Activity 1.1 also highlighted deficiencies that will prevent us achieving Activity 1.2 (fine-scale climate mapping) in the way that was originally planned. Project partners are currently working to develop contingency plans that will generate useful outputs using the available data. M&E during Y2 has again primarily focussed on monitoring progress against individual Outputs, as the contribution of each of these to achieving the overall Outcome is explicit in the project design. In accordance with the project logframe, progress has been monitored by sharing preliminary results of individual activities between partners and, where appropriate, uploading these to the Project website. The first peer-reviewed publications and final technical reports from Output 1 are also now available and provide the primary means of verification that this output is close to being fully achieved.

7. Lessons learnt

Many of the technical lessons that the project stands to learn await the completion of climate change impact modelling and mitigation trials in Y3. Nevertheless, with several final outputs from Output 1 now available, two broad conclusions can be made. Firstly, the engagement of specialist consultants to deliver specific work packages has continued to be a productive model in Y2. The consultants employed have worked efficiently to deliver Ascension-specific climate change forecasts on time and in accordance with

the agreed terms of reference. However, it is also clear that the information presented in consultancy reports and publications is currently too complex for consumption by policy makers and the wider public on Ascension, which will limit their impact. As other research outputs approach completion during Y3 we will be working to distil the key points from each work package into more accessible forms (e.g. infographics and animations) for dissemination locally.

From a project management perspective, adaptations to continuing COVID-related travel disruption have also helped to reinforce that, while site visits by overseas partners are desirable, considerable progress can nevertheless be achieved through remote collaborations (see Section 11). In the case of turtle work, this has largely been possible thanks to the conservation internship program, which has provided the local capacity needed to implement the work, combined with remote support from partners who already have extensive site knowledge. Future projects could look to capitalise further on remote collaborations between overseas technical experts – who possess specialist knowledge but are often time limited – and interns who are looking to gain career-relevant experience and are able to commit to longer periods of fieldwork.

Are complex, even with executive summaries, and we are working on inforgraphics for public consumption during Y1. Necessary to achieve high level

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

Q1. *Can the project leader provide further information on how they envisage the project results to be maintained, used and updated beyond the project duration.*

See Section 9.

Q2*. As the project is moving into Y2 and can showcase more robust results, broader lessons learned from the project should be identified and communicated so as other UKOTs and Darwin projects with a similar focus can benefit from these learnings.*

See Section 6.

Q3. *It will be important to closely track further impacts of international travel restrictions to the project schedule in Years 2 and 3. Could the Project Leader comment on mitigation strategies in case international travel cannot resume well into Y2? Are virtual consultations/meetings possible to replace some of the fieldwork?*

The risk of further COVID-related travel disruptions was carefully considered in Year 2 planning and a number of mitigation strategies have been developed which will allow us to achieve most of our planned activities over the remainder of the project (see Section 11). We are still hopeful that a site visit by our partners at INRA can be arranged during Y3, but we have found a partial solution that will allow them to complete some of their work remotely.

9. Other comments on progress not covered elsewhere

As briefly outlined in Section 3, the project experienced some unavoidable setbacks in Y2 due to the change in employment status of the Project Manager, Dr Sam Weber, based at the University of Exeter. In October 2021 (Y2Q3), Dr Weber was appointed to a permanent teaching position at the University and was forced to relinquish some of his responsibilities on this project. The Darwin Secretariat were notified of the change and approved the appointment of a replacement, although recruitment delays due to a lack of suitable applicants in the first round meant that his successor was not in post until March 2022 (Y2Q4). Dr Weber's replacement, Dr Liliana Colman, has worked extensively on marine turtles in the South Atlantic and will assume responsibility for analyses of turtle and seabird data. Unspent salary transferred from Y2 will allow Dr Poggio-Colman to be employed at a higher percentage FTE for the remainder project, helping to make up for the delays encountered. Dr Weber will also

continue to offer his time in kind to contribute to academic supervision, project management and reporting.

10. Sustainability and legacy

The Project's overall exit strategy of enabling sustained and well-informed action on climate change remains valid and achievable. Although it is still too early to demonstrate lasting impacts on policy and management, a number of important steps have been taken towards this goal. During Year 2, three different climate change adaptation trials have been initiated for endemic flora and sea turtles which will directly inform future management for these species. The project has also contributed critical datasets that can continue to be updated and used to monitor the progress and impacts of climate change. Long-term temperature and precipitation time series for Ascension Island recently published in the *International Journal of Climatology* (Activity 1.1) have been made freely available online https://www.uea.ac.uk/web/groups-and-centres/climatic-research-unit/data and will be periodically updated with new daily data collected by the UK Meteorological Office on Ascension Island. All model outputs summarised in the *Marine Climate Change Assessment* report (**Annex 5**) have also been transferred to Ascension Island Government and will be made available online once the results are accepted for publication in the peer-reviewed literature. The data files contain annual projections for a suite of ocean biophysical variables over the period 2015-2100 under 4 different emission scenarios, along with more spatially- and temporally-resolved forecasts for the 2040-2050 time slice. These projections can be used as inputs to downstream analyses seeking to understand how future climate change will impact a range of marine species and processes at Ascension Island and in the tropical Atlantic more widely. During Year 3, increasing emphasis will be placed on assimilating key findings into policy recommendations and management plans to help consolidate the legacy of the project.

11. Darwin identity

Darwin Initiative funding was acknowledged in the recently-published paper in the International Journal of Climatology (https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.7314) and on the cover page of the Ascension Island Marine Climate Change Assessment report. The Darwin logo also continues to be displayed prominently on the landing page of the project website (www.ascension-climate.org).

12. Impact of COVID-19 on project delivery

The COVID-19 pandemic has continued to impact project activities in two principle ways: postponement or cancellation of site visits by overseas partners and delays in delivery of equipment and materials due to shipping and supply chain disruptions. Although international travel has gradually normalized over the past year, Ascension Island has maintained a risk-averse policy with a view to protecting its limited healthcare provision. Quarantine periods have remained at 7 days and scheduled civilian flights via South Africa have only recently resumed, having previously been replaced by an irregular charter service. Combined with long-running access issues caused by continuing repairs to the Island's runway, minimum layovers on Ascension are currently 5-6 weeks which international partners have been unable to commit to. Fortunately, the risk of further disruption was anticipated in Y2 planning and we have taken a number of steps to minimize impacts on project activities. Green turtle nest shading experiments postponed from Y1 have now been initiated with remote support from partners at the University of Exeter and additional capacity recruited through AIG's Conservation Internship Programme. Conservation interns built the shade exclosures and have been relocating nests to the experimental plots using protocols reviewed and designed by UoE researchers. Once the experiments are completed, data will be sent to the UoE team for analysis. A remote solution to delayed fieldwork by INRA has also been developed involving laboratory measurements of plants grown from seed at a facility in France close to the INRA offices. Although this only represents a partial solution, it will ensure that some experimental data can be collected even if a site visit by the INRA team proves unworkable.

13. Safeguarding

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

No safeguarding issues or changes in the safeguarding policies of the lead and partner organisations have arisen in the past year of the project. All project team members have updated any mandatory safeguarding training as required by their employers.

14. Project expenditure

Table 1: Project expenditure <u>during the reporting period</u> (1 April 2021 – 31 March 2022)

Project spend (indicative) in this financial year	2021/22 D+ Grant (£)	2021/22 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs	[redacted]	[redacted]	[redacted]	The Project Manager role was gapped for a period following Sam Weber taking up a new role. This resulted in lower staff costs from University of Exeter.
Consultancy costs	[redacted]	[redacted]	[redacted]	The plant consult based on Ascension was engaged for extra hours while the project manager role was gapped. This need only became apparent after the change request deadline and we endeavoured to maintain within the 10% viring limit.
Overhead Costs	[redacted]	[redacted]	[redacted]	The Project Manager role was gapped for a period following Sam Weber taking up a new role. This resulted in lower overhead costs from University of Exeter.
Travel and subsistence	[redacted]	[redacted]	[redacted]	Due to Covid University of Exeter partners had to cancel a planned visit to Ascension in early 2022.
Operating Costs	[redacted]	[redacted]	[redacted]	
Capital items	[redacted]	[redacted]	[redacted]	An order was placed but only partially fulfilled due to stock shortages. This led to an unexpected underspend in this financial year.
Others (Consumables)	[redacted]	[redacted]	[redacted]	
TOTAL	[redacted]	[redacted]		

Checklist for submission

	Check
Different reporting templates have different questions, and it is important you use the correct one. Have you checked you have used the **correct template** (checking fund, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	X
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	X
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	
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.	X
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	X
Have you completed the Project Expenditure table fully?	X
Do not include claim forms or other communications with this report.	