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## Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

**Important note** - to be completed with reference to the Reporting Guidance Notes for Project Leaders: it is expected that this report will be about 10 pages in length, excluding annexes

**Submission Deadline: 30 April**

### Darwin Plus Project Information

Project Ref Number	DPLUS016
Project Title	Caicos pine forests: mitigation for climate change and invasive species
Territory	Turks and Caicos Islands
Contract Holder Institution	Royal Botanic Gardens Kew
Partner Institutions	Department of Environment and Maritime Affairs (DEMA)
Grant Value	£199,693
Start/end date of project	April 2014/March 2016
Reporting period (e.g., Apr 2015-Mar 2016) and number (e.g., AR 1,2)	Apr 2014-Mar 2015, AR1
Project Leader	Martin Hamilton
Project website	<a href="http://www.kew.org/science-conservation/research-data/science-directory/projects/turks-and-caicos-islands-pine-recovery">http://www.kew.org/science-conservation/research-data/science-directory/projects/turks-and-caicos-islands-pine-recovery</a>
Report author and date	Martin Hamilton & Michele Sanchez, 28 April 2015 (input provided from all Kew staff and DEMA project manager)

### 1. Project Overview

The Caicos pine is a keystone species of the pine forest ecosystem in the Turks and Caicos Islands (TCI), and also the National Tree. It is native to the Caribbean, occurring only on three islands of the Caicos bank (Figure 2) and on four islands in the Bahamas (Figure 1). The species is listed as Vulnerable on the IUCN Red List due to development pressure, climate change and attack by the pine tortoise scale insect, *Toumeyella parvicornis*, which is an invasive, exotic, pine-specific scale insect. Pine populations in the Caicos bank are small and highly threatened by the scale insect infestation, which has reduced the mature pine population numbers by c.90% in the past 10 years. Predicted climate change and sea-level rise in these low-lying islands will reduce suitable habitat and reduce available fresh water leading to stressed pine trees that are more susceptible to pest and disease attacks in the future.

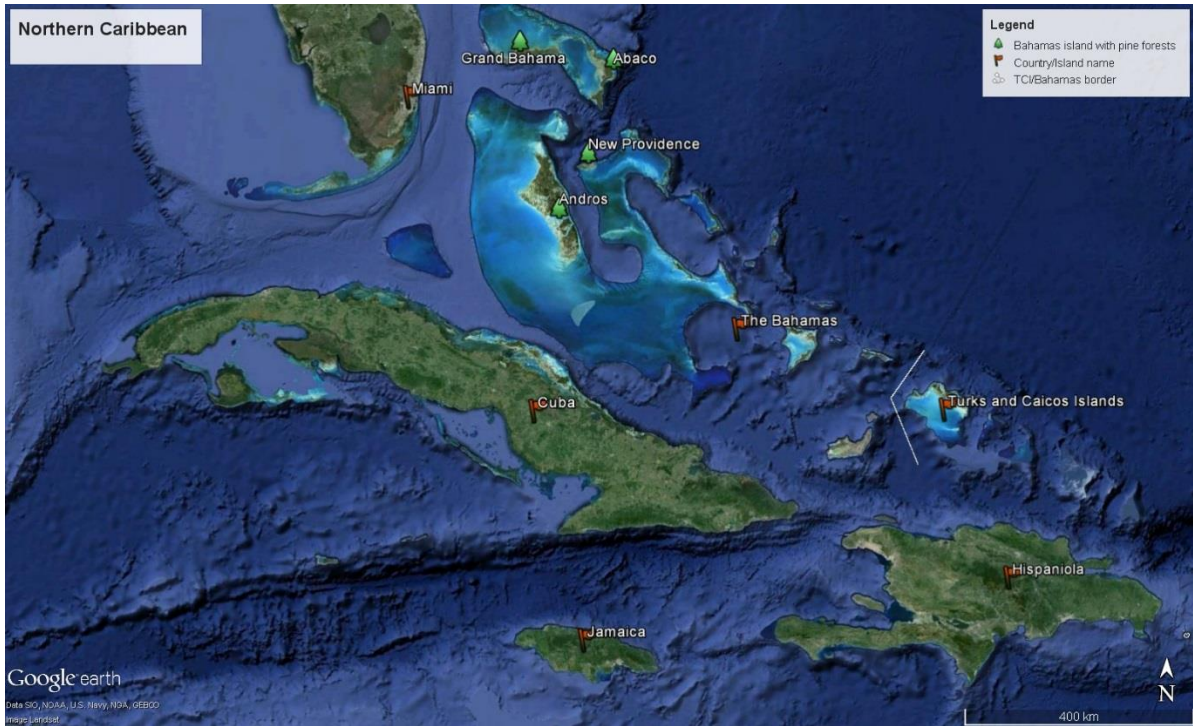


Figure 1: Northern Caribbean regional map showing Bahamas islands with pine forests

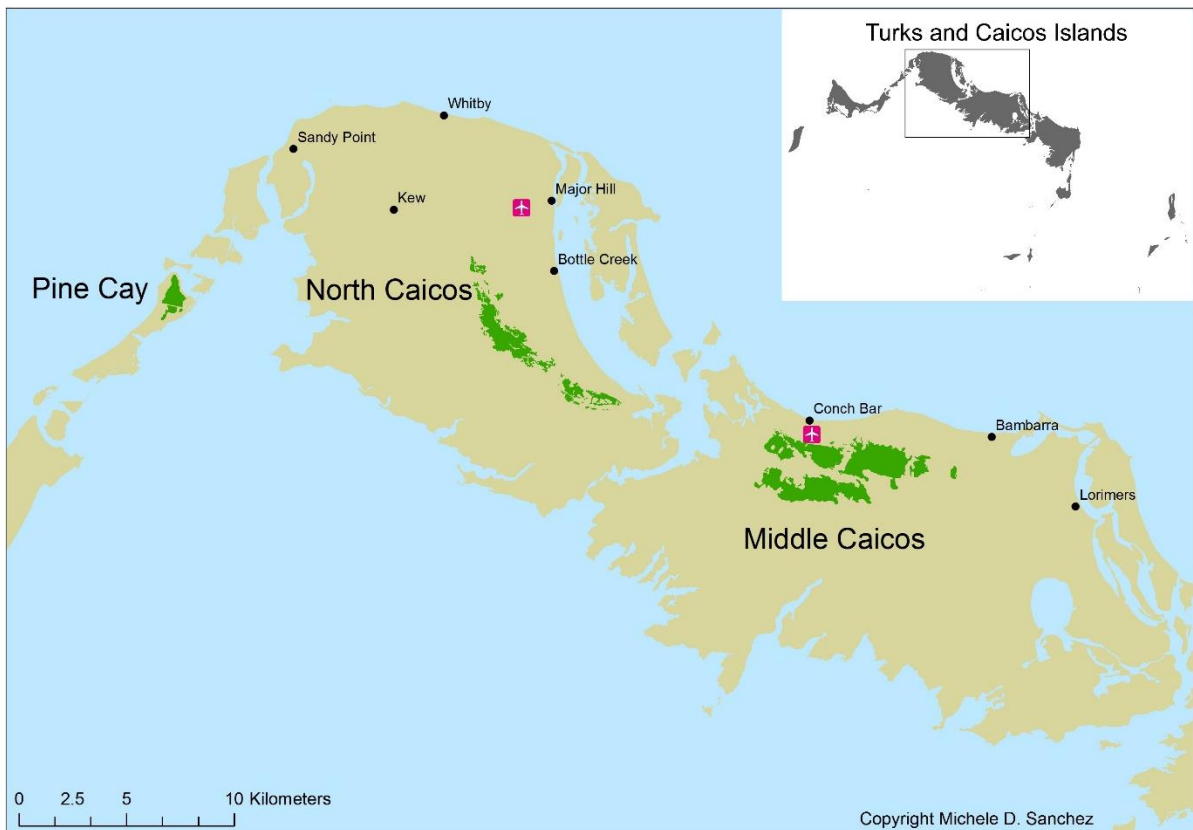


Figure 2. Turks and Caicos Islands map showing Caicos bank pine forests (in dark green)

Without urgent action, this species – TCI’s national tree – may disappear from the islands, degrading the ecosystem’s hydrology and vegetation structure. This loss would threaten biodiversity, impact ecosystem services and undermine TCI’s growing green economy.

Restoring the Caicos pine forests is a complex challenge which requires an in-depth knowledge of the habitat; the genetic diversity of extant trees and conservation collections; the role of mycorrhizal fungi and plant chemistry; and a healthy and genetically representative collection of live trees and seeds. A team of experts from the Royal Botanic Gardens Kew (Kew) in genetics, mycology, restoration ecology, chemical interactions, seed physiology and horticulture combined efforts with TCI Department of Environment and Maritime Affairs (DEMA) through this project to strengthen local capacity and develop a scientifically underpinned emergency restoration protocol to guide the management and restoration needed to save the Caicos pine forests, enhancing the species resilience to invasive species and climate change. This protocol forms a tangible outcome enabling the TCI government to deliver long-term conservation of Caicos pine forests in the face of climate change – a strategic priority of DEMA.

Restoring the pine forests will have positive impacts on many other native and endemic species that are found in TCI. The project will contribute to commitments of the UK and TCI to strengthen capacity to restore key habitats and ensure the protection of key species, promoting a better co-operation and use of UK expertise.

## **2. Project Progress**

### **2.1 Progress in carrying out project activities**

The main project activities are progressing well and as scheduled. Scientific research on the Caicos pine is being carried out (output 1), the *ex-situ* collection of pine trees is being extended in TCI and in Kew's Millennium Seed Bank (MSB) in the UK (output 2), local DEMA staff are being trained on many techniques (output 3) and initial steps took place for the restoration strategy (output 4) including data collection for the population viability analysis (PVA).

Successful field trips to TCI in May and November 2014 (3 weeks each) by project researchers enabled the experimental design to be tested and implemented and a large part of the samples collected for genetic (248 samples), mycological (188), chemical (81) and ecological/PVA (142) analyses (outputs 1.1 and 1.2). Samples have been processed and are being analysed at Kew with initial lists of genotypes, mycorrhizal fungi species and chemical compounds being produced (outputs 1.3, 1.4 and 1.5). Data required for producing the protocols are being collated as they become available (output 1.6). Standards for data collection and monitoring were developed, tested, refined and agreed with partners (outputs 4.1 and 4.2) during the joint field exercises.

Key DEMA staff, i.e. local project manager and *ex-situ* nursery officer, participated in all field activities and were trained by team researchers in scientific sampling and monitoring techniques to form the basis of the protocols and tree health monitoring programme, e.g. ectomycorrhizal fungi and pine DNA sampling, extraction of chemical volatiles and testing the effect of chemical compounds on the scale insect as well as monitoring ecological and environmental parameters (outputs 3.1 and 3.2). Evidence of the success of the capacity building are the samples returned to Kew for analysis (see above) following the field trips and training.

Reports on field activities and outcomes were produced following each field trip to TCI and shared with the project team and partners (output 3.3). The second fieldtrip of year 1 in November allowed the consolidation and assessment of learnt techniques and feedback from project partners (output 3.3). Field visits and quarterly meetings with UK and TCI based project team members were crucial to assess, review and endorse progress on local capacity building towards pine forest management (outputs 3.3 and 3.4) and also to ensure planning and implementation of planned activities. Evidence of the success of the capacity building and development of protocols are the new accessions growing in the nursery and seed stored at the MSB (see below and 2.3 below).

A large collection of Caicos pine seeds was secured in Quarter 3 by DEMA project staff and is now banked at the Millennium Seedbank (MSB) in the UK (outputs 2.1 and 2.2), allowing the start of the seed longevity study at the MSB which is part of the seed collection and restoration protocol (output 4). DEMA staff sowed 1200 Caicos pine seeds at TCI project nursery resulting in a fourfold increase of the *ex-situ* collection (output 2.3). New plants have been accessioned (see 2.3 below), data recorded and incorporated into the Kew's Species and Specimens Database along with all data from field collections and monitoring plots (output 2.4).

## **2.2 Project support to environmental and/or climate outcomes in the UKOT's**

Our main project partner in TCI, the Department of Environment and Maritime Affairs has been fully engaged with the project throughout and ministerial support for the project has been provided as necessary to ensure successful delivery. Two key DEMA staff, i.e. local project manager and nursery officer, have participated in all field activities and received training in several techniques applied to pine forest management, e.g. monitoring pine tree health, recording environmental/ecological data, removing broadleaf competitors and using prescribed fire to promote pine regeneration. They have secured a large pine seed collection from two of the islands, now safely banked at the MSB in the UK, and are successfully growing pine trees in the local project nursery. These activities are key for the long-term management and restoration of the threatened Caicos pine forests. Besides the active management of a growing conservation collection in the TCI nursery (discussed in 2.1 above), further evidence for the success of the project so far can be seen in the development of a 650 acre 'Core Conservation Area' on Middle Caicos that has effective fire breaks in place along three sides.

Besides capacity building, new scientific data on the Caicos pine and the pine forests in TCI have been shared with DEMA through field reports and meetings and are being consolidated into protocols for the restoration strategy for the pine forests in TCI going forward. All data generated through the project in year 1 will be shared with DEMA during the first trip of year 2 for inclusion in the TCI National GIS to assist local environmental management.

## **2.3 Progress towards project outputs**

The project outputs for year 1 have been achieved on time and on budget and we are not anticipating major problems to deliver the outputs for year 2 and the final outcome.

Two successful field visits to TCI in year 1 enabled the project team to collect samples and start analyses to deliver the scientific basis for the restoration of Caicos pine (output 1).

A 'Core Conservation Area' (discussed in 2.2 above) has been identified on Middle Caicos and scientific research in the area is on-going (output 1, a). New natural regeneration in this area of pine forest is genetically diverse (having 50% of all alleles) and trees are showing some resilience to the scale insect; increasing the chances of forest recovery in the future. DNA samples for the *ex-situ* collection have been extracted and are being analysed, so far showing genetic diversity (output 1, b and 2, c). Genotypes are being identified and will guide future re-introduction or seed collection from these trees. The main ectomycorrhizal fungi associated with pines has been identified as *Rhizopogon* sp. and fungi fruiting bodies were collected and extracted for ID (output 1, d). The presence of ectomycorrhizal fungi associated with other plants, i.e. *Diplocystis* fungi associated to *Coccoloba* sp., in the habitat indicate that areas currently without pines could be targets for successful future re-introduction, but more data is being collected to confirm this hypothesis. Five main chemical compounds have been identified from healthy and unhealthy trees and are showing differences in concentrations for both groups (output 1, c). Tests are on-going to find which chemicals are repelling the insects and helping tree's resilience to pests. Several

experiments were set up to obtain data for the PVA, including seed predation/germination/dormancy, and data collected on water stress, Nitrogen content, seed production, reproductive potential and environmental variables (output 1, e). Preliminary analysis of results does not suggest that tree size (height and DBH) is related to scale infestation rate or that scale infestation has a direct effect on tree (water) stress; but there is an overall gradient of differential water stress between islands, with trees on Middle Caicos being the most stressed and those on North Caicos the least stressed.

The *ex-situ* collection in TCI has been expanded from 100 to 461 trees and a pine seed orchard with 101 trees is now established (output 2, b). After initial training on horticultural techniques by Kew staff (output 3, a), DEMA nursery officer has been able to improve quality and quantity of the collections and run the nursery more efficiently. The ability to produce healthy pines locally is key for the implementation of the restoration strategy. DEMA staff members have also made a large collection of seeds in year one and increased the number of collections banked at the MSB from 3 to 8, considerably closer to the target of 12 collections by the end of the project (output 2, a).

Two key DEMA project staff, i.e. local project manager and nursery officer, have been trained in scientific collection, horticultural techniques and use of power tools for pine forest management including opening fire breaks and reducing competition for pine regeneration (output 3, a). The same staff members have also been trained in monitoring the health of wild and re-introduced trees (output 3, b). This training has enabled the successful establishment of a seed orchard on North Caicos and high survivorship (>95%) of out-planted trees.

Methods and protocols were trialled in the field in year 1 with the assistance and input from key DEMA staff, before being refined and agreed. Collation of data and writing of protocols started (output 4, a to e) on time.

## **2.4 Progress towards the project outcome**

The key outcome of this project is to provide the basis for managing and restoring the Caicos pine forests and building future resilience to climate change and invasive species through a scientifically underpinned 'Restoration Strategy'. The project started well and outputs set out for year 1 have been achieved on time and within allocated budget (see 2.1 above and Appendix 1). Scientific research is well advanced, protocols are being developed with the partners, *ex-situ* collections have increased significantly (see 4.3 above) and key DEMA staff trained, indicating that the outcome will be achieved by the end of the project.

Two successful field visits to TCI with the participation of 7 members of the Kew research team and 2 TCI DEMA staff were paramount in moving the research and protocol elements of the project forward and delivering planned outputs. Standards for collecting and monitoring were developed, tested and refined with input from DEMA staff and along with scientific data collected and analysed are being collated to produce the respective protocols that will be the core of the restoration strategy.

Active monitoring of the pine forests in year 1 has identified an important area for the future management and restoration of the Caicos pine in TCI. This 'Core Conservation Area' on Middle Caicos has many healthy pine trees, both mature and immature, showing some resilience to the scale insect. The basis of pine tree resilience in this area to the scale insect infestation is now being studied (genetic, symbiotic, ecological) by the team and findings could prove essential to guide the protocols and future strategy.

Another key element for the implementation of the Restoration Strategy is the ability to grow new Caicos pine trees locally for restoration and to safeguard the genetic pool for the species through *ex-situ* collections. This element had a very good start with the expansion of the *ex-situ* collection from 100 to >400 trees achieved by the local nursery officer and project

manager (DEMA staff), after their initial training by Kew staff on nursery standards, seed sowing techniques and pest control. As a direct result of project staff monitoring the pine population and taking decisions on when and where to collect, a large seed collection was secured and is now safely banked at Kew's MSB.

Specialised and targeted training delivered by Kew experts to the local nursery officer and project manager enabled the DEMA staff to maximise results, build confidence to promptly and effectively take necessary actions in the nursery and managed areas as well as creating a basis for the future local restoration strategy implementation.

## **2.5 Monitoring of risks**

A few issues with minor impacts have arisen in year one. A hurricane and subsequent flooding as well as a project vehicle maintenance issue limited local activities for several weeks; however, the project team have been able to deal with these impediments and there are no notable problems that we feel will have a lasting impact on the project budget or delivery of project activities.

Risks assessed at the beginning of the project still hold true, but some have been minimised through pro-active risk management. Fire breaks have been cleared around healthy groups of pine trees in Middle Caicos pine yard and Pine Cay Crown Land and a prescribed fire has been done in 2 acres of an area containing healthy pine trees identified as the 'Core Conservation Area' to promote regeneration and reduce risks of devastating unplanned fires in the area. Pine seed has been collected and trees with new cones are being monitored and geo-referenced for future seed collection.

A new risk has been identified after the re-structure of the Science Department at Kew with the dissolution of the Restoration Ecology Unit having a negative impact on the delivery dates for the Population Viability Analysis (PVA) and Restoration Protocol. This risk is being mitigated by moving the delivery of the PVA results and restoration data for the protocols to Q2 instead of Q3. This will be closely monitored by the PI and senior management at Kew will be kept apprised of the situation to minimise any risks associated with project delivery.

## **3. Project Stakeholders**

The main project partner is the TCI Department of Environment and Maritime Affairs (DEMA) with whom Kew has a long-standing working relationship and detailed Memorandum of Collaboration. DEMA has been fully involved in delivering the project outcomes through local project management including continued liaison with local community, field support for visiting researchers, supervision of nursery officer and collection of data and samples following required training. The existing nursery officer for the *ex-situ* pine collection in TCI (DEMA funded) has been responsible for the daily management of the nursery and was able to increase the number of trees and their health condition in this first year of the project (see 2.3 above). New seedlings were produced and larger trees planted out in the seed orchard on North Caicos or in the restoration plots on Pine Cay with high survivorship (discussed previously). The local project manager has taken the lead in organising a workshop for schools and the prescribed fire workshop, as well as sorting out necessary permits and logistics for fieldtrips. He has been actively engaged in providing feedback and helping Kew experts to set out and refine sampling and data collection and monitoring standards, helped to source equipment needed and has been very creative and effective in getting community support for the project.

The Pine Cay Homeowners Association (PCHA) and the Meridian Club on Pine Cay have been key partners providing free transport and local logistics on the island of Pine Cay. They were fully supportive and accommodating during field visits in the first year, including providing accommodation at the Meridian Club so researchers could do water stress

measurements before dawn and offering transport during the off-season so that a large seed collection could be secured by DEMA staff.

Local communities on North and Middle Caicos have been supportive throughout and are updated by visiting researchers and DEMA on a regular basis through community meetings, interviews with local press and school visits. Positive feedback and support from the community, other DEMA staff and TCI's Governor's office was received in person during workshops and local visits or through Twitter.

The US Forest Service has provided prescribed fire training and fire management support in year one, issuing 'basic wildland fire' certificates to four members of DEMA staff. They have also produced a detailed report on the restoration of fire into the Caicos pine yards which is a main element for the Caicos pine forest management.

Other local stakeholders involved include TCI Department of Environmental Health (DEH), TCI Tourist Board, TCI Department of Education, and TCI Fire Department. There has been little interaction with these stakeholders in year one, except the latter which has been involved during the prescribed fire activities. More interaction and feedback from these stakeholders will be sought in year 2 through meetings before and during the implementation of the restoration strategy.

#### **4. Monitoring and evaluation**

Project progress towards outcome was monitored through the project work plan and an annual work plan that was developed in consultation with DEMA at the beginning of the project. Reports generated following field visits and prior to quarterly meetings by Kew and TCI team members provided were measured against the assumptions identified in the work plans and assessed by the project steering committee (specifically staff from DEMA and Kew). Any required updates or changes to the work plan were agreed by the committee at quarterly meetings.

The project leader, project co-ordinator and TCI project manager have been in regular contact with the rest of the team and partners throughout the year to prompt actions or make sure that key elements of the project were delivered on schedule and on budget; being also responsible for logistics and finance. Reported progress on the several areas by the team were compared against the respective baseline information gathered in the beginning of the project (initial situation of the *ex-situ* conservation efforts, genetic variation in the Bahamas archipelago, known mycological associations in the region, existing chemical compounds found in pines and restoration principles for limestone forest ecosystems) to ensure the project was delivering successfully against the outputs.

The evaluation of progress towards the outcome was done through the completion of the main activities and outputs for year one set out in the project (see 2.1 and 2.3 above). This will ensure that scientific data, living plants, seed stock as well as adequate and relevant staff training are in place for the production of the protocols and delivery of the Restoration Strategy by the end of the project.

#### **5. Lessons learnt**

Overall the project has gone smoothly, especially considering the impact of hurricanes and flooding in TCI as well as the complete restructuring of the Science Department at Kew. These issues were well outside the control of the project team but were handled well to ensure that the project moved forward successfully. We secured matched funding from the John Ellerman Foundation that has enabled a considerable amount of additional activities reported in Appendix 2. This funding has been a huge help and enabled the project to do many activities, but has also brought considerable additional administration responsibilities

and practical challenges that were not originally planned. This has meant that the PI, Project Coordinator and TCI Project manager have had to commit a considerable amount of additional time to deliver these activities. For the second year, the PI has agreed additional time with senior management to address these activities and has identified key periods for project administration to be undertaken.

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

N/A

## **7. Other comments on progress not covered elsewhere**

There have been other achievements in pine forest management, community engagement and outreach which are complementary to the project through matched funding from the John Ellerman Foundation and work towards the same goals. These are reported in Appendix 2.

## **8. Sustainability**

The project has enabled further community engagement and outreach through a workshop organised on North Caicos by the Kew/DEMA team for the International Day for Biological Diversity in May 2014. The aim of the workshop was to highlight the need to conserve and restore the Caicos pine forests and demonstrate scientific techniques being used to gather data to enable this action. Media (Radio show) and Twitter has also been used to provide a more dynamic interaction with the community and enabling the project to reach other government officials, i.e. Governor's office, in real-time.

We think that the engagement and support of the local government and communities to the project is paramount for the long-term success of the restoration strategy. Therefore, activities in year two will focus on enhancing our engagement with the community and local authorities in the project. The ecological and potentially economical legacy of the project will be highlighted through meetings and pine forest visits we have planned. The main exit strategy is still valid and focused on the participation and agreement of the Restoration Strategy with DEMA and other relevant TCI authorities.

## **9. Darwin Identity**

The Darwin logo has been used extensively. It was specifically used for posters/interpretation panels produced and displayed at the National Environmental Centre on Providenciales and in the three TCI pine yards. The panels and our public presentations have all included details about Darwin Plus funding and the official project name was mentioned. Several articles about the project were written for TCI (Island Life and Times, Times of the Island) and UK magazines (Kew Magazine Autumn 2014, pg24) with the funding from Darwin Plus acknowledged. Other publicity included a blog about the project on the Kew website, an article for the Darwin Initiative Newsletter and active reporting of activities through Twitter (#KewTCI, @BNaqqi, @KewUKOTS). The project was also publicised through a talk at Kew as part of the Brown Bag Seminar Series and a poster presentation at the Pine Rockland Working Group Symposium in Miami, Florida, USA. Please see Appendix 2 for detailed information and links.

The Darwin Initiative support is recognised as part of the overarching 'Caicos Pine Recovery Project', which is a long-term collaboration between Kew and TCI to save the Caicos pine. However, the Darwin Plus project has very specific objectives that sits inside the main umbrella project and is always formally recognised as such.



## 10. Project Expenditure

**Table 1 Project expenditure during the reporting period (1 April 2014 – 31 March 2015)**

Project spend (indicative) in this financial year	2014/15 Grant (£)	2014/15 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others (Please specify)				Changes in equipment & consumable costs
<b>TOTAL</b>	96,166	96,178		

## 11. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes

I agree for the Darwin Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here)

The Darwin Plus project “Caicos pine forests: mitigation for climate change and invasive species (DPLUS016)” being undertaken by the Royal Botanic Gardens, Kew (Kew) and the Turks and Caicos Islands (TCI) Department of Environment and Maritime Affairs (DEMA) has had a successful first year. A 650 acre ‘Core Conservation Area’ (CCA) was identified and demarcated with fire breaks on Middle Caicos. The CCA shows natural regeneration with good genetic diversity as well as signs of resistance to the invasive pine tortoise scale insect pest that has caused huge declines in the TCI wild population. Two successful joint field exercises in 2014 enabled the collection of samples for genetic, mycological, chemical and ecological analyses to get underway. DEMA staff collected and sowed 1200 Caicos pine seeds at the TCI project nursery resulting in a fourfold increase of the *ex-situ* collection. A pine tree seed orchard is now established on North Caicos and restoration plantings have continued on the island of Pine Cay with very high survivorship. A large collection of seeds in year one was also used to increase the number of collections banked at Kew’s Millennium Seed Bank. Overall the project has made great progress and is on track for successful delivery by the end of year two.

Requests for images should be addressed to the PI, Martin Hamilton using [m.hamilton@kew.org](mailto:m.hamilton@kew.org)



## Appendix 1: DPLUS016 Annual Report Year 1 (2014-2015)

### Caicos pine forests: mitigation for climate change and invasive species

Expected outputs	Indicators of success	Achievements in Year 1
1) Scientific basis for Caicos pine restoration established	a) Models identify preferred habitat in face of sea level rise; optimal environmental conditions	<ul style="list-style-type: none"> <li>Core conservation area of 650 acre in Middle Caicos identified and environmental variables measured; investigation on-going on suitable habitats depending on GIS mapping/modelling and scientific results.</li> </ul>
	b) <i>Ex-situ</i> collections and remaining wild trees genotyped (500 samples)	<ul style="list-style-type: none"> <li>All 95 DNA samples collected in the wild and 153 from nursery stock extracted; genotypes of 81 samples completed; some genetic diversity in the wild and nursery but still some alleles missing; saplings from natural regeneration in the core conservation area showing 50% of all alleles; sampling and analysis on-going.</li> </ul>
	c) Chemical analyses demonstrate health of different populations	<ul style="list-style-type: none"> <li>Samples of healthy and unhealthy trees from all populations for chemical volatiles (40) and non- chemical volatiles (41) collected and analysed at Kew- five main compounds identified; testing the effect of natural chemical compounds on the scale insect on-going; sampling and analysis on-going.</li> </ul>
	d) Mycorrhizal fungi associated with Caicos pine identified	<ul style="list-style-type: none"> <li>166 ectomycorrhizal root samples and 22 fungi fruiting bodies collected; c.400 root tips sequenced and main fungi associated with pines identified as <i>Rhizopogon</i> sp.; 288 samples collected from Kew Fungarium sequenced to build a reference library for ectomycorrhizal fungi in the Caribbean; sampling and analysis on-going.</li> </ul>
	e) Population Viability Analysis (PVA) produced	<ul style="list-style-type: none"> <li>Kew staff trained on PVA modelling; 84 trees selected and monitored for demographic parameters; 24 seed bags deployed to monitor seed predation, germination and dormancy; 41 trees analysed for water stress; 35 samples collected and analysed for Nitrogen content; 101 pine cones assessed for seed production; sampling on-going- to be finalised in April 2015</li> </ul>
2) <i>Ex situ</i> plant collections strengthened	a) Increase in number of seed collections held at MSB from 3 to 12	<ul style="list-style-type: none"> <li>Total of 8 seed collections now banked at the MSB; seed collection techniques and size of collections improved; on-going</li> </ul>
	b) Increase in number of trees held in the CPRP nursery on North Caicos from 100 to 400	<ul style="list-style-type: none"> <li>1200 seeds sown; 461 seedlings and saplings growing; seed orchard in TCI expanded from 29 to 101 pine trees.</li> </ul>

Expected outputs	Indicators of success	Achievements in Year 1
3) Capacity building to enable DEMA to manage the Caicos pine forests	<ul style="list-style-type: none"> <li>c) Increase allelic richness in <i>ex-situ</i> collections from 3.1 to 3.6 – the known wild allelic richness</li> <li>a) Two key DEMA staff fully trained in implementing the Restoration Strategy for Caicos pine.</li> <li>b) DEMA staff monitoring the health of wild and re-introduced trees.</li> <li>c) DEMA adoption of protocols</li> </ul>	<ul style="list-style-type: none"> <li>• Initial results show allelic diversity in the collections; analysis of new seedlings and saplings will determine if allelic richness have risen; on-going.</li> <li>• Two key DEMA project staff, i.e. local project manager and nursery officer, trained in scientific collection, horticultural techniques and use of power tools for pine forest management including opening fire breaks and reducing competition for pine regeneration.</li> <li>• Two DEMA project staff trained in monitoring the health of wild and re-introduced trees; monitoring on-going.</li> <li>• To be done in Year 2 after completion of protocols</li> </ul>
4) Restoration Strategy for local implementation	<ul style="list-style-type: none"> <li>a) Data collection protocol</li> <li>b) Seed collection protocol</li> <li>c) Nursery production protocol</li> <li>d) Restoration protocol</li> <li>e) Monitoring protocol for health of wild and reintroduced trees</li> </ul>	<ul style="list-style-type: none"> <li>• Methods and protocols trialled in the field with assistance and input from key DEMA staff; collation of data and writing of protocols started; on-going (a to e).</li> </ul>

## Appendix 2: DPLUS016 Annual Report Year 1 (2014-2015)

### Caicos pine forests: mitigation for climate change and invasive species

#### Media/Publications:

Manco, B. N. (2014). Caicos Pine Recovery Project: Saving the National Tree. Island Life and Times. Providenciales, TCI. Available at: <http://www.islandlifeandtimes.com/islanders/caicos-pine-recovery/>

Manco, B. N. (2014). A new lease on life for TCI's National Tree- Caicos Pine Recovery project receives funding from Darwin Plus. Times of the Islands Spring 2014. Providenciales, TCI, Times Publications Ltd.: pg. 23.

Sanchez, M. (2014). Rescuing the threatened Caicos pine in the Turks and Caicos Islands. Blog in the Kew website: <http://www.kew.org/discover/blogs/rescuing-threatened-caicos-pine>

Corcoran, M.R. & Manco, B. N. – Twitter feeds during TCI fieldwork in 2014. <https://storify.com/KewUKOTs/recovering-habitats-turks-and-caicos-islands>

Kew Scientist, Spring 2014, Issue 45- Genetic diversity in Caribbean pine. Note about publication of genetic data in Bot. J. Linnaean Society 174, 359 (2014) with mention to DPLUS and John Ellermann Foundation funding.

Page on Caribbean Pine updated on the Kew internet site by Sanchez, M.D. available at: <http://www.kew.org/science-conservation/plants-fungi/pinus-caribaea-caribbean-pine>

Pain, Stephanie (2014). Kew helps to rescue the Caribbean pine. Science News. Kew Magazine Autumn 2014 Issue, pg. 24

Sanchez, M.D and Hamilton, M.A. (2014) [Multi-disciplinary research and international collaboration to rescue the Caicos pine forests](#). Darwin Initiative Newsletter: UK Overseas Territories. August 2014, pg.9.

Manco, B. N. (2014) *Pinus caribaea* var. *bahamensis* habitat recovery in the Turks & Caicos Islands. Pine Rockland Workgroup Symposium 2014, Miami, Florida, USA

Green, P.W.C., Hamilton, M.A., Sanchez, M.D., Corcoran, M.R., Manco, B.N. and Malumphy, C.P. (2015) [The scope for using the volatile profiles of \*Pinus caribaea\* var. \*bahamensis\* as indicators of susceptibility to pine tortoise scale and as predictors of environmental stresses](#). Chemistry & Biodiversity 12(4), pp.652–661.

Sanchez, M.D and Hamilton, M.A. 'Mobilising Kew Science to save the Caicos pine' Brown Bag Seminar Series, Jodrell Laboratory Lecture Theatre, Kew. October 13<sup>th</sup> 2014.

**Community engagement:**

International Day for Biological Diversity activities in North Caicos, TCI. Kew and DEMA hosted half-day workshop with displays on 21/05/14. Joined by the Bottle Creek High School environmental club and several community members.

Several members of the community helped with conservation work during May and November 2014 and January 2015 fieldwork. Field activities have been posted through Twitter (#KewTCI, @KewUKOTS, @BNaqqi) to engage with the local community and wider public.

**Other activities complementary to the project enabled by the John Ellerman Foundation:**

Second prescribed fire in TCI pine forests was carried out on Middle Caicos in December 2014 under leadership and supervision of fire boss Kevin Hiers from the University of the South, Tennessee, USA and fire specialists Ben Hornsby and Joe O'Brien from the US Forest Service, Georgia, USA. The prescribed fires were training exercises for DEMA staff supported by Kew. Prescribed fire activities were announced on TV and radio, having a good response from the community. Live Twitter feeds by the local CPRP project manager Bryan Naqqi Manco on the prescribed fire in Middle Caicos raised community interest and support to the project and received excellent feedback. Twitter posts included the TCI Governor's office congratulating the team for a well-executed and important prescribed fire. Three DEMA staff and one DEMA intern trained and certified in basic wild land fire techniques by US fire specialists in December 2014, including the Caicos Pine Recovery Project (CPRP) nursery officer and the Darwin Plus project manager.

New CPRP interpretation signs were developed by Kew team in consultation with DEMA and taken to TCI in November 2014 for installation in the Pine Cay and Middle Caicos pine yards, at the National Environmental Centre (NEC) in Providenciales and at DEMA's office on North Caicos.

Native plant garden was developed at DEMA's office in the Kew Settlement, North Caicos in December 2014. Area is centrally located in the settlement with free and easy access for the community. There was great interaction with community members who visited the garden, read the panels about the project and gave very positive feedback on the work being carried out. This raised local interest in TCI native plants, being an effective way to educate the community about environmental issues. Community members demonstrated interest in using the new garden also as a place to relax and as a meeting point, as there are no public parks in the area. A community Christmas Tree Lighting was held in the garden in December 2014. The recently planted pines will become the focal point for these festivities in time eliminating the need to source exotic species for this purpose.

New CPRP Interpretive Trail in the Middle Caicos pine forest was laid out and initial contact made with local ecotourism company Big Blue Unlimited to scope future uses of the trail in ecotourism. Markers for the trail were designed by the Kew team and produced. The trail bed was cleared and rock-lined by DEMA staff with the assistance of two Kew volunteers and nine community members.

Two Kew volunteers joined the TCI project team in January 2015 for 3 weeks to help plant out nursery grown pines into restoration plots and seed orchard, and finalise Interpretive Trail layout as well as clear new access trails and fire breaks in the three pine yards.