

CHARLES DARWIN FOUNDATION  
**SCIENCE PLAN**  
**2023 - 2028**



**THE MISSION OF THE CHARLES DARWIN FOUNDATION  
AND ITS RESEARCH STATION IS TO TACKLE  
THE GREATEST THREATS AND CHALLENGES TO  
GALAPAGOS THROUGH SCIENTIFIC RESEARCH AND  
CONSERVATION ACTION, IN ORDER TO SAFEGUARD  
ONE OF THE WORLD'S MOST IMPORTANT NATURAL  
TREASURES**

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# INTRODUCTION



## Scientific Research and Conservation Action

As one of the most renowned planetary treasures, the Galapagos Islands have played an unrivalled role in the history of science. For more than 60 years, the research undertaken at the Charles Darwin Foundation (CDF) has focused on furthering our understanding of the natural systems, their relationship with those living in the archipelago, and the intricate and delicate balance between climate, mankind, and nature. Major research efforts have also focused on the prevention, control, and eradication of invasive species to maintain Galapagos as one of the best-conserved archipelagos in the world.

Nonetheless, the Galapagos Islands continue to face urgent challenges, as well as novel threats, which are adding pressure to the islands' already fragile ecosystems and putting them at risk. Science, in concert with conservation action, can provide answers to many of the challenges and threats facing Galapagos.

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## Charles Darwin Foundation

We are an international non-profit organization registered in Belgium and created in 1959 under the auspices of UNESCO, the International Union for Conservation of Nature (IUCN) and the Ecuadorian state to provide the highest quality scientific research, technical advice, and practical expertise on conserving and protecting the archipelago. Over the years, conservation action has been integrated into our scientific work, in the form of environmental education, advocacy and sharing of scientific information with the global community.

[darwinfoundation.org](http://darwinfoundation.org)

# Science Strategy

Our Science Plan outlines how we will focus our research and conservation agenda for the next 5 years in our quest to tackle the greatest and most urgent threats and challenges to Galapagos and the Eastern Tropical Pacific (ETP) region. While these priorities in all likelihood transcend that timeframe, after 5 years we will

revisit this Science Plan and recalibrate our priorities to ensure they remain current and relevant to the needs of Galapagos.

Our basic and applied research focus now align to five Scientific Priorities that will help us achieve more impact in and for Galapagos. These Priorities are:

- 1 BIODIVERSITY
- 2 BIOINVASIONS
- 3 CLIMATE AND OCEAN CHANGE
- 4 ECOSYSTEM RESILIENCE AND RESTORATION
- 5 SCIENCE TO ACTION

Each Scientific Priority is underpinned by an objective which is supported by a set of sub-objectives designed to focus our research and conservation efforts to deliver on our mission. Its successful implementation, and resulting impact, relies on the experience and resources we already hold, as well as our continued collaboration with partners around the world. It will further rely on the strategic pillars set out in our [2022-2027 Strategic Plan](#), including the establishment of new alliances and strengthening of existing ones,

improvement of our infrastructure, strengthening of fundraising efforts, improved organizational efficiency, and continued close work with the community.

This Science Plan forms a critical part of our Strategic Plan, guiding the core mandate of both the Charles Darwin Foundation and its operative arm, the Charles Darwin Research Station. Its implementation and progress will be monitored and evaluated through our Annual Operative Plan.

## THE EASTERN TROPICAL PACIFIC

Galapagos sits at the heart of the Eastern Tropical Pacific (ETP) region which encompasses four countries: Costa Rica, Panama, Colombia, and Ecuador.

Protected islands in this region are linked by a series of underwater ridges and seamounts that are a migratory pathway for key species and are in of themselves underexplored biodiversity hotspots.

# SCIENTIFIC PRIORITIES





## 1

## BIODIVERSITY

### Document nature, recognize threats, and leverage the unique reach of the biodiversity of Galapagos to conserve threatened regional ecosystems

The unique marine and terrestrial biodiversity of Galapagos is the most salient characteristic of the archipelago, which attracts thousands of visitors annually alongside scientists who have been coming to the islands for decades. As such, a core mandate of CDF is to ensure that the irreplaceable biodiversity, habitats, ecosystems, and key ecological processes of Galapagos are secured, while recognizing and appraising threats to push for responsible management and effective protection.

Insular species encompass many of the endangered species on earth and Galapagos is no exception. Many emblematic Galapagos species have small populations that are in constant flux, requiring long-term monitoring alongside biodiversity assessments to track species and ecosystem health. Through the implementation of robust monitoring programs, changes can be detected allowing for a more rapid and effective response.

Finally, despite centuries of research and exploration, there remains much to discover of the unique biodiversity and environment of this region – especially in the lesser explored marine realm. The continued documentation of the biodiversity of Galapagos through expansive exploration and monitoring efforts, our Natural History Collections, alongside a new genetic repository biobank are fundamental to securing long-term conservation goals and consolidating what CDF has been doing for more than six decades.

#### 1.1. Exploration and discovery

Explore and discover new ecosystems, biota, and their interactions, and work towards filling critical knowledge gaps in understudied and little understood locations, species, habitats, and processes in Galapagos and the Eastern Tropical Pacific.

#### 1.2. The Galapagos biobank

Expand curation of physical specimen collections by establishing a genetic repository as the Galapagos biobank reference collection for Ecuador.

#### 1.3. Biodiversity assessments

Identify threatened species and areas of high conservation value that need protection (e.g., gap analysis, sensitivity mapping, sensitive Key Biodiversity Areas, IUCN Red list of threatened species).

#### 1.4. Tracking ecosystem health

Develop and implement robust long-term species- and community-level monitoring protocols, alongside biophysical and socio-ecological monitoring protocols and adaptive evaluation programs with partners to mitigate against biodiversity loss.

#### 1.5. Engaging visitors and residents

Leverage the reach of the iconic status of Galapagos' biodiversity by developing state-of-the-art exhibits that capture the work that we do and empower visitors and local residents to become active stewards for conservation.

# 2

## BIOINVASIONS

### Reduce the threat and impact of invasive species and pathogens in Galapagos and the Eastern Tropical Pacific

Invasive and pathogenic species are the main biotic threat to Galapagos ecosystems. Research in this field, much of it led by the Charles Darwin Foundation, has set a precedent for our understanding of marine and terrestrial bioinvasions in Galapagos and the Eastern Tropical Pacific, and has applications in other threatened island ecosystems worldwide.

Despite prior successes in tackling bioinvasions, introduced species that are highly invasive and threaten the endemic and native flora and fauna of the region persist. Furthermore, the danger of introducing new invasive species and pathogens is omnipresent given growing numbers of visitors to the islands, the internal movement of people, and the continuous transportation of imported goods from mainland Ecuador. As such, a core goal for CDF is to provide continuity with risk identification and, in partnership with other organizations, develop long-term holistic solutions for the prevention and control of Invasive Alien Species (IAS).

#### 2.1. Prevention

Carry out scoping studies, identification of transport pathways, and prioritization exercises to proactively identify and prevent the arrival of potentially problematic terrestrial and marine species and pathogenic agents.

#### 2.2. Impact assessment

Understand and quantify time- and spatially-sensitive impacts of IAS, and anticipate habitat shifts under possible climate change and development scenarios.

#### 2.3. Mitigation

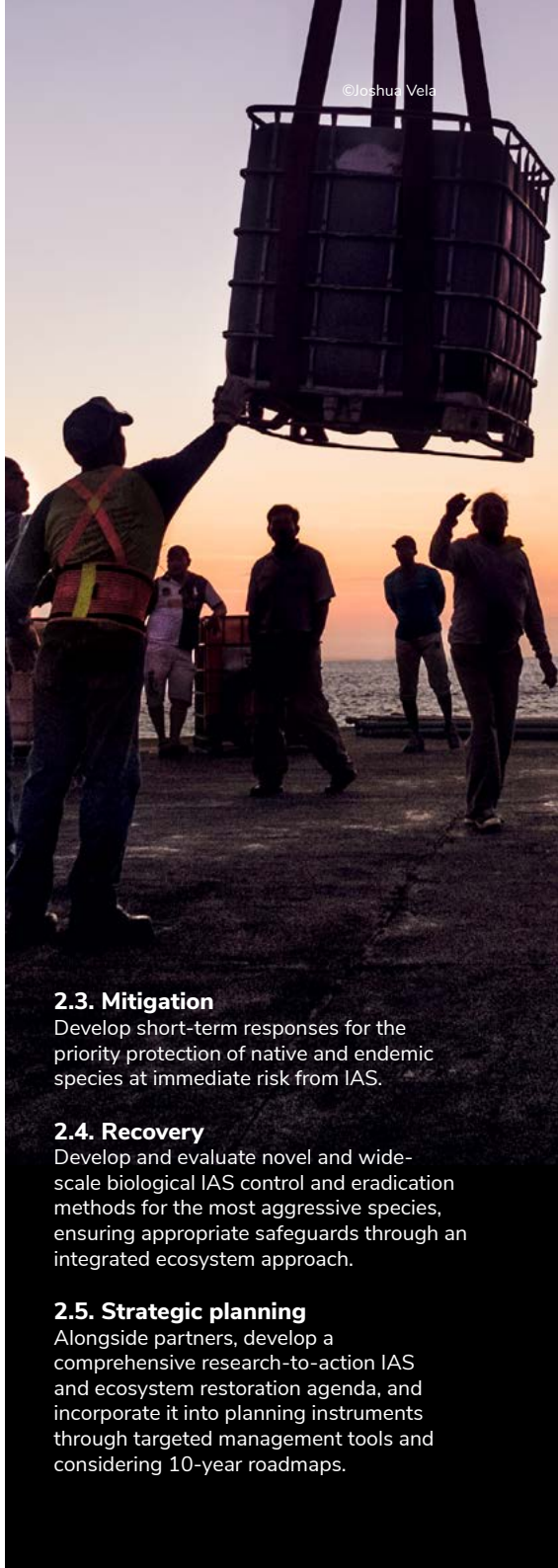
Develop short-term responses for the priority protection of native and endemic species at immediate risk from IAS.

#### 2.4. Recovery

Develop and evaluate novel and wide-scale biological IAS control and eradication methods for the most aggressive species, ensuring appropriate safeguards through an integrated ecosystem approach.

#### 2.5. Strategic planning

Alongside partners, develop a comprehensive research-to-action IAS and ecosystem restoration agenda, and incorporate it into planning instruments through targeted management tools and considering 10-year roadmaps.



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# 3

## CLIMATE AND OCEAN CHANGE

*Be the reference institution for climate and ocean research to further regional understanding and implications of climate change on communities and ecosystems in the Eastern Tropical Pacific*

Climate change is a global threat that is already affecting island and ocean systems worldwide. Understanding and predicting the effects and impacts of climate change is central to Galapagos and regional Eastern Tropical Pacific terrestrial and marine conservation, with important insights available through the strong El Niño patterns that have historically shaped and influenced the region. Indeed, Galapagos represents a bellwether model system to assess climate change vulnerability and resilience on communities and ecosystems. Positioning CDF as the central regional climatic repository for both data and scientific expertise will allow for synthesis and sharing of big climatic data, while also assessing available means to mitigate and adapt to the regional impacts of climate change.

### 3.1. Climate repository of data and scientific expertise

Establish CDF as a regional repository for climate data and scientific expertise regarding the climate and oceanography of the Eastern Tropical Pacific. Develop and implement climate monitoring technology and integrated support networks to obtain and manage climate data, contribute to climate data clearing houses, and deliver information through innovative data sharing with partners.

### 3.2. Paleoclimate reconstruction and climate modelling

Use historical information to understand boundary conditions that structure nature through strategic collaborations with partners, and by developing hindcasting and predictive models under varied Intergovernmental Panel on Climate Change (IPCC) emission and remediation scenarios.

### 3.3. Nature-human responses

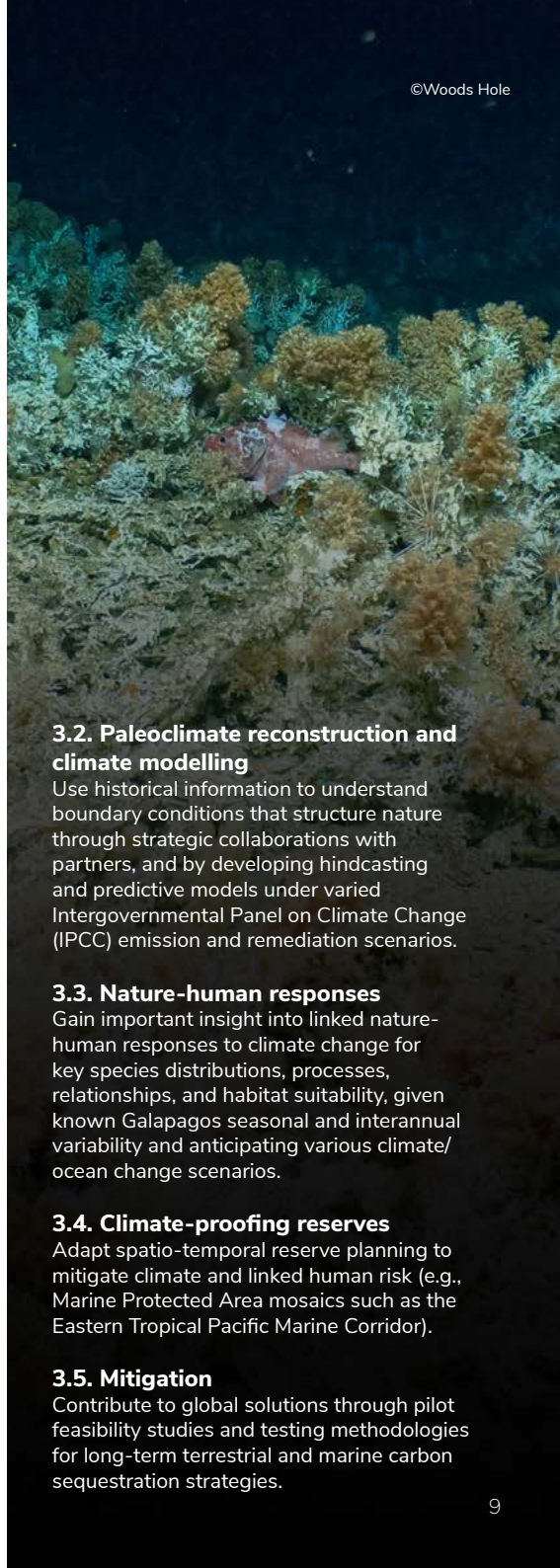
Gain important insight into linked nature-human responses to climate change for key species distributions, processes, relationships, and habitat suitability, given known Galapagos seasonal and interannual variability and anticipating various climate/ocean change scenarios.

### 3.4. Climate-proofing reserves

Adapt spatio-temporal reserve planning to mitigate climate and linked human risk (e.g., Marine Protected Area mosaics such as the Eastern Tropical Pacific Marine Corridor).

### 3.5. Mitigation

Contribute to global solutions through pilot feasibility studies and testing methodologies for long-term terrestrial and marine carbon sequestration strategies.



# 4 ECOSYSTEM RESILIENCE AND RESTORATION

## Understand linked nature-human processes to ensure sustainable resource use and enhance ecosystem resilience and restoration

Galapagos has had a permanent human presence since the early 19th Century and, given the fragility and limitation of insular systems, this use has in some cases had deleterious effects on the natural systems and ecosystem health of the archipelago. With global-scale climate and ocean change, there are now new additional vulnerabilities for wildlife and ecosystem health, human well-being, and food security in the islands. By valuing how society uses and depends upon natural capital and linked processes, and enhancing biological ecosystem resilience and restoration, we can find novel solutions to ensure their longevity. This interdisciplinary research approach takes on added importance in Galapagos due to the scale and speed of change that is taking place in the archipelago.

### 4.1. Socio-ecological linkages

Understand cascade effects, thresholds, and tipping points in human-natural systems to frame and value ecological functional traits and processes as goods and services (i.e., ecosystem services) that drive community well-being.

### 4.2. Sustainable solutions

Investigate critical interventions and provide technical assistance and advocacy for a sustainable Galapagos model, including island system carrying capacity, cargo management, waste management, energy, basic services, nature-based financial solutions, and sustainable food systems.

### 4.3. Resilience

Understand the compounding impact that climate change will have on socio-ecological systems of Galapagos to determine vulnerability, and evaluate the ability to adapt to change. Create a portfolio of climate change adaptation and mitigation actions for Galapagos and the Eastern Tropical Pacific that can be adopted by governments and communities.

### 4.4. Restoration

Develop, apply, and evaluate scalable long-term species- and ecosystem-level restoration and recovery measures for current and historically human-impacted and degraded habitats.

### 4.5. Stewards of Galapagos

Investigate novel mechanisms for effective stakeholder engagement and conservation agreements, including incentives through sustainable financing, experimental ecosystem accounts, bankable business cases and preferential markets that support responsible practices.

### 4.6. Governance

Assess the governance arrangements within the institutional social system in Galapagos and the ETP, particularly the interaction between bodies (state, civil society, and the market) to improve governability and effect substantive change.



# 5 SCIENCE TO ACTION

*Make scientific discovery relevant, accessible, and impactful through innovative engagement, illustration, and dissemination*

The research carried out by CDF for more than six decades has generated important volumes of data, information, and knowledge under a broad range of thematic lines. These long-term datasets have the potential to be used for big data mining, artificial intelligence, and machine learning analyses to address complex research questions of today and tomorrow. It is also important to continue to find effective and innovative ways to advocate, raise awareness, and share this knowledge to a wide and varied audience. Above all, we must continue to inspire the local community to become active stewards of their islands.

This transversal axis integrates with the other thematic priorities in the science plan, and seeks to establish open lines of communication and innovation through technologies and engagement strategies that utilize and take advantage of existing data and knowledge within CDF to raise awareness and effect lasting change.

## 5.1. Open-source platforms

Design and implement open-source data and information platforms that host and maintain large data sets that are readily accessible to users.

## 5.2. Shared Research Hub

Develop a shared data clearinghouse and scorecard dashboards with our partners to recognize and utilize the increasing sources of information generated for Galapagos and the Eastern Tropical Pacific. This will encourage a culture of information retention and sharing, as well as transparent and accessible open-source data with engaging visualization tools.

## 5.3. Big data

Evaluate and develop applications for big-data management, the use of artificial intelligence, and machine learning across a range of Galapagos research applications (e.g., image analysis, fast-tracking monitoring results within management response timescales, expert supervised habitat mapping).

## 5.4. Citizen science

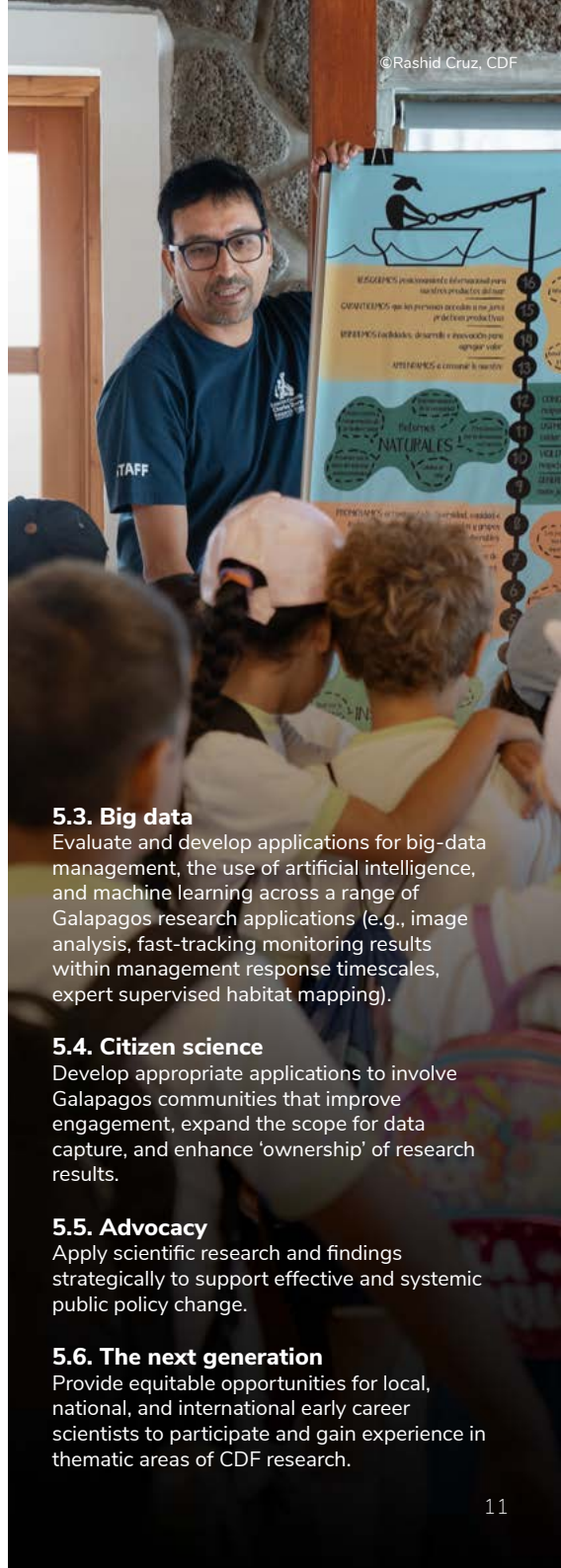
Develop appropriate applications to involve Galapagos communities that improve engagement, expand the scope for data capture, and enhance 'ownership' of research results.

## 5.5. Advocacy

Apply scientific research and findings strategically to support effective and systemic public policy change.

## 5.6. The next generation

Provide equitable opportunities for local, national, and international early career scientists to participate and gain experience in thematic areas of CDF research.







# KEY ENABLERS OF SUCCESS



## Infrastructure

Central to enabling cutting-edge scientific research is the provision of facilities that allow us to investigate the often complex and multifaceted conservation challenges of today, and that make room for the growth and expansion needs of tomorrow.

While some buildings at the Charles Darwin Research Station have been recently upgraded and provide for state-of-the-art research, (e.g., The Inspiration Complex pictured above), others will be overhauled as part of the five-year strategic plan in order to meet envisioned research needs.

The new Fischer Complex facility will bring laboratories and offices in line with the modern scientific needs of today, and encourage and expand collaboration and engagement with visiting scientists and students alike. It will also provide room for growth and expansion of research programs as well as house our four natural history collections in a modern and centralized climate-controlled environment. Finally, the overhaul of the Fischer complex will aim to position science closer to visitors through an immersive experience that will see a small portion of collections exhibited to the more than 125,000 tourists that visit our research station every year, thereby maximizing engagement and inspiring both international visitors and the local community.

### OUR 2022-2027 STRATEGIC PLAN

CDF's Strategic Plan sets the course for the Charles Darwin Foundation and its Research Station for the period 2022-2027, and is framed around six core pillars, all designed to better position the foundation to address today's challenges.

### THE SIX PILLARS OF OUR STRATEGIC PLAN:

- Scientific Research
- Infrastructure
- Education and Outreach
- Partnerships and Visibility
- Financial Stability
- Institutional Governance and Culture

View our [2022-2027 Strategic Plan](#)



## Education and Outreach

Most if not all conservation challenges in Galapagos today comprise a human dimension. As such, actively involving and considering the needs of key community stakeholders in the research and conservation efforts we engage in has to be a central mandate.

## Partnerships and Visibility

Partnering with key institutions to expand our research portfolio and address the myriad of challenges in Galapagos is essential to long-term success, and a key pillar in our five-year Strategic Plan. Engaging with the broader scientific community also requires increasing the visibility of what we do to enhance partnerships and increase the potential impact of our scientific findings.

## Financial Stability

A stable funding platform is essential to bring our Science Plan to life. It is what will provide the needed continuity and means to tackle our ambitious Scientific Priorities and objectives, in service of our mission. This involves not only expanding our current fundraising strategy but also envisioning new and innovative means to secure long-term funding, further outlined in our five-year Strategic Plan.

## Governance and Culture

CDF is a mature and well-established foundation with a solid operating platform and governance structure. Nonetheless, we must periodically review normatives and make sure they are current and effective, while also streamlining processes wherever possible to maximize efficiency and strengthen our organization's culture.



# PROTECT GALAPAGOS, IMPACT THE WORLD

Support us on our mission to safeguard one of the world's most important natural treasures

## **BECOME A DONOR TODAY**

Donations in the US are tax-deductible. Your gift directly supports our scientific work at the Charles Darwin Research Station.

**THANK YOU FOR MAKING AN IMPACT WITH US!**





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