Applicant: **Kotzen, Benz**
Organisation: **University of Greenwich**
Funding Sought: **£0.00**

DIR31IN\1214

Mass and Precise Mangrove Restoration Using Aerial Drone Systems

The project will demonstrate the efficacy of aerial drones to reinstate mangrove coastal intertidal areas. Although hand planting of mangrove seedlings can be effective, large-scale reinstatement of forests is impossible without step changes in planting techniques. This pilot project will show how large areas can be effectively seeded and restored to increase coastal ecological resilience, reduce poverty, increase long-term biodiversity, responding to climate change, with sea level rises and storm surges and past poor land use and management decisions.

PRIMARY APPLICANT DETAILS

Title	Prof
Name	Benz
Surname	Kotzen
Organisation	University of Greenwich
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Address	

DIR31IN\1214

Mass and Precise Mangrove Restoration Using Aerial Drone Systems

Section 1 - Contact Details

PRIMARY APPLICANT DETAILS

Title	Prof
Name	Benz
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GMS ORGANISATION

Type	**Other**
Name	University of Greenwich
Phone (Fax)	[redacted]
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Address	

Section 2 - Project Summary, Ecosystems, Approaches and Threats

Q3. Project Title

Mass and Precise Mangrove Restoration Using Aerial Drone Systems

Please attach a cover letter as a PDF document.

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Q4a. Is this a resubmission of a previously unsuccessful application?

⦿ No

Q5. Key Ecosystems, Approaches and Threats

Please select up to 3 biomes that are of focus, up to 3 conservation actions that characterise your approach, and up to 3 threats to biodiversity you intend to address, from dropdown lists.

Biome 1

Brackish tidal systems

Biome 2

Shoreline systems

Biome 3

Anthropogenic shorelines

Conservation Action 1

Species Management

Conservation Action 2
Livelihood, Economic & Moral Incentives
Conservation Action 3
Research & Monitoring

Threat 1
Biological resource use (hunting, gathering, logging, fishing)
Threat 2
Agriculture & aquaculture (incl. plantations)
Threat 3
Climate change & severe weather

Q6. Summary of project

Please provide a brief non-technical summary of your project: the problem/need it is trying to address, its aims, and the key activities you plan on undertaking.

The project will demonstrate the efficacy of aerial drones to reinstate mangrove coastal intertidal areas. Although hand planting of mangrove seedlings can be effective, large-scale reinstatement of forests is impossible without step changes in planting techniques. This pilot project will show how large areas can be effectively seeded and restored to increase coastal ecological resilience, reduce poverty, increase long-term biodiversity, responding to climate change, with sea level rises and storm surges and past poor land use and management decisions.

Section 3 - Dates & Budget Summary

Q7. Country(ies)

Which eligible country(ies) will your project be working in?

Country 1	Indonesia	**Country 2**	Philippines
Country 3	*No Response*	**Country 4**	*No Response*

Do you require more fields?

⦿ No

Q8. Project dates

Start date:	End date:	Duration (e.g. 1 year, 8 months):
01 April 2025	30 September 2026	1 year, 6 months

Q9. Budget Summary

Darwin Initiative Funding Request	2025/26	2026/27	Total request
(1 Apr - 31 Mar) £	£134,437.00	£65,550.00	199,987.00

Q10. Do you have proposed matched funding arrangements?

⦿ Yes

Please ensure you clearly outline your matched funding arrangement in the budget.

Q11. If you have a significant amount of unconfirmed matched funding, please clarify how you will fund the project if you don't manage to secure this?

No Response

Q12. Have you received, applied for, or plan to apply for any other UK Government funding for your proposed project or a similar project?

⦿ Yes

Please give details.

If you have received, applied for or plan to apply with similar projects, explain how your activities are distinct and complementary.

A similar application was made to UKRI/BBSRC. The title was Sustainable and Resilient Aquaculture Systems in Southeast Asia. The proposal was rejected because the Team misunderstood the scope of the call where there were 2 distinct themes, and they only responded to one Theme. The scope of that project was larger, for a longer period including the training of local people to build drones, become proficient with them and also training paraecologists. The current Darwin project only provides for local staff at the two SE Asian universities to be trained, as a start towards looking towards an extended project. The development of technology is speeded up in this project with the

inclusion of the robotic skills from the University of Panama and the company Inverto. It should be noted that both groups are committed to passing down the skills and means for local people to undertake their own habitat creation.

Section 4 - Darwin Objectives and Conventions

Q13. Problem the project is trying to address

Please describe the problem your project is trying to address in terms of biodiversity and its relationship with multi-dimensional poverty.

Analysis of NASA's satellite images has shown mangrove forest losses between 2010 and 2016 [1]. Out of the 138,000 km2, 3,400km2 has been lost [1]. That is close to 2.5%. This does not take account for the losses that occurred over the last 50 years [1]. In 1997 Spalding estimated the forests to be 181,000km2 [2] which means the losses since then have been 47,000 km2, which is close to 25%. The losses have been due to the past, vast construction of fish and shrimp ponds, many of which no longer function efficiently. Some mangrove habitats have been removed as a result of urbanisation and for making pulp for paper and charcoal.
The problem this project is addressing is that there is a great need for mangrove restoration, but whilst hand planting methods can be successful there are not enough hands nor available funds in the world to effectively rectify the lost habitats in a timely manner, which 1) can respond to climate change and flooding in the mid-term and 2) reinstate the ecosystem services as part of aquatic/coastal resources that the mangroves provide for local people, where numerous products can be harvested, produced and sold including, aquatic creatures (shrimp, crabs, molluscs, fish etc), wood for charcoal, dyes and tannins, sea weeds, honey, green fodder and mangrove fruit drinks, and the forest used as tourism sites, and 3) reinstate failed and failing pond aquaculture systems with integrated mangrove biofiltration which clean the water and improve the fish and fisheries ecosystems, improving fish quality, biodiversity and economic viability for impoverished local farmers and fishers.
The project has a global reach, where mangrove restoration is required, but the pilot is restricted to the Philippines and Indonesia, which will both benefit from the knowledge gained in using this technical innovation in providing an efficient nature based solution. The local societies will benefit immediately through being closely involved in the project and with training in monitoring, including biodiversity monitoring and eventually through the benefits that restoration will bring and also through being able to undertake the drone seeding themselves. This technology will also be useful in future further work, such as the aerial seeding of seagrass not associated with this project.
There are two technical issues that this project aims to solve: 1) making the seeds/propagules stay and root where they are dropped in an intertidal area, and 2) creating drone magazines and robotically controlled drop mechanisms that can be attached to a drone and that will repeatedly be able to drop seeds where they are wanted.
The need for the project was confirmed with both the Indonesian and Philippine collaborators when visited in Spring 2024 and seeing the flooding and loss of livelihoods that have occurred through the removal of mangrove forests.

Q14. Biodiversity Conventions, Treaties and Agreements

Q14a. Your project must support the commitments of one or more of the agreements listed below. Please indicate which agreement(s) will be supported.

- ☑ Convention on Biological Diversity (CBD)
- ☑ Ramsar Convention on Wetlands (Ramsar)
- ☑ United Nations Framework Convention on Climate Change (UNFCCC)
- ☑ Global Goals for Sustainable Development (SDGs)

Q14b. National and International Policy Alignment

Using evidence where available, please detail how your project will contribute to national policy (including NBSAPs, NDCs, NAPs etc.) and in turn international biodiversity and development conventions, treaties and agreements that the country is a signatory of.

IPB, Indonesia
The project supports the NBSAP by restoring degraded ecosystems, enhancing biodiversity, and promoting sustainable land use practices. By rehabilitating mangroves in coastal areas, the project helps Indonesia meet its NDC targets under the Paris Agreement and the country's participation in the UN Framework Convention on Climate Change (UNFCC). The restoration efforts align with the CBD by promoting the conservation and sustainable use of biodiversity. It will help Indonesia meet its commitments under the Aichi Biodiversity Targets and the post-2020 Global Biodiversity Framework, and directly supports several SDGs, namely 6,13 and15, due to improving ecosystem health and resilience. It contributes to sustainable development and poverty reduction. Rehabilitation of mangroves and coastal areas can be linked to the implementation of activities that have Carbon Economic Value (NEK) in accordance with Presidential Decree No. 98/2021.

UPV, Philippines
The Philippines is a signatory to the Convention on Biological Diversity (CBD) and the Ramsar Convention. It aims to protect and sustainably manage wetlands and biodiversity, including mangroves. The country also participates in the UNFCCC and the Paris Agreement, recognizing mangroves as vital for climate change mitigation due to their role as carbon sinks. Additionally, the Philippines adheres to CITES and cooperates regionally through the ASEAN Agreement on Conservation of Nature and Natural Resources. These efforts align with global goals, e.g. UN's SDGs, particularly in ecosystem conservation and climate action. In May 2023, the Philippine House of Representatives Bill 7767, making coastal management a national policy, aiming to create a national plan for protecting coastlines.

For both Indonesia and the Philippines, the project complements national policies and international obligations in innovating mangrove restoration, enhancing biodiversity, meeting environmental commitments and alleviating poverty. This project aligns with the countries' goals under global initiatives and will contribute to sustainable ecosystem management, climate resilience and poverty reduction.

Section 5 - Method, Innovation, Capability & Capacity

Q15. Methodology

Describe the methods and approach you will use to achieve your intended Outcome and contribute towards your Impact. Provide information on:

- **how you have reflected on and incorporated evidence and lessons learnt from past and present similar activities and projects in the design of this project.**
- **the specific approach you are using, supported by evidence that it will be effective, and justifying why you expect it will be successful in this context.**
- **how you will undertake the work (activities, materials and methods).**
- **what the main activities will be and where these will take place.**
- **how you will manage the work (governance, roles and responsibilities, project management tools, risks etc.).**

Output 0: Evidence and Lessons Learned - Leads to Realising New Technology Investigation Needed
- Spring 2024, PI from University of Greenwich (UoG) visited IPB University in Bagor, Indonesia and the University of the Philippines, Visayas (UPV): Scoping issues and sites. The issue is real and extent is large.
- Current restoration of mangroves is by hand: Too slow/costly to meet extent of the problem in these countries and globally.
- Realisation: A technological step change needed: Follow nature's method of mangrove natural regeneration - but nature's method is haphazard
- 'Seed bombing' is now far more frequent in restoring many terrestrial habitats, including mangroves. Abu Dhabi - 1 million trees [4] with 30% success rate but density is not controlled – more precision to vary the density for biodiversity purposes with new anchoring systems is required.
- Building a Team is required: Balanced locally and internationally.

Output 1: Literature Review Check - Evidence of Efficacy and Justification - New Method of Seeding is Justified
- Literature Review of all aspects.
- Confirm Local Community involvement/scope/species/sites.
- Confirmation of Local Government/other stakeholder authorities re participation/approvals.
- Agreements with partners on timetable(s) and delivery of outputs.

Output 2. Materials and Methods – New anchoring and delivery systems and trials
- Two main technical issues to overcome: 1) ensuring seeds/propagules are anchored where dropped - anchoring systems devised for each species. 2) creating seed dispensers to be fitted to drones. The method is as follows:
- Seeds collected by local community and sent to international partners, with Phytosanitary Certificates – PI had previous licence to bring in seeds.
- Seed anchoring systems devised with Technological University of Panama (TUoP) and tested in laboratory conditions in Panama and simulation tanks at UoG.
- Design and test magazines for holding seeds/propagules and dropping mechanisms devised at UoG with the TUoP and consultants Inverto.
- Testing drones with delivery mechanisms.

Output 3: Capacity Building and Training
- Drone building / training for UoG, IPB and UPV.
- Drone flight training for IPB, UPV and UoG.
-Training 9 women from each community monitoring seedling growth/environmental conditions.

Output 4: In Situ Testing
-2nd collection of seeds by local community women.
-Preparation of seeds with local community for dropping.
-Preparation of sites for seeding including bamboo barriers.
-Seeding operations on sites.
-Marking seeds with flag markers so that movement of seeds on substrate can be monitored.
-Aerial photography of seeds and markers as baseline and linked mapping.

Output 5: Monitoring
-On site monitoring/data collection of seed growth/movement and environmental conditions by local monitors.
-Reporting data to local universities.
-Compiling data by local universities

Output 6: Project Management
-Overall management – UoG.
-UoG distributes funds according to the grant agreements.
-Steering Committee with leads and others from each of the 3 institutions will oversee the project and meet every 3 months.

Output 7: Knowledge Exchange and Dissemination
-Website about project with updates every month.
-Posters at community sites and local authority and at universities.
-Publication of peer reviewed paper(s).

Q16. Innovation

Please specifically outline how your approach or project is innovative.

Is it the application of a proven approach in a distinctly different geography/issue/stakeholder (novel to the area), or in a different sector (novel to the sector), or an unproven approach in any sector (novel to the world)?

Reforestation by drone is being done and explored in many regions around the world. Also with mangroves in the Gulf States [4], Panama etc.[5]. The technology is being used because the scale and related costs of planting by hand are too great and too expensive. Whilst drones can drop seeds scattering them effectively, in fluid intertidal zones, the dynamics of tidal waters means that the seeds/propagules can end up in the wrong areas and/or concentrated so that there are too many seedlings in one area and none in others.

Innovation is a key part of this project in devising anchoring mechanisms which enables the seeds/propagules 1) to remain where they have been dropped, this has not been done before and 2) devise seed holding magazines suitable for the various seeds so that they can be dropped individually. The anchoring mechanisms will need to be devised for each individual species. Additionally this will be the first use of this technology for mangrove restoration in Indonesia and the Philippines and also with regard to commencing training for drone pilots at the 2 universities so that their capabilities can be extended internally but also in terms of transferring knowledge and skills to local people. The use of self-built drones using tried and tested designs and technology in mangrove seeding will also be a first and will facilitate experience and knowledge in this area opening up the opportunity for more cost effective seeding by local people in the future.

Q17. Capability and Capacity

How will the project support the strengthening of capability and capacity of identified local and national partners, and stakeholders during its lifetime at organisational or individual levels? Please provide details of what form this will take, who will benefit (noting any Gender Equality and Social Inclusion (GESI) considerations), and the post-project value to the country.

Through hands-on workshops/training sessions, participants, including local community members, government officials, and environmental NGOs, will acquire valuable skills in drone technology and seed bombing techniques, and mangrove ecology, empowering them to manage future rehabilitation efforts more independently. Engagement with the local communities will foster a sense of ownership and responsibility for mangrove conservation, ensuring that those most affected by environmental changes are actively involved in the decision-making process. Collaborating with national and local government agencies will ensure that the project aligns with existing coastal management policies providing evidence-based recommendations for policy development. The project will build local capacity for monitoring and evaluation by equipping stakeholders with the tools and methods needed to track the success of mangrove rehabilitation efforts. Post-project, the skills and knowledge gained will provide sustained environmental benefits, enhancing coastal resilience and improving livelihoods for communities dependent on mangroves for fisheries and tourism.

The project has already consulted with the local government (mayors) and their agencies, as well as with local community groups that are involved with mangrove restoration. The majority of these are women. The administrative and local community groups include in Indonesia, 3 Community Reliance Groups – Mangrove Community Organisation 'Dewi Mangoversari Brebes' supported by the KEHATI Foundation, the members consist of women, fisherfolk and youth, an additional group supported by the Kemitraan supported by the Local Agency and the 3rd 'Kompak, supported by OISCA (Organisation for Spiritual and Cultural Advancement and the Fisheries agency of Brebes Municipality, Central Java. In the Philippines (Iloilo Mayor and Departments, Leganes Mayor and Departments including the Office of Municipal Environment and

Natural Resources, the Community Based Mangrove Seedlings Association, Leganes and the local Barangay leaders. The project will liaise with national partners including the Forest Management Bureau, the Philippines and the Mangrove Restoration Agency, for the Indonesian Government.

If necessary, please provide supporting documentation e.g. maps, diagrams, references etc., as a PDF using the File Upload below:

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Section 6 - GESI, Awareness, Change Expected & Exit Strategy

Q18. Gender Equality and Social Inclusion (GESI)

All applicants must consider whether and how their project will contribute to promoting equality between persons of different gender and social characteristics. Please include reference to the GESI context in which your project seeks to work. Explain your understanding of how individuals may be disadvantaged or excluded from equal participation within the context of your project, and how you seek to address this. You should consider how your project will proactively contribute to ensuring individuals achieve equitable outcomes and how you will ensure meaningful participation for all those engaged.

In discussing how our project fosters equality, we acknowledge the significance of Gender Equality and Social Inclusion (GESI). We recognize that individuals may encounter disadvantages or exclusion stemming from gender, socioeconomic position, disability, or other reasons.
As part of its Strategy 2030 and ongoing commitment to addressing gender inequalities and embedding inclusive cultures, the University of Greenwich has pledged its commitment to the principles of the Athena Swan Charter which is a framework to support and transform gender equality within higher education and research.
Inserting, realising and maintaining gender equality is integral to the project in all aspects and at all levels. Gender equality and social inclusion has been discussed from the very start and there is a direct focus on gender balance with strong female participation and leadership within the universities as far as possible, as well as regarding female representation within local communities. In the universities, in each country e.g., one male and one female drone pilot will be trained. In the Philippines women are well represented in mangrove rehabilitation and in running nurseries and centres. Regarding, seed collection and the training of monitors we shall undertake selection and training amongst marginalised groups and in the local language, accessible formats and ensure gender equality. The training will also be gender-sensitive.
Moving from proposal to project we will re-evaluate the local GESI environments and endeavour to enable people to participate who encounter disadvantages or exclusion stemming from gender, socioeconomic position, disability, or other reasons. Our methodology is as follows:
1. Through comprehending and acknowledging obstacles to equitable participation;
2. Creating targets and for equitable participation following the above;
3. Following through to actively include underrepresented groups employing participatory methods e.g. focus group/community talks/workshops to collect varied opinions and foster inclusive decision-making;
4. Monitoring and evaluating our effectiveness in GESI.

Q19. Change expected

Detail the expected changes and benefits to both biodiversity and multi-dimensional poverty reduction, and links between them, that this work will deliver. You should identify what will change and who exactly will benefit a) in the short-term (i.e. during the lifetime of the project) and b) in the long-term (after the project has ended).

Understanding the Limitations:
This is an Innovation project, focusing on delivering methods for mangrove restoration which will enable long-term benefits in the 2 countries but also globally where mangroves need to be restored/planted. The short term biodiversity benefits are limited by the short project duration of 18 months, with only a 3 month growing period as well as the size of the pilot sites which are 1ha in size in each of 2 locations with a total of 400 seeds/propagules (s/ps) of 2 species, so 800 in each country and 1600 in total. However, even in this time there should be some increase in biodiversity in these areas. Whilst there will be direct short-term socio-economic benefits, similarly the most significant impacts are considered long-term, once the pilot has shown the innovations to be successful.
A. Short-term Benefits
-Seeding and the subsequent growth of seedlings should improve the biodiversity associated with mangroves over 2ha in two separate areas and this will significantly increase over time.
-This also means that the people centred ecosystem services will increase as time proceeds.
-Drones will be built using open tried and tested plans, materials and components which will enable IPB and UPV to expand their knowledge and capabilities.
-Additionally drone pilot training will be undertaken by 2 female staff at each university, increasing their skills and capabilities which can be passed on.
-Women from Community Groups will collect seeds for testing and for seeding. Payment will be provided for this service benefitting the women and their families
-Training will be given to 3 women from each local community in environmental data collection and monitoring of the environment and of the growth progress of the seedlings. This will improve their skills and provide them with payment for the work that they undertake, benefiting themselves and their families.

B. Long Term Benefits
The long term benefits relate to the immediate 4 ha (2ha each/community) of seeded mangrove forest which will significantly increase biodiversity including marine and terrestrial invertebrates and birds. The potential average long-term benefits for ecosystem services per ha/annum for Indonesia as published by the World Bank in 2022 [6] is as follows:
A. Coastal Protection – [redacted]
B. Climate Regulation [redacted]
C. Fisheries Support Services – [redacted]
D. Raw Materials Provision – [redacted]
E. Cultural Services – [redacted]
This is a total of [redacted] On Java where the sites are this is [redacted] and in Bali [redacted] based on a high value of coastal protection of [redacted] / ha.
In the Philippines total economic values of mangroves across 2 sites on average per ha were PHP [redacted] and [redacted]. This includes the harvest of crabs, shrimps, other molluscs and the use of timbers for various purposes [7].
The project also envisages mangrove reestablishment in pond areas creating cleansing biotopes for neighbouring ponds. This will be a desktop study to design systems which can be undertaken at a later date but also reliant on reforestation by drones.

Q20. Pathway to change

Please outline your project's expected pathway to change. This should be an overview of the overall project logic and outline why and how you expect your Outputs to contribute towards your overall Outcome and, in the longer term, your expected Impact.

The logic of the project is linear and follows a list of sequential, as well as parallel and scheduled tasks that are delivered by the institutions and other stakeholders in a measured and collaborative way. The project has been scoped and collaborations with the institutions and the key local group and local authority stakeholders forged prior to the application. An extensive review of the literature and best practice has also been undertaken in order to ensure that 1) the project is necessary and will make a

difference locally and globally and 2) we are not 'reinventing the wheel' in terms of aerial seed bombing, the use of drones and in particular with regard to mangrove restoration. What is totally new is the technology of anchoring the seeds so that we can increase biodiversity richness. The TOC clearly illustrates the essential targeted stages and tasks linked to the Work Plan. In essence, the pathway is simple and effective as follows: Pre-application agreements and scoping with stakeholders – project starts with agreements/approvals and reviews of scope – next mid stage used to trial technologies and undertake training – 2nd mid-stage used to test in-situ – final months used for monitoring and reporting.

Q21. Sustainable benefits and scaling potential

Q21a. How will the project reach a point where benefits can be sustained post-funding? How will the required knowledge and skills remain available to sustain the benefits? How will you ensure your data and evidence will be accessible to others?

The objective of the project is to design, produce and implement devices and systems that make mass seeding of mangrove seeds by drone possible. This is based on creating new systems based on existing systems at the same time using local community knowledge and input. In the longer term the aims are fulfilled by restored mangrove forest in the seeded areas and the transfer of knowledge (drones building, drone piloting, monitoring capabilities) to the local institutions and communities. This knowledge will then be made accessible via scientific papers as well as a website in the 3 languages as well as local community and local authority workshops. As a pilot project the knowledge and skills will be used to inform more extensive projects with greater and more extensive collaborations with the local institutions and communities, with an emphasis on women's' participation to enable them eventually to be key protagonists.

Q21b. If your approach works, what potential is there for scaling the approach further? Refer to Scalable Approaches (Landscape, Replication, System Change, Capacitation) in the guidance. What might prevent scaling, and how could this be addressed?

As a pilot, a key aim is that the systems/methods are scalable and can be used worldwide where mangrove restoration /creation is required. Whilst every drop-site is unique, the project utilises 4 sites in 2 different countries ensuring the technology is tested under different conditions. Whilst the scale of this project is limited, the potential for upscaling has been a key aim as there are tens of thousands of hectares that need to be planted worldwide and the technology/techniques discovered here can be relevant to other habitats as well. The scaling potential is as follows:
-Landscape: In local and global intertidal areas and abandoned fish ponds;
-Replication: Applicable to other habitats and communities such as seagrass restoration;
-Systems change: Opening potentials for greater restoration through government and private incentives as costs reduced and using drones for other habitat restoration; and
-Capacitation: Legacy generated locally and globally through Knowledge Exchange.

Section 7 - Risk Management

Q22. Risk Management

Please outline the 7 key risks to achievement of your Project Outcome and how these risks will be managed and mitigated, referring to the Risk Guidance. This should include at least one Fiduciary, two Safeguarding, and one Delivery Chain Risk.

Risk Description	Impact	Prob.	Gross Risk	Mitigation	Residual Risk
Fiduciary (financial): funds not used for intended purposes or not accounted for (fraud, corruption, mishandling or misappropriated). Partners receiving project allocated funds and not using them for the intended purpose.	Major	rare	Moderate	Mitigated by working with known partners with known integrity. IPB initiated a Rule Book covering Financial Management. Univ. of the Philippines' financial transactions are covered by the 'Philippine Transparency Seal' complying with the conditions of good governance, Section 106 of the General Provisions, FY 2019 General Appropriations Act (GAA).	Minor

Safeguarding: risk of sexual exploitation abuse and harassment (SEAH), or unintended harm to beneficiaries, the public, implementing partners, and staff. Partners and collaborators do not comply to code of conduct ignoring safeguarding principles during project activities including meetings, training courses, and site based activities and/or whilst collaborating with local stakeholders and communities.	Severe	Unlikely	Major	Mitigated by ensuring all partners and collaborators agree to adhere to University of Greenwich Code of Conduct including Safeguarding Policy (https://www.gre.ac.uk/docs/rep/sas/university-of-greenwich-safeguarding-policy#:~:text=The%20University%20is%20committed%20to,all%20members%20of%20its%20community. Mitigated by stressing at outset the code of conduct, safeguarding and other policies as a condition of funding and project initiation. Mitigated by working with well-known and reputable organisations.	Minor
Safeguarding: risks to health, safety and security (HSS) of beneficiaries, the public. Implementing partners, and staff. Staff and local community individuals at risk of harm through physical injury and injury to general health.	Moderate	Unlikely	Moderate	All project work, including fieldwork will have a risk assessment done to highlight any risks and mitigate them. Procedures will be formulated, and agreed on, including items associated with drones, on site work regarding seeding and monitoring relating to tides and ground conditions including no lone working.	Minor
Delivery Chain: the overall risk associated with your delivery model. Targeted local communities and local authorities renege on collaboration and use of sites.	Moderate	Unlikely	Moderate	There are numerous other local communities, local authorities and sites that could be brought in, instead. .	Minor
Risk 5 -Delivery - Skills Drone pilots do not have the appropriate skills	Moderate	Unlikely	Moderate	Drone pilot training will enable skills, with refresher training before seeding, with backup drone pilots from the Philippine military. (UPV has close contact with Philippine military drone operators) and in Indonesia experienced drone pilots from REKAM an NGO that is closely linked to IPB University.	Minor
Risk 6 -Delivery - Programming Weather including typhoons at time of seeding is poor and seeding cannot be undertaken and/or tidal flows and winds are so strong that seeds do not remain where dropped	Moderate	Unlikely	Moderate	The timing of the seed dropping and monitoring are during the most benign monthsof the year in both countries. If by chance there are weather disruptions at the scheduled time then seeding can be delayed This is possible because the seeding/monitoring period is extensive at 4 months.	Minor

Risk 7 -Outcome	Severe	Unlikely	Severe	Viable seeds/propagules collected by local people and the seeding methods discussed and designed in collaboration with them. As with many seeds, some may not germinate. To mitigate there will be at least 400 seeds dropped of each mangrove species in each country. Seeds also tested in laboratory conditions.	Minor

Q23. Project sensitivities

Please indicate whether there are sensitivities associated with this project that need to be considered if details are published (detailed species location data that would increase threats, political sensitivities, prosecutions for illegal activities, security of staff etc.).

⦿ No

Section 8 - Workplan

Q24. Workplan

Provide a project workplan that shows the key milestones in project activities.

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Section 9 - Monitoring and Evaluation

Q25. Monitoring and evaluation (M&E)

Describe how the performance of the project will be monitored and evaluated, making reference to who is responsible for the project's M&E. How will the project robustly evaluate the innovation to support its future application?

The University of Greenwich (UoG) project team including our Research and Enterprise Office and a dedicated team and officer and the Steering Committee (SC) will lead the M&E of the project. Project meetings will be held every month (or at critical times every 2 weeks/or as necessary) with M&E as a key item on the agenda, keeping track of progress and ensuring that the timetable (workplan) and the logical framework are adhered to. Meetings will also include local community and government stakeholders as necessary. Most meetings will be online and will gauge progress against the workplan/timetable (WPT). Should issues arise that affect the WPT then solutions will be discussed, found and be expected to be implemented to ensure timely progress. The progress will be evaluated according to the logframe and its indicators. Should delays/potential delays occur or be foreseen then the SC will discuss the issues and arrive at the best possible solution taking account of the sequence of steps, the final objectives and any risks associated with any changes. Additionally, the overall Project Leader and the two leads from Indonesia and the Philippines and the lead from Panama will liaise continuously on a weekly basis and as necessary via e-mail and Teams/Zoom to discuss project progress. The Project Lead will monitor work progress as well as the linked expenditures with the other leads and the UoG, dedicated research office officer and the dedicated finance officer allocated by the UoG.
The progress in technological development is key to the success of the project and this will be monitored closely and evaluated in terms of timeliness but also efficacy of solutions. The inclusion of local communities and authorities enables the project to be inclusive and prepares the ground for the actual seeding and monitoring, but also for handing over skills and knowledge which will enable more control of larger scale restoration in the future. This aspect requires constant attention and evaluation ensuring that these stakeholders participate as planned and that they have a full and positive experience with positive outcomes. The collection of seeds, training for monitoring and monitoring itself once seeding has taken place are key activities involving local people and their engagement will be monitored and assessed to ensure that any challenges are tabled and dealt with and then post activities the SC will design a survey so that local people can inform the project team of their experience so that lessons can be learned. With regard to the actual monitoring of how the dropped seeds perform in-situ, a simple but effective proforma will be used to enable the local monitors to record environmental conditions, any movement of the seeds/propagules relative to the positions they were dropped and then also the growth characteristics of each seed in terms of rooting, stem and leaf growth. The monitoring will be assisted by staff from each of the local universities. Analysis of the data from the monitoring process will enable the project team to assess the level of success.

Total project budget for M&E (£) **(this may include Staff and Travel and Subsistence Costs)**	[redacted]
Total project budget for M&E (%) **(this may include Staff and Travel and Subsistence Costs)**	[redacted]
Number of days planned for M&E	[redacted]

Section 10 - Logical Framework & Standard Indicators

Q26a. Logical Framework (logframe)

Darwin Initiative projects will be required to monitor and report against their progress towards their Outputs and Outcome. This section sets out the expected Outputs and Outcome of your project, how you expect to measure progress against these and how we can verify this.

Combined_Logframe_and_TOC_Benz_Kotzen_2
21/10/2024
11:03:13
pdf 802.88 KB

Impact:

Controlled mass seeding of mangrove seeds/propagules enables fast track restoration of mangrove habitats increasing coastal biodiversity and enabling people to reestablish livelihoods with reductions in poverty and increasing local capabilities.

Outcome:

Concept of precise global mass mangrove restoration using drones is established using sites in Indonesia and the Philippines with the aim of >50% establishment.

Project Outputs
Output 1:
Literature reviews of relevant areas that inform the project, including technical, environmental, botanical.
Output 2:
Prototyping for robotically controlled seed containers/magazines for 2 or 3 species of mangrove which will then be placed under the drone so that seeding can take place – Rhizophora sp., Sonneratia sp. and Avecinnia sp. - depends on consultations.
Output 3:
Prototyping of anchoring mechanisms for 2 or 3 mangrove species to ensure seeds remain in place and can set roots - Rhizophora sp., Sonneratia sp. and Avecinnia sp. - depends on consultations.
Output 4:
Seeding of sites in Indonesia (Java) and The Philippines (Panay).
Output 5:
Data collection and analysis of outcomes of seeding by drone.

Do you require more Output fields?
It is advised to have less than 6 Outputs since this level of detail can be provided at the activity level.

⦿ Yes

Output 6:
Knowledge Exchange
Output 7:
Education and enhancement of local community and local authority knowledge, experience and capabilities
Output 8:
No Response

Activities

Each activity is numbered according to the Output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1.

1.1. Desktop studies carried out by UoG by IPB and UPV.
2.1. Collection of seeds to be sent to UoG and UoP for analysis and testing.
2.2. Design studies and prototyping/manufacture of seed holding magazines and dropping mechanisms with UoG and TUoP and Inverto who have specialist expertise in robotics.
2.3. Drone training for 2 new pilots each at IPB and UPV, and update training for 1 at UoG.
2.4. Building drones with open-source material at UoG, IPB and UPV.
3.1. Design studies, prototyping/manufacture/testing of anchoring mechanisms with UoG and UoP. UoP will undertake studies with up to 20 Masters students to investigate.
4.1. Training local community monitors in order to monitor behaviour of seeds in the intertidal conditions and their growth.
4.2. Collection of seeds by local community for seeding.
4.3. Preparation of the seeds with weights and/or anchoring mechanisms.
4.4. Seeding in situ by drone pilots from IPB, UPV and UoG, using prototype delivery mechanisms and anchoring systems attached to seeds/propagules.
5.1. Monitoring by local community group noting positions and growth of seeds/propagules.
5.2 Monitoring of seed positions by drone photography.
6.1 Website set up.
6.2 Website updated monthly by UoG with assistance from all partners including local community and local autrhority.
6.3 Data collected, collated and analysed for paper
6.4 Paper writing, collaboration by all partners including local community.
7.1 Minutes - notes and recorded meetings with Local Authorities
7.2 Minutes - notes and recorded meetings with Local Community Groups
7.3 Training curriculum devised and manual written, printed and given to monitors
7.4 Monitoring carried out according to monitoring manual
7.45 Drone pilot training attendance records, flight times and pilot certification and registration

Q26b. Standard Indicators

Standard Indicator Ref & Wording	Project Output or Outcome this links to	Target number by project end	Provide disaggregated targets here
e.g. DI-A01: Number of people in eligible countries who have completed structured and relevant training	**e.g. Output indicator 3.4 / Output 3**	**e.g. 60**	**e.g. 30 non-indigenous women; 30 non-indigenous men**
DI-A01: Number of people in eligible countries who have completed structured and relevant training	Output indicator 2.3 / Output 2	22	4 indigenous women drone pilots, 9 indigenous women each from Indonesia and the Philippines as monitors.

DI-A03: Number of local or national organisations with enhanced capability and capacity	Output indicator 2.3 / Output 2	3	UoG, IPB, UPV
DI-C08: Number of Media related activities	Output indicator 6.1 / Output 6	19	Website updated monthly , 1 peer reviewed paper, 3 radio broadcasts in 2 countries = 6, 3 TV broadcasts in 2 countries = 6,
DI-C10: Number of decision-makers attending briefing events	Output indicator 7.1 / Output 7	120	60 indigenous men, 60 indigenous women
DI-D01b: Area improved through restoration	Output indicator 4.1 / Output 4	2.4ha	1600 seedlings, 1.2 ha in each country
DI-D03b: Number of people with improved income	Output indicator 7.3 / Output 7	18	18 indigenous women, 9 in each country
DI-D04d: Number of people with improved education	Output indicator 7.3 / Output 7	18	18 indigenous women, 9 in each country
DI-D06: Value of Ecosystem Services Generated or Protected	DI-D06: Value of Ecosystem Services Generated or Protected Output indicator 4.3 / Output 4	1600 plants over 2.4 ha	At least 2 species each 800 plants per country
No Response	*No Response*	*No Response*	*No Response*
No Response	*No Response*	*No Response*	*No Response*
No Response	*No Response*	*No Response*	*No Response*
No Response	*No Response*	*No Response*	*No Response*
No Response	*No Response*	*No Response*	*No Response*

If you cannot identify three Standard Indicators you can report against, please justify this here.

No Response

Section 11 - Budget and Funding

Q27. Budget

Please complete the appropriate Excel spreadsheet, which provides the Budget for this application. Some of the questions earlier and below refer to the information in this spreadsheet.

BCF_Budget_over_100k_MASTER_25.07.24_locked
21/10/2024
13:13:14
xlsx 95.64 KB

Q28. Alignment with other funding and activities

This question aims to help us understand how familiar you are with other work in the geographic/thematic area, and how this proposed project will build on or align with this to avoid any risks of duplicating or conflicting activities.

Q28a. Is this new work or does it build on existing/past activities (delivered by anyone and funded through any source)?

⦿ New Initiative

Please give details.

The use of aerial 'seed bombing' to restore terrestrial habitats is well recorded and is being undertaken worldwide. This is particularly prevalent in restoring woodlands. Benz Kotzen has been researching habitat restoration using aerial seed bombing since 2017 and carried out a small trial at South East Kenya University, in 2018, within a dryland zone with two types of grasses, which had disappeared from the area. These were successfully re-established using a variety of seed bomb materials.

Research into the potentials for restoration of mangrove habitats commenced in 2023, with a literature review and also visits to Indonesia and the Philippines in March 2024 to investigate sites where mangroves had been removed and meeting local community groups, local authorities, visiting potential trial sites and also visiting programmes and sites where restoration has been and is being carried out by planting seedlings that are grown in local nurseries which were also visited.

A thorough literature survey has been undertaken to ascertain what has been done where and by who and this revealed the work done by the University of Panama and the company 'Inverto' and these have become relatively small partners in the project, bringing their knowledge and expertise.

Q28b. Are you aware of any current or future plans for work in the geographic/thematic area to the proposed project?

⦿ No

Q29. Value for Money

Please demonstrate why your project is good value for money in terms of impact and cost-effectiveness of each pound spend (economy, efficiency, effectiveness and equity). Why is it the best feasible project for the amount of money to be spent? Please make sure you read the guidance documents, before answering this question.

We have engineered this project to fulfil its ambitions. Its aims/objectives have been scoped to fit within the budget. Staff time has been calculated with regard to efficiency and effectiveness, consolidating tasks amongst the institutions where they are best able to be undertaken. Thus, the seed carrying and anchoring systems will be focused in the University of Greenwich and the University of Panama, with Inverto assisting. The preparations for seeding including local stakeholder engagements are all undertaken

in Indonesia and the Philippines as are the trials and monitoring themselves. We have calculated, that approximately 70% of the funds go to the entities in these countries. Staff time and expenses are thoroughly considered and fine-tuned and sites for seeding have been located as close as possible to the university bases sites so that travel and associated costs are limited. We have also allocated funds to train 18 local monitors who will get paid for their time during training and when undertaking monitoring. Thus ensuring that at least some funds go to the local community. Funds will also be used for the local community to build suitable wave reducers from bamboo thus adding funds in other ways to the local economy.
The cost of drones can be expensive and thus we have followed the route of enabling the institutions to build their own drones using tried and tested open access plans and with parts and materials that are readily available. We have backup drones in event of anything going awry.

Q30. Capital items

If you plan to purchase capital items with Darwin funding, please indicate what you anticipate will happen to the items following project end. If you are requesting more than 10% capital costs, please provide your justification here.

We are not intending to spend more than 10% on capital costs
- 3 open source self-built drones (Dronex) made from available materials and parts. One each for the UK, Indonesia and The Philippines. These are purchased with UK funds as importing the component parts may be difficult in Indonesia and the Philippines. One drone will remain in Indonesia and one in the Philippines.
- Bamboo wave barriers will remain in place
- Small items of equipment will be purchased for use in the laboratories in the UK, e.g. to test seed anchoring, these will remain at the University of Greenwich.
- Small items of equipment and materials that are used by students in Panama will remain there.

Section 12 - Safeguarding & Ethics

Q31. Safeguarding

All projects funded under the Biodiversity Challenge Funds must ensure proactive action is taken to promote the welfare and protect all individuals involved in the project (staff, implementing partners, the public and beneficiaries) from harm. In order to provide assurance of this, projects are required to have specific procedures and policies in operation.

Please outline how your project will ensure:

(a) beneficiaries, the public, implementing partners, and staff are made aware of your safeguarding commitment and how they can confidentially raise a concern,

(b) safeguarding issues are investigated, recorded and what disciplinary procedures are in place when allegations and complaints are upheld,

(c) you will ensure project partners also meet these standards and policies.

Indicate which minimum standard protocol your project follows and how you meet those minimum standards, i.e. CAPSEAH, CHS, IASC MOS-PSEA. If your approach is currently limited or in the early stages of development, please clearly set out your plans to address this.

The lead partner, the University of Greenwich (UoG) has due diligence procedures to ensure compliance by parents and sub-contractors. All project partners are required to pass a review to ensure they have appropriate procedures in place. All staff are required to pass training on safeguarding following theUoG's code of conduct. There is a whistle-blowing policy, registers of cases and investigative procedures to manage safeguarding issues that may arise.

From the outset at the kick-off meeting safeguarding, whistleblowing, code of conduct and health and safety, will be tabled and will be a fixed item on meeting agendas. The leads for each institution will be responsible for safeguarding with regard to the project where the overall Project Lead will have overall responsibility under the University's safeguarding representative Professor Louise Owusu-Kwarteng.
- The project will be run according to the UoG's commitment to safeguarding with zero tolerance to bullying, harassment, sexual exploitation and abuse.
- The UoG has a clear process for raising concerns and it will protect whistle=blowers from reprisals.
- The UoG has a Code of Conduct which clearly sets out expected behaviours within and outside the workplace for everyone and this includes those involved in the project. The results of non-compliance or breaches of these standards are made clear.
- The UoG has a Health and Safety Strategy and Plan embedding best practice as set out in the Universities Safety and Health Association (USHA) USHA/UCEA Leadership and management of health and safety in higher education institutions.
The project will make everyone involved aware that the project is managed according to the 'Six Core Principles' of the Inter-Agency Standing Committee (IASC).

Defra recommend you appoint a safeguarding focal point to ensure the project's PSEAH work is taken forward. This can be a separate member of staff or a current member of staff who spends a proportionate amount of time for safeguarding and PSEAH activities. Please name this individual here - this person should also be included in your overall staff list at Q34 and in your budget.

Professor Louise Owusu-Kwarteng

Q32. Ethics

Outline your approach to meeting the key principles of good ethical practice, as outlined in the guidance.

The project will meet all legal and ethical obligations of all countries and organisation involved in the project. The project will ensure that it enables local people and institutions to participate and takes due notice of their views, knowledge and experience related to the project and ensures that no harm befalls any person(s) involved and there are procedures and opportunities for people to voice any concerns. The project is very keen to understand and acknowledge local knowledge and also help local people to engage as far as possible with the technology and science. They will be engaged throughout and specifically trained to undertake monitoring. The project will also acknowledge rights, privacy and safety of all people and ensure that no damage is done to property and the environment and consult the communities prior to any actions using prior informed consent principle (PIC) at all times. Safety of staff and others working on the project is paramount. Site visits and activities will always have at least 2 people. Ethical approval will be submitted to the University of Greenwich's Ethics Committee. Any advice from the committee will be acknowledged and responded to.

Section 13 - British Embassy or High Commission Engagement

Q33. British embassy or high commission engagement

It is important for UK Government representatives to understand if UK funding might be spent in the project country/ies. Please indicate if you have contacted the relevant British embassy or high commission to discuss the project and attach details of any advice you have received from them.

⊙ Yes

Please attach evidence of request or advice if received.

Letter_to_UK_Embassy_in_Philippines
17/10/2024
09:15:45
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Letter to UK Embassy in Indonesia
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10:53:47
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Section 14 - Project Staff

Q34. Project staff

Please identify the core staff (identified in the budget), their role and what % of their time they will be working on the project.

Name (First name, surname)	Role	% time on project	1 Page CV or job description attached?
Benz Kotzen	**Project Leader**	10	Checked
Mike Sharp	Engineer	5	Checked
Budy Wirwayan	Indonesian Co Lead	30	Checked
Am Azbaz Taurusman	Research Core Team - Mangrove Restoration/marine biodiversity	30	Checked

Do you require more fields?

⦿ Yes

Name (First name, surname)	Role	% time on project	1 Page CV or job description attached?
L Teguh Pambudi	Research Core Team - Mangrove Restoration/marine biodiversity	30	Checked
Mary Grace Sedanza	The Philippines Co Lead	30	Checked
Fredsen Huervana	Research Core Team - Mangrove Restoration/marine biodiversity	30	Checked
Diana Paguntalan	Research Core Team - Mangrove Restoration/marine biodiversity	30	Checked
Humberto Rodriguez	Project Coordinator Panama - Drone delivery and anchoring - Panama	30	Checked
Dania Montenegro	Project Coordinator Panama - Drone delivery and anchoring	20	Checked
Christopher Jakits	Research Core Team - Manufacturing	40	Checked
No Response	*No Response*	*No Response*	Unchecked

Please provide 1 page CVs (or job description if yet to be recruited) for the project staff listed above as a combined PDF.

Combined CVs_FINAL_2
21/10/2024
14:01:03
pdf 1.18 MB

Have you attached all project staff CVs?

⦿ Yes

Section 15 - Project Partners

Q35. Project Partners

Please list all the Project Partners (including the Lead Organisation who will administer the grant and coordinate delivery of the project), clearly setting out their roles and responsibilities in the project including the extent of their engagement so far.

Lead Organisation name:	University of Greenwich
Website address:	https://www.gre.ac.uk ; https://www.gre.ac.uk/research

Why is this organisation the Lead Organisation, and what value to they bring to the project? **(including roles, responsibilities and capabilities and capacity):**	The University of Greenwich is a 'modern university' which has made great strides in its research, research outputs and impact. The university and the Natural Resources Institute carry out research across numerous disciplines and in this case, the proposed research is based within the School of Design and with Prof. Benz Kotzen, who is Professor of Landscape and Nature Based Solutions. He led Unit of Assessment 32 which did very well at the last REF. He has been Head of Research and has had many research administrative roles in the university. He also runs the laboratories in the School which have the capacity to run the proposed intertidal based experiments. He is also a drone pilot. Most importantly, is the focus of his research and also his position in the School, Faculty provides him with the time to pursue innovative and impactful research. This focus is on landscape scale issues but which also have enormous social and economic importance. The work centres on combining technology with landscape solutions, in this case mass seeding of mangroves using drones. Benz is well set to lead this project with suitable partners in Indonesia and the Philippines. Having been able to meet them, the local communities and local authorities and see the proposed sites first hand is invaluable. He has also led numerous successful complex projects over the last 10 years. The projects' successes are also due to the Faculty's and University's research environment and offices/officers that assist in setting up and running the projects ensuring the necessary support that is required. In other words, the University has all the systems set in place to ensure smooth progress and successful outcomes. This administrative support will also be reinforced with project support of an engineer from the School of Engineering and a research assistant.
International/In-country Partner	⦿ In-country
Allocated budget (proportion or value):	[redacted]
Representation on the Project Board (or other management structure)	⦿ Yes
Have you included a Letter of Support from the Lead Organisation?	⦿ Yes

Do you have partners involved in the project?

⦿ Yes

1. Partner Name:	Institut Pertanian Bogor (IPB)
Website address:	https://www.ipb.ac.id : https://fpik.ipb.ac.id
What value does this Partner bring to the project? **(including roles, responsibilities and capabilities and capacity):**	IPB is a well respected University with a focus in 'Agriculture, Ocean and Biosciences for a Sustainable World'. The Project Lead met the staff involved in this project in March 2024, particularly due to their connections in areas where mangrove losses are great and where local societies have been affected particularly through the loss of biodiversity and livelihoods. The staff are mainly connected to fisheries and aquaculture but the mangrove habitats are so important for the health of the ecosystems within and beyond the forests, providing the spawning grounds and nurseries for the fishers' livelihoods as well as those who use the mangroves to provide the variety of fish and bivalves that they eat and sell to make a living. The staff are immersed in the local society, from local to national government, as well as the local community groups and they are well respected and this will enable the pilot sites to be drone seeded. Collaborating with this institution will benefit them as well, providing them with new knowledge and skills, which can then also be passed on to local communities. Furthermore they are well versed in working on international projects funded by other international agencies such as USAID.
International/In-country Partner	⦿ International
Allocated budget:	[redacted]
Representation on the Project Board (or other management structure)	⦿ Yes
Have you included a Letter of Support from this partner?	⦿ Yes

2. Partner Name:	University of the Philippines Visayas
Website address:	https://www.upv.edu.ph ;
What value does this Partner bring to the project? **(including roles, responsibilities and capabilities and capacity):**	The UPV Project Partners will provide the services of biodiversity, aquaculture, and fisheries science experts to conduct seminars, workshops, and orientations relevant to the project. The team members have past and current experiences in leading and/or organizing government-funded research projects including but not limited to mangrove diseases in oil-spilled areas, agroforestry systems and plant diseases in important crops, finfish and invertebrate aquaculture systems, aquaponics agritourism, aquatic ecology, and development of aquafeeds for important aquatic organisms. Through these projects, they have experience in community and stakeholder engagement that could promote advocacies to enhance the project's reach and impact in the Philippines. The team members have leadership and management skills not only applied in leading research projects but also in fulfilling their administrative roles in the university concurrent to their teaching roles. The team members who are occupying administrative posts have also made available their facilities as venues for meetings and research activities necessary for the project's implementation. Moreover, all the team members have mentored undergraduate and graduate students in the implementation of their thesis projects. They are also capable of working through inter- and trans-disciplinary collaborations that could benefit the exchange of knowledge and upskilling of both local and international partners
International/In-country Partner	⦿ International
Allocated budget:	[redacted]

Representation on the Project Board (or other management structure)	⊙ Yes
Have you included a Letter of Support from this partner?	⊙ Yes

3. Partner Name:	Technological University of Panama
Website address:	https://utp.ac.pa
What value does this Partner bring to the project? **(including roles, responsibilities and capabilities and capacity):**	Universidad Tecnológica de Panamá , The Technological University of Panama, is the second largest university in Panama. There are two main reasons for the institution and staff to collaborate on the project. In the first instance the staff have expertise in robotics as well as drones and specifically there has been some research through 'Panama Flying Labs which is run by the Panamanian Project Lead, Dr Humberto Rodrigues and with the other staff as well. The project requires additional robotics and engineering expertise, which they have and the project will also help them in Panama's need to restore their own mangrove habitats as well as in neighbouring countries. The second reason is because Dr Rordrigues is able to bring the project to up to 20 Engineering Masters students who will investigate the seed holding and release mechanisms and the anchoring systems as well. They can also test the prototypes in very similar intertidal conditions which is a real bonus. They also bring significant drone flying experience which has bearing on creating seed holding magazines that can be fixed to drones, the release mechanisms and also in collecting environmental data with drones including sequential photographs.
International/In-country Partner	⊙ International
Allocated budget:	[redacted]
Representation on the Project Board (or other management structure)	⊙ No
Have you included a Letter of Support from this partner?	⊙ Yes

4. Partner Name:	Zoological Society of London
Website address:	https://www.zsl.org/what-we-do/science-research
What value does this Partner bring to the project? **(including roles, responsibilities and capabilities and capacity):**	As a globally renowned research organisation with research and publications on mangrove restoration the Zoological Society of London (ZSL) were an obvious choice for partnering any mangrove restoration project, with not only extensive knowledge of mangroves worldwide but also in the Philippines and in the area were have located for drone seeding. The main role of the ZSL would be with regard to species selection for trials and providing knowledge on the species and the best ways to get successful rooting and thus establishment of the species so that we get successful growth. Whilst having experts in the UK, they also have local experts who will also be consulted. Whilst their role in this project is small it is important.
International/In-country Partner	⊙ In-country
Allocated budget:	[redacted]
Representation on the Project Board (or other management structure)	⊙ No
Have you included a Letter of Support from this partner?	⊙ Yes

5. Partner Name:	Inverto
Website address:	https://www.inverto.tech
What value does this Partner bring to the project? **(including roles, responsibilities and capabilities and capacity):**	Inverto are a small Swiss company which worked with the University of Panama on using a specifically designed hold and drop mechanism for mangrove propagules and they can bring their knowledge and/or mechanisms to the project. As leaders in this area, it makes sense to include them, as we 'do not want to reinvent the wheel' as it were. They also bring the ethos, like all the partners, that eventually this knowledge will be transferred to local communities so that they can manage and undertake their own restoration projects.
International/In-country Partner	⊙ International
Allocated budget:	[redacted]
Representation on the Project Board (or other management structure)	⊙ No
Have you included a Letter of Support from this partner?	⊙ Yes

6. Partner Name:	*No Response*

Website address:	*No Response*
What value does this Partner bring to the project? **(including roles, responsibilities and capabilities and capacity):**	*No Response*
International/In-country Partner	○ International ○ In-country
Allocated budget:	*No Response*
Representation on the Project Board (or other management structure)	○ Yes ○ No
Have you included a Letter of Support from this partner?	○ Yes ○ No

If you require more space to enter details regarding Partners involved in the project, please use the text field below.

No Response

Please provide a combined PDF of all Letters of Support for all project partners or explain why this has not been included.

Combined Letters of Support
19/10/2024
12:06:53
pdf 3.09 MB

Section 16 - Lead Partner Track Record

Q36. Lead Organisation Capability and Capacity

Has your organisation been awarded Biodiversity Challenge Funds (Darwin Initiative, Darwin Plus or Illegal Wildlife Trade Challenge Fund) funding before (for the purposes of this question, being a partner does not count)?

⊙ Yes

Please provide details of the most recent awards (up to 6 examples).

Reference No	Project Leader	Title
29-019	Dr Jeremey Haggar	Indigenous biocultural landscapes for livelihoods and connectivity in Verapaces, Guatemala
DARSC196	Dr Jeremey Haggar	Conservation and use of native coffee species in Sierra Leone
19-018	Dr Jeremey Haggar	Agroforests: a critical resource for sustaining megadiversity in Guatemala
No Response	*No Response*	*No Response*
No Response	*No Response*	*No Response*
No Response	*No Response*	*No Response*

Have you provided the requested signed audited/independently examined accounts?

⊙ Yes

Section 17 - Certification

Q36. Certification

If this section is incomplete the entire application will be rejected.

Please note if you do not upload the relevant materials below your application may be ineligible.

On behalf of the

Trustees

of

The University of Greenwich

I apply for a grant of

£199,987.00

I certify that, to the best of our knowledge and belief, the statements made by us in this application are true and the information provided is correct. I am aware that this application form will form the basis of the project schedule should this application be successful.

(This form should be signed by an individual authorised by the applicant institution to submit applications and sign contracts on their behalf.)

- **I have enclosed CVs for key project personnel, a cover letter, letters of support, a budget, logframe, theory of change, Safeguarding and associated policies, and project workplan.**
- **Our last two sets of signed audited/independently verified accounts and annual report (or other financial evidence – see Finance Guidance) are also enclosed.**

Checked

Name	Prof Benz Kotzen
Position in the organisation	Professor of Landscape and Nature Based Solutions
Signature (please upload e-signature)	Benz Kotzen signature 05/10/2024 11:24:48 pdf 102.75 KB
Date	16 October 2024

Please attach the requested signed audited/independently examined accounts.

ug17782-report-accounts-31072022-update[91]
17/10/2024
09:36:10
pdf 5.83 MB

report-and-financial-statements-for-year-ended-31-july-2023[91]
17/10/2024
09:36:09
pdf 2.04 MB

Please upload the Lead Organisation's Safeguarding Policy, Whistleblowing Policy and Code of Conduct as a PDF. Optionally you can also upload your Health, Safety and/or Security policy or Security Plan here.

Combined Whistleblowing and Safeguarding Policies
14/10/2024
09:23:03
pdf 278.28 KB

Section 18 - Submission Checklist

Checklist for submission

I have read the Guidance**, including the "Darwin Initiative Guidance", "Monitoring Evaluation and Learning Guidance", "Standard Indicator Guidance", "Risk Guidance", and "Finance Guidance".**	Checked
I have read, and can meet, the current Terms and Conditions **for this fund.**	Checked
I have provided actual start and end dates **for the project.**	Checked
I have provided the budget based on UK government financial years **i.e. 1 April – 31 March and in GBP.**	Checked
I have checked that the budget is complete**, correctly adds up and I have included the correct final total at the start of the application.**	Checked
The application has been signed by a suitably authorised individual **(clear electronic or scanned signatures are acceptable).**	Checked
I have attached the below documents to my application: • **a** cover letter from the Lead Organisation.	Checked
• **a** completed logframe **as a PDF using the template provided.**	Checked
• **a 1 page** Theory of Change **as a PDF which includes the key elements listed in the guidance.**	Checked
• **a** budget **(which meets the requirements above) using the template provided.**	Checked
• **a signed** copy of the last 2 annual report and accounts **for the Lead Organisation (or other financial evidence – see Finance Guidance), or provided an explanation if not**	Checked
• **a completed** workplan **as a PDF using the template provided.**	Checked
• **a copy of the** Lead Organisation's Safeguarding Policy, Whistleblowing Policy and Code of Conduct **(Question 31).**	Checked
• **a copy of the Lead Organisation's** Health, Safety and/or Security policy or Security Plan **(Question 31)**	Checked
• **1 page CV or job description for all the Project Staff identified at Question 34, including the Project Leader, or provided an explanation of why not, combined into a single PDF.**	Checked
• **a** letter of support from the Lead Organisation and partner(s) identified at Question 35, or an explanation of why not, as a single PDF.	Checked
I have been in contact with the FCDO **in the project country(ies) and have included any evidence of this. If not, I have provided an explanation of why not.**	Checked
The additional supporting evidence is in line with the requested evidence, amounts to a maximum of 5 sides of A4, and is combined as a single PDF.	Checked
(If copying and pasting into Flexi-Grant) I have checked that all the responses have been successfully copied into the online application form.	Checked
I have checked the Darwin website **immediately prior to submission to ensure there are no late updates.**	Checked
I have read and understood the Privacy Notice on the Darwin Initiative website**.**	Checked

We would like to keep in touch!

Please check this box if you would be happy for the lead applicant (Flexi-Grant Account Holder) and project leader (if different) to be added to our mailing list. Through our mailing list we share updates on upcoming and current application rounds under the Biodiversity Challenge Funds. We also provide occasional updates on other UK Government activities related to biodiversity conservation and share our regular newsletter. You are free to unsubscribe at any time.

Checked

Data protection and use of personal data

Information supplied in the application form, including personal data, will be used by Defra as set out in the Privacy Notice, available from the Forms and Guidance Portal**.**

This Privacy Notice must be provided to all individuals whose personal data is supplied in the application form. Some information may be used when publicising the Darwin Initiative including project details (usually title, lead organisation, project leader, location, and total grant value).

Project Summary	**SMART Indicators (including disaggregated targets)**	**Means of Verification**	**Important Assumptions**
Impact: Controlled mass seeding of mangrove seeds/propagules enable fast track restoration of mangrove habitats increasing coastal biodiversity and enabling people to reestablish livelihoods with reductions in poverty and increasing local capabilities. (Max 30 words)			
Outcome: (Max 30 words) Concept of precise global mass mangrove restoration using drones is established using sites in Indonesia and the Philippines with the aim of >50% establishment.	0.1 Dropped seeds/propagules remain in place/close to where they were dropped. 0.2 Dropped seeds/propagules start rooting and growing. 0.3 With 2 communities over 4 sites in Indonesia and the Philippines over 2ha/country with 2 species in each country and 1600 plants.	0.1 Seed displacement measured for each of 1600 seeds every 2 weeks for 2 months and then once per month for 2 months over 4 month period by local monitors and then recorded – every 4 weeks seed displacement recorded by drone photography and analysed. 0.2 Each of the 1600 seeds monitored for root establishment and leaf and stem growth.	+ Drone holding and dropping mechanisms that are established prior to dropping in-situ work. + Laboratory proven anchoring and weighting systems work. + Trained local people undertake their monitoring duties rigorously.
Outputs: **1**. Literature reviews of relevant areas that inform the project, including technical, environmental, botanical.	1 Concise literature review.	Literature review made available on the web site and on the University of Greenwich open access document repository GALA.	-
Outputs: 2. Prototyping for robotically controlled seed containers/magazines for 2 species of mangrove which will	2.1 Designs formulated by both by UoG and UoP with assistance of Enviro Tech	2.1 Records of discussions during on-line workshops re the designs. 2.2 The drawn designs themselves.	+ Seeds imported from Indonesia and the Philippines to be worked on by UoG and UoP.

then be placed under the drone so that seeding can take place – *Rhizophora sp*. and *Sonneratia sp.*	2.2 In drawing form and (at least 2 designs for each seed species). 2.3 Prototypes in 3D form	2.3 The physical forms of the designs to be tested with the seeds/propagules. 2.4 Record of testing. 2.5 Focused report on this activity.	
3. Prototyping of anchoring mechanisms for 2 mangrove species to ensure seeds remain in place and can set roots - *Rhizophora sp*. and *Sonneratia sp.*	3.1 Designs formulated by both by UoG and UoP with assistance of Enviro Tech. 3.2 In drawing form and (at least 2 designs for each seed species). 3.3 Prototypes in 3D form.	2.1 Records of discussions during on-line workshops re the designs. 2.2 The drawn designs themselves. 2.3 The physical forms of the designs to be tested with the seeds/propagules. 2.4 Record of testing. 2.5 Focused report on this activity.	+ Seeds imported from Indonesia and the Philippines to be worked on by UoG and UoP.
4. Seeding of sites in Indonesia (Java) and The Philippines (Panay).	4.1 Seeding carried out of 400 seeds of 2 species equalling 800 seeds in Indonesia and the Philippines, with a total across both countries of 1600 seeds. In total this will cover 2ha in each country totalling 4 ha overall. 4.2 Success measured by numbers rooting and growing.	4.1 Seeding verified by inspection at seeding time and then monitoring of seed movement and growing record and passed on to local universities by local community monitors. 4.2 Seedling rooting and growing.	+ Seeds are collected by local people and are viable for dropping.
5.Data collection and analysis of outcomes of seeding by drone.	5.1 Numbers of successful growing plants counted. 5.2 Movement of each seed measured relative to the baseline dropping location which is recorded when dropped. 5.3 Environmental conditions recorded weekly based on local meteorological data.	5.1 Local monitors record each seed movement on a data collection sheet which then is sent to the local universities for collation and analysis. 5.2 Local monitors record seed growth on prepared proforma which is then sent to the local	+ training of local community monitors to record seed positions, growth and environmental conditions

		universities for collation and analysis.	
6. Knowledge Exchange	6.1 Website published and updated monthly. 6.2 At least one peer reviewed paper on outcomes of project 6.3 Local Radio interviews x 3 in each SE Asia country = 6 6.4 Local TV interviews x 3 in each SE Asia country = 6 6.5 1 radio broadcast in UK 6.6 1 TV broadcast 6.7 1 podcast	6.1 Website available on the web and updates published 6.2 Published in open access journal. UoG has arrangements with Springer, Wiley, Taylor and Francis. 6.3, 6.4, 6.5.6.6, 6.7 - Broadcasts	+ updates needed from all partners + Input by all partners + interest by local and national media
7. Education and enhancement of local community and local authority knowledge, experience and capabilities	7.1 Sharing of information with local authorities – at least 3 (at least 1 in Indonesia and 2 in the Philippine: Iloilo local council and Leganes council) 7.2 Sharing of information with local communities. 2 or more community groups – at least 1 in each country 7.3 Training of local communities members in monitoring – 18	7.1 Attendance at meetings – records of meetings, letters and e-mail correspondence. 7.2 Attendance at meetings – records of meetings, letters and e-mail correspondence. 7.3 Invitations and training records and certificates of training.	+ buy in to project in both countries by local authorities and local community groups

	women (9 women from each country) 7.4 Local university staff trained as drone pilots – 4 women (2 from each country)		

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1. Each activity should start on a new line and be no more than approximately 25 words.)

Note: UoG = University of Greenwich, IPB = Institut Pertanian Bogor University on Java, UPV = University of the Philippines, Visayas on Panay Island and TUoP = Technical University of Panama, Panama.

Output 1

1.1. Desktop studies carried out by UoG by IPB and UPV.

Output 2

2.1. Collection of seeds to be sent to UoG and TUoP for analysis and testing.
2.2. Design studies and prototyping/manufacture of seed holding magazines and dropping mechanisms with UoG and TUoP and Inverto who have specialist expertise in robotics.
2.3. Drone training for 2 new pilots each at IPB and UPV, and update training for 1 at UoG.
2.4. Building drones with open-source material at UoG, IPB and UPV.

Output 3

3.1. Design studies, prototyping/manufacture/testing of anchoring mechanisms with UoG and UoP. UoP will undertake studies with up to 20 Masters students to investigate.

Output 4

4.1. Training local community monitors in order to monitor behaviour of seeds in the intertidal conditions and their growth.
4.2. Collection of seeds by local community for seeding.
4.3. Preparation of the seeds with weights and/or anchoring mechanisms.
4.4. Seeding in situ by drone pilots from IPB, UPV and UoG, using prototype delivery mechanisms and anchoring systems attached to seeds/propagules.

Output 5

5.1. Monitoring by local community group noting positions and growth of seeds/propagules.
5.2 Monitoring of seed positions by drone photography.

Output 6
6.1 Website set up.
6.2 Website updated monthly by UoG with assistance from all partners including local community and local autrhority.
6.3 Data collected, collated and analysed for paper
6.4 Paper writing, collaboration by all partners including local community.

Output 7
7.1 Minutes (notes and recorded meetings with Local Authorities
7.2 Minutes (notes and recorded meetings with Local Community Groups
7.3 Training curriculum devised and manual written, printed and given to monitors
7.4 Monitoring carried out according to monitoring manual
7.45 Drone pilot training attendance records, flight times and pilot certification and registration