
DIR29CC\1130

Growing Indonesian Genomics

Genomics is a powerful tool that can identify how resilient agriculture and biological diversity will be to a changing climate. Indonesia is an island nation with a huge diversity of crops and wild plant species at risk from rising temperatures and more frequent climate extremes. RBG Kew and BRIN here aim to build a cohort of Indonesian plant scientists who employ the latest genomics methods to determine and improve the resilience of the country's plant megadiversity to build food security.

PRIMARY APPLICANT DETAILS

Title Dr
Name Liam
Surname Trethowan
Website (Personal) [REDACTED]
Tel (Mobile) [REDACTED]
Email (Work) [REDACTED]
Address [REDACTED]
[REDACTED]

CONTACT DETAILS

Title Dr
Name Maria
Surname Fitzpatrick
Organisation Royal Botanic Gardens, Kew
Website (Work) [REDACTED]
Tel (Work) [REDACTED]
Email (Work) [REDACTED]
Address [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Section 1 - Contact Details

PRIMARY APPLICANT DETAILS

Title Dr
Name Liam
Surname Trethowan
Website (Personal) [REDACTED]
Tel (Mobile) [REDACTED]
Email (Work) [REDACTED]
Address [REDACTED]

CONTACT DETAILS

Title Dr
Name Maria
Surname Fitzpatrick
Organisation Royal Botanic Gardens, Kew
Website (Work) [REDACTED]
Tel (Work) [REDACTED]
Email (Work) [REDACTED]
Address [REDACTED]

GMS ORGANISATION

Type	Organisation
Name	RBG Kew
Phone (Work)	[REDACTED]
Email (Work)	[REDACTED]
Address	[REDACTED]

Type	General
Name	Royal Botanic Gardens, Kew
Phone (Work)	[REDACTED]
Email (Work)	[REDACTED]
Address	[REDACTED]

Section 2 - Title & Summary

Q3. Title:





Growing Indonesian Genomics

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

No

Please attach a cover letter.

Please include a response to any previous feedback in your cover letter.

-  [Darwin Cover Letter](#)
-  04/11/2022
-  12:35:17
-  pdf 235.02 KB

Q5. Summary

Please provide a brief summary of your project: the capability and capacity problem/need it is trying to address, its aims, and the key activities you plan on undertaking. Please note that if you are successful, this wording may be used by Defra in communications e.g. as a short description of the project on the website.

Please write this summary for a non-technical audience.

Genomics is a powerful tool that can identify how resilient agriculture and biological diversity will be to a changing climate. Indonesia is an island nation with a huge diversity of crops and wild plant species at risk from rising temperatures and more frequent climate extremes. RBG Kew and BRIN here aim to build a cohort of Indonesian plant scientists who employ the latest genomics methods to determine and improve the resilience of the country's plant megadiversity to build food security.

Section 3 - Title, Dates & Budget Summary

Q6. Country(ies)

Which eligible country(ies) will your project be working in? Where there are more than 4 countries that your project will be working in, please add more boxes using the selection option below.

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

Do you require more fields?

No

Q7. Project dates

Start date:	End date:	Duration (e.g. 1 years, 8 months):
01 April 2023	31 March 2024	1

Q8. Budget summary

Year:	2023/24	2024/25	Total request
Amount:	██████████	██████	██████████

Q9. Proportion of Darwin Initiative budget expected to be expended in eligible countries: %

Q10a. Do you have proposed matched funding arrangements?

Yes

What matched funding arrangements are proposed?

RBG Kew has fund matched [REDACTED] of staff costs. This is Kew's internal policy for Darwin projects.

Q10b. Total confirmed & unconfirmed matched funding (£)

Q10c. 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

Section 4 - Project need

Q11. The need that the project is trying to address

Please describe evidence of the capability and capacity need your project is trying to address with reference to biodiversity conservation and poverty reduction challenges and opportunities.

For example, how have you identified the need? Why should the need be addressed or what will be the value to the country? Please cite the evidence you are using to support your assessment of the need (references can be listed in a separate attached PDF document).

RBG Kew has been working alongside Indonesian scientists under multiple memoranda of understanding and have successfully carried out Darwin projects together as far back as 2001 (Darwin ref 10-018). Kew's latest government funded (NERC/Newton Fund) collaborative project with Indonesian institutes, including Herbarium Bogoriense, ran from 2019-2022. Following discussions with Indonesian colleagues, during the NERC/Newton project, it was made clear that there is a need for qualified local scientists who can help prevent crops and species loss due to climate change.

Genomics can play a major role in building resilient agricultural systems and can help us understand which species in natural systems are more at risk from climatic extremes, such as drought [1-4]. As the tropics' crops experience more extreme climates, adaptation and mitigation strategies are needed that continue to support consistent or increased yields. More frequent extreme climatic events likewise threaten the biodiversity found in natural systems. Indonesia is one of the most biodiverse countries on earth [5], with a substantial arable agriculture sector that contributed 440 trillion rupiah (£2.5 billion) to the economy [6].

The skillsets to exploit the latest genomic techniques are rare in Indonesia [7]. A recent study found that zero plant genomes had been sequenced in Indonesia, contributing to a pattern of limited contribution from the global south [8]. There are generic online tutorials available to acquire genomic skills however in-person teaching by experts with experience closely related to the interests of participants is more efficient to accelerate the growth of genomic skills [9]. Fast growth in genomic studies is required if we want to address the many pressing threats posed by anthropogenic/climate change upon Indonesian biodiversity. We therefore need many individuals who have the capability to carry out the bioinformatics that allow genomic data to be processed and analysed [10-11]. This project aims to strengthen the capacity of Indonesian participants enabling them to access and use relevant genomic tools and to design and conduct studies using these tools to improve plant resilience to climate change.

Skills developed can then be applied to taxa, crops, and wild relatives beyond the scope of this project. This will give participants the agency to design their own genomics-based projects and teach others. Knowledge growth can address pressing questions such as, where and how populations or species are most likely be lost or altered because their genotypes are associated with conditions that are threatened by imminent rapid change. These skills can also be applied to crops to identify genotypes that are associated with, e.g. drier conditions, that may be suitable for cultivation more widely in the coming years, retaining reliable yields and reducing poverty risk.

Section 5 - Darwin Objectives and Conventions

Q12. Biodiversity Conventions, Treaties and Agreements

Q12a. 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)
- Nagoya Protocol on Access and Benefit Sharing (ABS)
- International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)
- Convention on International Trade in Endangered Species (CITES)
- Global Goals for Sustainable Development (SDGs)

Q12b. National and International Policy Alignment

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

The key reason why this project addresses national and international policy:

Although Indonesian researchers can sample their country's considerable genetic resources, those resources remain inaccessible without the ability to use the latest analytical methods (ITPGRFA; Nagoya; CBD 15, 16, 17). We plan to directly address this educational need for Indonesia's plant research community by providing genomics training to a gender equal cohort of participants (CBD article 12; NBSAP 19; SDGs 4, 5).

There are multiple supporting reasons why this project provides the first step to addressing national and international policy requirements:

New techniques taught will allow important wild and crop plants that are at risk from climate change to be identified from a functional perspective e.g. they lack genes/alleles contributing to drought tolerance (CBD 8d, i; NBSAP 12; SDGs 13, 15). Conversely, this will help the identification and breeding of tolerant genotypes, which will enhance sustainability of communities by securing future yields and limit the risks of climate change driven hunger (SDGs 2, 11). Tolerant genotype identification will also inform decisions regarding species in or ex situ conservation and species choice for ecosystem restoration and agroforestry (SDG 15).

Genomic techniques also enable novel uses of crops and wild relatives to be examined (NBSAP 18).

Genomic studies can be scaled up to cover enough species to assess ecosystem resilience and likely changes to ecosystem functioning and associated services, such as watershed protection (NBSAP 14; SDG 6).

Participants will gain the initial genomic skills that are becoming part of the international toolkit to identify illegally traded species (CITES Strategic Vision 2021-2030 Goal 3).

Section 6 - Method, Change Expected, Gender & Exit Strategy

Q13. Methodology

Describe the methods and approach you will use to achieve your intended capability and capacity 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.).
- What practical elements will be included to embed new capabilities?

Theoretical background and skills required for the production and analysis of genomic data will be taught across two 13-day workshops at Herbarium Bogoriense, Research Center for Biosystematics and Evolution – BRIN, West Java. The first with 2-4 participants who will then become additional instructors for a second larger workshop with c. 10 participants. This repeated structure generated positive feedback during two IUCN red-listing courses run by RBG Kew for Indonesian participants during the pandemic. We learnt from these workshops that translated teaching materials are key to reinforce taught skills and support attendees post workshop; teaching resources in English and Indonesian will therefore be made freely available (e.g. via figshare or zenodo) during this project. The involvement of the first workshop participants in the teaching of the second workshop will lead to capacity building in genomics but also in teaching genomics, which will enhance capability beyond the project's duration.

The workshops will be adapted from genomic workshops and courses previously delivered by Sidonie Bellot (e.g. at Ludwig Maximilian University, Munich and Universiti Brunei Darussalam). The bioinformatics syllabus will cover basic Unix coding, and quality assessing and cleaning of the two most relevant types of genomic data for the participants: short-read Illumina DNA sequencing data, and long-read DNA sequencing data from Oxford Nanopore Technology (ONT) miniON. The participants will then learn draft genome assembly and annotation using a combination of Illumina and ONT data, as well as population genomic analyses essential for studying associations between genes and traits or environments (e.g. sequencing read mapping, variant calling and association statistics).

For the first workshop, teaching will rely on published genomic datasets (e.g. from NCBI). However, instructors will also collect silica-dried leaf material from individuals within the breadfruit/breadnut species complex (*Artocarpus altilis*-*Artocarpus camansi*), a key crop in South-East Asia. The material will be sent to external companies for Illumina sequencing so that the data can be obtained before the second workshop. Samples will be collected around Bogor (high precipitation) and Purwodadi (low precipitation) Botanic Gardens, to cover a precipitation gradient. Two of the samples will also be submitted to state-of-the-art sequencing in the field using the Oxford nanopore miniON (e.g. Maestri et al. 2019. Genes). This will take place during each workshop so that participants can learn how to use the ONT miniON. Generating new breadfruit data for the project between the first and second workshops will enable the participants of the first workshop to practice their newly acquired skills on real data before being involved in the teaching of the second workshop, while participants from the second workshop will be able to work on a system, they are familiar with and interested in, which is key for successful teaching. Furthermore, the new data can then be used by workshop participants to develop a larger study of the genetic bases of drought resilience in breadfruit, if they wish to do so. In addition, a roadmapping session will be carried out to develop participants ideas for genomics projects including those around crop resilience.

Enhanced capability and capacity will be embedded three ways:

- (1) The initial cohort of participants will help teach during the second workshop showing their aptitude to continue to teach post-project and spread the knowledge gained more widely in Indonesia.
- (2) A miniON, bento field lab and 15 laptops will remain with participants for use post project. The above will help ensure future work for participants currently unable to afford these pieces of relatively high value equipment.
- (3) Roadmaps for future in-country budgeted genomics projects will be built. These should incorporate further teaching of the gained skills whilst also harnessing the power of genomics to understand resilience to climate change, and to reveal species traits with beneficial uses for Indonesian communities.

Management structure: RBG Kew will lead project management bringing previous experience of teaching Indonesian participants and genomics skillsets. Liam Trethowan will coordinate the project. Sidonie Bellot and Oscar Pérez Escobar will be responsible for teaching provision. Himmah Rustiami will lead in-country organisational support around workshops and fieldwork locations and alongside LT help facilitate teaching material translation. This project builds on an effective and strong 6-year collaborative relationship between Herbarium Bogoriense, Research Center for Biosystematics and Evolution - BRIN and LT/RBG Kew.

Q14. How will you identify participants?

How did/will you identify and select the participants (individuals and organisations) to directly benefit from the capability and capacity building activities? What makes these the most suitable participants? How will you ensure that the selection process is unbiased, fair and transparent?

Based primarily in Java for easy access to workshops and to reduce internal flight costs. We aim to select mainly younger researchers (under 30) but will cover an inclusive range of ages. Participants will have a vested interest in plant genomics and have access to equipment and/or funding sources for future genomics work.

Participants will be selected by Herbarium Bogoriense, Research Center for Biosystematics and Evolution - BRIN. The cohorts involved are the key to ensuring the skills taught are embedded and spread widely post project and as such we required our partners' knowledge to select the most enthusiastic and capable students possible.

Final selection will be based upon an unbiased, fair and transparent skills-based training assessment form adapted from RBG Kew's job application form. This will ensure participants are equipped with the baseline knowledge required for the training. In addition, our provision of laptops will mean participants currently unable to afford sufficiently high-performance laptops will be able to attend.

Q15. Gender equality

All applicants must consider whether and how their project will contribute to reducing inequality between persons of different gender. Explain your understanding of gender equality within the context of your project, and how is it reflected in your plans. Please summarise how your capability and capacity project will contribute to reducing gender inequality. Applicants should, at a minimum, ensure proposals will not increase inequality and are encouraged to design interventions that proactively contribute to increased gender equality.

Higher positions within the Indonesian academic system are mostly held by males. By achieving an at least 50/50 female/male participant list we aim to give a cohort of female participants skills that should be advantageous to their future career prospects. This will be possible as we will be selecting participants across the numerous Badan Riset Inovasi Nasional (BRIN) institutes – meaning a large diverse pool to select from.

The first four confirmed participants from Herbarium Bogoriense for the workshops are female.

We also have fully budgeted for childcare throughout both workshops.

The investigator team also has a 50/50 split Male/Female. Partnership with Herbarium Bogoriense is led by Himmah Rustiami (female). The Kew team consists of Liam Trethowan and Oscar Pérez Escobar (male) and Sidonie Bellot (female).

Q16. Change expected

Detail what the expected changes to in-country capability and capacity will deliver for both biodiversity and poverty reduction. You should identify what will change and who will benefit a) in the short-term (i.e. during the life of the project) and b) in the long-term (after the project has ended) and the potential to scale the approach.

When talking about how people will benefit, please remember to give details of who will benefit, differences in benefits by gender or other layers of diversity within stakeholders, and the number of beneficiaries expected. The number of communities is insufficient detail – number of households should be the largest unit used

Short-term change will centre on the ability of the c.15 participants to produce and analyse genomic data. This will be

measured initially via scoring of short reports written by participants summarising data analysis that they will carry out post workshop. Specifically, skills acquired will be:

Theoretical understanding of DNA sampling, preparation and sequencing for obtaining genomic data.

Unix language basics (focusing on what is relevant for DNA sequence data processing).

DNA library preparation for ONT minION.

Quality assessment and filtering of ONT and Illumina sequencing data.

Draft genome assembly and annotation using a combination of ONT and Illumina data.

Variant calling and genotype likelihood estimations using Illumina data.

Association statistics (e.g. identify genetic variants associated with dry vs wet conditions).

How to budget effectively for a genomics project.

Long-term change will result in participants able to build their own genomics projects relevant to biodiversity conservation and agricultural resilience in Indonesia. We will cement the confidence of our participants, to proceed with their ideas, by carrying out an end of workshop project roadmapping session. These projects could have multiple applications. A new trained cohort of researchers could tackle the identification of genes/alleles linked to resilience to drought and other stressors like pollution, diseases and temperature increases across a broad range of crops and wild plants, supporting crop breeding, species conservation and ecosystem restoration in a context of global change. The genomic skills learnt by participants can also be used for identification of illegally traded plant products, which will be extremely valuable given there are 33208 plant species CITES listed for Indonesia and accurate species identification via morphological studies often requires leaf, flower and fruit material that are rarely traded together. Such investigations will benefit communities that derive their livelihoods from plant growing or exploitation from the wild, and the population that rely upon food crops grown in Indonesia. They will also help NGOs, Universities and government agencies such as Balai Konservasi Sumber Daya Alam (BKSDA) that are trying to clampdown on the wildlife trade and understand and limit current and future threats to rare species and whole ecosystems. This long-term change is dependent upon the choices made by the participants in deciding who they choose to collaborate with and which research directions they choose to take.

The approach has the potential to scale up as our participants can replicate the teaching/workshops, reaching a whole new audience across the islands of Indonesia. Such scaling up would lead to genomic autonomy and breakthroughs with applications that address the needs of society and biodiversity in the coming years. Scaling up will be facilitated by the free availability of all our teaching material in English and Indonesian and by having participants of the first workshop teaching in the second workshop, cementing the skillsets needed to pass on knowledge more widely.

Q17. Exit Strategy

How will the project reach a sustainable point and continue to deliver benefits post-funding?

How will the built capability and capacity be maintained in-country? How will the new capability and capacity be replicated to strengthen additional future environmental leaders beyond the project? How will the benefits be scaled? Are there any barriers to scaling and if so, how will these be addressed? How will the materials developed during the project be made more widely accessible during and after the project?

From the beginning of the project, we will work to strengthen relationships with participants to ensure they are invested in the new genomics working group that they are a part of. Ownership in the project from the start will help smooth expansion of the knowledge base post-project through further teaching/workshops led by the participants, where those next participants can go on to teach new participants and so on. We will produce, hone and translate teaching materials prior to both workshops and after the final workshop. Freely available Content will be produced in partnership with participants throughout, they will be encouraged, at multiple evaluation points (see Q20), to suggest where they would like improvements and additional material.

Participant project ideas, that include teaching will be cemented into place during a post-workshop roadmapping session.


The key barriers to benefit scaling are twofold.


First, the participants require an enthusiasm for passing on their skills. To combat this, we have planned a two-stage workshop programme so that we can confirm that at least the first student cohort are likely to continue to develop in country skillsets. Our participant selection criteria will also focus upon aptitude and enthusiasm for teaching. Our choice of breadfruit as a study taxon should also help retain interest for future expansion as it will provide direct evidence to the participants that their work can be directly relevant to people and the economy e.g. via crop improvement.

Second, future funding from local government may be insufficient for ambitious plans to scale up Indonesian genomics lead research. Despite this, our project will stimulate growth of in-country genomics expertise that can be leveraged in ODA applications from countries with better funded research programmes.

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

 [Q11 References](#)

 03/11/2022

 17:07:54

 pdf 40.4 KB

Section 7 - Risk Management

Q18. Risk Management

Please outline the 6 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, one Safeguarding, and one Delivery Chain Risk.

Projects should also draft their initial risk register, using the [Risk Assessment template](#), and be prepared to submit this when requested if they are recommended for funding. Do not attach this to your application.

Risk Description	Impact	Prob.	Gross Risk	Mitigation	Residual Risk
Fiduciary (financial) The project budget could be misappropriated. For instance, equipment funds could be used elsewhere if equipment is already present at an institution.	Minor	Rare	Minor	RBG Kew has a transparent acquisition pipeline which makes it simple to account for all expenditure. We have also budgeted for a financial audit. Funds sent to Indonesia will only be transferred post evidencing of relevant contracts.	Minor
Safeguarding Participants may be alienated or harassed by instructors and other participants.	Minor	Unlikely	Moderate	Instructors with little experience in Indonesia will become acquainted with social norms and treat participants with the respect befitting a colleague i.e. we will follow Darwin Initiative ethical guidance document. In addition, we will follow/offer participants access to the reporting procedure in Kew's mandatory safeguarding training.	Minor

Delivery Chain Dual structure of workshops means delay to the first may have knock on effects for the start of the second. This may be caused by lack of availability of participants.	Minor	Unlikely	Moderate	We will leave a sufficient time buffer to limit the chances of delays. We will also identify as many participants as early as possible (four participants confirmed so far) so we can determine suitable dates for workshops.	Minor
Risk 4 In-country visas unavailable for instructors.	Minor	Rare	Minor	Both Sidonie Bellot and Liam Trethowan have successfully obtained visas previously. If visa collection fails, we can competently, though potentially less effectively, carry out workshops online – see Risk 5 for backup training data.	Rare
Risk 5 New genomic data unavailable early enough for first cohort of participants to practice with it post-workshop and for teaching the second cohort of participants.	Moderate	Unlikely	Moderate	We are in possession of backup data that will allow us to teach all methods irrespective of availability of novel data.	Minor
Risk 6 Poor access to Internet hindering data processing and teaching using cloud computing.	Minor	Unlikely	Minor	Mobile phone data is available in Indonesia, given the widespread lack of wifi outside Java and Bali. This means we can use phone hotspots if needed. We will also have mini-datasets that can be processed on laptops if cloud computing fails.	Minor





Section 8 - Implementation Timetable

Q19. Provide a project implementation timetable that shows the key milestones in project activities

Provide a project implementation timetable that shows the key milestones in project activities, linking them to your Outputs. Complete the Word template as appropriate to describe the intended workplan for your project.

[Implementation Timetable Template](#)

Please add/remove columns to reflect the length of your project. For each activity (add/remove rows as appropriate) indicate the number of months it will last, and fill/shade only the quarters in which an activity will be carried out.

 [DI Bioinformatics Java BCF-Implementation-Timetabl](#)
[e-Bioinformatics Java](#)
 03/11/2022
 17:37:13
 pdf 73.09 KB

Section 9 - Monitoring and Evaluation

Q20. Monitoring and evaluation (M&E)

Describe how the progress of the project will be monitored and evaluated, making reference to who is responsible for the project's M&E.

Darwin Initiative projects are expected to be adaptive, and you should detail how the monitoring and evaluation will feed into the improved delivery of the project including its management. M&E is expected to be built into the project and not an 'add' on. It is as important to measure for negative impacts as it is for positive impact. Additionally, please indicate an approximate budget and level of effort (person days) to be spent on M&E (see Finance Guidance).

RBG Kew will lead M&E. This will be done collaboratively with partners and participants and recorded using the Microsoft teams education format which we have used successfully for NERC funded workshop M&E in 2020/2021.

Monitoring will be done continuously throughout workshops, primarily by Liam Trethowan and Himmah Rustiami, who will be tasked with clarifying how well the content and methods are being retained by students.

There will be four key evaluation points. (1) Prior to the first workshop when partners and participants will be able to review drafts of prospective content and identify if there are any other aspects of the methodology they want to learn. At this point we will also ascertain participant capability and current knowledge. (2) Post first workshop where we will gather participant satisfaction surveys, short reports and our own notes to clarify what worked well or not. The next workshop and teaching materials will be altered accordingly. (3) Post workshop two, where overviews of this altered content will be given to second workshop participants who will be able to request additional content they would be interested in, and content will be altered accordingly. (4) Post second workshop where we will review the teaching resources together with the participants to make sure they are in the best possible format/structure for participants to re-use post project.

Total project budget for M&E in GBP (this may include Staff and Travel and Subsistence costs) [REDACTED]

Percentage of total project budget set aside for M&E [REDACTED]

Number of days planned for M&E

5

Section 10 - Indicators of Success

Q21. Indicators of success

Please outline the Outcome and Outputs of the project and how you will show that they have been achieved by using SMART indicators and milestones.

See the Monitoring, Evaluation and Learning Guidance for advice on selecting SMART indicators and milestones.

Please note that the number of participants in training is not an output, please consider how to measure the success of the training rather than participation in training.

In the table below please outline your Outcome and between 1-4 Outputs. Each statement should have between 2-3 SMART indicators and end target (figure/state/quality) including how you would evidence achievement – i.e. "Means of Verification".

	SMART Indicator	Means of Verification
<p>Outcome</p> <p>Scientists trained in applying cutting edge genomic techniques to enhance sustainable livelihoods and plant conservation.</p>	<p>0.1 Participants have a theoretical understanding of genomic approaches to characterize genotype-phenotype-environment (GPE) associations.</p> <p>0.2 Participants have bioinformatic and analytical skills required to characterise GPE associations.</p> <p>0.3 Resources are available for participants to continue and expand training post project.</p>	<p>0.1 Participants successfully outline the design and methods required to achieve a future project looking at associations between genes and traits and/or environmental conditions.</p> <p>0.2 Participants successfully process genomic data and identify genomic regions potentially associated with climatic preference.</p> <p>0.3 Adaptable teaching material, templates and analytical pipelines are freely available via an online repository e.g. figshare/zenodo.</p>
<p>Output 1</p> <p>Genomic data are generated from samples collected across the Javan rainfall gradient.</p>	<p>1.1 Prior to the first workshop samples of 4 individuals for 6 populations (24 samples total) are obtained for breadfruit, across the rainfall gradient at sites near Bogor and Purwodadi Botanic Gardens that span the drought gradient in Java.</p> <p>1.2 Prior to the first workshop medium coverage Illumina sequencing data for the 24 samples is generated. Additional Illumina high coverage genome sequencing data are obtained for 2 of these samples.</p> <p>1.3 MinION sequencing data are obtained for the same 2 samples – a sample is sequenced as part of each workshop.</p>	<p>1.1 List of samples deposited made available via an online repository e.g. figshare/zenodo. Samples and vouchers deposited and databased at Herbarium Bogoriense.</p> <p>1.2/3 Genomic data will be deposited in online depositories by stakeholders. A report highlighting what data has been produced will be made available via an online repository e.g. figshare/zenodo.</p>
<p>Output 2</p> <p>Bilingual teaching materials produced by the investigator team.</p>	<p>2.1 Teaching resources built and translated pre first workshop.</p> <p>2.2 Post second workshop teaching resources honed and translated for use post project.</p>	<p>2.1 Version 1 teaching materials made available via an online repository e.g. figshare/zenodo.</p> <p>2.2 Final version of teaching materials made available via an online repository e.g. figshare/zenodo.</p>
<p>Output 3</p> <p>Capacity for teaching and analysis of genomic data is enhanced.</p>	<p>3.1 All four participants of the first workshop are capable of processing Illumina and minION genomic data for association studies and understand the rationales behind the analytical decisions. Three female participants are confirmed.</p> <p>3.2 All 11 second workshop participants are capable of processing Illumina and minION genomic data for association studies and understand the rationales behind the analytical decisions.</p>	<p>3.1 The four participants from the first workshop successfully teach the second cohort of participants.</p> <p>3.2 Short summary report written by participants of the bioinformatics workshops.</p>

Output 4

A roadmap towards future genomics teaching and/or future genomics projects to be held in Indonesia and led by some of the participants.

4.1 Further teaching or capacity building needs and potential future students identified.

4.2 Potential future projects identified and outlined by participants including genomics costings for a tractable budget.

4.3 An adaptable template to produce personalised roadmaps and draft budgets for future projects built.

4.1 Future needs/support summary report made available via an online repository e.g. figshare/zenodo.

4.2 Details of specific projects designed by participants available on request if permission given by participant.

4.3 Roadmap template made available via an online repository e.g. figshare/zenodo.

Activities

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

1.1a Field breadfruit leaf sampling takes place around Bogor and Purwodadi botanic garden – led by instructors.

1.1b DNA is extracted and sent to selected company for sequencing.

1.2a ONT minION sequencing carried out in the field by instructors and participants.

2.1a Preparation/translation of theoretical lectures.

2.1b Preparation of practical teaching material.

2.1c Preparation of teaching data.

2.1d Setting up hardware and software.

2.2a Teaching resources improved during a collaborative session with participants of workshop 1.

2.2b Teaching resources improved during a collaborative session with participants of workshop 2.

3.1a First workshop participants identified and selected dependent upon pre-agreed criteria.

3.1b During first workshop in Bogor relevant bioinformatic pipelines are taught using training data for both ONT and genome skimming data.

3.1c Feedback gathered from participants and this used to improve materials/2nd workshop structure.

3.1d The four participants analyse novel data from 1.2a/b post workshop with assistance where needed from instructor team.

3.2a Second workshop participants identified and selected dependent upon pre-agreed criteria.

3.2b Instructors/participants from cohort 1 prepare for workshop 2.

3.2c Second workshop in Bogor. Larger cohort learn and carry out the required bioinformatics for both ONT and genome skimming data.

3.2d Feedback gathered from participants and this used to improve final teaching materials that are made freely available.

4.1 Main project report writing with participants. Results summarised and possibility for formal paper(s) assessed.

4.2 Collaborative writing post workshop two and later via google docs to produce future project roadmaps. Focusing upon projects suggested by participants.

4.3 Instructors informed by participants produce an adaptable project roadmap/budget template.

Important Assumptions:

Please describe up to 6 key assumptions that, if held true, will enable you to deliver your Outputs and Outcome.

In-country access for instructors.

Participant availability.

Field access results in sequencing/genomic data available for analysis.

Sufficient internet access for data processing and teaching.

Teaching material adapted to the knowledge level and expectations of the participants

Sufficient time allowed for teaching and learning.

Section 11 - Budget and Funding

Q22. 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.





Note that there are different templates for projects requesting under £100,000 and over £100,000. Please refer to the [Finance Guidance](#) for more information.

- [Budget form for projects under £100,000](#)
- [Budget form for projects over £100,000](#)

Please ensure you include any co-financing figures in the Budget spreadsheet to clarify the full budget required to deliver this project.

NB: Please state all costs by financial year (1 April to 31 March) and in GBP. The Darwin Initiative cannot agree any increase in grants once awarded.

Please upload the Lead Partner's accounts (or other financial evidence – see Finance Guidance) at the certification page at the end of the application form.

 [DI_Bioinformatics_Java_BCF-Budget-over-£100k-MAST
ER-Apr22](#)
 03/11/2022
 17:47:23
 xlsx 94.33 KB

Q23. Funding

Q23a. Is this a new initiative or does it build on existing work (delivered by anyone and funded through any source)?

- New Initiative

Please provide details:

This is a new initiative. We are unaware of genomics capacity building initiatives in Indonesia. In the last decade, Indonesian workshops have been funded by the NSF to grow skills underpinning Sanger sequencing (PI Campbell O. Webb, Harvard/Alaska Fairbanks, see Dean et al. 2018. APPS. <https://doi.org/10.1002/aps3.1167>). However, most advances in genomics are beyond the possibilities of Sanger sequencing hence the need for our workshops. Several of the expected participants attended these prior Sanger workshops.

Q23b. Are you aware of any current or future plans for similar work to the proposed project?

- No

Q24. 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 plan to leave minION and bento field lab equipment in the possession of Himmah Rustiami at Herbarium Bogoriense, Research Center for Biosystematics and Evolution - BRIN. Participants will also be given laptops. This will enable participants to use the equipment post project, supporting their self-designed projects, further knowledge sharing and reducing funding need for new equipment.

Q25. 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). Please make sure you read the guidance documents, before answering this question.

This project brings together Kew staff with the most recent experience working in Indonesia and in collaboration with Indonesian scientists and staff who work at the forefront of genome analysis. Kew based instructors are all early career scientists meaning project wage contributions are reduced compared to more senior staff. Overheads match Kew standard costs for all projects.

The applicants have a history of successfully teaching Indonesian participants and there will be clear indicators of long-term impact as publication of genomic datasets from Indonesia can be easily measured.

The key reason for this project is to increase equity in genomics research particularly for institutes and individuals in the global south. We also expect at least 50 % female participants.

We have also chosen to keep a close to 2:1 participant to instructor ratio for both workshops. Whilst we could increase this ratio to increase the number of participants per pound spent, it would risk the expected skill development of participants. For the long-term change that we aim for from this project, it is crucial that participants have the skills to not only carry out genomics research in Indonesia but also to pass on these skills more widely. Therefore, the low participant to instructor ratio is key to project success. This also means that Kew staff only need to apportion a small percentage of their schedules toward the project and expensive overheads for Kew staff are reduced and not required during the post project expansion phase.

Section 12 - Safeguarding and Ethics

Q26. Safeguarding

Projects funded through the Darwin Initiative must fully protect vulnerable people all of the time, wherever they work. In order to provide assurance of this, projects are required to have appropriate safeguarding policies in place.

Please confirm the Lead Partner has the following policies in place and that these can be available on request:

Please upload the Lead Partner's Safeguarding Policy as a PDF on the certification page.

We have a safeguarding policy, which includes a statement of our commitment to safeguarding and a zero tolerance statement on bullying, harassment and sexual exploitation and abuse	Checked
We have attached a copy of our safeguarding policy to this application (file upload on certification page)	Checked
We keep a detailed register of safeguarding issues raised and how they were dealt with	Checked
We have clear investigation and disciplinary procedures to use when allegations and complaints are made, and have clear processes in place for when a disclosure is made	Checked

We share our safeguarding policy with all partners	Checked
We have a whistle-blowing policy which protects whistle blowers from reprisals and includes clear processes for dealing with concerns raised	Checked
We have a Code of Conduct for staff and volunteers that sets out clear expectations of behaviours - inside and outside the work place - and make clear what will happen in the event of non-compliance or breach of these standards	Checked

Please outline how you will implement your safeguarding policies in practice and ensure that all partners apply the same standards as the Lead Partner. If any of the responses are “no”, please indicate how it is being addressed.

RBG Kew's safeguarding code of conduct will be shared at project onset and followed by all partners. This will be ensured via completion of Kew's international safeguarding risk assessment form. Safeguarding issue reporting will follow the protocol outlined in Kew's code of conduct.

Section 13 - FCDO Notifications

Q27. FCDO Notifications

Please state whether there are sensitivities that the Foreign Commonwealth and Development Office will need to be aware of should they want to publicise the project's success in the Darwin Initiative in any country.

No

Please indicate whether you have contacted FCDO Embassy or High Commission to discuss the project and attach details of any advice you have received from them.

No

If no, why not?

Britain is represented by Owen Jenkins CMG in Indonesia. As there are not FCDO issues around this project and that it is being run by civil servants at Kew and their Indonesian equivalents at BRIN we have not contacted them at this point.

Section 14 - Project Staff

Q28. 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.





Please provide 1-page CVs or job description, further information on who is considered core staff can be found in the Finance Guidance.

Name (First name, Surname)	Role	% time on project	1 page CV or job description attached?
Liam Trethowan	Project Leader	20	Checked
Himmah Rustiami	In Country Project Leader	15	Checked
Sidonie Bellot	Joint Lead Instructor	15	Checked

Do you require more fields? No

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

Ensure the file is named clearly, consistent with the named individual and role above.

 [Team CVs](#)
 07/11/2022
 10:32:03
 pdf 392.02 KB

Have you attached all project staff CVs? Yes

Section 15 - Project Partners

Q29. Project Partners

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

This section should demonstrate the capability and capacity of the Project Partners to successfully deliver the project. Please provide Letters of Support for all project partners or explain why this has not been included.

Lead Partner name: Royal Botanic Gardens Kew

Website address: <https://www.kew.org/science>

Why is this organisation the Lead Partner, and what value do they bring to the project? (including roles, responsibilities and capabilities and capacity):

RBG Kew is a global leader in plant conservation and biodiversity research. Staff frequently apply genomics to answer questions about the sustainability of human plant use and natural ecosystems that provide many services needed for future agricultural productivity and poverty alleviation. Kew also has a strong track record in successful Darwin funded projects (51 according to the Darwin online portal).

Kew staff regularly train students in the latest genomics methods as part of its MSc programmes and closely linked doctoral training programmes (e.g. London, Imperial, CENTA etc). Informal genomics workshops have been carried out in both Kew and Brunei.

Regular collaboration between Kew and Indonesian partners has been carried out since the 80s. The latest success was an Herbarium Bogoriense/Kew collaborative NERC funded project studying and building capacity in the seasonal forests of the Lesser Sunda archipelago. This included field-based teaching at the end of 2019 and multiple online workshops to teach IUCN redlisting, seed banking, vegetation surveys and plant identification.

International/In-country Partner International

Allocated budget (proportion or value): ██████████

Represented on the Project Board (or other management structure) Yes

Have you included a Letter of Support from this partner? Yes

Do you have partners involved in the Project?

Yes

1. Partner Name: Research Center for Biosystematics and Evolution - BRIN

Website address: <https://www.brin.go.id>

What value does this Partner bring to the project?
(including roles, responsibilities and capabilities and capacity):

The National Research and Innovation Agency (BRIN) is at the heart of scientific research in Indonesia. Herbarium Bogoriense (BO) and associated laboratories have been responsible for much of the plant genetic research and teaching performed in Indonesia. BO is part of the Research Center for Biosystematics and Evolution one of six Research Centers in the Life Science Research Organisation (ORHL). The other five Research Centers: Ecology and Ethnobiology, Applied Microbiology, Genetic Engineering, Plant Conservation and Forestry, Biomass and Bioprocess alongside Biosystematics and Evolution will supply participants that fit our criteria and fulfil our requirement for at least 50 % female participation.

The Research Center for Systematics and Evolution also has access to computing, internet and meeting room facilities enabling successful hosting of workshops.

In addition, the two Botanic Gardens in Bogor and Purwodadi are part of BRIN and will support field sampling and teaching.

International/In-country Partner In-country

Allocated budget: ██████████

Representation on the Project Board (or other management structure) Yes

Have you included a Letter of Support from this partner? Yes

2. Partner Name: *No Response*

Website address: *No Response*

What value does this Partner bring to the project? *No Response*

(including roles, responsibilities and capabilities and capacity):

International/In-country Partner International
 In-country

Allocated budget: £0.00

Representation on the Project Board (or other management structure) Yes
 No

Have you included a Letter of Support from this partner? Yes
 No

3. Partner Name: *No Response*

Website address: *No Response*

What value does this Partner bring to the project? *No Response*

(including roles, responsibilities and capabilities and capacity):

International/In-country Partner International
 In-country

Allocated budget: £0.00

Representation on the Project Board (or other management structure) Yes
 No

Have you included a Letter of Support from this partner? Yes
 No

4. Partner Name: *No Response*

Website address: *No Response*

What value does this Partner bring to the project? *No Response*

(including roles, responsibilities and capabilities and capacity):

International/In-country Partner International
 In-country

Allocated budget: £0.00

Representation on the Project Board (or other management structure) Yes
 No

Have you included a Letter of Support from this partner? Yes
 No

5. Partner Name: *No Response*

Website address: *No Response*

What value does this Partner bring to the project? *No Response*

(including roles, responsibilities and capabilities and capacity):

International/In-country Partner International
 In-country

Allocated budget: £0.00

Representation on the Project Board (or other management structure) Yes
 No

Have you included a Letter of Support from this partner? Yes
 No

6. Partner Name: *No Response*

Website address: *No Response*

What value does this Partner bring to the project? *No Response*

(including roles, responsibilities and capabilities and capacity):

International/In-country Partner International
 In-country

Allocated budget: £0.00





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.

 [LT - Darwin Support Letter 07.11 07-11-2022 at 10.52.15](#)
 07/11/2022
 10:52:44
 pdf 308.94 KB

Section 16 - Lead Partner Capability and Capacity

Q30. Lead Partner Capability and Capacity

Has your organisation been awarded 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

If yes, please provide details of the most recent awards (up to 6 examples).

Reference No	Project Leader	Title
DARCC014	Aisyah Faruk	Enhancing the capacity and capability of orchid conservation in Armenia
DPLUS144	Rosemary Newton	Protecting South Georgia's terrestrial communities from climate change-invasion synergies

28-012	Maria Vorontsova	Native grass forage management to feed people and protect forests
27-014	Aaron Davis	Coffee natural capital for environmental and livelihood sustainability in Uganda
DPLUS144	Martin Hamilton	Tropical Important Plant Areas and Important Plant Species in TCI
<i>No Response</i>	<i>No Response</i>	<i>No Response</i>

Have you provided the requested signed audited/independently examined accounts (or other financial evidence - see Finance Guidance)?

If yes, please upload these on the certification page. Note that this is not required from Government Agencies.

Yes

Section 17 - Certification

Q30. Certification

On behalf of the

Trustees

of

Royal Botanic Gardens Kew

I apply for a grant of

[REDACTED]

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, Safeguarding Policy and project implementation timetable
- 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

Professor Alexandre Antonelli

Position in the organisation

Director of Science





Signature (please upload e-signature)





 [Alex signature](#)
 07/11/2022
 10:55:23
 jpg 3.28 KB

Date





07 November 2022

Please attach the requested signed audited/independently examined accounts or other financial evidence (see Finance Guidance)

 [rbg-kew-annual-report-and-accounts-2019-2020](#)
 04/11/2022
 10:34:13
 pdf 1.02 MB

 [Royal Botanic Gardens Kew - annual report and accounts 2021 to 2022](#)
 04/11/2022
 10:34:13
 pdf 761.3 KB

Please upload the Lead Partner's Safeguarding Policy as a PDF

 [Safeguarding-Policy-January-2022](#)
 04/11/2022
 10:34:25
 pdf 389.28 KB

Section 18 - Submission Checklist

Checklist for submission

	Check
I have read the Guidance, including the "Darwin Initiative Guidance", "Monitoring Evaluation and Learning Guidance", "Risk Management 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 my budget based on UK government financial years i.e. 1 April - 31 March and in GBP.	Checked
I have checked that our budget is complete, correctly adds up and I have included the correct final total at the start of the application.	Checked
The application been signed by a suitably authorised individual (clear electronic or scanned signatures are acceptable).	Checked
I have attached the below documents to my application:	Checked
<ul style="list-style-type: none">• My budget (which meets the requirements above)	
<ul style="list-style-type: none">• My completed implementation timetable as a PDF using the template provided	Checked

<ul style="list-style-type: none"> • I have included a 1 page CV or job description for all the Project Staff identified at Question 28, including the Project Leader, or provided an explanation of why not. 	Checked
<ul style="list-style-type: none"> • A letter of support from the Lead Partner and partner(s) identified at Question 29, or an explanation of why not. 	Checked
<ul style="list-style-type: none"> • I have included a cover letter from the Lead Partner, outlining how any feedback received 1 has been addressed where relevant. 	Checked
<ul style="list-style-type: none"> • I have included a copy of the Lead Partner's safeguarding policy, which covers the criteria listed in Question 26. 	Checked
<ul style="list-style-type: none"> • I have included a signed copy of the last 2 annual report and accounts for the Lead Partner (or other financial evidence – see Finance Guidance), or provided an explanation if not. 	Checked
<p>(If copying and pasting into Flexi-Grant) I have checked that all my responses have been successfully copied into the online application form.</p>	Checked
<p>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.</p>	Checked
<p>I have checked the Darwin Initiative website immediately prior to submission to ensure there are no late updates.</p>	Checked
<p>I have read and understood the Privacy Notice on the Darwin Initiative website.</p>	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 Darwin Initiative and our sister grant scheme, the IWT Challenge Fund. We also provide occasional updates on other UK Government activities related to biodiversity conservation and share our quarterly project 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 partner, project leader, location, and total grant value).

Project Title: Growing Indonesian Genomics

	Activity	No. of months	Year 1 (23/24)			
			Q1	Q2	Q3	Q4
Output 1	Genomic data generated for samples collected across the Javan rainfall gradient.	1				
1.1	Field based sampling around Bogor and Purwodadi Botanic Gardens.	< 1				
1.2	Sample DNA extracted and exported for external sequencing. MinION sequencing carried out in the field.	< 1				
Output 2	Instructors produce relevant bioinformatic teaching materials.	1-2				
2.1	Teaching resources built and translated pre workshop	1-2				
2.2	Teaching resources honed and translated for use post project.	< 1				
Output 3	Fifteen students' capacity for genomics enhanced.	1				
3.1	First workshop hosted in Bogor. Participants taught to carry out the required bioinformatics for nanopore and genome skimming data. Landscape population genomics taught.	< 1				
3.2	Second workshop carried out. Larger cohort learn and carry out the required bioinformatics for both nanopore and genome	< 1				

Project Title: Growing Indonesian Genomics

	Activity	No. of months	Year 1 (23/24)			
			Q1	Q2	Q3	Q4
	skimming data. Landscape population genomics taught.					
Output 4	Roadmapping of current and future genomics projects.	< 1				
4.1	Further teaching or capacity building needs and potential future students identified.	< 1				
4.2	Potential future projects identified and outlined by participants including genomics costings for a tractable budget.	< 1				
4.3	An adaptable template to produce personalised roadmaps and draft budgets for future projects built.	<1				