

# Impact of clean energy on Biodiversity and its mitigation measures

*Dr Norhayati Ahmad  
Institute for Biodiversity & Environmental Research,  
Universiti Brunei Darussalam*





# اينستيتوت فيلديقن بيوديورسي تي دان عالم سكيتر

Institute for Biodiversity and Environmental Research

- Biodiversity as a key research thrust of UBD
- Establishment of the Biology Department in 1986
- The UBD-Royal Geographical Society Expedition to Kuala Belalong (1991-1992)
- Institute for Biodiversity and Environmental Research in 2013

## VISION

Centre of Excellence for  
Biodiversity & Environmental  
Research

## MISSION

Undertake Innovative Research,  
Education & Outreach Activities in  
Tropical Biodiversity and Environmental  
Studies

<https://iber.ubd.edu.bn/>





# The Kuala Belalong Field Studies Centre

ubd | Universiti  
Brunei  
Darussalam



## **Mission:**

To generate, describe and disseminate knowledge in science and education related to the vast diversity of Brunei's tropical rainforests, including all the varied life forms and ecosystem processes.



# UBD Botanical Research Centre



## **Vision**

Centre of excellence for botanical research, education and conservation.

## **Mission**

To protect and share the knowledge of plants for a better sustainability.



# Research areas

## UBD Botanical Research Centre:

- 1) Ex-situ and in-situ conservation of Brunei's flora
- 2) Cataloguing Brunei's plant diversity
- 3) Natural products and medicinal plant research

## The Kuala Belalong Field Studies Centre:

- 1) The Kuala Belalong Conservation Research Project

## IBER Permanent Forest Plots Network:

- 1) Long-term monitoring of forest dynamics
- 2) Climate change impacts on Brunei's forests

## Applied research:

- 1) Genomics of native flora
- 2) Medicinal and herbal plants research
- 3) Ethnobotany and traditional uses of plants
- 4) Plant propagation for ex-situ conservation

## Terrestrial research on flora & fauna:

- 1) Diversity and ecology of Brunei's flora
- 2) Diversity and ecology of small mammals & birds
- 3) IBER Herbarium and Museum

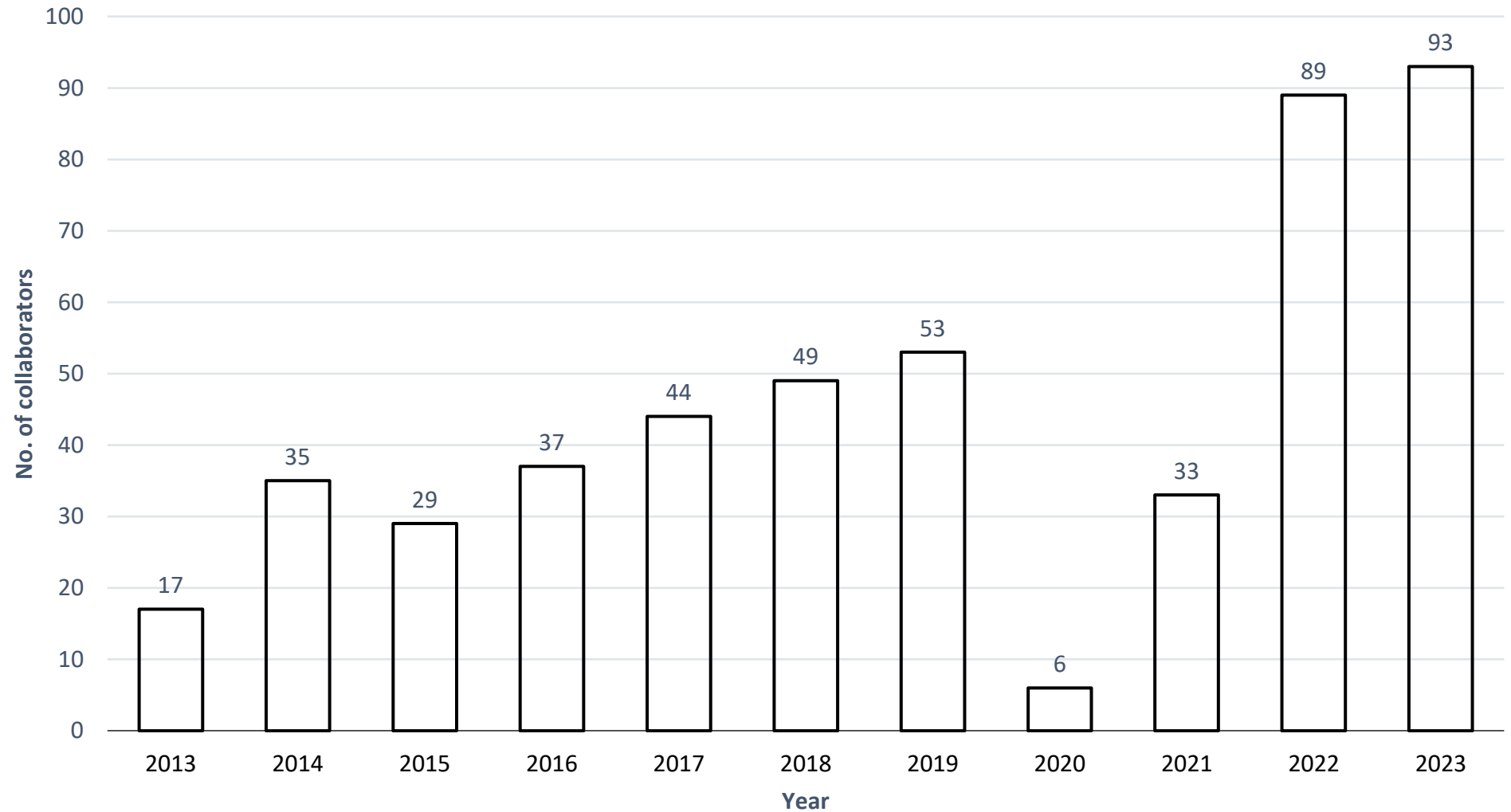
## Marine & freshwater studies:

- 1) Diversity & ecology of aquatic fishes

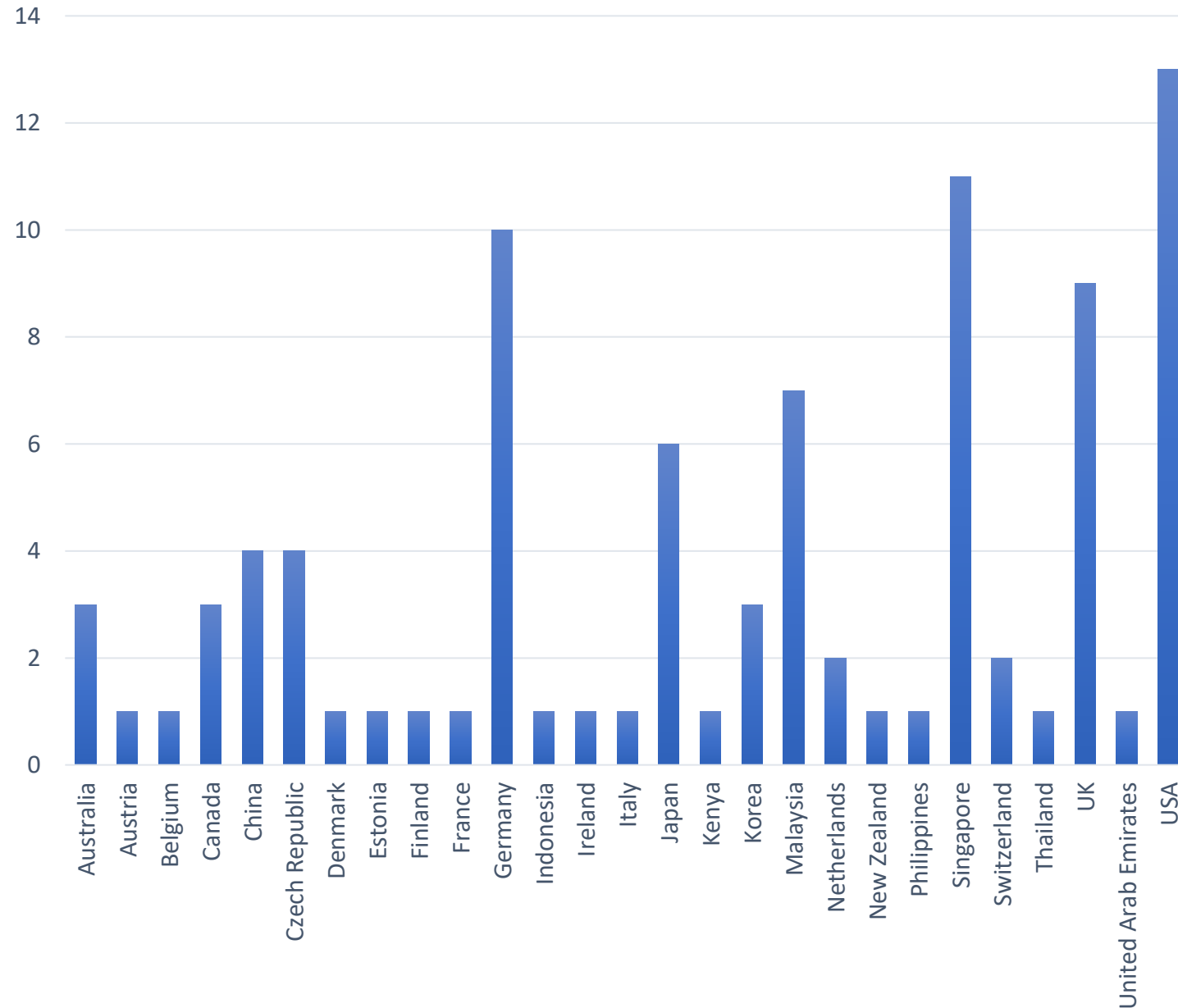
## Ecosystem research:

- 1) Peat swamp biodiversity and ecology
- 2) Reforestation of degraded areas as nature-based solution
- 3) Nutrient cycling dynamics and aboveground carbon stock in tropical forests
- 4) Invasion ecology of Acacias in Brunei

# International research collaborators (2013 – 2023)



## No. of collaborating institutions by countries



### Top international collaborations:

- ❖ National Cancer Centre of Singapore
- ❖ Singapore-MIT Alliance for Research and Technology
- ❖ Nanyang Technological University
- ❖ National University of Singapore
- ❖ Stanford University
- ❖ Massachusetts Institute of Technology
- ❖ University of California Los Angeles
- ❖ Brown University
- ❖ Palacky University
- ❖ Leiden University
- ❖ University of Aberdeen
- ❖ Cambridge University
- ❖ Oxford University
- ❖ University of Sunshine Coast Australia
- ❖ Korea University
- ❖ Ehime University

# Collaborations with Botanic Gardens, Herbarium and Museums

No	Botanic Gardens, Herbarium, Museums	Countries
1	Museum für Naturkunde, Leibniz	Germany
2	Botanic Garden and Botanical Museum, Berlin	Germany
3	Institute of Evolution and Biodiversity Research	Germany
4	Naturalis Biodiversity Center, Leiden	Netherlands
5	Lee Kong Chian Natural History Museum	Singapore
6	Singapore Botanic Garden	Singapore
7	Natural History Museum of Bern	Switzerland
8	Royal Botanic Garden, Kew	UK
9	Field Museum of Natural History, Chicago	USA
10	Smithsonian National Museum of Natural History	USA
11	North Carolina Museum of Natural Sciences	USA



Smithsonian  
National Museum of Natural History



Lee Kong Chian  
Natural History Museum





# Partners and industry collaborators

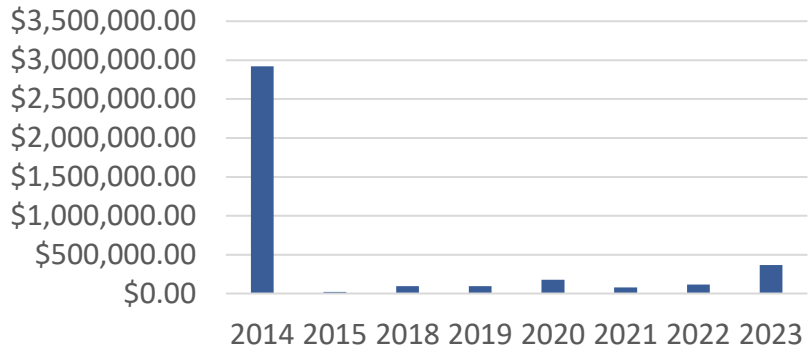


NGO/government agencies	Countries
Forestry Department	Brunei Darussalam
Brunei Heart of Borneo Centre	Brunei Darussalam
Brunei Museums Department	Brunei Darussalam
Wildlife Division	Brunei Darussalam
Brunei Shell Petroleum Co Sdn Bhd	Brunei Darussalam
Brunei Liquefied Natural Gas Co Sdn Bhd	Brunei Darussalam
Fisheries Department	Brunei Darussalam
Survey Department	Brunei Darussalam
Brunei Climate Change Secretariat	Brunei Darussalam
Wetlands International	Brunei Darussalam
BruWILD	Brunei Darussalam
Borneo Futures	Brunei Darussalam
DHI Water and Environment	Brunei Darussalam
Sabah Forestry Department	Malaysia
BirdLife International	Singapore
Mandai Nature	Singapore
Forest Research Institute Malaysia (FRIM)	Malaysia
National Cancer Centre	Singapore
SingHealth Duke NUS	Singapore
Hornbill Specialis Group	Global
Helmeted Hornbill Working Group	Southeast Asia



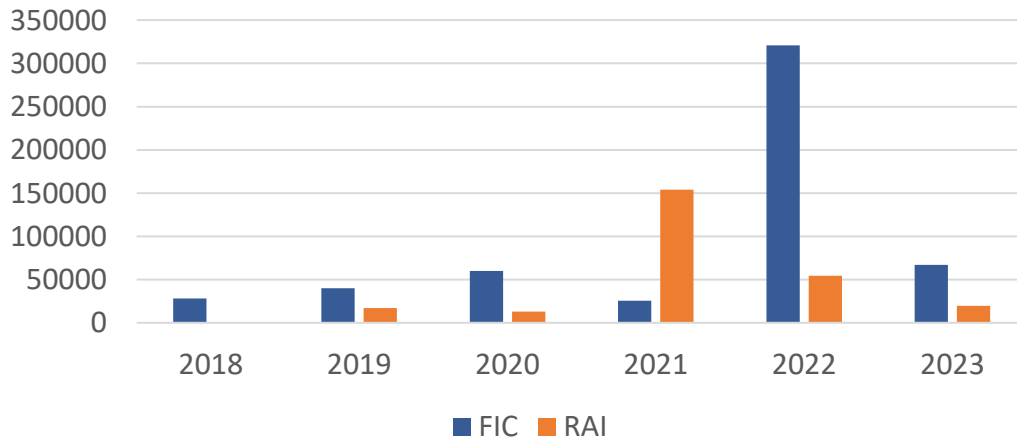
# External funding & research grants

External grant



- External grant of **\$3,932,951.79**
- In-kind support value at **\$78,400.00**

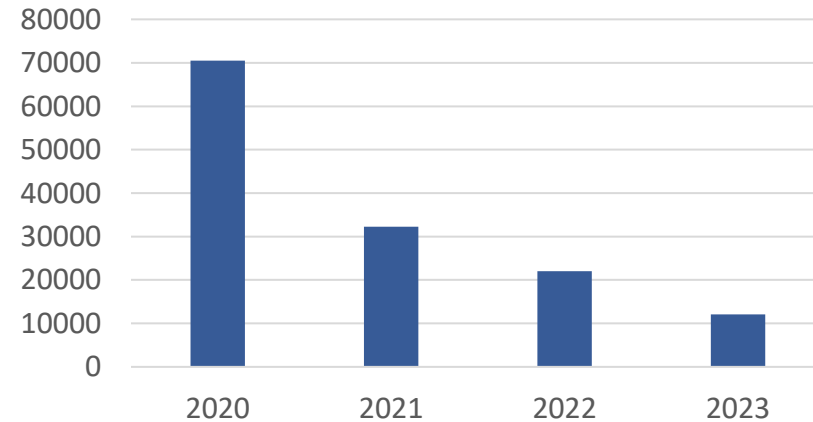
FIC and RAI grants



FIC and RAI grant of **\$799,840.90**



Matching grants



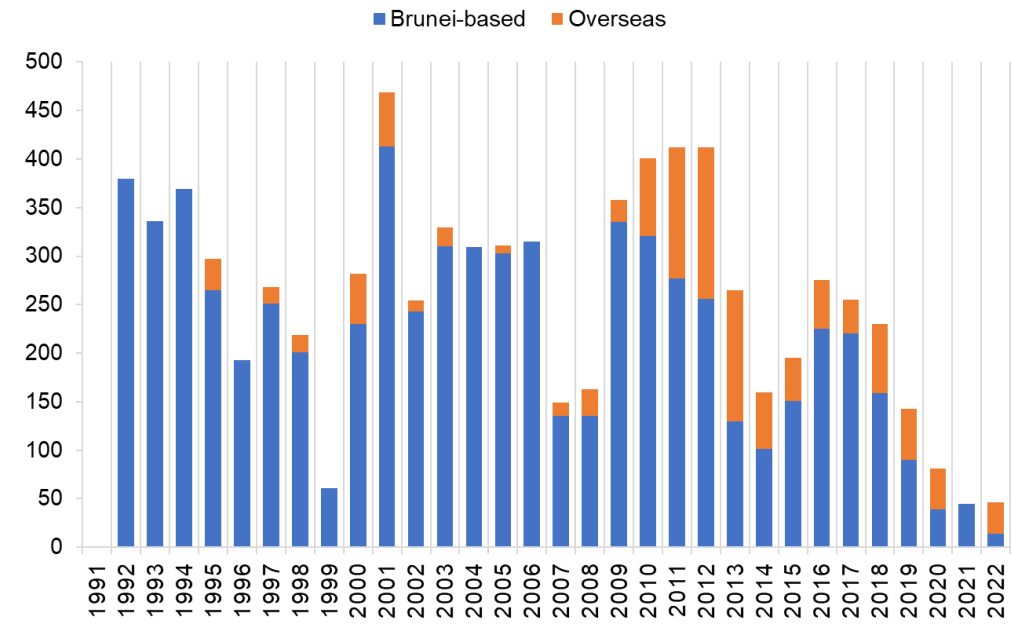
Matching grant of **\$136,912.04**

# Education programmes at IBER

## KBFSC Environmental Education Programme & Field courses

- The KBFSC Environmental Education Programme is the longest running education programme in Brunei (since 1992).
- 4 days and 3 nights residential field course on tropical biodiversity and ecology that is opened for secondary school students.
- The programme is designed for students **to experience, discover and explore** the natural environment of the Belalong rainforest and to promote understanding about the environment, especially regarding its protection and conservation for the wellbeing of both society and the environment.

NUMBER OF PARTICIPANTS IN EDUCATION PROGRAMS AND FIELD COURSES AT KBFSC





# Education programmes at IBER

**KBFSC hosts field courses and workshops at undergraduate and graduate levels**

## **UBD-based field courses:**

- Field ecology (FOS)
- Environmental policy (SBE)
- Education Management and Leadership (SHBIE)
- Masters of Teaching (SHBIE)

## **International groups:**

- Griffith University (Australia)
- University of Vienna (Austria)
- University of Würzburg (Germany)
- Queen Mary University of London (UK)
- Hiroshima University (Japan)
- Princeton University (US)
- Palacký and Ostrava Universities (Czech Republic)
- Yale-Nus College (Singapore)
- James Madison University (US)
- University of Otago (New Zealand)
- University of Sunshine Coast (Australia)
- Taxon Expeditions

## **International workshops:**

- ASEF workshop (2005)
- ASEM workshops (2010, 2013)
- iCUBE workshop (2012)
- Brunei Darussalam – Commonwealth Third Country Training Programme on Environmental Sustainability & Management” (2018)
- 11<sup>th</sup> Flora Malesiana Symposium – Excursion (2019)



# IBER's new education initiatives

## Tropical Research Experience



**TREx**  
Tropical Research Experience

**New Dates:**  
26 June - 7 July 2023

**Application extended to**  
15 MAY 2023

**Open to students and**  
nature enthusiasts

Explore Brunei's immaculate rainforests!  
Conduct tropical research activities and  
get exclusive hands-on field work done  
- all in an unforgettable environment like  
no other.

Carefully tailored courses focus on  
developing research skills and critical  
thinking.  
Brunei's pristine forests and diverse  
inhabitants await you!

Find out  
more



Visit <https://iber.ubd.edu.bn/trex-2023> for details.

office.iber@ubd.edu.bn  
iber.ubd.edu.bn  
ubd.iber.kbfc  
ubd\_iber



- IBER's International Field course on tropical Biology.
- The program provides training on tropical biodiversity research and experience tropical rainforests.
- Piloted in 2020 and launched in 2021.
- TREx 2023 is scheduled on 26 June to 7 July.



## Nature Classroom

- A 3-hour education programme designed for local primary school students in Years 4 to 6 in Brunei.
- Aim: To introduce Brunei's biodiversity to local primary school students
- Piloted on 10 March 2023.
- Programme launch is planned in October-November 2023.



## Biodiversity Watch

- A proposed collaborative education programme between IBER and HoB Centre of Forestry Department (MPRT).
- Uses the citizen science approach to connect and engage various groups of the public to promote increased awareness and understanding of Brunei Darussalam's biodiversity and instil the value of biodiversity conservation.
- The pilot programme is planned in August 2023.



# Biodiversity expeditions

iCUBE Bukit Pagon Expedition

A total of 21 researchers (11 UBD and 10 foreign researchers) from iCUBE member universities took part in a one-week scientific expedition to Bukit Pagon.



Over the period 2009-2012, with support of WWF, a team of from UBD lead an expedition to survey the [Sungai Ingei Protection Forest](#).



Flag-off session and travel from Miri to Long Mekaba, Gerrenai FMU Sarawak, Sept 2022. Participants from Brunei Darussalam include officers from IBER and Forestry Department.



iCUBE Bukit Teraja Expedition took place in July 2019 with a team from UBD to survey flora and fauna in Bukit Teraja, Labi.



# Outreach activities

‘Friends of Belalong’ is IBER’s volunteer programme aimed to engage members of the public in IBER’s biodiversity research and education activities as well as environmental initiatives.



## Plantastique Day

- A one-time event facilitated by the Office of Alumni Relations and Advancement (OARA) and co-organised by UBD Botanical Research Centre (UBD BRC), IBER.
- It is aimed to promote giving back to the university by contributing plants through the "Give a Plant to University" initiative and to expose the UBD BRC to alumni and the public.

## Environmental Clean-up Event

- This event was organised by IBER in conjunction with the ‘Online Joint Environment Clean-up Event’ led by Kagawa University of Japan.
- 26 FoB volunteers participated in this event.
- Held in UBD BRC and the vicinity.



<https://iber.ubd.edu.bn/>

[ibd.iber.kbfc](https://ibd.iber.kbfc)



[peatswamp.iber](https://peatswamp.iber)

[ibd.botanicalgarden](https://ibd.botanicalgarden)



# National impact

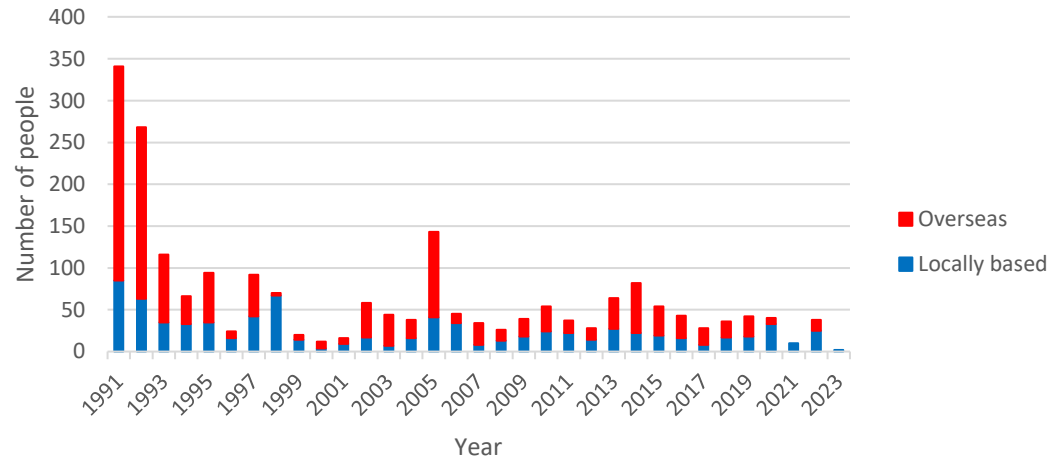
- IBER has led the development of permit workflows concerning biodiversity research with MPRT
- IBER's research has helped guide national policies:
  - Biodiversity Order (upcoming), Forestry Department policies on conservation and forest management, Brunei National Climate Change Policy, list of protected fauna species.
- IBER's researchers contribute to national committees:
  - Adaptation & Resilience Working Group for the Brunei Darussalam National Climate Change Policy
  - Judge for Brunei Wildlife Photography Challenge 2022 organized by Forestry Department.
- Capacity building and skills transfer with key stakeholders:
  - Forestry Department, Wildlife Division, Department of Agriculture and Agrifood, Brunei Climate Change Secretariat, Department of Environment, Parks and Recreation.
- IBER's Biodiversity database and IBER plot databases.



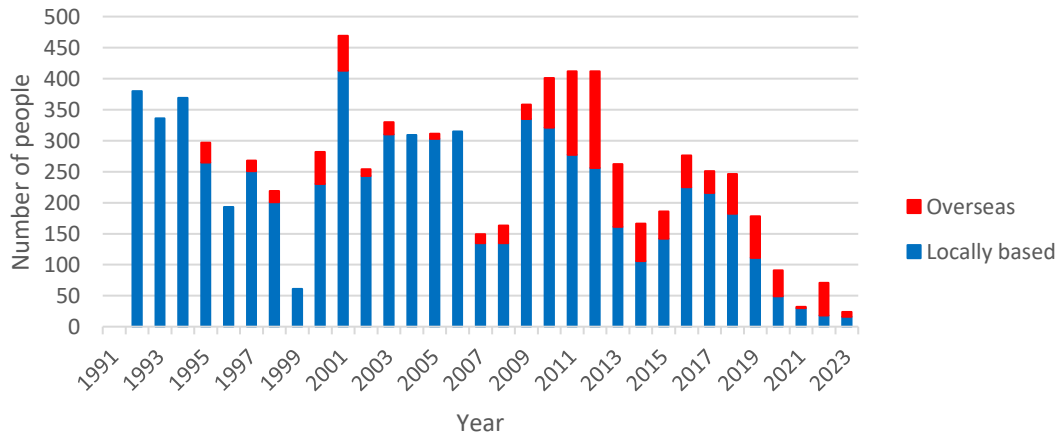
# International impact

KBFSC is Brunei's premier field studies centre and has operated since 1992.

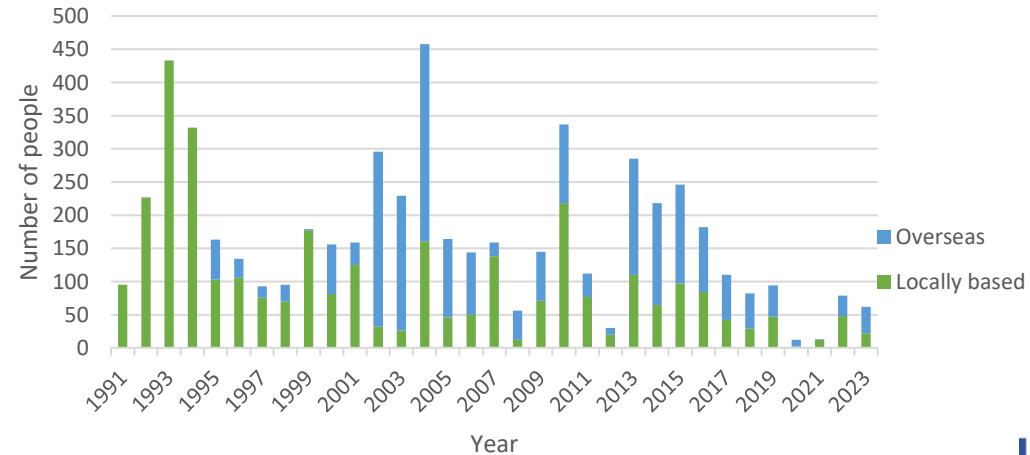
Research



Education



OTHERS





# Global Biodiversity

- The need for ecological consideration when planning renewable energy developments
- To counter climate change – need to change to cleaner energy sources, to reach climate goals
- Need to minimize potential conflict between mitigation and conservation of biodiversity
- Address challenges such as lack of awareness, limited capacity, monitoring, weak involvement of different stakeholders i.e. local communities

# Impact of renewable energy on Biodiversity

- Some renewable energy pathways can have major impact on biodiversity by disrupting the ecosystem processes, impact ecosystem services
- Wind energy developments – raise concern about effects on wildlife.
- Wind farms – impact birds, e.g. birds are known to collide. Wind farms are constructed in areas where wind yield is high which is important to migratory birds,
- Offshore wind energy developments – affect marine organisms as they have very high acoustic sensitivities



- Off-shore wind farms – become marine protected areas which lead to these marine animals congregating and establishing their own habitats
- Downstream effects include habitat loss when building infrastructure,
- Mitigation measures –

The International Union for Conservation of Nature (IUCN) recommendations (Asante, 2021):

to provide knowledge products – clear guidelines from the planning to the completion of project

Outcomes from the mitigation process should be measurable, robust monitoring

Consideration of cumulative impacts, not just one aspect

# References

- E. Schuster, L. Bulling, J. Köppel. Consolidating the state of knowledge: a synoptical review of wind energy's wildlife effects. *Environ Manag* (2015), pp. 300-331,
- Rachel Asante – Mitigating Biodiversity Impacts Associated with Solar and Wind Energy development. IUCN. 2021