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The Global Tree Seed Bank Programme

Report for the Millennium Seed Bank Partnership, Royal Botanic Gardens, Kew

Period covered by this report

Year: 2 (2nd half) FORRU

From: June to December 2022

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1.0 Project Overview

This project is part of the international ‘Global Tree Seed Bank Program’, co-ordinated by the Royal Botanic Gardens Kew, UK, which aims to collect and bank seeds of 3,000 tree species to provide material for research, propagation and use by future generations. Its contribution is 300 seed collections of Thailand native tree and shrub species (new to the GTSBP), collected by two partner organisations: The Forest Herbarium (BKF) and the Forest Restoration Research Unit Chiang Mai University (FORRU-CMU). FORRU-CMU is responsible for collecting 150 species. Seeds are banked at the Millennium Seed Bank (MSB), UK, with duplicate batches banked in Thailand as facilities become available. Field and processing data on all collections are shared among project partners, via the Millennium Seed Bank Partnership’s Data Warehouse online database. In addition, the project is assessing the distribution and extinction risk of 250 of Thailand’s rare and endemic native woody species, of which FORRU-CMU is responsible for 112 species, with technical and financial support from RBG Kew’s Plant Assessment Unit (PAU). The rest are being done by BKF.

2.0 Achievements

Seed Collection

Seeds of eight species were collected in in the period June - December 2022, missing the target for the same period by 17 and bringing the total number of species collected to 71, or 47.3% per cent of target of the entire project period (150 to Dec 2023). Collections were restricted to areas outside of national parks until recently, when we finally received a seed-collection permit from the DNP. The total of 71 species includes twenty-four tree species, which were collected during the interim period between the GW2 and GW3 projects (Table 3), whilst were we waiting for contract finalization. Seed batches of all these species are being prepared for shipment to National Seed Bank of Thailand and KEW, following the new guidelines recently received.

Table 1 – Collection Summary Table.

Collections	Actual (June-Dec 22)	Target (Jan-June 22)	Total Actual (entire project)	Total Target (entire project)
Number of Collections	8	25	71	150
Number of Species	8	25	71	150
Number of Species New to MSB	8	No target		
Number of Species New to GW GTSBP	8	25	71	150
Number of Threatened Species	0	*	3	
Number of Endemics	0	*	0	
Number of Useful Species	8		71	

*Endangered and endemic species will be prioritised but there is no specific target

Table 2.1 – Species Collected (interim report – 7th June 2022)

Scientific Name	Threatened	Endemic	Useful	New to MSB	Period ^a	Status ^b
<i>Adenanthera pavonina</i>	N	N	Y	Y	I	RSK
<i>Adinandra integerrima</i>	N	N	Y	Y	I	RSK
<i>Aegle marmelos</i>	NT	N	Y	Y	P	RSK
<i>Albizia lebbeck</i>	LC	N	Y	Y	I	RSK
<i>Alstonia scholaris</i>	LC	N	Y	Y	P	RSK
<i>Antidesma bunius</i>	LC	Y	Y	Y	P	RSK
<i>Antidesma montanum</i>	LC	N	Y	Y	P	RSK
<i>Antidesma sootepense</i>	N	N	Y	Y	I	RSK
<i>Barringtonia acutangula</i>	LC	N	Y	Y	P	RSK
<i>Bauhinia purpurea</i>	LC	N	Y	Y	P	RSK
<i>Bauhinia racemosa</i>	N	N	Y	Y	P	RSK
<i>Bauhinia variegata</i>	LC	N	Y	Y	I	RSK
<i>Biancaea sappan</i>	LC	N	Y	Y	P	RSK
<i>Bombax ceiba</i>	LC	N	Y	Y	P	RSK
<i>Buchanania lanzan</i>	N	N	Y	Y	I	RSK
<i>Callicarpa arborea</i>	LC	N	Y	Y	P	RSK
<i>Canarium subulatum</i>	N	N	Y	Y	I	RSK
<i>Cassia fistula</i>	LC	N	Y	Y	P	RSK
<i>Cassia grandis</i>	LC	N	Y	Y	P	RSK
<i>Cassia javanica</i>	LC	N	Y	Y	P	RSK
<i>Catunaregam spathulifolia</i>	N	N	Y	Y	I	RSK
<i>Catunaregam tomentosa</i>	N	N	Y	Y	P	RSK
<i>Ceiba pentandra</i>	LC	N	Y	Y	P	RSK
<i>Choerospondias axillaris</i>	LC	N	Y	Y	P	RSK
<i>Chukrasia velutina</i>	LC	N	Y	Y	P	RSK
<i>Dalbergia sp.</i>	N	N	Y	Y	P	RSK
<i>Ficus benjamina</i>	LC	N	Y	Y	I	RSK
<i>Ficus glaberrima</i>	LC	N	Y	Y	I	RSK
<i>Ficus religiosa</i>	N	N	Y	Y	P	RSK
<i>Ficus sarmentosa</i>	N	N	Y	Y	I	RSK
<i>Ficus semicordata</i>	LC	N	Y	Y	P	RSK
<i>Ficus subulata</i>	LC	N	Y	Y	P	RSK
<i>Flacourtia indica</i>	LC	N	Y	Y	P	RSK
<i>Fraxinus floribunda</i>	LC	N	Y	Y	P	RSK
<i>Hydnocarpus annamensis</i>	VU	N	Y	Y	I	RSK
<i>Ilex umbellulate</i>	LC	N	Y	Y	P	RSK
<i>Magnolia baillonii</i>	LC	N	Y	Y	I	RSK
<i>Mallotus paniculatus</i>	LC	N	Y	Y	P	RSK
<i>Mallotus philippensis</i>	LC	N	Y	Y	P	RSK

Scientific Name	Threatened	Endemic	Useful	New to MSB	Period ^a	Status ^b
<i>Mammea siamensis</i>	N	N	Y	Y	P	RSK
<i>Markhamia stipulata</i>	LC	N	Y	Y	P	RSK
<i>Mastixia euonymoides</i>	N	N	Y	Y	I	RSK
<i>Melia azedarach</i>	LC	N	Y	Y	P	RSK
<i>Millettia pubinervis</i>	N	N	Y	Y	I	RSK
<i>Morinda citrifolia</i>	N	N	Y	Y	P	RSK
<i>Morinda tomentosa</i>	N	N	Y	Y	I	RSK
<i>Moringa oleifera</i>	LC	N	Y	Y	P	RSK
<i>Nyssa javanica</i>	N	N	Y	Y	I	RSK
<i>Oroxylum indicum</i>	N	N	Y	Y	P	RSK
<i>Ostodes paniculata</i>	LC	N	Y	Y	P	RSK
<i>Peltophorum pterocarpum</i>	N	N	Y	Y	P	RSK
<i>Phyllanthus emblica</i>	LC	N	Y	Y	P	RSK
<i>Pterocarpus indicus</i>	EN	N	Y	Y	P	RSK
<i>Salix tetrasperma</i>	LC	N	Y	Y	I	RSK
<i>Saurauia roxburghii</i>	LC	N	Y	Y	P	RSK
<i>Schoepfia fragrans</i>	LC	N	Y	Y	I	RSK
<i>Siphonodon celastrineus</i>	LC	N	Y	Y	I	RSK
<i>Sterculia foetida</i>	N	N	Y	Y	P	RSK
<i>Terminalia bellirica</i>	LC	N	Y	Y	I	RSK
<i>Terminalia chebula</i>	LC	N	Y	Y	I	RSK
<i>Toona ciliata</i>	LC	N	Y	Y	P	RSK
<i>Vitex peduncularis</i>	LC	N	Y	Y	I	RSK
<i>Ziziphus mauritiana</i>	LC	N	Y	Y	P	RSK

Table 2.2 – Species Collected (This period report – 8th June 2022 to 7th December 2022)

Scientific Name	Threatened	Endemic	Useful	New to MSB	Period ^a	Status ^b
<i>Crateva magna</i>	N	N	Y	Y	Y2H2	RSK
<i>Daphniphyllum griffithianum</i>	N	N	Y	Y	Y2H2	RSK
<i>Fernandoa adenophylla</i>	N	N	Y	Y	Y2H2	RSK
<i>Flacourtia rukam</i>	N	N	Y	Y	Y2H2	RSK
<i>Nauclea orientalis</i>	LC	N	Y	Y	Y2H2	RSK
<i>Senna siamea</i>	LC	N	Y	Y	Y2H2	RSK
<i>Trema orientale</i>	LC	N	Y	Y	Y2H2	RSK
<i>Ziziphus oenopolia</i>	LC	N	Y	Y	Y2H2	RSK

^a"I", Interim period; "P" previous project period; "Y2H2", current project report period

^b"SK", sent to Kew; "RSK", ready to send to Kew, "CMU" (duplicate sub-sample stored in CMU seed bank and "NTB", will send or sent to National Biobank Thailand (in Bangkok)

3.0 Images with Captions



Oroxylum indicum



Nauclea orientalis



Flacourtia indica



**Seed extracting
(*Nauclea orientalis*)**



Seed dying (*Ziziphus oenopolia*)

A small seed bank with 3 freezers and a small seed-processing lab (separately funded) was recently opened in CMU's Nature Centre, with some financial support for consumables etc. from the GW3 project and technical advice from training provided by Kew staff under previous projects. This facility is being used to accumulate duplicate seed collections generated by the GW3 project—thus facilitating in-country seed banking.

Seeds from the CMU seed bank are being used to supply graduate students with seeds and seedlings for research, including an investigation of *Mesua ferrea* for the treatment of diabetes (Dongdong Zhang). Two Thai students are using seeds from the bank for studies of seed storage behaviour and seed morphology (Nattanit and Khuanpirom). Nattanit also studied how to disinfect some seeds that have a problem with fungal infection in moist storage (mostly recalcitrant seeds - moist storage might help to increase the length of short-term storage).

A new development this year has been expanded use of the seed bank for the Young Forest Restorers (YFR) project. This project (separately funded by KNCF) is involving secondary school children in seed collection for growing trees in their own school tree nurseries for forest restoration projects. When a school collects an excess of seeds of a certain species, the seeds are banked and swapped with other schools, using the LINE app to communicate which seed species are available. By sharing seeds in this way, schools have an opportunity to grow a great diversity of tree seedlings in their nurseries. For more information, please see the [project website here](#).

Another knock-on effect of Kew's support of the seed bank is education has been education and training in Thailand and nearby countries. The facility was used for training sessions for senior Forest Department officers from Bangladesh in July and staff from Souphanouvong University and Savannakhet University (Lao PDR) and Kasetsart University (Thailand) in November. An open day at the seed bank was held in September for school children. Earlier

in 2022, we had 2 educational events for the general public and school teachers under the Plant Genetic Conservation Project under the Royal initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (organized by Chiang Mai University). For these 2 events, we had about 60 participants. We also used the seed bank for CMU undergrad student class practicals: courses entitled “Doi Suthep Studies (40 students) and “Restoration Ecology” (2 students).

In addition to Kew’s financial support, the project also attracted 100,000 THB in matching funds from Chiang Mai University to cover the budget-line shortfall for support of nursery/seed-bank staff. This matching funding has also just been confirmed for Y3 of the project.



CMU Seed Bank – used for graduate research projects – Nattanit seed storage behaviour and sterilization methods

Local school children learning about seed banking during the [YFR](#) open day.








Another knock-on effect of GW3 – use of the CMU seed bank for [FRAME project](#) (improving higher education on forestry). Left: project co-ordinator Dipjoy Chakma from Helsinki U. visiting in August to plan the workshop. Above: FRAME trainees from Lao PDR (Souphanouvong and Suvannakhet Universities) and Kasetsart University, Bangkok learn seed banking during the workshop in November.

KNOCK-ON EFFECTS - YFR PROJECT, SEED COLLECTION AND BANKING



A LIST OF THE SPECIES AVAILABLE IN THE SEED BANK

 ใบหนามพวย <i>Turpinia pomifera</i>	 มะปราง <i>Antidesma bunius</i>
 ถั่วพราง <i>Cassia bakeriana</i>	 มะนาก้าง <i>Choerospondias axillaris</i>
 มะไฟป่า <i>Afzelia xylocarpa</i>	



Red Listing

Information on 113 species has been gathered from secondary online sources, and two local herbaria and associated libraries: Chiang Mai University (CMUB) and Queen Sirikit Botanical Gardens (QBG). Furthermore, Forest Herbarium (BKF), Bangkok Herbarium (BK), Khon Kaen University Herbarium (KKU) and Prince of Songkla University Herbarium (PSU) were visited (dates see table 3) and information extracted from herbarium labels there. Information was stored as PDF files collated into folders: 1 for each species. Progress with Red Listing is summarized in Table 4. Out of 113 species assigned to FORRU, 109 have been completed and uploaded to the SIS database. The review tool was used to verify them and we are awaiting the results of external review.

Table 3. Herbaria visit summary

Herbarium	Date
Queen Sirikit Botanical Gardens (QBG)	21 June 2022
Forest Herbarium (BKF)	18 July 2022
Bangkok Herbarium (BK)	19 July 2022
Khon Kaen University Herbarium (KKU)	21 July 2022
Prince of Songkla University Herbarium (PSU)	3 August 2022



Bangkok Herbarium

Forest Herbarium

Khon Kaen Herbarium

Revised targets for project-extension letter:

	To Dec 2022	June 2023	Dec 2023	Total
6-monthly	8	39	40	150
Cumulative	71	110	150	150

*[KH note: Project ends Dec '23 (2566), so we have 19 more months.
Suggested revised targets = remaining collections (150-70? =80) / 3 = 42.7 / six-month period.]*

Red List Summary Table

Collections completed	Actual <i>(Jan-June 22)</i>	Total Actual <i>(for the length of the project)</i>	Total Target <i>(for the length of the project)</i>
Number of Assessments – completed by NBC	25	84	113

Revised Red Listing targets for project extension letter:

	To Dec 2022	June 2023	Dec 2023	Total
6-monthly	84	4	0	113
Cumulative	109	113	113	113

*[*KH note: We aim to finish Red Listing in Sept 2023 (2566), to allow time to do the RL reviews and start writing the summary paper. Jun'22-Sept'23 = 16 months. Suggested revised targets: total remaining (113-28? =85?) divided by 16 months = 5.3/month]*

Table 3 - Progress with Red Listing

Species	Assessment
<i>Adinandra oblonga</i>	Draft Assessment complete
<i>Afzelia xylocarpa</i>	Draft Assessment complete
<i>Allophylus eustachys</i>	Draft Assessment complete
<i>Allophylus montanus</i>	Draft Assessment complete
<i>Allophylus pallidus</i>	Draft Assessment complete
<i>Allophylus sootepensis</i>	Draft Assessment complete
<i>Archidendron conspicuum</i>	Draft Assessment complete
<i>Ardisia betongensis</i>	Draft Assessment complete
<i>Ardisia ionantha</i>	Draft Assessment complete
<i>Ardisia kerrii</i>	Draft Assessment complete
<i>Ardisia labisiifolia</i>	Draft Assessment complete
<i>Ardisia multipunctata</i>	Draft Assessment complete
<i>Ardisia nervosa</i>	Draft Assessment complete
<i>Ardisia pachysandra</i>	Draft Assessment complete
<i>Ardisia palustris</i>	Draft Assessment complete
<i>Ardisia paralleloneura</i>	Draft Assessment complete
<i>Artocarpus montanus</i>	Draft Assessment complete
<i>Artocarpus rubrosocatus</i>	Draft Assessment complete
<i>Barringtonia khaoluangensis</i>	Draft Assessment complete
<i>Barringtonia schmidtii</i>	Draft Assessment complete
<i>Barringtonia thailandica</i>	Draft Assessment complete
<i>Bauhinia saccocalyx</i>	Draft Assessment complete
<i>Blachia andamanica</i>	Draft Assessment complete
<i>Bridelia affinis</i>	Draft Assessment complete
<i>Burkilliodendron album</i>	Draft Assessment complete
<i>Chionanthus ambliirrhinus</i>	Draft Assessment complete
<i>Chionanthus decipiens</i>	Draft Assessment complete
<i>Chionanthus maxwellii</i>	Draft Assessment complete
<i>Chionanthus velutinus</i>	Draft Assessment complete
<i>Chisocheton grandiflorus</i>	Draft Assessment complete
<i>Chisocheton penduliflorus</i>	Draft Assessment complete
<i>Chorisandrachne diplosperma</i>	Draft Assessment complete
<i>Claoxylon putii</i>	Draft Assessment complete
<i>Cleistanthus denudatus</i>	Draft Assessment complete
<i>Croton fluviatilis</i>	Draft Assessment complete
<i>Croton hutchinsonianus</i>	Draft Assessment complete
<i>Croton kerrii</i>	Draft Assessment complete
<i>Croton kongkandanus</i>	Draft Assessment complete
<i>Croton poomae</i>	Draft Assessment complete
<i>Croton santisukii</i>	Draft Assessment complete

Table 3 - Progress with Red Listing (continued)

Species	Assessment
<i>Croton sepalinus</i>	Draft Assessment complete
<i>Dalbergia cultrata</i>	Draft Assessment complete
<i>Distylium indicum</i>	Draft Assessment complete
<i>Drypetes dasycarpa</i>	Draft Assessment complete
<i>Drypetes harmandii</i>	Draft Assessment complete
<i>Drypetes helferi</i>	Draft Assessment complete
<i>Dysoxylum papillosum</i>	Draft Assessment complete
<i>Ehretia siamensis</i>	in progress
<i>Erythrophleum teysmannii</i>	Draft Assessment complete
<i>Ficus griffithii</i>	Draft Assessment complete
<i>Ficus mollissima</i>	Draft Assessment complete
<i>Ficus oreophila</i>	Draft Assessment complete
<i>Firmiana kerrii</i>	Draft Assessment complete
<i>Garcinia plena</i>	Draft Assessment complete
<i>Gardenia truncata</i>	Draft Assessment complete
<i>Glochidion santisukii</i>	Draft Assessment complete
<i>Gluta usitata</i>	Draft Assessment complete
<i>Grewia hypotephra</i>	Draft Assessment complete
<i>Knema globulatericia</i>	Draft Assessment complete
<i>Lagerstroemia spireana</i>	Draft Assessment complete
<i>Lagerstroemia undulata</i>	Draft Assessment complete
<i>Madhuca chai-ananii</i>	Draft Assessment complete
<i>Madhuca Chiangmaiensis</i>	Draft Assessment complete
<i>Madhuca esculenta</i>	Draft Assessment complete
<i>Madhuca floribunda</i>	Draft Assessment complete
<i>Madhuca punctata</i>	Draft Assessment complete
<i>Madhuca stipulacea</i>	Draft Assessment complete
<i>Madhuca takensis</i>	Draft Assessment complete
<i>Mallotus calocarpus</i>	Draft Assessment complete
<i>Mallotus hymenophyllus</i>	Draft Assessment complete
<i>Mallotus pallidus</i>	Draft Assessment complete
<i>Memecylon tricolor</i>	Draft Assessment complete
<i>Ormosia mekongensis</i>	Draft Assessment complete
<i>Palaquium garrettii</i>	Draft Assessment complete
<i>Palaquium hansenii</i>	Draft Assessment complete
<i>Phyllanthus angkorensis</i>	Draft Assessment complete
<i>Phyllanthus orientalis</i>	Draft Assessment complete
<i>Pinus kesiya</i>	Draft Assessment complete
<i>Planchonella stellibacca</i>	Draft Assessment complete
<i>Polyosma adangensis</i>	in progress
<i>Psydrax calcicola</i>	Draft Assessment complete
<i>Pterospermum littorale</i>	Draft Assessment complete

Table 3 - Progress with Red Listing (continued)

Species	Assessment
<i>Pterospermum peterianum</i>	Draft Assessment complete
<i>Schoutenia godefroyana</i>	Draft Assessment complete
<i>Senegalia meeboldii</i>	Draft Assessment complete
<i>Spathiostemon moniliformis</i>	Draft Assessment complete
<i>Streblus perakensis</i>	Draft Assessment complete
<i>Syzygium cacuminis</i>	Draft Assessment complete
<i>Syzygium corticosum</i>	Draft Assessment complete
<i>Syzygium craibii</i>	Draft Assessment complete
<i>Syzygium fuscescens</i>	Draft Assessment complete
<i>Syzygium globiflorum</i>	Draft Assessment complete
<i>Syzygium ixoroides</i>	Draft Assessment complete
<i>Syzygium kerrii</i>	Draft Assessment complete
<i>Syzygium lakshnakarae</i>	Draft Assessment complete
<i>Syzygium nitrasirirakii</i>	Draft Assessment complete
<i>Syzygium refertum</i>	Draft Assessment complete
<i>Syzygium smalianum</i>	Draft Assessment complete
<i>Syzygium winitii</i>	Draft Assessment complete
<i>Tarenna cinerea</i>	Draft Assessment complete
<i>Tarenna puberula</i>	in progress
<i>Tarenna sakae</i>	Draft Assessment complete
<i>Terminalia glaucifolia</i>	Draft Assessment complete
<i>Terminalia pedicellata</i>	Draft Assessment complete
<i>Thaigentadopsis tenuis</i>	Draft Assessment complete
<i>Toxicodendron rheticsoides</i>	Draft Assessment complete
<i>Trigonostemon kerrii</i>	Draft Assessment complete
<i>Urophyllum aequale</i>	Draft Assessment complete
<i>Urophyllum talangense</i>	in progress
<i>Xantolis burmanica</i>	Draft Assessment complete
<i>Xantolis siamensis</i>	Draft Assessment complete

4.0 Project Challenges

Previous challenges were i) late contract signing due to COVID, ii) problems with working the SIS system, iii) delay in receiving seed collection permit, iv) closure of protected areas during COVID and v) difficulty accessing other herbaria. These have now largely dissipated or been overcome, but led to knock-on delays in project outputs particularly seed collecting. However, we are well on track to meet the Red List target and will step up seed collection to meet the target by the end of the project.

This period project is a rainy season, most of species is recalcitrant species. Target species in Doi Suthep Pui NP mostly have been collected. The collection team need to do seed collections to another National Park in northern Thailand. The target lists will be revised.