Samara

The International Newsletter of the Millennium Seed Bank Partnership

Millennium Seed Bank 25th Anniversary Edition 2025

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Millennium Seed Bank 25th Anniversary

What one word would you use to describe the Millennium Seed Bank Partnership?

Contents

Celebrating the Past, Seeding Our Future

Millennium Seed Bank 25th Anniversary

Photo: RBG Kew.

The seed banking facilities in the mansion chapel at Wakehurst in the 1970's.

Together, we're seeding a brighter future for people and planet.

This year marks a proud milestone as we celebrate 25 years of the Millennium Seed Bank (MSB) at Wakehurst, Kew's wild botanic garden in Sussex. Since opening in 2000, with your help, this pioneering facility has safeguarded nearly 2.5 billion seeds from over 40,000 wild plant species – protecting biodiversity for generations to come.

None of this would have been possible without the Millennium Seed Bank Partnership (MSBP): a global collaboration of over 275 partners across 100 countries and territories. Together, we've shared knowledge, built skills, and worked to protect wild plant species threatened by deforestation, disease, and climate change. This special issue is dedicated to you and shares a snapshot of all the inspiring seed conservation work happening across the globe.

Our celebrations are well underway at Wakehurst. Visitors can explore *Seedscapes*, an inspiring outdoor art trail bringing seed science to life, and step inside our Elizabethan mansion – the original home of the seed bank, which famously began in a domestic freezer in the tiny chapel! Families can get hands-on as young seed scientists with our interactive seed processing prototype, whilst a series of autumn events will engage policymakers, scientists, and supporters alike. We're also excited to announce our work with Wakehurst Ambassador, Cate Blanchett, who will lead our fundraising appeal and a brand new podcast series exploring seed science through time.

This anniversary honours our combined achievements and the vital work ahead. We're grateful for your continued support and hope you'll join us – in person or online – to celebrate, share stories, and champion plant conservation within your own communities.

“The Millennium Seed Bank Partnership has achieved remarkable things over the past 25 years. 40,000 species have been banked, thus ensuring their future survival and creating an invaluable gene bank for research and restoration. The MSBP collections are a global asset, vital to the future health of life on earth and it underpins national commitments to the Global Biodiversity Framework and the UN’s Sustainable Development Goals. Perhaps most impressively, it has been a global collaboration between over 275 organisations who have worked with common purpose and commitment in creating this international Partnership. Described as the most important *ex situ* conservation project in the world, it provides a model for global co-operation in tackling our most pressing challenges.”

Richard Deverell, Director of RBG Kew

“It has been my great privilege to manage the MSBP since 2019, overseeing the growth of the MSBP team at Kew and the development and delivery of some truly impactful projects. None of this would have been possible without the amazing network of partners who help deliver our joint vision of no plant being left without a conservation option. I am continually inspired by those I work with, in the UK and around the world – their commitment and dedication as well as their unparalleled knowledge of the habitats and plants they work with. I am also indebted to those who designed and delivered the MSB back in the 1990s, for their foresight and planning (the seed vault at the MSB is built to last 500 years) in the creation of this international plant conservation centre, whose importance continues to grow now an estimated 45% of plants are threatened with extinction. It is thanks to all of these people that we already have 40,000 species banked at the MSB, and more across the partnership, providing solutions to issues today and for generations to come. My sincere thanks to all those involved.”

Elinor Breman, MSBP Manager

“My daughter is now half my age, a little bit more than 25 years old. So, the generation gap in my family matches that of the MSB as it celebrates its 25th year. Both the MSB and my daughter are approaching their prime, with the energy and imagination to make positive change and to adapt. Around us, the changes in the natural world are occurring faster and having a greater impact, at the same time as those in our social and political environments. The efforts we are putting into reversing damage to both domesticated and wild living environments need to match and scale up. There is no time for futile projects to plant unsuitable trees and neglect them. The MSB, and all the partner institutes where we have worked to save and store seeds, feel the call to restore and rehabilitate our living world. To achieve that we are now tasked to improve our policies, collaboration, processes and resources to build and sustain a much stronger dynamic between *ex situ* and *in situ*. So much effort has been put into collecting, studying and storing seeds, the future is to ensure that they still have a place in our living world to adapt and thrive.”

Charlotte Lusty, Head of Seed Collections

“Over the past 25 years, the Millennium Seed Bank Partnership has created one of the world’s greatest biological safety nets – a vast and invaluable collection of wild plant seeds. This extraordinary global collaboration has laid the foundation for cutting-edge research, innovative conservation, and the sustainable use of plant diversity across the planet. But this is only the beginning. As we look ahead, the next 25 years will be defined by how we rise to the urgent challenges of biodiversity loss, climate change, and food insecurity. Together, we aim to unlock the full potential of seed collections. From future-proofing ecological restoration and agriculture, to preserving the world’s most exceptional and threatened plant species, to decoding the genetic foundations of climate resilience and adaptation, our work will be ambitious, innovative, and driven by the needs of both people and planet. We are proud of what has been achieved, but even more inspired by what lies ahead.”

Alex Antonelli, Executive Director of Science

Photo: Sophia Spring.

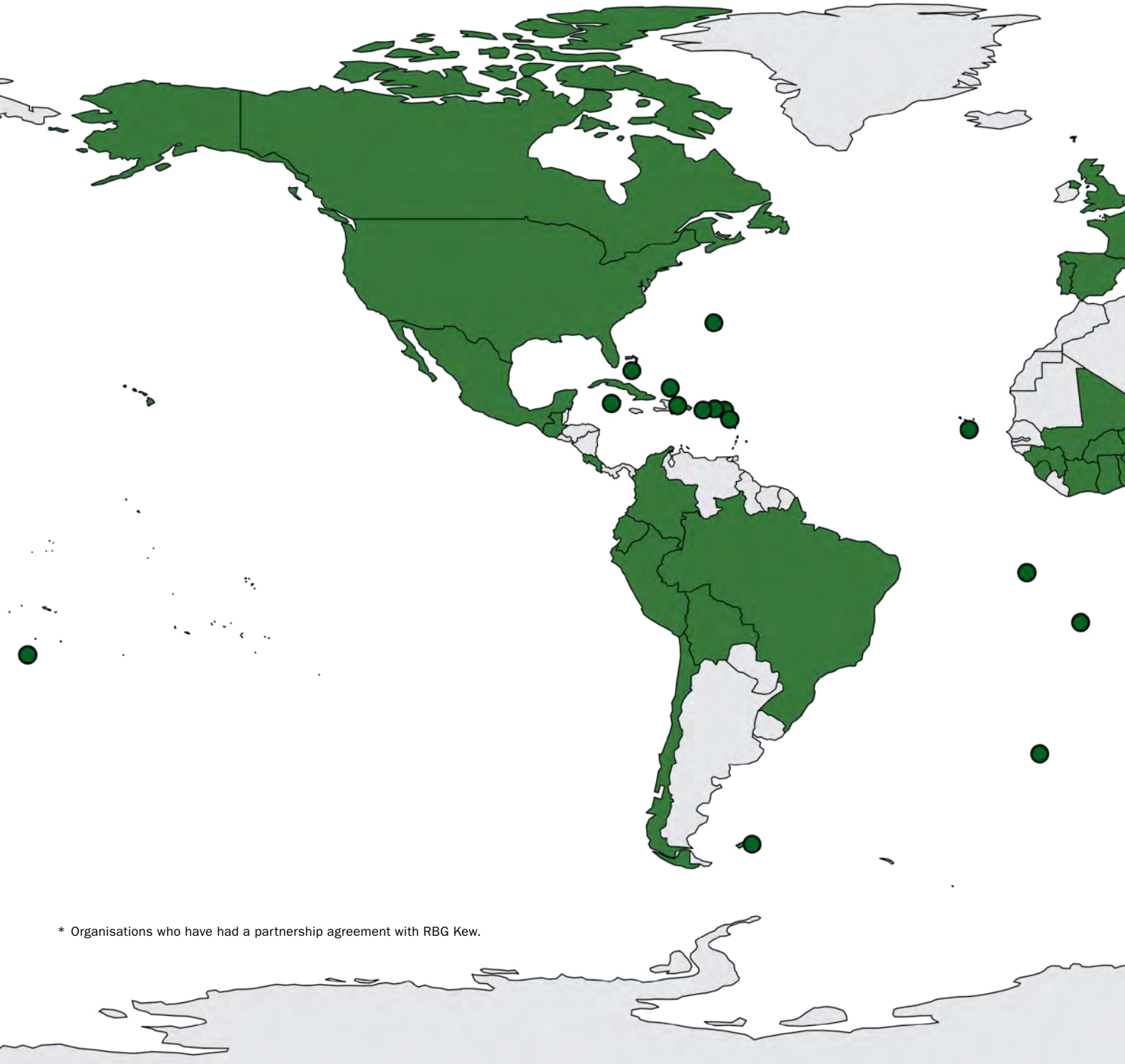
Cate Blanchett, Wakehurst Ambassador, and Susan Raikes, Wakehurst Director, hosted a dinner and event to launch the Seeds Future Fund for the Millennium Seed Bank as we kick off celebrations for its 25th anniversary. Here they are joined by Richard Deverell, Director of the Royal Botanic Gardens, Kew.

Photo: RBG Kew.

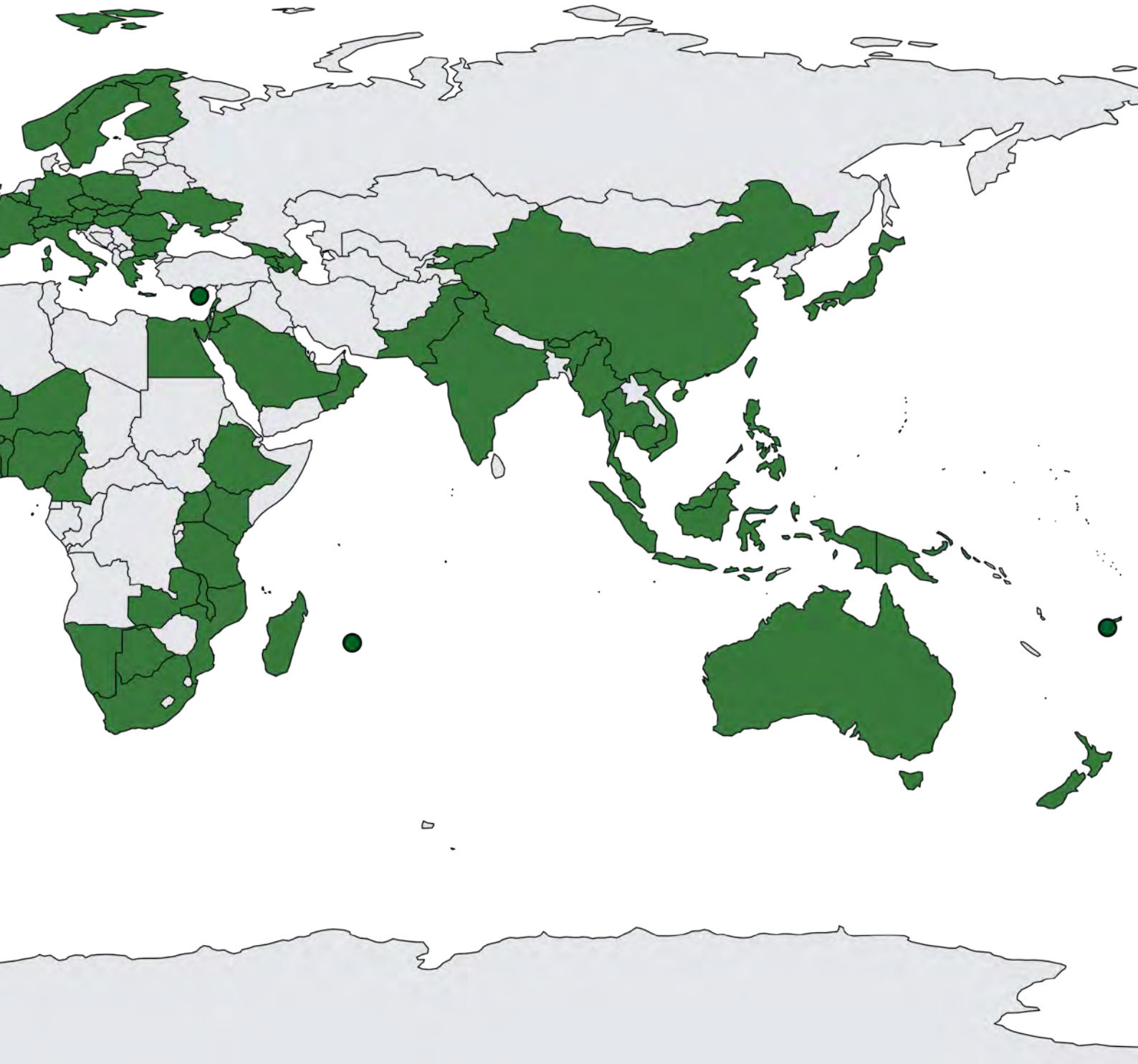
Shiraaz Ali’s Unleashed on the front of the MSB.

Millennium Seed Bank Partnership Countries and Territories*

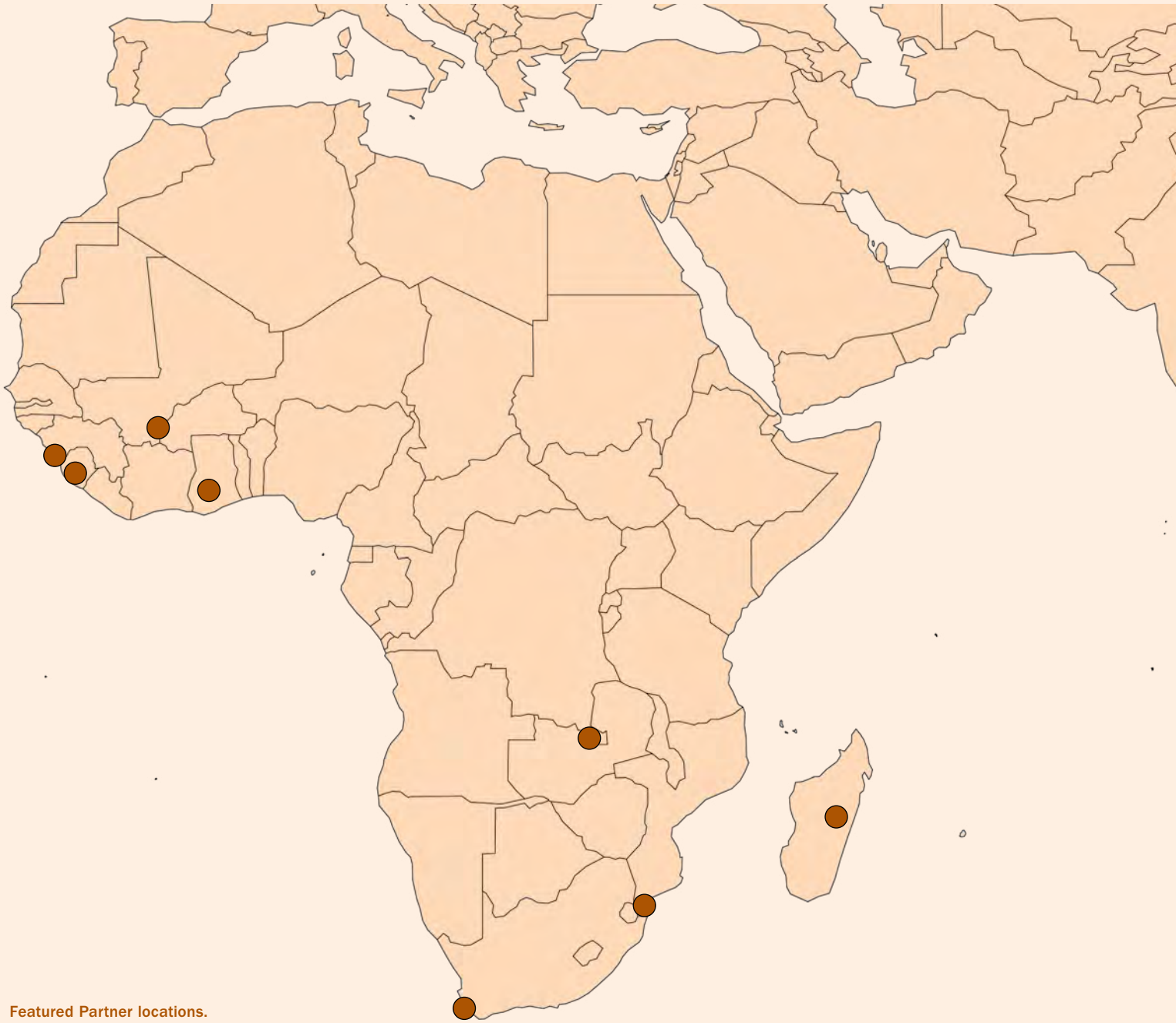
2000 to 2025



* Organisations who have had a partnership agreement with RBG Kew.



Africa



Featured Partner locations.

CSIR-Forestry Research Institute of Ghana (National Tree Seed Centre)

Contributed by James Amponsah

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Pericopsis elata* (Harms) Meeuwen
Local name: Afromosia

We would choose *Pericopsis elata* (Afromosia). This is an indigenous, endangered tree species found across West Africa. Seeds of *Pericopsis* respond quite well to dormancy-breaking pre-treatment. Over the years, our organisation has contributed significantly to this species' conservation through seed banking, nursery seedling propagation and field planting to secure its future.

Fruits of *Pericopsis elata*.

Seeds of *Pericopsis elata*.

Tell us a little about your seed conservation team, facilities and current activities.

Our team at the National Tree Seed Centre (NTSC) at CSIR-FORIG, is made up of three scientists undertaking seed-related research and a field team consisting of a driver, tree climber and a technician who undertake yearly seed collecting missions across the country. The NTSC Seed Laboratory team is made up of three technical officers who assist in seed testing and research experiments. The NTSC has two cold rooms operating at -10 and +5°C for long-term and short-term tree seed banking. The centre is also equipped with training facilities for students, local farmers and other organisations. There is a one million seedling capacity nursery attached to the NTSC supporting propagation and supply of tree seeds towards land restoration in Ghana.

National Tree Seed Centre staff in the cold room.

What have you gained through being in a network of seed conservationists?

Being in a network of seed conservationists such as the MSBP has enhanced experience-sharing and the adoption of best practices for seed conservation. The network has also provided opportunities for joint project implementation and scientific research. In some cases, being part of a network has given us the chance for capacity building through exchange programmes, technical attachments and seed conservation techniques training. The supply of equipment to improve our operations has also been possible as a result of being part of a network of seed conservationists.

National Tree Seed Centre staff in the lab.

Photos: James Amponsah.

The National Tree Seed Centre nursery.

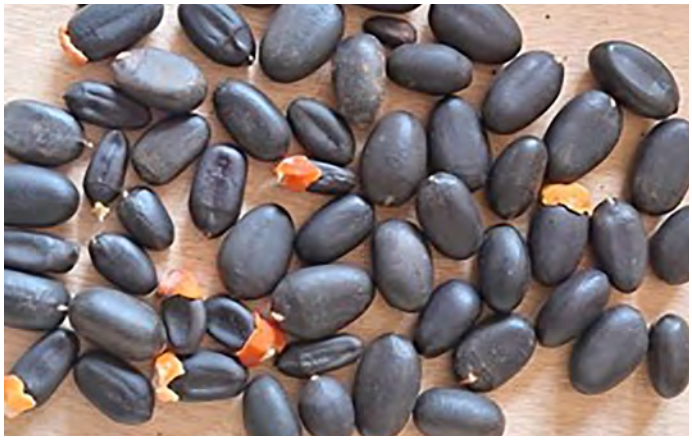
Herbier National de Guinée (HNG)

Contributed by Sékou Magassouba

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Afzelia africana* Sm. ex Pers.

I choose the seeds of *Afzelia africana*. It is a species of savannas and open forests, with a wide distribution, reaching 15–20 m in height. Leaves are alternate, compound-paripinnate, and 8–10 foliolate. The seeds are black, surrounded at the base by an orange-red aril. It is a fast-growing plant and would be good for reforestation of degraded habitats.



Photos: Mlle Aminata Thiam.

Seeds of *Afzelia africana*.

Tell us a little about your seed conservation team, facilities and current activities.

We have a very small team (three to five people) responsible for harvesting endangered species and monitoring their phenology. Some of the harvested seeds are stored in a freezer for this purpose and the other part in a nursery. We are currently in the process of expanding our facilities to include seed drying and testing.

The Herbier National de Guinée team in action.

Photo: Julien Simbiano.

Quality checking prior to collection in the field.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

For the next 25 years, the challenge will be to have an efficient seed bank structure with well-trained staff and adequate equipment to meet the needs of communities, researchers and other stakeholders involved in the conservation of native and endangered species. Our most ardent wish is that all future reforestation will be done with local species. For example, the largest collections we have made were with endangered plant species including; *Calophyllum africanum*, *Cryptosepalum tetraphyllum*, *Tessmannia baikiaeoides* and *Apodiscus chevalieri*. The seeds of these species were grown on in nurseries to be used in the reforestation of degraded habitats.

Kew Madagascar

Contributed by Vonona Randrianasolo

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Coffea boinensis* A.P.Davis & Rakotonas.
Local name: Kafe ala

If we could choose one seed to represent our organisation and seed conservation activities, we would select *Coffea boinensis* (local name: kafe ala, meaning kafe = coffee, ala = forest).

Coffea boinensis is a small, single-stemmed tree endemic to Madagascar, belonging to the Rubiaceae family and classified as Endangered by the IUCN. Its name reflects its natural habitat in the dry forests of Parc National d'Ankarafantsika, where it is restricted to a very small area. This species was described in 2008 by Aaron P. Davis, a British Rubiaceae specialist at Kew, and Franck Rakotonasolo, a Malagasy Rubiaceae expert.

We chose *C. boinensis* to represent Kew Madagascar because of its uniqueness among all the seeds we have collected, as well as its remarkable survival strategy in arid environments. This coffee tree defies the biological norms of its genus with its deciduous leaves and oversized seeds, both rare traits in coffee species. Our team made the first seed collection from this species this year, marking a significant step in saving this species from extinction. However, there is a strong possibility that the seeds are of intermediate storage behaviour, based on their characteristics, but this will only be confirmed after the ongoing 100-seed test at SNGF (Silo National des Graines Forestieres) is completed.

Coffea boinensis has been selected as a target species for our restoration trials in Ankarafantsika, our new phenology monitoring strategy aims to improve our understanding of the species' life cycle.

What piece of advice would you give to someone starting their seed conservation journey?

Ensure sustainable funding, qualified staff who view their work as an honour to save species rather than just a job, reliable equipment, and a well-designed strategy. Every element: funding, personnel, equipment, and strategy must be perfectly coordinated, as a gap in one area risks compromising the entire conservation effort. For example, the most significant improvements to our seed conservation facilities include upgrading our national seed bank (at SNGF) with a dedicated drying room, a zigzag seed cleaner for efficient debris removal, and an incubator for precise germination testing. Based on this advice, we would like to see the MSBP not only continue safeguarding seeds but also take a more active role in ecological restoration, since restoration starts with seeds and the MSBP is uniquely positioned to lead this work. By using the valuable information collected alongside the seeds-such as data on germination, genetic diversity, and species' ecological requirements, the MSBP could help guide and support large scale habitat restoration and species reintroductions.

Tell us a little about your seed conservation team, facilities and current activities.

Our team is based at Kew's third site in Antananarivo, composed of Malagasy scientists and technicians, and is committed to bridging the gap between *ex situ* and *in situ* conservation efforts, and recognising that the future of Madagascar's forests depends on integrated action. The facilities we use for seed banking are at SNGF.

As a team, our current activities focus on increasing collections of endemic, rare and threatened tree and shrub species, as well as establishing multi-provenance collections of framework species essential for forest landscape restoration. We are committed to expanding the restoration seed bank, increasing seed supply for restoration projects, and improving facilities for germination testing. We are also developing advanced tools for species identification and IUCN Red List assessments using artificial intelligence, while deepening our understanding of restoration ecology and species traits. Community engagement is central to our mission, as we know that sustainable outcomes depend on local stewardship and knowledge sharing. To this end we are investing in the capabilities of Kew Madagascar staff and strengthening Madagascar's plant conservation network through targeted training. The work carried out in the Ankarafantsika protected area through partnerships with local organisations, the government, and international experts demonstrates that with the right tools, knowledge, and commitment, it is possible to restore and protect one of the world's most unique and threatened ecosystems. In addition, across Madagascar's protected area network we are expanding a network of regional phenology monitors who are collecting data on the phenology of target tree species to enable the team to collect, analyse and publish more accurate data on changing phenology due to climate change.

Photo: Kew Madagascar staff.

The Kew Madagascar team with colleagues from the MSB and SNGF.

Photo: Lalatiana Rajoelson.

The new dry room at SNGF.

Photo: Nomentsoa Randriamamonjy.

Coffea boinensis in fruit.

Silo National Des Graines Forestieres (SNGF)

Contributed by Mamy Andriamahay

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Vitex humbertii* Moldenke
Local name: Ombalahiala

Our chosen species is *Vitex humbertii* because this species is threatened and is one of the target species in the restoration of Ankarafantsika National Park.

Photo: Vonona Randrianasolo.

Vitex humbertii.

Tell us a little about your seed conservation team, facilities and current activities.

SNGF facilities include a seed processing laboratory equipped with incubators for controlled environment studies, a germination chamber, two cold rooms, a drying room, specialised equipment such as a zigzag aspirator for seed cleaning, and other laboratory tools. Through the Weston Global Tree Seed Bank: Unlocked (GTSB:U) programme, we continue to acquire additional equipment for seed processing, storage, and germination research, and we are committed to continually building our capacity and sharing our knowledge with our partners. Three staff members are currently working with the MSB on the GTSB:U, as well as two other people based at SNGF who are part of the Kew Madagascar team.

Photo: SNGF.

A zigzag aspirator and incubator at SNGF.

Photo: SNGF.

The SNGF team out seed collecting.

Photo: SNGF.

SNGF herbarium.

Photo: SNGF.

The seeds of *Vitex humbertii.*

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

Madagascar has a very high level of floral endemicity, with approximately 82% of native vascular plant species described as endemic. Many species remain undescribed, but of those that have been described, at least 60% are threatened with extinction. Every seed collection we make is therefore important, and most are from rare and endemic species. For example, we have successfully collected all six endemic baobab (*Adansonia*) species and duplicated them at the MSB. Furthermore, we have also managed to conserve some IUCN threatened species *ex situ*, such as *Aloe suzannae* and *Dypsis decaryi*. At SNGF, we are in the process of doubling the number of rare and endemic species that we conserve.

Institut d'Économie Rurale (IER) du Mali

Contributed by Sidi Sanogo

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Carapa procera* DC.
Local name: Bamanankan (Kobi, Tulukuna)

We would choose *Carapa procera* seeds. *Carapa procera* is a plant that is very useful in human and animal health. The oil extracted from the seeds (nuts) of *C. procera* is very bitter and is used to control harmful insect attacks in cotton fields and vegetable plots. In recent years, demand for *C. procera* oil has grown as a natural insecticide for organic cotton cultivation in Burkina Faso and Mali.

Immature fruits of *Carapa procera*.

Tell us a little about your seed conservation team, facilities and current activities.

Our Forest Seed Bank and Herbarium Unit is the result of a partnership between the Malian Institute of Rural Economy, through its Forest Resources Programme and the Royal Botanic Gardens, Kew, as part of the Millennium Seed Bank Partnership. The Forest Seed and Herbarium Unit was established and equipped with support from Kew. Our seeds are stored in freezers with temperatures ranging from -5°C to -12°C for medium storage, and in ventilated rooms. In freezers, seeds are packaged in glass jars and aluminium foil packets. While, in ventilated rooms, seeds are packaged in plastic barrels and cans.

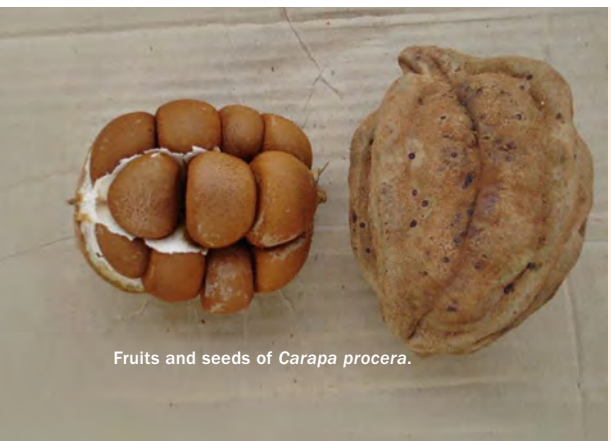
Seeds are collected, prepared, and packaged for supply to producers for plant regeneration.

IER and RBG Kew staff.

Photos: Sidi Sanogo.

Seed storage.

Drying seeds in the incubator.



Fruits and seeds of *Carapa procera*.

What piece of advice would you give to someone starting their seed conservation journey?

Seed conservation is essential for plant survival and propagation. A research programme must be developed on priority species that benefit communities. Scientific and technical collaboration must be established with centres of conservation excellence such as the Royal Botanic Gardens, Kew. In the coming years, I would like the MSBP to focus on collecting plants and seeds in arid areas where the survival of many plant species is in danger. In particular, I would like to revitalise the plant and seed collection and conservation programme between the MSBP and the IER of Mali.

Agricultural Research Institute of Mozambique (IIAM) – IIAM Genebank

Contributed by Cacilda Chirinzane-Manhiça

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Afzelia quanzensis* Welw.
Local name: Chanfuta

We choose *Afzelia quanzensis*, known locally as 'chanfuta', to represent IIAM. This tree is important all over Mozambique because it is very useful for making furniture. The wood is hard and beautiful with a reddish colour. The seeds are also very beautiful with red arils.

Afzelia quanzensis seeds.

Photos: IIAM.

Left to right: Cremildo Bucuane, Horácia Mula, Cacilda Manhiça, Aurélio Banze, Zélia Malate and General Director of IIAM: Professora Doutora Zélia Menete.

Tell us a little about your seed conservation team, facilities and current activities.

Mozambique has six seed conservation network teams from south to north with three to five people per team, a total of 19 people. Our network teams (from different agroecological zones) make a big difference, allowing us to collect seeds from across the whole country. The different networks send the seed collections to IIAM's gene bank in Maputo to finish processing, for drying in the dry room, banking and organising the duplicates for sending to the MSB.

Our network was trained by MSB staff in Maputo, Mozambique at the 'Seed Conservation Techniques' (SCT) training course in 2022. Eleven people were trained but now the number of seed collectors is increasing as we are training new seed collectors. We undertake all activities regarding collection, harvesting, cleaning, drying, germination, viability, storage and identifying seed behaviour. We also work on the restoration of habitats with the local communities using the species that we are collecting during MSB expeditions. It is amazing.

Our *ex situ* activities have also contributed to our conservation aims – to have healthy populations of all those species returned *in situ* through restoration programmes.

Left to right: Vânia Cossa, Person Chirutse, Cacilda Manhiça and Xadreque João.

What is the most important thing you've learnt since starting seed conservation?

The non-destructive method for determining seed equilibrium relative humidity. Previously we used an oven to dry a sample of seeds to determine the seed moisture content. The non-destructive method means that we don't lose any of the valuable seeds from our threatened plant species.

This helps us in our mission to conserve our Mozambique flora in our national gene bank (the seeds) to avoid extinction! Especially the rare, endemic and near-endemic species, medicinal, and crop wild relatives which we aim to duplicate in the region and also at the MSB.

The National Herbarium of Sierra Leone (SL), Njala University

Contributed by Aiah Lebbie

If you could choose one seed to represent your organisation or seed conservation activities, what would it be and why?

Scientific name: *Habropetalum dawei* (Hutch. & Dalziel) Airy Shaw
Local name: Sangi, Toma, Njolie

The seed I have chosen to represent my organisation and seed banking activities is called *Habropetalum dawei* (Hutch. & Dalziel) Airy Shaw. It is an endemic species restricted entirely to a small habitat in the southern region of Sierra Leone. It is listed as Endangered, largely due to habitat loss. It is the only genus and species in the Dionconphyllaceae family that is found in Sierra Leone. It grows in a sandy habitat in what is described as coastal park savannah. The fruit has been described as "shaped like a spiral galaxy" with the seed located outside the fruit with wings that are circular. The plant is well adapted to survive fires as it has developed an underground tuber system that allows it to sprout after fire has passed through its habitat. The vines are an important construction material in local communities and the leaves are also used as fish poison.

Tell us a little about your seed conservation team, facilities and current activities.

The current team is headed up by Prof. Aiah Lebbie, who serves as the head of the National Herbarium of Sierra Leone (Njala University), as well as the Vice Chancellor and Principal of the University of Sierra Leone. Dr. Jonathan Johnny is a Senior Lecturer at Njala University and coordinates field seed collections with other staff. Mr. Samuel Sokpo and Mr. Momoh Sesay are both associated with the National Herbarium and support all field initiatives in terms of specimen collection and curation. One additional staff member (Fanny Massally) is currently undertaking training at Kew and Queen Mary University, where she is completing an MSc in Plant and Fungal Taxonomy. The team has access to the National Herbarium facility as well as a building that supports seed drying efforts. We also have drums and silica gel that are used to dry seeds, as well as a dedicated field vehicle to take team members out across the country for seed collection. The team has conducted two field expeditions across the southern, eastern and northern regions of Sierra Leone to collect seeds from 60 important tree species. These seeds are currently being processed. Additional seed collecting is planned for the end of the rainy season across the country.

Photos: Prof. Aiah Lebbie.

Habropetalum plant.

Habropetalum fruit.

Photo: Fanny Massally.

Fanny Massally at Kasewe Forest Reserve.

Photo: Samuel Sokpo.

Prof. Aiah Lebbie with immature *Habropetalum* fruits and seeds.

Photo: Dr Jonathan Johnny.

The National Herbarium of Sierra Leone staff from left to right: Momodu, Momoh Sesay, Samuel Sokpo, Mohamed and Foday.

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

I am looking forward to positioning the National Herbarium of Sierra Leone to take leadership in seed conservation in the country. The partnership developed with the Royal Botanic Gardens, Kew and the MSB at Wakehurst will help to strengthen my institution's capacity to deliver in this direction, by providing capacity building among staff, and enhancing in-country infrastructure to support such an initiative. I would like to see our seed banking initiative playing a pivotal role in habitat restoration, especially in a region where most of our threatened plant species are fast losing their habitats and seed sources are becoming increasingly rare.

South African National Biodiversity Institute (SANBI)

Contributed by Victoria Wilman

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: Species belonging to the *Strelitzia* genus

We choose *Strelitzia*: not only because it is a significant part of SANBI's logo, but its seed when viewed under a microscope beautifully symbolises SANBI's mission to conserve biodiversity. The black, rounded part of the seed represents the plant itself and the potential for life, while the striking orange appendage evokes wildlife, highlighting the vital connection between flora and fauna in our ecosystems.

Photo: Wolfgang Stuppy.

Strelitzia reginae seeds.

What piece of advice would you give to someone starting their seed conservation journey?

Plan carefully in advance, prioritise, know your species, know your seeds and strive for quality through the whole process and then you are in the right place.

Sibahle Gumede field collecting.

Photos: SANBI.

SANBI team.

Tell us a little about your seed conservation team, facilities and current activities.

South Africa is vast, and in order to cover most of our provinces, our seed collectors are based countrywide at some of SANBI's National Botanical Gardens (NBG). Victoria Wilman leads the programme from Kirstenbosch NBG and Naomi Mdayi is the seed collecting technician focused on the Western Cape where there is a high number of species, especially threatened ones. Sibahle Gumede focuses on the Eastern Cape and Kwazulu Natal provinces, which were identified as not so well represented in the bank and is stationed at Kwelera NBG, while Ntsakisi Masia focuses on the northern parts of the Country from one of SANBI's newest Botanical Gardens, Thohoyandou. We also have a focus on the succulent Karoo Biome within the Northern Cape, where plants have been lost due to poaching. Philile Khuzwayo is based at Karoo Desert NBG and has been working on Critically Endangered succulent species that are threatened due to almost being poached to extinction. Sphephelo Kheswa was recently appointed as species recovery technician to coordinate species recovery work in the Karoo Biome as well as countrywide with the rest of the team. Thembeka Malwane coordinates our seed processing and laboratory work and works alongside our seed processing team, Georgina Wilkinson, Deon Smith, Siyabonga Magadla and until his retirement last month, Patrick Kettledas. We also host interns and students as well as volunteers. We have just recently renovated the old seed room at Kirstenbosch NBG to become a wonderful facility complete with preparation, processing and germination laboratories, a much larger dry room and walk in freezer. Once complete it will allow South Arica to store its own seeds in country while still sending a backup collection to the MSB in the UK.

Photo: SANBI.

SANBI seed conservation team.

Zambia National Seed Centre (Forestry)

Contributed by Mpande Sichamba

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Pterocarpus tinctorius* Welw.
Local name: Mukula

This species has gained significant attention from both the Zambia Forestry Department and the whole nation. This heightened interest can be traced back to 2018 when the species of *P. tinctorius* came into the spotlight due to its timber, leading to rampant exploitation. The escalating demand for Mukula timber resulted in indiscriminate cutting across its habitats to meet the lucrative market needs. The alarming rate of exploitation poses a severe threat to the existence of this species in the wild, prompting the government to take decisive action by imposing a ban on harvesting and trading in Mukula. The prohibition on the harvesting and trade of this species was effectively instituted in 2017 and subsequently reinforced in 2021. The overexploitation of this species coincided with the initiation of a collaborative seed conservation programme in 2018 for safeguarding plant species in Zambia, including threatened species, commercially important trees like Mukula, and other useful native plants through seed banking. As part of the *ex situ* conservation initiative, *P. tinctorius* was recognised and prioritised for seed collection and preservation. Thanks to the dedicated work of the staff at Forestry Research, thousands of high-quality Mukula seeds were successfully gathered and preserved for long-term storage. In addition to seed banking, initiatives were undertaken to establish tree nurseries and trial plots specifically dedicated to the cultivation and study of *P. tinctorius*. These conservation measures not only ensure the survival of Mukula but also contribute to the broader goal of preserving Zambia's rich biodiversity for future generations.

Photo: David Mwale.

Pterocarpus tinctorius – mukula fruit & seed.

Photo: Christopher Saluhandu.

After the field practical during regional training in SCT in Zambia.

Tell us a little about your seed conservation team, facilities and current activities.

The seed conservation team consists of:

- An Officer in charge of seeds, ensuring high quality seed is collected and banked.
- A Herbarium curator/assistant for accurate plant identification and associated vegetation descriptions and a high-quality herbarium voucher collection.

The team also includes an officer or intern to help with data entry into standardised field data sheets. High-quality data is gathered and accurately input into the computer. The main aim of this team is to ensure that quality seeds, herbarium vouchers, and data are obtained to the required standard. In addition to the above staff, representatives from the local community living close to the forests are integrated into a collection team. These local community members provide information on local plant names, uses, distribution and factors affecting plants. Regarding seed processing, quantification, development of germination protocols, data entry and analysis, trained members of staff and interns in seed conservation techniques conduct these important tasks. The main facilities used for the seed conservation programme include seed storage containers, freezers, germination testing kits, herbarium voucher collection kits, and computers.

The seed conservation programme progresses alongside other projects, including the development of a phenological calendar showing the flowering and fruiting periods of Zambian native plants. Furthermore, seed quantification and the development of germination protocols for various species are ongoing, as well as the digitisation of herbarium vouchers for all collections. Many seeds are also being distributed to different government institutions and other organisations for forest restoration in highly deforested and degraded land areas across the country.

What are the best improvements you have made to your seed conservation facilities since you started?

Upgrading the seed storage room, including acquiring refrigerators to keep the seeds cool and fresh; blue drum dryers, large drums consisting of silica gel for drying seeds; moisture meters for checking how much moisture is in the seeds to keep the seeds dry; and seed storage containers, special containers designed to keep the seeds safe and organised. In all, upgrading the seed storage room with these prerequisites ensures seeds stay fresh, dry, and well-organised, which is important for maintaining high-quality seed.

Upgrading the herbarium by acquiring a plant specimen dryer which will help dry out plants so they can be preserved for a longer period, and an improved lighting system. This involved adding better lights to the herbarium so that the plants could be seen more clearly and easily. Good lighting is important for studying and identifying plants.

Acquisition of a freezer: Keeping plants in a freezer helps preserve them for longer and prevents them from decaying.

For the digitisation of herbarium flora and the data entry and analysis of seed collections, computers were acquired. The computers facilitate the digitisation of the herbarium vouchers, enabling them to be viewed and studied in a digital format. Data entry and analysis of seed collections involve inputting seed accessions into a computer system for the digital study of their characteristics. The staff are trained in operating BRAHMS, but more training is needed, including in-country. Staff members have also been trained in seed conservation techniques to ensure the effective and efficient implementation of the conservation programme.

Americas

Featured Partner locations.

Instituto de Investigaciones Agropecuarias (INIA) Base Seed Bank

Contributed by Carolina Pañitrur

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Argemone crassifolia* Ownbey
Local name: Cardo Santo

We chose the seed of *Argemone crassifolia* to represent our work because it embodies what drives us: discovery, conservation, and hope. This species, known only from a single specimen collected in Chile's Atacama Region in 1925, was declared Extinct after nearly a century without new records. Our team followed the historical trail of botanist I.M. Johnston, analysing old place names and maps to track down the original collection site. The effort paid off: we rediscovered the species in a nearby ravine and today, its seeds are safely stored in the Base Seed Bank collection at INIA.

This seed is more than just a plant. It's a symbol of persistence, teamwork and the role of science in safeguarding biodiversity.

Photo: Carolina Pañitrur.

Seeds of *Argemone crassifolia*.

Tell us a little about your seed conservation team, facilities and current activities.

Our seed conservation team at the INIA Base Seed Bank in Chile is currently small, but at times our team has included more than ten people, among them a botanist, a collection curator, a technical manager, and a dedicated support team working on seed handling and plant propagation.

Our facilities are within the Vicuña Experimental Station, in the Elqui Valley (Coquimbo Region), where we maintain a long-term conservation collection of native and endemic Chilean seeds. Our current activities include seed collection, processing, viability testing and documentation of priority species, especially threatened species or those poorly represented in *ex situ* conservation efforts.

Photo: Carolina Pañitrur.

Base Seed Bank of INIA.

What is the most important thing you've learnt since starting seed conservation?

One of the most important things we've learnt through our work in seed conservation is that patience and persistence are key. Seeds don't always follow our timelines, some take years to germinate, others surprise us by returning from presumed extinction, like *Argemone crassifolia*. Conservation is a long-term commitment, and success often comes from carefully building knowledge, respecting the rhythms of nature, and working collaboratively.

Group photo of the INIA Seed Base Bank team. From left to right: Genesis Reyes, Bastián Rodríguez, Carolina Pañitrur, Britt Wallberg, Ana Sandoval and Ebor Vergara.

Photos: INIA.

Alexander von Humboldt Institute Seed Bank (IAvH-CS)

Contributed by Amalia Díaz Peña and Mónica Flórez

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: Species belonging to the *Espeletia* genus
Local name: Frailejones

After conversations with the staff, we agreed that "Frailejones" – plants belonging to the genus *Espeletia* – are what best represents the mission and spirit of our seed bank. They are endemic to the High Andean Páramos, and are flagship species for Colombian biodiversity because of their key role in the water cycle and origin of rivers, as well as their high levels of endemism and risk of extinction. One of the Critically Endangered Frailejón species, whose small population was recently the subject of a devastating fire, is *Espeletia tibamoensis*. This species was incorporated into our seed bank during the course of the Kew BBVA-funded project.

Photo: Jennifer Díaz.

Espeletia sp. seed.

What are the best improvements you have made to your seed conservation facilities since you started?

Since we started, we have been able to acquire some pieces of equipment such as a stereomicroscope and a new freezer, which facilitate the process of plant material processing and banking. However, we are about to make the biggest step, moving to the “Future Seeds” facilities, located inside the Alliance CIAT-Bioversity campus in Palmira, Colombia. This will give us access to modern pieces of equipment and moving from a freezer into a vault where conditions are well controlled. The most important aspect is we will be working next to colleagues from the Colombian Network of Seed Conservation, which strengthens the connection with collaborators. Networking is vital. We would say to someone just starting their seed conservation journey to have a clear goal or mission for the new bank, be very organised, and always work with collaborators with common conservation goals. It would be great to increase connections and communication among the members of MSBP in order to identify our strengths and interests, so we can work together for common goals. Maybe this can be achieved by creating a network or any communication channel among the institutions.

Tell us a little about your seed conservation team, facilities and current activities.

Our seed bank started in 2018 and during these seven years the team has developed and matured with researchers, curators, interns, and external collaborators. Nowadays we have banked 215 species of endemic and threatened plants, mainly from endangered ecosystems such as the High Andean Páramos and tropical dry forest. One of our main goals we are currently aiming towards is to include seeds from culturally important species. Also, one of our biggest achievements to date, was to lead the formation of the Colombian Network of Seed Conservation in 2019, which is still working and getting stronger.

Over the past seven years, these people have been part of the seed bank:

- **Past and present Curators:** Mónica Florez, Jeniffer Díaz.
- **Head of Plant Conservation and Manager of Species and Collections Center, IAvH:** Carolina Castellanos.
- **Head of Botanical Collections:** Amalia Díaz.
- **Past and present Interns:** Manuel Mercado, Laura Galindo, Julieta Gallo, Laura Garzón.
- **Past and present Collaborators:** Fundación Salvamontes, UPTC, CorpoBoyacá, National University of Colombia.
- **Members of the Colombian Network of Seed Conservation:** Alliance CIAT-Bioversity, Cartagena Botanical Garden, Bogotá Botanical Garden, Agrosavia.

Photo: Mónica Flórez.

Espeletia tibamoenisi.

Photo: Diana Acosta Rojas.

The Alexander von Humboldt seed bank team.

Fundación Moscoso Puello, Inc.

Contributed by Andrés Ferrer

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Juniperus gracilior* Pilg.
Local name: Sabina Criolla

We think it would be the *Juniperus gracilior* seed, common name "Sabina Criolla". Why? Because as per the IUCN Red List it is Critically Endangered. Accordingly, our organisation has been working to protect it by maintaining a seed stand originally planted in 1997. It provides a yearly seed output that yields approximately 5,000 seedlings, and we have been restoring its habitat by planting with associated species.

Tell us a little about your seed conservation team, facilities and current activities.

Currently, we tend to our seed stand, harvest seeds and transfer them to the National Botanical Garden seed bank for treatment and storage. By coordinating with the Ministry of Environment, we make available seed germination spaces at their nursery in Constanza, La Vega Province, D.R. We also transport seedlings annually to nursery facilities at La Siberia for acclimatisation and tend to them until the planting season in October. Finally, we coordinate volunteers to support planting of suitable seedlings of the species and companion plantings.

A 10-year-old *Juniperus gracilior* grown from a seed collected at our seed stand, growing in an open forest slope at 2,171 m elevation close to our station in Valle Nuevo National Park, Madre de las Aguas Biosphere Reserve.

Juniperus gracilior seedlings in Valle Nuevo National Park, Madre de las Aguas Biosphere Reserve grown from seeds of our seed stand, developed and waiting for the planting season in October at La Siberia nursery operated jointly by our organisation and the Ministry of Environment of the D.R.

What is the most important thing you've learnt since starting seed conservation?

We've learnt many things since starting but to list a few of the most important: the influence of "spacing" in the seed stand to improve seed production, the importance of establishing bushy plantings at least one year in advance of arboreal seedling plantings, and the importance of timing planting seedlings with sufficient development to avoid mortality in the hard climate of highland environments. We would like to use these lessons to complete ecological restoration of Mogote and Pinar Bonito aquatic systems and re-establish viable populations of *Juniperus gracilior* at La Vuelta de la Culebra in Valle Nuevo National Park, Madre de las Aguas Biosphere Reserve.

Fundación para el Mejoramiento Humano – PROGRESSIO, Dominican Republic

Contributed by Ramón Elías Castillo and Jorge Reid

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Magnolia pallescens* Urb. & Ekman
Local name: Ébano verde (Green ebony)

We choose, *Magnolia pallescens* ("ébano verde" is the common name in Spanish), because even though it is a tree that thrives in environments that have not been affected by the hand of man, we still find relics of virgin woodlands where it resides. By conserving Ébano Verde we are keeping them intact so they can serve as a blueprint for how to restore depredated areas in a bleak future. It serves as a flagship species, helping us protect not only the species itself but also the surrounding forest and other key plant species. This is the main species conserved by our non-governmental organisation. The name of the scientific reserve, Reserva Científica Ébano Verde, is dedicated to this species.

Photos: Ramón Elías Castillo.

Magnolia pallescens flower.

Tell us a little about your seed conservation team, facilities and current activities.

The PROGRESSIO Foundation is a private, non-profit service institution established on May 18, 1983, and legally incorporated into the Dominican Republic. Recognised for its contribution to the conservation of natural resources and the environment, PROGRESSIO promotes sustainable development through programmes that improve human well-being by protecting ecosystems.

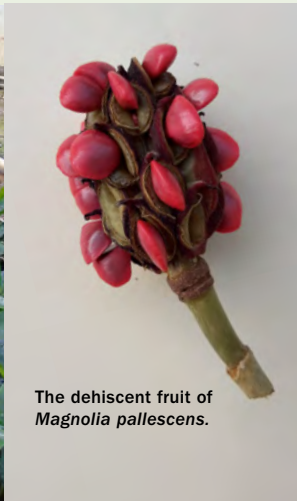
One of its main initiatives is the management of the Ébano Verde Scientific Reserve, a protected area known for its rich biodiversity and high levels of endemism in both flora and fauna. It is noteworthy that the reserve is of great importance for the protection of the sources of streams and rivers in the region, as well as for bird conservation. Within this reserve, PROGRESSIO focuses on seed conservation, particularly of *Magnolia pallescens*, an Endangered tree species on the IUCN Red List and endemic to the Dominican Republic. The foundation's work includes seed collection, propagation in specialised nurseries located at the reserve's research station, and reforestation efforts aimed at preserving and restoring natural populations.

Furthermore, the reserve has the potential to provide seeds of endangered species to the country's seed banks in the future. PROGRESSIO's seed conservation efforts not only support the survival of the magnolia species but also serve as a living laboratory for students and researchers from local and international universities, particularly those in natural sciences. These efforts also provide a basis for environmental education and capacity building in local communities, particularly around the provision of native plant seeds.

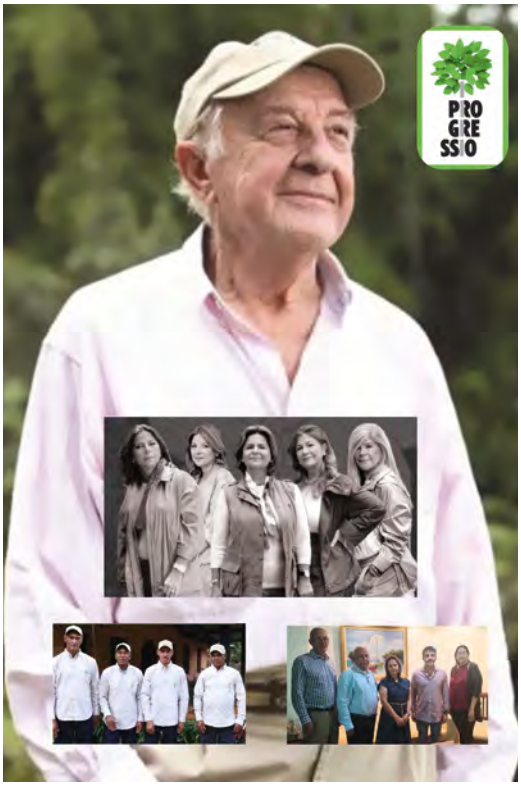
What is the most important thing you've learnt since starting seed conservation?

The most important thing for me has been being able to see *Magnolia pallescens* seeds germinate in nurseries, since it was once said they couldn't reproduce. So, after 30 years of work, it has been very satisfying to see how we've learnt to propagate the species by developing a propagation protocol and also how we've learnt to plant magnolia seedlings in their natural habitats. This experience has also been extended to other endemic magnolia species, for example *Magnolia hamorii* and *Magnolia domingensis,* in the Dominican Republic, as well as to *Magnolia ekmanii,* a species endemic to Haiti.

Nursery stock of *Magnolia pallescens* seedlings, approximately 10 months after sowing at PROGRESSIO.



The dehiscent fruit of *Magnolia pallescens*.



Fundación Progessio team.

Banco de Semillas del Jardín Botánico Nacional "Dr. Rafael M. Moscoso"

Contributed by Wilkin Encarnación

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Reinhardtia paiewonskiana* Read, Zanoni & M.M. Mejía
Local name: Coquito cimarrón

Photo: Wilkin Encarnación.

Seeds of *Reinhardtia paiewonskiana*.

A magnificent palm endemic to the Dominican Republic, *Reinhardtia paiewonskiana* is found exclusively in certain locations between 800 and 1,300 m elevation in Sierra de Bahoruco, in the southwest of the country. It is the tallest species in its genus, reaching 8 m in height with a trunk diameter of 14 cm, and the only one found in the Caribbean.

The species is threatened by a combination of habitat destruction and, historically, by its use in the construction of rural homes, with the trunks providing timber and the leaves used as roof tiles.

It is listed as Critically Endangered on both the Red List of Vascular Flora of the Dominican Republic (2016) and, more recently, on the IUCN Red List (2023). Just 50 individuals remain in the type population, most of which are only accessible via cliffs. This isolation could be negatively impacting its genetic diversity. In addition, a current, notable threat is an unknown predatory insect which damages the seeds. The problem has become so severe that, in 2024, only 600 seeds were collected, of which just 20 germinated. The Seed Bank and the Conservation Division of the Dominican Republic's National Botanical Garden are exploring other populations to collect healthy seeds from. However, further research on seed biology and plant propagation is needed. It is therefore urgent to protect known individuals and increase the overall population through both *in situ* and *ex situ* conservation to ensure the long-term survival of this rare species.

Photo: Wilkin Encarnación.

Seed processing at Jardín Botánico Nacional Seed Bank.

Tell us a little about your seed conservation team, facilities and current activities.

The National Botanical Garden's Seed Bank focuses on collecting seeds from native and endemic species under some degree of threat. It prioritises *ex situ* and *in situ* conservation, while also providing material for research, propagation in nurseries, and ecological restoration of priority areas. The seed bank is also a training centre that supports universities and research centres through training technicians in seed management and conservation.

The development of our seed bank for native and endemic plants is crucial, as it allows us to prevent the extinction of species of our flora and promote the sustainable use of many of them. It also helps increase the populations of threatened native and endemic species, which, without the support of an initiative like this, could disappear within the next 10 years.

It has the capacity to store millions of seeds in a space that includes a laboratory, a research area, a cold room where samples are preserved, and an *in vitro* Culture Laboratory, designed for the propagation of orchids through seeds and meristematic tissues. It uses cutting-edge technology and meets the quality standards required for a project of this magnitude.

Since 2007, we have worked in collaboration with the MSB of the Royal Botanic Gardens, Kew, UK, in the collection, conservation, and study of seeds from native, endemic, and endangered flora in different regions of the Dominican Republic.

Photo: Wilkin Encarnación.

Jardín Botánico Nacional seed storage room.

What piece of advice would you give to someone starting their seed conservation journey?

Learn about the life cycles of the species of interest, their germination needs, and their natural habitats. Test their germination capacity to ensure viability. Keep a record of collection dates, species, and preservation methods. This will help you improve your techniques over time.

Think also about your capacity needs for storing seeds and how you will fund the acquisition of equipment and materials necessary for seed banking and the germination of different species.

Pronatura Veracruz – Reserva de Semillas (RESEM) + Vivero Bosque Mesófilo de Montaña (VBMM)

Contributed by Elisa Peresbarbosa Rojas

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Ulmus mexicana* (Liebm.) Planch.
Local name: Mexican elm

The Mexican elm (*Ulmus mexicana*) is one of the tallest tree species in Mexico. This situation is incredible; given that its seed is so, so tiny, it's astonishing how such a tiny seed can give rise to one of the tallest trees in Mexico. This is how we feel as a team; that despite being a small group, the elm inspires us to make our work as grand as the fully-grown tree.

Photo: Marcos Alejandro Martínez Gonzalez.

Fruits of a Mexican elm tree.

Photo: Elisa Peresbarbosa Rojas.

ProNatura Veracruz staff. Back row, left to right: Víctor Virgilio Hernández Vidal, Ángela Viviana Rojas Rojas, Marcos Alejandro Martínez Gonzalez, Elizana Xoca and Roberto Aburto Martínez. Front row, left to right: Ricardo Muñoz Aburto, Ana Gabriela Zamora Martínez, Emmanuel García Gutierrez and Lucero García Miranda.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

Some of the most important collections are related to species that are listed as threatened which have significant collecting challenges due to land use change or because very few individuals remain like *Podocarpus matudae* and *Hediosmum mexicanum*. We also face several long-term challenges to sustain our work in seed conservation, such as achieving financial sustainability for us to continue, increase, and scale our work. Also constantly maintaining internal processes that allow us to maintain quality and international standards for seed conservation. Additionally, changes in phenology, species distribution and increases in pests, caused mainly by climate change, as well as an increase in land-use changes, and the loss of conservation areas are important challenges for our seed conservation journey.

Tell us a little about your seed conservation team, facilities and current activities.

Our work at the Seed Reserve (RESEM) and the Cloud Forest Nursery (VBMM) contributes to the conservation of native tree species and the restoration of forests in Veracruz, supported by a team of nine. Of these team members, six come from local communities that have built capacities with us, three are technicians with training as biologists and one anthropologist.

These areas (RESEM+VBMM) emerged because within the ecological restoration process, low biological diversity was identified as a critical component used in reforestation, rehabilitation, or even ecological restoration programmes and projects.

We look to locate, collect, store, and distribute seeds and plants of native species to various nurseries or restoration projects. Our main goal is to diversify production in forest nurseries, ensuring the enrichment of the forest landscape with a diversity of native species, and to generate experience and capacity in the propagation of a wide variety of native trees.

The RESEM is located in the central office of Pronatura Veracruz A.C., in Coatepec, known as the land of shade grown coffee, at the foot of Cofre de Perote. In RESEM we process seeds and perform viability analyses as we have areas for seed storage and germination testing. The VBMM is located in a private conservation area on the border between the municipalities of Coatepec and Tlalnelhuayocan. It is a well-preserved property, immersed in the cloud forest, which inspires us to work hard to save the native trees that can be used for restoration and recovery.

A Mexican elm tree.

Photo: Marcos Alejandro Martínez Gonzalez.

Universidad Nacional Autónoma de México FESI-UNAM Seed Bank

Contributed by Isela Rodríguez Arévalo and María Chávez

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Gyrocarpus mocinoi* Espejo

Gyrocarpus mocinoi is a Mexican tree species, and its seeds are represented in the logo of the FESI-UNAM Seed Bank. This species is considered Vulnerable by the IUCN and is widely used as a toy by Mexican communities. The species name is dedicated to the naturalist José Mariano Mociño, a botanist of the Royal Botanical Expedition to New Spain.

Photo: César Miguel Talonia.

Gyrocarpus mocinoi seeds.

Tell us a little about your seed conservation team, facilities and current activities.

The Seed Bank is located on the premises of the Facultad de Estudios Superiores Iztacala. It has a specialised team of collectors, seed technicians, and researchers. It currently collaborates on multiple projects to collect and conserve seeds from native Mexican trees, funded by UK-PACT and the Garfield Weston Foundation.

However, over the course of more than 20 years of uninterrupted work, projects with diverse approaches have been developed. For example, for more than five years, the useful flora of the Tehuacán-Cuicatlán Valley was studied. Collection and conservation work was also carried out on species of interest in the Sky Islands in the state of Sonora and the flora of the Baja California Peninsula. Central Mexico is very well represented in the bank, as long-standing work has been carried out in regions such as the Sierra Gorda in the state of Querétaro, the Sierra de Taxco-Huautla in Guerrero, and the temperate forests and the semi-desert region of the state of Hidalgo, among others.

Photo: Armando Ponce Vargas.

The FESI-UNAM team.

Photo: FESI-UNAM.

Accessions collected in the Sierra de San Pedro Mártir, Baja California, Mexico.

Photo: FESI-UNAM.

Collecting *Abies hickelii*.

What's the most important seed collection you've made and why?

We consider each and every accession made by our institution to be the most important, because this seed bank is unique in the country and safeguards Mexico's natural capital of wild and native seeds. To date, it safeguards approximately 13% of the plant species registered in the country.

However, one of the most emblematic species in our bank is *Abies hickelii*, which was recently collected. This Endangered species was found on the slopes of the Cofre de Perote volcanic cone, which belongs to the mountain range known as the Eje Neovolcánico Transversal. This species is represented in the area by small populations in patches near the road, which puts it at greater risk of extinction.

Department of Environment and Coastal Resources

Contributed by B Naqqi Manco

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Pinus caribaea* var. *bahamensis* (Griseb.) W.H.Barrett & Golfari
Local name: Caicos pine

Caicos pine is the National Tree of the Turks and Caicos Islands. Following the introduction of an invasive alien scale insect, *Toumeyella parvicornis,* in the late 1990s on live cut Christmas trees imported from the USA, the pine and its unique habitat was nearly lost. From 2005 to 2015, a loss of over 97% of individuals occurred. Unfortunately, Turks and Caicos Islands (TCI) had not yet made a seed collection of Caicos pine, and so collections made from languishing trees for storage at the MSB and for use in TCI were valuable, but small. Due to low populations and out-of-season terminal masting, cones with the capacity to produce 80–100 seeds were only producing an average of 2–3 seeds each. Following several projects with RBG Kew, we are now seeing recovery of the species and ecosystem in TCI. Increased tree numbers and improved tree health has resulted in pine cones producing more seed and seedling recruitment. We hold the image of the Caicos pine cones as a symbol of continued hope for the future, but also as a caution of the risks of not having strong seed collections in place.

Photos: B. Naqqi Manco.

First wild Caicos pine seedling observed since 2008, in December 2019 in the Conch Bar Pine Yard, Middle Caicos.

What are the best improvements you have made to your seed conservation facilities since you started?

We haven't made any significant improvements yet, as securing funding for necessary building renovations has been extremely challenging. Mr Blaise and I visited the MSB in August 2024, and this was an excellent experience to strengthen our relationship and gain inspiration for the seed storage facilities we hope to build.

Tell us a little about your seed conservation team, facilities and current activities.

Our current team is only three individuals, and each only have a small amount of time to dedicate to seed collections: Assistant Director of Research and Development B Naqqi Manco; Terrestrial Ecologist Dodly Prosper (currently in the UK on a Chevening Scholarship working with RBG Kew and the Natural History Museum), and Nursery and Field Officer Junel "Flash" Blaise. We do not yet have suitable seed storage facilities in TCI, but we maintain a small collection of native plant seeds for supplying our native plant nursery and for various targeted projects. We have been applying for funding to refurbish our Field Office to house the National Herbarium Collection and National Seed Bank for almost a decade. We are not currently making seed collections for the MSB, but we have over 200 species banked there (about 40% of our flora).

Junel 'Flash' Blaise and B Naqqi Manco, Department of Environment and Coastal Resources, Turks and Caicos Islands Government, with a collection of cones and seeds from them in October 2010 for nursery use and storage in the MSB.

Junel 'Flash' Blaise and B Naqqi Manco, Department of Environment and Coastal Resources, Turks and Caicos Island Government, and Marcella Corcoran, RBG Kew, inspecting Caicos pine seedlings in the Native Plant Nursery in Kew Settlement, North Caicos.

The Conservation Seed Bank of the Atlanta Botanical Garden

Contributed by Jessamine Finch

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: Species belonging to the *Sarracenia* genus
Local name: Green pitcherplant

To represent the Atlanta Botanical Garden and the Conservation Seed Bank we selected seeds of North American pitcher plants (genus *Sarracenia*), which have a centre of diversity in the southeastern United States. The Atlanta Botanical Garden maintains a nationally accredited plant collection of *Sarracenia* as recognised by the Plant Collection Network, a programme of the American Public Gardens Association. The Conservation Seed Bank safeguards the seeds of over 30 unique *Sarracenia* taxa, including all three pitcher plants listed as federally Endangered: *S. oreophila*, *S. rubra* ssp. *alabamensis*, and *S. rubra* ssp. *jonesii*. The Conservation Seed Bank collection also includes many other carnivorous plants, such as sundews (*Drosera*), butterworts (*Pinguicula*), and tropical pitcher plants (*Nepenthes*). It is estimated that one fourth of all carnivorous plants are at risk of extinction as a result of climate change and threats like land clearing and poaching. Seed banking, as a component of an integrated plant conservation strategy, is critical in preventing extinction of these unique, charismatic plants, and the Atlanta Botanical Garden is honoured to be part of that effort.

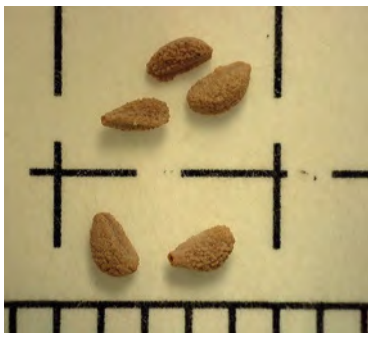


Photo: Lina Arabyat.

Sarracenia rubra subsp. *guifensis* seeds.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

I think one of the most common challenges faced by seed banks is sustainable growth. While seed banking is a space, time, and energy efficient means of *ex situ* plant conservation, as the collection grows, so does the amount of curatorial work and necessary staff time. While a fledgling seed bank can get off the ground with a single part-time staff member or volunteer, if the collection rate is maintained, the volume of viability checks for stored seeds rapidly increases, requiring more person hours and more space for seed testing (e.g., more lab space, additional growth chambers, etc.). Over the next 25 years, one of the major challenges I see for Atlanta Botanical Garden is growing the space and staff time dedicated to baseline seed bank operations, such as regularly withdrawing seeds from the bank for viability testing. Relatedly, when advertising positions with our Seed Bank, we have found a shortage of qualified candidates to take on this work. Through our commitment to training and outreach, we hope to develop a larger community of seed conservation professionals to support the growth of established seed banks and the emergence of new banks.

Tell us a little about your seed conservation team, facilities and current activities.

The Conservation Seed Bank programme was created in 2019 by Jason Ligon (Conservation Specialist, former Micropropagation & Seed Bank Coordinator) and Dr. Emily Coffey (Vice President of Conservation & Research). Today, the Seed Bank team includes Lina Arabyat (Seed Bank Lab Manager), Dr. Jessamine Finch (Research Scientist – Seed Bank), and Oliver Hutchens (Seed Bank and Micropropagation Technician).

The Conservation Seed Bank operates out of the Southeastern Center for Conservation (SECC), a two-storey facility in the heart of the Atlanta Botanical Garden encompassing more than 11,000 square feet dedicated to offices, training facilities, and laboratories. Seed reception, processing and testing is carried out in the Seed Lab, which is equipped with a frost free -20°C freezer and cryo-storage capabilities. The Seed Lab works closely with the Micropropagation Lab on *in vitro* orchid germination and the propagation of recalcitrant seeds.

The Conservation Seed Bank simultaneously supports many SECC projects with regional, national, and international partners. Current projects include: Seed banking endemic orchids on the El Yunque National Forest, Puerto Rico (supported by Botanic Gardens Conservation International, Forest Service Rare Plant Partnerships), seed and pollen banking of the Atlanta Botanical Garden's Conservation Collections (supported by the Institute of Museum and Library Services) and integrating native plant materials development with conservation seed banking to safeguard and restore vulnerable wetland communities within National Forests of the Southern Blue Ridge Region (supported by the U.S. Forest Service).

Photo: Jessamine Finch.

Capturing images of seeds and germination is important for documenting and communicating the work for the seed bank. Here Lina Arabyat (foreground) and Oliver Hutchens (background) photograph seeds and seedlings using dissecting microscopes.

Photo: Lina Arabyat.

At the end of a germination trial any ungerminated seeds are tested for viability. Here Jessamine Finch (left) and Oliver Hutchens (right) carry out germination trial post-processing and prepare ungerminated seed for tetrazolium staining.

Photo: Brad Harten.

The staff of the Conservation Seed Bank at Atlanta Botanical Garden. From left to right: Lina Arabyat (Seed Bank Lab Manager), Oliver Hutchens (Seed Bank and Micropropagation Technician), Jessamine Finch (Research Scientist, Seed Bank), and Jason Ligon (Conservation Specialist).

Hawai'i Island Seed Bank

Contributed by Jill Wagner

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Erythrina sandwicensis* O.Deg.
Local Name: wiliwili

I would choose the *Erythrina sandwicensis* seed. It is called wiliwili in Hawaiian culture. This tree is iconic in Hawai'i and a very important endemic species of the Hawaiian dry forest. In the past, the dry forest would occur on the leeward (dry) side of all the Hawaiian Islands, but there is now only 10% of it left. The best of the last dry forests is on Hawai'i Island. Wiliwili is an important tree in the dry forest. The seed is bright red and was used by Hawaiians for adornment. They made lei, haku (head) lei, bracelets, hat bands and ankle bracelets from wiliwili seeds. Wiliwili wood is buoyant, so it floats. Hawaiians invented surfing and made their surfboards with wiliwili wood. In fact, all the surf boards at the Bishop Museum are made from wiliwili wood. This is one of the few deciduous trees of Hawai'i. The tree drops its leaves and then it flowers. The seed is orthodox and can be stored for decades. This tree is being grown for restoration and for people on the leeward side who want to grow a native tree.

Photo: Jill Wagner.

Erythrina sandwicensis seeds.

What have you gained through being in a network of seed conservationists?

We have deepened our commitment to saving flora *ex situ* and realise what an important conservation tool seed banking is, especially since our work involves a lot of critically endangered species, many of which are orthodox. Additionally, seed banking enables us to plan our restoration and save resources properly; we collect seeds when we can and save them so we can carefully work on propagation and planting in the field in a thoughtful way.

We have received a grant to expand our storage capacity. We believe in short-term banking and recollection intervals; thus, we are setting up the seed bank for proper storage with refrigeration and freezing facilities for the next 20 years. It is our intention to provide the next generation with the resources they need to care for the Earth.

Tell us a little about your seed conservation team, facilities and current activities.

We have a team consisting of a Master Gardener, a high school senior intern, and a college intern. These people are committed to seed work and are wonderful servants of nature.

We work a lot with Critically Endangered species, and many of them are orthodox. We collect the seeds when we can and save them so we can carefully work on propagation and planting in the field in a thoughtful way. Seed banking enables us to plan our restoration and save resources properly.

Photo: Doug Perrine.

A flowering *Erythrina sandwicensis* at sunset.

Photo: Jill Wagner.

Jill Wagner (right) is the founder and director of the Hawaii Island Seed Bank, which was started in July 2008, with Maxine Kilgore, a high school intern that comes to train at the seed bank every Friday instead of going to school.

Jarae Simpliciano is a Hawaiian college student and comes to the seed bank three days a week to conduct germination trials.

Photos: Jill Wagner.

Rune Dahl is a Master Gardener and has volunteered every week for two years at the seed bank.

The Lyon Arboretum Seed Conservation Lab

Contributed by Nate Kingsley

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Cyanea pinnatifida* (Cham.) E.Wimm.
Local name: hāhā

Hawai'i, comprising less than one percent of the United States landmass, is home to 45% of plant species on the United States Threatened and Endangered (T&E) list. Unfortunately, over 100 native Hawaiian plant taxa have already gone extinct, and another 260 are on the brink of extinction (50 or fewer individuals remaining in the wild). To combat this, the Harold L. Lyon Arboretum Seed Conservation Lab (LASCL) has focused on preserving and recovering Critically Endangered native plants, serving as the State's most diverse *ex situ* germplasm repository of rare plants for research, propagation, and distribution. With the help of partners at the Hawai'i Plant Extension Prevention Program and Division of Forestry and Wildlife (DOFAW), the LASCL has banked over 33 million seeds, representing more than 300 T&E taxa across 55 families. One notable species in the lab is *Cyanea pinnatifida*, or hāhā, an endemic plant in the Campanulaceae family. Last observed in 2001, it is Extinct in the Wild, previously known from only one plant in Kalua`a Gulch in the Wai`anae Mountains on the island of O`ahu. Climate change, invasive species, disease and increased urban development led to this species' decline. Fortunately, individuals were propagated from the now-dead wild founder at the Lyon Arboretum Greenhouse. These nursery plants produced fruit and seeds, which were further propagated and stored. Currently, the LASCL has 27 seedling lines banked from 2007 to 2023, totalling over 40,500 seeds. Approximately 1,800 seeds have been sown over the years for viability testing, producing numerous seedlings sent to DOFAW's rare plant nurseries for reintroduction efforts at the original wild site.

Photo: Lyon Arboretum Seed Lab.

Cyanea pinnatifida seed.

Photos: Susan Ching.

Cyanea pinnatifida in flower.

Cyanea pinnatifida in fruit.

Tell us a little about your seed conservation team, facilities and current activities.

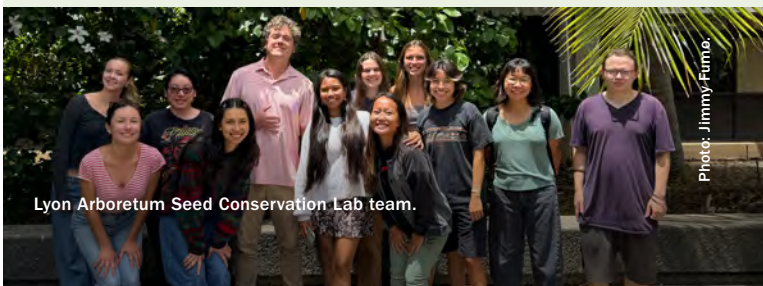
The LASCL serves as the state's germplasm repository, collaborating with various partners in the Hawai'i Plant Conservation Network to manage Critically Endangered plant species at risk of extinction. Since 1995, the LASCL has received over 33 million seeds, spanning over 15,000 accessions, with 65% on the T&E list.

The success of the LASCL is driven by its dedicated staff, students and volunteers, who actively research methods to enhance seed longevity and germination success tailored to Hawai'i's unique flora. Our conservation-focused approach employs rigorous, data-driven analyses to identify optimal storage conditions and dormancy-breaking techniques. We are developing predictive modelling tools to interpret viability trends and establish adaptive re-collection intervals, directly informing our conservation management strategies. Additionally, we are expanding our research and seed banking capacities to support native plant restoration efforts across Hawai'i's federal lands. This initiative aims to mitigate the decline of native species caused by wildfires, drought, and invasive species, ultimately improving biosecurity.

We have also digitised our collection using Z-stacking software to develop high-resolution images of native seeds. These images and detailed metadata are accessible via our online reference library, SeedsofHawaii.org. This resource is a foundation for language learning models that utilise AI algorithms to assist researchers in identifying species, modelling populations, and predicting adaptation trajectories. The LASCL is undergoing significant facility upgrades to further safeguard our collection, including a hurricane-resistant structure equipped with an emergency backup system and a drying room. These improvements, slated for completion by 2026, will substantially enhance our ability to preserve Hawai'i's irreplaceable flora.

What's your organisation's favourite thing about working in seed conservation?

Our favourite aspect of seed conservation is the opportunity to make meaningful, lasting impacts in protecting our native biodiversity. Each seed we store represents the potential to restore threatened ecosystems, protect rare species from extinction, and preserve our unique flora. We deeply value the collaborative spirit of Hawai'i's conservation community and the relationships that foster an inspiring environment where knowledge-sharing, innovation, and teamwork thrive. Ultimately, the most rewarding part of our work is the excitement of discovery through research and the opportunity to mentor students who often become lifelong conservation stewards. We take pride in knowing that today's collective efforts help conserve threatened species tomorrow.



Lyon Arboretum Seed Conservation Lab team.

Photo: Jimmy Fumo.

San Diego Zoo Wildlife Alliance (SDZWA) Native Plant Gene Bank

Contributed by Stacy Anderson

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Dudleya brevifolia* (Moran) Moran
Local name: Short-leaved dudleya

Dudleya brevifolia or short-leaved dudleya is a tiny succulent species known from just five existing populations found in an area that is roughly eight square miles centred around Torrey Pines State Reserve, in San Diego, California. It grows in unique habitat on the edges of delicate sandstone bluffs in soil known as Torrey sandstone. Suitable habitat was largely destroyed to build the communities of Del Mar and Carmel Valley. Of the five remaining populations, three are relatively small and in need of restoration and stabilisation. Seed collection from all remaining populations was our first task.

With our ongoing genetic studies into population relatedness, we learned it would be safe to use seeds from populations in the same genetic cluster to augment the smallest populations. We positioned ourselves to be the local experts and stewards of this species, ready to contribute genetically diverse seed from multiple populations and consult with landowners in managing their properties to optimise the species' recovery. Our work with short-leaved dudleya focused on securing the species' genetic diversity *ex situ*, development of germination and propagation protocols and an exploration of the wild populations' ranges and habitats potentially suitable for reintroduction efforts. We also performed genetic studies to determine population relatedness and the most effective management strategies for reintroductions and population stabilisation. In 2019, we began experimental reintroduction efforts which over the course of six years has allowed us to perfect our techniques, resulting in the establishment of over 50 individuals, roughly double the number in one of the smallest and most imperilled populations. Reintroduced individuals have reached maturity and seedling recruitment has been documented.

Photo: Stacy Anderson.

Dudleya brevifolia flowers.

Tell us a little about your seed conservation team, facilities and current activities.

Located at the San Diego Zoo Wildlife Alliance Safari Park, the Native Plant Gene Bank (NPGB) has been striving to conserve the rarest plant populations of the most botanically diverse counties in the United States. The NPGB holds conservation seed collections from around 1,000 native plant populations in San Diego County and has been used as a resource to restore plant biodiversity *in situ* and provide plant material to researchers. The core seed bank team are Stacy Anderson, who manages the seed bank and is the primary co-ordinator of field and lab activities, Joe Davitt, our field botanist who also oversees germination testing and Dylan Jeffery who is our rare plant propagator. We participate in the California Plant Rescue project, a strategic effort by botanical institutions throughout the state, the California Native Plant Society and the Center for Plant Conservation to conserve the species most at risk in California. The NPGB is part of the San Diego Zoo Wildlife Alliance's (SDZWA) Wildlife Biodiversity Banking (WBB) efforts which integrates collections of plants, clinical collections of veterinary staff and cryogenically preserved animal cell lines, reproductive cells and DNA in SDZWA's Frozen Zoo®. Through a partnership with the International Union for Conservation of Nature Species Survival Commission (IUCN SSC) SDZWA has become a Center for Species Survival for Biodiversity Banking.

Photo: Joe Davitt.

The SDZWA Native Plant Gene Bank team from left to right: Joe Davitt, Dylan Jeffery and Stacy Anderson.

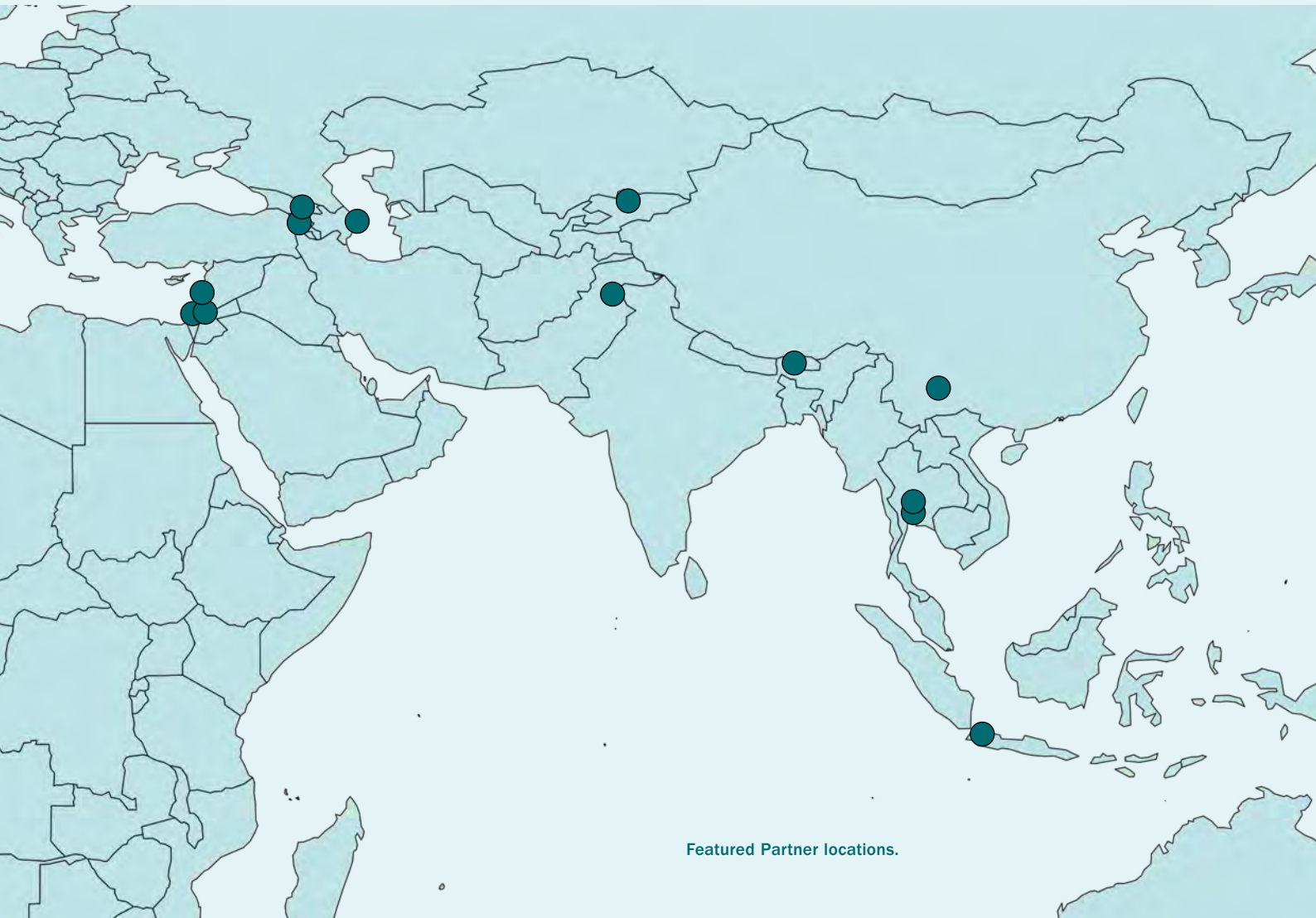
What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

As a wildlife conservation organisation, we love that seeds are a powerful, living embodiment of hope. If we have seeds, we can learn more. If we have seeds, we can grow more. We can conserve a species. Seeds are an amazing resource.

Seeds are mysterious and powerful tools in the fight against extinction. Evolution has created such a diverse array of seed sizes, shapes, and triggers for germination – which makes the work of seed bankers experimental and investigative. We are excited to leverage new technologies to improve our methods for storing and reviving seeds to protect the incredible diversity of rare plants in San Diego.

We are looking forward to seeing our seed banking efforts grow in multiple ways. We will conserve more populations represented from the various species we hold, we will explore alternative seed conservation methods for orchids and recalcitrant species, and we'll be investing our seed in more projects for research and *in situ* conservation of plants. We also hope to collaborate with the IUCN SSC Center for Species Survival-Biodiversity Banking hosted at San Diego Zoo Wildlife Alliance to provide guidance and support for emerging seed banking partners in our SDZWA Conservation Hubs.

Asia



Featured Partner locations.

Seed Bank of Armenian Flora (SBAF) of the A. Takhtajan Institute of Botany, National Academy of Sciences of the Republic of Armenia (NAS RA)

Contributed by Anush Nersesyan

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Astragalus holophyllus* Boriss.
Local name: Գազ ամբողջատերև or Entire-leaved Milkvetch

Astragalus holophyllus, commonly known as the milkvetch, is endemic to Armenia. It grows in semi-desert, on dry, stony and loamy slopes. It is a small stemless plant in the legume family with entire roundish leaves, pink flowers and elliptic-oblong seed pods. This local endemic species is rather rare, and every year we collect a small amount of seed in order not to damage the population of the plant. The species is assessed as Vulnerable (VU) in the IUCN Red List and as Endangered (EN) in the Red Data Book of Armenia (2010). The main threats for the taxon are overgrazing and intensive agriculture, mining, and construction works. We are proud to have living seeds of this Armenian treasure in our seed bank and to help the species to survive.

Tell us a little about your seed conservation team, facilities and current activities.

Our Seed Bank of Armenian Flora (SBAF) was established in 2011 with the help of the MSBP as well as with support from the Berlin Botanical Garden and Botanical Museum.

Our team is small, consisting of six permanent staff members. SBAF holds almost 3,000 accessions of more than 1,000 species, including 91 taxa listed in the Red Data Book of Armenia.

At present, SBAF has all the necessary facilities for seed processing and storage, except cryopreservation facilities. Every year the collection is replenished with new seeds and germination tests are carried out. It is a real miracle to have in one place seeds of different herbs, trees, and shrubs, and to understand that your team is able to help any natural population to survive. Finding a good population of the target species during a field trip is always exciting, particularly when the population has good, mature seeds. Every time it is a real challenge!

Photo: Anush Nersesyan.

Astragalus holophyllus.

Photo: Sona Galstyan.

Sona Galstyn, Hripsik Kosyan, Anush Nersesyan, Yevgenia Navasardyan in the Lab.

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

Going forwards, we plan to collect and store seeds of the majority of the Armenian flora. We are doing our best to collect seeds from different populations of the same taxon in order to have more genetic diversity in the collection. We are thinking about development of our facilities, including a cryopreservation laboratory. We are looking for ways to enlarge our team, to have more space and to be able to reinforce as many damaged natural populations as possible.

Astghik Papikyan in the field with her daughter.

Photo: Astghik Papikyan.

Institute of Botany, Ministry of Science and Education of the Republic of Azerbaijan

Contributed by Sayyara Ibadullayeva and Aida Ibrahimova

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Calligonum bakuense* Litv.

If we could choose one seed to represent our organisation and seed conservation activities, it would be *Calligonum bakuense*. This rare and endemic species is found only in limited areas along the Absheron Peninsula in Azerbaijan. *Calligonum bakuense* is highly adapted to arid and semi-desert ecosystems, where it plays a crucial role in stabilising sandy soils and supporting local biodiversity.

Its seeds represent the uniqueness of Azerbaijan's flora and highlight the importance of conserving narrowly distributed species that are vulnerable to habitat degradation and climate change. This species reflects our commitment to safeguarding the genetic diversity of rare and endangered plants through long-term *ex situ* conservation, scientific research, and international collaboration.

Seeds of *Calligonum bakuense*.

Calligonum bakuense – a species endemic to Azerbaijan.

Tell us a little about your seed conservation team, facilities and current activities.

Our seed conservation team is based at the Institute of Botany, Ministry of Science and Education of the Republic of Azerbaijan. The team includes botanists and researchers with expertise in plant taxonomy, ecology, and seed conservation. We are dedicated to the collection, documentation, and long-term storage of seeds from rare and threatened plant species across various ecosystems of Azerbaijan, with a focus on endemic and relict species.

Our seed bank facility includes a dry room for seed processing and a cold storage chamber maintained at -18°C, following international standards. We also conduct field expeditions, viability testing, and collaborate with international partners, including the MSB, to ensure the conservation of Azerbaijan's unique plant genetic resources.

Photos: Aida Ibrahimova.

Fieldwork involving the collection of red list species.

What have you gained through being in a network of seed conservationists?

Being part of an international network of seed conservationists, such as the MSBP, has brought significant benefits to our work at the Seed Bank Department of the Institute of Botany, Ministry of Science and Education of the Republic of Azerbaijan.

Through this collaboration, we have gained access to global expertise, advanced technical knowledge, and best practices in seed collection, processing and storage. It has also provided valuable opportunities for training, capacity building and the exchange of scientific experience with partners from around the world.

This network has strengthened our ability to conserve rare and endemic plant species effectively and has elevated the visibility of our national conservation efforts. It has also opened doors to joint research projects, co-authored publications, and participation in international dialogues on biodiversity and climate resilience.

Most importantly, it has reinforced the sense of shared purpose – knowing that we are part of a global community working together to safeguard plant diversity for future generations.

Over the next 25 years, our organisation's seed conservation efforts will continue to develop in response to several key directions. One important focus we will be addressing is the growing impact of climate change on plant species and their habitats. Many of the species we conserve are adapted to specific ecological conditions that may be increasingly vulnerable to temperature shifts, altered precipitation patterns and extreme weather events. Adapting our collection strategies to meet environmental changes will be crucial to ensuring the long-term viability of our collections.

Another priority will be the continuous need for technological advancements in seed storage and conservation techniques. As our collections grow and diversify, maintaining the genetic integrity of the seeds and improving storage methods will require ongoing application of new technologies and research.

Finally, expanding public awareness and local community involvement in plant conservation will remain an important focus. Engaging the public in understanding the importance of seed conservation not only for biodiversity but also for the resilience of ecosystems that sustain human livelihoods will continue to be essential.

National Biodiversity Centre

Contributed by Kezang Tobgay

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Cycas pectinata* Buch.-Ham.
Local name: Assam Cycas

We would choose *Cycas pectinata,* commonly known as Assam Cycas. It is an ancient, palm-like gymnosperm now listed as Vulnerable on the IUCN Red List due to widespread habitat loss. Once common across the Indian subcontinent, it is now restricted to fragmented populations, including in Bhutan, where it is the only native *Cycas* species and of significant scientific and conservation value. Despite its ecological importance, it remains understudied in Bhutan and is not legally protected under national conservation laws.

The species grows in rugged, isolated river gorge terrain, making populations vulnerable to genetic erosion. Major threats include infrastructure development (roads, hydropower, power lines), habitat destruction, illegal collection for ornamental and cultural use, and climate change, which is expected to further reduce its suitable habitats.

Globally, cycads are among the most threatened of plant groups, with 62% listed as threatened. Although *C. pectinata* is one of the more widespread cycads, its global population of 200,000–250,000 individuals is declining, with 30% of its natural habitat lost in the past 90 years.

Field studies in Bhutan report small and declining populations with poor regeneration, especially in the Ramjar and Kurizampa regions. Very few individuals bear cones, and female coning is significantly lower than male. Some natural regeneration through bulbils is observed, but insufficient to support long-term population stability.

Conservation efforts are urgently needed, especially in Bhutan, where the species faces increasing threats from both human activities and natural factors like pest infestations.

Photos: Kezang Tobgay.

Cycas pectinata in its natural environment.

Tell us a little about your seed conservation team, facilities and current activities.

The Plant Genetic Resources (PGR) Division in Bhutan was established under the National Biodiversity Centre following the 1997 Biodiversity Action Plan I, itself a response to Bhutan's ratification of the Convention on Biological Diversity. The Division addresses the decline in traditional crop diversity due to urbanisation, changes in farming systems, and other factors. It promotes both *ex situ* and on-farm conservation of plant genetic resources for food and agriculture. The National Plant Genebank currently holds around 3,500 accessions of 46 crop species and 262 accessions of 197 tree species, supported by the MSB. *Ex situ* activities include germplasm collection, sample multiplication, accession characterisation, and conservation via *in vitro* and cryopreservation techniques.

On-farm conservation is carried out at 37 sites across Bhutan, focusing on preserving traditional crop varieties through participatory varietal selection, crop improvement, value addition, and farmer capacity building. Drought-tolerant rice varieties such as Zangthi and Bhur Kamja were introduced during the 11th Five Year Plan. Several Community Seed Banks were also established to support seed preservation.

The National Plant Genebank.

The lab at the National Plant Genebank.

Close up image of *Cycas pectinata.*

What piece of advice would you give to someone starting their seed conservation journey?

The Seed Bank Programme is a global initiative to safeguard some of the most threatened, rare and useful wild plant species. Specifically, the work of seed banking is for the conservation of seeds to protect species from extinction, provide material for research, and to enhance knowledge around methods for successful species recovery and restoration of plant communities.

Seed conservation helps in building conservation efforts for native plant species within Bhutan, which will contribute to global efforts to combat potentially catastrophic threats to human wellbeing by safeguarding wild plant diversity.

Germplasm Bank of Wild Species (GBOWS), Kunming Institute of Botany, Chinese Academy of Sciences

Contributed by Jie Cai

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Taiwania cryptomerioides* Hayata

Taiwania cryptomerioides (Cupressaceae) is a large coniferous tree native to eastern Asia, mainly in the Yunnan, Guizhou and Taiwan provinces of China. This species is valued for the high decay resistance of its wood and is listed on the "National Key Protected Wild Plants" of China. The seed collecting team at GBOWS collected the seeds from the canopy of a *T. cryptomerioides* tree up to 72 metres tall from the Yunnan-Myanmar border in 2021. The team surprisingly found and recorded more than 30 species of epiphytic vascular plants, including 18 species of orchids on the journey to the treetop. This tree is estimated to be more than 1,000 years old, and we expect the offspring of this old tree could last for another several hundred years in the seed bank, for its and our future.

To climb up to the tree top needs skill, courage, persistence and an upward mood, so do the seed conservation journeys of GBOWS and our international counterparts.

Photo: Kunming Institute of Botany.

Climbing to collect *Taiwania cryptomerioides* seeds.

Photo: Yang Yunshan.

GBOWS building.

Tell us a little about your seed conservation team, facilities and current activities.

GBOWS was established in 2008 in Kunming city, Yunnan, where it is close to three biodiversity hotspots (Indo-Burma, Himalayas and the Mountains of Southwest China). The facilities at GBOWS consist of a seed bank, a plant tissue bank, a plant DNA bank, an animal gene bank and a microbial bank with aims to safeguard China's unique flora and fauna, and to support the sustainable use of biological resources. The seed bank of GBOWS currently preserves more than 10,000 Chinese plant species from across China, including the seeds of *Solms-laubachia himalayensis* from Mt. Everest collected at 6,210 metres above sea level. The seed conservation practices of GBOWS greatly boost the implementation of China's national actions to the Convention on Biological Diversity, it also functions as one of the national germplasm resource centres of the country. GBOWS plays an important role within China in knowledge sharing to other regional seed banks on seed bank management and seed collecting activities through technical training and joint collaboration.

Current seed conservation activities at GBOWS include everything from botanical surveying and seed collecting to seed dormancy and storage behaviour research. The preservation priorities of GBOWS are mainly focused on the Red List species, crop wild relatives and plants with medicinal properties. GBOWS also works closely with various research teams across China to screen the unique genes for enhancing the climate change resilience in crops.

Photo: Kunming Institute of Botany.

GBOWS seed bank team.

What have you gained through being in a network of seed conservationists?

The old saying goes that, "If you want to walk fast, walk alone. If you want to walk far, walk together". The journey to successful conservation is a long run. It's always helpful to have a leader or companion. GBOWS started as a freshman in seed conservation. With the technical support from the Millennium Seed Bank Partnership since 2005, standardised operating procedures were established and adopted in GBOWS, and cascaded across China. We also extended the conservation practice from orthodox seed preservation to short-lived seed and recalcitrant seed conservation. The sharing of knowledge and expertise in a network of seed conservationists contributed tremendously to GBOWS's phase-based achievements, and will lead with a strategic vision for long term success in seed conservation.

National Botanical Garden of Georgia – National Seed Bank

Contributed by Tsira Mikatadze-Pantsulaia, Ana Gogoladze and Sandro Kolbaia

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Sorbus migarica* Zinserl. (synonym of *Aria graeca* (Spach) M.Roem.)
Local name: Ampura – ამპურა

I can recall one of our field trips trying to pin down and collect the fruits of Greek whitebeam (*Sorbus migarica*). The field trip involved traversing the high mountain forests, alpine steppes and wetlands of Central Georgia. The locality of the Greek whitebeam was found at the lesser-known Managed Reserve of Tetrobi, a marvellous high mountain depression with pine forests, juniper scrub and subalpine steppe. The entire depression is surrounded by steep cliffs creating an impression of desolation. I was there with my colleague Mamuka, who was driving us at this time and was eager to help me collect ripe orange to red drupes sheathed in the dense foliage of the few individual trees. After the collection, I hiked up towards the cliffs to look for more trees, but to no avail. However, what I saw were magnificent juniper patches, gloomy faces of rocks facing down on us and bear faeces, coupled with a strong sense that the bear would also ramble out from the nearest woods.

Each seed collection is an adventure of its own, as is the journey of the seed from the plant to the lab to the seed bank, in hope that one day it will find its way back to nature.

Tell us a little about your seed conservation team, facilities and current activities.

Our team is experienced and motivated. We are a small team of conservation biologists covering a wide spectrum of plant conservation activities: target species selection, nature search, species identification, seed collection and cleaning, seed suitability and germination testing, sowing and plant propagation for plant repatriation, which is all in line with our department's motto: From seed to seed! In addition, we have living collections of native plants from Georgia (the Caucasian biodiversity hotspot) and undertake IUCN Red List assessments of selected plants.

Photo: Giorgi Andiashvili.

Front row from right to left: Laura Gabedava, Irakli Grdzelishvili, Irina Danelia, Tsira Mikatadze-Pantsulaia, Tinatin Barblishvili, Ana Gogoladze and Nina Melia. Back row from right to left: Natia Samsonidze, Ketevan Lomidze, Ripsime Airapetiani, Sandro Kolbaia and Mariam Kikvidze.

Photo: Sandro Kolbaia.

Sorbus migarica seed.

Photo: Sandro Kolbaia.

Collecting *Sorbus migarica*.

What are the best improvements you have made to your seed conservation facilities since you started?

Since the establishment of the Plant Conservation Department, our goal has been to establish a seed bank.

The seed bank was established in 2001 in the Niko Ketskhoveli Institute of Botany (as it was then called) with a collaborative project from 2001 – 2006 with Missouri Botanical Garden (USA). Next, and a very important step in the development of the seed bank, was collaboration with Kew's MSBP, which commenced in 2005. Researchers from the Department of Plant Conservation of the National Botanical Garden of Georgia (NBGG) and colleagues from the Institute of Botany of Ilia State University work together to achieve the targets of the MSBP. This is a great help for the *ex situ* conservation of our plants.

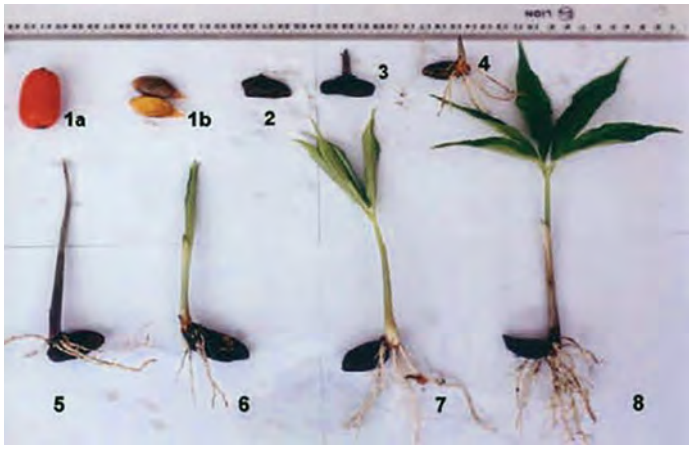
Indonesian Seed Bank and Research Center for Applied Botany (BRIN)

Contributed by Dian Latifah

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Amorphophallus titanum* (Becc.) Becc.
Local name: Corpse flower

We would choose *Amorphophallus titanum*, the enormous corpse flower. It draws tourists and has become a botanical landmark in several botanical gardens around the world. This endemic species is unique to Sumatra Island, Indonesia, and is a member of the Araceae family. *A. titanum's* habitat varies from 600–900 m asl to 1,200 m asl and from 120–365 m asl. Its natural population has been declining significantly as a result of habitat modification. *Ex situ* conservation techniques are therefore crucial, both in botanic gardens and in seed banking facilities. Bogor Botanical Gardens (260 m asl) is one of Indonesia's *ex situ* conservation areas. Pollen storage, manual pollination, propagation methods, and future seed conservation are all covered in the strategies. Using stored pollen from another plant that flowered on November 29, 2011, an inflorescence of *A. titanum* that opened in Bogor Botanic Gardens on February 2, 2012, was manually pollinated. The fruit (infructescence) produced on February 22, 2012, was the first time this huge aroid had been successfully pollinated by hand in Indonesia. The morphology of *A. titanum* pollen was closely examined in this study, and the quality of the pollen that was kept and used for hand pollination was evaluated. A number of germination-enhancing treatments were also tested. *In vitro* technology has been successfully used for reproduction, with the resulting plantlets undergoing acclimatisation. Although previous research indicated that Araceae seeds tend to be orthodox, our preliminary research has shown that the seeds of this species are potentially desiccation sensitive (Exceptionality Factor 2 – doi.org/10.1016/j.biocon.2021.109440).



From fruit to seedling of *Amorphophallus titanum*.

Tell us a little about your seed conservation team, facilities and current activities.

The members of our seed conservation team are mainly under the Seed Biology Research Group. However, depending on the availability of funded projects, the members can be drawn from different research groups under the Research Center for Applied Botany, the Research Organisation for Life Sciences and Environment, or different Research Organisations under National Research and Innovation Agency of The Republic of Indonesia (BRIN). We are also in collaboration with the Indonesian Seed Bank under the Directorate of Scientific Collection Management BRIN. The facilities that support our activities are located at several laboratories and the Indonesian Seed Bank at the Dr (H.C.) Ir Soekarno Integrated Science Campus at Cibinong Bogor. Our current activities include the Arcadia Threatened Biodiversity Hotspot programme – Indonesia, the Weston Global Tree Seed Bank Unlocked: Indonesia and the Gates Foundation-Wild Banana Seed Conservation Projects – Indonesia.

Photos: BRIN.

Putri, Farid, Aini and Meyga cut-testing in the field.

Yuli checking the equilibrium relative humidity of a seed sample.

Mimin checking on seed germination.

What piece of advice would you give to someone starting their seed conservation journey?

We normally start our seed conservation journey when we think we are ready. Here are some questions to help someone starting out to know if they are ready: Is there an official legalised institution/organisation you can work with? Does this institution have a job role relating to the seed conservation activities? Can they support you with the facilities you need? Are you and your institution able to look for opportunities, such as proposing to collaborate with related institutions/organisations? In parallel, you may be working in your own institution's facilities, following your passion alongside other researchers and staff. Do you have access to the skills you need, training, publications, knowledge and experience? Good luck and enjoy your seed conservation endeavours!

Israel Gene Bank

Contributed by Einav Mayzlish Gati and Dikla Lifshitz

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Triticum turgidum* subsp. *dicoccoides* (Asch. & Graebn.) Thell.
Local name: Wild Emmer Wheat

We've chosen this species because wheat is one of the most important plants for food security and was first domesticated in the Fertile Crescent, which includes Israel. The populations in Israel are among the southernmost, making them a crucial population for addressing climate change.

Photos: Israel Gene Bank.

Triticum dicoccoides subsp. *dicoccoides.*

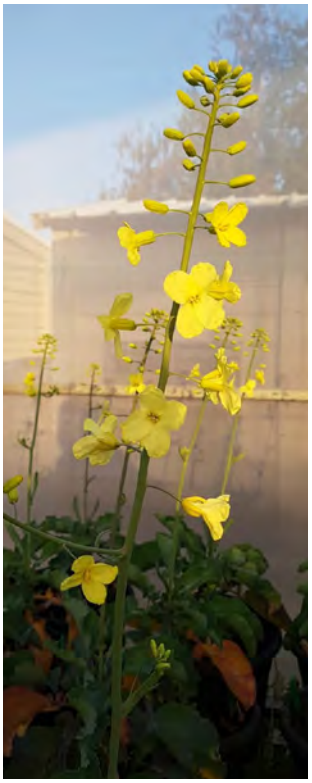
What's the most important seed collection you've made and why?

Crop wild relatives (CWR) – Defined by the European Crop Wild Relative Diversity Assessment and Conservation Forum as wild species closely related to food and fodder crops, and by extension, forestry species, ornamental and industrial crops, and other species of socio-economic importance (such as medicinal and aromatic plants), and to which the wild relatives may contribute genetic material. The IGB holds 95% of the 370 different CWR of Israel. *Brassica cretica* is an example of an important CWR conserved at the IGB, being endangered in Israel.

The value of CWR has long been recognised: they are of major importance to agriculture and forestry, both of which have benefited for millennia from CWR genes that confer, for example, pest and disease resistance, drought tolerance, and other advantageous traits currently needed in agriculture around the world. Cultivars of modern crops are genetically uniform, reinforcing the need for wild relatives with the appropriate genetic diversity to develop new resistant and better adapted cultivars. The demand for new cultivars remains high and will continue to be met by obtaining novel genes from wild relatives.

Tell us a little about your seed conservation team, facilities and current activities.

The Israel Plant Gene Bank (IGB) is the national centre tasked to preserve the diversity and genetic resources of local vegetation. The long-term aim of the IGB is to conserve *ex situ* seeds of wild species, crop cultivars and landraces collected from their natural habitats throughout Israel. The IGB currently houses over 50,000 seed accessions and supplies samples for research, cultivation and ecological conservation. One of the main focusses of the IGB is the collection of additional species and populations, aiming to conserve the entire flora of Israel, according to prioritisation lists. The list is evaluated annually, based on the existing inventory and the current projects. The IGB database management system was expanded to include a new GPS-based field system, where information is acquired from the IGB inventory, the distribution map of the target species and the location of the collector botanists. Seed samples are cleaned and dried at 15% relative humidity in special temperature- and humidity-controlled rooms. Samples are sealed in aluminium bags and deposited in the IGB vault, with underground freezers at -20°C. The humidity level and temperatures in all conservation facilities at the IGB are monitored and supported by backup systems. In addition, the gene bank has a cleaning lab, germination lab and greenhouse facilities, as well as *in situ* conservation fields. The IGB team consists of research technicians, students, and volunteers. The technicians are PhD, MSc, and BSc employees. The volunteers include young adults completing their National Service, retirees, and young adults with mental and physical disabilities.



Brassica cretica.

The IGB inventory bank, specifically the freezers. We currently store our samples in aluminium bags to ensure a proper seal.

The IGB cleaning lab, showcasing the tools we use to clean seed samples before preparing them for storage.

The National Seed Bank at the National Agricultural Research Center (NARC)

Contributed by Khaled Abulaila

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Anacamptis sancta* (L.) R.M.Bateman, Pridgeon & M.W.Chase

We would choose the seed of *Anacamptis sancta,* because it belongs to the Orchidaceae family and has a very restricted range (the forest ecosystem) within Jordan. It is used as an indicator species to indicate healthy ecosystems. The conservation biology of this species was studied from both *ex situ* and *in situ* conservation sides, showing that the seeds of *A. sancta* have special requirements for fungal association *in situ* that makes its habitat of occurrence very special. The study resulted in some interesting data regarding the acquisition of desiccation tolerance and optimal conservation conditions of the plant species. Seeds of the *A. sancta* are conserved already in the National Seed Bank of Jordan and shared with the MSB.

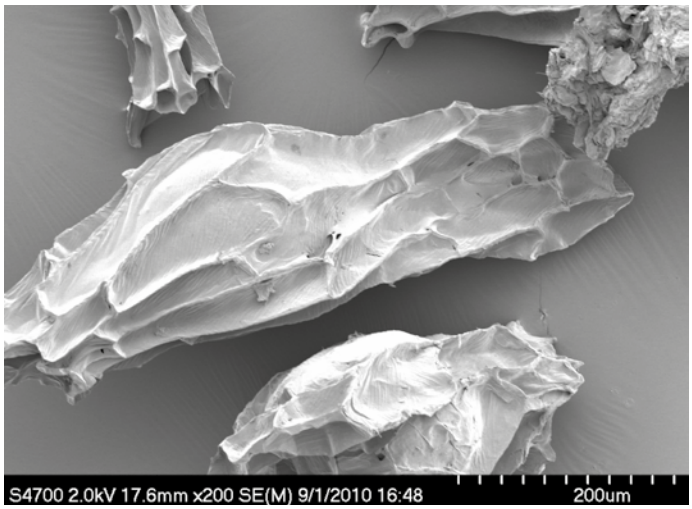


Photo: Khaled Abulaila.

Anacamptis sancta seeds under the scanning electron microscope.

Photo: Khaled Abulaila.

Anacamptis sancta in flower.

Tell us a little about your seed conservation team, facilities and current activities.

The National Seed Bank of Jordan has thirteen staff.
The structure of the seed bank directorate is as follows:

Seed and tissue culture

Seed preparation and curation
Germination ecology and seed viability
In vitro conservation/tissue culture

Biodiversity characterization and multiplication of accessions

Phenotypic and genotypic characterization
Screening and Pre-breeding
Multiplication of accessions
Field gene bank

Biodiversity of range land and forests

Range land management and utilization
Forest management and utilization
Natural vegetation cover and restoration

Documentation and databases

Data entry and extraction
Data management and user queries
Software maintenance and upgrades

We are looking forward to having conserved the flora of Jordan in the seed bank but also to have safeguarded it in its natural habitats over the next 25 years.

Photo: NARC.

The National Seed Bank building. The National Seed Bank team consists of a conservation biologist, a seed multiplication specialist, a head of forests and rangeland resources, a head of multiplication and characterisation, a specialist in rangeland resources, an accessions curator, a specialist in *in vitro* storage, a specialist in seed physiology, a specialist in seed preparation and cleaning, and a specialist in seed characterisation.

What is the most important thing you've learnt since starting seed conservation?

The sooner the better to safeguard precious genetic resources as we are in a race against climate change and the fast pace of land use change. The diversity in seed shapes and their dispersal mechanisms is one of our favourite things about seed conservation and needs to be conserved.

Seed Bank in the Institute of Biotechnology, National Academy of Sciences of the Kyrgyz Republic

Contributed by Anara Umralina

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Scutellaria andrachnoides* Vved.
Local name: Skullcap andrachnoides

We would choose Skullcap andrachnoides (*Scutelaria andrachnoides*) as it is one of the poorly studied endemic plant species of Kyrgyzstan, listed in the Red Book of Kyrgyzstan. There is no information on the chemical composition of the plant, however, it was assumed that its roots, as well as the roots of 300 other species of skullcap, contain flavones, which have a wide range of physiological activity in demand in modern and traditional medicine. To introduce this plant into *in vitro* culture, pRi T-DNA transformed hairy roots of skullcap were used, obtained by co-cultivation of seedlings with *Agrobacterium rhizogenes*. When introducing skullcap roots into the culture, at a certain period of their adaptation to the growing conditions, along with hairy roots, an undifferentiated growing callus culture was obtained, which, like hairy roots, grows stably for six years on a nutrient medium without hormones. Chemical analysis of hairy roots of *S. androchnoides*, carried out using high-performance liquid chromatography, showed that isolated roots retain the ability to synthesise the main flavones typical of the roots of the whole plant, at a level comparable to their content in the intact plant. However, hairy roots differ from the roots of the whole plant in the ratio of the main flavones in them. Analysis of the results of growth activity of hairy roots and callus tissue of skullcap, as well as the content of flavones in them, indicates the prospect for the large-scale cultivation of this species for the purpose of obtaining the flavone wogonin by biotechnological means.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

We represent the only scientific organisation in Kyrgyzstan engaged in the preservation of wild plants in a seed bank. In addition, we use the natural properties inherent in plants, which can be introduced into pharmaceutical practice. The technologies we use allow us not to reduce natural reserves, but to maximally increase biomass in laboratory conditions.

One of the most important challenges that our seed collection team may face is climate change, the difficulty of collecting in remote places, and human impact on the environment.

Tell us a little about your seed conservation team, facilities and current activities.

Our collection team consists of eight people. Our team includes a taxonomist – Georgy Lazkov (Prof.), the team is headed by a leading specialist – Tatyana Chernysheva (PhD). The collection of seeds is carried out by laboratory researchers – Sergey Hegay (PhD) and Rakhat Konurbaeva (MSc). Seed cleaning and cold storage is carried out by Galina Pindyurina. The group also includes two laboratory assistants: Natalya Korobova and Alexander Petrenko. The manager of the work is Doctor of Biological Sciences – Anara Umralina. We have the necessary equipment for storing and processing seeds as well as technical support provided by Kew. It is desirable to have equipment for digitising the herbarium.

Tatyana Chernysheva, Georgy Lazkov and Sergey Hegay in the field.

Tatyana Chernysheva and Rakhat Konurbaeva pressing herbarium specimens.

Photos: Biotechnology Institute National Academy of Sciences.

Collecting at an altitude of 3,000 metres.

National Genebank of the Lebanese Agricultural Research Institute (NGB-LARI)

Contributed by Joêlle Breidy

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Cedrus libani* A.Rich.
Local name: Lebanese cedar

If we could choose one seed to represent our organisation's conservation efforts and values, it would be the seed of *Cedrus libani*, commonly known as the Lebanese cedar. The Lebanese cedar is not only a majestic and ancient tree species – it is a national emblem of Lebanon, deeply woven into our identity, culture, and history. It symbolises resilience, strength, and endurance. This iconic tree has stood the test of time, surviving centuries of environmental challenges and human pressures, much like the Lebanese people themselves. For millennia, these trees have been revered and mentioned in ancient texts, including the Bible and the Epic of Gilgamesh. They once covered vast areas of Mount Lebanon, and while their numbers have declined due to deforestation and climate change, ongoing conservation efforts are helping to restore them. Choosing the seed of the Lebanese cedar is a tribute to the importance of seed conservation, ecological heritage, and the hope we place in regeneration and preservation for future generations.

Photos: Joêlle Breidy.

Seeds and cone of *Cedrus libani*.

Tell us a little about your seed conservation team, facilities and current activities.

The National Gene Bank of the Lebanese Agricultural Research Institute (NGB-LARI) is responsible for the *ex situ* conservation of Lebanon's plant genetic resources. Since 1996, LARI has collaborated with RBG Kew on seed banking, focusing on the conservation of native, endemic, endangered, and useful Lebanese wild plants. By 2010, this long-standing partnership had conserved 1,376 seed accessions representing 877 species, over 31% of Lebanon's flora, with duplicate samples stored at Kew. NGB-LARI now holds over 2,500 accessions.

Expansion of NGB-LARI's limited facilities began in 2013 with the launch of a dedicated seed bank facility at Tel Amara. It grew from a single drying room, medium-term storage, and seven upright freezers to a comprehensive facility including a seed preparation room, drying and fumigation rooms, seed viability and processing labs, medium- and long-term storage, a herbarium, and four offices. Two greenhouses and an experimental field support regeneration activities.

The team has expanded from a single staff member in 2013 to six core members in 2022, including a gene bank manager, a documentation officer, and four trained technicians, with additional field staff recruited as needed. Since 2023, the team has undertaken advanced training at the International Center for Agricultural Research in the Dry Areas gene bank.

Today, NGB-LARI plays a central role in national and international conservation efforts, participating in projects like Biodiversity for Opportunities, Livelihoods and Development, and Crop Wild Relatives. It actively engages in seed viability testing, regeneration, and the conservation of crop wild relatives, landraces, and the wild flora of Lebanon.

What is the most important thing you've learnt since starting seed conservation?

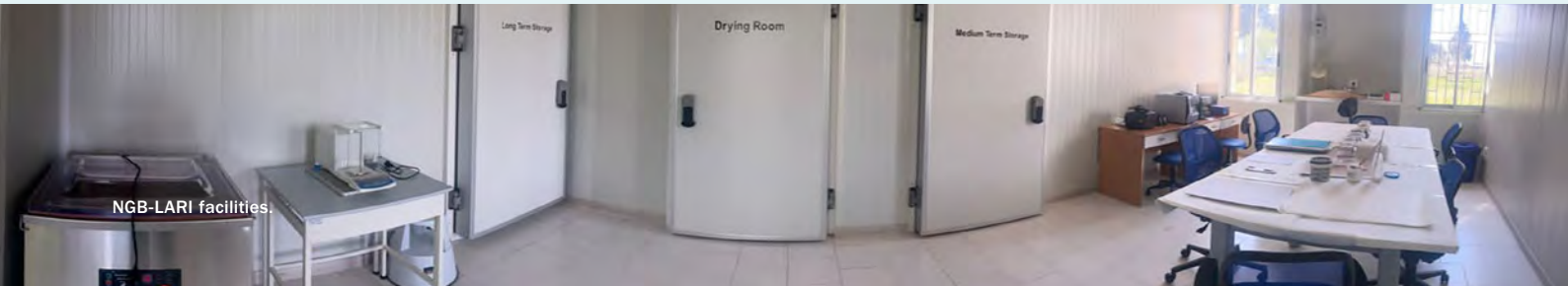
The most important thing I've learnt since starting seed conservation is that preserving seeds is not only about safeguarding genetic material, it's about securing resilience, heritage, and hope for future generations.

Through my work, I've come to deeply appreciate the role that seeds play as silent guardians of biodiversity, cultural identity, and food security. Each seed holds the potential to restore ecosystems, adapt to a changing climate, and reconnect communities with their agricultural roots.

I've also learnt that seed conservation is a long-term commitment requiring both scientific precision and continuous collaboration. From viability testing and regeneration to upgrading storage conditions and training staff, every step matters. Partnerships, both local and international, have proven essential for building capacity, exchanging knowledge, and responding to emerging challenges together.

Ultimately, the greatest lesson is that even the smallest seed can be a powerful agent of change when preserved, shared, and cultivated with care.

Over the next 25 years, NGB-LARI looks forward to strengthening its role as a key national and regional hub for plant genetic resources conservation. Our vision includes expanding *ex situ* collections to cover a larger share of Lebanon's rich flora, with a special focus on crop wild relatives, landraces, and underrepresented native species that are vital for food security, ecological restoration, and climate resilience.



NGB-LARI facilities.

National Genebank of Pakistan

Contributed by Shakeel A. Jatoi

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Triticum aestivum* L.
Local name: Wheat

If one seed could represent our work, it would be wheat (*Triticum aestivum*) – a staple vital to Pakistan's food security, economy, and heritage. Situated near the Fertile Crescent, Pakistan has a rich legacy of wheat domestication. Our Genebank conserves over 5,000 wheat accessions, including landraces, modern cultivars, and wild relatives with valuable traits like drought tolerance, disease resistance, and improved nutrition.

Through preserving and studying these seeds, we honour our agricultural legacy while preparing future generations to meet food security challenges. Wheat stands as a symbol of our commitment to conserving the genetic diversity that sustains life.

Photo: Mr Faraz Ahmed

A *Triticum aestivum* head.

What is the most important thing you've learnt since starting seed conservation?

Over decades of conserving Pakistan's plant genetic resources, one truth stands clear: seeds are the living foundation of our future. Each seed in our Genebank holds an irreplaceable story of resilience, adaptation, and survival.

We have seen how swiftly traditional landraces vanish – drought-tolerant wheats and disease-resistant chickpeas disappearing within a generation as modern varieties spread. These losses remind us that seed conservation is a race against time. The medicinal plants from Himalayan meadows and wild rice from coastal belts are not just specimens; they are lifelines for an uncertain future.

Our work has taught us that seeds carry more than genes – they carry memory, culture, and hope. Elderly farmers have entrusted us with seeds that hold the legacy of generations.

Perhaps our greatest realisation is that we are not merely preserving plants, but protecting opportunities yet unseen. That wild barley from a distant village may one day feed millions. In safeguarding these seeds, we honour the past, secure the present, and offer possibilities for the future.

We are not just scientists – we are guardians of resilience, stewards of hope, and protectors of life itself.

Tell us a little about your seed conservation team, facilities and current activities.

The National Genebank of Pakistan (NGP), hosted at the Plant Genetic Resources Institute (PGRI) under the Pakistan Agricultural Research Council, is the country's leading centre for the conservation of plant genetic resources. Working closely with diverse stakeholders, NGP safeguards biodiversity critical for food security and research. NGP along with its associated institutions, serve as a national hub for *ex situ* conservation, genetic research, and data management.

Our multidisciplinary team of plant geneticists, taxonomists, field botanists, seed conservation specialists and data managers bring decades of expertise to safeguarding Pakistan's plant genetic resources. We operate through advanced seed banking facilities equipped for long-term germplasm preservation, including climate-controlled storage and cutting-edge processing labs.

From 2017–2019, our scientists conducted extensive seed collecting across Pakistan's ecological extremes – from the Arabian Sea coast to 4,000 m elevation in the Karakoram range. This Crop Wild Relatives initiative yielded 203 collections (over 2 million seeds) spanning 32 species linked to 18 crops, with habitats ranging from saline lowlands to alpine zones. Through our partnership with Kew's MSB, we have also documented 200+ Medicinal and Aromatic Plant species, including rare endemics, from diverse agroecological regions. In total the NGP has conserved over 43,000 accessions of cultivated crops, crop wild relatives, and medicinal plants, contributing significantly to biodiversity collections and seed banking.

Looking ahead, we are prioritising climate-resilient species and threatened endemics, while expanding digitisation efforts through a digital Genebank management system with online germplasm ordering – a milestone in enhancing global access to our collections. By strengthening collaborations with global partners like the Crop Trust, we aim to bridge conservation science with farmer-led adaptation strategies. Every seed preserved reflects our commitment to securing genetic diversity for future generations.

Photo: Mr Faraz Ahmed, DSC & P, NARC.

PGRI staff, front row left to right: Ms Hira Saleem, Ms Attiqa Saleem, Ms Saeeda Naz, Dr. Riffat Tahira, Ms Mahrine Rashid, Dr. Shazia Waqar, Ms Armeesha Amir, Middle row left to right: Irfan, Dr. Raees, Mr Ashtar Khan, Dr. Shakeel Jatoi, Dr. Nadar Khan, Dr. Asif Javaid, Dr. Amir Sultan, Dr. Kashif Ilyas, Dr. Tariq Rafique, Dr. Umar Iqbal, Mr. Moeez Qureshi. Third row left to right: Mr. Qaiser, Mr. Ansar, Mr. Hanan Majeed, Mr Ihsan, Mr Faisal Khan, Mr. Aftab Ahmad, Mr. Anees ur Rehman, Mr. Farooq Shah, Mr. Rizwan Nazir, Mr. Aamir, Mr. Shahzad Zafar, Mr. Abdul Ghaffar.

Photo: Director, PGRI, NARC.

Bangkok Forest Herbarium (BKF)

Contributed by Voradol Chamchumroon

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Buxus sirindhorniana* W.K.Soh, von Sternb., Hodk. & J.Parn.

I would like to choose the seed of *Buxus sirindhorniana*. It is an endemic species found in western Thailand and is representative of an important plant area of Thailand.

Dr Somran Sudee, Pachok Pudja, Orathai Kreadkhaew, Theerawat Thananthaisong and Kunanon Downurai.

Tell us a little about your seed conservation team, facilities and current activities.

My team consists of three permanent researchers and two assistant researchers. We established our seed bank on the 5th floor of the Bangkok Forest Herbarium, Bangkok. It has two refrigerators for storing seeds. In our current activities, we are working with the MSB on three projects: Arcadia Threatened Biodiversity Hotspots, Western Global Tree Seed Bank: Unlocked, and Conservation Without Borders. We are also working to collect endemic species, sending them to botanic gardens for propagation and reintroduction to native habitats.

Photos: Niyana Tetsana.

Dr Somran Sudee, Suchart Chunhomhow, Pachok Pudja, Orathai Kreadkhaew, Theerawat Thananthaisong and Nanthawan Suphantee at Doi Hua Mot hill.

Theerawat Thananthaisong, Chandee Hemraj and Nanthawan Suphantee.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

The main objective is to provide infrastructure for long-term conservation of plant diversity and sustainable use. It is to preserve species in *ex situ* conservation, utilising modern technology and standardised seed storage processes. This method applies to seeds that are able to withstand reduced moisture levels, known as "orthodox seeds". We are working in collaboration with other national agencies such as the National Biobank and the Forest Restoration Research Unit (FORRU), as well as at global levels such as with the MSBP.

National Biobank of Thailand (NBT)

Contributed by Pramote Triboun

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Dipterocarpus alatus* Roxb. ex G.Don

We would choose *Dipterocarpus alatus* – the fruits are winged and disperse widely representing new generations spreading far from the mother plant. The trees are big, long lived and hold a lot of fruit – just like the seed bank! It's also useful as the sap can be used to start fires.

Photo: Phongsak Phonsena

Fruits of *Dipterocarpus alatus*.

Photo: Phongsak Phonsena

Flower of *Dipterocarpus alatus*.

What are the best improvements you have made to your seed conservation facilities since you started?

Thailand is a country rich in biodiversity, yet it once faced a lack of expertise in seed bank management. The support from the MSB through knowledge sharing and funding, has played a vital role in strengthening the capacity of institutions at both the national and organisational levels. This collaboration has significantly enhanced the country's ability to conserve and manage its plant diversity.

Tell us a little about your seed conservation team, facilities and current activities.

At present, NBT serves as the primary governmental agency responsible for seed management and regulation in Thailand. We collaborate with other organisations such as the Bangkok Forest Herbarium to make seed collections of wild species across Thailand. We have a team of six people and we cover all aspects of seed conservation from taxonomy and collection to curation and germination. We conduct research on seed biology and morphology and recently produced the first volume of Thai Plant Seeds – a seed atlas for Thai native species.

Photo: Theerawat Kaewkarn

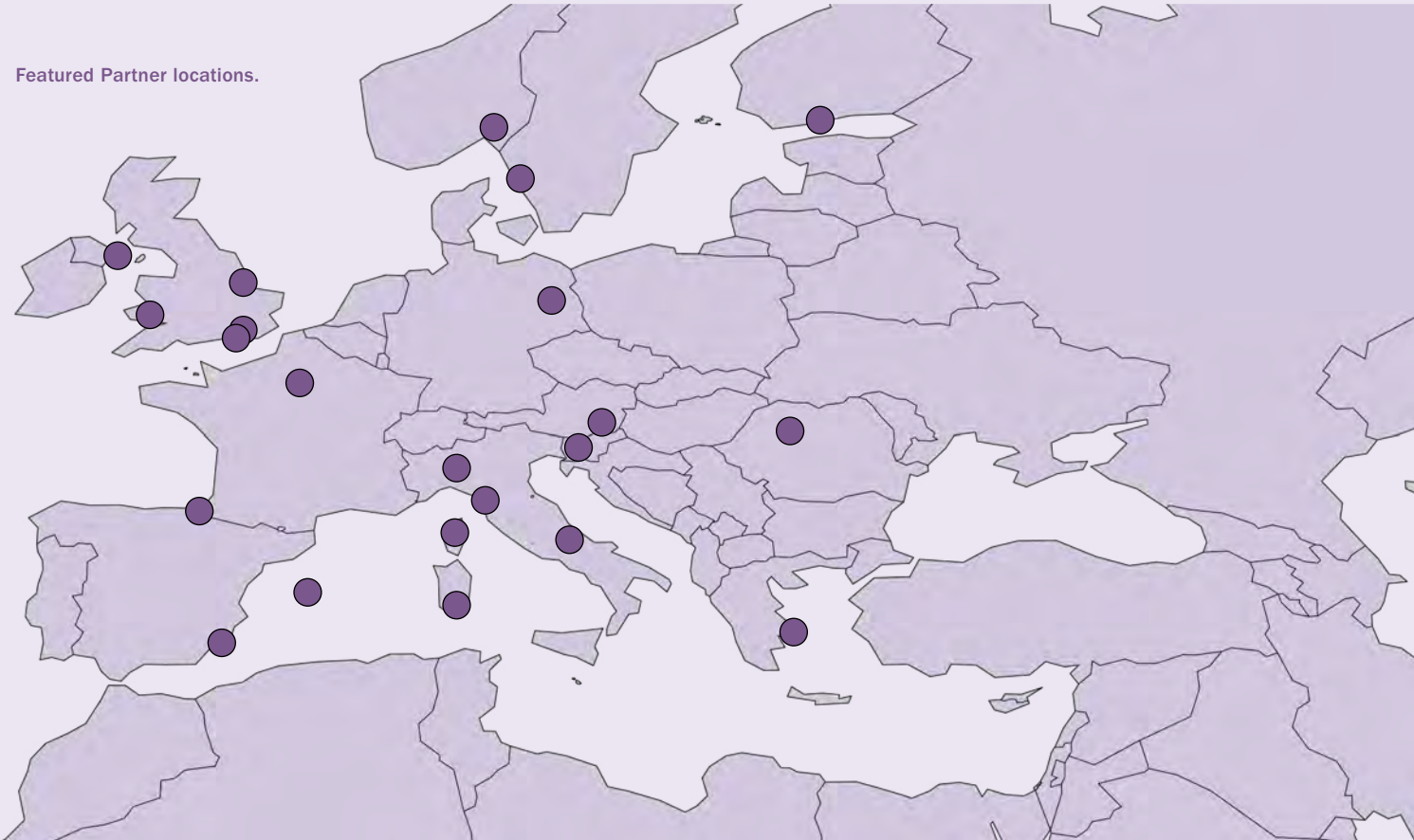
The general public may not know that this organism is a flowering plant. They may think that it is only algae or lichens that grow on rocks along streams. Although the plants produce a large number of seeds each year, they are at high risk of extinction, due to reasons such as, the species being highly specialised to their habitat, requiring good water quality, clean and free from pollution from any activities. In this species' distribution, water is often used for agriculture or for human consumption with limited consideration of the impact on the environment, including reduced rainfall each year due to global warming. For these reasons, NBT are prioritising studying, monitoring and conserving of these unique plants.

Photo: Pramote Triboun.

The team work with the mission of collecting seeds according to standard procedures and ensuring a sufficient amount of seed is collected. After spending 3–4 hours sitting, bending, and sweating under the hot sun, at over 42°C, the team smiled and asked to rest in the shade. They enjoyed a well deserved break, with water and sweets, before continuing to explore and collect targets of other populations and species.

Europe

Featured Partner locations.



Botanical Garden of the University of Graz, Austria

Contributed by Sarah Bürli

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Prunella laciniata* (L.) L.
Local name: Weiße Braunelle

Prunella laciniata is a striking white-flowered species from the Lamiaceae family, threatened in Austria. This perennial hemicryptophyte is typically found in moderately dry, neutral, and nutrient-poor grasslands, thriving in open, well-lit habitats. It is part of the *ex situ* conservation collection at the Botanical Garden of the University of Graz. To counteract its decline – primarily caused by increased meadow fertilisation – reintroduction efforts were carried out aiming to restore this species to its natural habitat.

Photo: Uni Graz/Bongers.

Team members of the Botanical Garden of Graz collecting seeds from wild plants species in Rablgrat, Weizklamm in Eastern Styria, Austria.

Tell us a little about your seed conservation team, facilities and current activities.

We carry out plant translocations, primarily focusing on the reintroduction of rare and threatened species in Austria. Our team consists of gardeners, technicians and apprentices, the Technical Manager, and the Head of Research. We are often joined by students and interns, and work in close collaboration with Styria's Nature Protection Office. Our facilities, located in the Botanical Garden of the University of Graz, consist of raised beds dedicated to *ex situ* cultivation and a seed bank.

Photo: Christian Berg.

Reintroduction of *Prunella laciniata* by the Botanical Garden of the University of Graz.

Photo credit: Jonathan Wilfling.

Seeds in sealed tubes at the Botanical Garden of the University of Graz.

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

Over the next 25 years, we envision building a more comprehensive seed bank representing a wider range of Austria's rare and threatened native plant species, with a focus on those most at risk due to habitat fragmentation and shifting environmental conditions. We are looking forward to advancing research into seed germination, dormancy, and long-term viability to ensure the effectiveness of our conservation strategies.

Finnish Museum of Natural History

Contributed by Mari Miranto

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Polygonum oxyspermum* C.A.Mey. & Bunge ex Ledeb.

I would choose *Polygonum oxyspermum*. The species is critically endangered in Finland and has only one population left in the southwestern archipelago. It is a species endemic to the coasts of the Baltic Sea, and Finland holds great responsibility to safeguard the species. In terms of seed collecting, the plant requires exceptional measures and thus leaves unforgettable memories with a seed bank manager. Sampling large numbers of mature seeds was tricky, because the seeds mature gradually over a long period of time. One shoot typically flowers and produces seeds at the same time, and mature achenes quickly fall onto the seashore sand. When the only existing site is on a remote island, repeated collecting trips are infeasible. That is why we transferred seedlings from germination tests to the botanic garden nursery for further growing and seed sampling. The plants were checked for mature seeds twice a week, and the persistent work over one and a half months eventually yielded approximately 3,000 seeds for the seed bank.

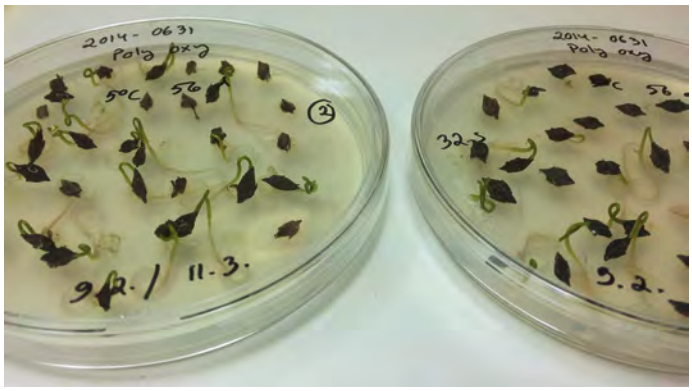


Photo: Mari Miranto.

Polygonum oxyspermum seeds germinating on agar.

Tell us a little about your seed conservation team, facilities and current activities.

The seed bank of the Finnish Museum of Natural History is a small-scale facility operating with just two members of permanent staff. We currently hold around 50% of all the threatened and near threatened Finnish species. The number of accessions increases slowly but steadily. The seed bank was set up in 2013, and we are currently monitoring the germination after 10 years of storage. We also put an effort into raising awareness of threatened Finnish plants. For this reason, we display about 80 threatened or near-threatened taxa in the botanic garden collections.

Photo: Aino Anttila

Plant biologist Mari Miranto and Senior Horticulturist Marita Tiiri admiring near threatened *Asperugo procumbens* seedlings derived from the seed bank germination tests.

Photo: Henry Väre.

Achenes of Critically Endangered *Polygonum oxyspermum*.

National Botanical Conservatory of Corsica (CBNC)

Contributed by Cloé Trouillet

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Anchusa crispa* subsp. *valincoana* Paradis, C.Piazza & Quilichini
Local name: Buglosse du golfe de Valinco

The National Botanical Conservatory of Corsica will be represented by the emblematic *Anchusa crispa* subsp. *valincoana*.

The two Corsican subspecies *A. crispa* subsp. *valincoana* (endemic to Corsica) and *A. crispa* subsp. *crispa* (endemic to Corsica and Sardinia), are assessed as Endangered (EN) on the IUCN French Red List. Since the 1980s, their habitats have undergone major changes linked to the strong development of tourist activities. Despite measures implemented over the last thirty years, these taxa remain threatened. Since 2012, they have been the subject of National Action Plans, the aim of which is the re-establishment of all *A. crispa* populations on the island of Corsica. A major challenge that the CBNC team and its partners are closely monitoring.

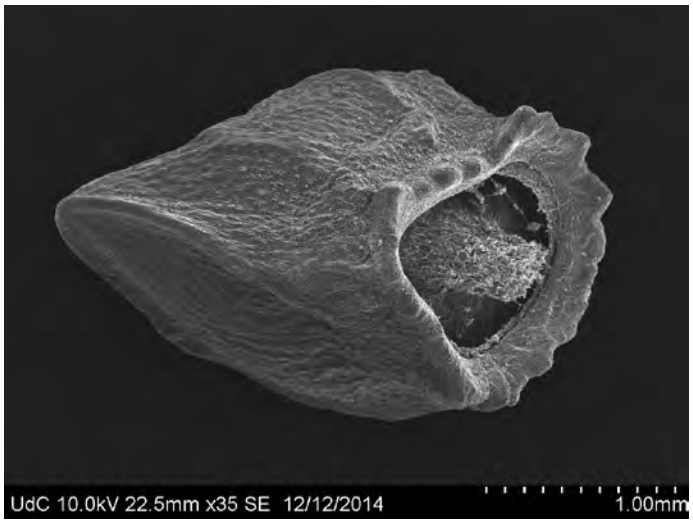


Photo: Yann Quilichini, Laboratoire Sciences Pour l'Environnement, University of Corsica/CNRS.

Anchusa crispa subsp. *valincoana* seed.

What piece of advice would you give to someone starting their seed conservation journey?

As a beginner myself and the person in charge of the seed bank at the CBNC, I would advise you take the time to familiarise yourself with the various protocols, in particular those in the reference documents published by the Royal Botanic Gardens, Kew, and the Agency for Environmental Protection and Technical Services (APAT). What's more, surrounding yourself with resourceful people who can exchange knowledge seems to me to be crucial to getting off to a good start in this field.

Tell us a little about your seed conservation team, facilities and current activities.

Due to increasing pressure on biodiversity, seed conservation is now a major tool for safeguarding our natural heritage. Corsica, along with the other Mediterranean islands, is recognised as a biodiversity hotspot and an area of high priority for conservation.

The National Botanical Conservatory of Corsica, a department of the Corsican Environment Office, has the scientific and technical task of understanding and protecting the island's flora. Approved by the Ministry of Ecology since 2008, it is part of the network of national botanical conservatories.

Involved at both the national and international level in networks for the conservation of genetic resources, and of botanic gardens and seed banks such as GENMEDA (Network of Mediterranean Plant Conservation Centres), the National Research Institute for Agriculture, Food and Environment; The Botanical Conservatory and Garden of Geneva; CBNC's *ex situ* conservation unit helps to increase biological and physiological knowledge of plant species. In recent years, two lines have been followed to determine the requirements for collection and germination testing:

- National Action Plans (NAP), aimed at defining actions needed to conserve and restore the most threatened species, including five Corsican endemic *Limonium*, serpentine species, and the two *Anchusa crispa* subspecies mentioned earlier.
- The Citadella XXI project, which includes the creation of a botanical garden at the Citadel in Corte.

The CBNC's seed bank and the future botanical garden were showcased at a recent exhibition focused on seed dispersal, an opportunity to show images of seeds taken with a scanning electron microscope by the University of Corsica.

Since starting our laboratory for conservation *ex situ*, improvements to our facilities are ongoing. Priority is currently being given to the acquisition of a new, larger Auto-star desiccator. We are also considering investing in a freeze-dryer. This method presents promising opportunities for the long-term conservation of orthodox seeds.

Photo: Caroline Favier.

Binocular observation station and sieve set.

Photo: Cloé Trouillet.

Batches of seeds from the two Corsican subspecies of *Anchusa crispa* after assessment and labelling.

Banque de Graines – Jardins botaniques du Muséum National d'Histoire Naturelle (MNHN)

Contributed by Denis Larpin, Sophie Kling and Simon Lang

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Medicago orbicularis* (L.) Bartal.
Local name: Luzerne orbiculaire (Button medic)

We would choose *Medicago orbicularis,* a species found across nearly the entire French territory – common in the South, rare in the North. It is a good illustration of the diversity preserved by the Museum's seed bank which spans from the very rare to the very common across the whole of France.

It also stands as a symbol of adaptability (much like the Seed Bank throughout its history), with its modes of fruit and seed dispersal (barochory and anemochory) and a strong capacity to adapt to a wide range of ecosystems.

Photo: D. Larpin.

Seed pod of *Medicago orbicularis* (L.) Bartal. (Luzerne orbiculaire, Button medic) – Fabaceae.

For many years, our work focused more specifically on the Mediterranean region (both in France and abroad), and we collected this species extensively. The fruits and seeds can be preserved for a long time – echoing, in a way, the enduring nature of the Museum itself. Proper cleaning requires skilled seed-handling techniques.

Photo: S. Lang.

Work bench for seed cleaning, equipped with extractor hoods and cleaning tools (sieves, strainers, pestle and mortar etc.).

Tell us a little about your seed conservation team, facilities and current activities.

We have a motivated, versatile team, fully committed to conservation. Despite the challenges, the entire team strongly believes in the necessity – and value – of conservation and devotes a significant part of its energy to this goal.

However, the team currently consists of only three people, supported by a few dedicated volunteers.

The MNHN Seed bank (which we also call "the Graineterie") is equipped with a 16m³ cold room, freezers, extractor hoods, growth chambers, experimental plots, greenhouses, and a polytunnel. Some of the equipment is aging, but a modernisation process is currently underway.

Current activities include seed collecting in various regions of France; identification, cleaning, packaging; germination tests conducted both in growth chambers and in open field conditions; production of seed-bearing plants for future seed harvests; provision of plant material for research projects that highlight the value of conservation work. The team also hosts interns and Master's students, provides expertise, and contributes to knowledge dissemination through guided tours, interviews, and filming projects.

Photo: S. Lang.

The 16 m³ cold room, temperature 5°C and relative humidity 20–22%.

Photo: D. Larpin.

The team of the MNHN Seed Bank (Banque de Graines). Left to right: Ségolène de Chabalier, Simon Lang (responsible for the seed bank) and Olivier Viger.

What is the most important thing you've learnt since starting seed conservation?

The importance of collection, genetics, and population sampling. We have encountered degraded genotypes in populations on several occasions. In these cases, germination and/or propagation issues often become insurmountable.

At the same time, this has allowed us to develop expertise in the cultivation of wild plants and to better refine our germination and cultivation protocols: a true experimental seed technician's role.

Germination tests, both in growth chambers and outdoors, remind us that we are working with living organisms and the complexity that comes with it. It's not just about references on a list or in freezers; it is primarily about living material. In the future we would like to expand our scope of action to the French Overseas Territories. Additionally, we would like to continue the modernisation of our facilities and increase our human resources.

Dahlemer Saatgutbank

Contributed by Elke Zippel

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Scabiosa canescens* Waldst. & Kit.
Local name: Duft-Skabiose

Scabiosa canescens is a typical species of eastern Germany found on poor, dry, alkaline, and sandy soils. The fruits, which ripen in a capitate inflorescence and tightly enclose the seed, have a delicate, paper-like crown and short, light-coloured bristles. The light-violet flowers have a delicate fragrance, therefore, their German name is “Duft-Skabiose”.

S. canescens is a species that does not like competition so has declined massively in recent decades and only forms large, self-sustaining populations in a few locations. Genetic studies conducted at the Botanic Garden and Botanical Museum Berlin show a clear genetic differentiation of the remaining populations in Germany as well as a lack of gene flow between the populations, especially in the Northern populations.

The Dahlem Seed Bank has been able to collect seeds from 155 populations in recent years. All our accessions together comprise a total of over half a million seeds. Some of these populations are now completely or almost extinct in the wild. Some of the collected seeds were used to support populations and reintroduce the species on suitable inland dunes in Berlin, where it was almost extinct, but also in other regions (Brandenburg, Mecklenburg-Vorpommern). Plants from the remaining Berlin population were propagated and seeds from the nearest populations in Brandenburg were used to increase the genetic diversity of the established populations. The species is now spreading in some of these areas. We hope that this attractive species, which flowers in late summer and autumn and is a valuable food source for insects, will once again become more common in Berlin.

Tell us a little about your seed conservation team, facilities and current activities.

The Dahlem Seed Bank stores seeds from many countries, including numerous collections of rare and endangered species. Its main geographical focus is Germany (especially north-east and central Germany) and the eastern Mediterranean region.

The seed bank, which was founded in 1994, is located in a small building in the Berlin Botanical Garden, built ten years ago thanks to a generous legacy. It has two drying chambers with 15% relative humidity at 15°C, a cleaning laboratory, a germination laboratory and two offices. In the neighbouring Botanical Museum, there is a walk-in freezer for permanent seed storage at -24°C.

After collection, some seeds are stored in one of the drying chambers and offered to other botanical gardens and scientific institutions in the Index Seminum. The rest are stored long-term in the freezer. Around 14,000 accessions of seeds are made available for scientific research, species conservation in the field, and plant cultivation in botanical gardens.

A small team of eight people work in the Dahlem seed bank, most of them part-time or voluntary. Fieldwork is largely project-financed, focusing on a Germany-wide joint project, called Wild Plant Conservation Germany, with four other botanical gardens (Mainz, Osnabrück, Potsdam and Regensburg). This project concentrates on plant species with a centre of distribution in Central Europe and for whose conservation and advancement Germany has a great responsibility. Furthermore, we reintroduce highly endangered species in suitable locations that preserve the local genetic adaptations of the species in various regions of Germany.

Photo: Marion Cubr.

Fruit of *Scabiosa canescens*.

The Dahlem Seed Bank, Botanical Garden Berlin.

Habitat of *Scabiosa canescens* in Sachsen-Anhalt, Germany.

The Dahlem Seed Bank team in the field: seed collecting of *Gentianella uliginosa* is time consuming work!

Photos: Elke Zippel.

What is the most important thing you’ve learnt since starting seed conservation?

I have learnt that it takes a lot of time and, especially, patience to convince those in authority, in science and politics that seed banks are an indispensable part of botanical species conservation and must be appropriately staffed and funded. I have also learnt that there are many committed people all over the country who have worked for decades to ensure that valuable, species-rich habitats are preserved in our agricultural and industrialised landscape and that this mostly voluntary work is of inestimable value.

Furthermore, I have learnt not to lose hope despite the ongoing biodiversity crisis, but to draw new strength again and again, be it from collaborating with colleagues from all over the world or from days spent outdoors in nature.

And, last but not least, I have learnt that seeds, with their enormous morphological diversity and their fascinating dispersal and germination biology, which has been finely balanced over evolutionary history, never cease to amaze me.

Seeds in our freezer.

National and Kapodistrian University of Athens Seed Bank (NKUA Seed Bank)

Contributed by Spyridon Oikonomidis

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Consolida samia* P.H.Davis (a synonym of *Delphinium samium* (P.H.Davis) Jabbour)

Probably one of the most important species for the NKUA Seed Bank collected during the last three years is the rare *Consolida samia,* found only in a small area of approximately 5 hectares with a relatively small population of around 2,000 individuals. The species was 'lost' for 61 years after its initial description, before its rediscovery by our team in 2023. During its rediscovery, the group led by Apostolis Kaltsis had the chance for the first time to photograph the plant in full flower and, later in the year during a second visit, to collect seeds which are now stored in the NKUA Seed Bank and at the MSB.

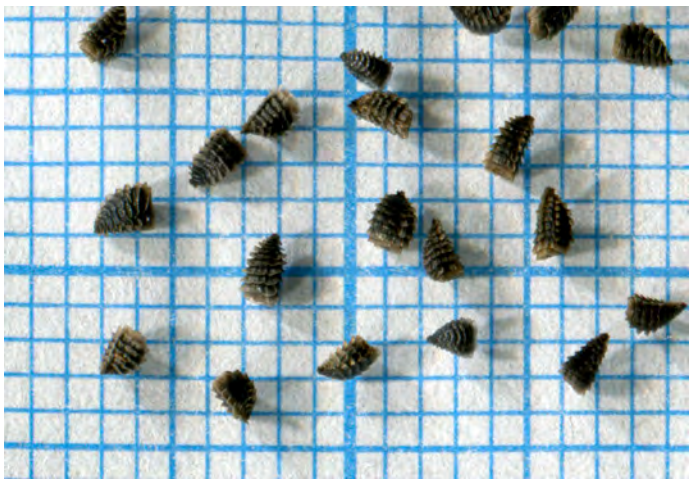


Photo: C. A. Thanos.

Seeds of *Consolida samia*.

Tell us a little about your seed conservation team, facilities and current activities.

The NKUA Seed Bank is likely the oldest seed bank dedicated to native wild plants in Greece. It was established in 1991 by Professors Emeriti Costas A. Thanos and Kyriacos Georghiou. Though relatively small, it currently holds around 1,600 seed lots representing 900 taxa from Greece and Cyprus. The bank's primary focus is the conservation of Greece's endemic flora, and it has already secured seeds from approximately 10–15% of the country's endemic plant taxa. In recent years, efforts to expand the collection have intensified. Through a collaboration with the Millennium Seed Bank Partnership (2022–2025), the number of seed lots and conserved taxa has increased by more than 60%. This marks a major step forward in safeguarding plant biodiversity in the region. Currently, the scientist responsible for the NKUA Seed Bank is Prof. Emeritus Costas A. Thanos. The core research team includes Apostolis Kaltsis (MSc), Katerina Koutsovoulou (PhD) and Spyridon Oikonomidis (PhD).

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

Looking ahead, the goal for the NKUA Seed Bank over the next 25 years is to significantly expand the number of species conserved *ex situ*, while also promoting the use of stored seed in *in situ* conservation efforts. Given the high number of endemic plant species in Greece facing various threats, this dual approach will be increasingly important. To support this vision, it will be essential to enhance the bank's capacity for seed collection and management, and to further refine protocols for seed handling, storage, and long-term viability testing. I think each member of our research group enjoys different aspects of *ex situ* seed conservation—some are more drawn to the fieldwork, while others prefer working with seeds in the lab. But for all of us, the most rewarding part is probably the opportunity to engage with the incredible plant diversity of Greece and to explore the stunning habitats where our target species grow.

Part of the NKUA Seed Bank team, from left to right: Stelios Markou, Giorgos Fakas, Apostolis Kaltsis, Katerina Koutsovoulou and Spyridon Oikonomidis near *Consolida samia*'s habitat during the 2024 population assessment.

Photo: I. Dimitriadis.

Sardinian Germplasm Bank (BG-SAR), Department of Life and Environmental Sciences (DiSVA), University of Cagliari (UNICA)

Contributed by Marco Porceddu, Ludovica Dessì, Alba Cuena-Lombraña, Lina Podda, Francesca Meloni, Maria Enrica Boi, Marco Sarigu, Mauro Fois and Gianluigi Bacchetta

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Ribes sardoum* Martelli
Local name: Sardinian Currant

We would choose the seeds of *Ribes sardoum*, the most endangered species of Sardinia, the second-largest island in the Mediterranean Sea. This plant species is unique in the world and preserves the memories and identity of the old Sardinian population. The only population, in fact, is found in Monte Corrasi (Oliena) and consists of approximately 80 reproductive plants. We ensure the long-term *ex situ* seed conservation of this taxon at the Sardinian Germplasm Bank, as well as for several endangered species of Sardinia, to conserve the highest possible genetic variability and obtain plant material for reinforcement activities. This plant species was considered unable to produce sufficient fruits or viable seeds and therefore reproduce via sexual reproduction. Thanks to our seed germination studies, it was possible to demonstrate that several fruits contained viable seeds, which we were able to germinate under laboratory conditions. Several translocation projects, using plants produced from seeds, have been carried out over the years and monitoring activities are currently ongoing to verify the effectiveness of these *in situ* conservation actions.

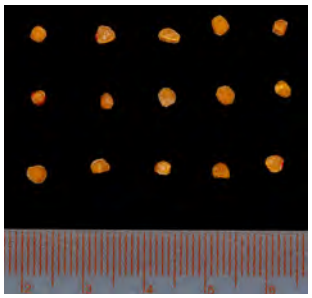


Photo: M. Porceddu.

Ribes sardoum seeds.

Photo: M. Porceddu.

Ribes sardoum in fruit.

What are the best improvements you have made to your seed conservation facilities since you started?

Seed quality is a critical factor in plant conservation and multiplication efforts, particularly for long-term storage. BG-SAR recently purchased and installed an X-ray seed radiography and inspection instrument for identifying and recording internal defects and abnormalities within seeds.

Tell us a little about your seed conservation team, facilities and current activities.

The Sardinian Germplasm Bank (BG-SAR) is a facility of the Department of Life and Environmental Sciences (DiSVA), which belongs to the University of Cagliari, Italy. Its main objective is the conservation, study and management of the germplasm of Sardinian endemic, threatened and policy species (i.e., species included on the Habitat Directive 92/43/EEC, CITES and Bern Convention), taxa from insular territories of the Mediterranean region, as well as Crop Wild Relatives (CWR), landraces, useful plants, plant remains and agrodiversity. Currently, BG-SAR preserves over 3,800 seed accessions of native species and more than 120 accessions of crop varieties, representing approximately 1,350 different taxa. The bank adopts a two-tier seed storage system, a base collection under long-term conservation at -25°C and an active collection under medium-term conservation at +5°C. Studies on the germination ecophysiology are constantly carried out to increase the biological knowledge and define the optimum germination protocols for the preserved taxa. In addition, image analysis techniques are developed to characterise the germplasm. The BG-SAR team actively participates in regional, national and international seed conservation consortia, including the Regional Germplasm Bank for Agriculture and Food (BRGAgris), the Italian Network of Germplasm Banks for the *Ex Situ* Conservation of Native Flora ETS (RIBES ETS), the European Native Seed Conservation Network (ENSCONET) and the Network of Mediterranean Plant Conservation Centres (GENMEDA). BG-SAR has contributed to various international conservation projects and currently, it collaborates on projects aimed at saving threatened plants from extinction through seed banks, such as LIFE SEEDFORCE (funded by the EU LIFE).

Photo: PANVIDEO srl.

The BG-SAR team top left to right: Sarigu M., Cuena-Lombraña A., Bacchetta G., Podda L., Fois M.; bottom left to right: Dessì L., Porceddu M., Meloni F., Lallai A., Boi M.E..

BG-SAR Seed selection laboratory.

Photo: M. Porceddu.

Maiella National Park – Maiella Seed Bank

Contributed by Luciano Di Martino and Valter Di Cecco

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Himantoglossum adriaticum* H.Baumann
Local name: Barbone dell'Adriatico

The Maiella Seed Bank, established in 2005 and a founding member of the Italian Network of Germplasm Banks, would choose the seed of *Himantoglossum adriaticum*, an orchid present in the area of the Maiella National Park, as a symbol of its conservation efforts. This species, monitored and preserved under the Life Seed Force project, embodies our commitment to the protection of plant species of community interest through integrated *in situ* and *ex situ* conservation actions.

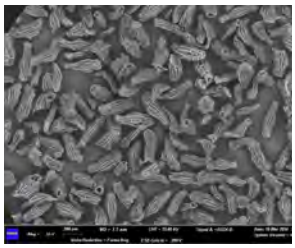


Photo: Maiella National Park.

H. adriaticum seeds under a scanning electron microscope.

Photo: Valter Di Cecco.

A protocorm grown a few months after sowing.

Our work with *H. adriaticum* has included studying populations in the Central Apennines, collecting seeds from the most representative populations, and using *in vitro* germination techniques to reproduce hundreds of seedlings. These young plants are currently growing in the park's nurseries and will soon be used in restocking operations to strengthen natural populations. This species not only symbolises our dedication to the conservation of rare and endemic species but also represents our active commitment towards a sustainable and aware future for the biodiversity of our territory.

Tell us a little about your seed conservation team, facilities and current activities.

The Maiella Seed Bank team consists of botanists, technicians, and volunteers dedicated to the conservation of native and rare plant species. The Maiella Seed Bank is part of the Plant Biodiversity Conservation Center, which includes the "Michele Tenore" Botanical Garden, the "Daniela Brescia" Botanical Garden, the native plant nursery in Sant'Eufemia a Maiella, (where species reproduction through seeds and cuttings takes place), and the park's herbarium. We currently manage about 500 different accessions in our database, ensuring that each seed collected from the field undergoes rigorous vitality and germinability tests, followed by drying and long-term conservation.

Our activities are not limited to conservation alone; the Maiella Seed Bank also serves as a research centre focused on the ecology of germination and the development of specific germination protocols. These studies are crucial for better understanding and supporting the survival of at-risk species in their natural habitats. Additionally, we are actively involved in concrete projects such as the Life projects, which focus on both *in situ* and *ex situ* conservation measures to protect and enhance populations of protected plant species.

Furthermore, the Maiella Seed Bank is not just a repository of genetic material; it is also a place of training and education. We provide training and practical experiences in biodiversity conservation to students, doctoral candidates, and volunteers, enriching their educational paths and offering them valuable skills in the field of conservation. This educational role complements our scientific efforts, promoting a comprehensive approach to biodiversity preservation.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

Climate Change and Thermophilization: Thermophilization, the increase of heat-loving species at the expense of cold-loving (cryophilic) species, is a phenomenon already observed in the Maiella National Park through data from the GLORIA project. The challenge will be to monitor these changes to adapt seed collection and conservation strategies. It will be crucial to develop protocols that can ensure the survival of high-altitude cryophilic species, potentially through specific collections and ad hoc *ex situ* conservation projects.

Abandonment of Traditional Agricultural Practices: The abandonment of traditional agriculture and the expansion of forests at the expense of meadows and pastures negatively affect biodiversity in certain areas. The reduction of open meadows, essential for many plant and animal species, requires a concrete commitment to landscape management. The Maiella Seed Bank could collaborate with local authorities and agricultural communities to encourage sustainable management practices and landscape conservation that includes the maintenance of meadows and pastures through the promotion of agriculture compatible with biodiversity conservation.

Regulatory and Funding Issues: Changes in environmental policies and the availability of funding for conservation can directly impact the bank's activities. The need to adapt to new regulations or find alternative funding sources could represent a significant challenge.

Education and Community Engagement: Lastly, a major challenge will be to continue educating and involving local communities and society at large on the importance of biodiversity and seed conservation. Raising public awareness and developing educational programmes that promote active and participatory conservation will be crucial for the long-term success of conservation initiatives.

Staff of the Maiella Seed Bank out seed collecting.

Photos: Valter Di Cecco.

Collecting *Adonis distorta* at a high-altitude environment.

Plant Germplasm Bank of Pavia University

Contributed by Graziano Rossi and Andrea Mondoni

UNIVERSITÀ DI PAVIA
DIPARTIMENTO DI SCIENZE DELLA TERRA E DELL'AMBIENTE

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Tulipa sylvestris* L.

We would choose *Tulipa sylvestris* from North Italy where it was once very common in vineyard and wheat cultivation fields but is now in danger due to non-sustainable agriculture practices. The species is also under threat in northern Italy and Switzerland. Pavia Germplasm Bank is now studying the germination requirement in Piedmont, as without being able to find the correct temperature treatment …. no germination! How can we save and improve their natural populations? The studies go on, and we are collecting seed for new experiments.

Photo: Stefano Re (Pavia).

Tulipa sylvestris in flower.

Tell us a little about your seed conservation team, facilities and current activities.

Pavia Plant Germplasm Bank at Pavia University was born 20 years ago as part of the ENSCONET Project under MSB leadership. We are a small but proactive seed bank conserving seeds of both wild and crop (landraces) species since 2005. Currently we hold 4,500 accessions of 800 species, available for research and long-term conservation purposes. Our staff includes university professors, researchers, and a technician. In addition, most of the work is carried out by students as part of their lab training experience in plant conservation.

Photo: Micol Orengo.

Tulipa sylvestris seed pod and seeds.

What have you gained through being in a network of seed conservationists?

We started our activities through being part of a network, but also the seed bank design was possible thanks to the strong help from the MSB, particularly Simon Linington, who was very important for us, but also Robin Probert, Hugh Pritchard and many other people. Through networks we are able to keep up with the most up-to-date protocols, can take part in seed exchanges and duplications, and have opportunities for joint research. For example, the Italian CWR for many mediterranean plants like carrot, wheat, oat, apple, and barley with a worldwide project managed by the MSB in 2012–13.

Photo: Graziano Rossi.

Collecting *Triticum vagans*.

Seed Bank of the Department of Biology, University of Pisa

Contributed by Angelino Carta and Diana María Cruz Tejada

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Crocus etruscus* Parl.
Local name: Tuscan wild saffron

This is an endemic species to south-central Tuscany, exhibiting a reproductive phenology finely tuned with the Mediterranean macroclimate and the microenvironmental conditions (doi.org/10.1111/plb.12168).

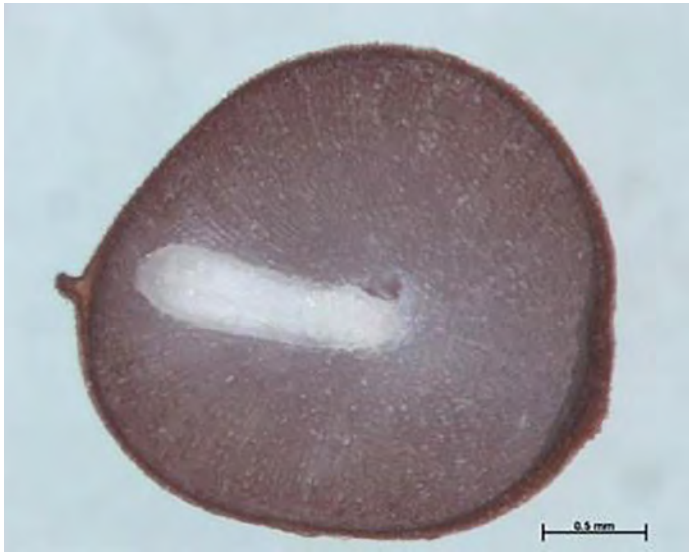


Photo: Angelino Carta.

Crocus etruscus seed.

Photo: Jacopo Franzoni.

Seed Bank Pisa team conducting field work on Elba Island, collecting seed and ecological data to support germination research and the conservation of Mediterranean species.

Tell us a little about your seed conservation team, facilities and current activities.

Our research brings together a multidisciplinary team of researchers and activities through collaborations with global institutions. We enjoy being part of an international community working toward the common goal of protecting plant diversity.

We combine laboratory experimental approaches and field work with phylogenetic comparative modelling to shed light on multiple topics, from fundamental science such as macroevolution (doi.org/10.1111/nph.20445) to applied research like seed longevity (doi.org/10.1017/S0960258524000291) and seed-based conservation policies (doi.org/10.1111/nph.70000). One of the most rewarding aspects of our work is the collaborative spirit of our team. As we look to the future, we are committed to bridging global scientific advances with local conservation actions.

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

Since starting seed conservation, we've learnt about the fascinating variation in seed form and function (doi.org/10.1093/aob/mcae099). One of the most important aspects has been understanding the incredible diversity in seed traits (e.g., from morphological features to light and thermal germination responses) and how these reflect the complex adaptations of plants to their environments. This knowledge could not be achieved without active global collaborations and it is essential to designing effective conservation and restoration strategies, especially in the face of climate change.

To this end, we are excited to expand our contribution to seed-based conservation under changing climates by current and future multidisciplinary global collaborations. One of our priorities is to continue developing MedGermDB, a unique database compiling high-quality germination data for Mediterranean species (doi.org/10.1111/avsc.12771). We aim to strengthen its role as a reference tool for scientists and practitioners, supporting restoration projects across Mediterranean ecosystems globally. We also aim to bring together evolutionary insights and functional understanding to advance seed biology, improve international collaboration, and enhance links between research, policy and practice (doi.org/10.1111/nph.70187)

The Norwegian National Seed Bank, Natural History Museum, University of Oslo

Contributed by Kristina Bjureke

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Arnica montana* L.
Local name: Solblom

A very difficult question. For us, all seeds of endangered plants in Norway are important. I choose *Arnica montana,* as it is a plant that I have devoted many years of my life to studying and creating management plans for. In older botanical literature for Norway, it is mentioned as abundant on hayfields and pastures. When agriculture began to modernise, around 1950, with artificial fertilisers, tractors and sown grasses, it began to decline. Now it has completely disappeared from urban areas and from sparsely populated areas where overgrowth is a problem. The species is assessed as Critically Endangered in the Norwegian Red List of Species 2021. We have many collections of *A. montana* from its entire distribution across Norway in our national seed bank, and the germination tests show that they are of good quality. The seeds are orthodox and have about the same germination rate after ten years of storage in the freezer. The seeds germinate easily when sown in seed trays, but the species is vulnerable at the pricking out stage. As with many other endangered Norwegian species, we want to have a living population outdoors in our botanical garden to showcase the species to the public and use in education. *A. montana* is a beautiful plant species and the image shows its seeds in our seed bank. It has now become a symbol of unfertilised hayfields characteristic of traditional farming here in Norway.

Photo: Karsten Sund, Natural History Museum, UiO.

Arnica montana seeds.

What piece of advice would you give to someone starting their seed conservation journey?

You start the most important journey of your life! Collaboration is extremely important. Work together with other botanical gardens or institutes in the country in order to cover the entire country. Collaboration with NGOs, like botanical associations, is very important.

Tell us a little about your seed conservation team, facilities and current activities.

Our seed bank is located in the historic greenhouse Palmehuset in the middle of the Botanical Garden of Oslo. It consists of two rooms plus a small cold room maintained at 15% RH. All six botanical gardens in Norway collaborate on seed collection and *ex situ* conservation. All seeds to be preserved in the national seed bank are sent to us in Oslo, and we are responsible for cleaning and counting the seeds, for conducting germination tests and for documentation in our database.

We started cautiously around 2010, but did not really get going until 2012 after two employees took a course at the MSB. Our work follows the seasons. From June to October, we collect seeds of endangered Norwegian plants. At the end of October, two of our horticulturists start cleaning and counting the seeds. Just before Christmas, we check the moisture content of the year's seeds and package them in foil bags. They are then left in the freezer for at least a month before we begin germination testing.

Next year we will conduct seed germination tests every Wednesday. In the spring, we will plan which areas and species we will focus on collecting and apply for the necessary permits if any of the species grow in nature reserves.

Every year I apply for funding from the Environmental Agency to finance part of our activities. We need at least one more person to work permanently in our seed bank and we need long-term funding.

Photo: Kristina Bjureke.

Eirin Bruholt, left, and Liv Aarvoll, right, working on seed germination testing.

Photo: Karl-Erik Solum.

Tor Mjaaland, left, and Kristina Bjureke, right, collecting fruits from *Hedlundia neglecta* in Norway.

Photo: Kristina Bjureke.

Tor Mjaaland climbing the cliffs hunting for fruits of *Hedlundia neglecta*.

Al. Borza Botanic Garden, Babeș-Bolyai University, Cluj-Napoca, Romania

Contributed by Mihai Pușcaș

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Hieracium vranceae* Mráz

If I had to choose a single species to represent our seed conservation work, I would choose *Hieracium vranceae* Mráz. This species is endemic to the Carpathians and is known only from two isolated rock outcrops in the Eastern Carpathians, within a very narrow range in the Vrancea Mountains.

Described only recently, in 2019, *H. vranceae* stands out not just for its limited distribution, but for its phylogenetic importance. It is one of the very few known diploid sexually reproducing species, in the genus *Hieracium*, which is otherwise dominated by apomictic and polyploid taxa. In this context, the discovery of such a rare diploid species is crucial for understanding the evolutionary history of the genus.

The Carpathian Mountains are well known as evolutionary centres and refugia for Hieracium, and the identification of *H. vranceae* reinforces the region's status as a hotspot of both biodiversity and genetic distinctiveness.

Therefore, *H. vranceae* is not only a botanical rarity, but a symbol of genetic heritage, of the deep evolutionary processes that shape plant diversity, and of the urgent need to conserve not just species, but the evolutionary legacy they represent.

Photo: Mihai Pușcaș.

Hieracium vranceae conserved *ex situ* in A. Borza Botanic Garden (Cluj-Napoca, Romania).

Photo: Pavel Dan Turtureanu.

Seeds at the A. Borza Botanic Garden.

Tell us a little about your seed conservation team, facilities and current activities.

Our team consists of four biologists and three plant researchers, actively engaged not only in the field collection of seeds using standardised protocols, but also in long-term storage of seeds under controlled temperature and humidity conditions.

Our primary focus is the conservation of Romania's native flora, with a particular emphasis on the Carpathian Mountains, a region of exceptional botanical and evolutionary significance. Through our work, we aim to safeguard the genetic diversity of wild plant species by integrating scientific rigor with practical conservation strategies.

Photo: Pavel Dan Turtureanu.

Liliana Jarda (biologist PhD) and Anca Șuteu (curator of seed collection and seed bank) in A. Borza Botanic Garden.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

Over the next 25 years, we anticipate several key challenges in our seed conservation effort.

One of the most pressing will be the accelerating human impact on natural ecosystems, which may not only threaten the habitats of many native species but also alter seed viability, phenology, and regeneration cycles, making collection efforts more complex and time sensitive. To this end we have collected seeds from a wide range of wild plant species, many of which are valuable from ecological, genetic, or cultural perspectives. However, the collections we consider most important are those that contribute directly to the *ex situ* protection of endemic and highly vulnerable species, particularly those threatened by the rapid changes of the Anthropocene. By conserving these seeds under controlled conditions, we not only preserve their genetic material for future restoration or research, but also honour our responsibility to protect the most fragile components of Romania's native flora, with a special focus on the Carpathian region.

Another challenge will be ensuring the long-term sustainability of our conservation infrastructure. Maintaining controlled seed storage facilities over decades requires consistent funding, institutional support, and ongoing investment in equipment, training, and data management. Securing these resources in a shifting economic and political context may become increasingly difficult.

University Botanic Gardens Ljubljana

Contributed by Blanka Ravnjak and Jože Bavcon

Botanični vrt Univerze v Ljubljani
215 let
University Botanic gardens Ljubljana

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Pastinaca sativa* var. *fleischmannii* (Hladnik) Burnat
Local name: Flajšmanov rebrinec

We would choose seeds of the species *Pastinaca sativa* var. *fleischmanni*. *Pastinaca sativa* var. *fleischmanni* is a Slovenian endemic plant, which was discovered in Ljubljana on the castle hill in the first half of the 19th century. In the second half of the 19th century, the species disappeared from nature, but thankfully, before that it was brought to the University Botanic Gardens Ljubljana by the gardener Andrej Fleischmann, after whom it is named. Since then, the only living population of this species is growing in the University Botanic Gardens Ljubljana. So, this is an example of long-term *ex situ* conservation. We have also re-populated a few specimens in the courtyard of the Ljubljana Castle.

Pastinaca sativa var. *fleischmanni*.

What piece of advice would you give to someone starting their seed conservation journey?

Our advice is that when collecting seeds and designing a seed bank, classical knowledge of systematic botany, plant ecology and traditional seed collection knowledge that farmers once had, must all be combined. It is important to know how to correctly collect seeds at the right time and to store them properly, because their survival depends on successfully germinating seeds. Nowadays, even modern devices cannot completely replace traditional knowledge.

Tell us a little about your seed conservation team, facilities and current activities.

Our seed conservation team consists of three people, two of whom have a PhD and mainly collect seeds of plant species in the wild. The curator of the collection makes seed collections in the botanical garden, takes care of drying, cleaning and storing the seeds, and organising the seed bank database. In winter, gardeners and volunteers help clean the seeds. The seed bank consists of a dry room and a freezing chamber for permanent seed storage, where only autochthonous plant species collected in the wild are stored at -20°C. Currently, there are a total of 20,000 accessions in the seed bank. We have collected seeds of over 3,500 plant species, and a total of over 900 autochthonous species, which is 26% of the Slovenian flora.

The permanent seed bank.

Photos: Archive of University Botanic Gardens Ljubljana.

Top left: botanist Blanka Ravnjak, bottom left: botanist Jože Bavcon, right: curator Janja Makše.

Aranzadi Science Society

Contributed by Maddi Otamendi Urbiztondo

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Galium arenarium* Loisel.
Local name: Itsas ziabelarra

Undoubtedly, the seeds of *Galium arenarium* Loisel. (Common name in basque: "itsas ziabelarra", which translates to sea urchin in English) are one of the best representatives of our activities. This plant is native to secondary dunes, also called white, mobile, or semi-fixed dunes. It is an endemic taxon of the southwestern Atlantic coastline of France, reaching its absolute southern distribution limit on the eastern coastline of the Basque Country. In the Iberian Peninsula it is only known from the sandy beaches of a single area, as it has disappeared from the Guipúzcoa beach of Orio. Historically, there are only ancient references to this plant in more easterly locations, such as San Sebastián and "Cabo Higuer" in Hondarribia, where the dune ecosystems have now completely vanished.

In the winter of 2014, due to a strong sea storm, all the patches in the front of the dune disappeared, with only those located at the river's edge surviving. Previously, several seed collections had been stored in the Vegetal Germplasm Bank of the Provincial Council of Gipuzkoa, and since germination and cultivation protocols had been developed, we were able to get to work on plant production. Within the LIFE ARCOS project, and in collaboration with the Provincial Council of Gipuzkoa, different activities have been carried out for dune restoration, including the planting of *G. arenarium* plants in the front of the dune.

Photo: Maialen Arrieta.

Galium arenarium plant.

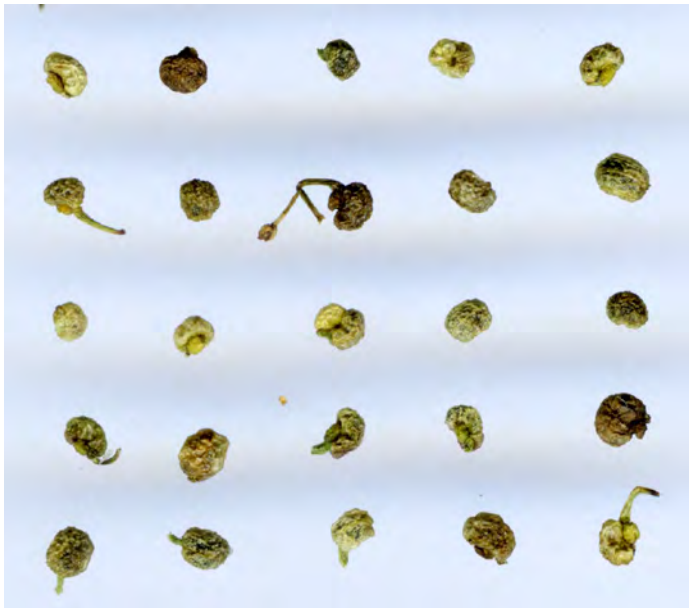


Photo: Maddi Otamendi.

Galium arenarium seeds.

Tell us a little about your seed conservation team, facilities and current activities.

The seed conservation team of Aranzadi Science Society has worked on the conservation of different species of the Basque Country and surroundings since 2008, managing the Vegetal Germplasm Bank of the Provincial Council of Gipuzkoa. Nowadays, thanks to funding from the Basque Government and the Provincial Councils of Gipuzkoa, Bizkaia and Araba, 50% of the protected plants of Basque Autonomous Community are conserved and we are working on germination and cultivation protocols of those species and others. In addition, we are part of REDBAG (Spanish Seed Bank Network) and ENSCONET (European Native Seed Conservation Network) and have collaborated with Kew's MSB on several projects, such as the *ex situ* conservation programme for the Pyrenees flora (WESTPYR) and Pyrenes and Cantabrian mountains seed collecting and research (PYRCANSEED).

Currently, we are collaborating on projects such as ConservePlants (European Cooperation in Science and Technology action) and the national strategy for the conservation and use of crop wild relatives and wild plants for food use. We also collaborate in a programme to collect and preserve seed accessions of Spanish species of protected flora. Additionally, we have led the PRIOCONEX project, whose objective has been to develop a methodology to catalogue species that present taxonomic uncertainty or high vulnerability to climate change, incorporating adaptive and genomic studies (both inter- and intra-population) as criteria for defining *ex situ* conservation priorities at the population and species level.

Photo: Aranzadi Science Society.

The Botany Department team of Aranzadi. Front row from left to right: Mari Azpiroz, Maddi Otamendi, Yoana García. Back row from left to right: Anaïs Mitxelena, Maialen Arrieta, Ana Irene Garcia, Mikel Etxeberria, Luzia Urkiola.

What have you gained through being in a network of seed conservationists?

Being in a network of seed conservationists, we have had the opportunity to exchange knowledge and best practice with experts in the field and laboratory, which has broadened our skills and perspectives on conservation techniques. Additionally, being part of this community has provided us with a sense of shared purpose and collaboration, knowing that together we are working towards safeguarding plant species for future generations. It's also given us access to valuable resources and networks that support and amplify our work in seed conservation. Finally, throughout this journey, we have had the opportunity to meet exceptional individuals with whom it is always an honour to collaborate.

Sóller Botanical Garden

Contributed by Magdalena Vicens-Fornés

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Euphorbia margalidiana* Kuhbier & Lewej.

Photos: © Archive of the Sóller Botanical Garden.

Euphorbia margalidiana seeds.

It would be the seed of *Euphorbia margalidiana*. These seeds were the first accessioned into our seed bank at the Sóller Botanical Garden. They represent the beginning of our conservation efforts and embody the essence of our work: preserving unique island plants that are often overlooked, yet irreplaceable.

This plant, endemic to the tiny offshore islet of Ses Margalides on the northwestern coast of Ibiza, is a symbol of both botanical rarity and the urgent need for *ex situ* conservation.

E. margalidiana is known only from this isolated, wave-battered outcrop of limestone – making it a single-islet micro-endemic, and one of the most geographically restricted plant species in the Mediterranean Basin.

This seed is far more than a unit of future regeneration. It is a living symbol of our mission: to protect the genetic heritage of rare, endemic, and threatened plants from the Mediterranean islands. It was chosen deliberately, early in the foundation of the garden, to reflect the fragility, uniqueness, and ecological importance of insular flora.

E. margalidiana is listed as Critically Endangered (CR) on the IUCN Red List, with a global population estimated at fewer than 250 mature individuals and an area of occupancy of less than 0.01 km². Though the islet is legally protected and uninhabited, the population remains vulnerable to stochastic events, erosion, and the unpredictable effects of climate change.

Choosing the seed of *E. margalidiana* is choosing to stand for all plant species that persist on the edge – botanical survivors that are irreplaceable, evolutionarily unique, and often overlooked because of their remoteness. This seed represents a story of isolation, adaptation, and resilience, and above all, the hope that even the rarest of species can be safeguarded for the future with care, science, and long-term commitment.

Tell us a little about your seed conservation team, facilities and current activities.

The conservation team consists of four people: the curator and the three horticultural technicians. We usually also have a part-time laboratory technician.

I am the Curator, responsible for maintaining the seed bank, the living plant collection, and the herbarium. The horticultural technicians take care of the living collections in the garden and carry out fieldwork to collect and replenish seed accessions for the seed bank. The laboratory technician supports seed processing, germination testing, and data management.

Seed collecting of *Euphorbia margalidiana* in the wild islet of Ses Margalides (Ibiza)

The Sóller Botanical Garden conservation team.

The Sóller Botanical Garden seed bank seed storage facilities.

What are the best improvements you have made to your seed conservation facilities since you started?

One of the most significant improvements has been the implementation of a digital database system to manage the collection data more efficiently, improving traceability and access to information. We also upgraded our database to a more modern and shared platform, which is now connected with the MSB and many other botanical gardens worldwide, greatly enhancing data accessibility and collaboration.

Additionally, we improved our seed cleaning and processing equipment and developed a protocol for prioritising endemic and threatened species, especially from island habitats.

These changes have increased the quality, security, and scientific value of our seed collections. To anyone else who is looking to start their own seed conservation journey, my advice would be to start small but be rigorous. Even a single collected seed represents an entire genetic legacy, so treat it with care. Learn from both traditional knowledge and scientific protocols. And remember that you are not just storing seeds, you are safeguarding the future of species, ecosystems and cultures as well.

Finally, I would like to see the MSBP continue strengthening its role as a global reference hub for plant conservation. It would be valuable to further develop shared tools for database management and viability testing, and to promote more joint projects on threatened endemics, particularly those restricted to fragile ecosystems.

Banco de Germoplasma Universidad Politécnica de Cartagena (Banco de Germoplasma UPCT)

Contributed by María José Vicente Colomer

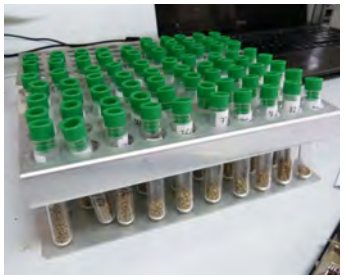
If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Astragalus nitidiflorus* Jiménez & Pau
Local name: Garbancillo de Tallante

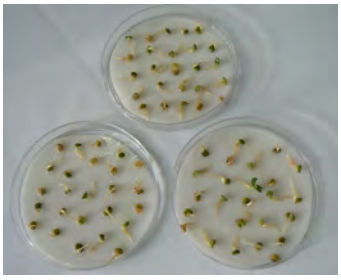
We selected the species *Astragalus nitidiflorus*, commonly known as "garbancillo de Tallante", which translates to Tallante chickpea. This is an endangered plant species endemic to the Cartagena area (Murcia), with its only natural metapopulation being located near the towns of Tallante and Los Puertos de Santa Bárbara, to the west of Cartagena. After nearly a hundred years without any recorded sightings, the species was rediscovered in 2004. Since then, the Technical University of Cartagena has been actively involved in its recovery and conservation.

Astragalus nitidiflorus plant.

Photos: Juan José Martínez Sánchez.



Individual collections of *Astragalus nitidiflorus* seeds.



Germination tests for *Astragalus nitidiflorus*.

Tell us a little about your seed conservation team, facilities and current activities.

Our seed conservation team is composed of Professors Juan José Martínez Sánchez, Encarnación Conesa Gallego and María José Vicente Colomer, all of whom belong to the Plant Production Knowledge Area within the Department of Agronomic Engineering at UPCT. In addition, we all carry out our research activities at the Plant Biotechnology Institute of the UPCT, where the facilities of the Germplasm Bank are located.

The UPCT Germplasm Bank was established in 2001 within the framework of various research projects, led by groups from the Department of Agronomic Engineering. These projects focus on the use and conservation of wild plant genetic resources, whether for ornamental, nutritional, or biological purposes, with special attention to threatened endemic species.

Currently, the Germplasm Bank holds around 800 accessions from over 60 different plant families and continues to expand its collection through field campaigns aimed at gathering native plant material, with a particular focus on endangered species.

UPCT Germplasm bank.

Photo: Mayra Aguado López

What's the most important seed collection you've made and why?

The most important seed collection we have carried out corresponds to the species *Cistus heterophyllus* subsp. *carthaginensis* (Pau) M.B. Crespo & Mateo, commonly known as the Cartagena rockrose. It is considered the most endangered plant species in Spain and one of the most threatened in Europe. In 2018, the Spanish government officially declared it to be in a Critically Endangered state, making it the only plant species (along with six animal species) included in this category at the national level.

Since 2017, the Polytechnic University of Cartagena has been actively working on its conservation through a combined strategy of *in situ* and *ex situ* actions. The *ex situ* efforts include the collection and preservation of seeds in germplasm banks and cultivated plant collections, as well as the propagation of germplasm for later reintroduction into natural habitats.

Within the framework of these recovery projects, seed collection has been a key activity. It has made it possible to restore the genetics of the species – which had been seriously compromised by hybridisation with *Cistus albidus*, a more common rockrose in the area – and increase the number of Cartagena rockrose individuals in the wild, as well as expand its distribution area.

Photo: Francisco Alcalde Acien.

Cartagena rockrose – *Cistus heterophyllus* subsp. *carthaginensis*.

Gothenburg Botanical Garden

Contributed by Stina Weststrand, Mats Havström and Sara Ulriksson

BOTANISKA
GOTHENBURG BOTANICAL GARDEN

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name *Eryngium maritimum* L.
Local name: Martorn in Swedish and sea holly in English

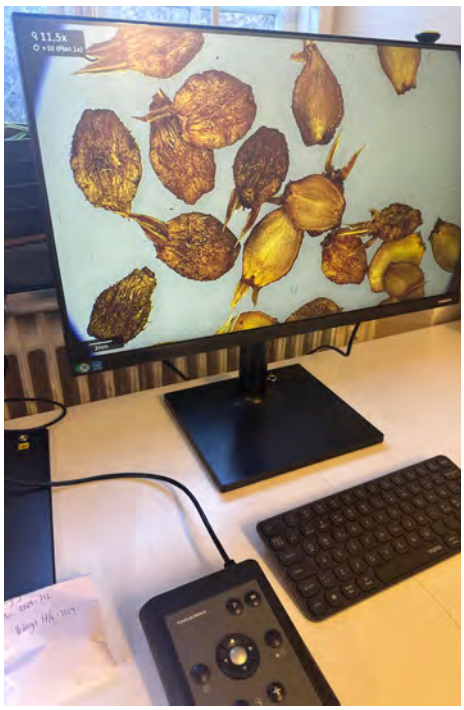
During the last ten years, Gothenburg Botanical Garden has been working together with the County Administrative Board in West Sweden on an integrated conservation project on, among other regional threatened plants, the sea holly *Eryngium maritimum*. In these projects where *in situ* and *ex situ* conservation is combined, seeds are collected from populations in the wild, banked and sown. The seedlings are later brought back to the wild to reinforce the natural populations.

Eryngium maritimum grows on sandy beaches on the islands in the archipelago of Gothenburg.

Tell us a little about your seed conservation team, facilities and current activities.

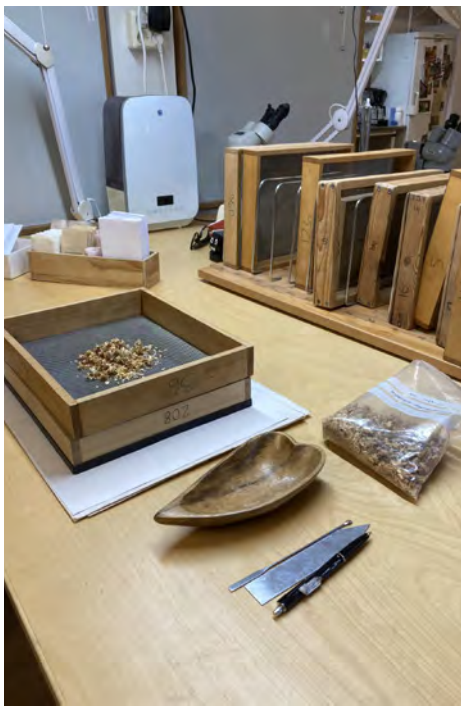
Seed conservation is a new chapter for Gothenburg Botanical Garden, and we have recently started to build up our seed banking facilities with a primary focus on the regional threatened flora.

Seed handling and cleaning have been part of the garden's expertise since the beginning, but we are now very excited to add seed conservation to this work. We recently got an incubator and a microscope camera and are now very keen on continuing to learn about relative humidity, germination testing, and also to develop protocols and add the aspect of seed availability for nature restoration projects.



Seeds of *Eryngium maritimum* through the microscope in the seed lab.

Sowing of *Eryngium maritimum*.



Seed cleaning in progress.

Photos: Stina Weststrand.

Photo: Sara Ulriksson.

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

To continue the development of the seed conservation facilities and the seed team in Gothenburg, to safeguard primarily the regional flora, but also to put this work in a broader context and work with conservation of the wild Nordic flora as a whole. This work should be done in collaboration with partners, both regionally and abroad.

We also look forward to being able to dive into the beautiful world of seeds and all the different aspects that come with it. From getting to know the plants in their natural habitat, to the seed cleaning process, germination testing and the sight of sprouting seedlings. This is one of our favourite things about seed conservation.

Eryngium maritimum in the wild.

Photo: Mats Havström.

Lincolnshire Wildlife Trust

Contributed by Tammy Marie Smalley

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Populus nigra* L.
Local name: Black Poplar

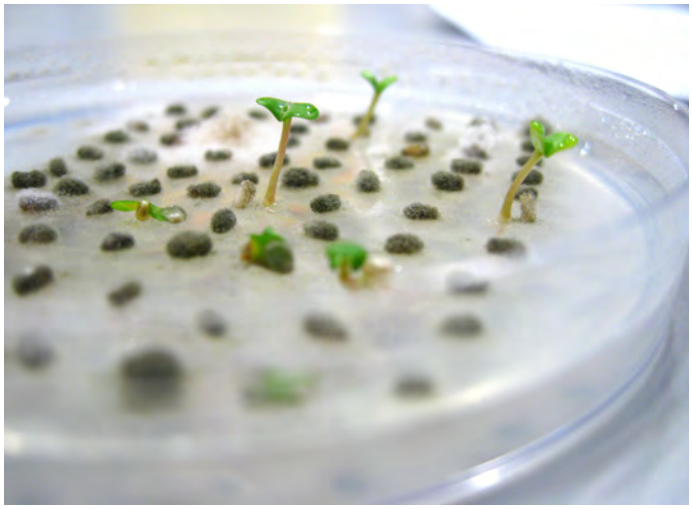


Photo: RBG Kew.

Germinating black poplar seeds.

Tell us a little about your seed conservation team, facilities and current activities.

Lincolnshire Wildlife Trust hosts the national network of Seed Bank and Plant Propagation linking all the relevant Wildlife Trusts in the UK and the MSB team. We hold virtual meetings to discuss issues, and to share knowledge and best practice. We also meet in-person once a year, in June, at one of the partners' facilities to build resilience within the network. In-person meetings truly got underway in 2023, once Covid restrictions were fully lifted, when we visited the MSB. Then, in 2024, we met at Cumbria Wildlife Trust, in the north of England. In June this year, we met in Cheshire. Each host of these face-to-face meetings provides a tour of their facilities and invites local experts and volunteers to share their experiences and undertake field site visits to discuss all things botanical.

We are also currently developing a joint funding bid which we hope to submit later this year. The funding will include capital to upgrade or build new seed banks, to support partners within the network to build capacity in areas such as genetic investigation, and to jointly develop materials describing our approach which we plan to share widely.

Annual face-to-face field visit, Cumbria 2024.

Wilder Humber new Seed Bank & Plant Propagation area construction, Lincolnshire Wildlife Trust, 2024.

Photos: Tammy Marie Smalley, Lincolnshire Wildlife Trust.

What have you gained through being in a network of seed conservationists?

Through establishing this national network, I have personally gained a much deeper understanding of the need for safeguarding our flora within the UK, particularly the need to maintain genetic diversity within a species so it may adapt and persevere as the climate and environment change. The impact of the network to our Trust in Lincolnshire has been great in that it has informed the design and build of our first seed bank, which includes plant propagation facilities. Funded by Ørsted, a leading green renewable energy company, our new facility launched in the spring of 2025 as part of the Wilder Humber, our seascape restoration project, in partnership with Ørsted and Yorkshire Wildlife Trust (https://www.lincstrust.org.uk/what-we-do/conservation-projects/wilder-humber). The project will focus on coastal species from habitats such as saltmarsh and sand dunes. The knowledge and joy I have gained from coordinating this network is truly wonderful; long may it continue alongside all the fabulous work the MSB undertakes.

Millennium Seed Bank, Royal Botanic Gardens Kew

Contributed by Elinor Breman, Alice Hudson, Charlotte Lusty and Tim Pearce

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Leucospermum conocarpodendron* subsp. *conocarpodendron*
Local name: Grey Tree Pincushion

Through a collective staff vote, the MSB has chosen *Leucospermum conocarpodendron* subsp. *conocarpodendron.* We chose this species as it shows how remarkable seeds are – that even without optimal conditions – they can survive the test of time. In 1803 a Dutch ship was captured by the British whilst returning from South Africa, and a leather wallet, along with other documents from the ship were transferred to the Tower of London and later the National Archives. The leather pouch containing the seeds was rediscovered in 2005 and sent to Kew. The seeds were investigated by germination specialists at the MSB who were able to germinate some after their 200 years of storage. This is one of the resulting species, brought back to life. The colonial origins of these seeds, having been originally taken from South Africa without permission, also act as a reminder of the work we have to do within RBG Kew to create a fairer and more inclusive future.

The resulting seedling from the germination test was grown on in the MSB glasshouse until it flowered and its identification confirmed. Due to the rarity of this species, a member of staff from the MSB worked with colleagues from the South African National Biodiversity Institute (SANBI) to identify the potential source population and revisit it. Whilst none of the original seeds from the leather wallet remain at the Millennium Seed Bank, a seed collection was made by SANBI in 2008. This new collection is maintained at SANBI with part duplicated at the MSB.

Photo: Wolfgang Stuppy.

Leucospermum conocarpodendron subsp. *conocarpodendron* flowering.

Tell us a little about your seed conservation team, facilities and current activities.

Opened in 2000, the MSB currently holds almost 2.5 billion seeds from over 40,000 wild plant species. This has been achieved through the collaborative effort of over 275 partners from 100 countries and territories globally who have undertaken seed collecting activities throughout the last 25 years.

Over 70 staff currently work at the MSB. Everyone plays a vital role in the functioning of the MSB, be that managing the global partnership and projects, caring for the seeds stored here, researching the properties of seeds that influence their storage and survival, or keeping the building running.

Current activities include projects focusing on threatened and critically endangered species, including the Arcadia Threatened Biodiversity Hotspots and Conservation Without Borders projects, as well as work overcoming barriers to seed based restoration through the Western Global Tree Seed Bank: Unlocked (GTSB:U) programme and Native Seeds for Restoration in the UK. Research on tree species includes identifying and characterising short-lived orthodox tree seeds, analysing desiccation and freezing tolerance of recalcitrant seeds and pollen, and assessing seed tolerance to stresses such as heat and drought during germination through the GTSB:U project. In addition, innovative research on UK native tree seeds is exploring the use of plasma technology to break seed dormancy, and phenotyping technologies to predict germination and seedling outcomes from seed morphological traits, as well as assessing the climate resilience of germination at the population level. Supporting all the work we do is training, and in addition to continuing the MSB training courses we are developing a trainer certification scheme to extend our reach and broaden our collaborative work with partners.

Photo: Bethan Hobbs.

The MSB team.

What piece of advice would you give to someone starting their seed conservation journey?

Firstly, we know that thousands of people know very well how to keep seeds. They've been doing it for millennia in tending their gardens, fields and lands. The first thing to learn from this is that the way you keep seeds should be suited to the way you use them. There are methods that communities or families know that work for many purposes.

If there are reasons for keeping seeds on a large scale or for long-term, then be sure to consider in detail what they are and make sure that your approach is fit for purpose. Anything needing a long-term commitment will need long-term funding and facilities to suit.

Many people have written about how to conserve seeds over decades and much of it remains relevant. Some of the rules of thumb that we advise are:

- Your aim should be to conserve seeds better than what can be achieved through natural processes (e.g. in the soil's seed bank). Good quality seed is like water – it will evaporate or spill at every step. In other words, move quickly and carefully with the fewest steps necessary to get the seed to its final destination.
- Seed without associated information is not conservation
- Don't leave curation decisions to someone else
- Safety duplicate everything worth keeping
- Putting seeds in a cold place is never the goal. The goal is to put them back into nature.

National Botanic Garden of Wales

Contributed by Kevin McGinn

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Salsola kali* L.
Local name: Helys Pigog, Prickly Saltwort

That's a tough one, but we're going to nominate the Prickly Saltwort, Helys Pigog, *Salsola kali*. Vulnerable to extinction at the Great Britain level, this remarkable species thrives in one of the harshest environments, growing in the shifting, wind-blasted sands at the very front of coastal sand dunes, exposed to salt spray. As part of the MSBP's UK Threatened Flora Project, we made four seed collections from across Wales, ensuring we captured genetic material from multiple populations. At two collection sites, strong autumn storms buried the plants in sand just before we planned to collect, but we managed to make successful collections the following year. Despite the harsh habitat, the seed collectors certainly weren't complaining at the chance to visit beautiful sand dune systems! While it arguably may not be the most eye-catching plant, upon cut-testing the seeds, we were amazed to learn that Prickly Saltwort seeds have stunning green coiled cotyledons and embryos.

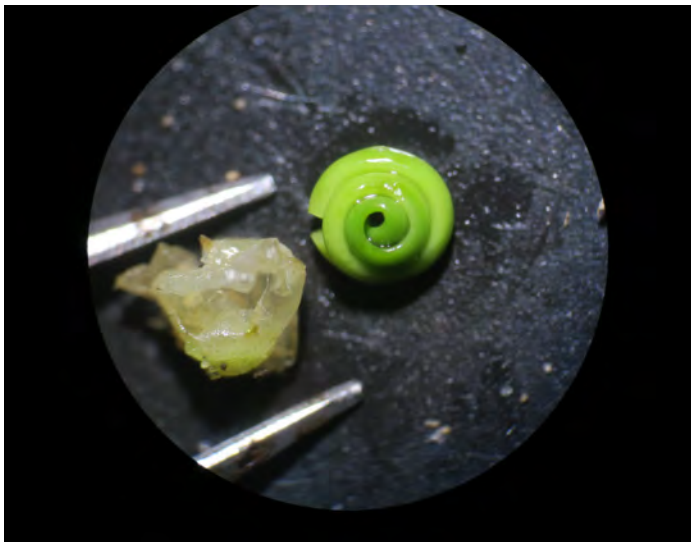


Photo: Kevin McGinn.

Cut-tested Prickly Saltwort seed.

What's your organisation's favourite thing about working in seed conservation?

It feels rewarding to be collaboratively making an impact on the conservation of the Welsh Flora, knowing that our seed collections are helping to safeguard species into the future. Seeing plants from our germination tests being grown by our horticulturist colleagues is very exciting, and the fieldwork is of course very fun! We're already seeing a positive impact, such as supporting *in situ* conservation efforts like the reintroduction of the endangered Shore Dock (*Rumex rupestris*) to a South Wales site in 2024: https://naturalresources.wales/about-us/news-and-blogs/news/endangered-coastal-plant-reintroduced-to-south-wales-conservation-area

Tell us a little about your seed conservation team, facilities and current activities.

Founded in 2018, two labs in the Science Centre at the National Botanic Garden of Wales are home to the National Seed Bank of Wales. These labs are equipped for the long-term conservation of orthodox seeds. Training and expert guidance from the MSBP were invaluable in establishing our facility.

Our focus is the Welsh flora, and we collaborate closely with the MSBP's UK Seed Banking team, contributing to initiatives such as the UK Threatened Flora Project and UK Tree Seed Project. Half of each seed collection that we make is duplicated at the MSB. We now hold 9% of Wales' native and archaeophyte (anciently introduced) taxa, and 19% of Wales' threatened taxa, from Wales-origin collections. For species at risk, we take a meta-population approach, targeting multiple populations across different habitats to capture as much genetic diversity as possible.

Our seed bank team currently has two members of staff: Kevin McGinn is the Curator for both the Seed Bank and the Herbarium, while Ellyn Baker holds the role of Quentin Kay Research and Collections Assistant. Both work part-time on the seed bank, but they're supported by a wider team, including other staff and student placements, who regularly join in with fieldwork, seed processing, and lab work. To learn more about the Seed Bank and our wider work, visit: https://botanicgarden.wales/our-work/collections/seedbank

Photo: Kevin McGinn.

The National Botanic Garden of Wales laboratory with three scientists performing cut tests.

Steyning Downland Scheme

Contributed by Matthew Thomas

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Damasonium alisma* Mill.
Local name: Starfruit

We would choose Starfruit (*Damasonium alisma*) – the plant we are attempting to introduce to our pond.

Photo: Matthew Thomas.

Planting Starfruit.

Tell us a little about your seed conservation team, facilities and current activities.

A registered charity since 2009, we reconnect local people from all walks of life to 170 acres of the South Downs National Park, transforming it into a wildlife oasis where people of all ages can experience nature close to home, benefiting their mind, body and spirit. We create inspiring opportunities for anyone to join in, through active volunteering, engaging events and inclusive access.

Photo: Chris Cockel.

Starfruit seeds.

What is the most important thing you've learnt since starting seed conservation?

That re-establishing an extinct plant is difficult but worth it, and that engaging young people in a practical conservation project is our organisation's favourite thing. Over the next 25 years, Steyning Downland Scheme are looking forward to measurable improvements in attitudes and behaviours in the countryside, amongst the local community.

Photo: Steyning Downland Scheme.

Steyning Downland Scheme volunteers.

Retired botanist

Contributed by Tim Rich

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Deschampsia antarctica* É.Desv.
Local name: Antarctic hair-grass

I single-handedly collected the flora of an entire continent! During a holiday to Antarctica with my mother in 2006, I collected seeds of *Deschampsia antarctica* and *Colobanthus quitensis* with full consent and permits in place, for the MSB; these are the only native flowering plants in the Antarctic.

Photo: Kaitalin White.

Deschampsia antarctica seed and floret collected by the Government of South Georgia and the Sandwich Islands.

Tell us a little about your seed conservation team, facilities and current activities.

My seed conservation team is made up of one, just me!

Photo: Judy Rich.

Collecting *Deschampsia antarctica*.

Photo: Naomi Rich.

Tim collecting *Hieracium substrigosum* in the Brecon Beacons.

What's the most important seed collection you've made and why?

Collecting the seeds of *Hieracium snowdoniense* on 8 August 2002, from the only known plant left in the world in Snowdonia. Two ripe seed heads were collected and the seeds grown on. This enabled the seed quantity to be bulked up and importantly, be used for reintroductions. We subsequently found two more wild plants that were undiscovered at the time! I have gained a real sense of my important contribution to plant conservation through this work, and see a challenge in the transfer of expertise from my generation to the next generation of botanists.

True Harvest Seeds

Contributed by Deborah Gillies

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Leucanthemum vulgare* Lam.
Local name: Oxeye Daisy

That's easy – *Leucanthemum vulgare*! We call the seed "Stripey pyjamas" because of its stripes and it is like us because of the many voluntary hours of overtime done in pyjamas at various kitchen tables, both early in the morning and late at night, to keep the charity going!

Photo: True Harvest Seeds.

Leucanthemum vulgare.

What are you looking forward to over the next 25 years in your organisation's seed conservation journey?

Simple, just one thing – having the Irish flora recognised as an island flora in its own right.

The Irish flora is crying out to be protected from importation of the same species from overseas. Our flora is being hybridised with cheap imports and needs government legislation very quickly to protect it.

We will continue to concentrate on not only Schedule 8 species (plant and fungi species legally protected in the UK) but also popular species, safe in the knowledge that we have many of them already preserved.

We are building not only a seed bank, but a native Irish Plant Resource Centre where everyone, from students to school children to the general public from around the world, can receive specialist knowledge and training about our island flora.

Tell us a little about your seed conservation team, facilities and current activities.

True Harvest Seeds charity is run by a small team of three staff and three trustees. We currently operate from temporary buildings deep in the County Down coastal countryside and have submitted plans to build a dedicated seed centre here. We run a seed shop online, using the funds to make wild seed collections to add to our gene bank. We currently have around 370 accessions of around 320 species – the largest single seed collection of Irish flora in the world.

Photo: Chris Cockel, RBG Kew.

Leucanthemum vulgare seeds.

Photo: True Harvest Seeds.

The True Harvest Seeds Mascot at the Balmoral Show.

Oceania

Featured Partner locations.

The National Seed Bank (NSB) at the Australian National Botanic Gardens

Contributed by Gemma Hoyle

Australian National Botanic Gardens

Australian Government
Director of National Parks

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Viola improcera* L.G.Adams
Local name: Dwarf violet

We would choose *Viola improcera* (Violaceae), commonly known as dwarf violet, a pretty, perennial herb endemic to southeastern Australia. It grows at high elevations (1,300–1,800 m above sea level) in open shrubland and snow-gum woodland. It was severely impacted by bush fires in 2020 and was listed as Endangered under the Environment Protection and Biodiversity Conservation Act 1999, effective September 2023. Little is known about the reproductive ecology of *V. improcera*. However, the NSB have made several recent conservation seed collections, and have carried out extensive seed biology and ecology research including discovering it hidden in the subalpine soil seed bank.

Photos: ANBG.

Viola improcera seeds, seedlings and flowering plant.

What are the best improvements you have made to your seed conservation facilities since you started?

The greatest improvement to the NSB has been growing the team from one position 13 years ago, to six positions and 30+ dedicated volunteers in 2025. Flashy facilities or not, a multi-skilled, cohesive and collaborative team of folk who enjoy working together can get the job done!

Architectural image representing the National Seed Bank upgrade to the main entrance and laboratories.

Tell us a little about your seed conservation team, facilities and current activities.

Our purpose is to protect species against extinction and build knowledge of Australian plant species through integrated collection, storage and research of plant germplasm. We specialise in threatened and significant native species in and around the Australian Capital Territory (ACT), and across Australia's Commonwealth parks and gardens.

Our team consists of:
Dr Gemma Hoyle – Seed Scientist. Gemma is responsible for designing, carrying out and reporting on research projects. She's also currently acting as Manager.
Tom North – Curator. Tom leads the collecting programme, prioritising species for collection and coordinating field expeditions. He also runs the volunteer programmes.
Millie Stevens – Seed Testing Manager. Millie leads the seed testing and re-testing programmes.
Freya Brown – Project Officer. Freya conducts conservation and seed banking research.
Mitch Korda – Seed Collector. Mitch works to deliver NSB collection targets and assists the Curator with collection trip planning and logistics.
Pip Alvarez – Technical Officer. Pip supports the Seed Retesting Programme and research projects.

Current activities include:
- Banking threatened grassy ecosystem species of the ACT and surrounding areas.
- Researching germination strategies of subalpine species affected by the 2019/20 bushfires.
- Working with First Nations' Peoples to explore opportunities for two-way science and knowledge sharing.

The NSB facility has been undergoing significant upgrade works this year to include larger seed storage capacity, increased research capability and improved accommodation for staff and volunteers. This expansion is largely thanks to Dr Lydia Guja who was the NSB manager 2012–2024.

Top row from left to right: Mitch Korda, Pip Alvarez and Millie Stevens. Bottom row from left to right: Freya Brown, Tom North and Gemma Hoyle.

Western Australian Seed Centre, Kings Park

Contributed by David Merritt

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Calandrinia polyandra* Benth. (synonym of *Parakeelya polyandra* (Benth.) Hershk.)

These tiny sparkling seeds of *Calandrinia polyandra* (Montiaceae), a succulent annual that brings colour to the harsh desert of Western Australia. They represent the optimism associated with seed banking and future possibilities that seeds, and the investments in seed banking, provide!

Photo: Dr. David Merritt.

Parakeelya polyandra seed.

Tell us a little about your seed conservation team, facilities and current activities.

The Western Australia (WA) Seed Centre, Kings Park, is located within the Biodiversity Conservation Centre at Kings Park and Botanic Garden, Perth, Western Australia. Seeds are banked for a range of purposes including for the conservation of WA's flora, the management and restoration of urban bushlands, the propagation of plants for display in the WA Botanic Garden, and for plant breeding and scientific research.

Seed collection and banking started in the early 1960s and has since evolved significantly. Today, seed conservation, research and activities are guided by Kings Park's *ex situ* Conservation Strategy, responding to pressing issues impacting WA's plant biodiversity including loss of habitat, changing climate, diseases such as myrtle rust and dieback, and invasive species. Approximately 14,000 accessions of 4,000 species are stored in the seed bank.

The facility is equipped with advanced infrastructure including a seed cleaning room and associated equipment, digital x-ray cabinets, more than 20 climate-controlled incubators, walk-in seed drying rooms (15°C and 15% RH), a -20°C seed storage vault, cryogenic storage facilities, and tissue culture laboratories. Supporting facilities include conservation genetics and plant physiology labs, and extensive nursery facilities supporting the botanic garden.

Our team includes a full-time seed collector and part-time supporting staff for seed processing and testing, a senior research scientist, post-doctoral scientists, and Higher Degree by Research students. Their applied research supports plant conservation and ecosystem restoration. Research focuses on seed storage behaviour and longevity, the ecology and physiology of seed germination, and the development of technologies to enhance seedling establishment for ecological restoration and threatened species management.

What challenges do you see arising in your organisation's seed conservation journey over the next 25 years?

Scale and diversity are our biggest challenges. Western Australia's plants and ecosystems face growing threats, including habitat loss, changing climate, and biosecurity issues. We must accelerate *ex situ* conservation, developing programmes to respond to these challenges, including through greater focus on increasing the quality and genetic representativeness of the collections.

The effective and evidence-based curation and development of our seed collections is also an ever-increasing challenge as the size and diversity of the collections grows and ages. Our challenge is to better leverage the scientific and horticultural expertise, and the public education opportunities within the botanic garden so our *ex situ* collections can support the conservation of our unique and threatened flora at the scale required, using the garden to promote greater community awareness of biodiversity loss and conservation issues.

Developing a prioritisation framework of collections is critical to these objectives, as with more than 12,000 plant species and a need to increase genetic representation and maternal line collections, we need to approach species collections in a strategic manner.

Our research continues to explore seed storage behaviour, including identifying shorter-lived or non-orthodox seeds. This requires greater use of cryostorage and integration of other germplasm types, such as tissue culture and nursery living collections, with seed bank collections.

To meet these goals, we must enhance the resourcing and curation of our collections, infrastructure and associated data. Improved use of, and access to our collections will support conservation, restoration, display, research, and education objectives.

The Australian PlantBank, Botanic Gardens of Sydney NSW Australia

Contributed by Cathy Offord

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Wollemia nobilis* W.G.Jones, K.D.Hill & J.M.Allen
Local name: Wollemi pine

Wollemia nobilis, known as the 'Wollemi pine', is a conifer species which grows in temperate rainforest in a world heritage national park near Sydney, Australia. Once common in the Cretaceous period, the remaining small stands of this large tree escaped discovery until 1994. Today there are fewer than 100 individuals of this species left in the wild. Due to its rarity and iconic status, this was the only plant species in the state of New South Wales (NSW) to have its own fire abatement plan, which was enacted in the 2020 Black Summer fires that consumed more than ten million hectares of wild habitat in one event. This species was very nearly lost in this fire, but the majority of plants were saved by fire-fighting efforts. In the decades since its discovery, efforts by the Botanic Gardens of Sydney have focused on establishing the diversity of this species *ex situ*, in our seed bank, and in living collections around the globe. Initially, seed collecting was very limited as the trees in the wild produced few cones which could only be harvested by helicopter. Initial seed collections were banked in our seed bank and at the MSB. Following breakthroughs in our understanding of the genetic diversity of the plants held *ex situ*, seeds from these trees are being used to re-establish this species in various wild locations in translocated populations.

Tell us a little about your seed conservation team, facilities and current activities.

The Australian PlantBank is located at the Australian Botanic Garden, on the outskirts of the Sydney metropolis, in one of three gardens of the Botanic Gardens of Sydney (BGS). The seed vaults are at the heart of this purpose-built hub that services the conservation needs of the state of NSW. Our remit is to work with the 7,000 species of NSW, around ten percent of which are currently listed as at risk of extinction. While BGS has had a small seed bank since its establishment in 1816, seed banking accelerated from 2004 when we joined the MSBP. The Australian PlantBank opened in October 2013 and has design features like the MSB, including public viewing of the vaults and work areas.

While our collection and curation work focuses on capturing the diversity of orthodox species across the state, we have research programmes aimed at understanding seed storage biology for a wide range of species with complex storage and growth needs. A current focus is on terrestrial and underground orchids, many of which require one or more biotic partners for growth post storage. Understanding seed storage behaviour of rainforest species is ongoing with a wide range of behaviours being observed and documented. Fire is a key feature in the Australian landscape, and we have programmes unlocking dormancy and fire response for fire-prone species. The Australian PlantBank has extensive laboratories and facilities for integrating other *ex situ* conservation methods for 'exceptional' species, including tissue culture, cryogenic storage of seeds, embryos and buds, as well as breeding programmes in the living collections to counter major existential threats to flora from myrtle rust and other diseases.


Photo: Sime Cottrell, Botanic Gardens of Sydney.

Processing *Wollemia nobilis* in the Australian PlantBank laboratories.


Photo: Glen Smith.

The PlantBank Team.

What's your organisation's favourite thing about working in seed conservation?

Seed banking is a highly collaborative process and we are all learning from each other. There are seed banks in each state of Australia each of which we have a partnership with, as well as other conservation organisations, through the Australian Seed Bank Partnership. There are regular get-togethers and meetings, and we have established an Australasian seed science conference format that is held every 3–4 years, including this year. Many of us don't just work on seeds in the bank, we also work on conservation of species in the wild including translocation into often very remote locations. We get to do some really cool projects, work with amazing people and get a great sense of achievement when we see the plants return to the wild.

South Australian Seed Conservation Centre (SASCC)

Contributed by Bradley Bianco

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Spyridium fontis-woodii* Kellermann & W.R.Barker

The seeds of *Spyridium fontis-woodii* encapsulate the work of the SASCC. Endemic to the Coorong region of South Australia, this species is known from a single roadside population. Seeds of *S. fontis-woodii* were first collected by the SASCC in 2006 and since then the number of plants in the population has continued to decline. In 2024, less than five mature plants remained.

To address the dire situation, the SASCC partnered with a local school to propagate plants from germplasm held in long-term storage by sharing insights into germination protocols gleaned through research. These plants then formed the foundation of a 'seed orchard' managed by the students to amplify the seeds to a quantity useful for restoration.

Through custodianship, the students were able to collect thousands of seed for deposit into the SA Seed Bank and to grow hundreds of plants for translocation to establish a new population. With the help of the SASCC and the leadership of many dedicated students and teachers, there are now hundreds of *S. fontis-woodii* growing in the Coorong region and the threat of extinction for this species is no longer so immediate.

The journey of those first seeds collected in 2006 – from wild plants, to deep-freeze, into the hands of dedicated stewards and then back into the wild – represents the mission of the SASCC well. We strive to capture the genetic diversity of remnant populations of threatened plants in the present, store them for the future, and empower the community to take ownership in the conservation of our shared natural heritage. The seeds themselves, scarcely larger than 1 mm, are a fitting metaphor of resilience and the ability to turn something small – a seed, an idea – into something great – a population of rare plants, a life-long love of the state's flora.

Spyridium fontis-woodii germinating.

Spyridium fontis-woodii.

Photos: South Australia Seed Conservation Centre.

Tell us a little about your seed conservation team, facilities and current activities.

The SASCC team consists of a group of dedicated flora conservationists with a diverse set of skills and strengths. Our team has a broad range of experience from restoration, field botany and plant ID, to highly technical laboratory *in vitro* propagation techniques and seed biology research. We spend our field season – spring and summer – searching for, surveying and collecting the germplasm of South Australia's most endangered plants. With our autumns and winters spent providing data and advice to the state's threatened species unit, conducting germination research and curating the Seed Bank.

Our laboratory and seed bank are housed in the historic Goodman Building at the Adelaide Botanic Gardens, where we have access to spaces for seed cleaning, seed biology research and office space. We also have a small seed production area and nursery within the grounds of the Gardens to increase the stock of seeds for restoration activities and propagate plants for translocation. The seed production area has recently been equipped with interpretive signage to provide information on the plants growing in the garden to the public.

Recently, a large round of retesting of seed collections stored for over 10 years has taken place, giving the team valuable data regarding the storage behaviour of many plant families and genera. This work is taking place in tandem with a diversity of partnership projects on threatened flora that takes the team across our large state and to the many ecosystems where threatened species are found.

SASCC team photo.

What's your organisation's favourite thing about working in seed conservation?

The SASCC values working with the community to collaborate in the conservation and restoration of South Australia's threatened flora. We believe that the public cannot value what they do not know, and we strive to help land managers and community members gain a better understanding of the status of their region's threatened flora and hopefully develop an appreciation for its beauty and importance.

The model we employ with great effect is one of project partnership. Being centrally located in the state's capital, we cannot be everywhere at once. Therefore, we rely on regional partners – farmers, land management officers, community groups and National Parks rangers – to assist us in our work. After all, the people best positioned to conserve a region's threatened flora are the people living and working in that region.

The Western Australian Seed Centre, Kensington

Contributed by Andrew Crawford

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Grevillea batrachioides* F.Muell. ex McGill.
Local name: Mount Lesueur Grevillea

I have chosen this species as it highlights the positive impact seed conservation can have on improving the conservation status of species in the wild.

Grevillea batrachioides is known from a single population in the Midwest of Western Australia and is listed as Critically Endangered, with less than 20 plants surviving in the wild. Conservation seed collections of the species were first made by the Western Australian Seed Centre, Kensington, in the early 2000s, with further collections made over subsequent years.

In 2005, plants grown from these seed collections began to be used for translocation and by 2007, 68 seedlings had been planted at the new location. Then, in early 2011, a wildfire caused by a lightning strike burnt out the translocated population killing all the plants. Fortunately, some of the translocated plants had flowered and produced seed before the wildfire and, as a measure of the success of the translocation, 50 seedlings were observed to have recruited post-fire. These natural seedlings were augmented with additional nursery-grown seedlings which were planted in 2012. By 2024, 95 of these plants were known to be surviving. In September 2024, the number of plants in the translocated population was enhanced by the addition of 61 seedlings, planted as part of Kew's Critically Endangered Project, helping ensure the long-term sustainability of this translocated population.

Indications are that this translocation has successfully established and should be able to persist long-term, even after fire, providing an insurance population to ensure the species' persistence in the wild.

Photos: Andrew Crawford/DBCA.

Grevillea batrachioides seed and fruit.

Grevillea batrachioides **in flower.**

Tell us a little about your seed conservation team, facilities and current activities.

The Western Australian Seed Centre's Kensington vault, previously known as the Threatened Flora Seed Centre, is a conservation seed bank that was established in the early 1990s with the purpose of collecting and storing seed of Western Australia's conservation significant plant species. The facility consists of the seed vault (-20°C), a dehumidifying room (15% relative humidity, 15°C), a seed processing room, a laboratory, two temperature-constant walk-in incubators, and an equipment room housing a range of equipment including incubators and ovens.

The current team consists of a full-time research scientist and two casual technical staff.

The focus of the centre's activities continues to be the collection and storage of seed of Western Australia's rare, threatened and poorly known plant species, with a focus in recent years on the state's threatened species. Collections held in the seed centre are actively being used for *in situ* species recovery through translocation, with over 50 species being planted at translocation sites using seed from the centre. Over the years, we've learnt that quality is everything. Taking the time to make seed collections to the highest standard can prevent problems down the track and can maximise the utility and longevity of the collections.

The current team at the Western Australian Seed Centre, Kensington. Left to right: Anne Kelly, Simone Dudley, Andrew Crawford.

What's your organisation's favourite thing about working in seed conservation?

Helping save plant species from extinction. To this end, I look forward to more of the collections being utilised through translocation to improve the conservation status of species in the wild.

Papua New Guinea University of Technology (PNGUOT)

Contributed by Gibson Sosanika

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

BULOLO CAMPUS
School of Forestry
Faculty of Natural Resources
P.O. Box 92
Bulolo 423

If you could choose one seed to represent your organisation or your seed conservation activities, what would it be and why?

Scientific name: *Caryota rumphiana* Mart.

I would choose the palm seed, *Caryota rumphiana,* Arecaceae. The plant has an interesting phenological characteristic. At the point of maturity of the last bunch of fruits, the plant will die completely. The plant bears fruit bunches from the top (shoot) downwards as the plant ages through the process of senescence.

Photos: Gibson Sosanika.

Caryota rumphiana seeds.

Caryota rumphiana seeds.

Tell us a little about your seed conservation team, facilities and current activities.

I have developed a keen interest in seed banking since 2017, through doing my Master of Philosophy degree in Forestry at the School of Forestry within the Papua New Guinea University of Technology. I have undergone training in crop wild relatives seed collecting at Kakadu National Park for the Australian Grains Genebank in 2017, and in wild species seed conservation techniques at the Millennium Seed Bank, RBG Kew in 2022.

In 2024, a collaborative team effort among partner countries (UK, Australia, New Zealand, Papua New Guinea) led to the creation of a network across the Asia Pacific region initiated by RBG Kew and its partners. This included the Grains Gene Bank, Australia, the MSB, UK, and the School of Forestry, PNGUOT-Bulolo Campus Papua New Guinea. I am grateful to be part of the establishment of this new seed conservation network group called “SPARK”. SPARK – Seed Preservation and Research Network – was established to contribute to supporting seed collection and conservation in the Asia-Pacific region. This includes the tropical rainforest in Papua New Guinea, as well as in the Asia-Pacific Island countries, Australia, and New Zealand.

As such, the SPARK network will play an important role in supporting the development of seed conservation work on approximately 32% of endangered tree species in the least explored tropical rainforest of Papua New Guinea (doi.org/10.1002/ppp3.10342). The island of New Guinea (Papua New Guinea and Papua (Indonesia)) is the most floristically diverse forested landscape on the second largest tropical island on the planet and requires seed conservation emphasis to preserve seed producing species for long term storage during the event of global climate change (doi.org/10.1126/sciadv.aaz1455).

What are you looking forward to over the next 25 years in your organisation’s seed conservation journey?

I teach subjects in forest ecology, forest botany and forest landscape restoration at the School of Forestry, Papua New Guinea University of Technology – Bulolo Campus (https://www.pnguot.ac.pg/bulolo-campus/) in Papua New Guinea.

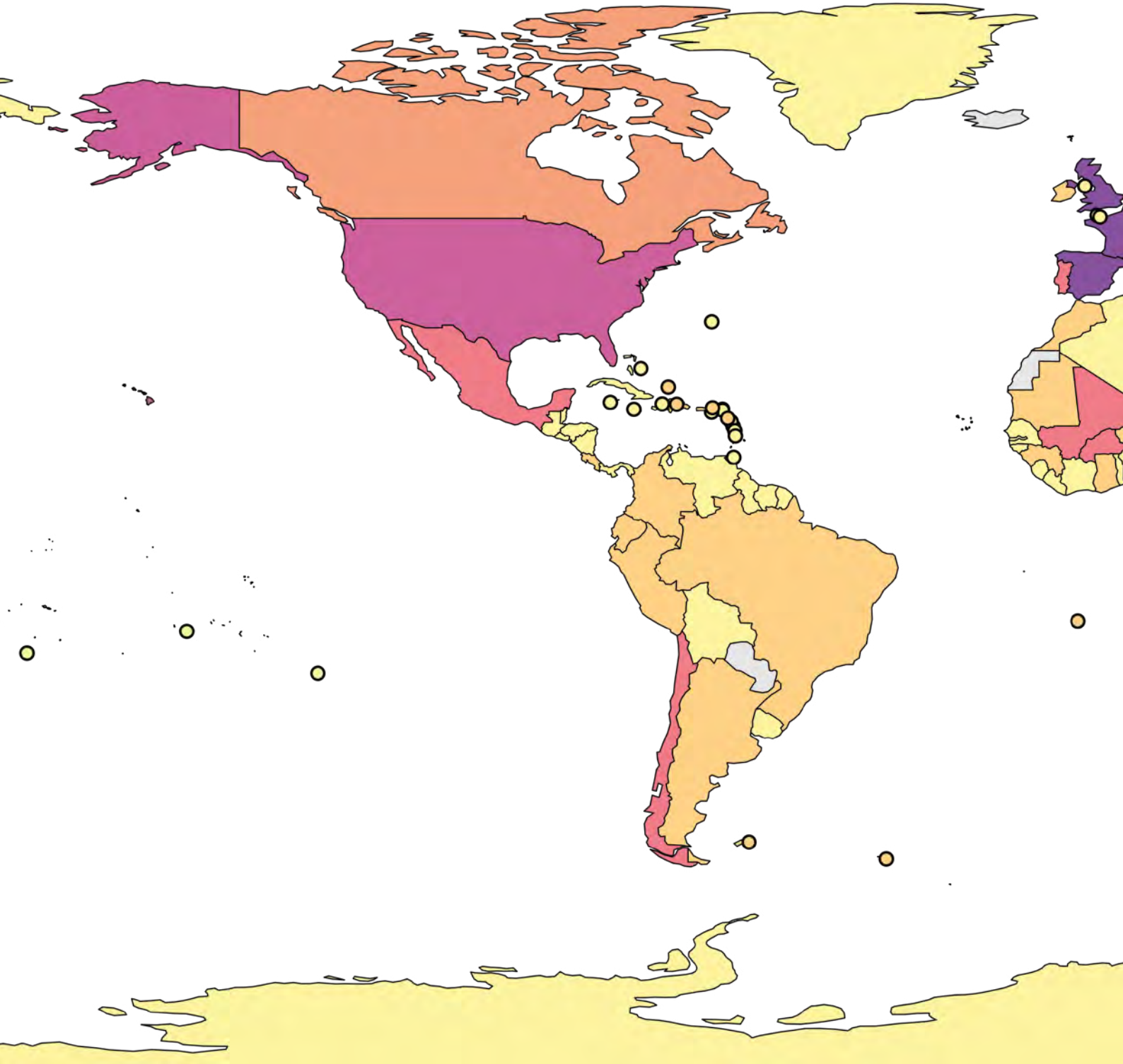
Seed collection and conservation are directly linked to forest ecology, plant morphology and physiology studies, as well as landscape restoration, which are taught at the university in the new bachelor’s programme, the “Bachelor of Forest Resource Management”. The new degree programme is the advanced level of study in forestry aligned to the existing Bachelor of Science in Forestry, upgraded from the old School of Forestry studies written circa 1962.

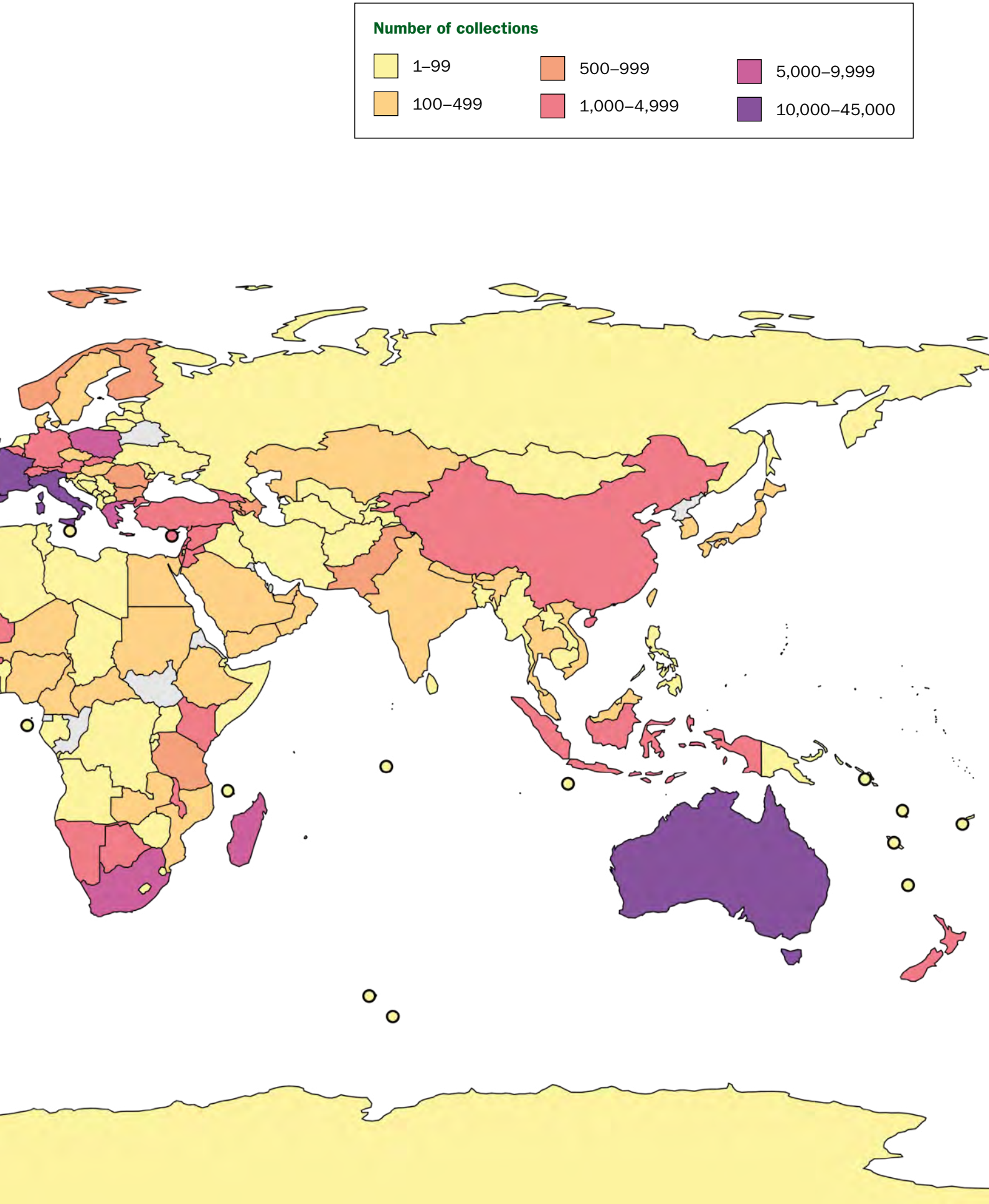
The new journey of seed conservation under the SPARK partnership network in the Asia-Pacific, is to incorporate research discoveries into student laboratory and field training programmes, as part of assessments and field applications.

The incorporation of seed ecology studies will contribute to uncovering understudied tree species in the tropical rainforest of Papua New Guinea, since this is one of the least explored ecosystems on the planet (doi.org/10.1002/ppp3.10342).

The seed bank ecological studies will play an important role in understanding when the plants flowering, fruiting and ripening phases are (phenology), as well as forest resource management for timber and non-timber products and sustaining the forest ecosystem as a carbon sink. This will be important for forest resource and ecosystem management to support climate action for the next 25 years. As such, I will have contributed to the School of Forestry, training more than 2,000 students. I am looking forward to the next phase of training, including field research training and to establishing more local and international collaboration to expand the seed preservation network and advocate for diversifying seed research in Papua New Guinea and the Pacific Island countries.

Collections made across the Millennium Seed Bank Partnership




Number of collections
1–99
100–499
500–999
1,000–4,999
5,000–9,999
10,000–45,000

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