Seed Conservation Specialist Group

Official Newsletter

"Native Seeds for the Restoration Decade"

UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

August 2022

IUCN SSC Species Survival Commission

CONTENTS

Seed Conservation Specialist Group – SCSG

The mission of the Seed Conservation Specialist Group is to promote seed conservation by providing a network for knowledge-sharing in different ecosystems around the world, and aiding in prioritization, capacity building, and development of best practices.

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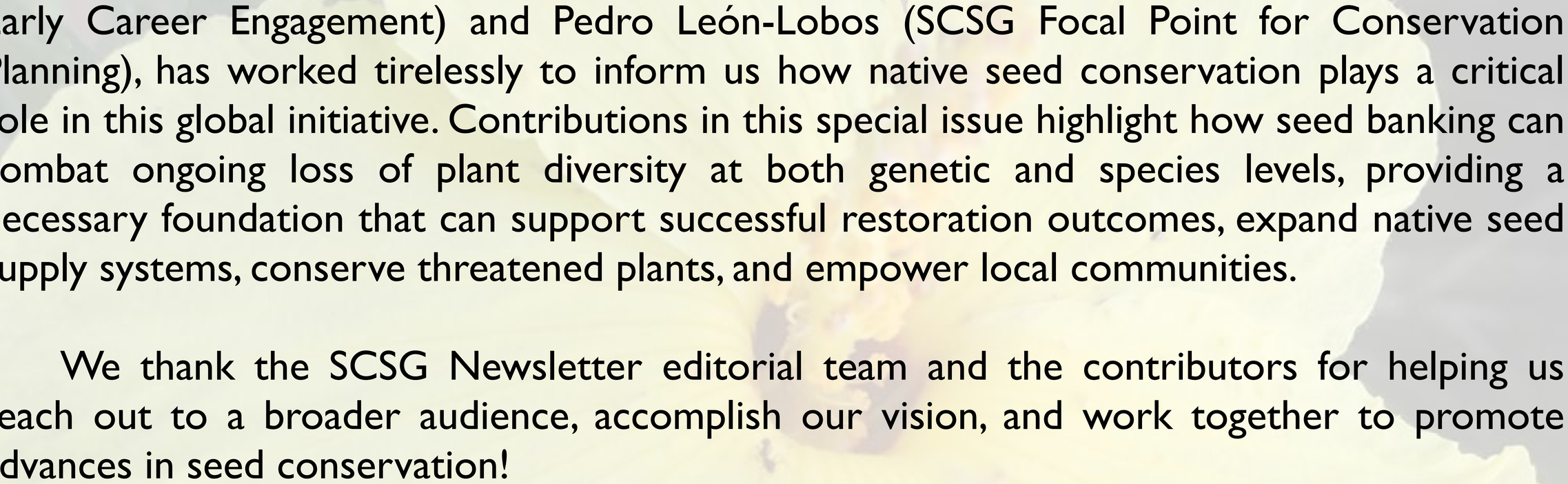
Background caption: Seeds of *Cyperus trachysanthos*, endangered
Photo credit: Lyon Arboretum Seed Conservation Laboratory

Letter from the Co-Chairs

We warmly welcome you to the second newsletter of the International Union for Conservation of Nature (IUCN) Seed Conservation Specialist Group (SCSG). As a specialist group of the Species Survival Commission (SSC) of the IUCN, we work together towards achieving the vision "A just world that values and conserves nature through positive action to reduce the loss of diversity of life on earth". This special issue of our newsletter is particularly relevant to achieving this vision, because it presents opinions and perspectives on the initiative "The Decade on Restoration" of the UN Environment Program (UNEP) and the Food and Agriculture Organization of the United Nations (FAO), showcasing on-the-ground work and research that contribute to restoration.

The editorial team of this issue, headed by Diana Castillo-Díaz (SCSG Focal Point for Early Career Engagement) and Pedro León-Lobos (SCSG Focal Point for Conservation Planning), has worked tirelessly to inform us how native seed conservation plays a critical role in this global initiative. Contributions in this special issue highlight how seed banking can combat ongoing loss of plant diversity at both genetic and species levels, providing a necessary foundation that can support successful restoration outcomes, expand native seed supply systems, conserve threatened plants, and empower local communities.

We thank the SCSG Newsletter editorial team and the contributors for helping us reach out to a broader audience, accomplish our vision, and work together to promote advances in seed conservation!



Dr. Uromi Manage Goodale (left) and Dr. Marian Chau (right), IUCN/SCSG Co-chairs
Zoom meeting - 2020

Background caption: *Hibiscus brackenridgei*
Photo credit: Lima Huli

Be Part of #Generation Restoration

Cara R. Nelson, PhD
Chair, Ecosystem Restoration Thematic Group, IUCN Commission on Ecosystem Management; &
Professor, Restoration Ecology, University of Montana (USA)

Through Resolution 73/284, the United Nations General Assembly declared 2021–2030 as the United Nations Decade on Ecosystem Restoration (hereafter, the "UN Decade"). Although the UN Decade has only just begun, it has already made a substantial contribution to the global restoration community by creating a forum for scientists, practitioners, managers, policy makers, and funders to create a strategic agenda and align work programs.

Towards this end, the Decade launched a series of task forces to synthesize existing knowledge and tools; these task forces are moving quickly to fill priority needs for restoration. For example, one of these task forces, the Best Practices Task Force, engaged members in co-production of 10 principles of ecosystem restoration that detail a shared vision of the types of ecosystem management activities that can be considered restorative. The Task Force is now developing standards of practice to guide the application of the principles to the planning, implementation, monitoring and maintenance of restoration projects. In addition, the Task Force conducted a capacity needs assessment and is using findings from this assessment to develop a strategic plan for capacity development. Central to these efforts will be identifying best practices and increasing capacity for seed-based restoration, given the large percentage of restoration initiatives that involve planting vegetation.

Although meeting current ambitious restoration targets for terrestrial ecosystems will depend in large part on the efficacy of planting efforts, there are several key bottlenecks to implementing seed-based restoration activities at scale (See page 6 in this issue). For many species of high conservation and restoration value, there is a lack of scientific and technical information about site-adapted ecotypes and seed transfer zones for both current and future climates. Without this information, considerable uncertainty exists about appropriate seed sources for transplanting to restoration sites. Furthermore, for many species, there is a lack of information on requirements for seed storage, as well as practices for breaking seed dormancy and germinating seeds. Additionally, there is insufficient knowledge about appropriate patterns for transplanting (e.g., optimal patterns of spacing among seedlings and clusters) in order to set the site on an adequate successional trajectory. In the absence of knowledge about ecological spatial patterns for planting, the default may be planting seedlings in rows, which may limit ecosystem functions. In addition to gaps in information, there is lack of capacity in all aspects of the seed supply chain from collection to storage to nursery production and native seed farming. Addressing these challenges must be part of the Decade agenda.

The UN Decade represents an unprecedented opportunity to advance the repair of degraded ecosystems and achieve sustainable development goals. However, success depends on harnessing the global network to work effectively and efficiently to expand scientific understanding and apply that understanding to practices. Experts in seed-based restoration are particularly needed to advance the strategic agenda and contribute to the co-production of knowledge and products. Please consider lending your expertise by joining a UN Decade Task Force or participating in global consultations on UN Decade products. Be part of #Generation Restoration.

Needs for the Seed Supply Chain for Restoration Success

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Urgent actions on ecosystem restoration are needed to mitigate the effects of the global and climate change (UN 2019). For terrestrial ecosystems, the needs for building capacity and adequate infrastructure to ensure high-quality and quantity native seeds and seedlings, are key aspects, particularly in tropical and subtropical countries or where biodiversity hotspots are found.

Genetic diversity of seeds requires the implementation of an integrated management system for native seed collection, drying, storage, tests, and distribution, collectively referred to as the *Seed Supply Chain* - SSC (Merrit et al. 2016, Ladouceur et al. 2018). Maintaining an efficient native SSC over time, involves having sufficient financial resources, and advanced technical, management, and logistical capabilities. Therefore, it is essential and urgent for countries to develop or strengthen native SSCs for ecosystem restoration by addressing challenges at the country level that prevent its suitable implementation (Figure 1).

Atkinson et al. (2018), refer to two major shared deficiencies in the national seed supply systems used in restoration projects in seven Latin American countries. First, a very low diversity of species is available and second, little consideration is given to the origin of seeds and their diversity. Therefore, we propose the below recommendations to enhance efficiency and effectiveness in the SSCs used in restoration projects:

a) **Address the certification of seed sources or seed zones.** It is essential to give special attention (including funding and research) to identifying seed transfer zones based on genetic, biogeographical and/or climatic criteria to meet market demands (León-Lobos et al. 2020).

b) Standardize and regulate seed collection. Work should be done on a certified system for seed collectors, which ensures genetic, morphological, and physiological quality (Pedrini and Dixon 2020), and follow ethical and sustainability considerations (Nevill et al. 2018).

c) Strengthen technical and infrastructure capacities. Within the framework of a strategic program, seed conservation (including cryopreservation) for ecosystem restoration (Merrit and Dixon 2011) should allow: 1) the provision of sufficient seeds from diverse origins and species to meet the high market demand based on the country's restoration commitments at the landscape scale (León-Lobos et al. 2020), and 2) to generate a rapid response to natural disasters including post-fire restoration and erosion control (Havens et al. 2015).

d) Training and capacity building. Training seed collectors and seed suppliers on sustainable harvesting, processing, and storage to allow the continuous and transversal improvement of the SSC.

e) Creation of local seed supply networks. The co-creation of SSCs for landscape restoration may generate opportunities to support community engagement by connecting local knowledge and livelihoods with technological and public policy development (Sampaio et al. 2020).

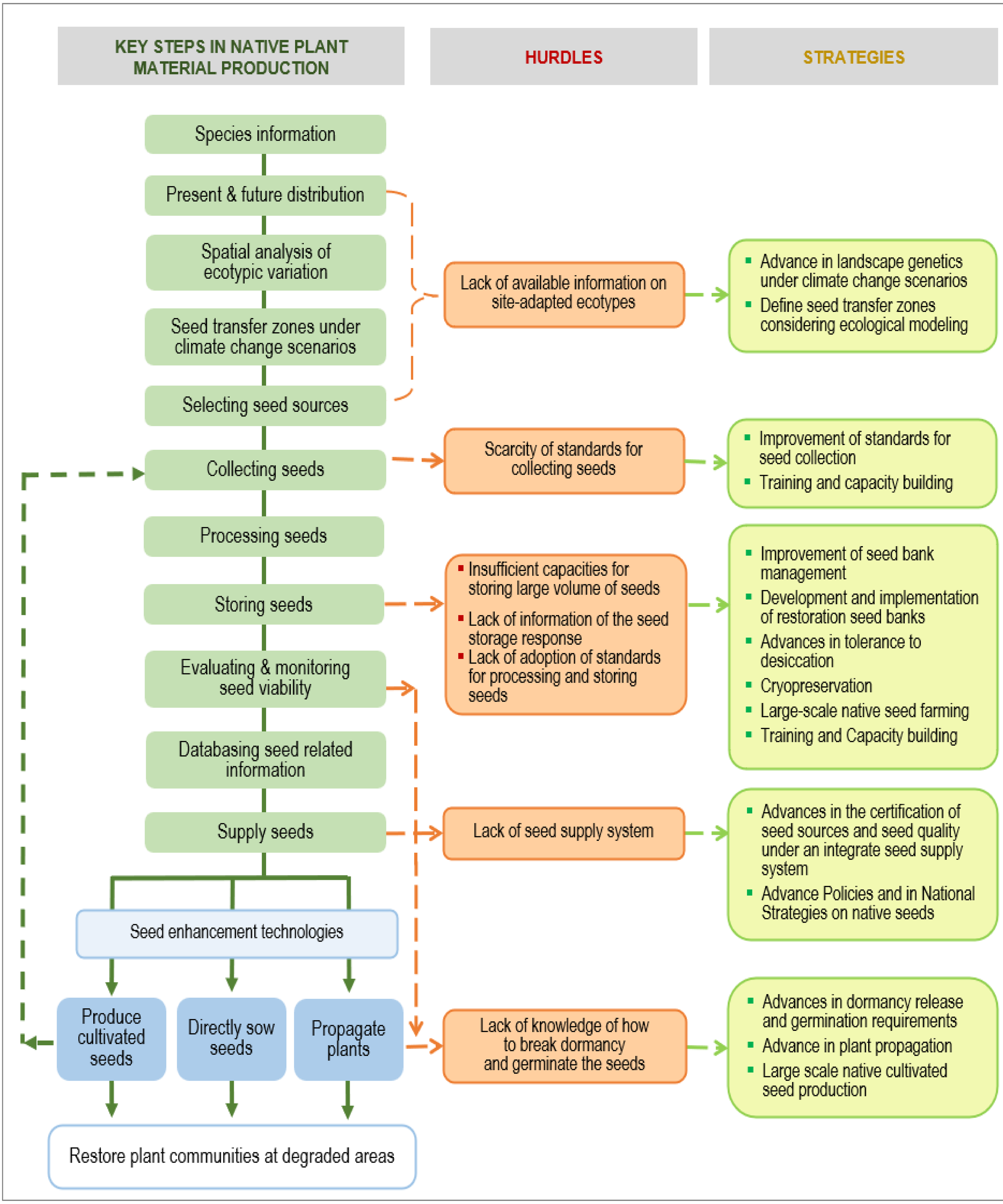

Figure 1. Key steps in the production of native plant material for seed-based ecological restoration projects, as well as the main hurdles and strategies associated with each step. Adapted from León-Lobos et al. (2020).

f) Direct efforts to accredit seed banks for restoration purposes. The process of native seed collection, drying, and storage following national or international guidelines should be certified in order to ensure the supply and distribution of genetic material of high quality and contribute for ecosystem restoration success.

g) Strengthening of research in the SSC. For most native species, limited knowledge on seed biology and handling practices result in failed or lower-than-expected restoration outcomes (Merrit and Dixon 2011). Therefore, it is essential to promote and strengthen research on the seed physiology, seed storage, seed farming and propagation of native plants.

For the SSC to be effective and meet restoration goals, actions must be considered under a National Native Seed System (NNSS). The NNSS defines a regulatory framework and sets minimum criteria or standards for an operation like the system for agricultural seed. Following the NNSS standards can ensure minimum thresholds of quality, efficiency and responsibility of all the stakeholders involved in the SSC to delivery certified seeds for restoration.

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Standards for Native Seeds can Improve the Practice of Global Restoration

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The UN Decade of Ecosystem Restoration challenges the world to reverse planet-wide ecosystem degradation by embarking on the largest coordinated restoration in human history. A key to guiding this bold and necessary mission is the use of standards such as The International principles and standards for the practice of ecological restoration (Gann et al. 2019) developed by the Society for Ecological Restoration (SER). For example, it specifies that a native reference ecosystem should be identified when planning for a restoration project and used as a benchmark to evaluate the progress and success of the initiative.

In building onto the Standards, a thematic section of the Society for Ecological Restoration, The International Network for Seed Based Restoration (INSR) has published as a special issue titled "Standards for native seeds in ecological restoration". Papers in this special issue were co-authored by seed scientists and practitioners from a variety of countries who share a deep understanding, knowledge, and practical experience of native seeds. The special issue covers, in depth, each step of the native seed supply chain: from seed planning, sourcing, and procurement (Erickson and Halford 2020), collection and production (Pedrini, Gibson-Roy, et al. 2020) cleaning, processing and quality testing (Frischie et al. 2020), storage (De Vitis et al. 2020) dormancy alleviation, and germination (Kildisheva et al. 2020) seed enhancement technologies (Pedrini, Balestrazzi, et al. 2020), to seed use in the field (Shaw et al. 2020) (Figure 1).

Figure 1. Schematic diagram of the interaction between restorative activities and key steps in the native seed supply chain. Image: Simone Pedrini from Cross et al. 2020.

All the steps of the seed supply chain are summarised and placed in the broader context of ecological restoration with a key component being the seed standards section: “International principles and standards for native seeds” (Pedrini and Dixon 2020). These standards have been designed to be accessible and practical for all those involved in the collection, production, and use of native seeds, and are relevant at all levels, from Indigenous community programs to large-scale commercial native seed enterprises.

A common problem found in some countries was the need to differentiate native seeds from seeds of selected varieties (cultivars). Cultivars are usually the result of long breeding programs for the selection of some desirable traits (e.g., high yield, synchronous seed maturation) followed by processes to maintain genetic purity and stability. In contrast, a native seed batch is considered appropriate for restoration when its genetic diversity is representative of the population of origin (Pedrini and Dixon 2020). In many countries, native seeds present logistical complexities not common for cultivars. For example, seed dormancy, which is mostly removed from selected varieties, is a common feature in many native species, especially in dryland environments. Methods for identifying and releasing dormancy can be species-specific and sometimes site-specific. Such information is essential for seed suppliers and users (Kildisheva et al. 2020).

The Standards for Native Seeds also highlight the global issues of seed supply where native seed quantity, quality, and diversity are insufficient to perform effective ecological restoration at scale. Often this limitation is not due to a lack of knowledge or understanding of seed biology or ecology (even though such topics always need further investigation), but practical and logistical shortcomings in the supply chain (Pedrini and Dixon 2020).

Such constraints exist for a variety of reasons, such as inadequate seed quality assurance, lack of relevant regulations, incorrect or inefficient practices, and immature or underdeveloped markets resulting in limited investment for infrastructure and technology.

Currently native seed supply in many countries relies primarily on seed collection from the wild, following the protocols developed for conservation seed banks (e.g., ENSCONET). Although this approach usually allows for good genetic representation of the natural population, it is often expensive and collection sizes are small. Implementation or expansion of native seed farming would increase seed availability, quality and reduce cost, but might result in involuntary selection (Figure 2) However, those risks can be mitigated by implementing cultural practices that minimise the selection of certain traits (e.g., harvest multiple times during the season) and by limiting the maximum number of generations that can be produced from a natural collection (usually from 3 to 5) (Pedrini, Gibson-Roy, et al. 2020).

Native seed farming systems have been developed for more than 30 years for grassland species (annual and perennial herbs) in North America and Europe by integrating standard agricultural techniques and equipment (soil preparation, weed control, mechanical harvesting) with ecological knowledge of each species (seed dispersal strategy, pollination, flowering time) (Pedrini, Gibson-Roy, et al. 2020). However, for many regions of the world such as rainforests or low productivity woody plant biomes, development of native seed farms is not always feasible and would require investment in research and development to evaluate species suitability , agronomics for row cropping and business case development.

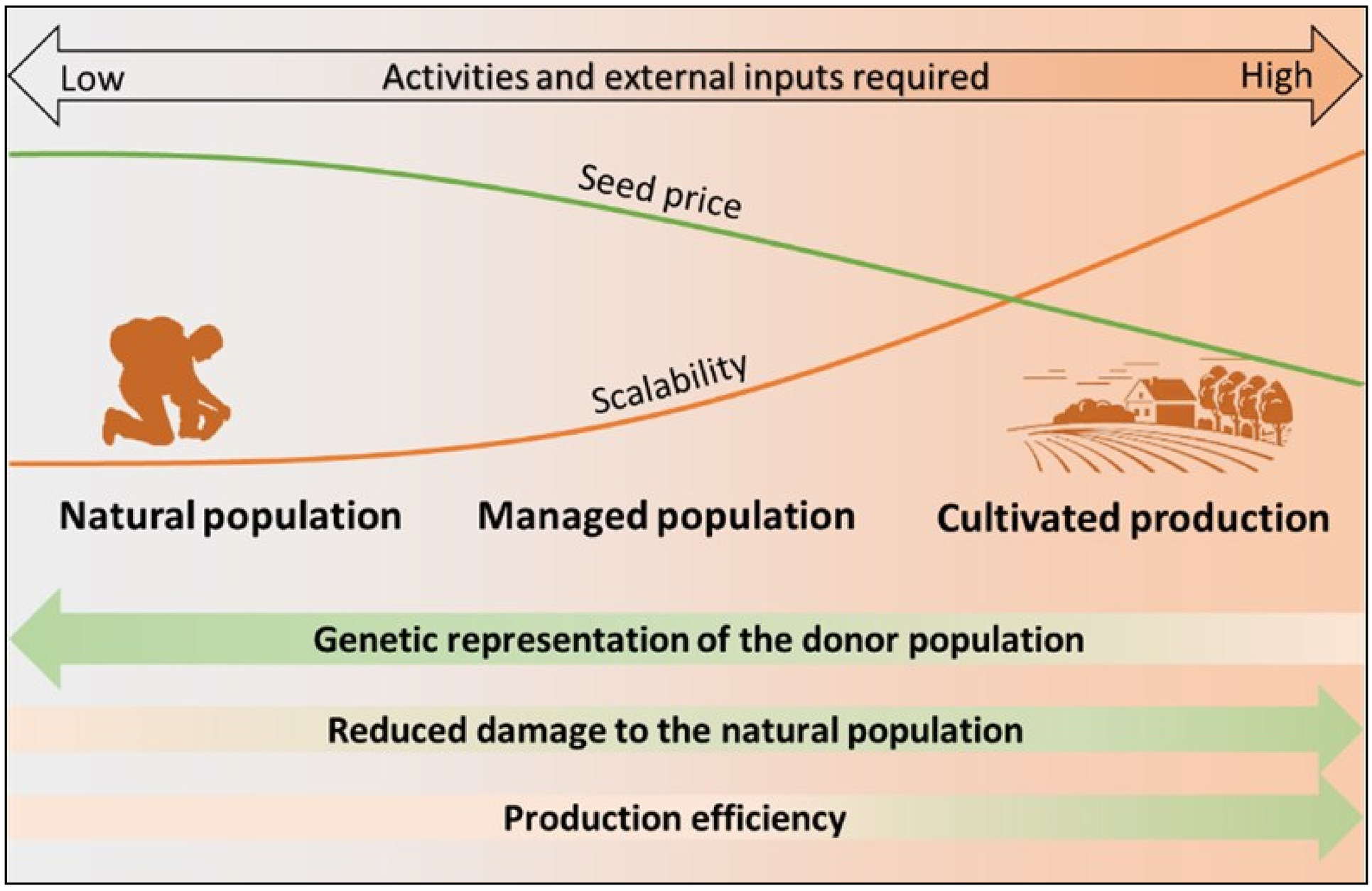

Figure 2. Trade-offs between native seed collection from natural populations and native seed farming (cultivated production). Image: Simone Pedrini from Pedrini, Gibson-Roy, et al. 2020.

By limiting wild seed collection for restoration programs, the unintended consequences of wild harvesting (trampling, overharvesting, spread of disease) can be overcome (Pedrini, Gibson-Roy, et al. 2020)

The seed standards also outline improvements in seed processing approaches to ensure that native seed lots are of high-quality (Frischie et al. 2020) and appropriately stored, to optimise seed viability (De Vitis et al. 2020).

An element that is often overlooked in most seed supply chains is quality testing, for which the seed standards provide comprehensive principles and guidance. The seed standards provide a step-by-step guide on how to perform, interpret and communicate the result of seed quality testing. These include a pro forma for recording relevant information about seed collection, storage conditions, quality testing, and enhancement technology, and templates for labels to be used on native seed batches (Figure 3).

Seed quality testing should become a standard procedure for native seed suppliers to improve transparency and provide vital information to the seed users. The seed standards also provide a useful starting point for country-by-country approaches nuanced to suit local conditions and species.

An example of how useful seed quality information can be for practitioners is a recent study on native seeds from Western Australia. This study revealed that viability across 189 species is on average 56%, and that resulted in a 2.5 increase in seed price when adjusted for viability (Pedrini et al. 2022).

The last, but crucial, step of the native seed supply chain is effective sowing at the restoration site. In the most traditional approach of 'broadcasting' (seed hand or machine cast across tilled land), the outcomes are usually low with poor seed to plant conversion.

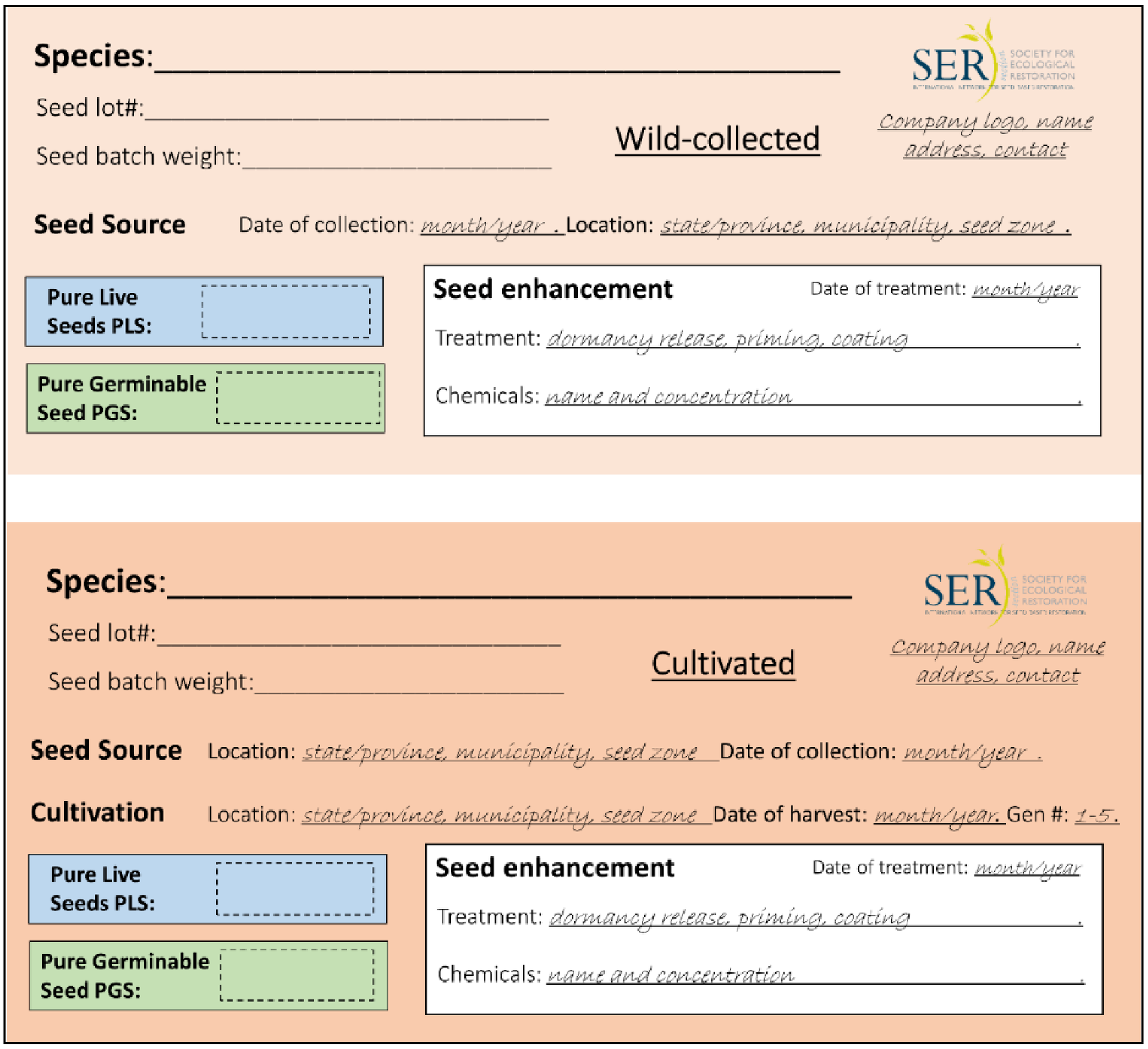

Figure 3: Example of labels that are applicable to point-of-sale release of native seed. Image: Pedrini and Dixon 2020.

Careful planning and seed sourcing strategies (Erickson and Halford 2020) alongside soil preparation, weed control, use of mechanical seeders, and post seeding management (Shaw et al. 2020) contribute to improvements in direct sowing outcomes for native seed. However, recent development in seed technology, such as seed coating, have potential to greatly improve successful restoration outcomes by standardizing seed size and shape (Figure 4) and providing compounds that could boost seed protection, seedling establishment and plant survival (Pedrini, Balestrazzi, et al. 2020).

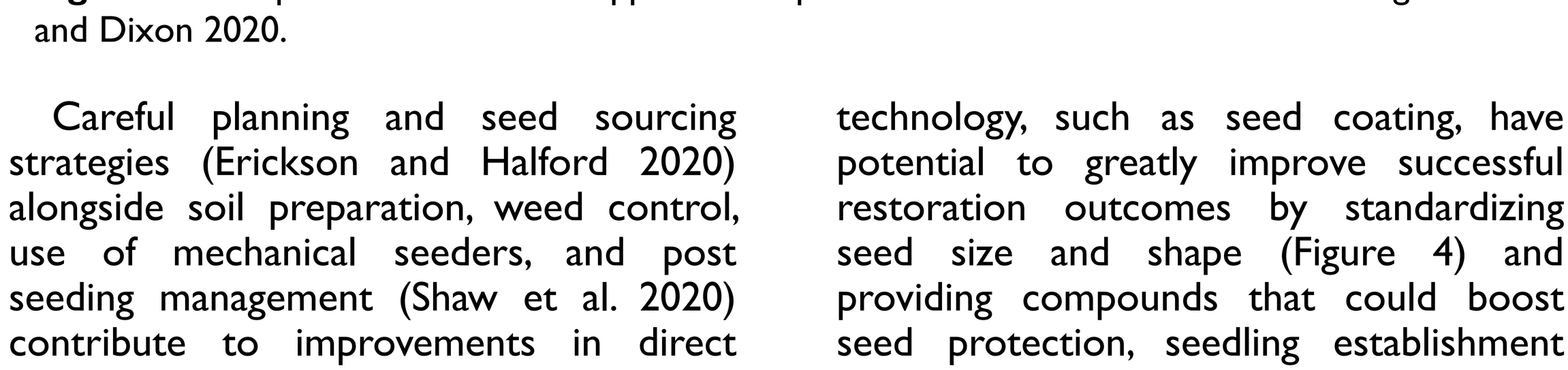

Figure 4: A) a mix on cleaned native seeds ready for seeding B) the same seed mix after seed coating (pelleting). Photos: Simone Pedrini.

The efficient use of native seeds can significantly improve the success of ecological restoration projects, but, in many cases, seeds alone might not be enough. For rare, difficult to collect, cultivate, or store (recalcitrant) species, nursery-grown seedling still represents a better alternative. Many projects that aspire to achieve a high level of recovery would need both approaches to return a level of complexity and diversity comparable to that of a native reference ecosystem.

Regardless of how sophisticated and advanced a native seed supply is, it won't matter unless it is fully integrated within the broader context of ecological restoration and the well-being of the local communities: the key to successful and enduring conservation outcomes.

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Indigenous and Local Participation in Native Seed Supply can Make the UN Decade on Ecosystem Restoration a Transformative Action

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Improving the availability of diverse native seeds for large-scale ecosystem restoration initiatives has required the rapid development of supply chain operations across the world. With an emergent restoration economy generating demand, multiple stakeholders have created commercial arrangements to scale-up plant material production at regional and local scales. While Indigenous peoples have been collecting, processing, and planting native seeds for thousands of years, conventional seed enterprises lack socioeconomic opportunities and participatory instruments for including community participation (Schmidt et al. 2019). Plant material supply systems for restoration projects are often dominated by private companies or governmental operations that create few jobs and neglect local engagements, resulting in few opportunities for enduring community livelihoods (Jalonen et al. 2017). Local engagements with native seed supply activities can enhance diverse livelihood assets on the ground, including local political agencies, women's group organizations, and economic opportunities for youth (Urzedo et al. 2016).

In recent decades, several native seed programs across the world have recognized the role of local communities in transforming ecosystem restoration plans and actions. Emerging community-led initiatives have reconfigured how seed supply systems operate through diverse modes of place-based knowledge production, organization models, and participation processes (e.g., Schmidt et al., 2019; Urzedo et al. 2020).

By focusing on the experiences of seed networks in Brazil and Indigenous-led organizations in Australia, our open-access perspective paper in Ambio (Urzedo et al. 2022a) discusses the importance of the inclusion of Indigenous and local communities in the native seed production and supply during the UN Decade of Ecosystem Restoration (Urzedo, Pedrini, Vieira, et al. 2022). This publication provides a participatory seed supply approach for community engagement, noting local geographical, social, and cultural contexts to tackle social and environmental injustices. This seed supply guideline relies on two decades of activities of the Brazilian seed networks operated through Indigenous and rural collectors in the Amazon, Cerrado, and Atlantic Forest, and emerging Indigenous Australian engagements with native seed collection and production in Australia.

Our paper shows that regional seed networks have united a diverse group of suppliers who have collected, processed, and stored seeds with practitioners implementing various restoration projects. More than 24 networks in Brazil have generated opportunities for Indigenous and rural communities to supply native plant materials (Figure 1) to restoration markets over the last two decades (Piña-Rodrigues et al. 2021). For instance, the Xingu Seed Network engages 600 Indigenous, rural and urban collectors who supply up to 25 tonnes of native seed yearly from 220 native species in the southeastern Amazon. In Australia, the emerging restoration economy ignites the participation of Indigenous Australian groups to co-create seed supply systems. The unprecedented demand to restore hundreds of thousands of hectares of mined lands in Australia require local participation to tackle the shortage of native seed sources (Merritt & Dixon, 2011). Indigenous Australian engagement with mine restoration and closure plans is an opportunity to generate place-based benefits and reshape political decision-making processes (Urzedo, Pedrini, Hearps, et al. 2022).

Examples include the seed collection program of the Rio Tinto's Weipa bauxite mine in Cape York Peninsula and the Gelganyem seed program to close the Argyle Diamond Mine in the East Kimberley region of Western Australia.

There are critical challenges for meaningful community engagement with the emerging restoration economy based on the local experiences of diverse groups. Overcoming these difficulties requires the inclusion of local perspectives and voices in co-producing regional arrangements. Local participation must be part of each step of the restoration supply chain, such as operating business management, establishing local institutions, and accessing benefits. In these processes, the state has a crucial role in promoting and supporting community-led seed networks, particularly through financial incentives and institutional changes to include democratic participation in political decision-making procedures. We highlight that community restoration networks focused on efficiency and revenue alone will not guarantee the long-term sustainable success of local seed production.

Figure 1. Yarang women's movement collecting native seed in the Xingu Indigenous Territory, Brazilian Amazon. Photo: Danilo Urzedo.

Co-creating participatory native seed programs is just the first step of the shared journey toward community empowerment linked to ecosystem restoration. A transformative restoration intervention to overcome structural inequalities during the UN Decade must recognize that degraded lands and environmental impacts are often the results of historical injustices. Restoration policies, programs and actions should include the diversity of local community members, equity in the distribution of benefits and risks, and ensure local groups regain ownership and power in different political processes.

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Plant Conservation Alliance (PCA) Initiative

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Conservation and restoration experts of the PCA developed the U.S. National Seed Strategy for Rehabilitation and Restoration (2015) to improve the use and availability of native plants needed for restoration. The National Seed Strategy fosters science-based, collaborative coordination on native plant materials development to accelerate the pace and scale of restoration.

The importance of selecting the right native plants for restoration may be overlooked. Limited commercial supply of native plants can result in the use of non-native species, a lack of species diversity, or native plants that are not adapted to the restoration site. For U.S. government agencies purchasing millions of pounds of seed annually to rehabilitate and restore public lands, improving the supply is key for restoration success and reducing project costs in the long run.

In 2021, the PCA released the 2015-2020 National Seed Strategy Progress Report, which highlighted 460 projects representing a sampling of the work underway to improve our nationwide seed supply (Figure 1). Federal, tribal, state, and local collaborators are pooling resources and sharing information toward common goals to advance broad-scale restoration. Progress being made across the United States and its territories demonstrates effective interagency coordination and achievements; highlights joint problem-solving for natural resource challenges; and showcases effective land management tools to sustain native ecosystems, assist in endangered species recovery, improve wildlife habitat, promote recovery from natural hazards and other disturbances, and sustain multiple types of land use.

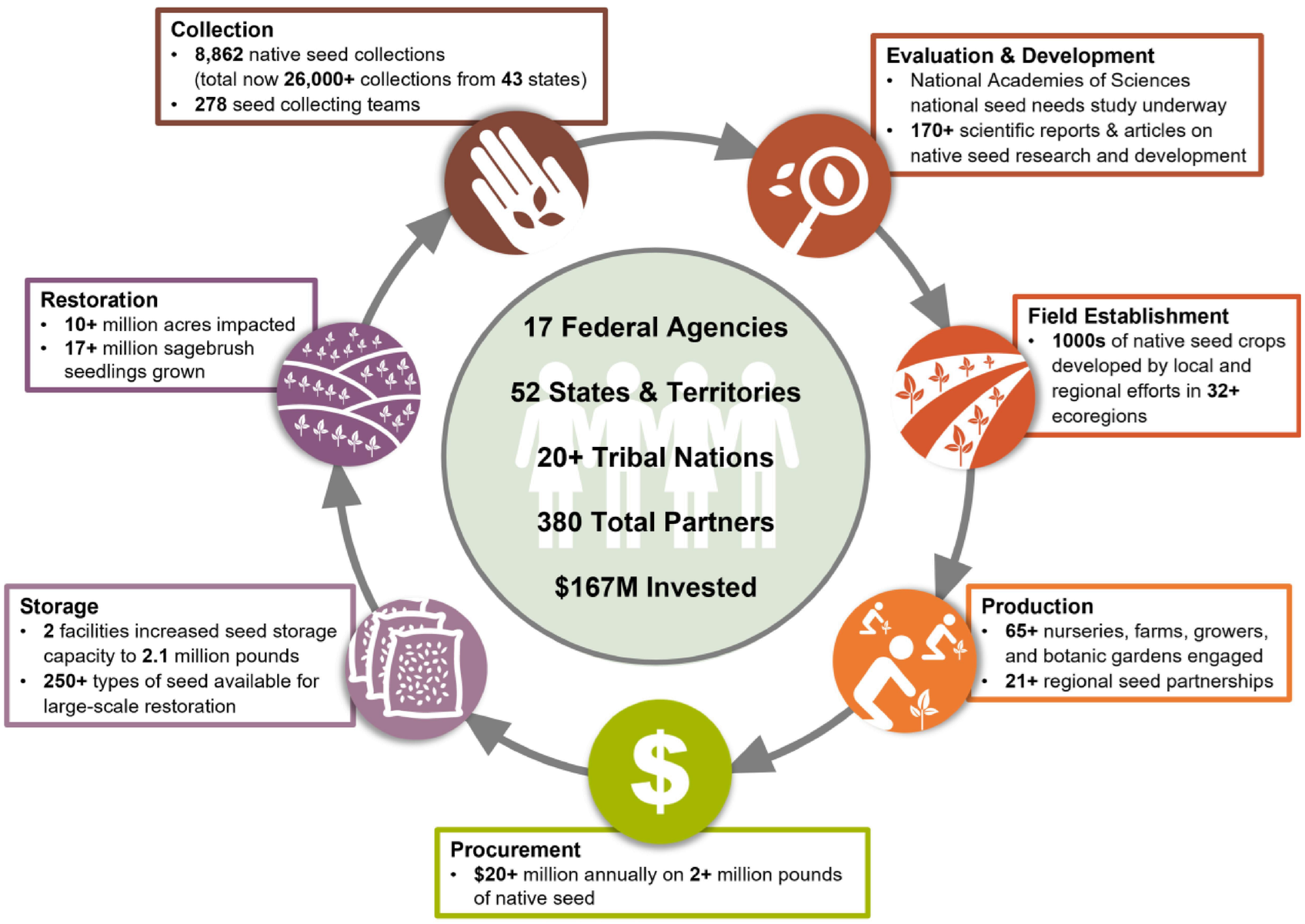

Figure 1. Accomplishments of the US National Seed Strategy (2015-2020)

Insights on the "Tree Diversity and quality tree seed for livelihoods, nutrition, water, soil, climate and nature" workshop

Jill Wagner, Hawai'i Island Seed Bank, Kailua-Kona, Hawai'i, USA. jillwagner3@icloud.com

On July 4-6 in Nairobi, Kenya, a workshop, "Tree Diversity and quality tree seed for livelihoods, nutrition, water, soil, climate and nature" was hosted by World Agroforestry - ICRAF, Botanic Gardens Conservation International and Terraformation. This event focused on the importance of using native species for restoration and preserving biodiversity by collecting and banking native seeds. The first day was a series of talks by presenters, and the next two days were hands-on training. The event was very successful.

In attendance for this East Africa workshop were numerous organizations, including Government organizations such as the Kenya Forest Service, National Museums of Kenya, and Tanzania Forest Service. There were also many non-profit organizations that are dedicated to native forest restoration and agroforestry. There were 90 people in attendance the first day, including the local newspaper, and 62 people from over 25 organizations signed up for the training.

The first day of the event began with presentations by scientists and forestry managers. Here are a few titles of the talks; "The economic and ecological value of tree seed and diversity", "Kenya's restoration and biodiversity targets: how can we meet them?", "Restoration Seed Banks: A Local Solution to Seed Supply Bottlenecks", "Biodiversity in Rwanda: a model", "The power of tree diversity", "Ethiopia case study: Building networks of tree seed collectors, why they are important, Train-the-Trainer programme, what has been the impact, and seed orchards". These talks stimulated people's thinking and caused them to think about diversity and native species in their own projects.

The training days started with a visit to the ICRAF gene bank. Then, talks about theory, planning a seed collection, and seed collection techniques. In the afternoon, a walk into the Karura forest demonstrated seed collection. In the afternoon there was handling of seed; cleaning, drying, and processing of seed. Other topics were touched upon such as breaking dormancy and germination testing.

The training ended with working groups sharing about priorities and new ways of networking. The hosting organizations presented Certificates of Training at the end. It was a very comprehensive and productive event.

Photos: **a.** Demonstration of seed collection, **b.** Attendees with the Certificates of Training.

Photo credits: Jill Wagner

Native Tree Species for Ecological Restoration and Sustainable Cocoa Production In Ghana

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Cocoa production supports the livelihoods of approximately four million farming households in Ghana. Increasing global demand for chocolate, have increased the economic and social pressure to achieve higher yields of cocoa beans. Management practices in cocoa farms have been associated with extensive forest clearing resulting in massive deforestation. It is estimated that 2.3 million hectares of rainforest in Ghana and Côte d'Ivoire have been cleared for cocoa farms between 1988 and 2007.

Agroforestry systems, which grow native trees together with cocoa trees have been intensified as they have the potential to increase the sustainability of cocoa production, can restore the ecosystem of the cocoa landscapes and help to combat climate change.

Funded through the UK People's Postcode Lottery, the "Ex-situ Seed Conservation of Ghana's Rare, Threatened and Economically Important Native Tree Species" project currently being implemented by the Forestry Research Institute of Ghana, the University of Ghana and the Royal Botanic Gardens, Kew's Millennium Seed Bank, has proved very beneficial to developing Cocoa agroforestry systems in Ghana. Techniques used and experience gained under the project in locating populations of complementary species, monitoring for flowering and fruiting, seed collection, extraction, cleaning, drying and testing for viability and moisture as well as storage are being applied to a number of tree species recommended by the Ghana Cocoa Board such as *Terminalia superba*, *Terminalia ivorensis*, *Milicia excelsa*, *Khaya ivorensis*, *Khaya anthotheca* and *Mansonia altissima*.

We hope our work on these species will accelerate the supply of planting material to nurseries to improve the productivity and value of the Cocoa landscapes in the country.

Photo credits: Joseph M. Asomaning

A New Native Seed Program at SGI to Improve the Availability of Ecoregional Native Plant Materials for Grasslands Restoration in the Southeast U.S.

Marcello De Vitis, Seed Program Director.
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Native grasslands and grassland-related ecosystems of the southeastern U.S. are recognized as biodiversity hotspots, but have lost 90% of their acreage since European settlement due to conversion to agriculture, overgrazing and replacement by non-native grasses, urbanization, and succession to forests via fire suppression. Surviving remnants now face a variety of threats, including invasive species and climate change. These losses increase the need for ecological restoration. However, a lack of regionally appropriate ecotype seed sources and a stable infrastructure for sourcing, increasing, and supplying native plant materials to federal, state and private stakeholders inhibits restoration of these ecosystems.

In October 2020, the Southeastern Grasslands Initiative (SGI), headquartered at Austin Peay State University (Clarksville, TN), received joint funds from the Bureau of Land Management and U.S. Fish and Wildlife Service, to develop a native seed program across the Southeast, including performing seed collections for the Seeds of Success Program. In 2020, SGI also received funding from USDA Natural Resources Conservation Service, to run the "Plant it Forward" project, to restore populations of grassland species in Tennessee, through ecoregional seed collection, seed processing, possible steps of seed increase and/or plant propagation, and reintroduction. SGI is working with local landowners and agencies to identify restoration needs, reference communities, and source populations for seed collection. These efforts provide a foundation upon which to grow a regional native seed program that tackles the shortage of ecoregional native plant materials for restoration in the southeastern U.S.

Photo: Southeastern Grasslands Initiative's Executive Director Dwayne Estes broadcasting native seeds in a prairie restored by SGI.
Photo credits: Rebecca Johnson

Recovery of Native Wetland Flora in the Río de la Plata Estuary.

Graciela M. Barreiro. Botanical Garden of the City of Buenos Aires "Carlos Thays", Argentina.
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Promoting recovery in the Río de la Plata estuary is an ongoing project for the Botanical Garden of the City of Buenos Aires.

The Río de la Plata delta is no longer a pristine ecosystem, and presents threats of varying degrees, affecting species composition and landscapes as well as cultural diversity. Today, the Monte Blanco forest vegetation has almost completely disappeared from the islands in the lower delta of the Paraná River and only relict patches are remaining.

The Botanic Garden of the City of Buenos Ares, has a tree species seedbank formed by collecting trips in the original habitat. The plants are grown in the Garden and transported and planted in site for restoration of small selected areas on the creek's high edges, serving as revegetation in patches and as educational paths as well.

The specific objectives for the project are:

- Enhancing ex situ conservation of native species of the Monte Blanco forest vegetation;
- Piloting restoration of degraded natural areas;
- Strengthening public outreach and networking to foster environmental sensitization of the ecological value of the Río de la Plata's wetland habitats for future generations.

Photo: Collecting seeds in Río de la Plata, Buenos Aires, Argentina.
Photo credits: Botanical Garden of the City of Buenos Aires "Carlos Thays".

The Hawaii Island Seed Bank

Jill Wagner, Hawai'i Island Seed Bank, Kailua-Kona, Hawai'i, USA. jillwagner3@icloud.com

The Hawaii Island Seed Bank (HISB) was started in 2008. Since then, it has supported native seed collections for large landowners who save their seed to support their own restoration projects because they don't have their own seed banking facilities. This conservation tool has been a game changer. It allows people to set larger goals for restoration activities, for the sharing of seed for research and restoration, and seed saving for the future. The seed bank has also provided the opportunity for education through internships. The seed bank stores common seeds for restoration and fire mitigation, as well as rare seed collections.

In 2020 the HISB was generously granted a solar-powered, containerized seed bank by Terraformation. The seed bank was the proto-type for their design to help people globally to set up regional seed banks so they can properly collect and store their native seeds. The seed bank is climate controlled with both temperature and relative humidity so seed collections can be dried in the room. There are drying racks which allow for larger collections to be dried and packaged properly.

The seed bank does several things. In addition to processing and storing collections and training conservation practitioners about seed banking, it also started selling common native seeds to the community. The sale of the seed packets gives people in the community a chance to grow native species, and it provides a little bit of funding for seed bank supplies.

The HISB is a founding partner in the Hawaii Seed Bank Partnership, a Hawaii State-wide collaborative of seed banks from each Island that meets to prioritize goals and support each other in our seed banking efforts.

For 2022, the HISB is working on a new collaboration with the Hawaii Agriculture Research Station (HARC). HARC conducts research on native seeds for disease resistance. It is working on a project to find resistant founder trees of *Acacia koa* and *Acacia koaia*. The resistant seedlings from the founder trees will be grown in seed orchards to ensure that we will have healthy stands of these foundational species for Hawaii.

Photos: a. Hawaii Island Seed Bank, Kona, Hawaii, **b.** *Acacia koaia*.
Photo credits: Jill Wagner

Special Issues

- Open call for contributions to the Special issue *Impacts of Climate Change on Long Term Viability of Trees Species with Recalcitrant Seeds*. Frontiers in Forests and Global Change.

Conferences

- International Society for Seed Science (ISSS): Seed Ecology Conference VII happening in September 2022.
- Protecting Nature on Mediterranean islands, Malaga, Spain, September 2022
- XI Colombian Congress of Botany happening in November 2022
- 2022 Botanical Bridges Congress, The Bahamas, November 2022
- 5th International Marine Protected Areas Congress (IMPAC5), February 2023
- XIII Latin American Congress of Botany happening in April 2023.
- UNESCO 45th session of the World Heritage Committee, postponed until further notice. The publication of official documents, including IUCN recommendations, will be established by UNESCO in accordance with the Rules of Procedure at the appropriate time.
- Past conference: International Plant Translocation Conference. Book of abstracts.

Courses

- **Winter course 2022:** ISSS Seed Functional Ecology.
- **Workshop:** Seed Conditioning and Quality Testing. Seed Science Center - Iowa State University, 2022

SEED CONSERVATION DIRECTORY OF EXPERTISE

The IUCN/SCC Seed Conservation Specialist Group is updating the Seed Conservation Directory of Expertise.

The directory contains a comprehensive list of individuals from over 400 institutions around the world that are working on collecting and conserving species of wild origin.

The directory includes easily searchable country, facility, research, and expertise information at the individual and institutional level. This tool benefits the global plant conservation community through expanding seed conservation networks, facilitating exchange of information and ideas, and enabling better seed conservation stewardship by facilitating connections, collaborations and exchange.

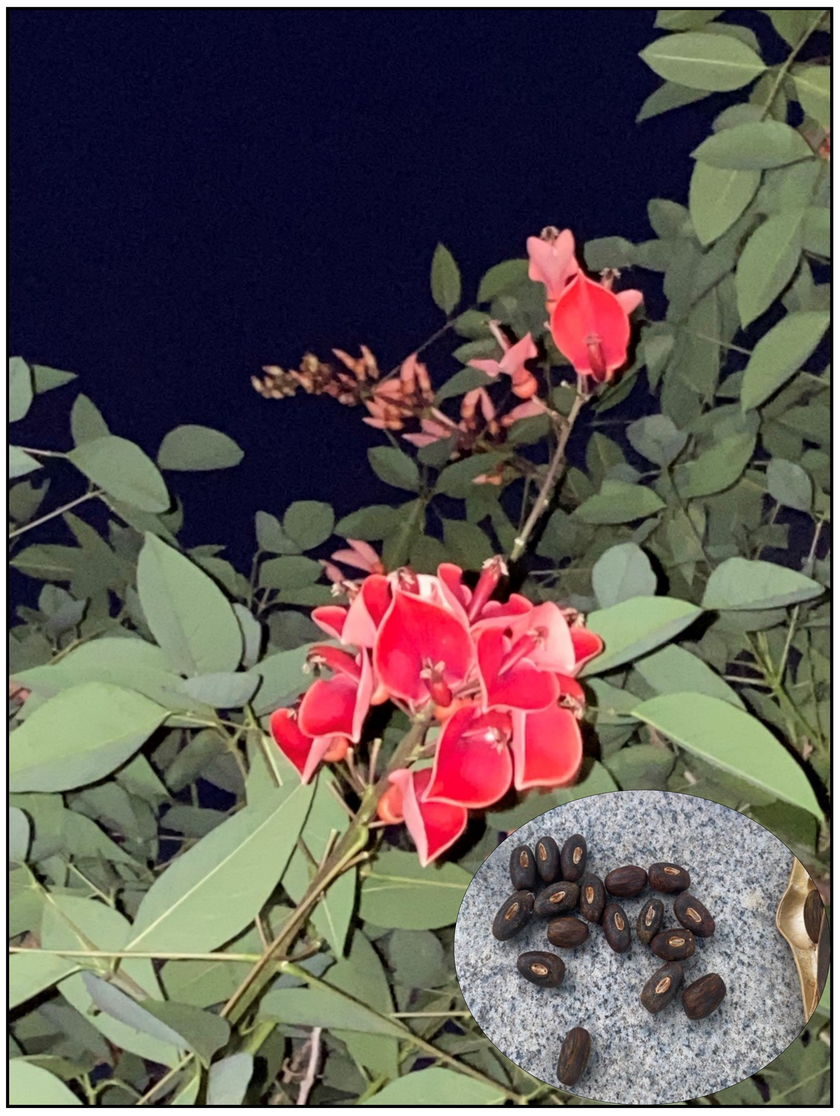
We are seeking to add the expertise of seed conservation practitioners **not currently** represented to the directory. To do this, please fill out the form found at https://www.surveymonkey.com/r/SeedDirectory.

Photo: Video screenshot of the Seed Conservation Directory of Expertise

HOW TO GET INVOLVED

We welcome anyone with a passion for seed conservation to become a member of the Seed Conservation Specialist Group (SCSG).

- Do you curate a seed bank, collect wild seeds in the field, use seeds in a restoration program, conduct research on seed biology, or have related experience? If your work happens in the context of plant conservation or ecosystem restoration, you could become a member of the SCSG. We welcome all levels of expertise, from senior program directors to students at any level - anyone with a passion for conserving native seeds.
- Members of the SCSG are also members of the IUCN Species Survival Commission, which grants them access to a network of over 10,000 volunteer experts and numerous shared resources.
- If interested, please contact the SCSG Co-Chairs at iucn-scsg@outlook.com to request an invitation. Attach a brief CV, summary of your expertise, or statement of interest in joining the SCSG.
- Not sure if you are ready to join, or just looking for advice? Feel free to Contact Us with your questions.



Flowers and seeds of *Erythrina crista-galli* L., a culturally and medicinally important Fabaceae species. **Photo credits:** Uromi Manage Goodale

SCSG Co-Chair Marian Chau at Millennium Seed Bank inside the storage freezer. **Photo credits:** Marian Chau

LEARN MORE ABOUT OUR COVER PHOTO AND THE PHOTOGRAPHER BEHIND IT!

Cover photo description: Jatobá seed (*Hymenaea courbaril* L.) germinating on the ground, with two young leaves and cotyledons in the Atlantic Forest, São Paulo, Brazil.

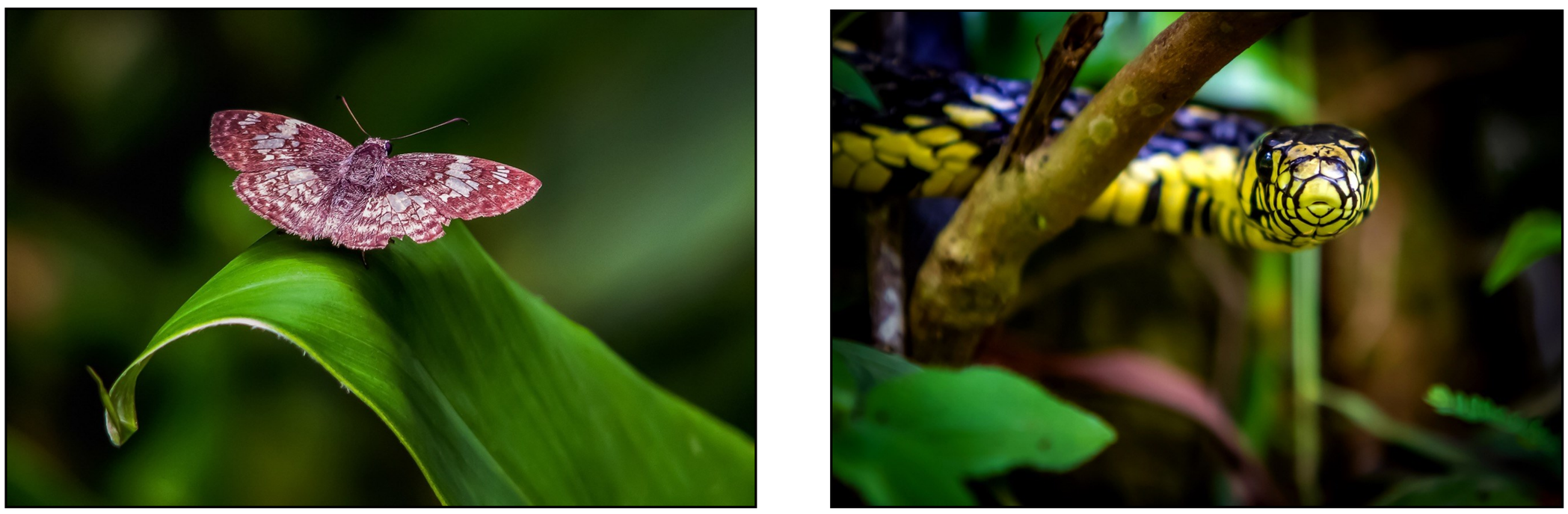
Author: Carlos Eduardo Camargo de Godoy

Carlos was born in Amparo city, São Paulo, Brazil, he is a biologist from the Institute of Biosciences of the University of São Paulo (1987) who loves to explore nature, take photos, and teach kids about natural sciences. Currently, he is a Teacher of Nature Sciences and the Head of Department of Nature Science.

"*Most of my photos focus on details of living beings such as flowers, seeds, small invertebrates, and giant animals. As a science teacher, I show these images to my students and challenge them to name the structure. They love it! You can learn more about it on my YouTube channel. I also share my passion for photography by giving children lessons about how to observe and take pictures of nature. I believe that by using beautiful images of nature, I can touch children's souls and contribute to developing their interest on the planet.*

I am very proud to be a teacher! In 2017, one of my school projects achieved Brazil's finals of the Prize Educator Note 10. As a teacher, I believe that I can help Planet Earth. And nature photography is an essential tool for this".

To learn more about Carlos, please visit his personal website, Instagram and his profile on the GuruShots, the world's greatest photography game, where photos of the best photographers of the world are shown!



Photos: Left - Butterfly laying on a leaf. Right - Caninana snake (*Spilotes pullatus*) looking at photographer. Both photos captured in the Atlantic Forest, São Paulo, Brazil.
Photo credits: Carlos Eduardo Camargo de Godoy