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“Plant Genetic resources: Opportunities and Challenges“
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Ex-situ conservation wild plant genetic resources of Georgia in partnership with the Millennium Seed Bank, RBG, Kew (UK)



**BOTANIC
GARDENS**
CONSERVATION
INTERNATIONAL

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Ana Gogoladze, Sandro Kolbaia, Mariam Kikvidze





Welcome, colleagues, guests, my name is Tsira Mikatadze - Phantsulaia, Head of the Plant Conservation Department of the National Botanical Garden of Georgia. The National Seed Bank of Georgia is operating under this Department.

I would like to give you a brief overview of our work, implemented within the framework of the Millennium Seed Bank partnership.



History of the Department of Conservation

In 2000, the Department of "Living Flora of the Caucasus" of the Niko Ketskhoveli Institute of Botany, existing since 1891, was named the Department of Plant Conservation

This historical department, located on the territory of the Botanical Garden, was the first scientific botanical institution in the Caucasus region

One of the directions of the department was collecting of species of local flora in nature, creating living collections, as well as transplanting plants to the collection plot near the department, storing seeds and propagating plants.

Since the establishment of the Conservation Division, our goal has been to establish a seed bank

The priority is conservation of endemic, relict, species of economic importance of the Caucasus / Georgia flora, wild relatives of crops and species of economic importance (food, medicinal plants, ornamentals, dyes, etc.).

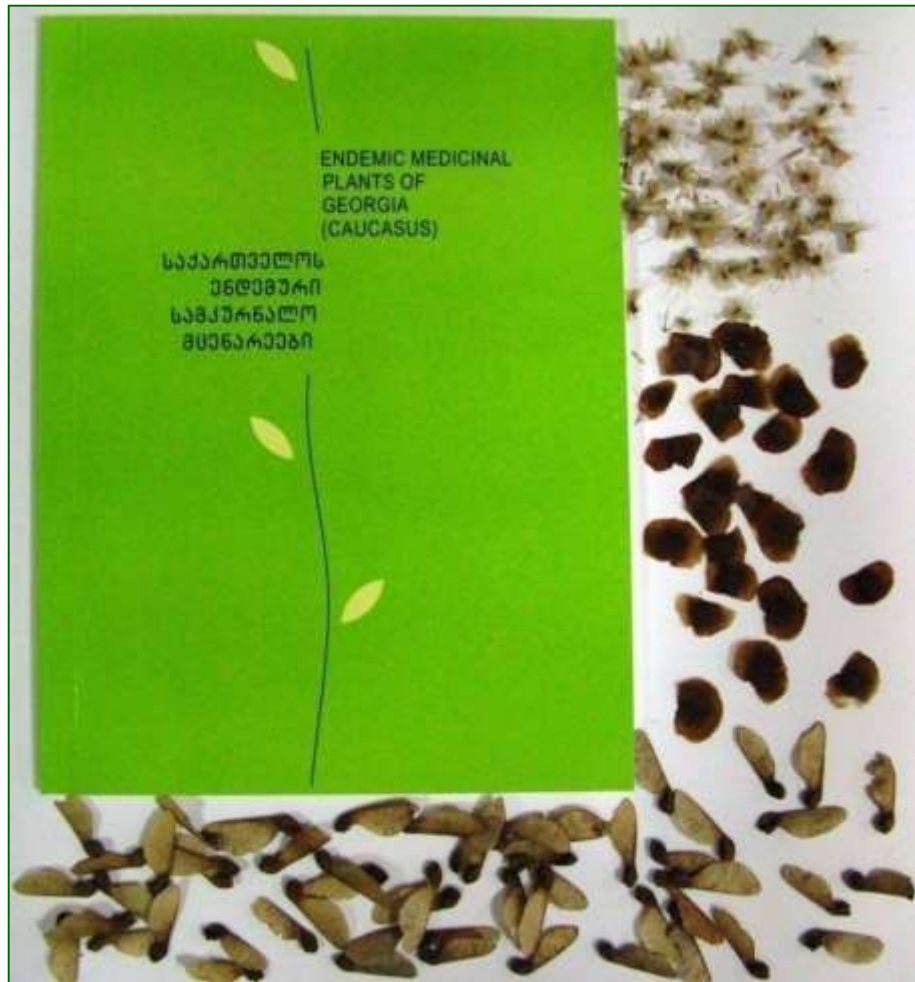
General Context: Plant Diversity in the Caucasus

- More than 4,200 (4,275) vascular plant species in Georgia.
- High endemism level reflects its species richness (21% of the local flora) with about 900 species of which 600 sp. are endemic to Caucasus and 300 sp. Endemic to Georgia
- Nearly 10% of vascular plants are woody species (~400 sp.)
- Around 2000 economically important plant species are concentrated in the region (Caucasus).



Davlianidze et al (2018) Nomenclatural Checklist of Flora of Georgia

CAUCASUS REGIONAL SEED BANK



“Endemic Medicinal Plants of Georgia (Caucasus)
J.S. Miller, K. McCue, T. Consiglio, J. Stone, M. Eristavi,
Sh. Sikharulidze,
Ts. Mikatadze-Pantsulaia, M. Khutsishvili, 2006

- Ex-situ conservation via establishing seed banks and living collections is one of the most efficient and comparatively low-cost methods for the protection of plant biodiversity.
- The Caucasus Regional Seed Bank (CRSB) was established in **2001** in the N. Ketskhoveli Institute of Botany (as it was then called) with a collaborative project **2001-2006** with the **Missouri Botanical Garden (USA)** by the financial support from the **CRDF** (Civilian Research & Development Foundation, U.S.).
- Two joint projects were accomplished during 2001-2006 with American colleagues and, as a result, seeds of 150 endemic and rare medicinal plant species were deposited in the seed bank, the data base created using the information system TROPICOS and the checklist published.

Ex-situ conservation efforts within the framework of the Millennium Seed Bank Partnership in Georgia



- Since 2000, Kew Botanical Gardens of Great Britain has been operating the "Millennium" seed bank program. The first stage - **MSB-1 2000-2010** - provided for the placement of 10% of the world's flowering plant seeds from 24,000 species.

MSB-2- 2010-2020 -15 %

MSB-3- 2020-2030 -25%



- Next and very important step in the development of the **Seed Bank** was collaboration with **Kew's Millennium Seed Bank Partnership** which commenced in 2005
- Researchers of the Department of Plant Conservation of the National Botanical Garden of Georgia (NBGG) and colleagues from the Institute of Botany of the Ilia State University work together to achieve the targets of the Millennium Seed Bank Partnership (MSBP) (MoU's -2005-2010; 2010-2020; 2020-2030).
- Georgia was the first former Soviet country to join the MSBP. Later Botanical institutes of Armenia and Azerbaijan joined the regional project (2011)
- The priority of MSBP is long term conservation of **rare, endemic, relict, threatened and economically important species among them Crop Wild Relatives (CWR) found in wild flora of Georgia and the Caucasus Region**



CAUCASUS REGIONAL SEED BANK

2011, 06 November, Tbilisi, Ministry of
Environment Protection



Mr. George Zedginidze, Deputy Minister of Environment Protection met the representatives of the **Millennium Seed Bank** at the **Ministry of Environment Protection of Georgia** and awarded them certificates in recognition of achievements in conservation of the Georgian and global flora.

CAUCASUS REGIONAL SEED BANK -

2011, 06 November, Tbilisi, Ministry of Environment Protection

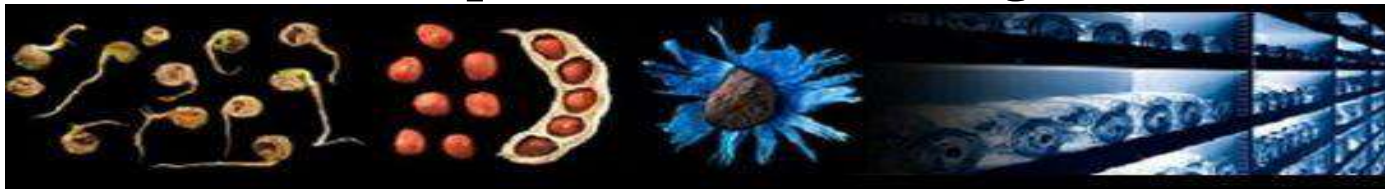


The certificates were awarded to **Dr. Paul Smith**, Head of Millennium Seed Bank (Royal Botanic Gardens, Kew); **Mrs. Clare Trivedi**, International Projects Coordinator, Seed Conservation Department (Royal Botanic Gardens, Kew); and **Mr. Noel McGough**, Head of Conventions and Policy Section (Royal Botanic Gardens, Kew).



Aims of the National Seed Bank of Georgia (NSBG)

- **Multi provenance high quality documented seed collections with seed numbers >500**
- **Safe Duplication of seed collections – seeds are stored in NSBG and duplicated to MSB, RBG, Kew, herbarium** vouchers are kept at the National Herbarium of Georgia (IoB) and the duplicates sent to the Herbarium of the Royal Botanic Gardens, Kew (K)
- **Research to overcome constraints to storage /germination/ propagation of priority species**
- **Research on reproduction biology of rare species**
- **Growing living collections, development of germination and propagation protocols**
- **Improving accessibility of seed collections for scientific research and conservation activities – reinforcement of natural populations and habitat restoration programmes**
- **Seeds of target species are collected in the wild. For each species field data sheet is filled in consisting of comprehensive information about the sample, its habitat and the collection process.**
- **Further development of seed banking infrastructure**



Projects implemented within MSBP partnership since 2005

MoU (2005 -2010)

“Collection of seeds of native plant species from Georgian flora for *ex-situ* conservation at the Institute of Botany, Georgia and the Millennium Seed Bank, (UK)” Royal Botanic Gardens (Kew) Grants UK# 4714 P 4/6

MoU (2010 -2020)

„Saving the Flora of Caucasus“, Royal Botanic Gardens (Kew) UK, MSBP (Millennium Seed Bank Partnership)

2# 4714 P 4/6 2011-2020 Armenia and Azerbaijan joined the Project

“Adapting Agriculture to Climate Change” (2014-2016)

Aimed at the conservation of germplasm of crop wild relatives (CWR), Crop Trust

“Garfield Weston Global Tree Seed Bank Project” (2015-2019)

Aimed at creation of 131 woody species from 144 populations.

“Enhancing rural Caucasian community livelihoods through fruit and nut conservation” (2018-2021)

Darwin Initiative

“Threatened Biodiversity Hotspot Programme” (2020 -2021)

MoU (2021-2030)

“Threatened Biodiversity Hotspot Programme” (2021 -2023)

“Unlocking the Caucasus Tree Seed Bank” (2024-2027) - ongoing



ADAPTING AGRICULTURE TO CLIMATE CHANGE

Collection of Crop Wild Relatives in Georgia by the National Botanical Garden and Institute of Botany; Global Crop Diversity Trust, Bonn, Germany

- ▶ NBGG and Institute of Botany implemented the project: “Towards the More Complete Coverage of the Diversity of Crop Wild Relatives in ex situ Collections” (2014-2016)
- ▶ The project have collected seed sets from 151 populations of the 27 target plant species – crop wild relatives
- ▶ Target list identified by the GCDT/MSB using the GAP-analysis for the purposeful pre-breeding activities

List of CWR collected within the project

| Species name | Family name |
|---|-------------|
| <i>Aegilops biuncialis</i> | POACEAE |
| <i>Aegilops cylindrica</i> | POACEAE |
| <i>Aegilops geniculata</i> | POACEAE |
| <i>Aegilops tauschii</i> | POACEAE |
| <i>Avena fatua</i> | POACEAE |
| <i>Avena sterilis</i> | POACEAE |
| <i>Daucus carota</i> | APIACEAE |
| <i>Hordeum murinum</i> subsp. <i>leporinum</i> | POACEAE |
| <i>Lathyrus hirsutus</i> | FABACEAE |
| <i>Lathyrus sylvestris</i> | FABACEAE |
| <i>Lathyrus tuberosus</i> | FABACEAE |
| <i>Lens culinaris</i> | FABACEAE |
| <i>Malus orientalis</i> | ROSACEAE |
| <i>Medicago marina</i> | FABACEAE |
| <i>Medicago papillosa</i> subsp. <i>papillosa</i> | FABACEAE |
| <i>Medicago rigidula</i> | FABACEAE |
| <i>Medicago sativa</i> | FABACEAE |
| <i>Medicago sativa</i> subsp. <i>glomerata</i> | FABACEAE |
| <i>Medicago sativa</i> subsp. <i>varia</i> | FABACEAE |
| <i>Pisum sativum</i> | FABACEAE |
| <i>Thinopyrum intermedium</i> | POACEAE |
| <i>Vicia grandiflora</i> | FABACEAE |
| <i>Vicia lutea</i> | FABACEAE |
| <i>Vicia sativa</i> | FABACEAE |



Trees and Shrubs (Garfield Weston Foundation) Global Tree Seed Bank Project 2015-2019

With the common efforts of NBGG and IOB, 131 woody species from 144 populations has been banked to date

This collection comprises relict species of Colchic forests important for the study of the history of the Caucasus flora from the following genera: Rhododendron, Betula, Ruscus, Ilex, Daphne, Hedera, Laurocerasus and others

Two of the species are selected for the IUCN Red List assessment (*Sambucus tigranii* and *Eversmannia subspinosa*) and this process is currently underway

Trainings and workshops were conducted and the work process is in progress

Fild Work

Periploca graeca L.



Population of
Malus orientalis,
Dedoplistskaro





Fruit and Nuts (Darwin Initiative)



Darwin Initiative project “Enhancing rural Caucasian community livelihoods through fruit and nut conservation” (Georgia) (2018-2021) (The regional current project – (NBGG , IoB of Ilia State University and Armenia)

Focuses on ex-situ conservation of threatened and economically important fruit and nut species, subspecies and populations in Georgia

Active engagement of local communities and strengthening of environmental education are central components of the project.



Ruscus colchicus



Collection of *Acer laetum*



Ilex colchica



Hedera pastuchowii

Mchadijvari community gardening workshop



Prioritization of species for Conservation

IUCN Red List

The most comprehensive information source on species extinction

NBGG specialiste were trained in species assessment according to IUCN categories

Family *Rosaceae*

The screenshot shows the IUCN Red List website interface. At the top, it says "The IUCN Red List of Threatened Species" and "2012.2". There are navigation links for "About", "Initiatives", "News", "Photos", "Partners", "Sponsors", and "Resources". A search bar is present with the text "Enter Red List search terms" and a "DONATE NOW!" button. Below the search bar, there are tabs for conservation status: "Least Concern", "Near Threatened", "Vulnerable", "Endangered", "Critically Endangered", "Extinct in the Wild", and "Extinct". A large circular image of a palm-like plant is featured, with the caption "Dypsis mcdonaldiana" and "© J Dransfield, RBG Kew". To the left of the image, there are several news snippets with dates and headlines, such as "A users' guide to the IUCN Red List web site" and "New report warns of uncertain future for African elephants". At the bottom, there are social media links for Facebook and Twitter, and the IUCN logo.

❖ *Rosa buschiana* Chrshan.

Endemic of the Caucasus NE –
LC

❖ *Rosa galushkoi* Demurova

Endemic of the Caucasus VU B1ab(iii)
VU B1ab(iii) + B2ab(iii)

❖ *Rosa tuschetica* Boiss.

Endemic of the Caucasus NE –
NT

❖ *Rosa doluchanovii* Manden.

Endemic of Georgia- DD -
EN B1ab(iii) + B2ab(iii)

❖ *Rosa transcaucasica* Manden.

Endemic of Georgia- DD
VU B1ab(iii)+2ab(iii)

❖ *Rosa rapinii* Boiss. & Balansa

NT

Training:





Partnership Results



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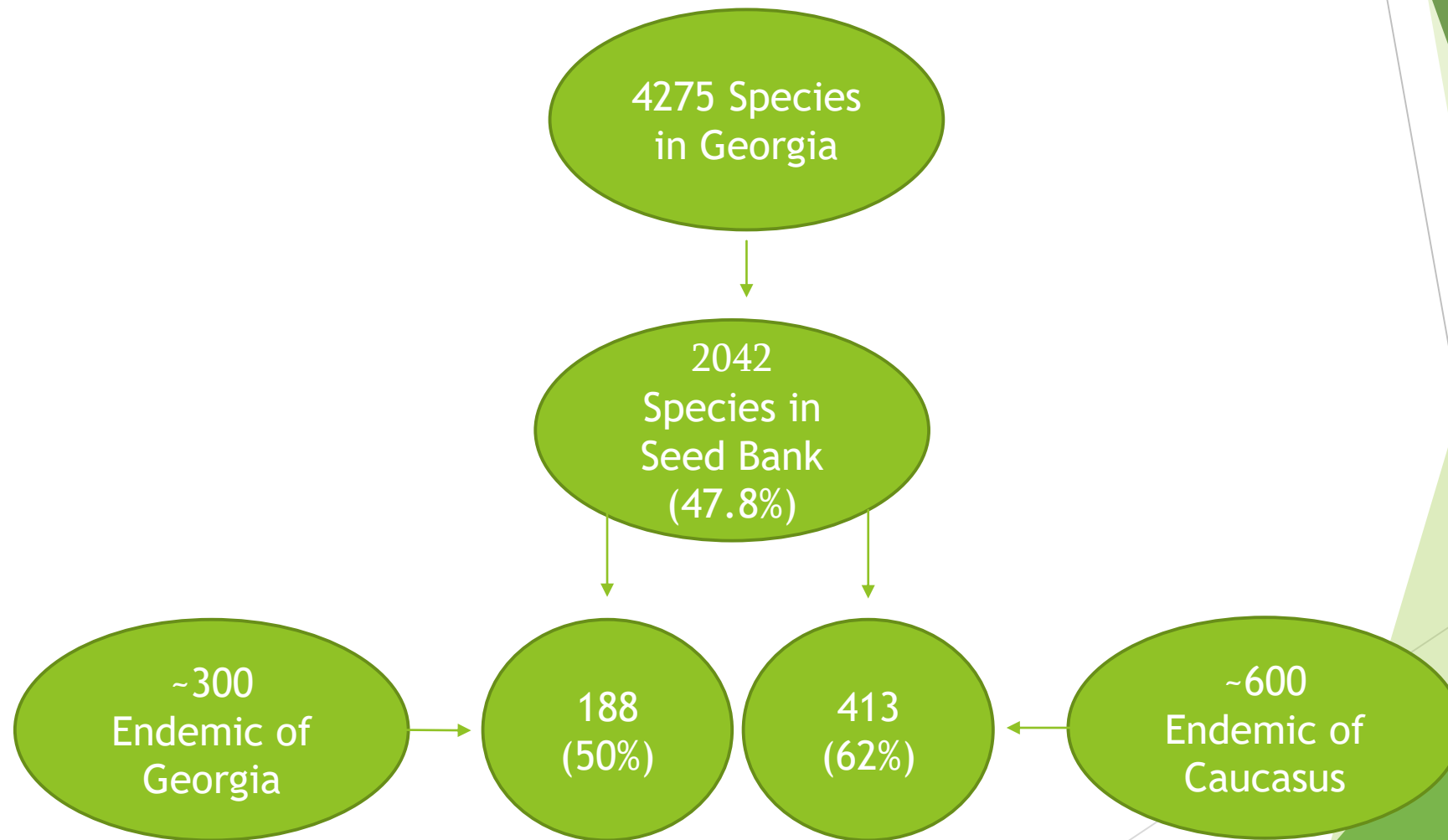


Under the scope of Millennium Seed Bank Partnership's MSB-1 and MSB-2 projects in the years between 2005-2022 seeds of 2,018 taxons and interspecific taxa, belonging to 109 families and 521 genera - **more than 47%** out of 4,275 species known for Georgia were collected and deposited in the National Seed Bank of Georgia (NSBG) 413 Caucasian (68%) and 188 Georgian (62%) endemics.

Young specialists have undergone training in accordance with IUCN Red List international criteria of species assessment, have improved their qualifications, and we have specialists in the country whose work results have been uploaded to the relevant portal.

The conservation department of the National Botanical Garden has a team of qualified scientists who can evaluate the viability, germination and emergence quality of the seeds of a particular species according to international standards.

Progress to date - Seed bank collections 2005-2023



Horticulture

Seed bank of 5 species of primary conservation status was created: *Galanthus kemlarae*, *Campanula cachetica*, *Cyclamen colchicum*, *Pulsatilla georgica*, *Paeonia steveniana*, which are used for the restoration of their reduced population.

Solomon J., Shulkina T., Schatz E. G. (2014) Red List of the Endemic Plants of the Caucasus: Armenia, Azerbaijan, Georgia, Iran, Russia, and Turkey. Monographs in Systematic Botany from Missouri Botanical



Cyclamen colchicum



Paeonia steveniana



Pulsatilla georgica



Campanula kachetica



Development of seed banking Laboratory and infrastructure:

The infrastructure was renovated and expanded, add two laboratories complexes and dry room. necessary Freezer laboratories for the seed bank were added modern technical equipment: such as Incubators, special device for seed cleaning, stereos and microscopes and more. The two expedition vehicles, were purchased for field trips.



Dry Room

Publication

The work carried out within the framework of the partnership has been published in more than 20 high-ranking scientific journals, and reports have been made at more than 10 scientific conferences and symposiums. The seeds placed in the seed bank are used for scientific research, ecological education, and are supplied to local and foreign interested institutions for research.

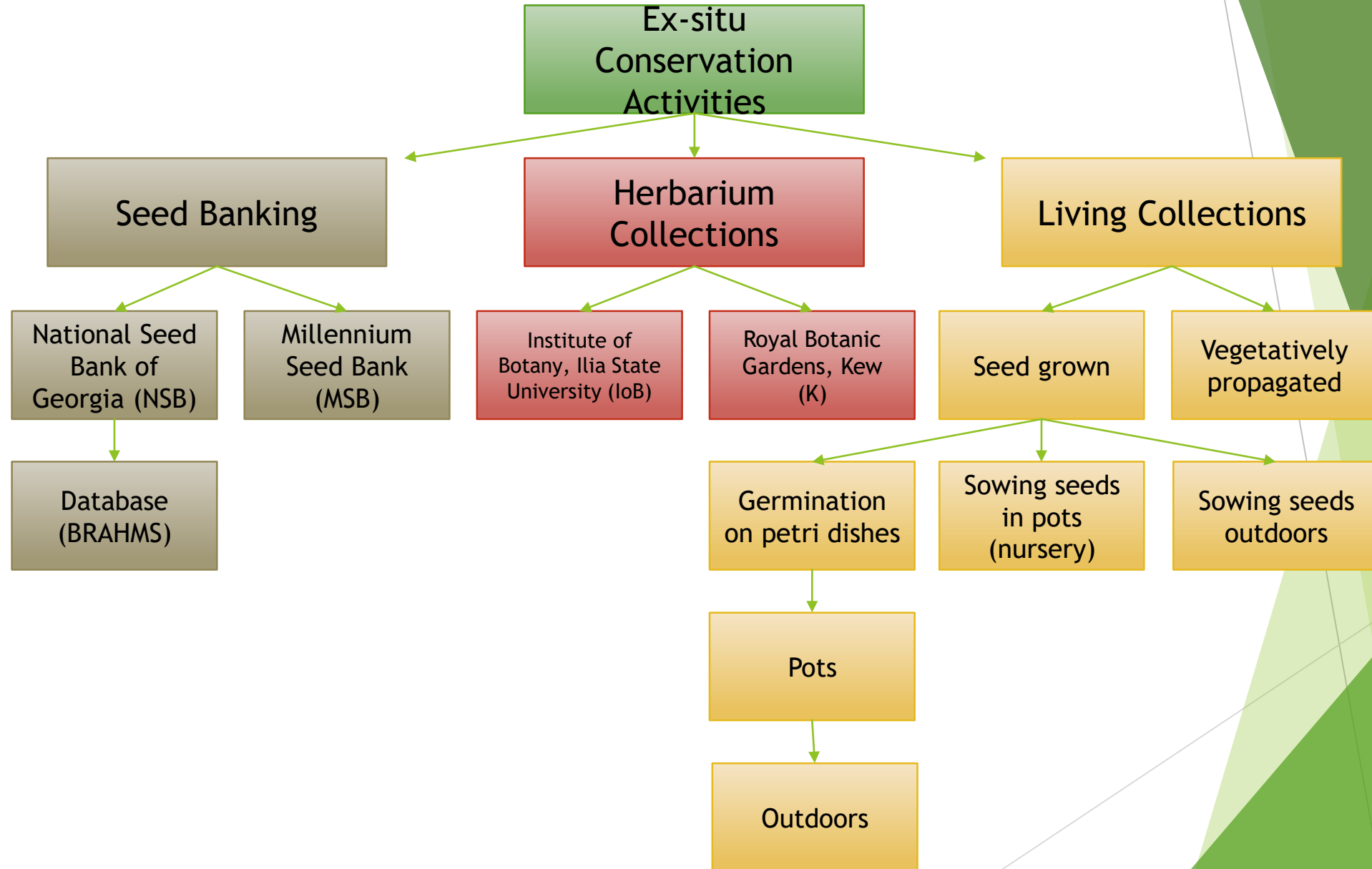




The above-mentioned conservation works are continued with within support of Tbilisi City Hall Municipality funding KPI (Key Performance Indicators)

| Result period | 2016 | 2017 | 2018-20 | 2021-25 | 2026-30 |
|---|-------|-------|---------|---------|---------|
| Red List Assessments | 0 | 1 | 30 | 50 | 50 |
| Germination protocols for threatened species | 6 | 2 | 5 | 10 | 15 |
| In-situ reintroduction species numbers | 1 | 1 | 3 | 5 | 7 |
| Percentages (%) of Georgian species placed in seed bank | 37.5% | 40.5% | 45% | 55% | 65% |

Work structure



The department's slogan is: "From seed to seed".





Thank you for your attention!