

A European research infrastructure for plant genetic resources – ‘GRACE-RI’

Sandra Goritschnig and the PRO-GRACE Consortium

PRO-GRACE-EMPHASIS Policy Symposium and Workshop

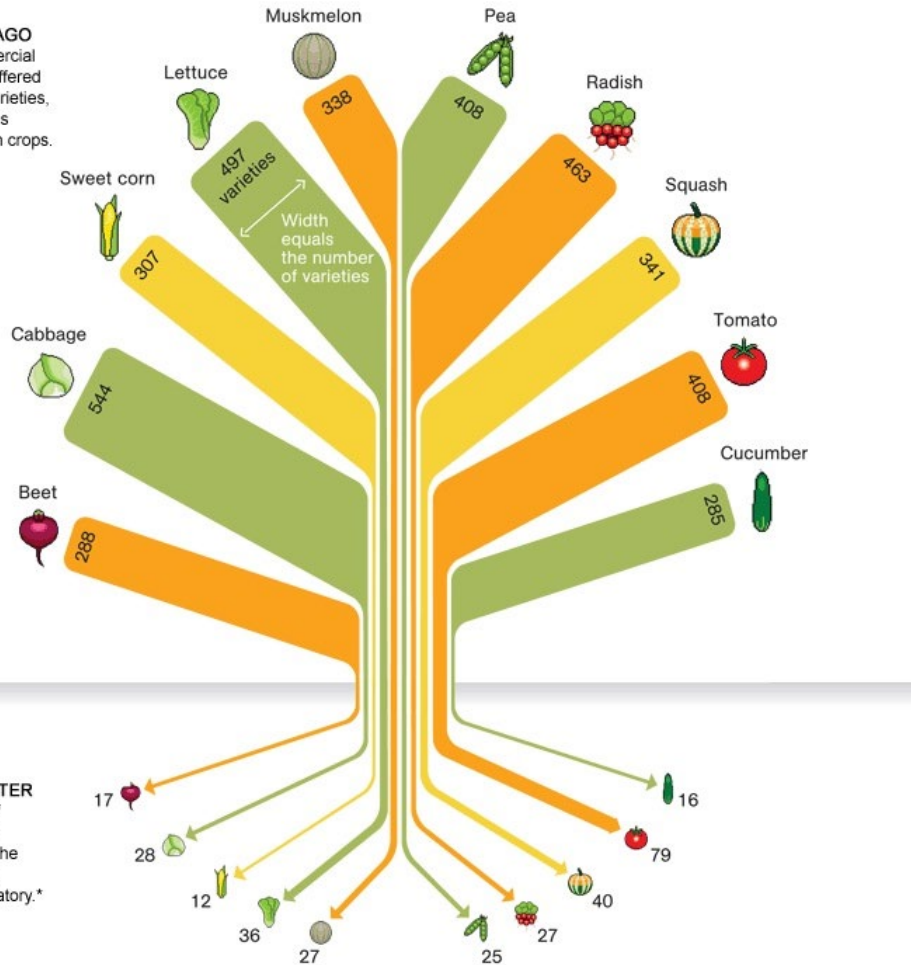
Brussels, 27 June 2024



PGRFA as a public good – Challenges and opportunities

Genetic erosion of cultivated crops and crop wild relatives threatens biodiversity

A CENTURY AGO
In 1903 commercial seed houses offered hundreds of varieties, as shown in this sampling of ten crops.



80 YEARS LATER
By 1983 few of those varieties were found in the National Seed Storage Laboratory.*

* CHANGED ITS NAME IN 2001 TO THE NATIONAL CENTER FOR GENETIC RESOURCES PRESERVATION

JOHN TOMANIO, NGM STAFF. FOOD ICONS: QUICKHONEY SOURCE: RURAL ADVANCEMENT FOUNDATION INTERNATIONAL

Since ~1920, farmer's varieties, landraces and wild relatives have been collected in genebanks

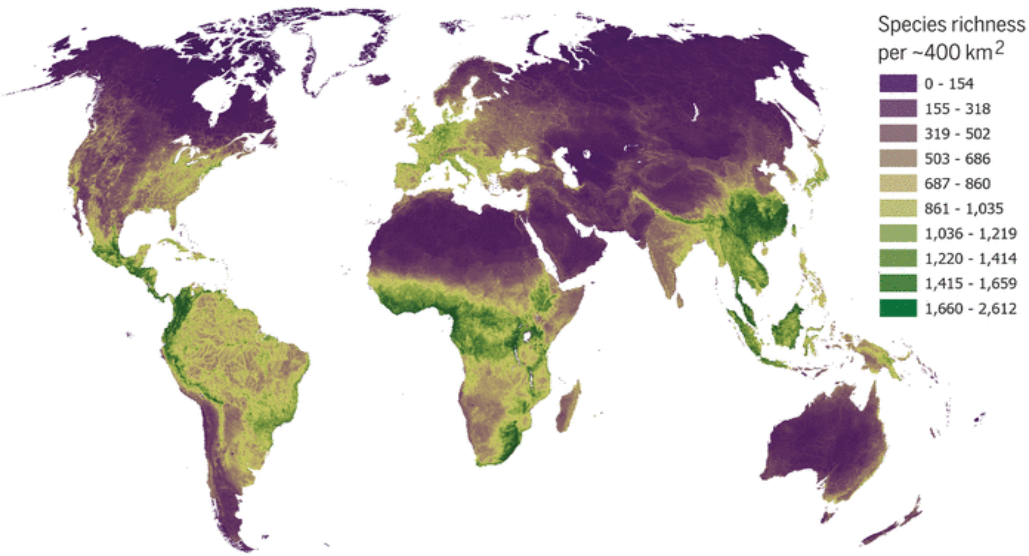


Maize conserved at the Portuguese genebank. Credit: L. Maggioni

Genetic erosion:

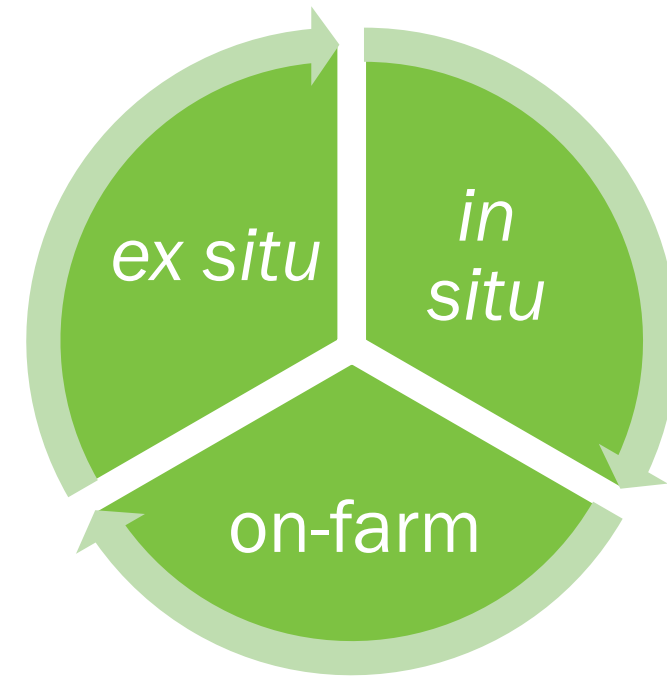
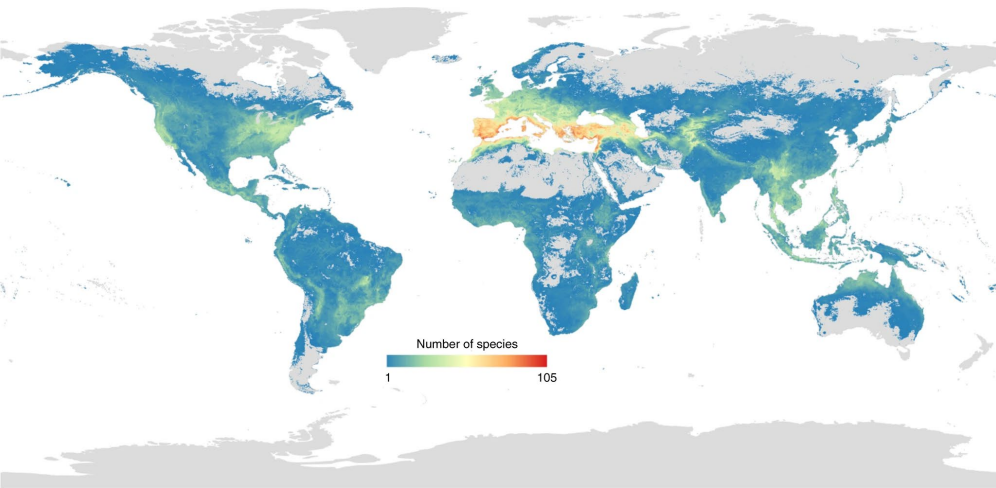
- Loss of crop varieties in active use by farmers over the past century
- Loss of crop wild relatives in nature, with 16-35% threatened with extinction

A Global distribution of utilized plant species richness



Effective conservation and management of critical biological infrastructure (=PGRFA) across Europe is necessary to address projected biodiversity loss

Crop wild relative species richness

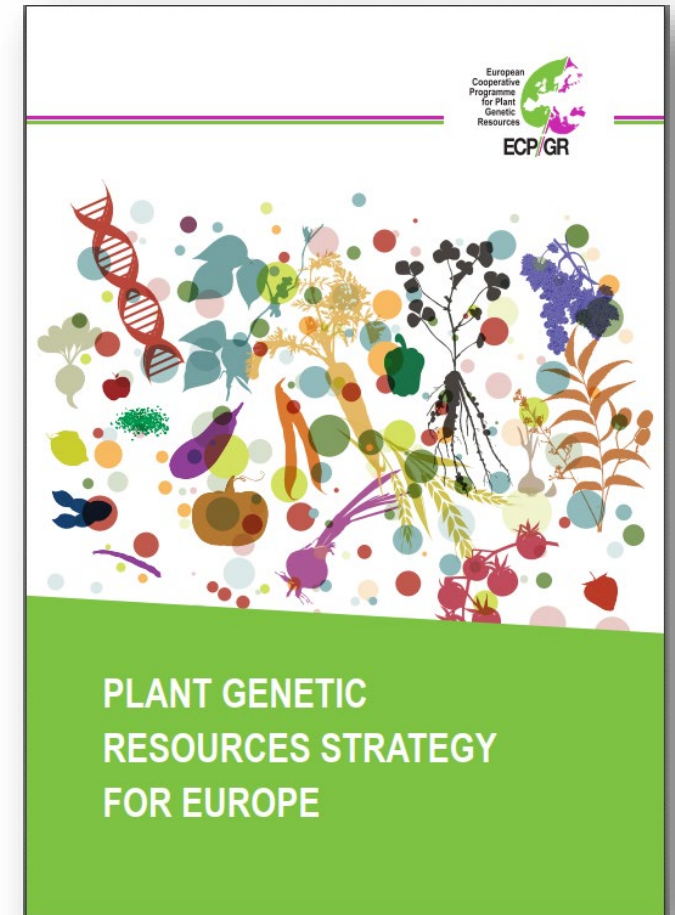


Pironon et al, 2024. The global distribution of plants used by humans, *Science*.

Vincent et al, 2019. Modeling of crop wild relative species identifies areas globally for in situ conservation, *Nature Communications*

Plant Genetic Resources Strategy for Europe – Priorities by 2030

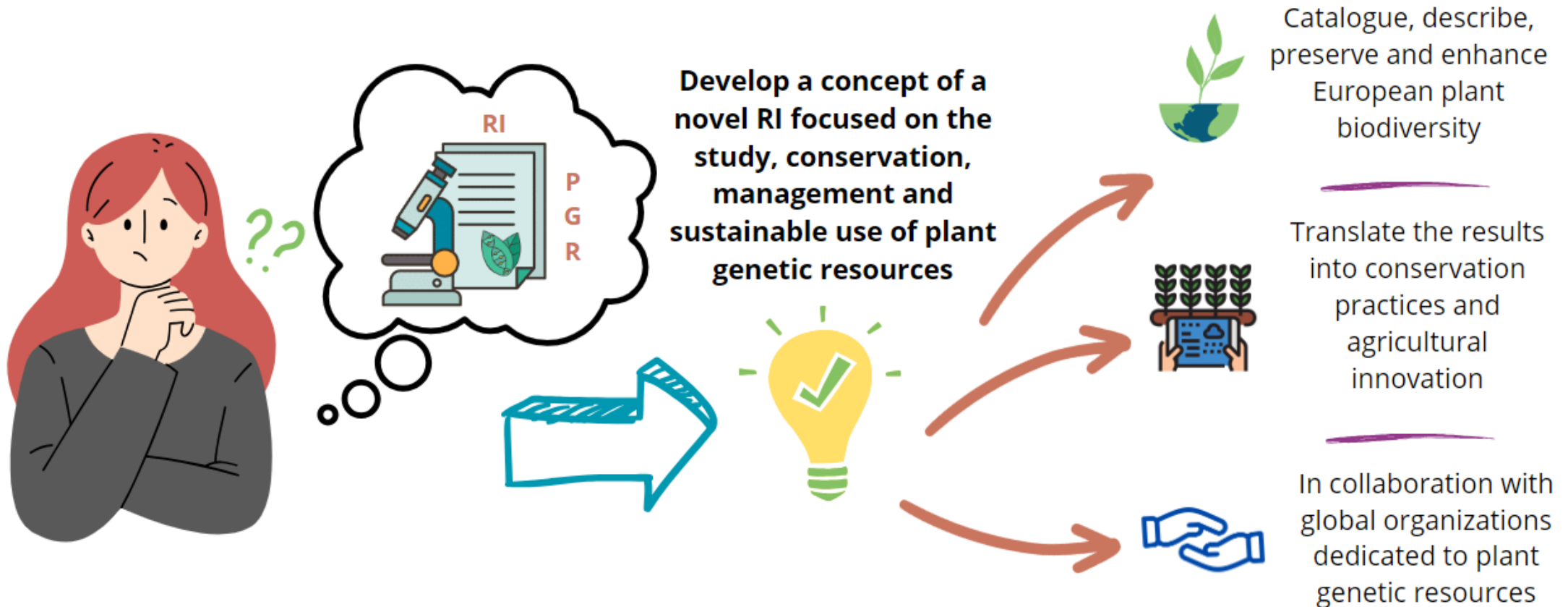
- Plant Genetic Resources are essential for our food security and bioeconomy, but are endangered by climate change, unreliable resource management and limited accessibility
- Researchers and plant breeders need access to an efficient system of conservation and targeted investments to explore and exploit the existing diversity
- Europe's Plant Genetic Resources require long-term investment and firm political will.



Launched in Brussels,
30 November 2021

PRO-GRACE can be a route to implementation: An efficient long-term infrastructure for conservation, documentation and sustainable use

PRO-GRACE: Promoting a Genetic Resources Community in Europe



<https://www.grace-ri.eu/pro-grace>

31 Pro-GRACE partners from Europe and across the globe, combining expertise in conservation, research, breeding, cultivation and policy of Plant Genetic Resources



Agricultural
Institute of
Slovenia



UNIVERSITÀ
DI TORINO



UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA



Instituto Nacional de
Investigação Agrária e
Veterinária, I.P.



NEMZETI BIODIVERZITÁS-
ÉS GÉNMEGŐRZÉSI KÖZPONT



Consiglio Nazionale
delle Ricerche



Rete
Semi
Rurali



IPGR-SADOVO



Royal Botanic Gardens
Kew



CROP
TRUST



Arabidopsis.info



World Vegetable Center



MAGYAR MEZŐGAZDASÁGI
AKADÉMIA



pro
specie
rara
Swiss Foundation
for Cultural and
Genetic Diversity of
Plants and Animals



CIP
INTERNATIONAL
POTATO CENTER



The James
Hutton
Institute

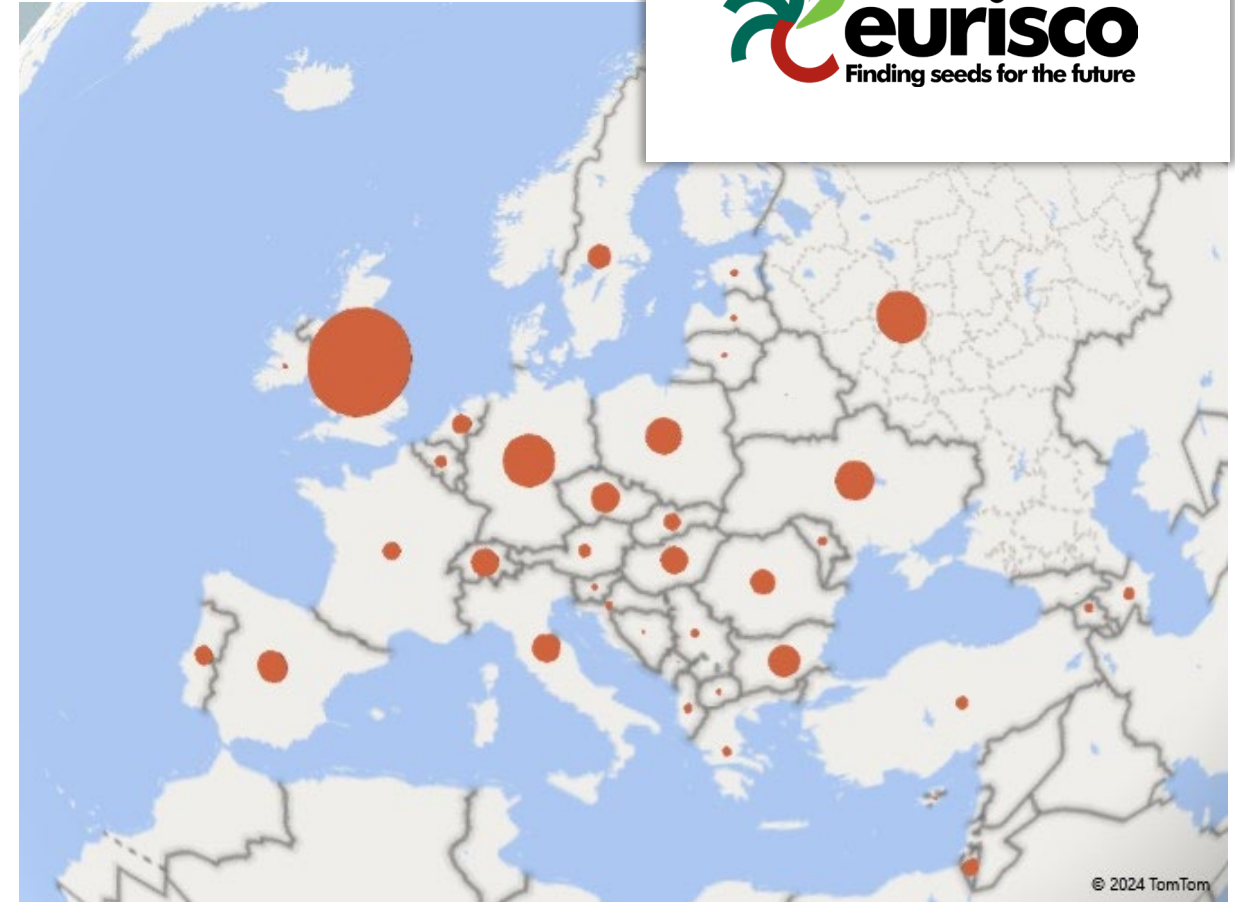
UNIVERSITY OF
BIRMINGHAM



Building on existing initiatives

European countries conserve >2M PGRFA *ex situ* accessions documented in 43 national inventories

- PGRFA include
 - Wild/natural populations
 - Traditional cultivars/landraces
 - Breeding/research materials
 - Advanced/improved cultivars
- PGRFA conservation follows **national mandates** (obligations under CBD and ITPGRFA)
- Global challenges require **collaborative solutions**



Circle size corresponding to size of national PGR inventory

European Cooperative Programme for Plant Genetic Resources

- Founded in 1980
- **Self-funded** programme belonging to the participating countries
- **Member countries also contribute in kind** to the programme, through collaborative PGR conservation activities

Stakeholders in Europe collaboratively,
rationally and effectively conserve *ex situ*
and *in situ* PGRFA, provide access and
increase sustainable use



In situ conservation in Europe

Commitments to *in situ* networking



Progress:

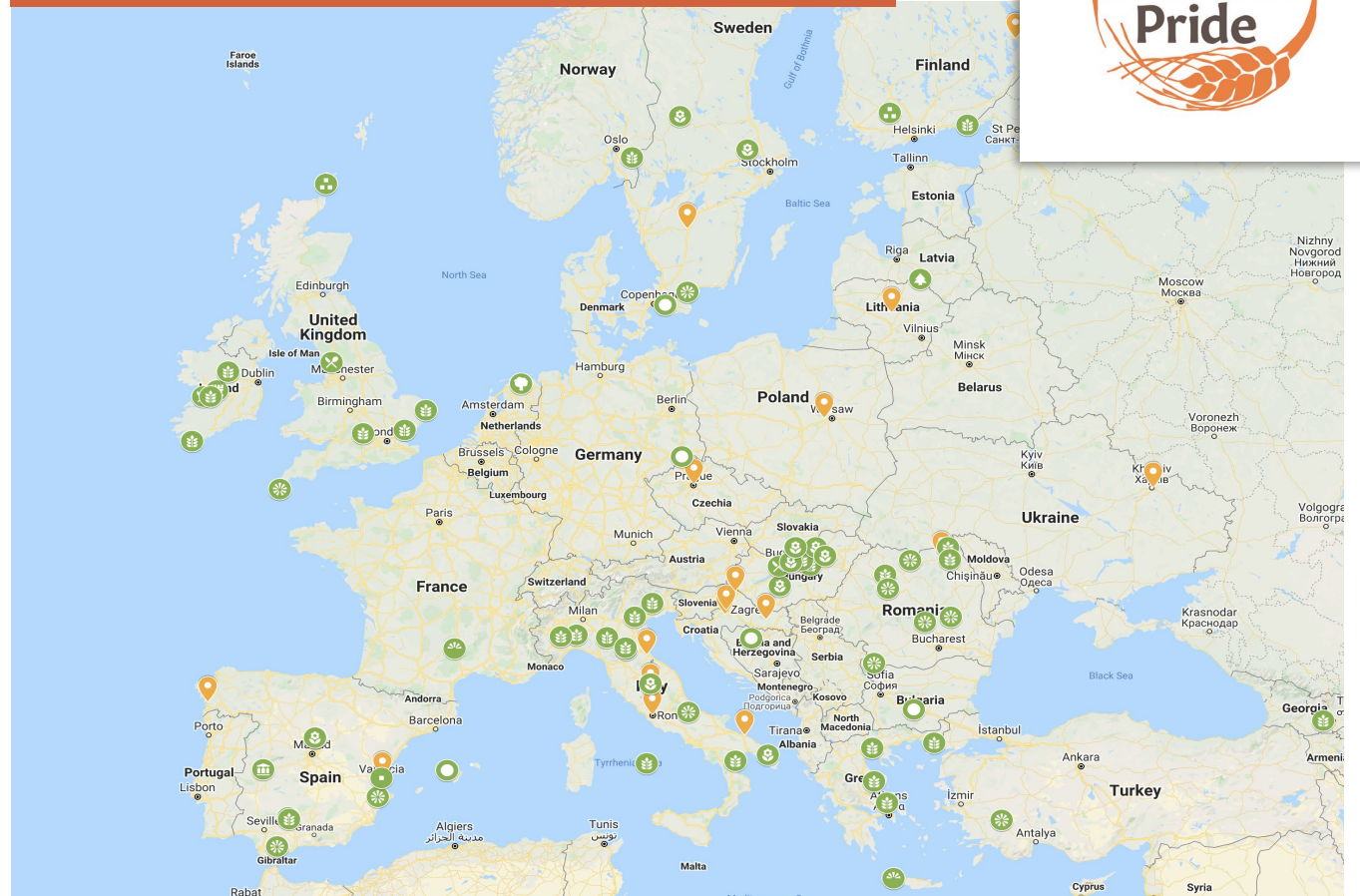
- Standards and guidelines for crop wild relatives conservation and management are available
- Assessment of priority taxa and conservation sites across Europe.

Reality check:

- Very few countries have initiated *in situ* genetic reserves in a few sites
- Standards are not implemented

Potential:

- Implementation regional/national *in situ* CWR networks in Europe would **double diversity available to breeders**



European Coordination of **on-farm** conservation: Let's Liberate Diversity!

Let's Liberate Diversity! boasts a robust **network of 20 members**:

- **170 national organizations** operating across **19 European countries** with a membership base of **>35,000** individuals.
- In collaboration with **~15,000 farmers**, LLD members engage in conserving and managing **~40,000 varieties**.

<https://liberatediversity.org/>

Countries	EC-LLD! Members
Italy	Rete Semi Rurali (RSR)
UK	Scottish Crofting Federation
Spain	Red de Semillas
Switzerland	ProSpecieRara - Switzerland
France	Reseau Semences Paysannes (RSP)
Germany	Dachverband Kulturpflanzen- und Nutztiervielfalt e. V.
Luxembourg	SEED
Greece	Aegilops
Belgium	RMRM - Reseau Meuse Rhin Moselle
Ireland	Irish Seed Savers Association
Austria	Arche Noah
UK	Heritage Seed Library- Garden Organic
Norway	KVANN - Norwegian Seed Savers
Georgia	ELKANA - Organic farmers association
Portugal	Association Quinta das Aguias
Estonia	Maadjas
Hungary	Maghaz Association
Sweden	Foreningen Sesam
Denmark	Danish Seed Savers
Finland	Maatiainen

European research on Plant Genetic Resources

- To implement the Biodiversity Strategy, **Horizon projects** doing research on PGR have increased in recent years, generating valuable knowledge
- **National and bilateral project** funding is also available for PGR research



and others

Mainstreaming research on plant genetic resources in a dedicated GRACE-RI

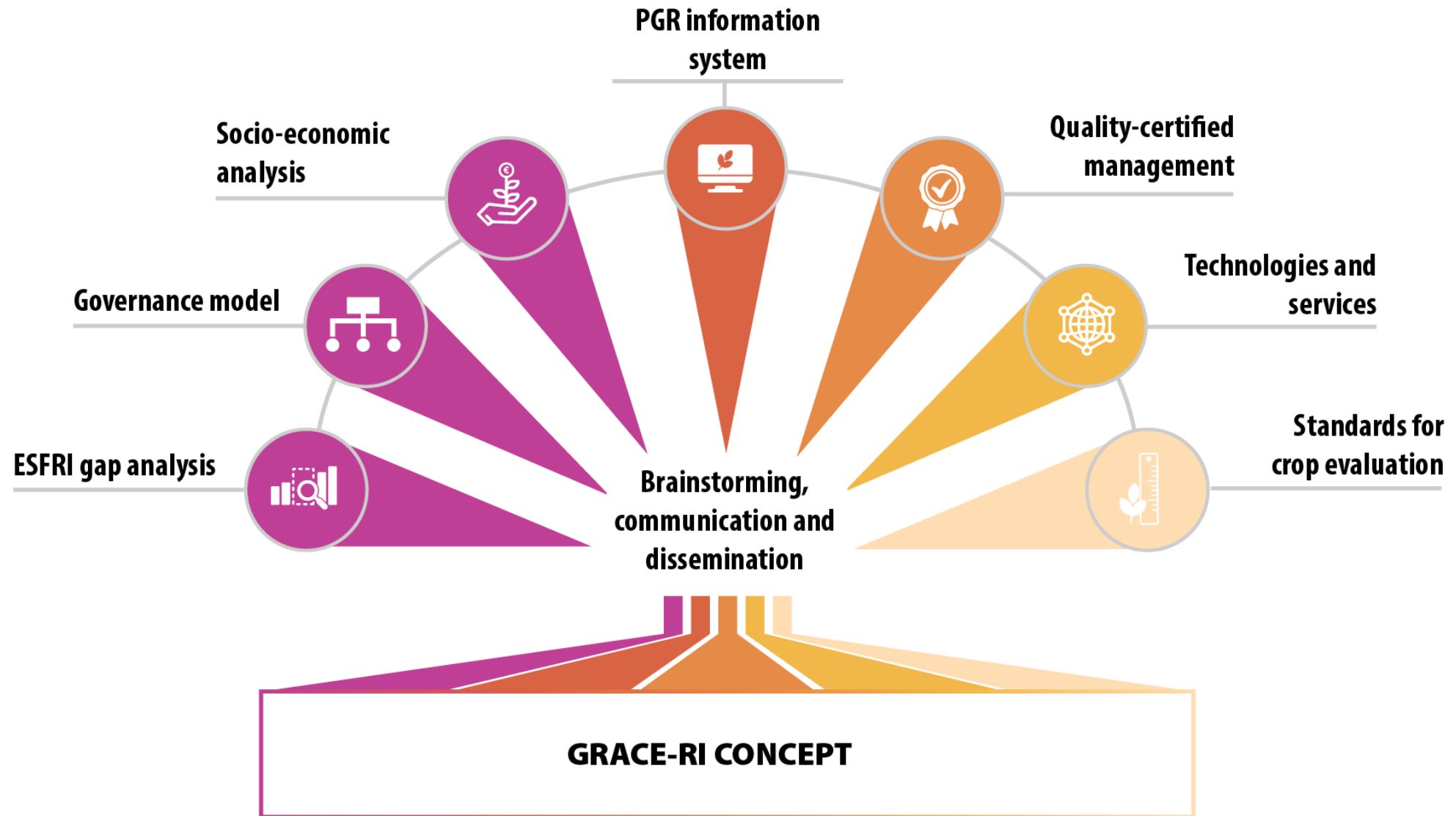
- Connect national PGR conservation actions with high-quality research to address regional-level challenges
- Increase reliability and access to plant genetic resources
- Involve all relevant stakeholders in the value chain
- Engage with and educate the public
- Increase diversity in nature, in our fields and on our plates



Progress in PRO-GRACE



What is involved in developing a concept for a GRACE-RI?



PRO-GRACE Deliverables

Standards for:



Displaying phenotypic data
and images



Genebank and *in situ*
operations



Displaying genetic
data



Phenotypic
evaluations

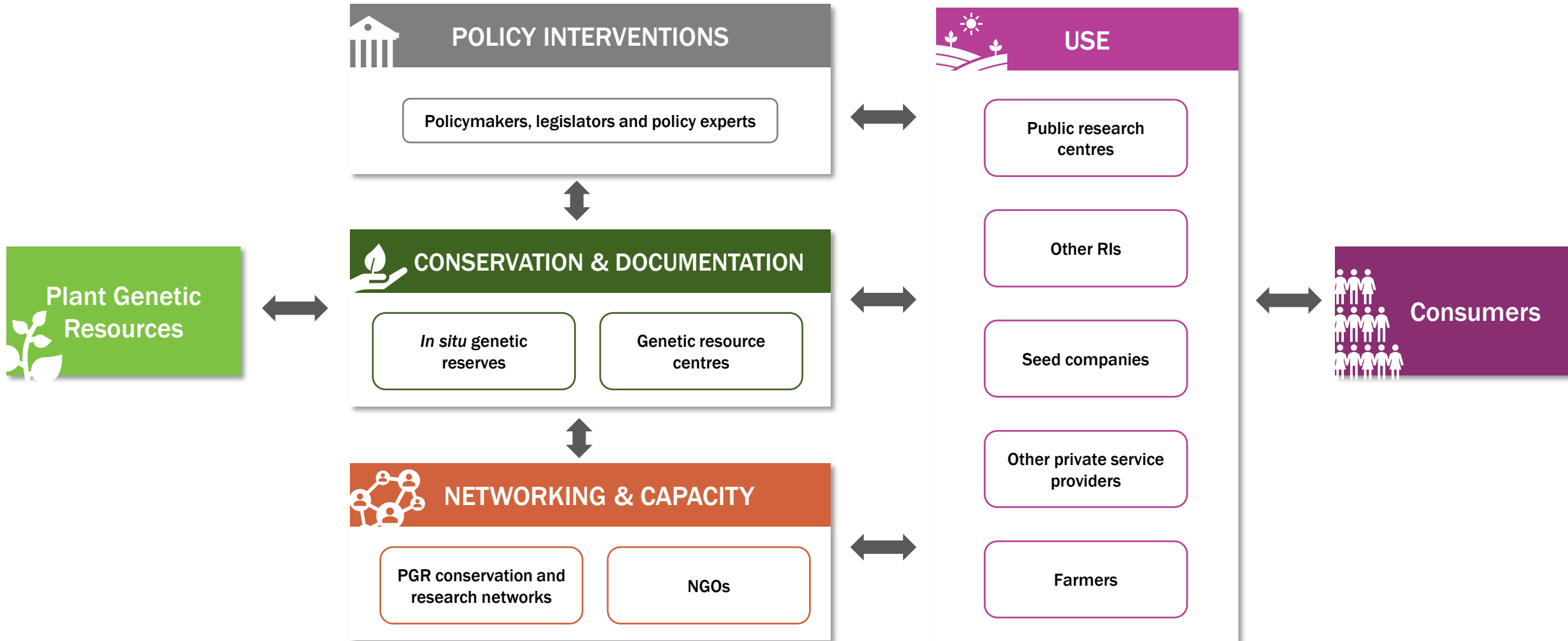
Protocols for:



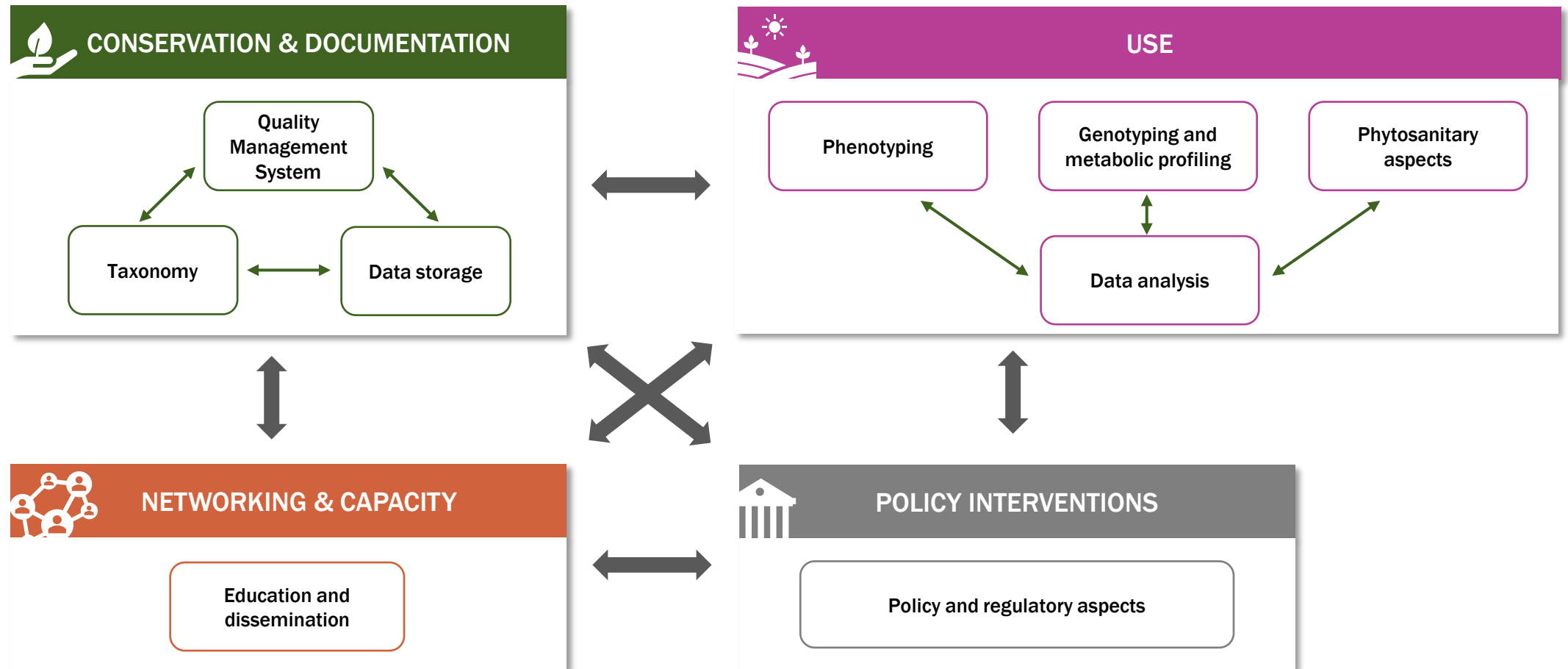
Sample collection

<https://www.grace-ri.eu/pro-grace/outputs/deliverables>

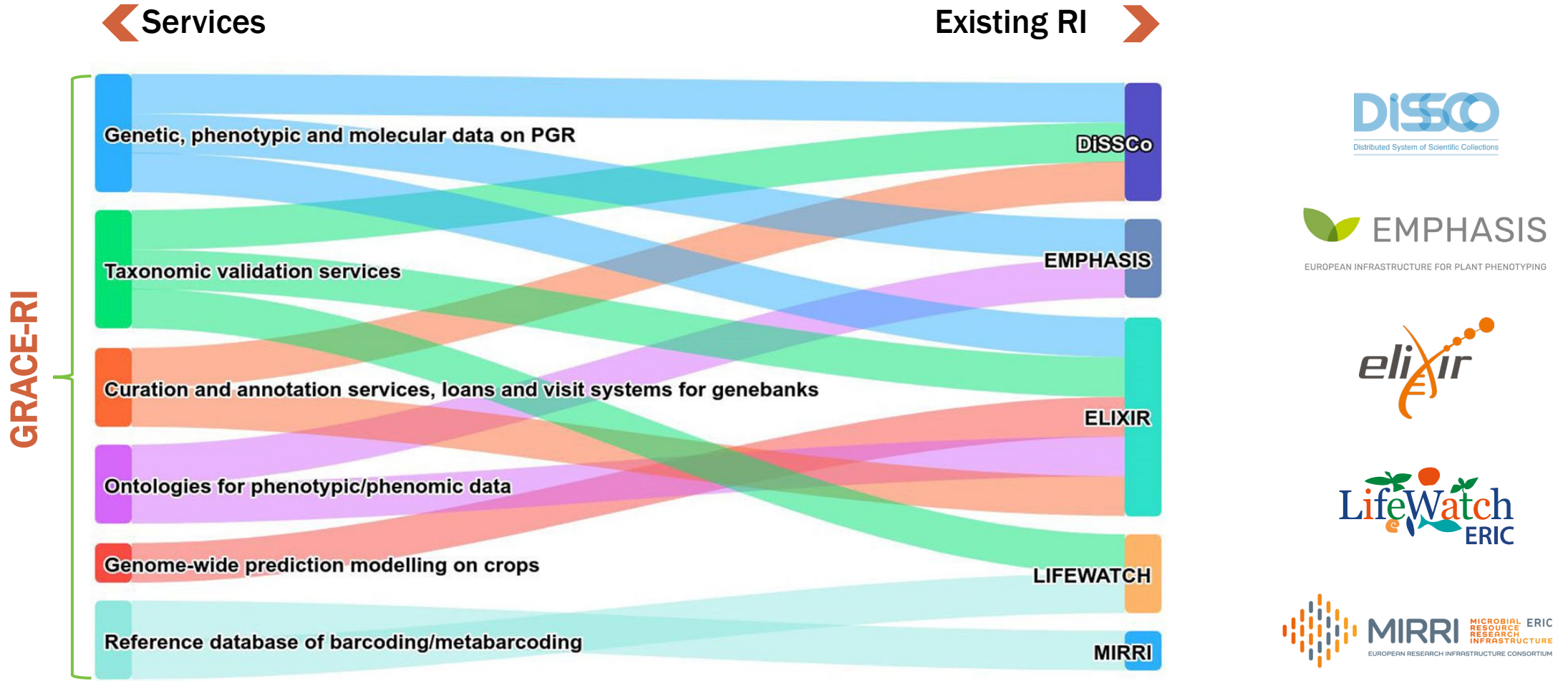
Grouping PRO-GRACE stakeholders



Grouping PRO-GRACE Services



GRACE-RI can complement existing European RIs in PGR Research



GRACE-RI can fill main gaps in PGR-related services

- Linking **multi-omic** information with germplasm **source materials** and policy/regulations on access and **benefit-sharing** by Digital Genetic Objects (DGOs)
- Integrated **Quality** Management (QMS) and **Certification** System for long-term conservation of PGR diversity in Europe that is readily accessible to users
- Integrated system for **safety duplication** of PGR accessions across European conservation sites
- **Pedigree** information/**kinship** relationships of PGR accessions within/across genebanks
- Identification of **duplications and gaps in diversity** for crop species and CWR across European PGR collections
- **Phytosanitary** surveillance, **diagnostic tools**, and related regulatory context on PGR
- **Dissemination** of national/international policies and legal regulatory contexts related to PGR.

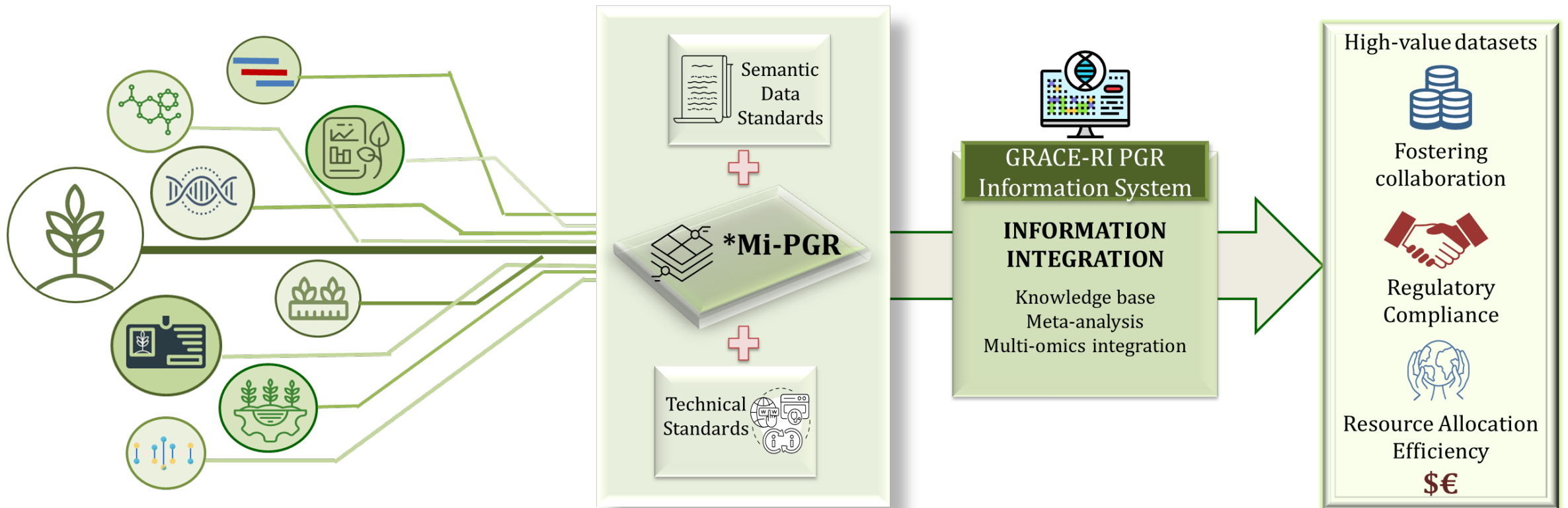
Upcoming important deliverables:

- **Blueprints** for genebank QMS and capacity building programs
- **Methods** and **standards** for *in situ* PGR management and documentation
- **Recommendations** for unique identification of PGR
- **Demonstration cases** for scientific services for PGR
- Standard **protocols** for PGR evaluation



Photo credit: NordGen

Mi-PGR: A proposal for an integrative framework and harmonized set of guidelines and recommendations that identify the **critical information** necessary to **describe a PGR accession**.



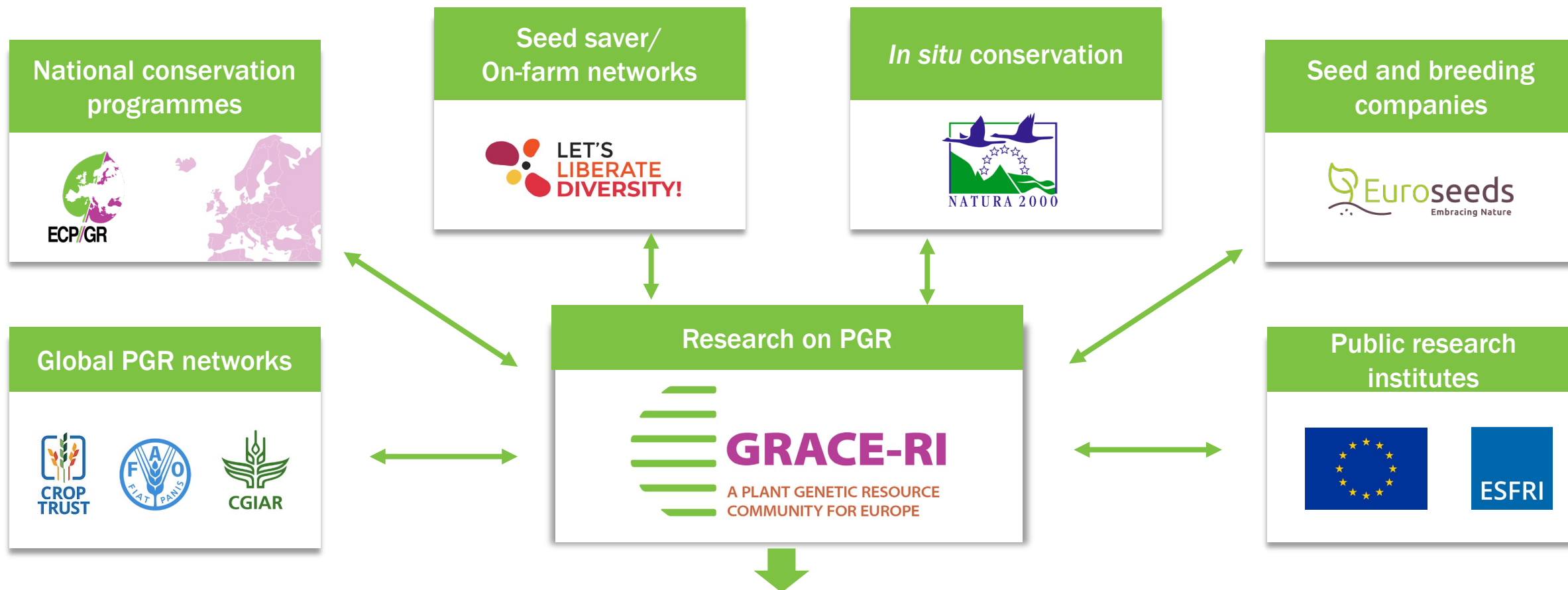
Where to next?

Building a business case for GRACE-RI

Europe needs increased investment in its PGRFA to:

- Significantly **enhance** the breadth of **diversity** made available to farmers and breeders through improved conservation actions and integration of *ex situ* and *in situ* conservation
- Add value to PGRFA through **high-quality** conservation, documentation and public access
- Generate **knowledge and FAIR data** on PGRFA
- Build **capacity** across Europe to improve management in *ex situ* and *in situ* conservation
- **Consolidate** dispersed national and regional resources and create a **cost-effective** framework for high quality research on PGR
- Support stakeholders in implementing **international agreements**
- Provide **nature-based solutions** for European agriculture and bioeconomy

GRACE-RI: Connecting existing initiatives



- Improving the conservation and documentation of PGR conserved *ex situ*, *in situ* and on-farm
- Improving access to PGR for breeding and research
- Improving biodiversity across Europe, in nature, in fields, on people's plates

What will GRACE-RI do?

- **GRACE-RI** will build on and connect better, but will **NOT** replace existing networks and initiatives
- **GRACE-RI** will expand current *ex situ* networks to integrate with new stakeholders: farmers, *in situ* conservation and social actors involved in PGR conservation and research.
- **GRACE-RI** will promote practical implementation of *in situ*/on-farm networks to complement *ex situ* activities
- **GRACE-RI** will build capacity to enhance effective conservation and management of critical biological infrastructure (=PGRFA) across Europe, which is under threat from biodiversity loss
- **GRACE-RI** will support agricultural research and innovation, providing strong coordination to offer facilitated PGR access, instruments and collaborative frameworks to address today's major societal challenges through research: climate change, resilient agriculture and food security
- **GRACE-RI** will thus be crucial for the implementation of and also accelerate progress on the EU Biodiversity strategy and the environmental elements within the Green Deal, also contributing to countries' compliance with UN policy initiatives (CBD, Nagoya, ITPGRFA etc.)

Continue work towards development of GRACE-RI

Pro-GRACE Follow-up project will:

- Engage member countries and institutions to **secure national and institutional support** and establish the GRACE-RI core structure and governance
- Develop **pilot projects** for PGR-specific services and tasks that GRACE-RI can provide for the research community
- Test pilot services with PGR stakeholders and **showcase their benefits**
- Develop the **business case** and engage with stakeholders
- Engage with other countries and organizations to **grow GRACE-RI**

Pro-GRACE
(2023-2025)

GRACE-RI
(2028→)

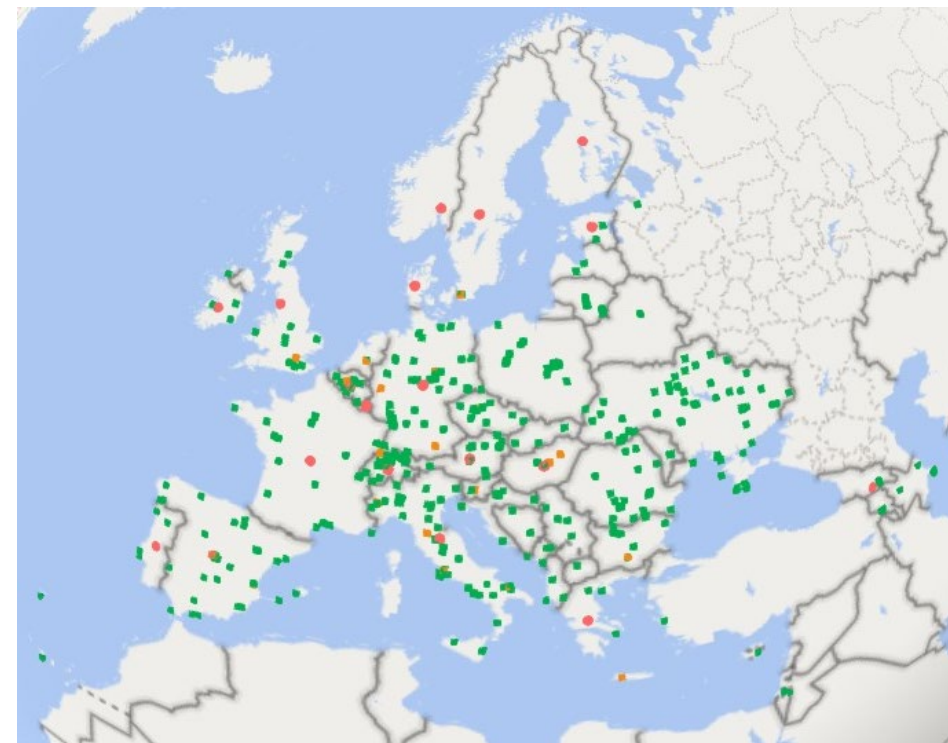


GRACE-Build
(2025-2027)



Europe needs a research infrastructure for PGR

- GRACE-RI should be dedicated to **join regional efforts** to **intensify research** on a pool of **well-conserved PGR** in European genebanks, in nature and on-farm, to address the main environmental, climatic and food security challenges in Europe
- GRACE-RI should **complement existing services** and create relevant **synergies** with other RIs



GRACE-RI is the opportunity to have an impact, to enable public good valorization, and to help the EU achieve the targets outlined in the Green Deal



THANK YOU

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