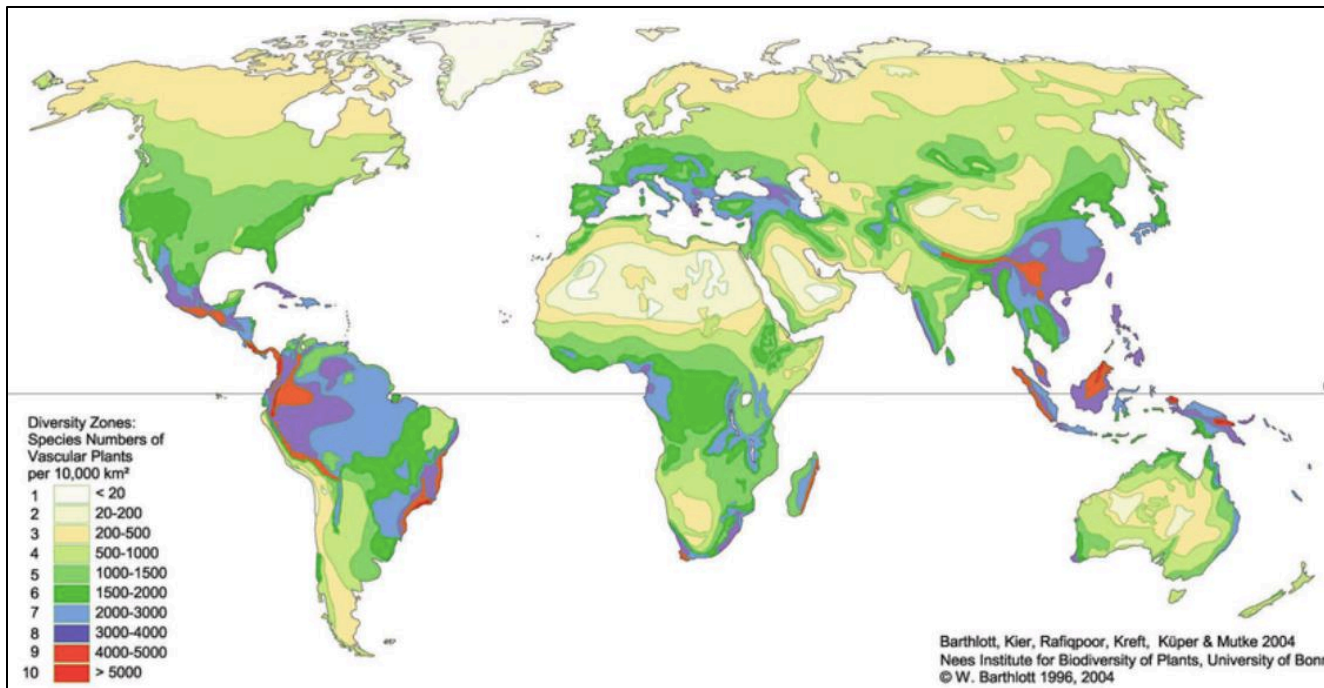


THE GRACE European Infrastructure on Plant Genetic Resources and (Pre)breeding

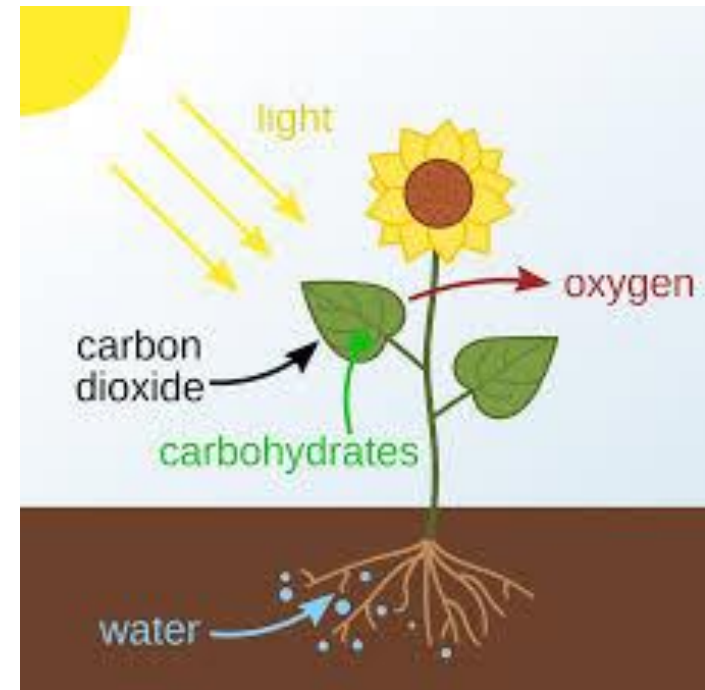
Giovanni Giuliano – PRO-GRACE Coordinator

Plants are essential for life on earth

- About 400,000 known species of terrestrial plants populate Earth. **We use about 8,000 of them as food, medicines, or raw materials for industry (timber, textile fibres,).**
- Plants, through photosynthesis, **fix CO₂** from the atmosphere and produce the **O₂ we breathe** and all the **organic matter** that we ultimately **use as food**.

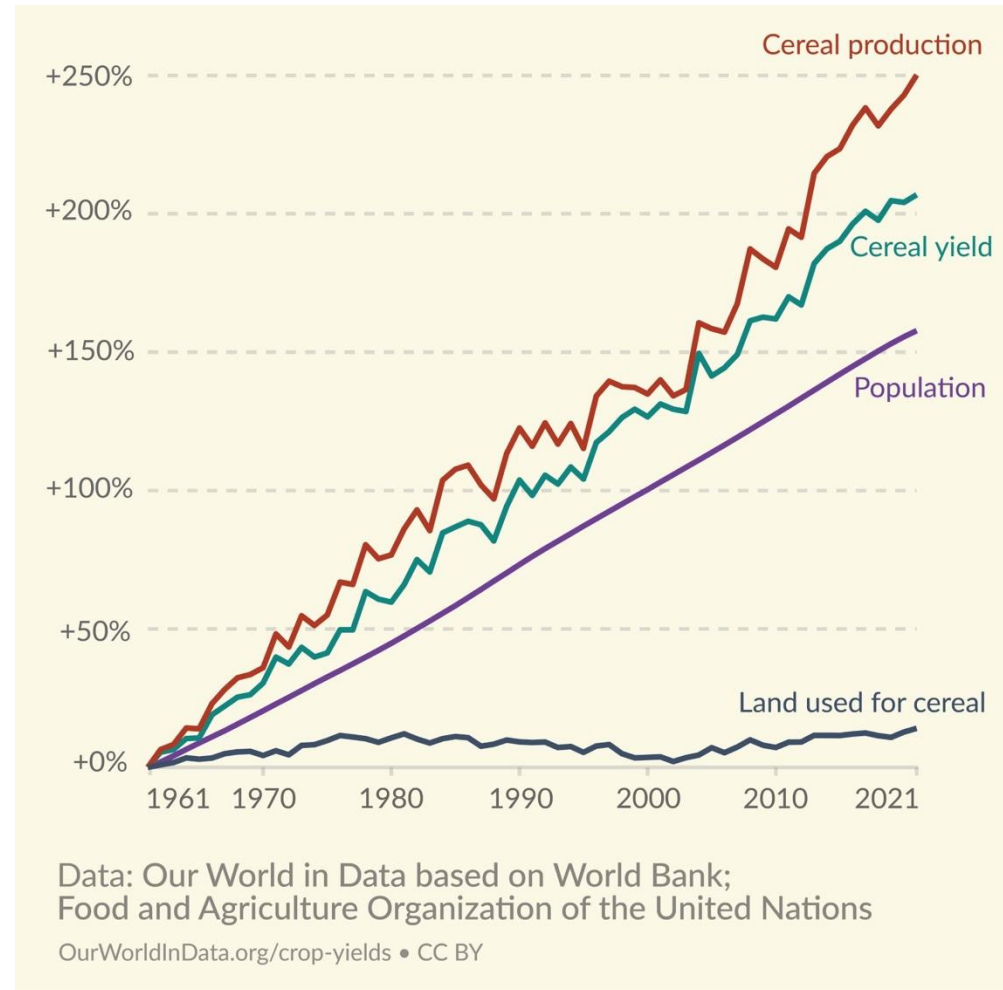


Worldwide distribution of plant biodiversity (Barthlott et al, 1996)

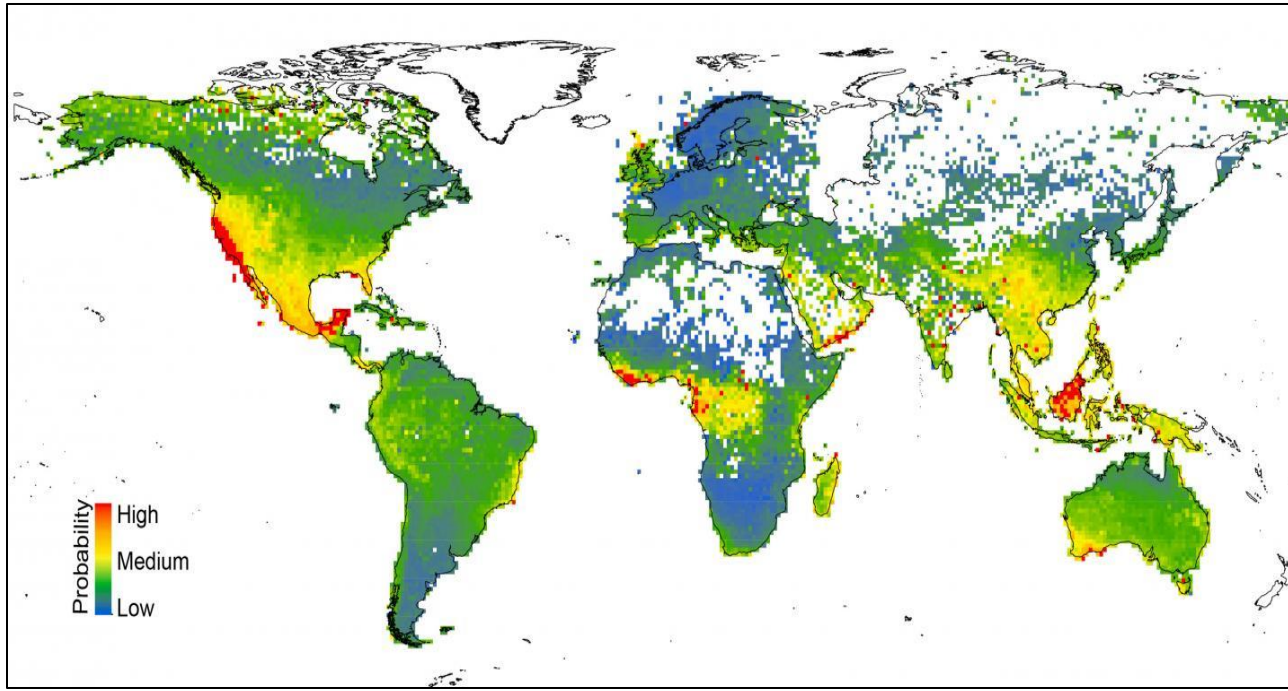


The photosynthetic cycle

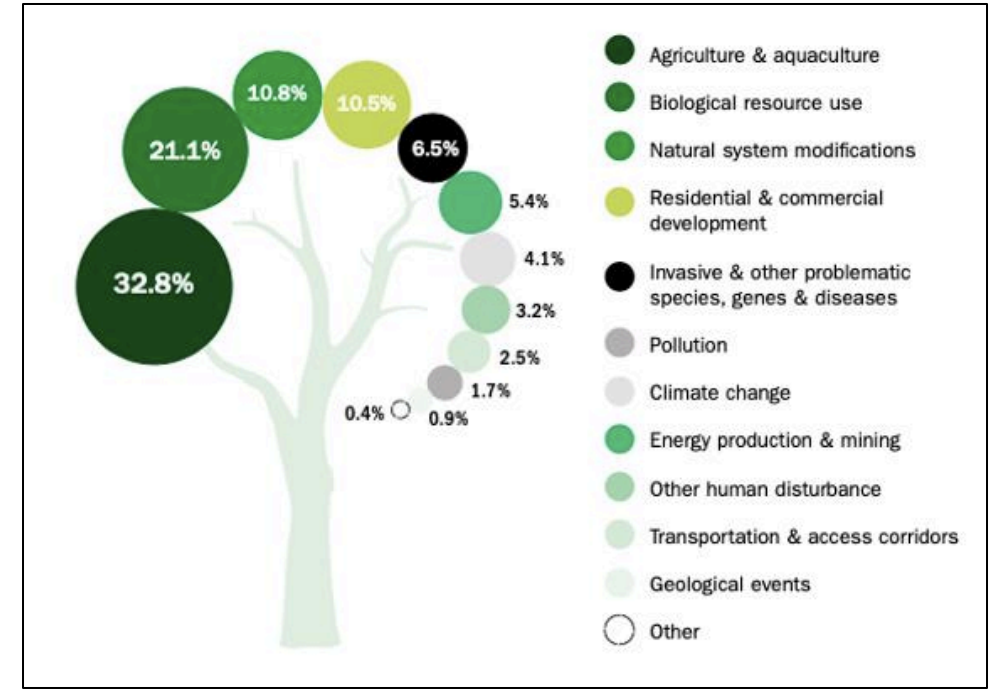
Plant breeding has prevented widespread famine in the past decades



We live at the beginning of the 6th mass extinction



Worldwide distribution of plant species at risk of extinction

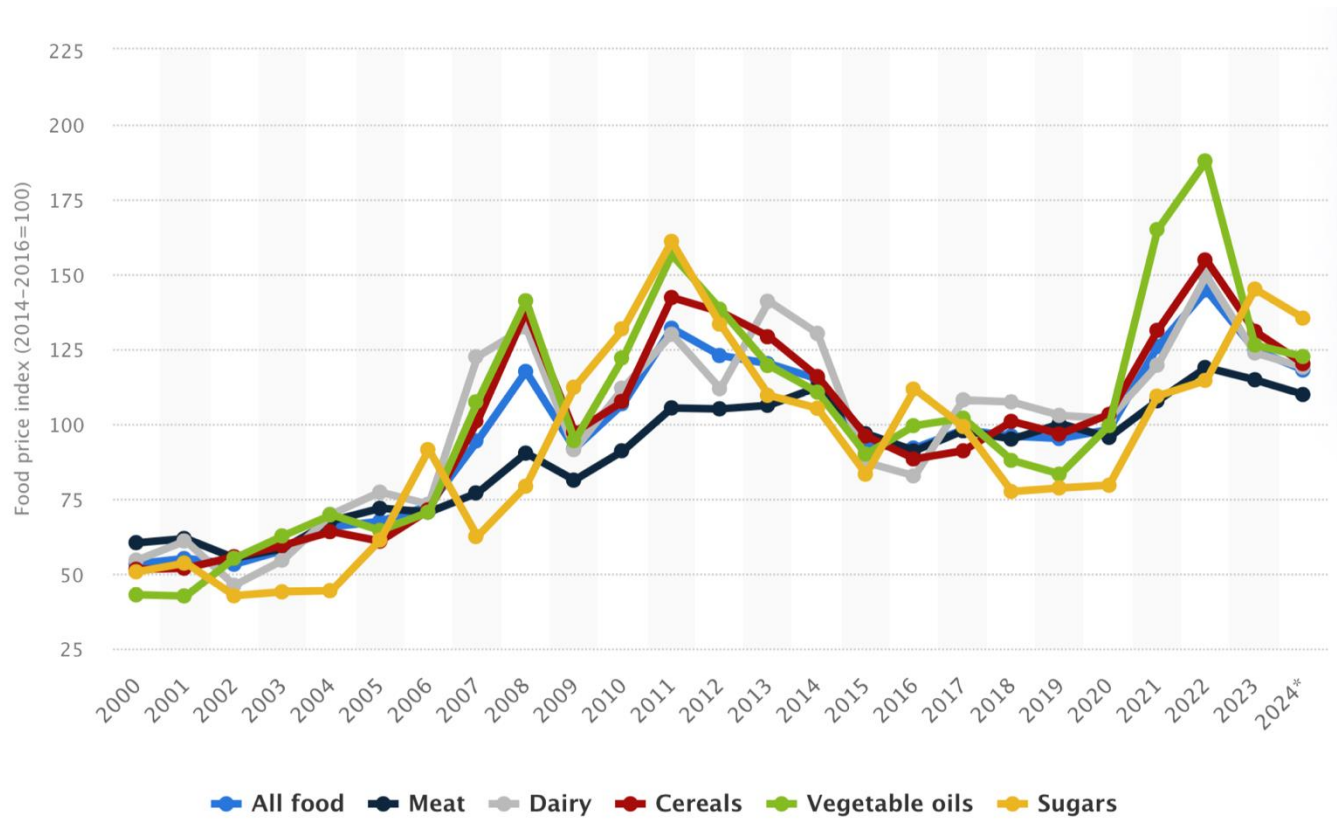


Main causes of plant extinction (1)

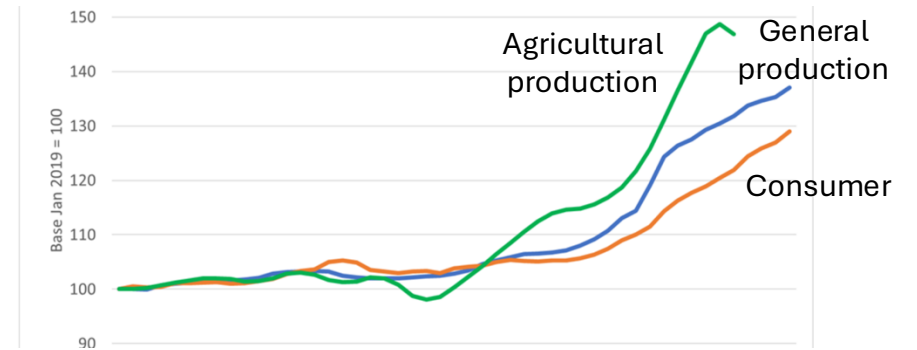
- **Around 40% of plant species are at risk of extinction globally.**
- **This figure fluctuates between 10%-45% for crop wild relatives, and reaches 60% for some groups (cycads, epiphytes, orchids)**

(1) Kew Gardens «State of the World's Plants and Fungi»

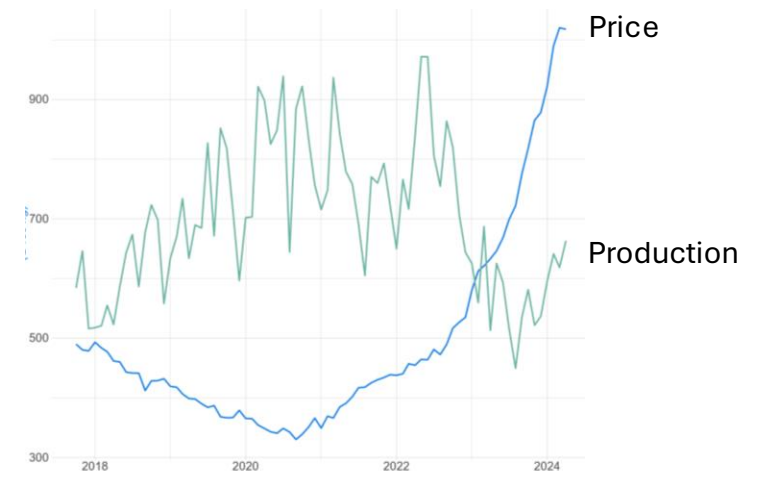
Is the era of cheap food coming to an end?



World food price indices by category
2020-2024



EU food price indices by
economic sector, 2019-2023



Extra virgin olive oil, EU27, 2018-2024

None of the present European Research Infrastructures is dedicated to the conservation and improvement of plants that feed humanity



We do not start from scratch

The European Cooperative Programme for Plant Genetic Resources (ECPGR) is a collaborative programme among most European countries aimed at ensuring the long-term conservation and facilitating the increased utilization of plant genetic resources in Europe

[Read More](#)

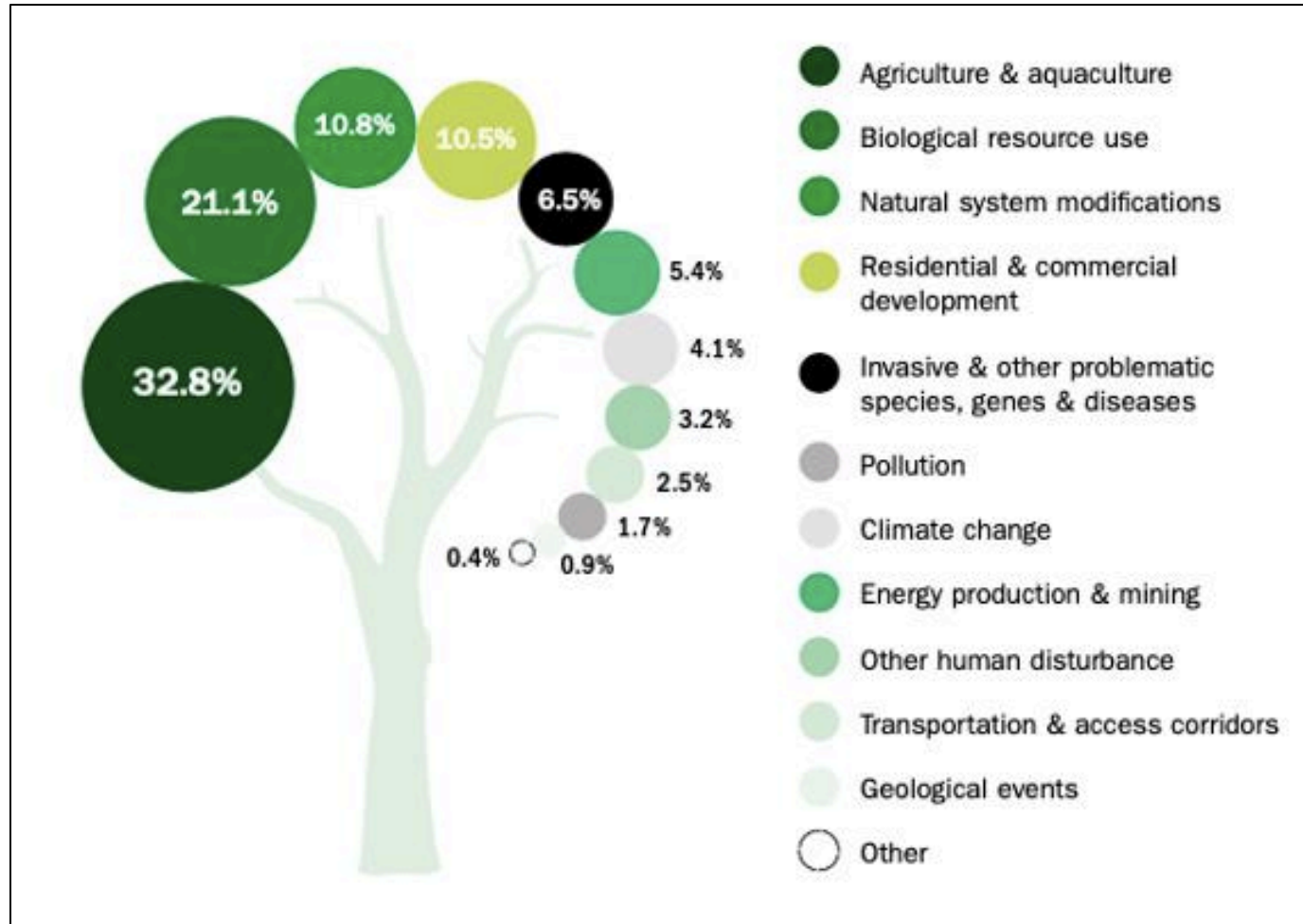
>90 EU-funded projects In FP7, H-2020 and H-EU have generated novel genetic resources and associated knowledge and methods on important crop plant taxa (Cereals, Solanaceae, Legumes, berries, trees).



The **European Search Catalogue for Plant Genetic Resources** (EURISCO) provides passport and phenotypic data on **>2 million accessions** of crop plants and their wild relatives, preserved *ex situ* by about **400 institutes** from **43 member countries**.



But this is largely insufficient to preserve plant biodiversity from the challenges it faces



We need more research and a stable, long term alliance between the PGR conservation and the plant research communities.

Main causes of plant extinction

The GRACE (Plant Genetic Resources Community for Europe) vision

The GRACE main stakeholders

- ~ 400 institutes holding «ex situ» PGR collections
- ~ 900 botanical gardens/arboreta
- Hundreds of European plant research institutes
- Hundreds of natural reserves/Natura 2000 sites
- International organizations: ECPGR, European forest genetic resources programme (EUFORGEN), European Plant Science Organization (EPSO), European and Mediterranean Plant Protection Organization (EPPO)
- Seed exchange NGOs, farmers' organizations
- Private seed companies



Research community



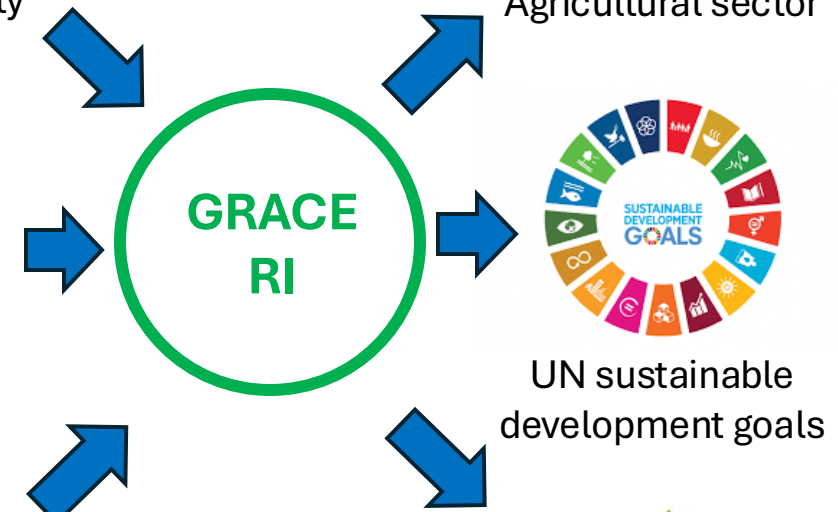
PGR conservation community



Plant breeding community



Agricultural sector



Plant-based bioproducts

The PRO- GRACE project

Topic: Research infrastructure concept development (HORIZON-INFRA-2022-DEV-01-01)

Duration: 1st January 2023 – 30 June 2025

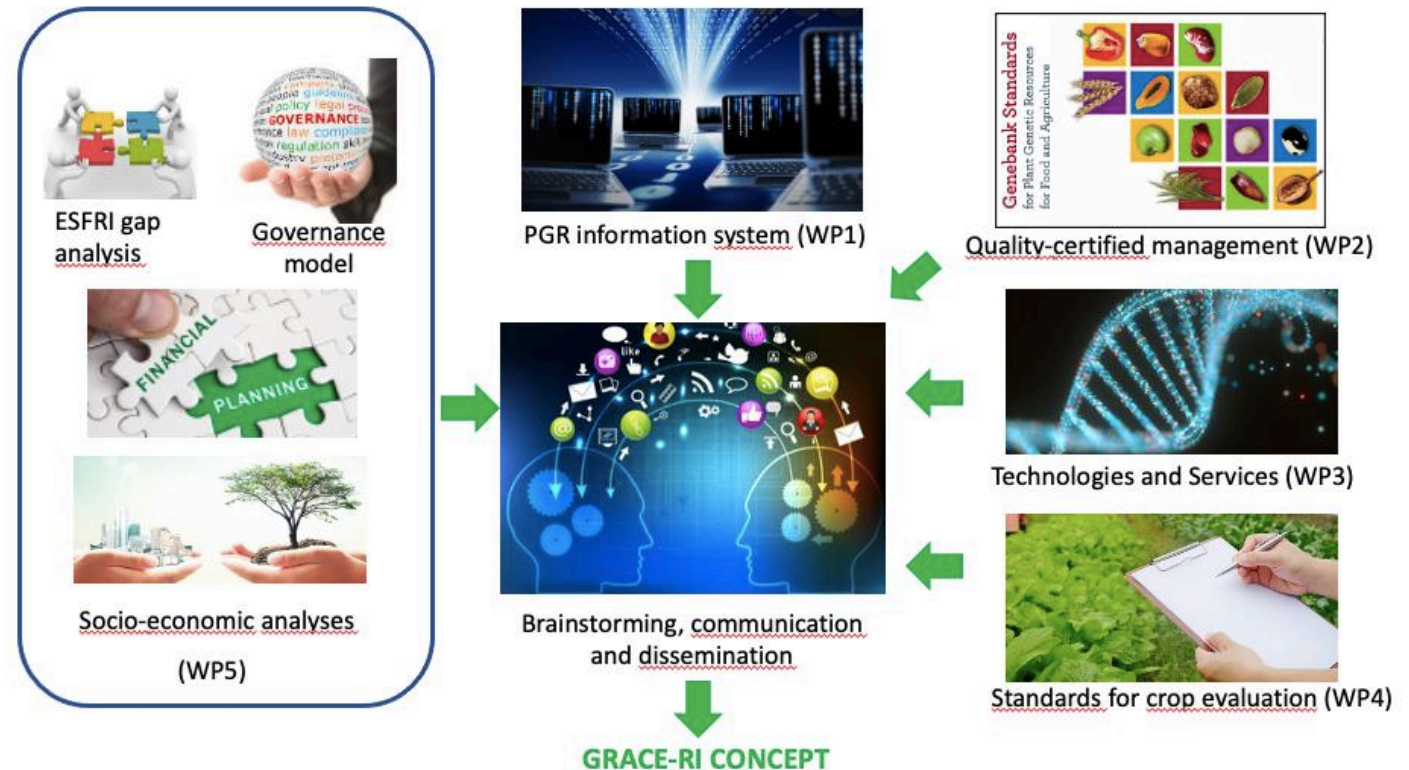
Partnership: 31 partners from 17 countries

Funding: 2.85 M€ EU + 0.37 Assoc. partners

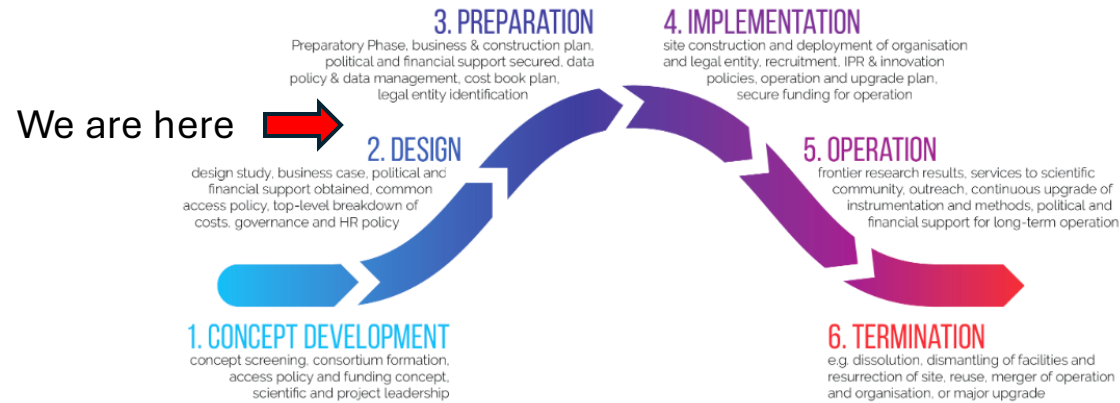
Coordinator: Giovanni Giuliano, ENEA; giovanni.giuliano@enea.it

Website: www.grace-ri.eu/pro-grace

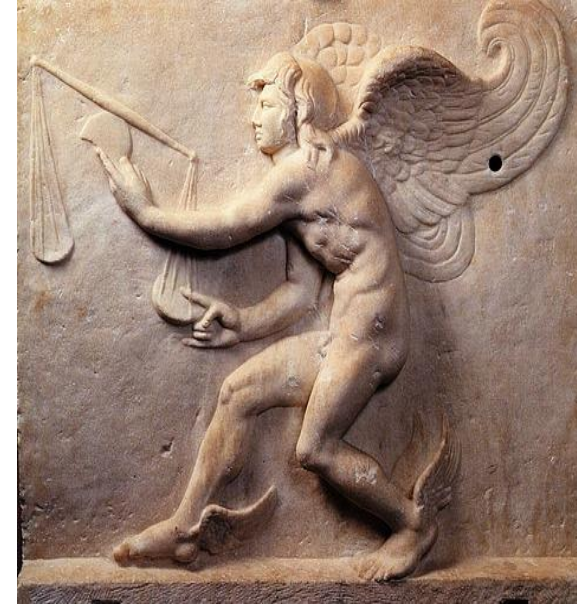
WP n.	WP title
WP1	Inventory and information system
WP2	Quality-certified ex situ and in situ management
WP3	Technologies and scientific services
WP4	Evaluation and valorisation
WP5	RI concept, social and regulatory aspects, governance and financial plan
WP6	Communication, dissemination, exploitation and training
WP7	Scientific coordination and management



GRACE is ready to enter the ESFRI roadmap



The ESFRI RI lifecycle



Kairos (the right occasion or moment)

- Loss of plant biodiversity – both “in situ” and “ex situ”, is happening as we speak.
- The GRACE concept and design have been developed in the INFRA-DEV project PRO GRACE (2023-2025)
- The next update of the ESFRI roadmap will be in 5 years – can Europe afford to wait so long?

The GRACE-RI planned scientific services

GRACE-RI SERVICES

SERVICES FOR <i>EX SITU</i> CONSERVATION	SERVICES FOR <i>IN SITU</i> CONSERVATION	PGR INFORMATION PORTAL	CHARACTERIZATION AND (PRE)BREEDING SERVICES	SERVICES FOR PGR ACCESS
<ul style="list-style-type: none">• Quality standards and protocols for <i>ex situ</i> conservation• Quality management system for Genetic Resource Centres• Genetic analyses to verify diversity and duplication of <i>ex situ</i> collections• Gap analyses guiding future collection expeditions	<ul style="list-style-type: none">• Quality standards and protocols for <i>in situ</i> conservation• Genotyping/phenotyping <i>in natura</i> (incl remote monitoring) of populations in natural reserves/farms• <i>Ex situ</i> duplication of threatened populations/landraces• Models and protocols for the management of invasive species and pests	<ul style="list-style-type: none">• FAIR, publicly accessible information system for the storage, management and integration of all PGR data (passport, genomic, phenomic, traits)• Trusted long-term repository of EU project data	<ul style="list-style-type: none">• Genomic, phenomic, metabolomic, bioinformatic services to small Genetic Resource Centres, PGR users and natural reserves for PGR characterization• Genomic, metabolomic, phenomic, bioinformatic services to PGR users for (pre)breeding	<ul style="list-style-type: none">• Legal advice to PGR users on international legislation/benefit sharing• Phytosanitary (diagnostic and quarantine) services to PGR users / small GRCs• High containment, centralized quarantine center for PGR movement

CAPACITY BUILDING , OUTREACH, ADVICE ON PGR TO NATIONAL GOVERNMENTS AND THE EU

Institutes/countries that have expressed their support for GRACE

Country	Full name of organization
Austria	Federal Ministry of Agriculture, Forestry, Regions and water management
Austria	Agency for Health and Food Safety
Belgium	Meise Botanic Garden
Belgium	Centre Wallon de Recherches Agronomiques
Belgium	Flanders Research Institute for Agriculture, Fisheries and Food
Bulgaria	Ministry of Education and Science
Bulgaria	Agricultural Academy
Czech Republic	Ministry of Education, Youth and Sports
Czech Republic	Crop Research Institute/ Czech Agrifood Research Center
Czech Republic	Institute of Experimental Botany of the Czech Academy of Sciences
Denmark	Aarhus University
France	National Polytechnic Institute of Toulouse
France	INRAE
France	Institut de Recherche pour le Développement (IRD)
France	CIRAD
Germany	Max Planck Institute for Molecular Plant Physiology
Germany	RWTH Aachen University
Germany	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)
Greece	Ministry of Rural Development and Food
Greece	Hellenic Agricultural Organization DIMITRA (ELGO DIMITRA)
Greece	Institute Molecular Biology and Biotechnology - IMBB-FORTH
Greece	Mediterranean Agronomic Institute of Chania
Greece	Agricultural University of Athens
Greece	University of Patras
Hungary	National Centre for Biodiversity and Gene Conservation

Country	Full name of organization
Italy	University of Udine
Italy	University of Naples, Dept. of Agricultural Sciences
Italy	Scuola Superiore S Anna, Institute of Plant Sciences
Italy	Rete Semi Rurali
Italy	Italian National Agency for New technologies, Energy and Sustainable Economic Development - ENEA
Italy	Università Politecnica delle Marche
Italy	University of Torino
Italy	University of Viterbo "Tuscia"
Italy	National Research Council of Italy - CNR
Italy	Council for Agricultural Research and Economics - CREA
Poland	Ministry of Agriculture and Rural Development
Poland	Warsaw University of Life Sciences
Poland	Plant Breeding and Acclimatization Institute
Portugal	National Institute for Agrarian and Veterinarian Research (INIAV)
Slovakia	Ministry of Agriculture and Rural Development
Slovakia	National Agricultural and Food Centre (NPPC)
Slovenia	Kmetijski institut Slovenije
Spain	Instituto de Investigación en Cambio Global, Universidad Rey Juan Carlos (IICG-URJC)
Spain	University of Cordoba, Dept. Agronomy
Spain	Consejo Nacional de Investigaciones Científicas - Instituto de Biología Molecular y Celular de Plantas
Spain	Universitat Politècnica de València
Spain	Asociación Profesional de Empresas Productoras de Semillas Selectas
Sweden	Nordic Genetic Resources Center (NordGen)
Switzerland	Pro Specie Rara
UK	Royal Holloway University of London
UK	Royal Botanical Gardens, Kew

6 Ministries and 46 institutions from 17 ESFRI and 1 non-ESFRI countries

Thank you for your attention!



Funded by
the European Union

www.grace-ri.eu

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