PRO-GRACE

PROMOTING A PLANT GENETIC RESOURCE COMMUNITY FOR EUROPE

EMPHASIS

Funded by the European Union

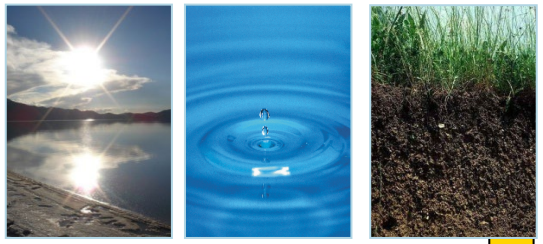
EMPHASIS: the European infrastructure for plant phenotyping

Roland Pieruschka

Forschungszentrum Jülich

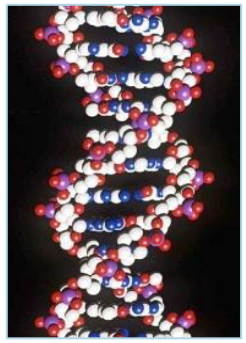
Brussels, 28.06.2024

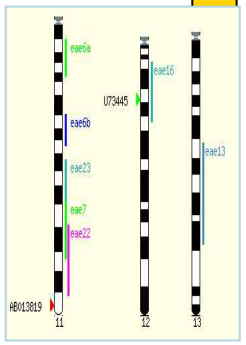
Plant Phenotyping key element of a sustainable agriculture



Environment

Genes





Plant performance and plant production

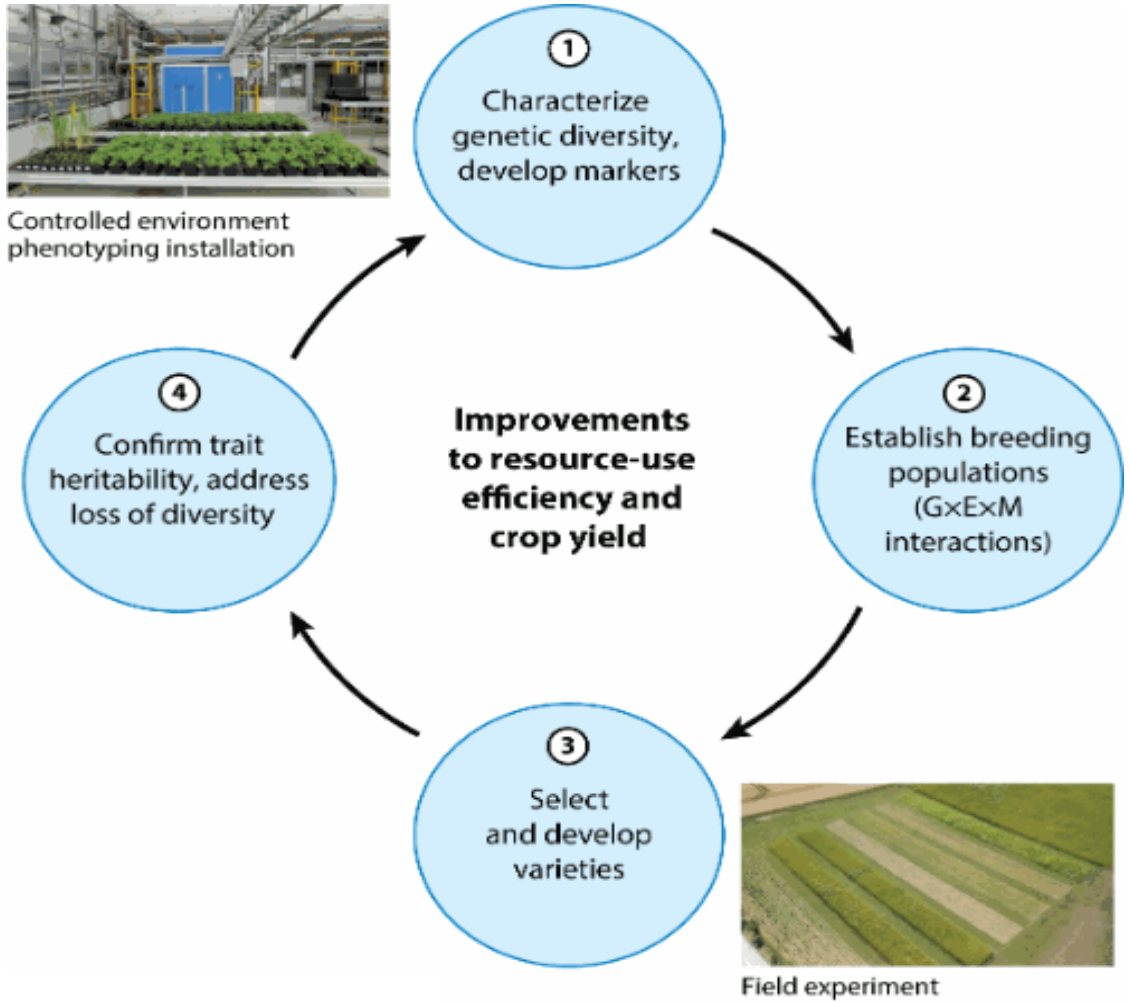
- Higher quantity and quality of plant biomass production
- Novel characteristics and products
- Yielding in stressful environments
- Sustainable production / intensification

nature x nurture → phenotype

Growing demand for quantitative plant phenotyping as a tool

- Addressing diverse crops and conditions
- Specialized infrastructure
  - plant characterization:
    - phenotyping
  - environmental simulation & monitoring
    - envirotyping
- Integrated (multi-disciplinary) approaches require dedicated technology and expertise
- Europe has been the global leader, but competition is growing

Improving value of phenotyping for plant breeding programmes

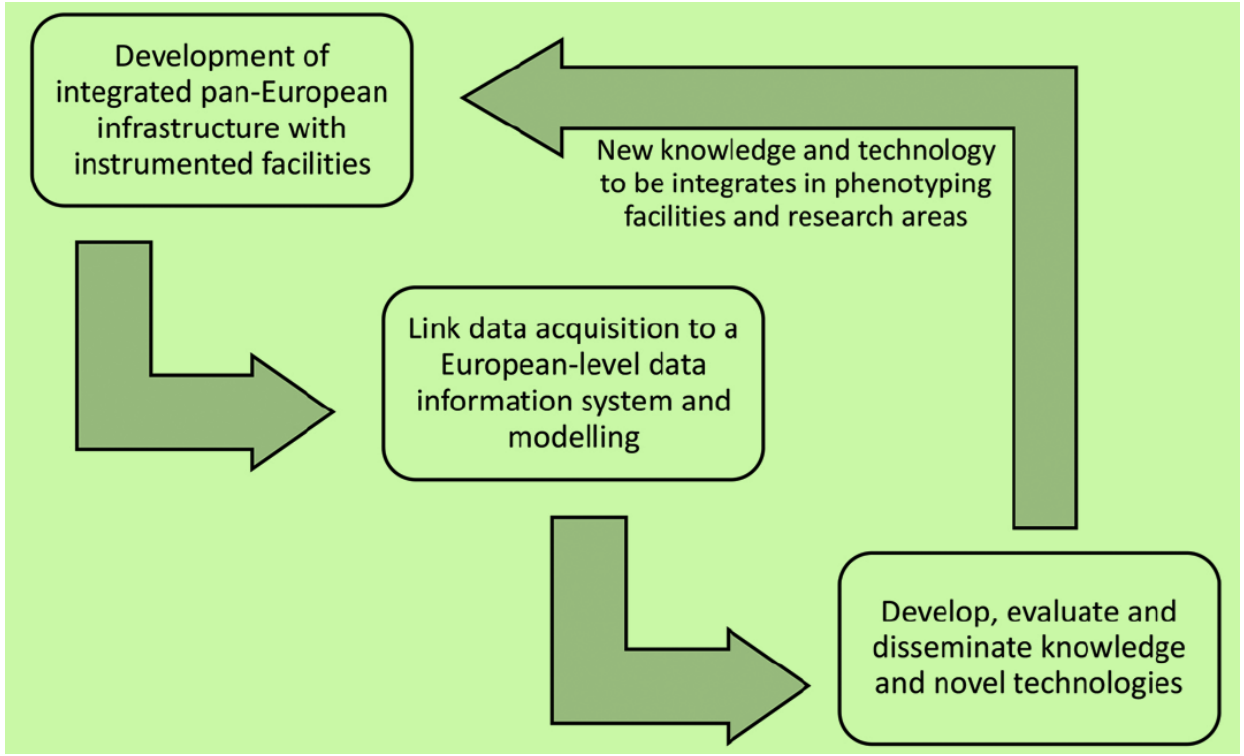


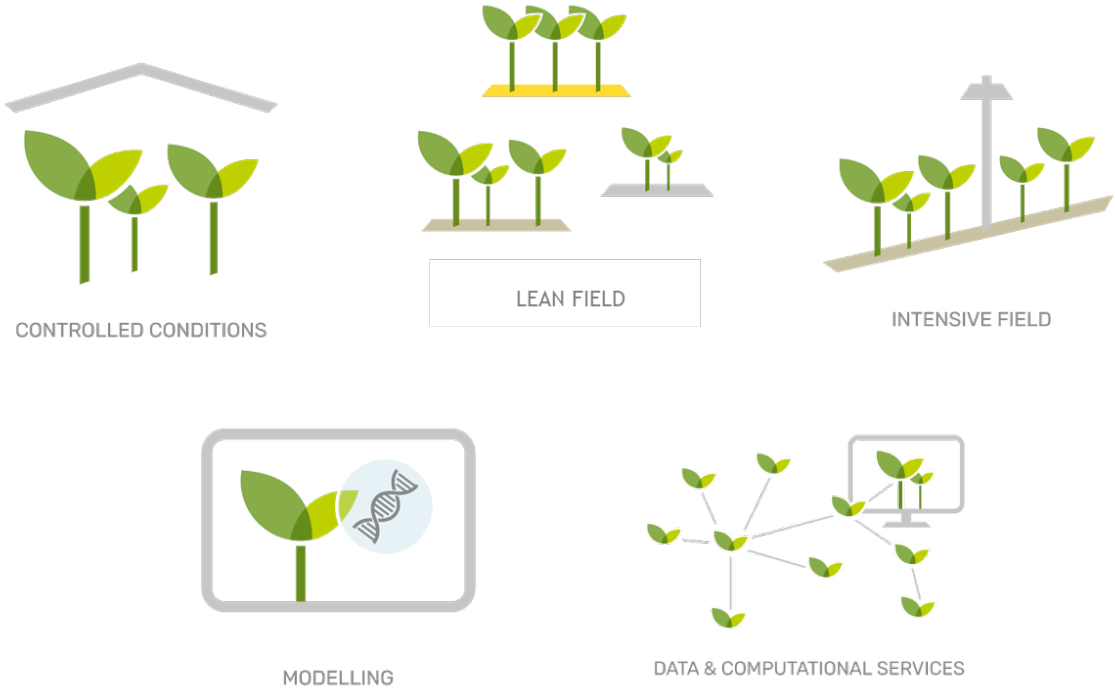
- Quantitative screening for optimized traits
- Development non-invasive methods, standards and infrastructure

Watt et al 2020 Annual Review of Plant Biology

Integrated concepts

explore the potential of plant phenotyping



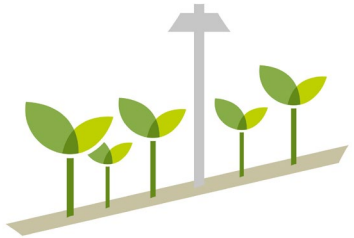


Source: EMPHASIS homepage (https://emphasis.plant-phenotyping.eu/emphasis_infrastructure_map)

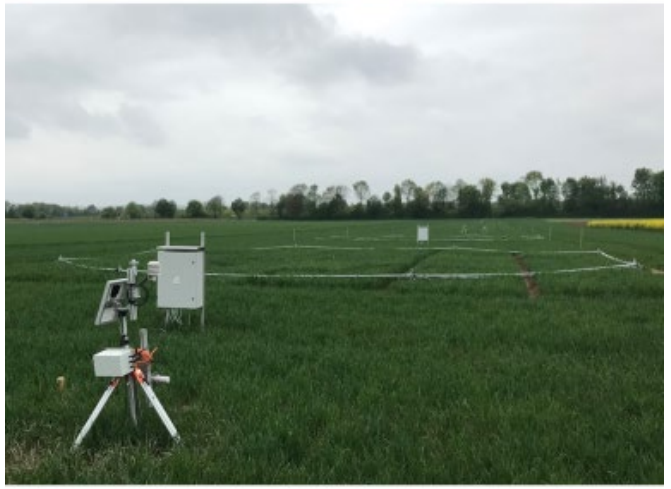
Infrastructure: controlled environment

- ✓ Greenhouses and growth chambers
- ✓ Simulation and monitoring of the environment
- ✓ High level of automation
- ✓ Deep phenotyping
- ✓ Throughput typically between 100-1000s plants

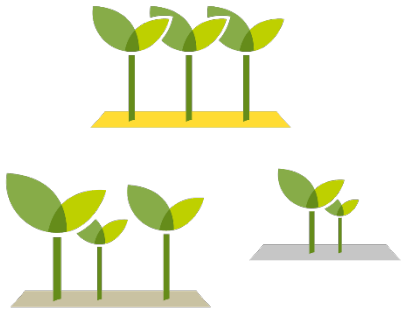
Infrastructure: intense field



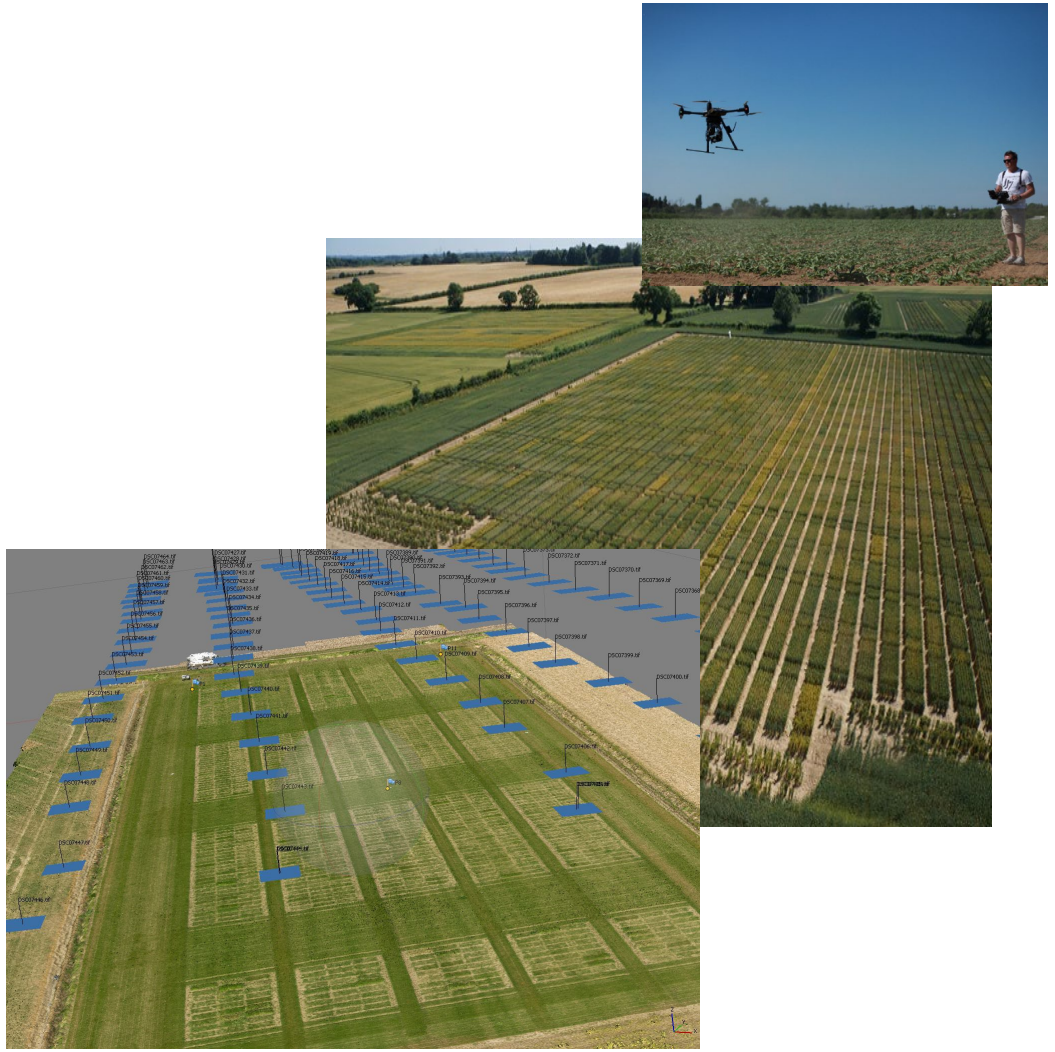
- ✓ Detailed environmental monitoring
- ✓ High quality, details measurements
- ✓ Field sites enabling environmental simulation

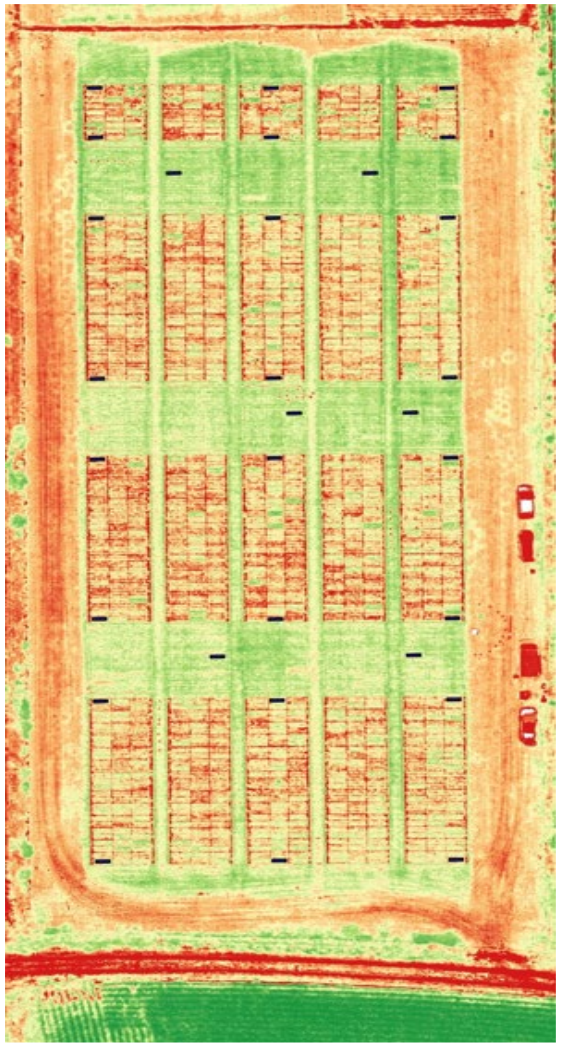


Infrastructure: lean field



- ✓ Field sites with environmental monitoring
- ✓ Phenotyping equipment for basic traits
- ✓ Potentially ground based or airborne sensing systems
- ✓ Networks of fields

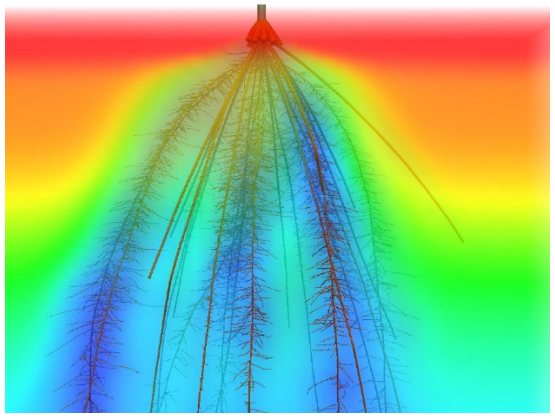


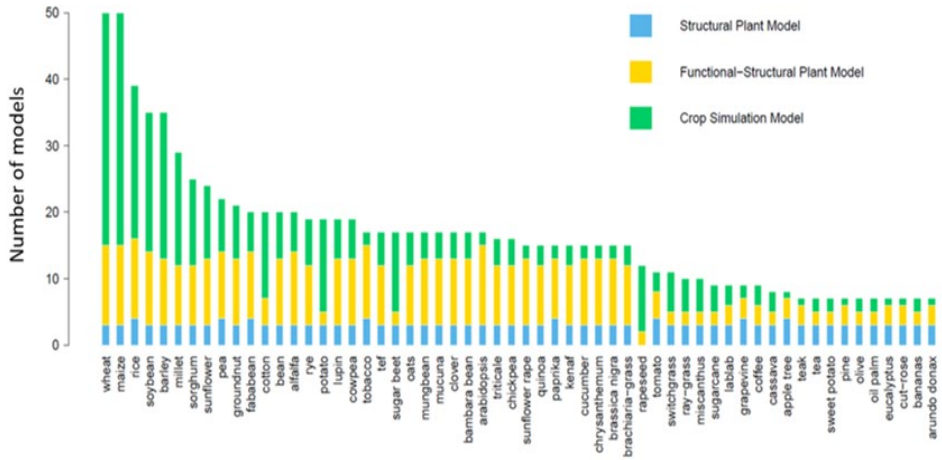


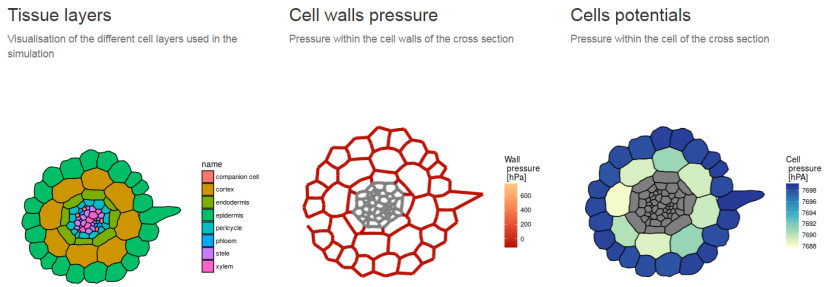
Infrastructure: MODELLING

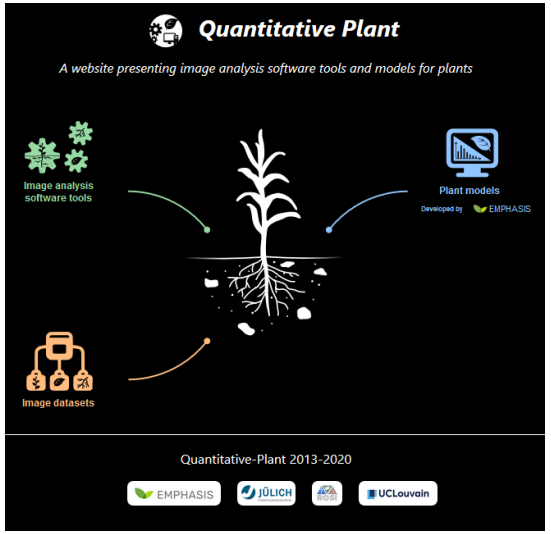
- ✓ Virtual platforms
- ✓ Different types of models: Crop Models, FSPM
- ✓ Integrated or interfacing with phenotyping installations

OPENSIMROOT



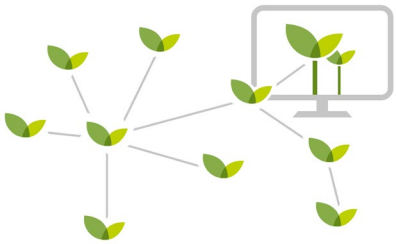






https://www.quantitative-plant.org/model

Infrastructure: information system



- ✓ FAIR Information systems plant phenotyping data
- ✓ Access to data
- ✓ Local installation data-management
- ✓ EMPHASIS installations should have integrated information systems

Data standards towards data integration

- Semantic description of the data

Crop Ontology
for agricultural data

- Formatting and organizing the data

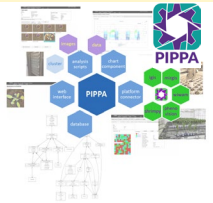
miappe

- Technical Data integration and sharing

BrAPI

local infrastructures

PHIS



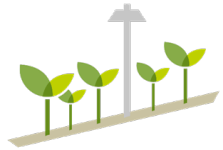
PhenOMIS Tools

From infrastructure to services

sustainable services provision (under development)

CONTROLLED CONDITIONS

LEAN FIELD



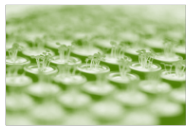
INTENSIVE FIELD

MODELLING

DATA & COMPUTATIONAL SERVICES

EMPHSIS service portfolio

User Access: facilitate user access to installations and facilitate under controlled and field conditions



Advancing phenotyping practices: develop and implement methods, tools for phenotyping workflow

Industry engagement: facilitate knowledge and technology transfer

Data management and modelling: establish FAIR data principles and a European information system

Communication: engage all relevant stakeholders in a research infrastructure environment

Training and education: develop and implement training activities

AgroServ: sustainable agriculture and agroecological transition

- Duration: 09.2022 – 08.2027 / 15 Mil EUR
- A toolbox of services: From molecule to ecosystems to society
- 73 partner institutions / 143 services offered
- Open for Transnational Access

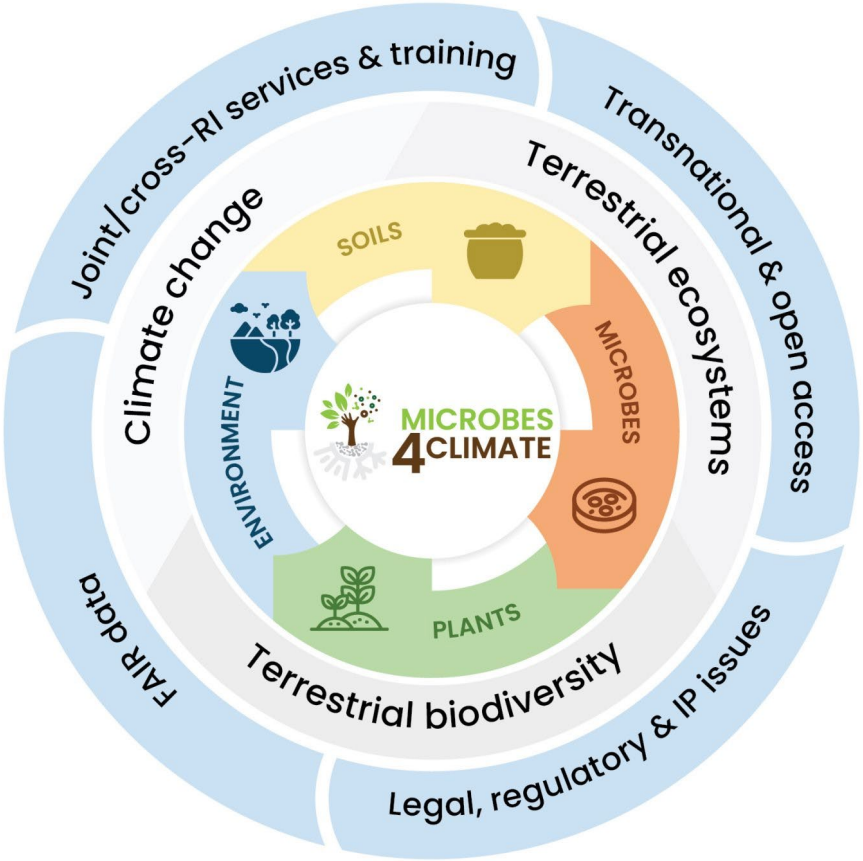
1st call – closed (101 applications)

2nd call – is open since yesterday

EMPHASIS

https://agroserv.eu/

Microbial services addressing climate change risks for biodiversity and for agricultural and forestry ecosystems

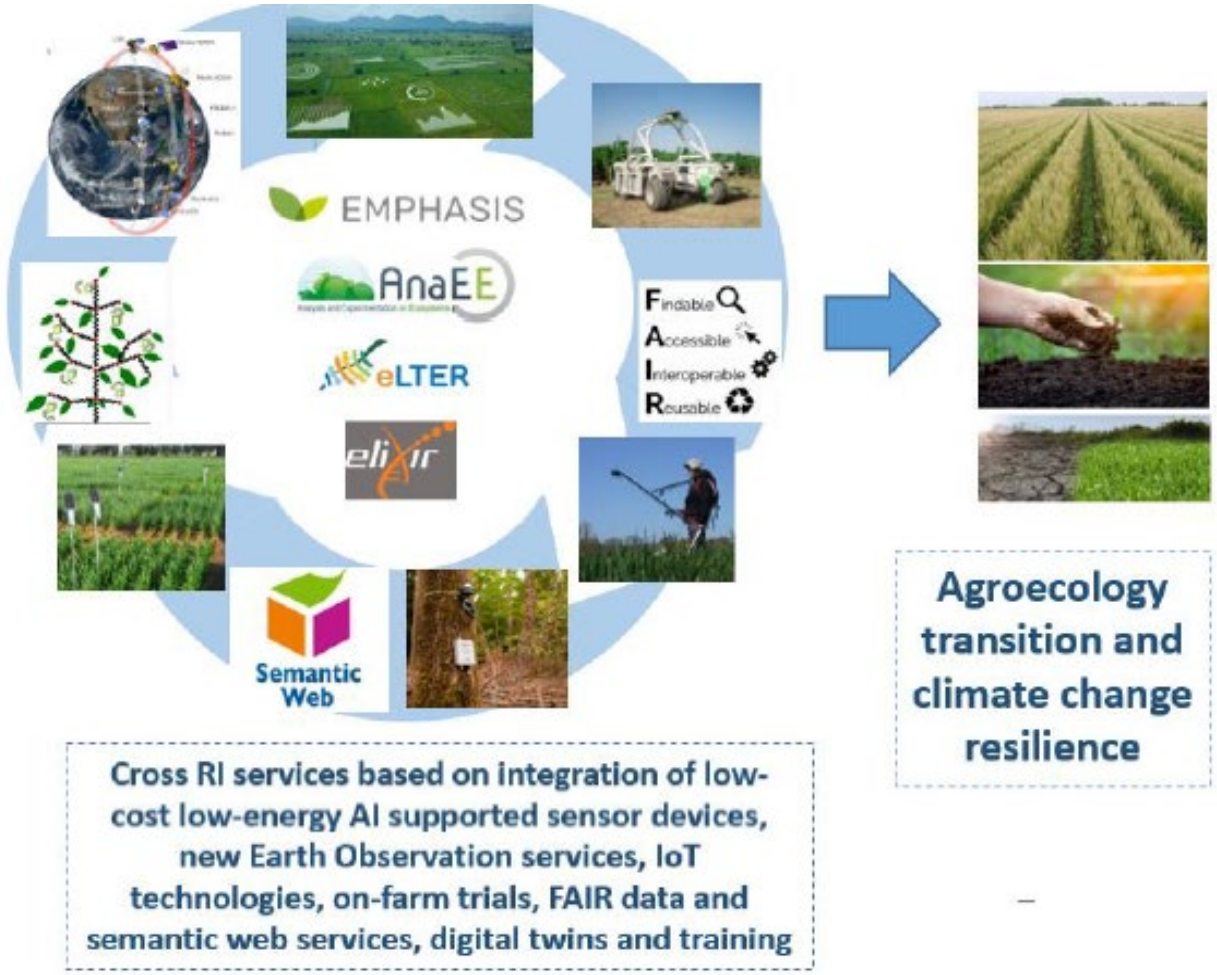


- Duration: 02.2024 – 01.2028 / 15 Mil EUR
- Microbes – Soil – Plant - Environment
- 30++ partner institutions
- >140 services offered
- A toolbox of services

1st call ~ end 2024

PHENET: Tools and methods for extended plant PHENotyping and EnviroTyping services of RIs

PHENET
TECHNOLOGIES FOR AGROECOLOGY



- Duration: 01.2023 - 12.2027
  10 Mil EUR
- 29 partner institutions
- Develop and test novel tools based on dedicated use cases
- Deliver new services for Research Infrastructures

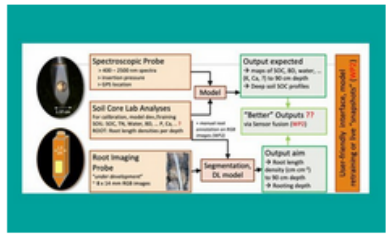
https://phenet.eu/

PHENET: Tools and methods for extended plant PHENotyping and EnviroTyping services of RIs

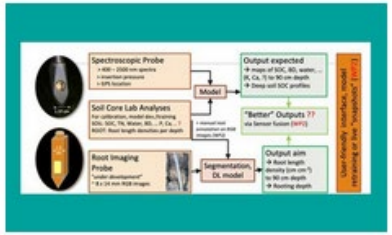
- Develop and integrate low-cost, AI-based, automated solutions (hardware, software, models)
- Capture, analyse a large diversity of traits (phenotyping), environmental variables (envirotyping)
- Enable predictions in agroecosystems

Test the solutions under realistic scenarios by addressing relevant scientific questions

Soil / root	GxE interactions	biotic interactions	across scales

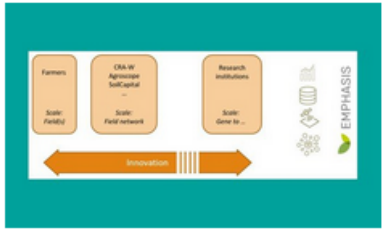


UC2
SOIL HEALTH AND ROOT PHENOTYPING



UC3
GXE CEREALS

UC1
PLANT HEALTH



UC5
FARMS 2 PLATFORMS (F2P)

UC6
SOIL PHENOLOGY

UC4
GXE ORCHARD

UC7
INTERCROPPING

UC8
LANDSCAPE

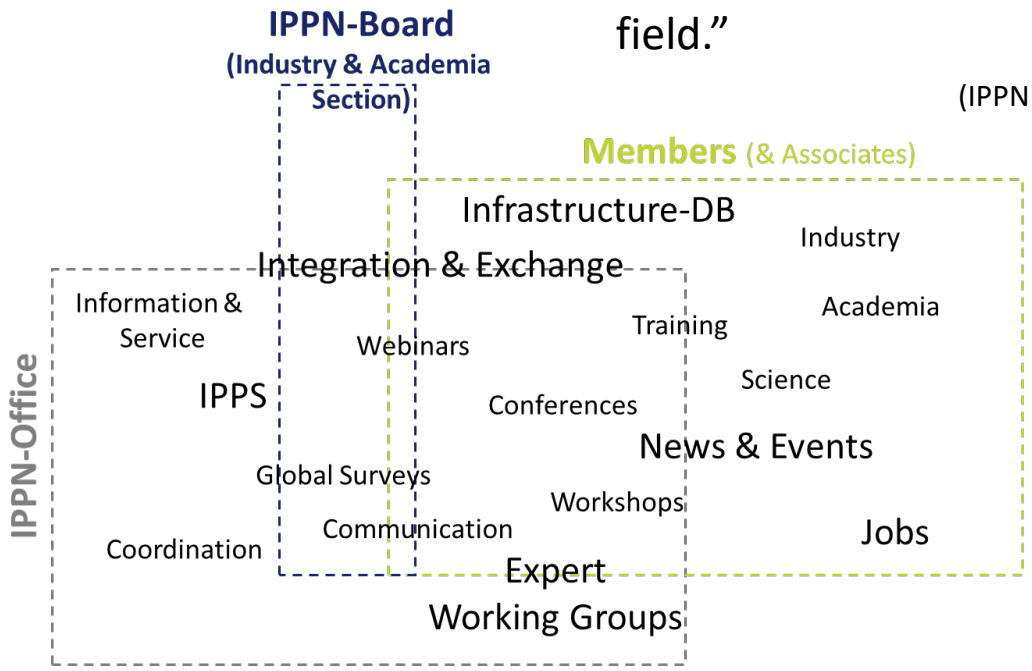
INTERNATIONAL PLANT PHENOTYPING NETWORK

IPPN

www.plant-phenotyping.org

"IPPN members recognize the need to globally integrate & advance plant phenotyping approaches across all levels of plant systems, from molecular to field."

(IPPN Mission Statement)



Our Goals are:

- **Integrate** regionally & globally fragmented activities
- **Enable** exchange of knowledge, information & expertise
- **Address** technology development & implementation
- **Advice** decision makers on state-of-the art and future opportunities & limits

GREEN HORIZONS

NAVIGATING THE FUTURE OF PLANT PHENOTYPING

IPPS №8

OCT. 07.–11. 2024 LINCOLN | NEBRASKA | USA

Jointly organized by:

University of Nebraska Lincoln

IPPN

The 8th International Plant Phenotyping Symposium is highlighting the state-of-the-art in both the science and application of plant phenotyping. In it's 8th iteration, it features distinguished speakers from various parts of the world. It provides an outstanding networking opportunity for researchers and companies, industry players in the plant phenotyping sector, and other international partners:

- **Expand your knowledge:** Attend sessions covering highlights in plant science research, featuring renown keynote speakers.
- **Industry Focus:** Participate in a dedicated industry session and connect with colleagues at the exhibitor space. Sponsorship opportunities are also available.
- **Showcase your research:** Present your findings at the poster sessions.
- **Get hands-on:** Take part in UNL field trips and gain practical experience in IPPN workshops.
- **Network & Celebrate:** Enjoy the conference dinner and celebrate your achievements with colleagues.
- **Sustainable Commitment:** We are committed to CO2 compensation for the event

Important Dates:

Registrations Deadline:
Early Bird Registration closes: May 15, 2024
Registration closes: August 15, 2024

Abstract Deadline:
Abstract Submission closes: June 15, 2024
Travel Grant closes: July 15, 2024

Session topics include:

- Phenotyping of biotic & abiotic stress responses
- Technology Session: From State-of-the-art towards the future
- Phenotyping of allocation & source-sink dynamics in woody- & herbaceous plants
- Next level AI, Models & Algorithms for Phenomics
- Advancing Crop Phenotyping in Africa: Exploring Perspectives
- Phenomics for Genebanks: Leveraging diversity towards new phenotypes
- Emerging Frontiers & Special applications in Plant Phenotyping

EMPHASIS

EMPHASIS is an ESFRI-listed project supported by the European Union.

EUROPEAN INFRASTRUCTURE FOR PLANT PHENOTYPING

EMPHASIS

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Emphasis on Plant Phenomics