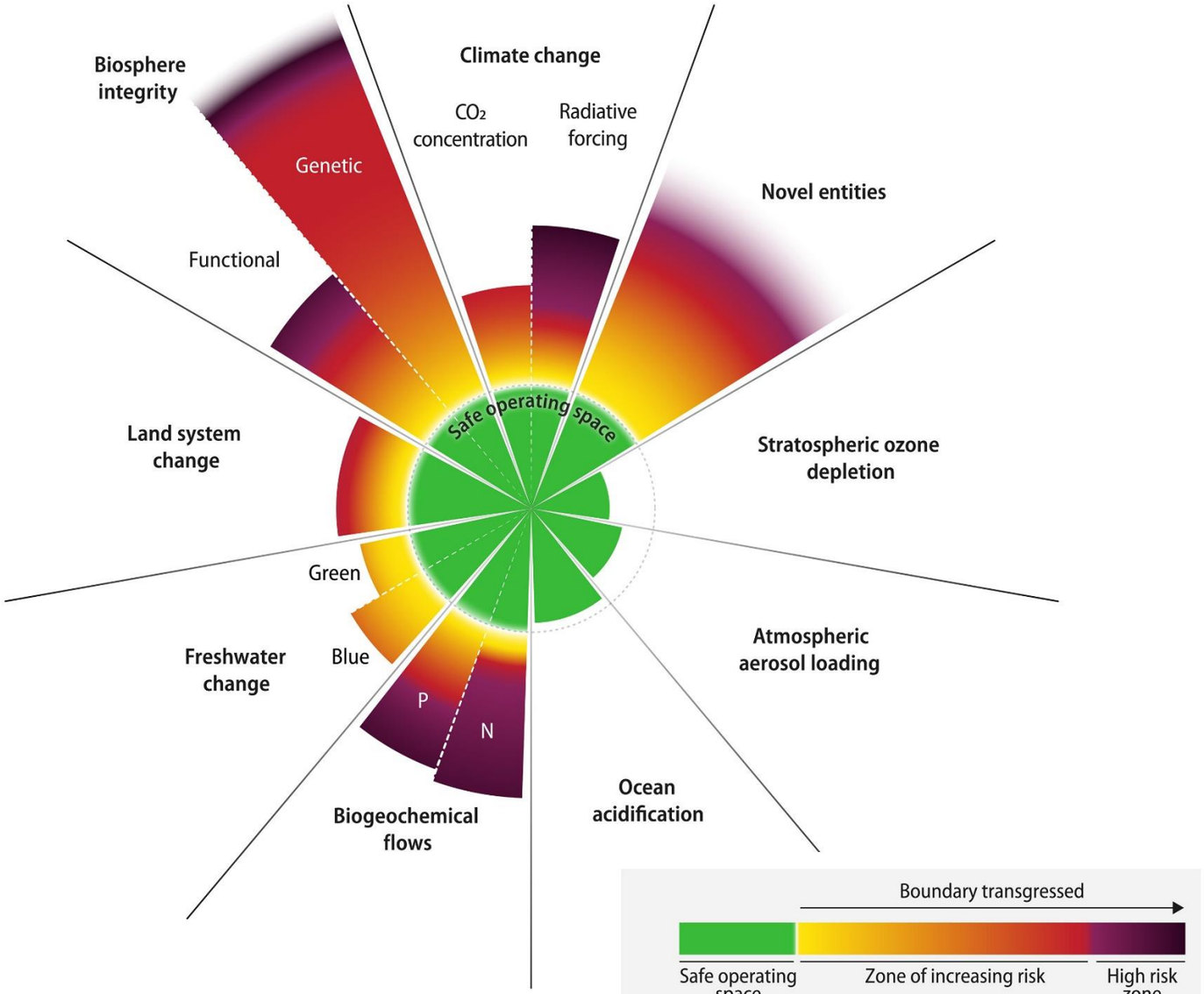
RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

Inria

AGROECOLOGY & DIGITAL SCIENCE AT INRIA

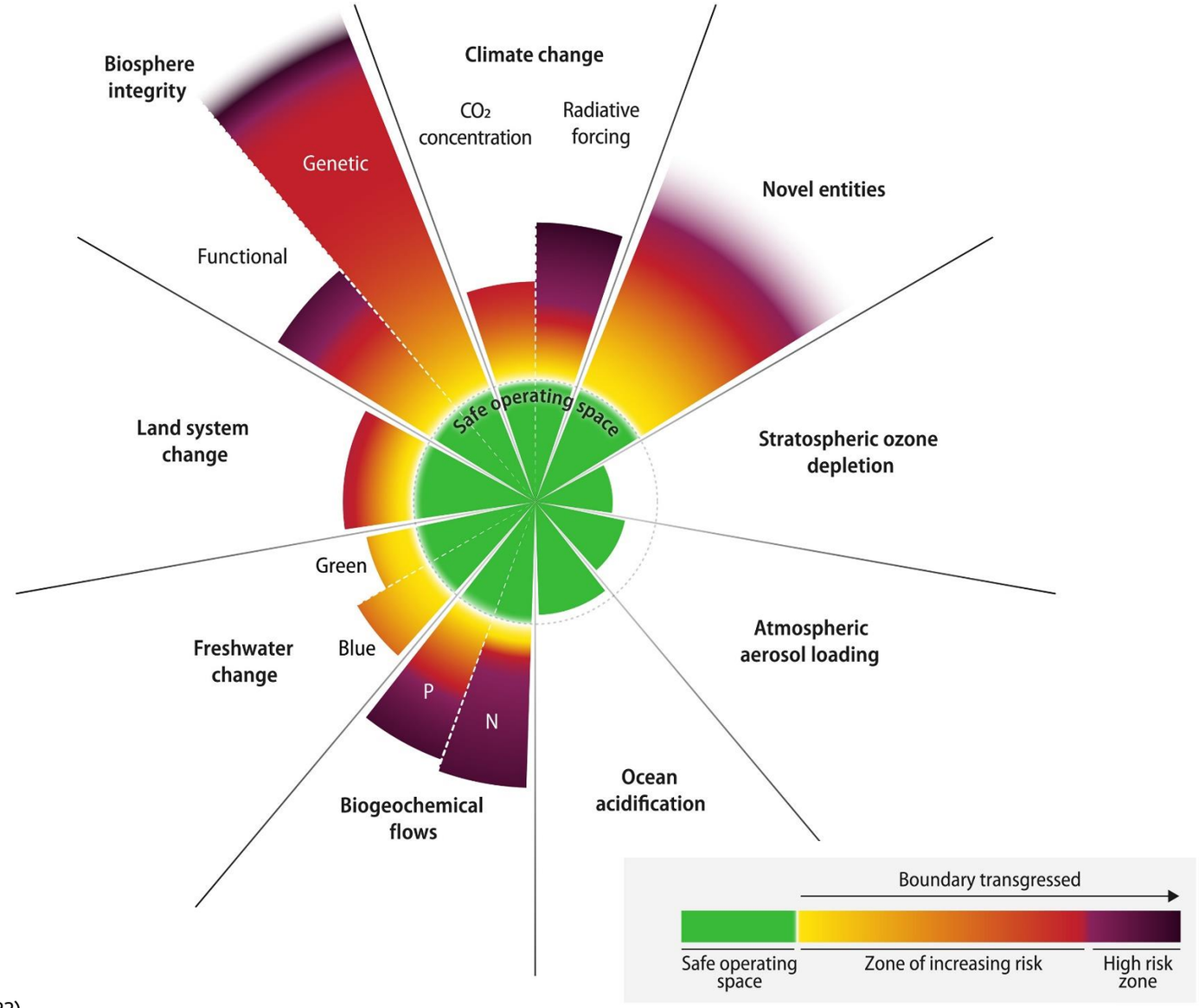
Inria Digital and Environment Program

Global & AgTech challenges with key numbers



(Richardson et al., 2023)

Global & AgTech challenges with key numbers



6 out 9

+56%

+1.1°C

~1/3

>4%

0,98 T/year

(Richardson et al., 2023)

Digital sciences & Environment program

Scope

- **Environment modelling**
- Using digital tech. to improve **decarbonation**
- **Environmental impact** of digital technologies
- **Digital, environment, health & society**

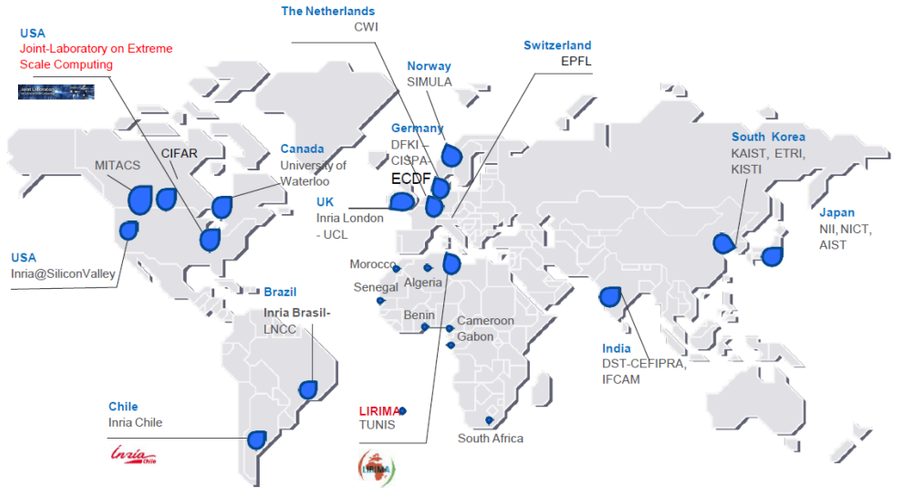
Means

- Structuring partnerships
- Exploratory projects
- Environmental issues that make sense
- Mediating and training

Research x Innovation x Partnership

3900 Scientists	**220** Teams-Project (80% joint with partners)
230 Startups since 1984	**10** Research centers (within Universities)

Inria International Partnerships



cea · cnrs · INRAE · AIRBUS DEFENCE & SPACE · DASSAULT SYSTEMES

Inserm La science pour la santé From science to health · Cerema CLIMAT & TERRITOIRES DE DEMAIN · ADEME AGENCE DE LA TRANSITION ÉCOLOGIQUE · ALSTOM · framatome · eraMET

ifp Energies nouvelles · IGN · TOTAL · GRDF GAZ RÉSEAU DISTRIBUTION FRANCE · EDF

Géosciences pour une Terre durable brgm · LEARNING PLANET INSTITUTE · ENGIE · SUEZ · orange

cirad · IRD Institut de Recherche pour le Développement FRANCE · PSA GROUPE · NAVAL GROUP · Valeo

AgroParisTech · université PARIS-SACLAY · MITSUBISHI · FUJITSU · SAMSUNG

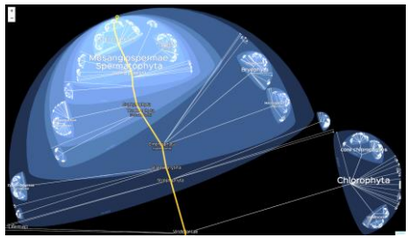
France Universités · esa · L'ORÉAL · LVMH

Teams with Agri/Agro/Environment activities

MOLECULAR LEVEL

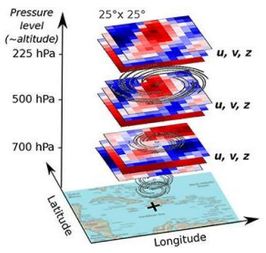
Dyliss, Genscale, Pleiade…

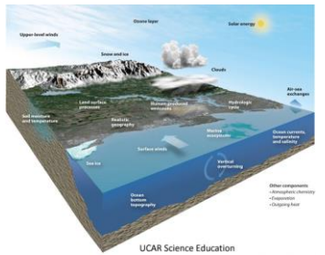
CELLULAR AND EVOLUTIONARY TIMESCALE



Biocore, Greenowl, Macbes, Mosaic, Microcosme, Inbio, Beagle…

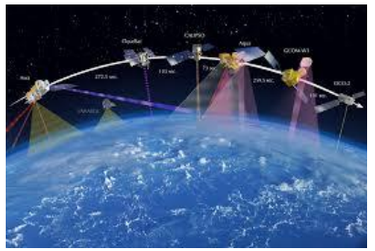
CLIMATE, METEOROLOGY & GEOPHYSICS





Odyssey, Airsea, Lemon, Ange, Arches…

SAT. IMAGERY



Ayana, Evergreen, Geostat…

Teams with Agri/Agro/Environment activities

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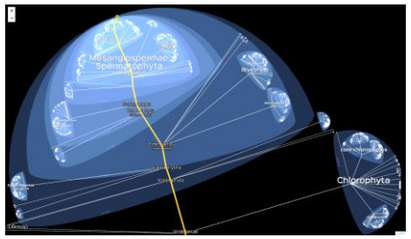

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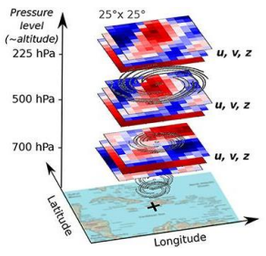

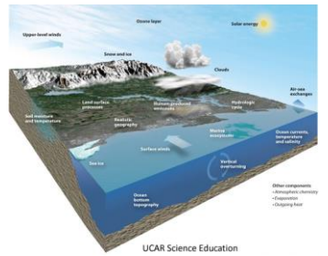

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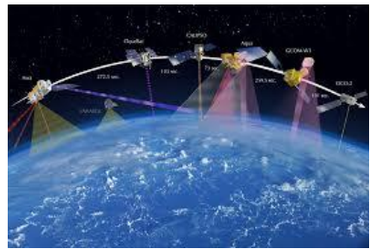


Ayana, Evergreen, Geostat…

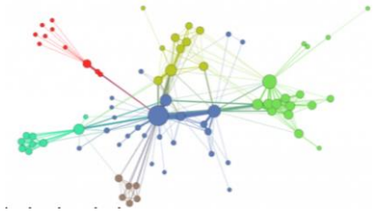
VISION SYSTEM & RECOGNITION

Zenith, Titane, Stars, Thoth…

DATA: ALGORITHMS, ARCHITECTURE & AI

Lacodam, Scool, Petrus, Modal…

INTERNET OF THINGS, NETWORK & UAV



Fun, Coati, Ermine, Aio, Neo…

AG-ROBOTICS

Acentaury, Defrost, Chroma, Rainbow…

Digital sciences & Environment program

Research projects

Research program« Agroecology and digital sciences »
- Co-lead with INRAE - 65 M€
- Upstream component of the SADEA national strategy

Research program « Sustainable digital »
- About to be launch - 25 M€

Decarbonisation of mobility
- Flasgship projet of the MOBIDEC Program

Structuring & risky projects

Alt Impact project « Digital sobriety »
- Co-lead with ADEME-CNRS - 15 M€

Digital twin of the national territory
- Co-lead with IGN, CEREMA - 80 M€

CO2 storage and monitoring
- Co-built with IFPEN, l'ENPC & industrial partners

+ Inria challenges & exploratory initiatives

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FRANCE 2030 PROGRAMME DE RECHERCHE AGROÉCOLOGIE ET NUMÉRIQUE

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Opportunities offered by digital technologies

- **Sensing, measuring & connecting**
  - From soil or crop sap sensor to sat. imagery (IoTs and networks)
  - Generating new and multiscale knowledge (genomics, ecology, climatology..)
- **Modeling**
  - To understand and predict complex system behavior (diagnostic and decision support tools)
  - Extracting new information from available data through ML
- **Supporting**
  - New practices & itineraries
  - New agro-equipment
- **Sharing through collaborative and participative tools**
  - Key information for agriculture (e.g. weather forecast)
  - Social links, creation of communities and commons
  - The example of Pl@ntNet

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Enabling news means & trajectories for agriculture

- Savings (inputs, investments, etc..)
- Traceability
- Reducing the drudgery of certain tasks
- Making agricultural jobs more attractive
- Supporting not one but all types of agriculture

Agroecology

"Producing better while respecting nature and ecosystems"

Basil Bensin (1928)

An area of innovations to

Increasing efficiency and economic performance by reducing

- Consumptions of fossils fuels, water and other inputs
- Physical impacts on soils
- Release of contaminants in the environment

Using precision technologies to

- Doing or providing the right thing at the right time at the right place

Engineering specialised farm machineries & new practices

- Increasing functional diversity of agrosystems
- Closing the loops of natural processes (soil, organic matter, biomaterials...)

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Conventional agriculture

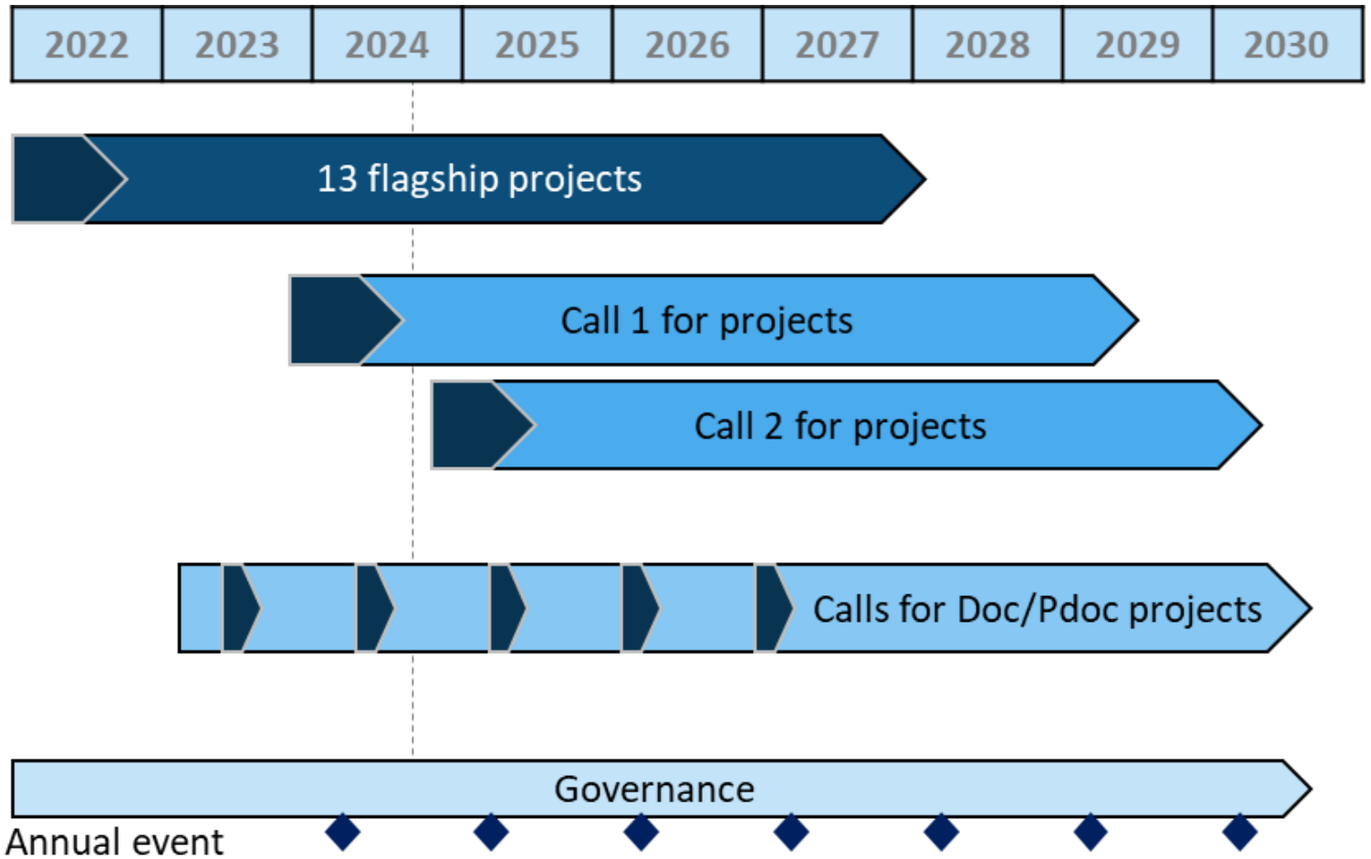
Best performing organisms in optimal environnement
(+ H2O, + nutrients, + disease control)

Agroecology

(Agronomy x Ecology)
Rely on interactions between living ecosystemic components where performance goes beyond productivity

Agroecology x Digital Sciences research program

Objective: Acquire knowledge to fuel innovation and accelerate the agroecological transition of agriculture



https://www.pepr-agroeconum.fr/

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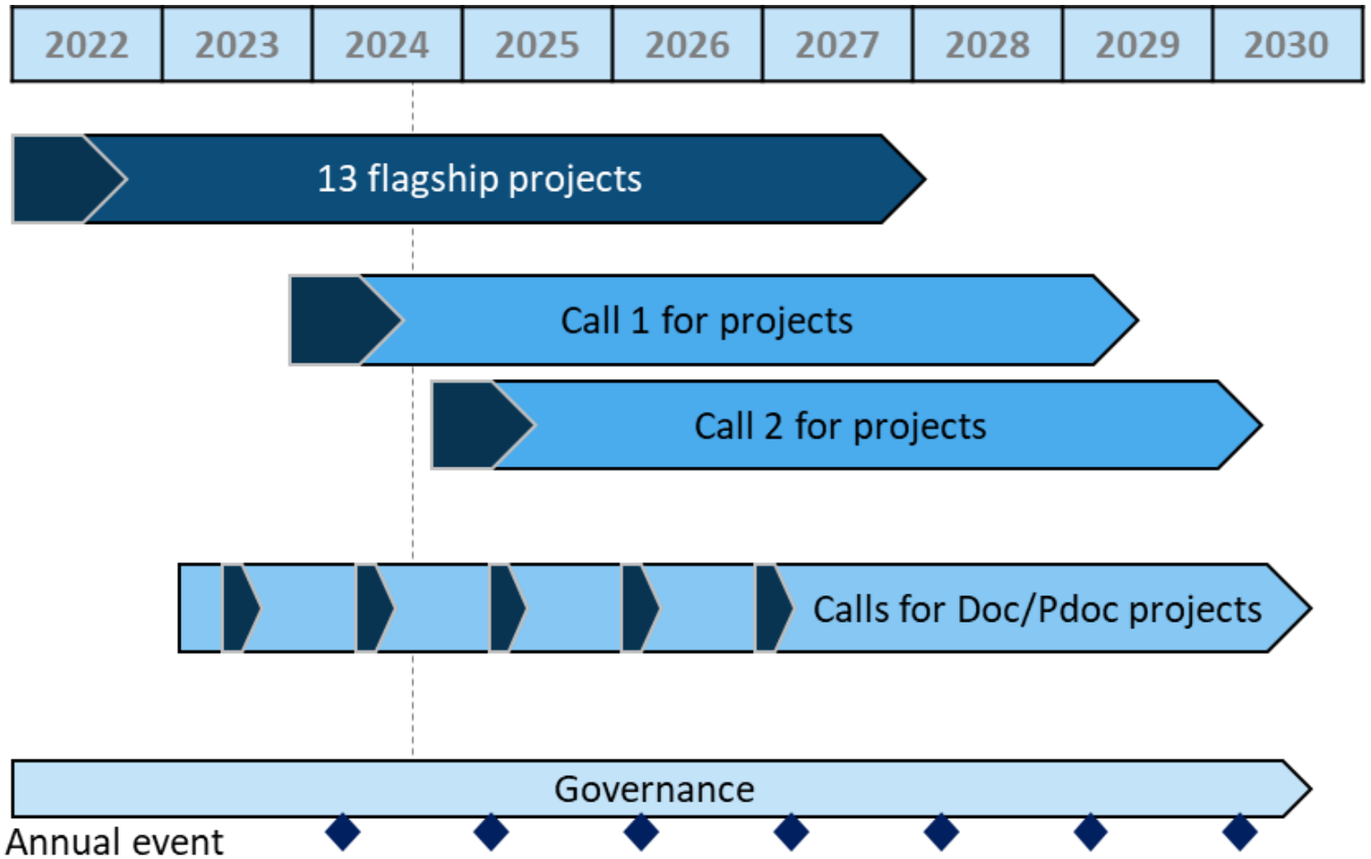


- **Social ecosystem**
- **Genetic ressources**
- **Agro-equipment**
- **Modeling**
- **infrastructures**

https://www.pepr-agroeconum.fr/

Social ecosystem to enable transitions

Objective: Building an ecosystem favourable to organisational, economic, institutional and political transitions

CoEDiTAg -> How digital technologies, equipments, socio-economic actors and public policies will support & strengthen the agroecological transition?

COBREEDING -> How to define and implement new breeding strategies to include a larger spectrum of environmental conditions and production systems?

LINDDA -> How to design and support collaborative activities of human, technologies and infrastructure to support changes associated with the agroecological transition?

Genetic ressources

Objective: Characterize plant, animal and microorganisms for their potential agroecological benefits

AGRODIV -> Engaging cutting edge genomic approaches to extensively characterize the biological material and evaluate their potential value for future use in an agroecological and climate change perspective.

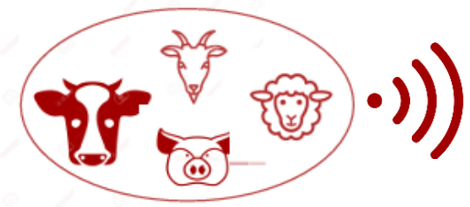
HOLOBIONTS -> Understanding how host genetics control symbiotic microbiota and determining the share of the mutual components in the determinism variability of the phenotypes

Agro-equipment

PROGRAMME DE RECHERCHE
AGROÉCOLOGIE ET NUMÉRIQUE

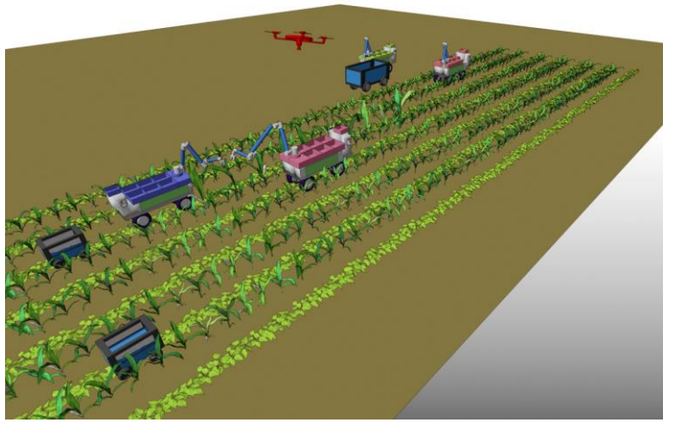
Objective: Designing robotic agroequipment and farming infrastructures to support agroecological itineraries

WAIT4 - **Artificial Intelligence and new Technologies for Tracking key indicator Traits in animals facing challenges of the agro-ecological Transition**



Animal Welfare

NINSAR -> **Defining and proposing autonomous system composed of several elementary and associable robots acting on soil and vegetation to conduct technical itineraries fullfilling agroecological requirements**



Modeling

Objective: Developing methods and tools relying on data analysis and modelling for decision making

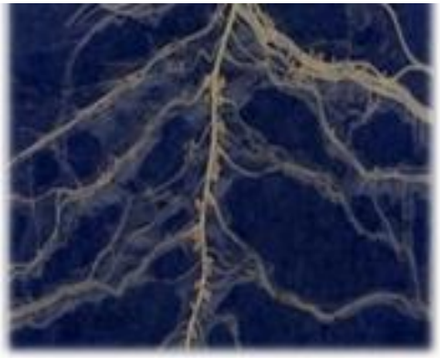
Pl@ntAgroEco -> New perspectives on plant disease characterization and taxon associations based on deep learning and participatory science

MELICERTES -> Geospatial approach to estimate soil organic carbon content and their uncertainties and the long-term experiments of the Integrated Carbon Observation System (ICOS)

MISTIC - -> Generating methodological AI and HPC approaches for digital twins of synthetic microbial communities, function-based models of microbiome-plant interaction, and discrete models of naturally occurring communities

Research infrastructures

AGROECOPHEN – High throughput plant root and shoot phenotyping for agroecological characters



PATASEL - Animal Phenotyping for the Agroecological Transition of Livestock Systems

BREIF - An e-Infrastructure to accelerate the use of diversified biological resources

Means to accelerate

Project support & Funding

- Inria International partnership
- Agroecology x Digital Sciences Program **call for projects 2025**
- Agroecology x Digital Sciences Program **annual call for PhD & Postdocs** (May-June)
- European projects

Networking

- This meeting !
- Agroecology x Digital Sciences Program website: https://www.pepr-agroeconum.fr/
- Agroecology x Digital Sciences Program LinkedIn

Events

- Annual meeting of the program : 29-31th of January 2025, Dijon, France
- International Scientific Event ~ January 2026

Thanks.

Patrick Armengaud
Program manager, Agence de Programme

Domaine de Voluceau, Rocquencourt – BP105
78153 Le Chesnay Cedex - France
Patrick.armengaud@inria.fr