Living Labs as a research tool – opportunities and limitations

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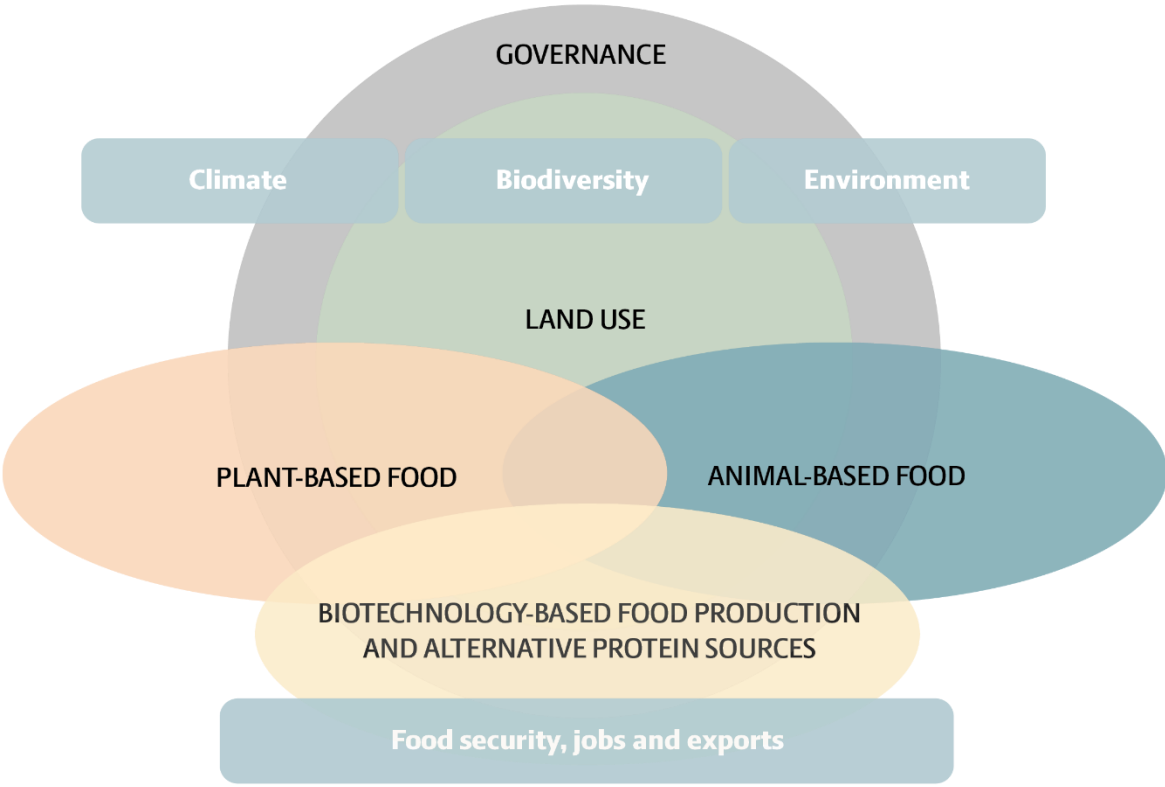
There a many sustainability challenges

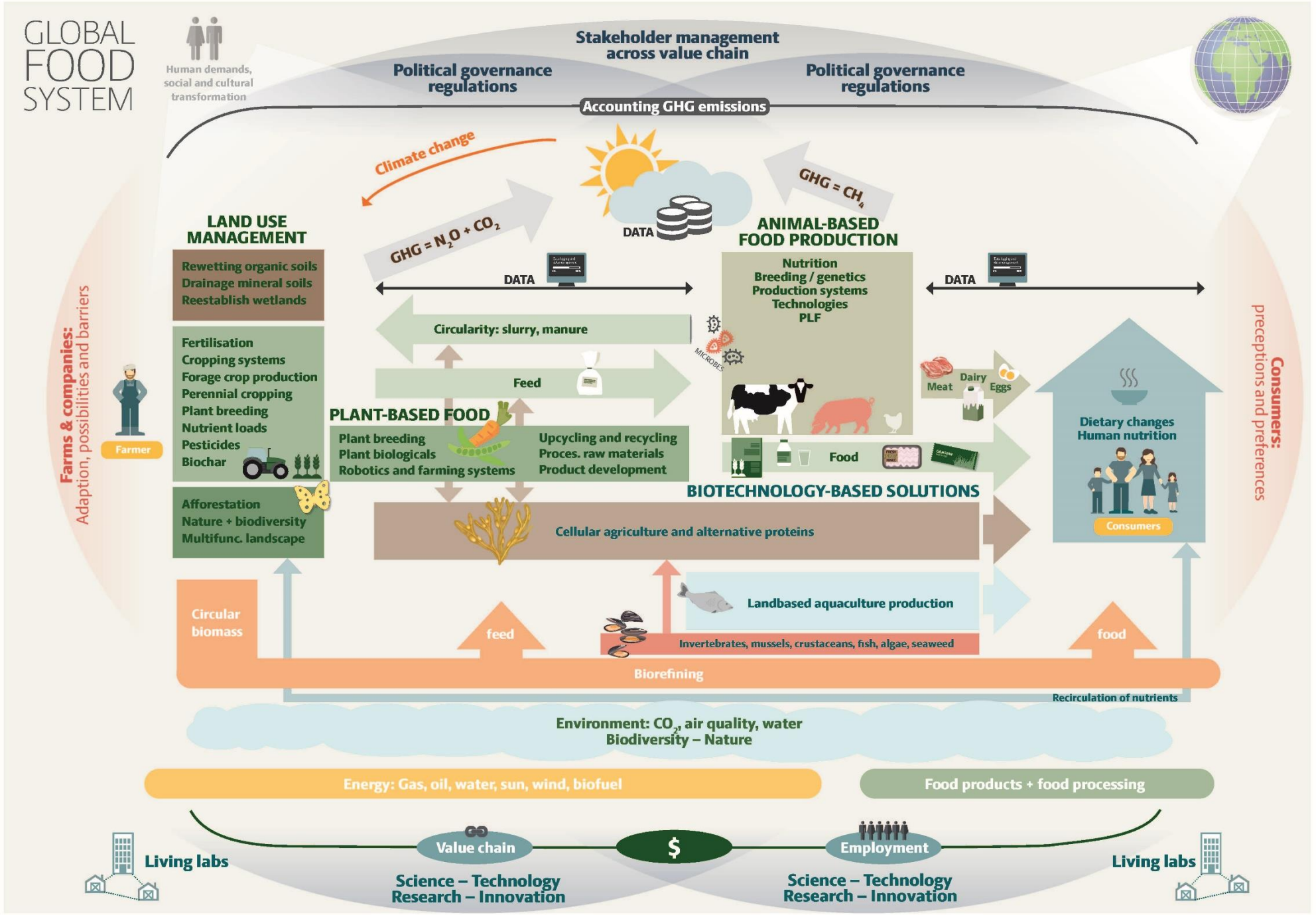
- Lower GHG and environmental footprint
- Enhance biodiversity (inside and outside farming)
- Less pesticide use
- Land area for other purposes (infrastructure, nature, recreation, climate change adaptation)
- Increased production of
  - Food (globally +45% by 2050)
  - Bioenergy
  - Biomaterials
- Jobs and growth outside cities

AgriFoodTure roadmap



Roadmap developed by universities and agroindustry in Denmark

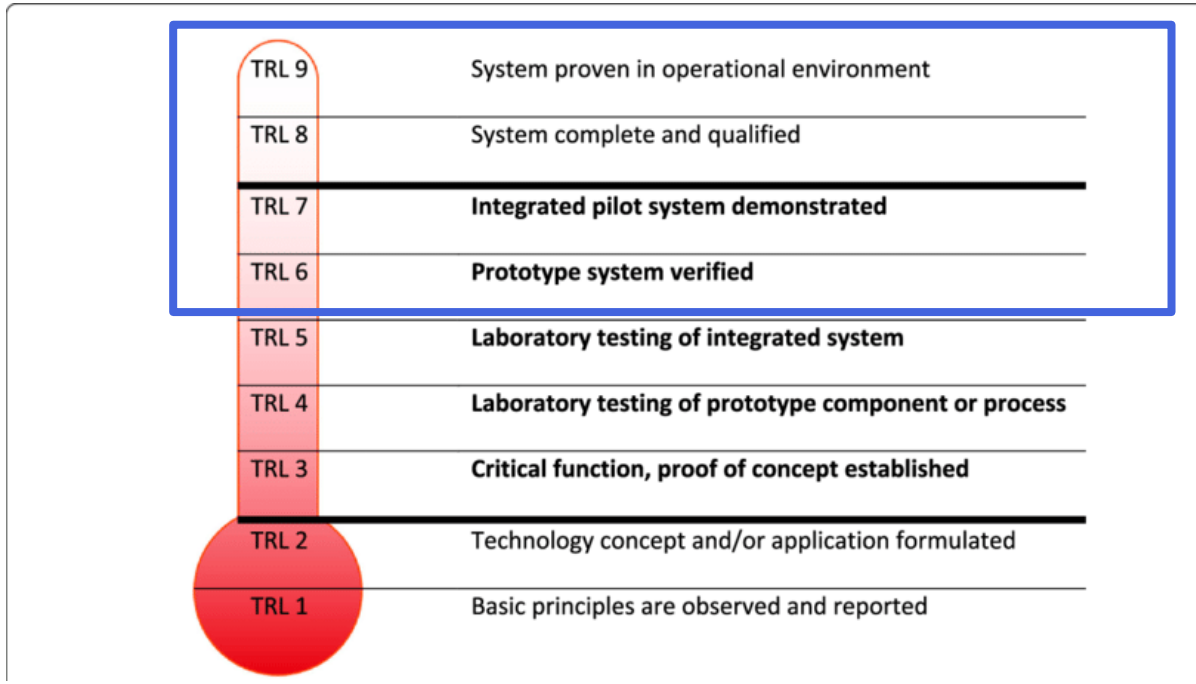
It is complex



What are living labs?

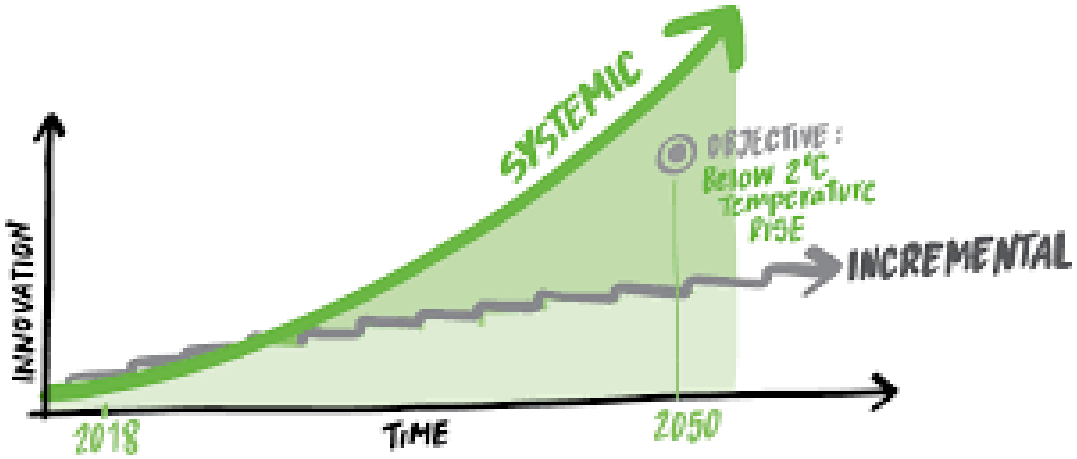
- Wikipedia: A living lab is a research concept, which may be defined as a user-centered, iterative, open-innovation ecosystem, often operating in a territorial context, integrating concurrent research and innovation processes within a public-private-people partnership.
- Agroecosystem living labs: Transdisciplinary approaches which involve farmers, scientists and other interested partners in the co-design, monitoring and evaluation of new and existing agricultural practices and technologies on working landscapes to improve their effectiveness and early adoption

Technological readiness level



Why do we need living labs?

- Speed up the green transition, which requires dealing effectively with barriers to adoption and making technologies market-ready
- Adoption of technologies are often context specific
- Adjustment and adoption of new technologies and management requires user involvement (co-creation)



There are many types and scales of living labs

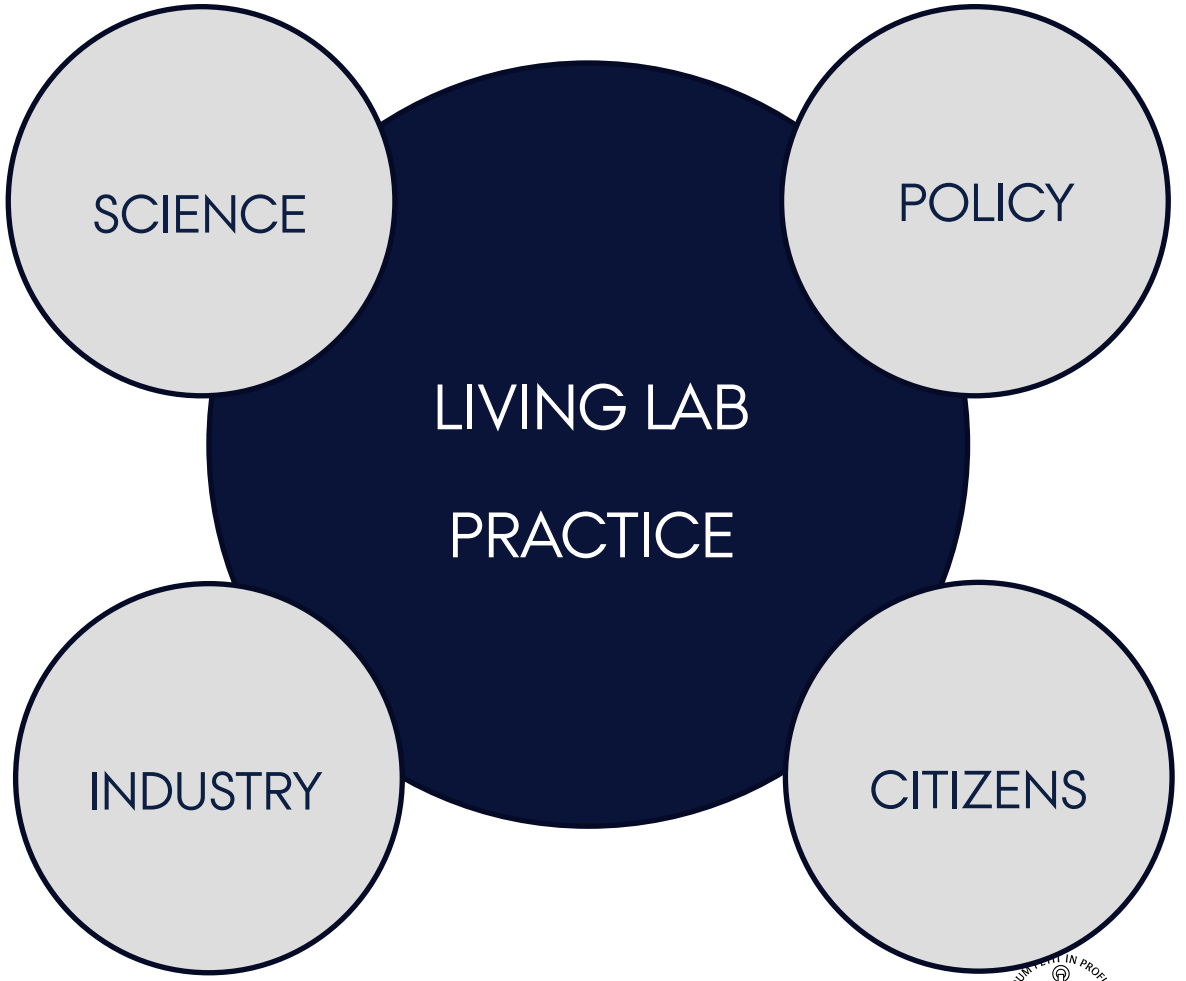
- Farm / field (management)
  - New management and technologies for growing crops and raising livestock
- Facilities (multiple farmers, cooperative)
  - Biorefining
  - Biogas
- Regional (governance)
  - Catchment (nutrients, water)
  - Landscape (biodiversity, recreation, multifunctional)

Working with living labs requires interdisciplinarity

Research in living labs requires a range of scientific competences (depending on the situation)

- Natural sciences
- Engineering
- Business
- Policy
- Humanities

But most importantly, the willingness to work with users and across disciplines



The role of science in living labs

- Support innovation (co-design)
- Document effects (sustainability impacts)
- Analyse barriers (to overcome them)
- Generate learnings (for society)

Land use and management is key to mission goals

Changes in landscape structure

Changes in functions and management

Governance to facilitate change

Reduced net GHG emissions

Greater primary production

Reduced nutrient loads

Reduced pesticide use

Greater bio-diversity

Cropping systems

FUNCTION AND MANAGEMENT

Arable cropping

- More biodiverse cropping systems, including legumes and mixtures
- Earlier harvesting of annual crops - improved establishment of cover crops to be harvested for biorefining (double cropping)

Forage cropping

- Grassland-based forage production based on multispecies mixtures

Perennial cropping systems

- Novel productive perennial crop production systems (incl. agroforestry)
- Integration with energy production (including photovoltaic)

Management

- Novel fertilizers and fertilization (including recycled nutrients)
- Precision farming technologies (sensors and robotics)
- Plant breeding - focus on environmental/climate aspects and efficiency in production chain
- Biorefining technologies - upcycle biomass from across the landscape
- Enhance soil carbon through biochar (integration with energy systems)

Governance aspects

Smart systems

- Tree species in forests for multiple use
- Agroforestry systems - certifications and standards

Documenting services and functions

- GHG emissions and offsets
- Drinking water formation
- Nutrient loads to the aquatic environment
- Biodiversity - forest and nature

Land sparing and sharing

- Prioritise areas for recovery and maintenance of biodiversity
- Protect and facilitate biodiversity on agricultural land

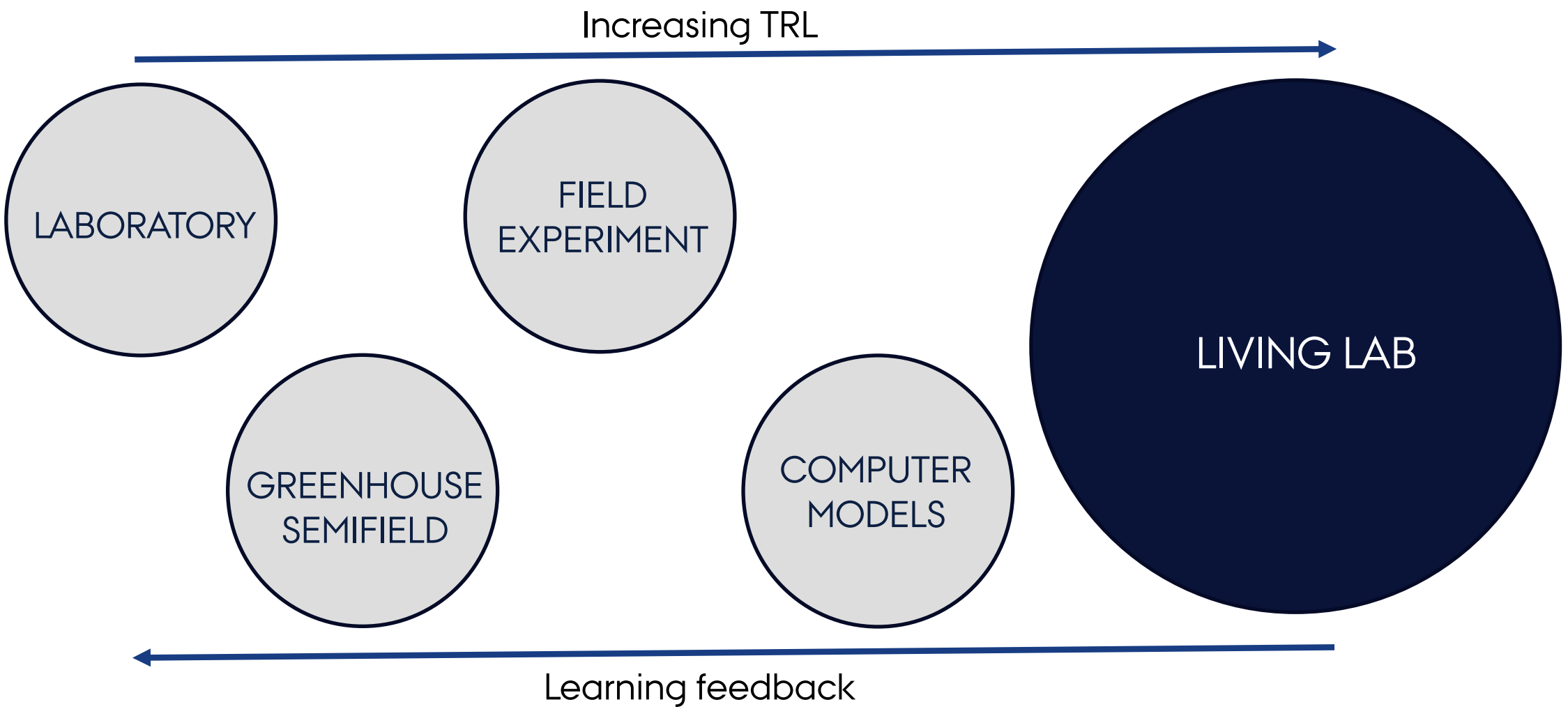
Methods for restoring natural and dynamic processes

- Establishment and evaluation of systems
- Tools to advice local managers

Concept for advising and counselling

- Speedy land distribution processes
- Value creation for stakeholders
- Reduced nutrient loads for target areas
- GHG reductions based on spatial data
- Automated observation systems (IoT, drones, remote sensing),
- IT support for decision making
- Involvement at municipality level

Living labs is one among many research tools



Research challenges with living labs?

- Is there a reference against which changes can be measured?
- Are changes sufficiently well defined?
- Is the role of researchers in the co-design process well defined (arms length)?
- Are technologies/methods available for measuring and documenting effects at the scale of the living lab?
- Do we need new standards for reporting and publishing from living lab studies?

- Interdisciplinarity requires additional effort for cross-disciplinary understanding

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