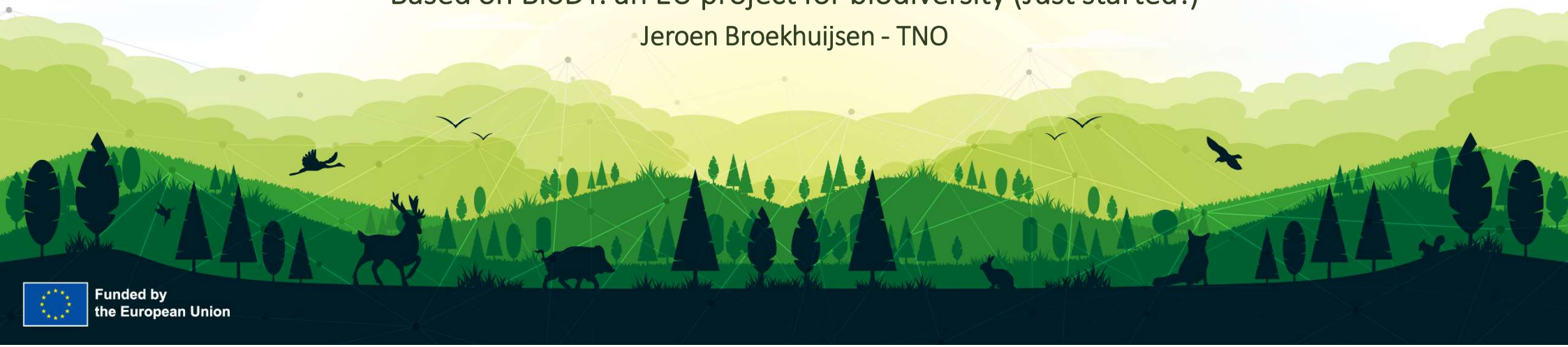
BIODT
biodiversitydigitaltwin

Digialisation for sustainble Nature

Based on BioDT: an EU project for biodiversity (Just started!)

Jeroen Broekhuijsen - TNO



Funded by
the European Union

Goal of BioDT

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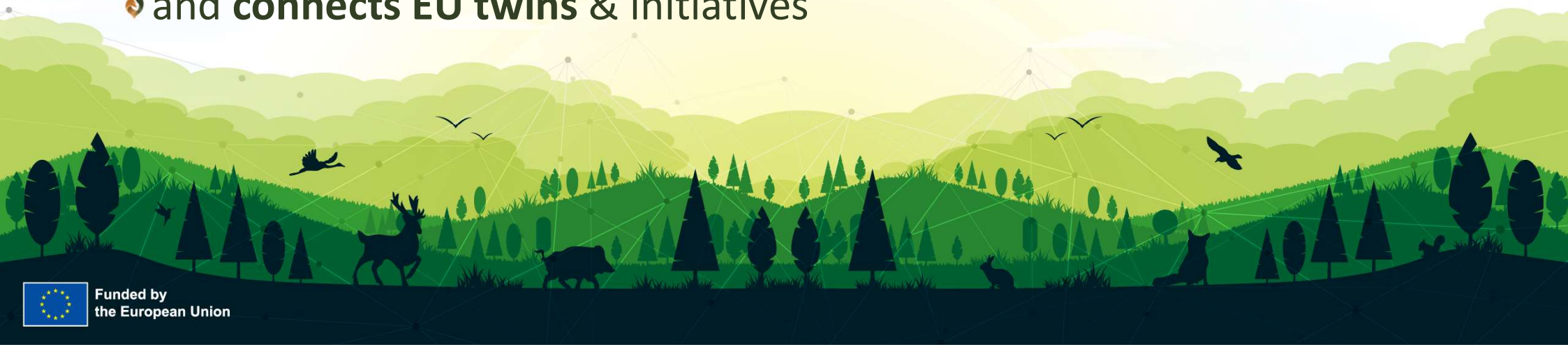
- **Support Research Infrastructures** for biodiversity
- by making a first **prototype digital twin**
- that **drives** both **science & uses cases**
- and **connects EU twins** & initiatives



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- Scientific community for biology, connecting to scientists at universities

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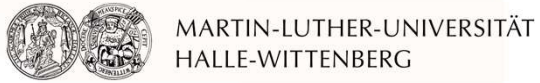

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- by making a first **prototype digital twin**
- **that connects EU twins & initiatives**

EUROPEAN OPEN SCIENCE CLOUD

ECMWF

- **With an interdisciplinary digital twin platform**

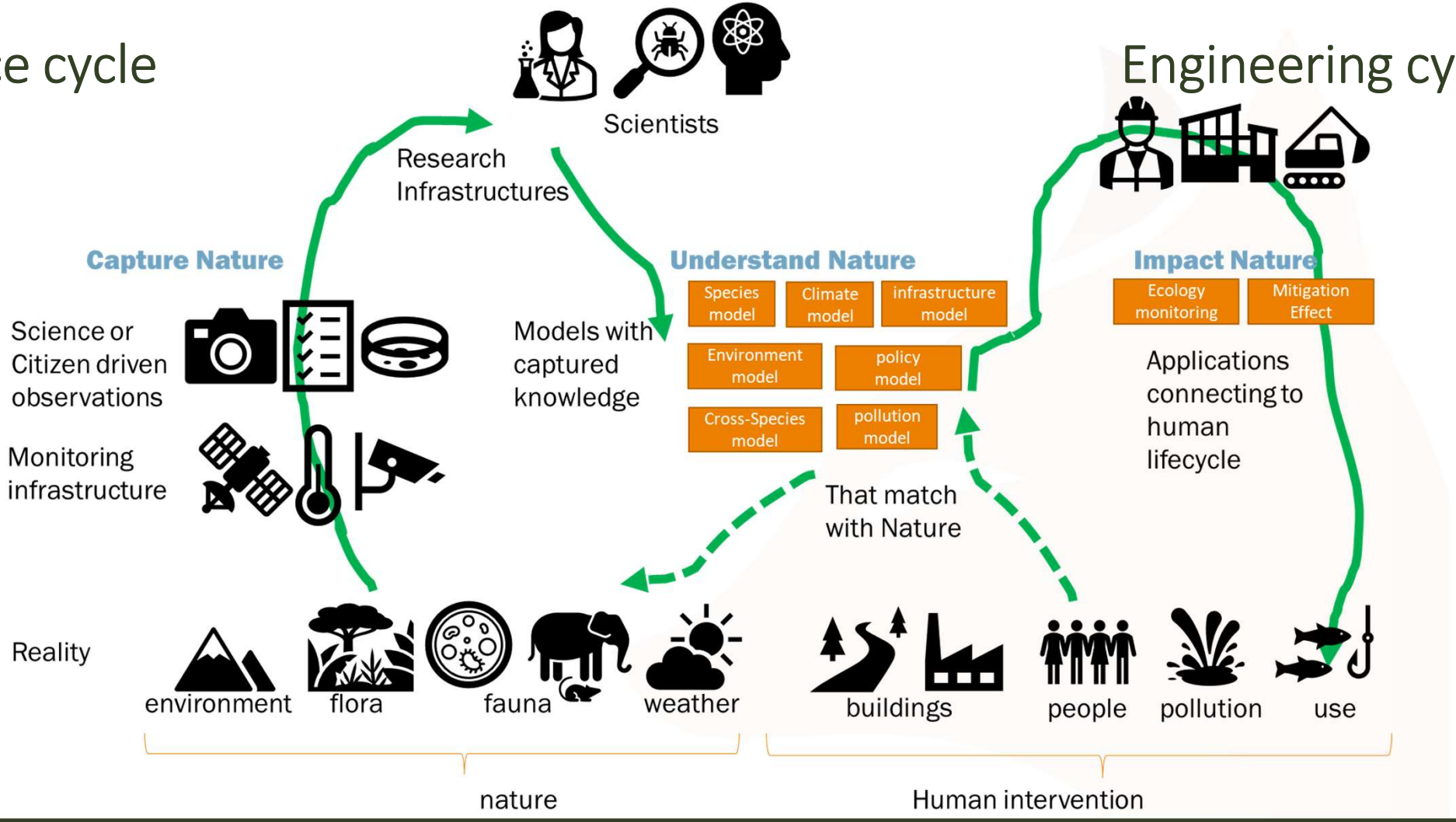
CSC

VSB TECHNICAL UNIVERSITY OF OSTRAVA | IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER

TNO innovation for life

Science cycle

Engineering cycle



Science! Not engineering!

- **Science** is the pursuit and application of **knowledge and understanding** of the natural and social world following a systematic methodology based on evidence.

- **Engineering** is the application of science and maths to **solve problems**. While scientists and inventors come up with innovations, it is engineers who apply these discoveries to the real world.

Definition of Twin

- A digital twin is a **virtual representation** of real-world entities and processes, synchronized at a specified frequency and fidelity

Goal of Science

- Create more **knowledge** on how our world works. Can we **capture this digitally** in our virtual representation?
- Like a game engine discovering the rules of physics!
- Can we ensure the right fidelity?

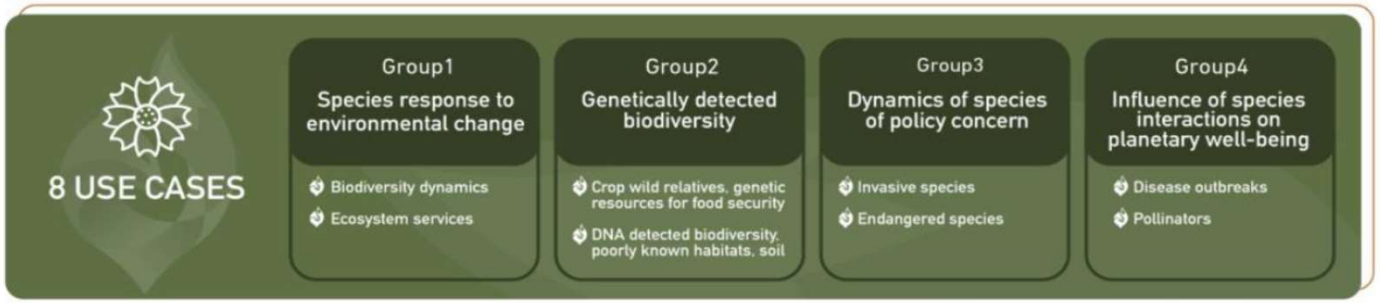
Aim

- Make it easier for scientists to discover new knowledge from (controlled) experiments
- By capturing more and more knowledge in virtual representations that can be used to more easily test hypothesis & compound knowledge

Usage

- Replicas that can be applied for…
- Engineering! So we can now apply this to our normal lifecycle in terms of what we humans do that affects biology

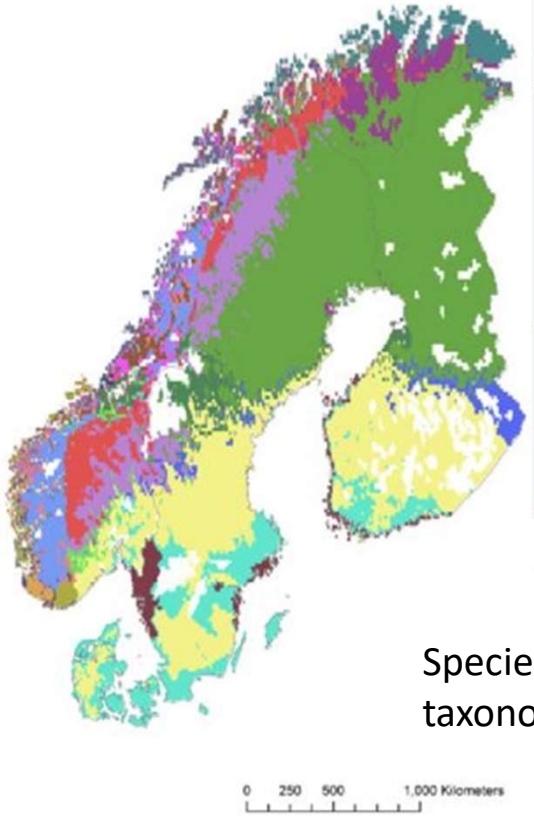
BioDT Use-Cases



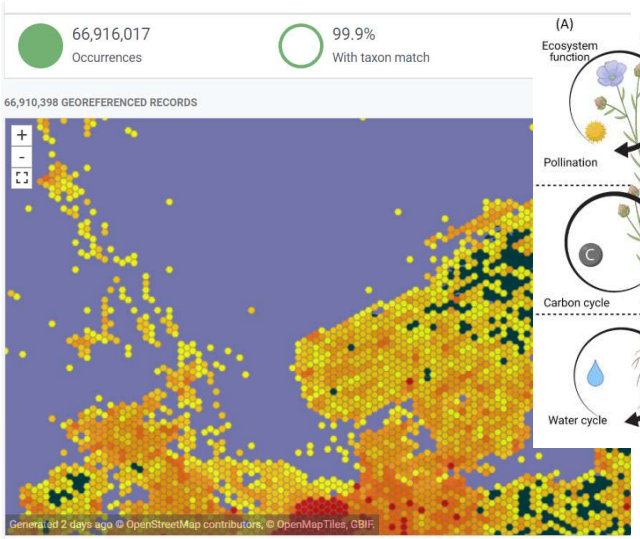
- **Species response to environmental change**
- **Genetically detected biodiversity**
- **Invasive & endangered species**
- **Influence of species interactions on planetary well-being like diseases & pollination**

Datasets

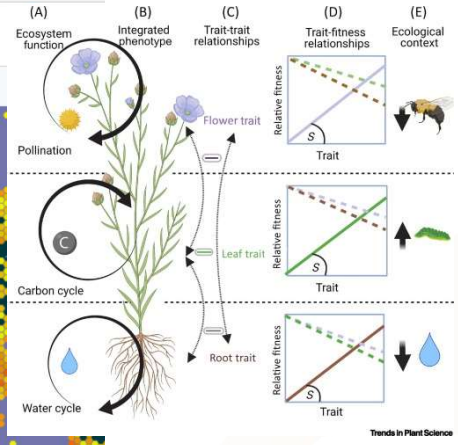
Ecological habitat map



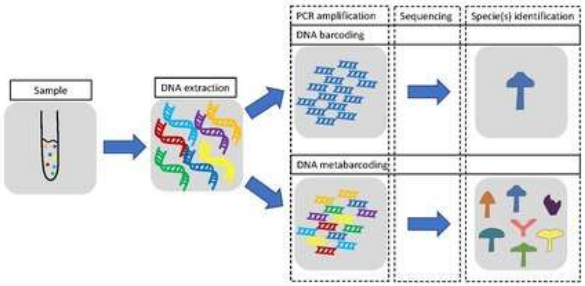
Species observations



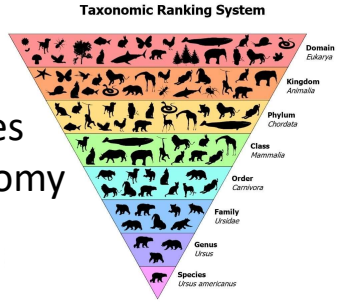
Species traits



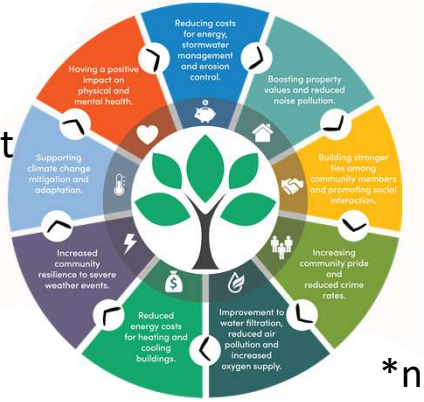
Species DNA sampling & meta-barcoding



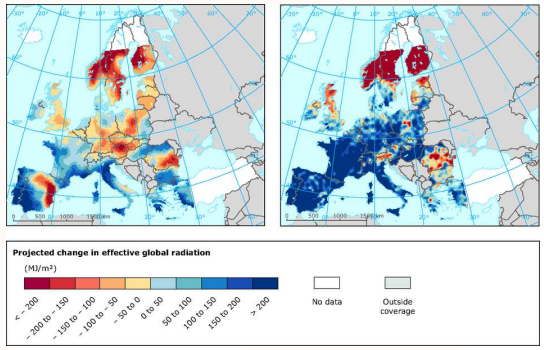
Species taxonomy



Management strategies



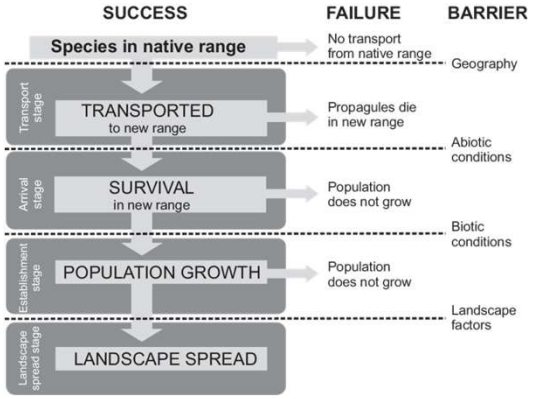
Potential effects of climate change



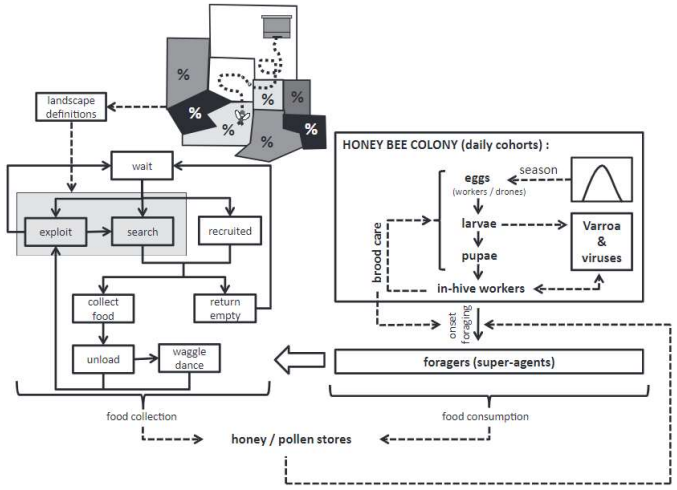
*not all these images are BioDT results

Models

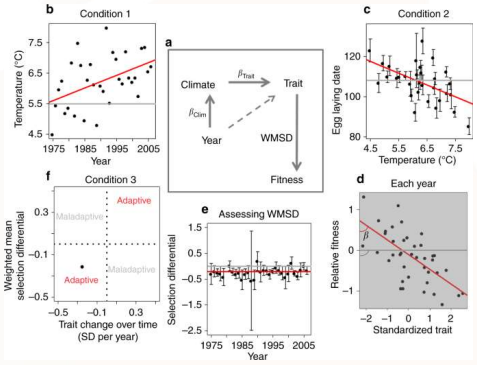
Species spread model



Species behavior model



Species adaptation model



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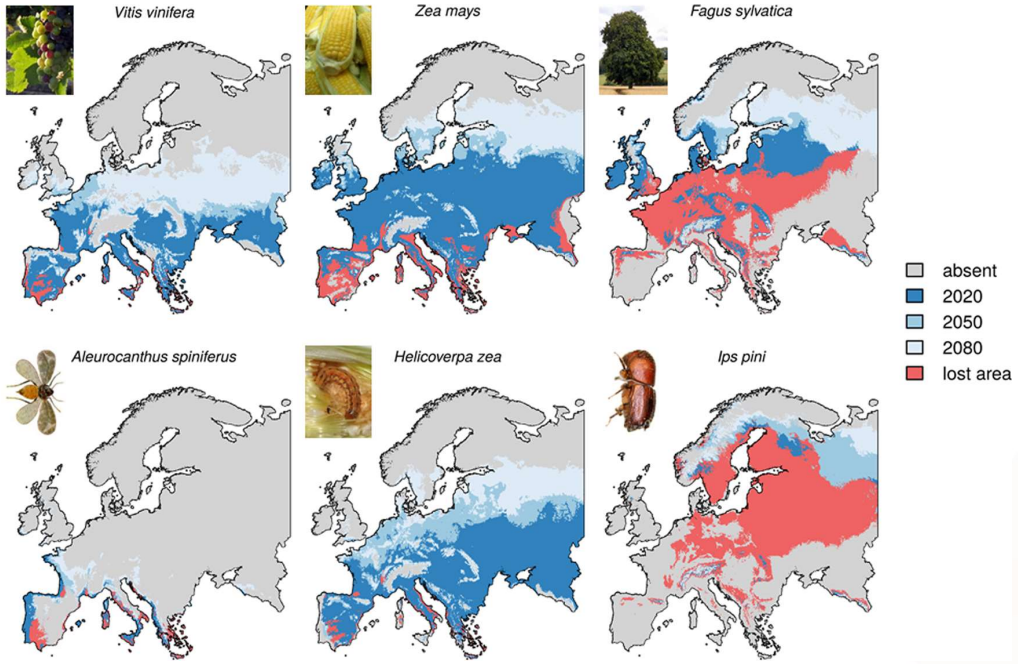
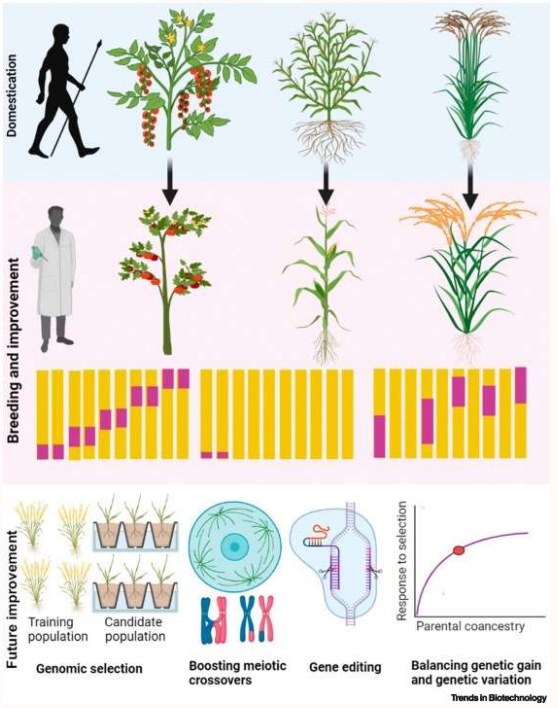
Applications

Impact of invasive species on crop loss due to climate change



Increased crop yield by cross-combination
Based on gene traits



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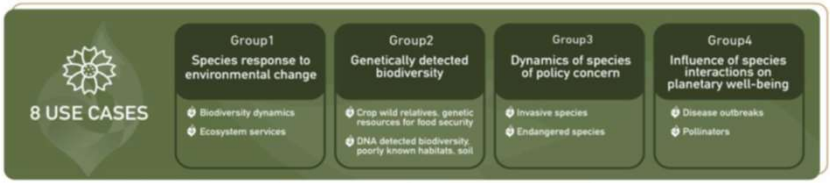
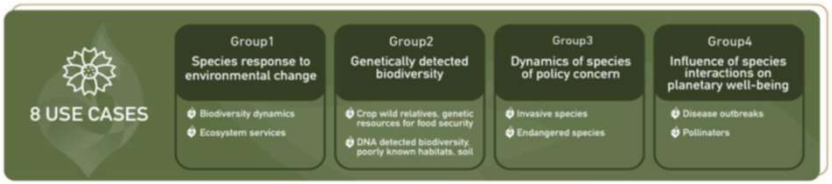


- Science questions:
  - Which habitat supports which species?
  - Which species, has which traits?
  - What is the variation within species
  - How do species interact with their habitat & other species?
  - How do species spread?
  - How do management strategies affect habitats, species, interaction

- Engineering questions:
  - Given the EU Biodiversity strategy for 2030
- Which management strategies create sustainable impact nature, our welfare and economy:
  - To conserve nature
  - Make it adaptable for climate change
  - Ensure our food supply (increase yield)
  - Mitigate diseases, risks & invasive species

Future outlook



- Species response to climate change:
  - Which management strategies will maintain or increase biodiversity best for grasslands & forests?
- Genetically detected biodiversity:
  - Which regions will most likely have wild-relatives that can diversify the crop gene-pool most? Can we identify genetic traits for cross-breeding?
- Species of policy concern
  - How can we better model the spread of invasive species. Which influence can we have as humans on this spread?
  - Which management strategy best conserves endangered species?
- Species interaction
  - Which land-use strategy best supports pollinators (honeybees) to ensure our food supply?
  - When will animal transmitted disease become common due to climate change and species interactions?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