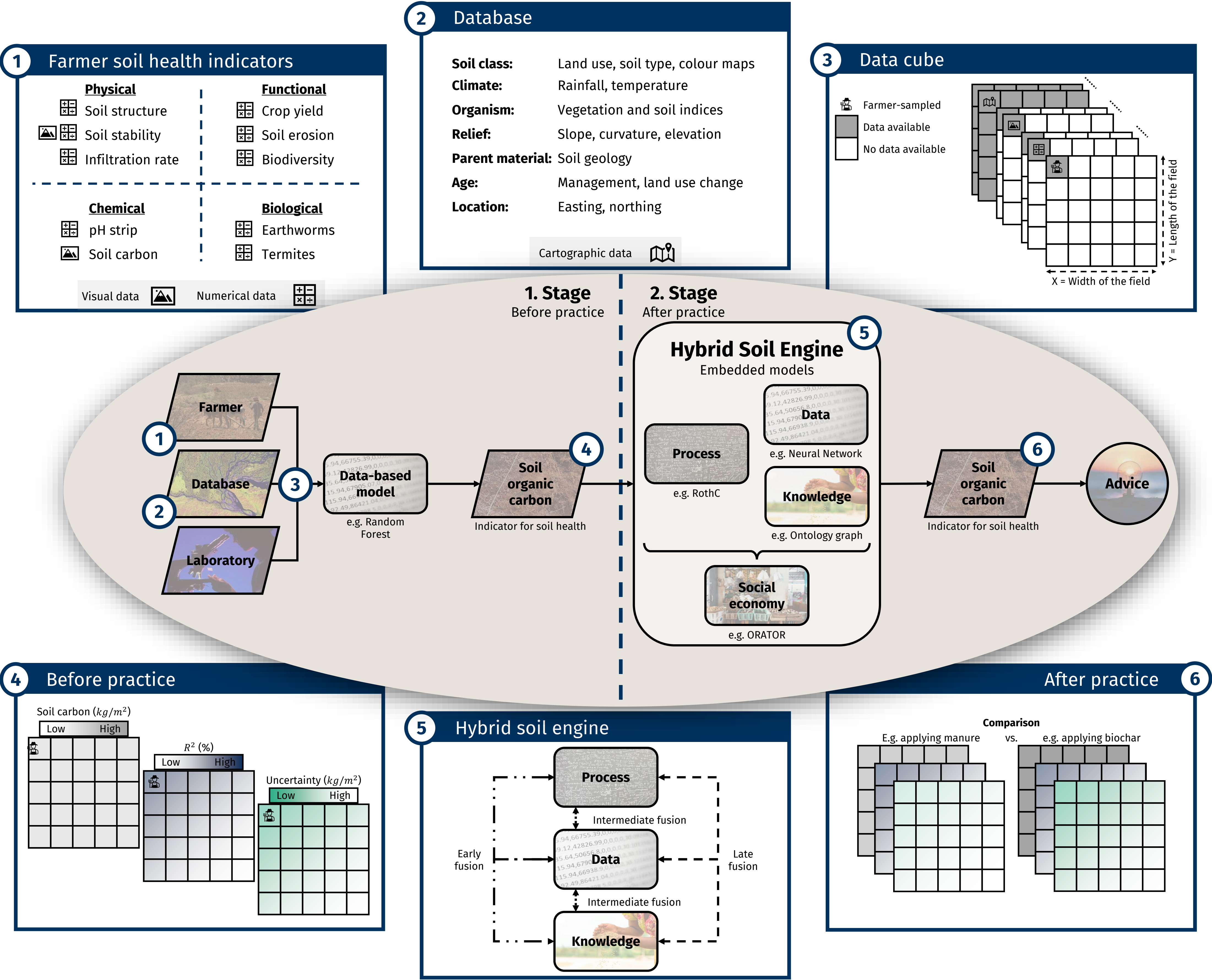# A **hybrid soil engine** to support **Ethiopian farmers** using **nature-based solutions**

Why?

Soils are incredibly important for maintaining ecosystem services such as food production. Nature-based solutions are the key to improving soil health, but their impacts must be assessed across diverse settings. We create an AI-powered app that will help farmers to assess soil health and predict the impact of these measures.

1 Farmer soil health indicators

Physical
- Soil structure
- Soil stability
- Infiltration rate

Functional
- Crop yield
- Soil erosion
- Biodiversity

Chemical
- pH strip
- Soil carbon

Biological
- Earthworms
- Termites

Visual data ▲   Numerical data ⊞

2 Database

Soil class:	Land use, soil type, colour maps
Climate:	Rainfall, temperature
Organism:	Vegetation and soil indices
Relief:	Slope, curvature, elevation
Parent material:	Soil geology
Age:	Management, land use change
Location:	Easting, northing

Cartographic data

3 Data cube

- Farmer-sampled
- Data available
- No data available

Y = Length of the field
X = Width of the field

---

1. Stage — Before practice
2. Stage — After practice

Farmer 1
Database 2
Laboratory
3 → Data-based model (e.g. Random Forest) → Soil organic carbon (Indicator for soil health) 4

Hybrid Soil Engine — Embedded models 5
- Process (e.g. RothC)
- Data (e.g. Neural Network)
- Knowledge (e.g. Ontology graph)
- Social economy (e.g. ORATOR)

→ Soil organic carbon (Indicator for soil health) 6 → Advice

4 Before practice

Soil carbon (kg/m^2) — Low / High
R^2 (%) — Low / High
Uncertainty (kg/m^2) — Low / High

5 Hybrid soil engine

Process
Intermediate fusion
Early fusion — Data — Late fusion
Intermediate fusion
Knowledge

6 After practice

Comparison
E.g. applying manure   vs.   e.g. applying biochar

Reliable?

The novel combination of different methods and perspectives is what makes all the difference: It aims to empower farmers with tailored, actionable insights, boosting soil health and securing sustainable livelihoods.

Hybrid AI-enabled impact assessment of sustainable farming on soil health in SSA
Dominik Bittner[1], Jo Smith[1], Georgios Leontidis[1], Grant Campbell[1], Pete Smith[1], Jeanne Biegel[2], Paul Hallett[1]
[1] University of Aberdeen, [2] University of Burgundy (France)

Interdisciplinary Institute
1495 UNIVERSITY OF ABERDEEN