



Satellite × AI

Monitoring of Farmland Soil Carbon for Combating Land Degradation

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Co., Ltd.

Sagri at a Glance



- **Company Name:** Sagri Co., Ltd.
- **Founded in:** 2018
- **Business:** Data analysis using satellite data and machine learning and related services
- **Recognition:** Prime Minister's Award, 6th Space Development and Utilization Awards (2024)

Speaker



Kenshi Kobayashi

Project Manager, Applied Science Office, Engineering Department, Sagri Co., Ltd.

- Runs joint projects with research institutions in Japan and overseas on soil organic carbon, agricultural water management and greenhouse gas measurement
- Panellist, JAXA Earth Observation Data Utilization 30th Anniversary Symposium (2025)
- M.Sc. in Geoscience, University of Tsukuba

Agri-Innovation

New solutions for the agricultural sector using satellite data



This talk is about Project 01 — measuring soil carbon, and what that measurement makes possible

Why Soil Carbon Is the Metric for Land Degradation

1 What SOC does

Holds water — drought resilience
Binds aggregates — resists erosion
Retains and supplies nutrients (CEC)
Sustains soil biology



2 All degradation depletes SOC

Erosion, continuous tillage, residue removal, overgrazing — every process depletes it
Different causes, one measurable number



3 Yield does not show it

SOC declines while yields still look normal
By the time yield drops, restoration costs far more



4 It is also the lever

Cover crops, residue retention and manure rebuild it
What can be measured can be managed

The same number also reports climate mitigation — the link between Sustainable Land Management (SLM), climate and biodiversity

Scope: SOC (organic carbon) is the pool that Land Degradation Neutrality (LDN) reports. In drylands, inorganic carbon — carbonates — is a separate and often larger pool, and is not what this work measures.

Carbon Stocks: the One LDN Indicator That Cannot Be Seen from Above

❗ The Challenge

- 🕒 High cost and long wait times for conventional soil analysis
- 🌐 Degradation stays invisible until yields fall — no baseline exists
- 🌱 Practices are chosen by intuition, not by soil evidence
- 📊 One-out-all-out: an unseen carbon loss still counts against LDN

What We Provide

CORE FUNCTIONS

- ✓ Auto-delineation of farm boundaries
- ✓ Digital soil mapping of SOC and soil chemistry
- ✓ Crop growth monitoring (NDVI analysis)
- ✓ Inundation Rate for irrigation management

ANALYSIS ITEMS

pH	CEC	CaO	MgO
Total Carbon	Total Nitrogen	Available N	
Boundaries	NDVI	Inundation Rate	

🔑 Key Benefits

FOR FARMERS

- ↑ Optimal fertilization (Cost Reduction)
- ↑ Stabilized yield & enhanced crop quality
- ↑ Data-driven water management

FOR LAND MANAGEMENT

- 🌱 Early warning where soil carbon is being lost
- 🌱 SOC: the agreed metric for carbon stocks — how SLM outcomes are verified

BIG DATA × AI

Solving food crises and climate change through the integration of satellite imagery, environmental data, and farm-level activity with AI algorithms.

01 / DATA INPUT

 **Satellite Data** **Climate Data** **Soil Data** **Farm Activity Data**

02 / CORE ENGINE

SAGRI AI

 **Farmland Delineation** **Soil Chemical Analysis** **GHG Calculation** **Water Detection**

03 / VALUE OUTPUT


**Ensuring Sustainable
Agriculture**
**Creating Decarbonization
Value**

Measure — Digital Soil Mapping with an Optimized Sampling Design

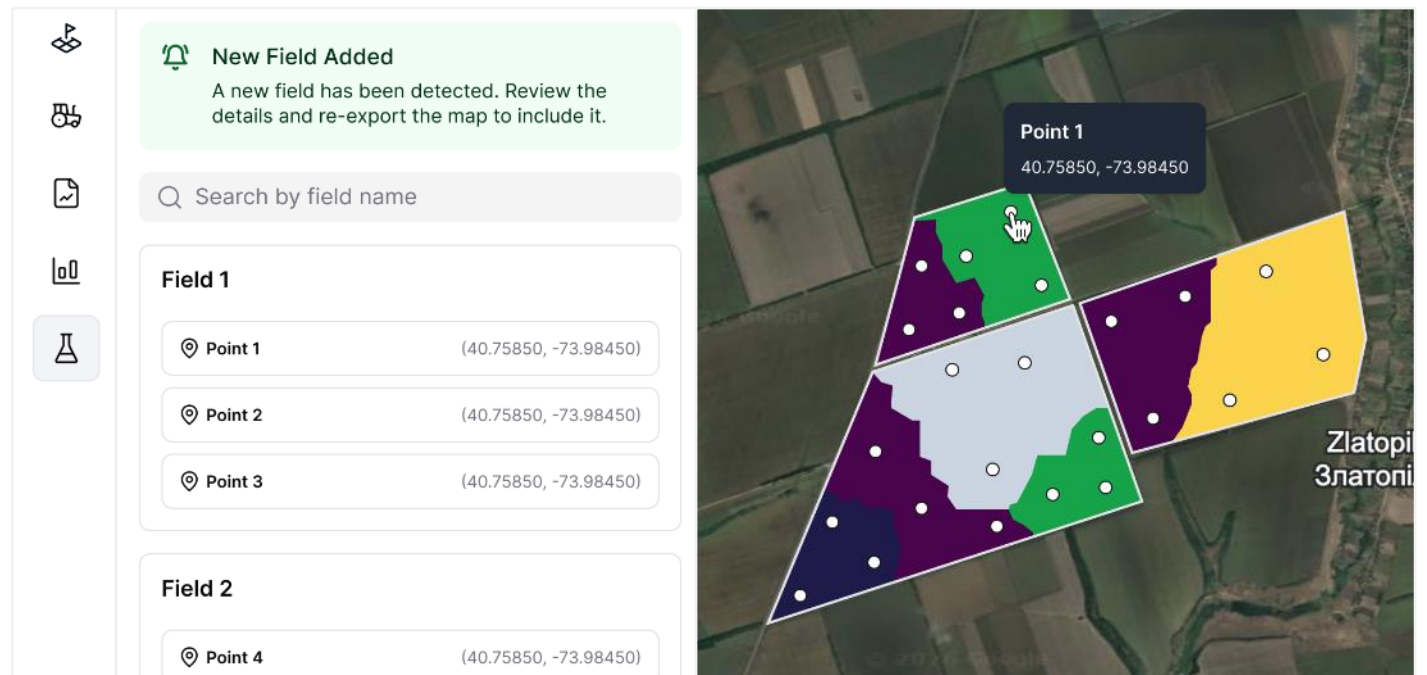
What Can Be Done

- 01/**Digital integrated management
- 02/**Optimal sampling point selection
- 03/**Visualization of SOC across wide areas

Key Benefits

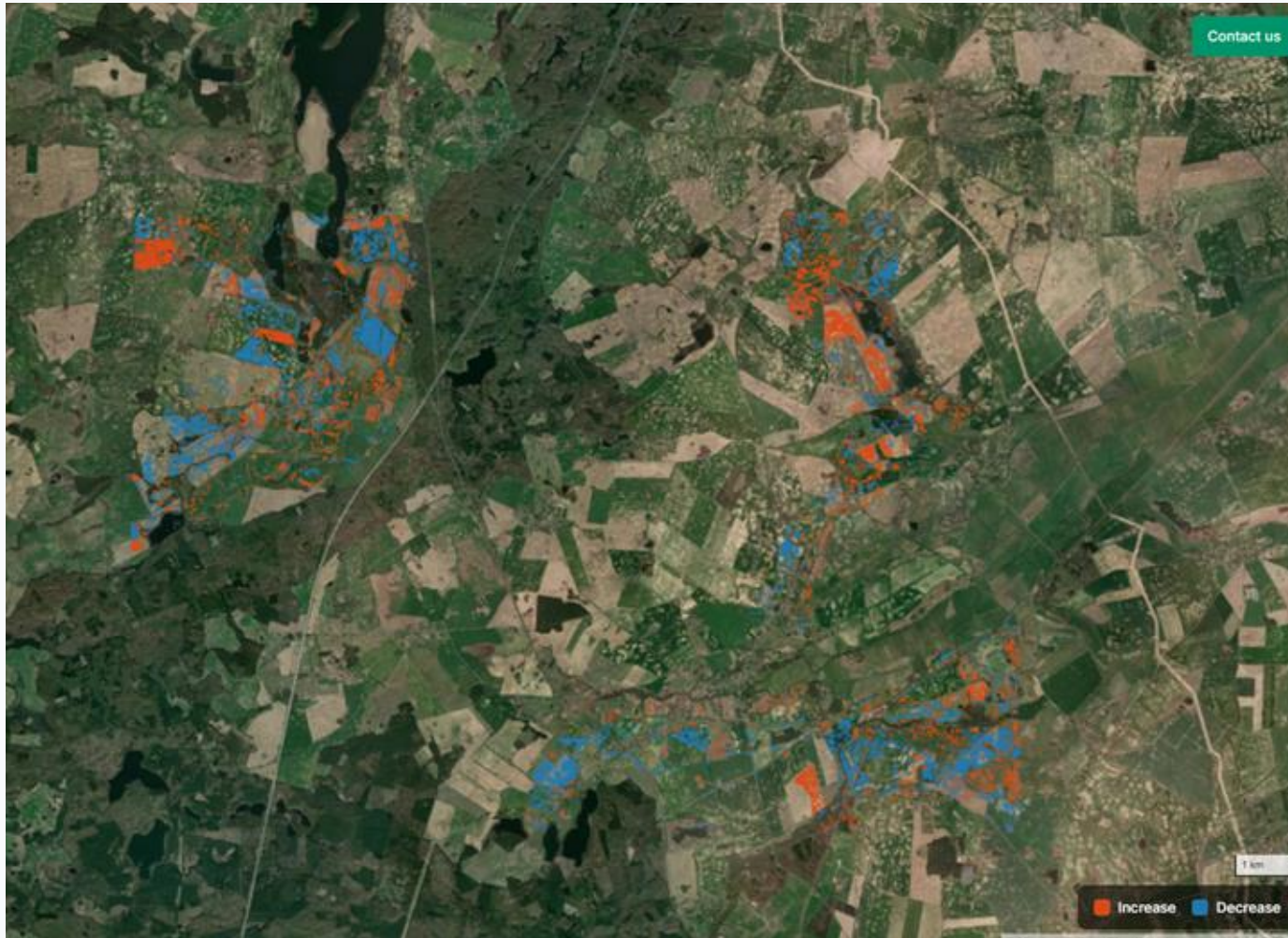
- 01/**Reduction in human resources and analysis costs
- 02/**Objective effect measurement of Regen Ag using SOC as an indicator

The platform chooses the sampling points



Detect

- Where soil carbon is gaining, and where it is being lost -

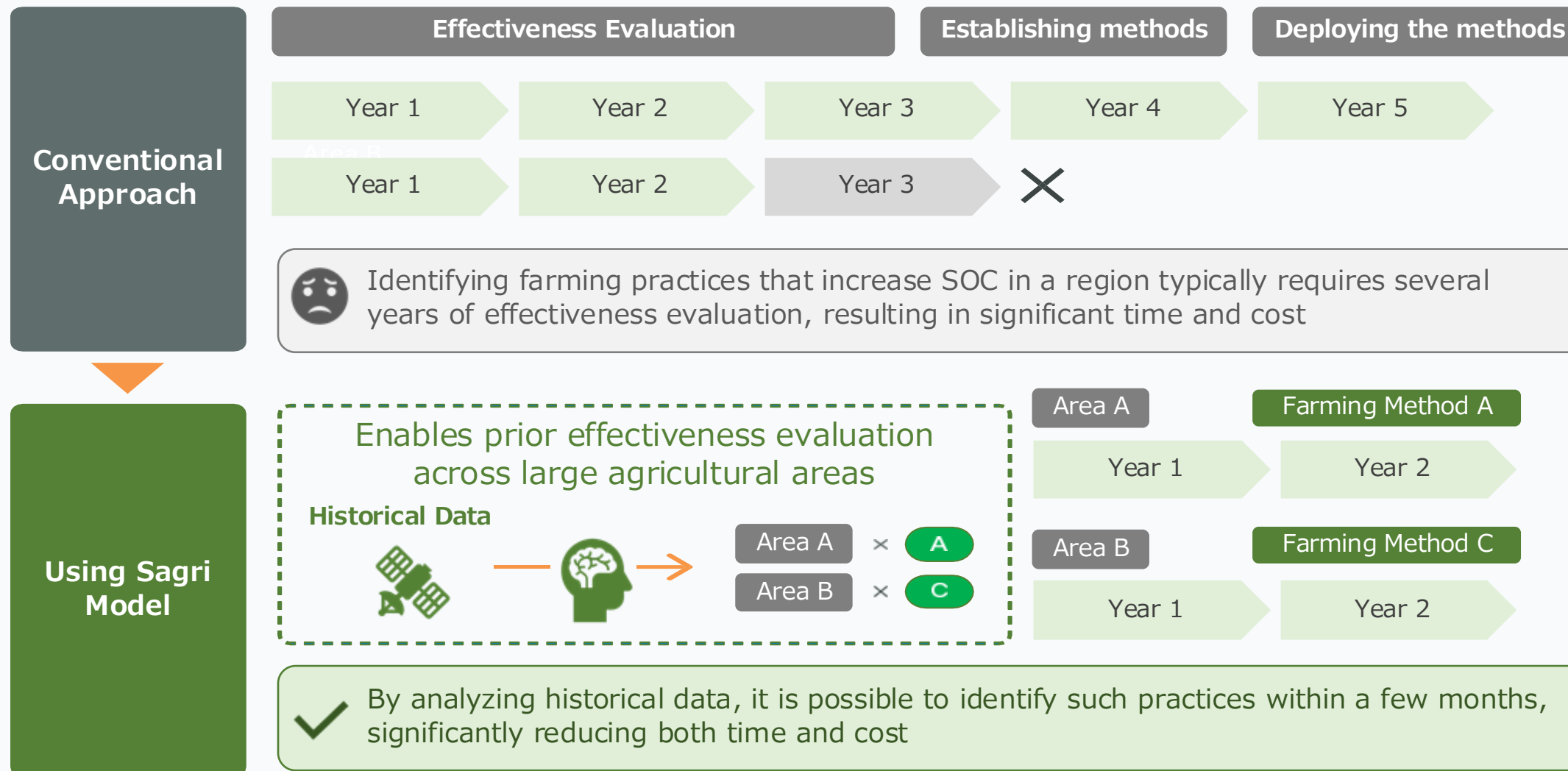


SOC Trend Detection

- ✓ Challenge: Developing local carbon farming methods is slow and costly.
- ✓ Solution: Satellite-based mapping of SOC trends with statistical analysis to spot increasing areas.
- ✓ Benefits: Faster adoption of proven practices, higher farmer motivation, and credibility.
- ✓ Land Degradation: Early detection of SOC loss, before yields fall.
- ✓ Where It Matters Most: Large landscapes with scarce ground data — Sahel drylands and Mongolian rangeland.

Learn — Which Practice Works, Faster

Five years of field trials, or a few months of satellite analysis



Forecast — Future SOC of Planned Farming

Methods

1 Advanced forecasting for future insights

2 Flexible area design tailored to diverse needs

3 Highly accurate business evaluation driven by data

Selection of Regenerative Farming Methods

☒ Cover crops

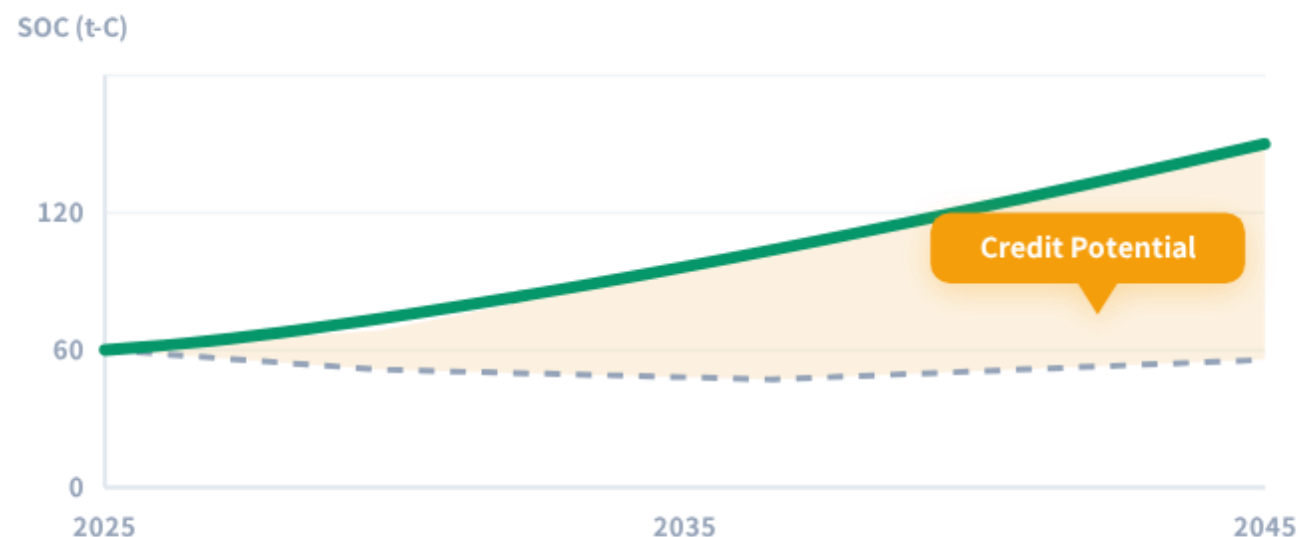
☒ Crop residue management

☐ Farmyard manure increase

☐ Reduced Tillage

Future SOC stock simulation

— Practice Implemented — Business as usual



A Second Indicator — Land Cover

- AI polygon -



Farmland Area Statistics

- ✓ Challenge: Many regions lack updated, digitized farmland data, making large-scale, objective monitoring difficult.
- ✓ Solution: AI Polygon technology for automatic farmland mapping, area quantification, and change monitoring using satellite imagery.
- ✓ Benefits: Reducing the cost and time required for statistical research.
- ✓ LDN Reporting: Farmland area and its change — an input to the land-cover indicator.

Our Solutions

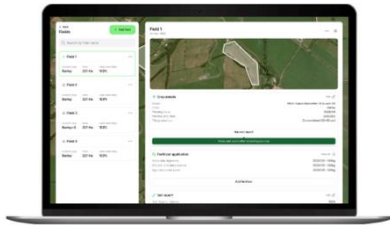


Empowering sustainable agriculture through big data and AI driven insights

Regenerative Agriculture

- SOC Measurement and Evaluation
- Comprehensive Digital Support tool
- Carbon Credits Program

SagriVision



Farmland Analysis Powered by Satellite data x AI

- pH Levels
- CEC
- Total Carbon
- Total Nitrogen
- Available Nitrogen
- Calcium Oxide
- Magnesium Oxide
- Inundation Rate
- Farmland Boundary
- NDVI (Vegetation Index)

AgriInsight Map

Explanation of Analytical Parameters and Advanced Analytical Case Studies

<https://agri-insight.sagri.io/en>

What It Takes to Scale SLM from Pilot to National Programme

❗ Barriers

- 🕒 Ground-truth soil data is scarce in most regions
- 🌐 Soil carbon methodologies are still being finalised
- 🌱 Farmers cannot carry measurement costs alone
- 📄 Qualified independent model reviewers are very few

What We Are Doing

OUR ACTIONS

- ✓ Scaling satellite MRV under the MAFF SBIR programme
- ✓ Verra VM0042 project in Vietnam
- ✓ Publishing in peer-reviewed journals

🔗 What Would Help

GOVERNMENT & BUYERS

- ↑ Reference soil datasets opened for calibration
- ↑ Outcome-based procurement
- ↑ Bridge finance for the first monitoring cycle

ACADEMIA & INTERNATIONAL

- 📖 More independent model reviewers
- 📖 Harmonised SOC accounting across standards

Thank You.



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SAGRIVISION

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AGRI-INSIGHT MAP

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