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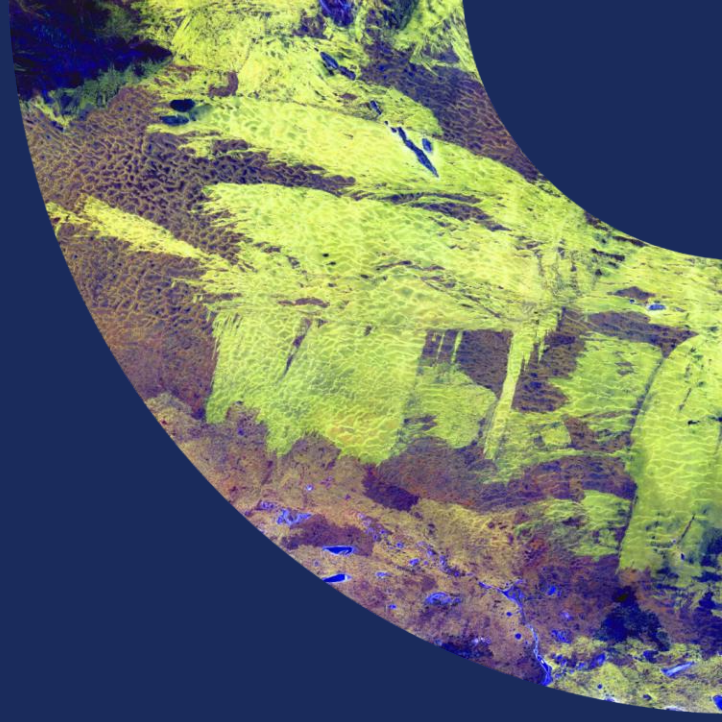

Leveraging Remote Sensing to Scale Regenerative Agriculture

HARVEST

In partnership with NASA Harvest

This report examines the collaboration between NASA Harvest and Agmatix, focusing on leveraging advanced remote sensing technologies to foster regenerative agricultural practices. These efforts aim to optimize crop yields, enhance soil health, and scale sustainable agriculture.

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01 Introduction

Global agriculture is facing a formidable challenge: by 2050, the world population is projected to reach 9.7 billion, requiring a 56% increase in food production to meet growing demand. Compounding this, the agricultural sector is responsible for 26% of global greenhouse gas emissions, making it crucial to implement sustainable practices that reduce environmental impact. This creates a dual necessity for both increased production and environmental conservation.

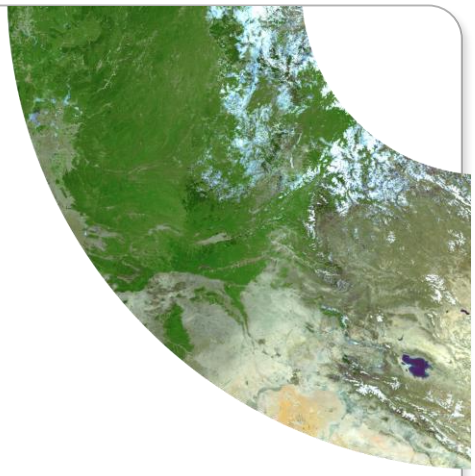
The adoption of regenerative agriculture - a practice focused on improving soil health, enhancing biodiversity, and improving ecosystems - can address these challenges. While the principles of regenerative agriculture are increasingly recognized, the scaling and monitoring of these practices on a global level are limited by the lack of large-scale, accurate data collection.

This is where remote sensing technologies come in. Agmatix's platform enhances data collection and analysis by integrating remote sensing with on-the-ground validation from agronomists. This approach streamlines monitoring while supporting education and decision-making.

By combining satellite data with ground truth observations, stakeholders gain a full picture of regenerative practices' impact. This enables continuous refinement of growing approaches to improve both crop yields and environmental outcomes.

02 What is Remote Sensing?

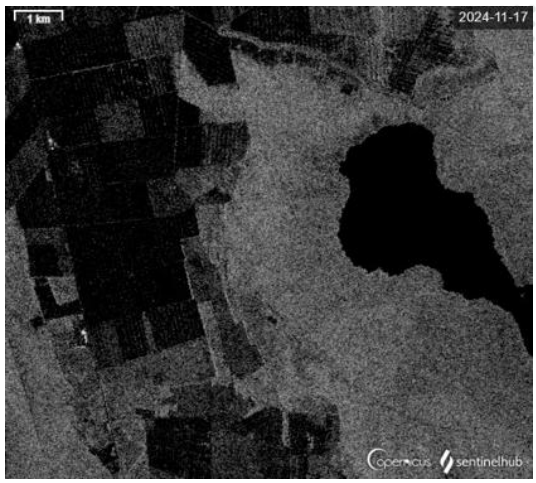
Remote sensing refers to recording the reflected or emitted energy from objects. This is typically done through satellites or drones. By analyzing the reflected energy spatially, temporarily, and spectrally, this technology allows for the monitoring of various environmental and agricultural factors, such as crop health, soil properties, and land use, without the need for physical presence. Several types of data gathered through remote sensing include :



- **Optical Imaging:** Captures visible and near-infrared light to assess vegetation health, detect land-use changes, and much more.
- **Radar Imaging:** Uses radar waves to create topographical maps, assess crop heights, and monitor fields even in cloudy conditions.
- **Thermal Imaging:** Measures soil moisture and irrigation efficiency by detecting temperature changes in the land and crops.

These forms of data are critical for precision agriculture, where growers need real-time, accurate information to manage their land and crops efficiently.

Optical Imagery



Radar Imagery

Thermal Imagery

03 Bridging the Data Gap

Historically, agricultural data collection relied on manual sampling, surveys, and periodic field inspections, and other conventional methods which were time-consuming, costly, and limited in scope.

Remote sensing fills this gap by providing expansive, real-time data over large areas, enhancing the ability to monitor crops, predict yields, and optimize resource use.

NASA Harvest plays a pivotal role in this space by applying Earth observation data to support global food supply and agricultural productivity. In this collaboration, Agmatix contributes extensive agronomic data and digital collection insights, while NASA Harvest provides the remote sensing expertise to interpret and enhance the data's utility. This synergy enables a comprehensive approach to monitoring agricultural systems and managing resources effectively.

"Through satellite monitoring, NASA Harvest provides actionable insights that guide better decision-making, from drought assessments in to water management initiatives. This global impact is enhanced by partnerships like the one with Agmatix, which integrates satellite data with on-ground information to validate and refine models for more precise agricultural insights".

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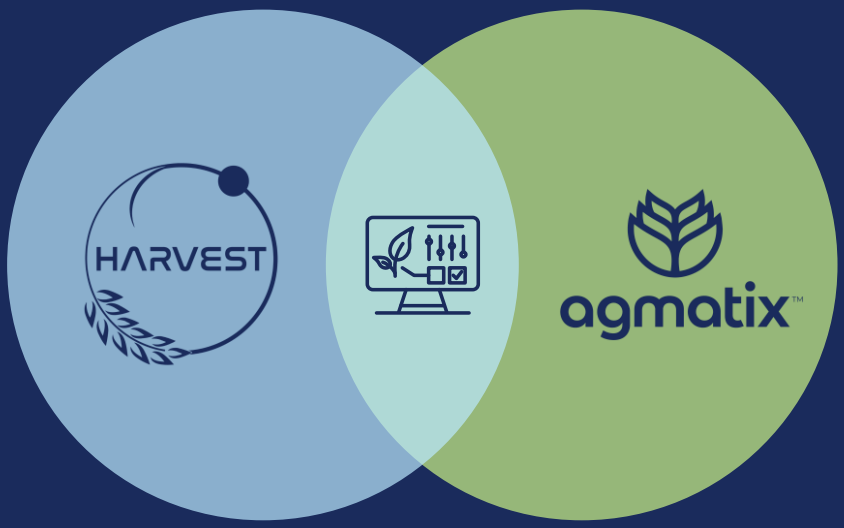
04 Agmatix & NASA Harvest

Agmatix, a leader in the agronomy data space, leverages its specialized data analytics platform, RegenIQ, to streamline data collection processes. The companies' comprehensive, precise agricultural data when combined with NASA Harvest's significant research expertise establish a robust framework for understanding and advancing regenerative agricultural practices on a global scale.

This collaborative effort focuses primarily on monitoring regenerative practices and measuring their outcomes at a large scale, especially within the food and beverage sectors. By pairing NASA Harvest's remote sensing capabilities with Agmatix's agronomic data and digital data collection efforts alongside field validations by teams around the world, this collaboration ensures precise, actionable insights for global sustainability in agriculture.

In Collaboration to Collect and Monitor Regen Practices at Scale



Example Data Types

- Ground Cover
- Tillage Level
- Yield
- Residue Management
- Crop Rotation
- N Levels
- Soil Texture
- P Levels
- Shading Trees
- And more....

05 Practical Applications of Remote Sensing

Remote sensing is changing how we understand and manage agricultural systems by providing essential data from a global perspective. This technology is a key factor in helping agronomists monitor and recommend regen ag practices to the growers they partner with. Offering real-time, accurate insights into crop health, soil properties, environmental factors, water management, and more, remote sensing facilitates efficient resource management and yield optimization - all crucial for optimizing agricultural outputs while maintaining environmental health. Here's why it's important:

- **Monitoring Crop Health:** Satellite data, combined with ground-truth data, provides insights into crop stress, pest infestations, and nutrient deficiencies. For example, spectral data from satellites can detect changes in vegetation where the human eye can't, indicating areas that may need intervention.

- **Monitoring Farming Practices:** Remote sensing technologies help monitor regen ag practices such as reduced tillage. In addition to row crop practices remote sensing technologies also help monitor practices relevant to plantations, such as identifying and counting shading trees in coffee, estimating planting density, and phenological stages. By comparing satellite images over time, NASA Harvest can detect soil degradation, track improvements in carbon sequestration, and measure the effectiveness of regenerative farming methods.

- **Land Use and Crop Rotation Assessments:** Agmatix's platform uses data from satellites to assess the effectiveness of crop rotation strategies. For example, data from Copernicus EO satellites is used to map crop growth over time, identifying areas where rotation practices may need to be adjusted. This allows growers to prevent soil depletion and maximize productivity in the long term.

- **Plantation Crop Management:** In plantations like coffee and cocoa, remote sensing helps identify and count shade trees, estimating planting density, and tracking phenological stages, crucial for sustainable plantation management.

- **Water Management and Pest Control:** Remote sensing aids in monitoring irrigation efficiency, detecting temperature changes, and controlling pest infestations through timely data.

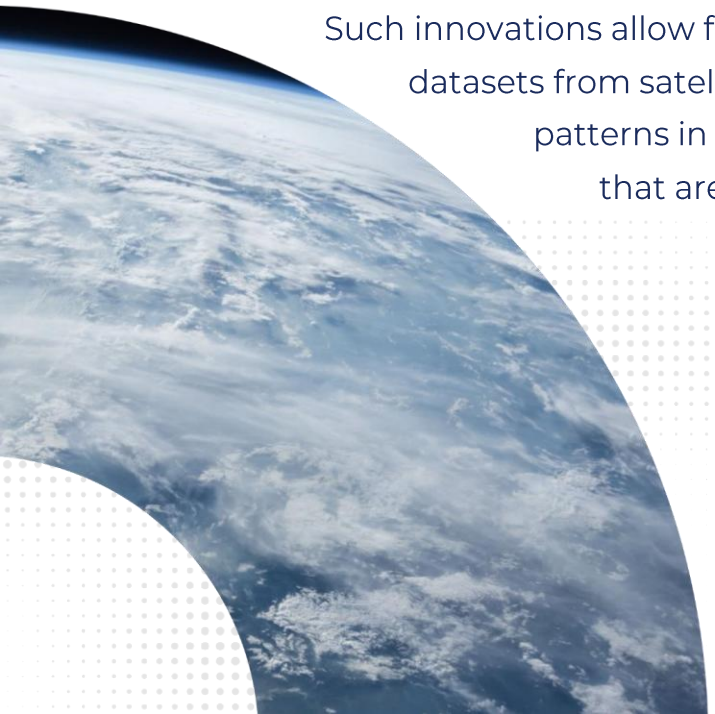
The Role of Ground-Truth Data in Scaling Regenerative Agriculture

While remote sensing provides a broad view of agricultural conditions, its accuracy is significantly enhanced by ground-truth data. Agmatix's platform allow growers to input real-time data on crop types, soil conditions, and yield estimates, which is then used to build and refine satellite-based models.

Ground-truthing is essential for improving model precision, ensuring that the insights provided by satellite data are accurate and relevant to specific field conditions. By combining satellite data with on-ground observations, NASA Harvest and Agmatix offer growers a full picture of their fields, enabling better resource allocation and more precise interventions.

Technological Innovations in Remote Sensing

One of the most exciting developments in this space is the integration of AI and machine learning into remote sensing technologies. These advancements are transforming the landscape of agricultural monitoring by substantially increasing the speed and accuracy of data processing.



Such innovations allow for deeper, more predictive analytics of vast datasets from satellites, enabling agronomists to detect subtle patterns in crop health, soil moisture, and climate variations that are critical for sustainable agriculture management.

06 RegenIQ: A Comprehensive Framework Combing Remote Sensing & Ground-Truth Data

RegenIQ is a specialized application in remote sensing, tailored for the agrifood sector. This framework plays a crucial role in monitoring and evaluating agricultural practices and their outcomes. It helps agrifood companies effectively meet both regulatory and sustainability goals.

By combing satellite data with precise ground-truth data, RegenIQ offers a robust platform for agronomists and agriculture professionals to implement and oversee sustainable practices with greater efficiency, accuracy, and compliance.

Both facilitating the mointoring of agricultural practices and tailoring recommendations, RegenIQ helps support the sustainable management of regenerative agriculture, adapting its approach to fit local conditions and maximize global impact.

Key Components of the RegenIQ Model

RegenIQ's high-level structure includes three components *(Figure 1)*:

Data collection of field and management indicators using remotely sensed data or field measurements.

An adaptive, cropping system-specific expert-based model for prioritization and normalization of indicators weight.

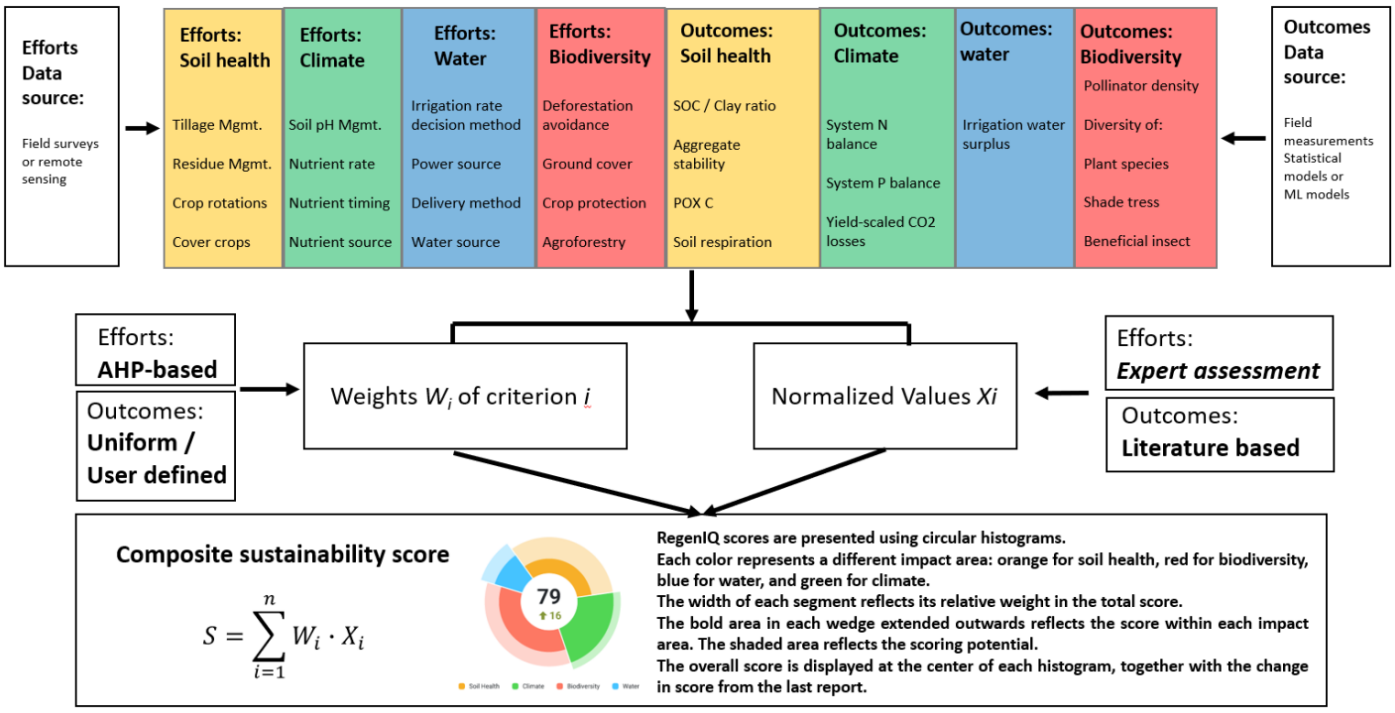
Weighted linear combination to assign a composite sustainability score.

RegenIQ scores are presented using circular histograms. Each color represents a different impact area:

WATER CLIMATE SOIL HEALTH BIODIVERSITY

The width of each segment reflects its relative weight in the total score—In the example presented in Figure 1 – the biodiversity impact area has the highest weight. The extent to which each wedge is extended outwards reflects the score within each impact area. In the example of Figure 1, the climate impact area has the highest score. The overall score is displayed at the center of each histogram, together with the change in score from the last report.

Figure 1



Future Perspectives: Regenerative Agriculture and Remote Sensing

As remote sensing technology continues to advance, its integration into sustainable agricultural management is becoming more prevalent. This tool is vital for delivering detailed analytics that enables agrifood companies and agronomists to effectively gauge the success of implemented sustainability strategies.

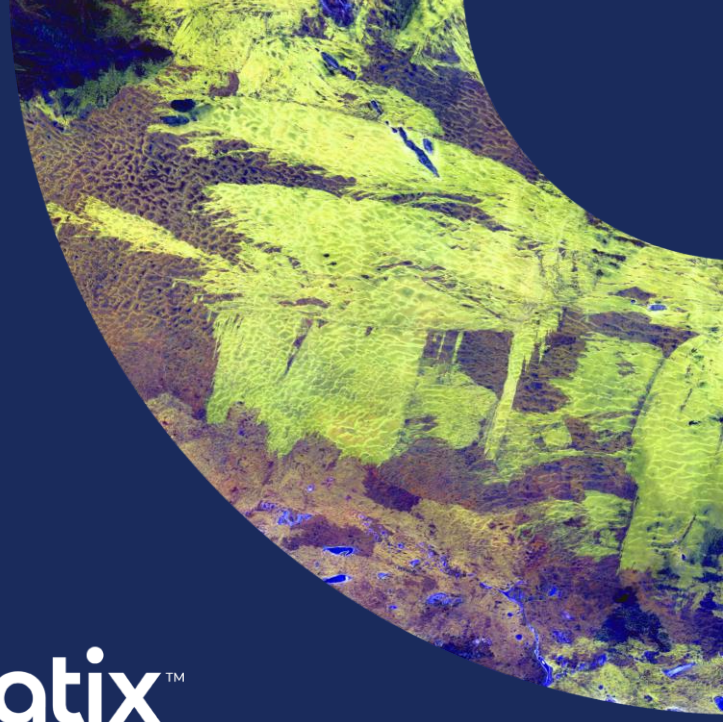
This technology offers a clear view of environmental impact and agricultural productivity. By providing accurate and timely data, remote sensing supports the optimization of resource use and supports the strategic application of sustainable practices. It also plays a crucial role in adjusting agricultural practices to better suit changing environmental conditions and regulatory requirements.

The evolution of this technology is key to building more resilient and sustainable agricultural systems, which are essential for meeting the challenges posed by a growing global population.

07 Conclusion

The collaboration between Agmatix and NASA Harvest marks a pivotal development in agricultural technology, combining remote sensing with ground-truth data to extend regenerative agriculture globally. This partnership supports sustainable growth and resource efficiency, crucial for future food security and environmental conservation.

As remote sensing technology evolves, it will continue to improve the management and monitoring of agricultural practices, supporting sustainable growth and resource efficiency. NASA Harvest and Agmatix are set to continue this partnership, aiming to inform agricultural policies worldwide and support the global community in achieving food security and ecological resilience.



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Contact us to explore how RegenIQ can support your sustainability goals.

Contact us →

agmatix.com

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