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# Satellite-based Soil-Carbon Monitoring

Implemented by the *Fund for the Promotion of Innovation in Agriculture (i4Ag)*
As part of the special initiative *Transformation of Agricultural and Food Systems*

## The Challenge

### Including smallholder farmers in the business of validating, protecting and up-building of soil carbon

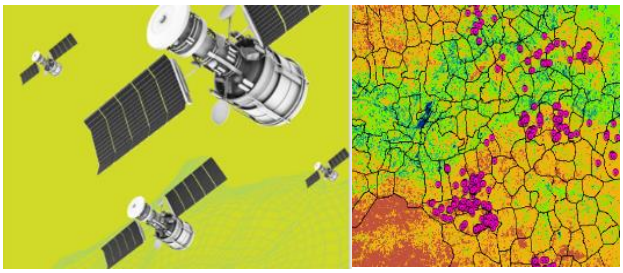
Climate change and soil degradation are two central global challenges. Every year, around 24 billion tons of fertile soil are lost; already, around 25 percent of the earth's surface is degraded. Small and medium-sized farms are severely affected by soil degradation and the effects of climate change. Global greenhouse gas emissions would have to be drastically reduced by 2030 in order to achieve the goal of international climate policy of limiting global warming to below 1.5 ° C.

At the same time, agricultural practices, such as the burning of crop residues or deep cultivation, exacerbate the release of greenhouse gases and the degradation of soils. Climate-friendly, soil-conserving cultivation methods such as minimal or no-plow tillage, the addition of mulch and organic fertilizers or the application of cover crops can help stop soil degradation and secure productivity in the long term. As these practices increase carbon sequestration in the soil, they directly contribute to lowering the concentration of carbon dioxide equivalents ($CO_2$ eq) in the atmosphere. Soil testing and Soil Organic Carbon monitoring has been an integral part of agriculture and climate adaptation-mitigation strategies. Over the last several decades agriculture has benefitted with new technologies and advancements in testing and monitoring methods. However, robust soil data collection, testing and field validations is complicated, expensive and time-consuming.

## The Innovation

### Economic and effortless capturing of soil organic carbon through satellite data and digital machine learning

To avoid expensive soil sampling, the improved soil carbon is measured via satellite data and innovative machine learning approaches. This will be used to remunerate farmers for soil protection. The generation and sale of carbon dioxide ($CO_2$) certificates for the voluntary carbon market is an example of existing incentive systems.



*Monitoring SOC using satellite-based machine learning platform*

## The Main Objective

### *Capture carbon stored in the soil using satellite-based monitoring approaches*

| | |
|---|---|
| Name of the Project | Satellite-based digital solutions for the valorisation of climate-friendly agriculture |
| Name of the Global Fund | Fund for the Promotion of Innovation in Agriculture (i4Ag) |
| Commissioned by | Federal Ministry for Economic Cooperation and Development (BMZ) |
| Project Region | India, Kenya |
| Implementing Partners | Agricultural Ecosystem Services Trading Initiative (aESTI), VAA-Impact, Spatialise, Earth Analytics India (EAI), Partners in Prosperity (PnP) |
| Duration | 10/2021 – 12/2023 |

*R.: India, Kenya*

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**15,000 tons** *less of $CO_2$ emissions measured*

**6,000** *smallholder farms and medium-sized enterprises the certification of soil carbon and carbon credits are prepared*

**1 digital control platform** *is available to automate the recording and administration of CO2eq savings*

**50% cost reduction** *of measuring soil carbon build-up per ha of agricultural land with the digital satellite-based method compared to established methods*

*The project contributes to the achievement of these Sustainable Development Goals (SDGs):*


*Satellite based soil moisture analys*

*Fieldworkers taking soil samples*

## Methodological Approach and Innovation Partnership

Through the development of an open-source satellite-based monitoring and evaluation system for soil organic carbon content on field level, this project aims to develop a digital control platform for automated processing and administration of $CO_2$ savings. After calibrating the satellite imagery and ground truth data into machine-deep learning algorithm, the developed algorithm will be applied over selected geographies of partners at the micro-, meso- and macro-levels to measure and understand changes in SOC in the field. This allows for the investigation into linkages to the carbon market. Monitoring the carbon sequestration of soil will help generate carbon credits which will not only offset carbon emissions but also provide an income for smallholder farmers.

## Important Activities

- Develop, implement, and scale remote sensing-based technologies to monitor the effectiveness of soil enriching strategies.
- Development of a control platform to automate certification and farm monitoring processes
- Initiate steps to verify the methodology of SOC monitoring via remote sensing technology with International Accrediting Agencies
- The project plans to link smallholder farmer aggregators (Farmer Producer Organisations (FPOs) and NGOs) with carbon project developers and certifiers to develop innovative solutions to reward regenerative practices that increase carbon sequestration in soil.

## Sustainability and Scaling Strategy

This initiative seeks to translate the learnings generated in the project into a product that can be offered to market participants, whether on a for-profit or non-for-profit business model. The sustainability of platforms developed during the project would be assured if the project were to reach its target of using the methodology to certify carbon offsets into soil. In this case, the methodology could be sold (as a product or as a service) to carbon project developers.

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On behalf of
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