

## Evidences

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### Study #3337

**Contributing Projects:**

- P1753 - Scaling soil-plant spectral technology for targeting and monitoring land restoration and agricultural intensification in Africa and Asia

**Part I: Public communications**

**Type:** OICR: Outcome Impact Case Report

**Status:** On-going

**Year:** 2019

**Title:** WLE/ICRAF soil spectral technology impacting soil restoration strategies and investments are being scaled up from Africa to global use

**Short outcome/impact statement:**

WLE/ICRAF's soil spectroscopy initiatives have moved from African outcomes to achieving global outcomes. Growing donor interest in deploying low-cost soil spectral technology in agricultural projects for better evidence-based investments is leading to major investments in India, Haiti, and elsewhere. WLE and the Food and Agriculture Organization-led Global Soil Laboratory Network are leading a new initiative to develop a free global soil mid-infrared spectral library and prediction service in collaboration with the Kellogg Soil Survey Laboratory in the United States.

### **Outcome story for communications use:**

Spectral technology is transforming soil restoration across Africa—and it's scaling globally

Soil-plant spectral technology has aided communities and countries in improving soil fertility restoration across 17 African countries. The results? Data and maps have supported smarter agricultural investments, restoring soils and boosting production, food security and livelihoods. And now, growing investments and support brings the technology to new countries around the globe.

Fostered by World Agroforestry (ICRAF) and the CGIAR Research Program on Water, Land and Ecosystems (WLE), soil spectroscopy is a light-based technology that makes it easy, fast and cheap to analyze large numbers of soil samples.

Soil degradation leads to substantial erosion and desertification, and slows food production. Smallholder incomes globally could grow by USD 35-40 billion by restoring just 12% of degraded agricultural land. Decision makers and governments across Africa had long worked to identify which preventive and restoration measures to implement, and where.

That's where this technology comes in. It quickly and cost effectively measures and maps soil and plant properties, also matching soil problems with solutions – methods unimaginable at scale using traditional soil testing technology. By 2018, smallholders were benefitting from soil- and plant-testing services through satellite-based data and mobile laboratories. WLE also collaborated with partners to design and test a new, cheap, hand-held infrared sensor.

Four African countries have since established national digital soil information systems through the Africa Soil Information Service (AfsIS). NGOs and the private sector also began delivering soil testing services to smallholder farmers.

And now, these initiatives are stretching to achieve global outcomes. Ethiopia, Ghana, Nigeria and Tanzania established national soil information systems using the technology and Rwanda has just started. Other national and state governments in Africa, Asia and elsewhere have requested support to target efforts for sustainable intensification and increased farm income, including Haiti, India and five additional African countries. Donor interest has grown with investment plans by the Bill & Melinda Gates Foundation, European Union, Islamic Development Bank, the Inter-American Development Bank, China Mountain Future Initiative, and GIZ.

Countries will also gain access to a global soil spectral library and prediction service, part of a WLE-led initiative of FAO's Global Soil Laboratory Network of the Global Soil Partnership, supported by the United States Department of Agriculture. In addition, WLE is harnessing a new high-resolution (30m) digital soil properties map of Africa, led by Innovative Solutions for Decision Agriculture (iSDA), to contribute soil property predictions.

**Links to any communications materials relating to this outcome:**

- <https://www.isda-africa.com>
- <https://tinyurl.com/ycrpahar>
- <https://www.flickr.com/photos/waterlandeco/46941268024/>
- <http://africasoils.net/>
- <https://tinyurl.com/yd8gxooob>
- <https://tinyurl.com/y9ntyb8f>
- <https://www.flickr.com/photos/waterlandeco/46941265824/>
- <https://www.flickr.com/photos/waterlandeco/46941268374/>
- <https://tinyurl.com/yvojgwmn>

**Part II: CGIAR system level reporting**

**Link to Common Results Reporting Indicator of Policies :** No

**Stage of maturity of change reported:** Stage 2

**Links to the Strategic Results Framework:**

Sub-IDs:

- Increased capacity of partner organizations, as evidenced by rate of investments in agricultural research

Is this OICR linked to some SRF 2022/2030 target?: No

Description of activity / study: NA

**Geographic scope:**

- Multi-national
- Global

Country(ies):

- Côte d'Ivoire
- Mali
- Mauritius
- Peru
- Rwanda
- Ethiopia
- Malawi
- Cameroon
- China
- Morocco
- Madagascar
- South Africa
- Mozambique
- United Kingdom of Great Britain and Northern Ireland
- Haiti
- Nigeria
- Tanzania, United Republic
- India
- Uganda
- Benin
- Kenya
- Ghana

Comments: This began as an Africa-focused program but has now gone global.

**Key Contributors:**

Contributing CRPs/Platforms:

- WLE - Water, Land and Ecosystems

Contributing Flagships:

- F1: Restoring Degraded Landscapes (RDL)

Contributing Regional programs: <Not Defined>

Contributing external partners:

- ISRIC - International Soil Reference and Information Centre
- Intellectual Ventures
- Rothamsted Research
- Si-Ware Systems
- FAO - Food and Agriculture Organization of the United Nations
- BMGF - Bill & Melinda Gates Foundation
- IISS - India Institute of Soil Science
- iSDA - Innovative Solutions for Decision Agriculture
- Luke - Natural Resources Institute Finland (Luonnonvarakeskus)
- Bruker Corporation
- USDA - U.S. Department of Agriculture

**CGIAR innovation(s) or findings that have resulted in this outcome or impact:**

Soil-plant spectral diagnostic protocols for rapid and low-cost analysis of soil properties and plant nutrients using only light (infrared, x-rays) (#1666)

**Innovations:**

- 1666 - Soil-plant spectral diagnostic protocols for rapid and low-cost analysis of soil properties and plant nutrients using only light (infrared, x-rays)

**Elaboration of Outcome/Impact Statement:**

WLE/ICRAF has supported work on soil spectroscopy since 2012. In 2018 we reported that WLE's support for scaling the technology in Africa was helping target soil fertility restoration strategies, restore soils and boost agricultural production in many African countries: 1) seventeen African countries using the technology; 2) four African countries established national digital soil information systems through the Africa Soil Information Service (AfSIS), and 3) NGOs and the private sector delivering soil testing services to smallholder farmers (1). The technology enables characterization and monitoring of soil health at scales and sampling densities unimaginable using traditional soil testing technology. This results in better evidence-based decision making and agricultural investments from farm to national scales.

In 2019, our soil spectroscopy initiatives started to achieve global outcomes. Donor interest in deploying soil spectral technology in agricultural projects has increased with new \$40 million investment plans by the Bill & Melinda Gates Foundation (9, 10), European Union (4), Islamic Development Bank (2), the Inter-American Development Bank (12), China Mountain Future Initiative (12), and GIZ (12). National and state governments have requested support for soil spectral technology to target efforts for sustainable intensification and increased farm income. These include the Haiti Government (12), the Indian Institute of Soil Science (IISS)(5), state governments of Andhra Pradesh and Bihar (12), as well as five additional African countries (2, 12).

WLE is leading a new initiative of the FAO-led Global Soil Laboratory Network (GLOSOLAN) of the Global Soil Partnership (GSP) (6). A significant development is the agreement to develop a global soil mid-infrared spectral library and prediction service (8). This will be based on the extensive soil spectral calibration library of the Kellogg Soil Survey Laboratory of the National Soil Survey Center of the Natural Resources Conservation Service of the United States Department of Agriculture (7). It will provide a free resource to all interested countries. In another strategic development, WLE is contributing soil property predictions from its extensive spectral libraries in support of a new 30-m resolution digital soil properties map of Africa, through Innovative Solutions for Digital Agriculture (iSDA)(9).

Finally, WLE has also contributed to the design and testing of a new handheld near infrared sensor, in partnership with Global Good of Intellectual Ventures and Si-Ware to produce the first low cost, full wavelength range (1300–2500 nm), open source device with capability for applications along the agricultural value chain (e.g., analysis of soils, plant nutrition, feed/fodder, organic manures, fertilizer quality, food product quality)(11).

**References cited:**

Evidence: journal articles, reports, emails, media coverage etc.

1. Water Land and Ecosystems Annual Report for 2018. OICR No. 2794.

<https://marlo.cgiar.org/projects/WLE/studySummary.do?studyID=2794&cycle=Reporting&year=2018>

2. IsDB Dakar workshop minutes. Approval email. Link below.

3.

<http://www.worldagroforestry.org/news/mountain-futures-2018-launches-major-new-centre-mountain-research>. (They have requested our support to help them establish a spectra lab at the center.)

4. Soils4Africa proposal. Approval email. Link below.

5. Minutes of India Institute of Soil Science meeting on soil spectroscopy, held 17 December 2019.

Link below.

6. First meeting of the Steering Committee on Spectroscopy.

<http://www.fao.org/global-soil-partnership/resources/events/detail/en/c/1245787/>

7. Soils Research Laboratory. <https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/research/>

8. A Global Soil Spectral Calibration and Prediction Service.

9. <https://www.isda-africa.com>. iSDA business plan.

10. Excellence in Agronomy workshop minutes. Link below.

11. New NIR sensor here:

<https://www.neospectra.com/si-ware-launches-small-lightweight-neospectra-scanner-for-in-field-material-analysis/>

12. Supporting materials are available here:

<https://www.dropbox.com/sh/f4nzwrw3kq8khrt/AABI9SE2YKyk5-4rEBr4vJmea?dl=0>

13. Letter from AgroCares, who have pioneered taking handheld spectroscopy into a commercial service in support of smallholders:

<https://cgiar.sharepoint.com/:f:/s/WLE/EjcXj91ArPhKvRskH6LxJCwBiVbD1eZIIbnF51IAZbqKg?e=kH05KN>

Promotional products: blogs, outreach materials (cannot be used as evidence but useful for promotion).

14. New Soil Intelligence System for India provides high-quality data using modern analytics.

<https://www.cimmyt.org/news/new-soil-intelligence-system-for-india-provides-high-quality-data-using-modern-analytics/>

15. Si-Ware launches small, lightweight NeoSpectra=Scanner for in-field material analysis.

<https://www.neospectra.com/si-ware-launches-small-lightweight-neospectra-scanner-for-in-field-material-analysis/>

16. Ethiopia is making maps to help improve soil health.

[https://theconversation.com/ethiopia-is-making-maps-to-help-improve-soil-health-123101?utm\\_medium=email&utm\\_campaign=Latest%20from%20The%20Conversation%20for%20December%204%202019%20-%201478514039&utm\\_content=Latest%20from%20The%20Conversation%20for%20December%204%202019%20-%201478514039+CID\\_cdca7c4dde951e1d1465d478cea7ed44&utm\\_source=campaign\\_monitor\\_africa&utm\\_term=Ethiopia%20is%20making%20maps%20to%20help%20improve%20soil%20health](https://theconversation.com/ethiopia-is-making-maps-to-help-improve-soil-health-123101?utm_medium=email&utm_campaign=Latest%20from%20The%20Conversation%20for%20December%204%202019%20-%201478514039&utm_content=Latest%20from%20The%20Conversation%20for%20December%204%202019%20-%201478514039+CID_cdca7c4dde951e1d1465d478cea7ed44&utm_source=campaign_monitor_africa&utm_term=Ethiopia%20is%20making%20maps%20to%20help%20improve%20soil%20health)

17. Investing in soil health is key to closing yield gaps.

<https://spore.cta.int/en/opinions/article/investing-in-soil-health-key-to-closing-the-yield-gaps-sid0347ad795-b36a-4254-a1e2-2c1576a0bd67>

18. How soil scientists can do a better job of making their research useful.

<https://theconversation.com/how-soil-scientists-can-do-a-better-job-of-making-their-research-useful>

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**Quantification:** <Not Defined>

**Gender, Youth, Capacity Development and Climate Change:**

**Gender relevance:** 0 - Not Targeted

**Youth relevance:** 0 - Not Targeted

**CapDev relevance:** 0 - Not Targeted

**Climate Change relevance:** 0 - Not Targeted

**Other cross-cutting dimensions:** NA

**Other cross-cutting dimensions description:** <Not Defined>

**Outcome Impact Case Report link:** [Study #3337](#)

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