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Scaling irrigation for sustainability and resilience of people and systems amid climate change

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INNOVATION LAB FOR SMALL SCALE IRRIGATION, 1st March 2023

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Scaling irrigation technologies **requires a good understanding of changes in water resource use and availability**

- Highland areas show a large spatio-temporal variation in water availability – complex targeting
- Changes in hydrological processes due to climate changes influence irrigation suitability
- Use of water accounting framework – availability and use to set expansion limits
- Models often provide a snapshot – need for dynamic system and include water quality as technologies go to scale

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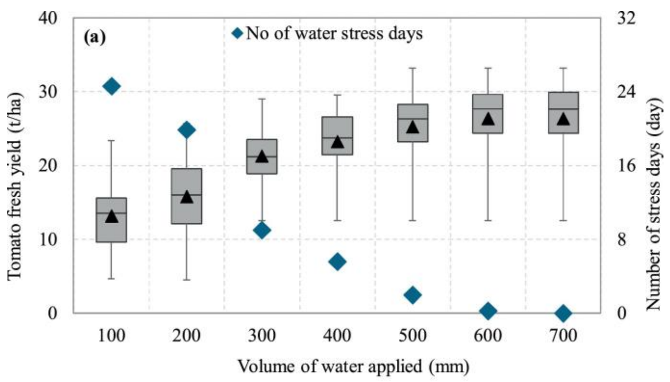
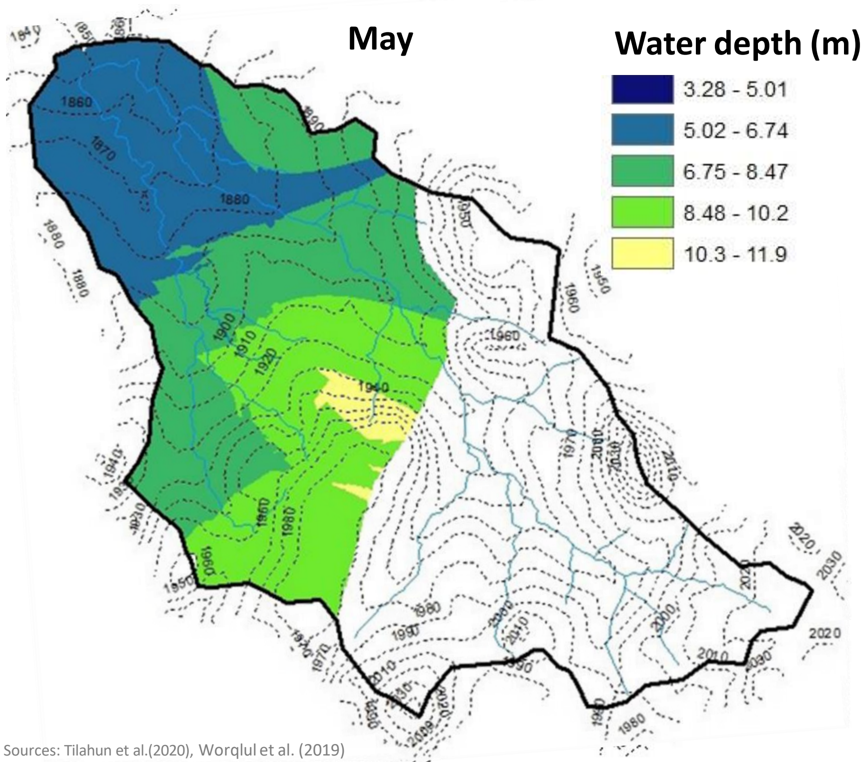
POTENTIAL TO SUPPORT SMALLHOLDER PRODUCTION …IS HIGHLY VARIABLE IN HIGHLAND AREAS

- 52% of the watershed contributes to the shallow aquifer
- Maximum storage 125 mm occurs near the end of rainy season
- High sub-surface flow rates in hillslope aquifers results in a 100-120 days cropping period before shallow wells "dry up" except near faults and valley bottom





Sources: Tilahun et al.(2020), Worqlul et al. (2019)

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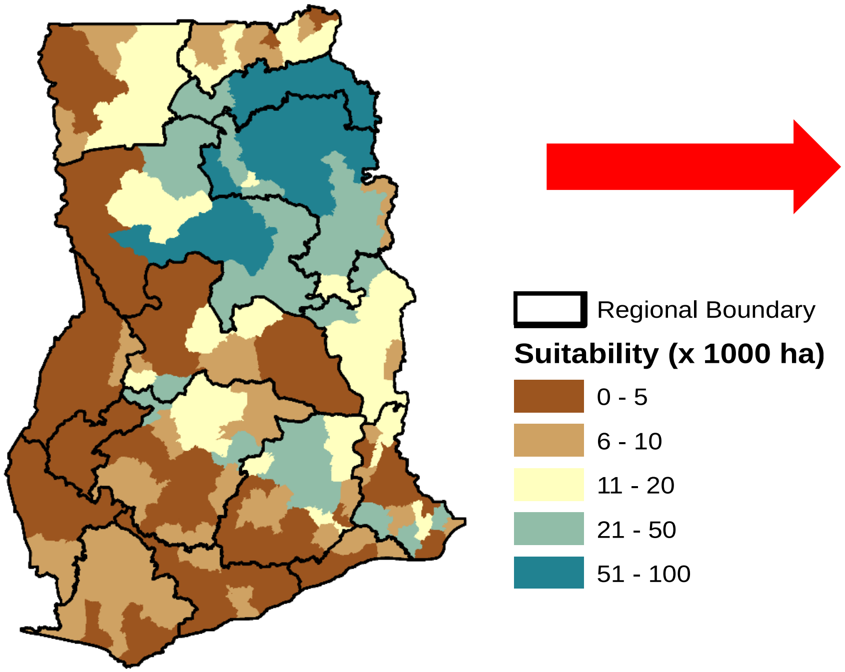
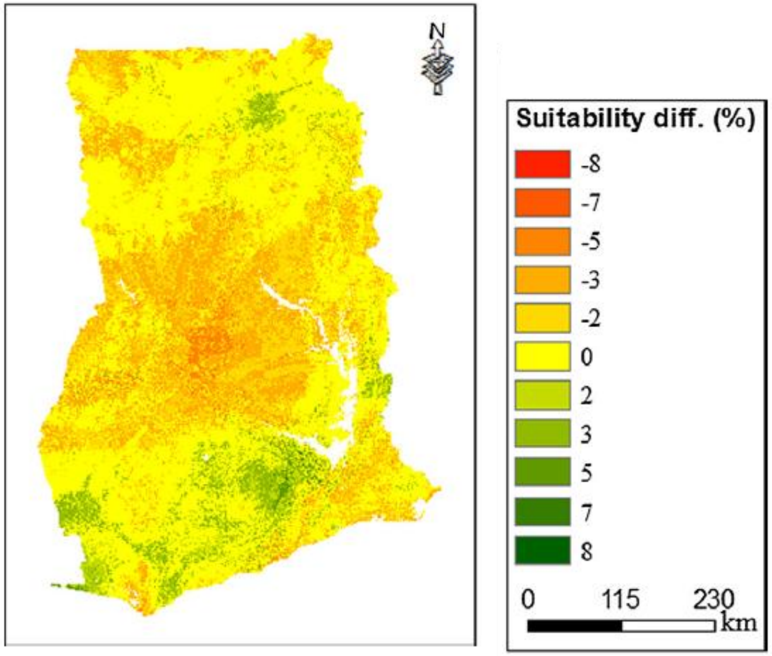
SUITABLE AREAS CHANGE DUE TO CLIMATE CHANGE

Irrigation suitability using shallow groundwater (25 m) & off-grid solar (2020)



Sources: Mansoor et al. (2019)

Suitability of irirgated land using shallow groundwater changes in 2050



Sources: Worqlul et al. (2019)

SETTING EXPANSION LIMITS IN FUNCTION OF RESOURCE AND TEMPORAL VARIATION

Wet season limit → 524,000 ha (SW)

Dry season limit → 270,000 ha (SW + GW)

Area suitable for small-scale solar irrigation (SSI)
The total area identified in **Sikasso** is 655,000 ha.

SSI water requirement
Total irrigation water required is about 600-920 mm/season.
(Average CWR of 350-550 mm/season, for major vegetable/cereal crops)

Area feasible for SSI
About 80% of the land identified suitable for solar irrigation could be irrigated using a crop with a low-to-medium water requirement

Surface water availability
Surface water can meet most crop water requirements during the wet season. Surface water yield of up to 800 mm is available during the wet season.

Groundwater availability
Areas identified as suitable for solar irrigation have medium to medium-high groundwater availability. In Sikasso, groundwater resources can support crops covering about 270,000 ha.

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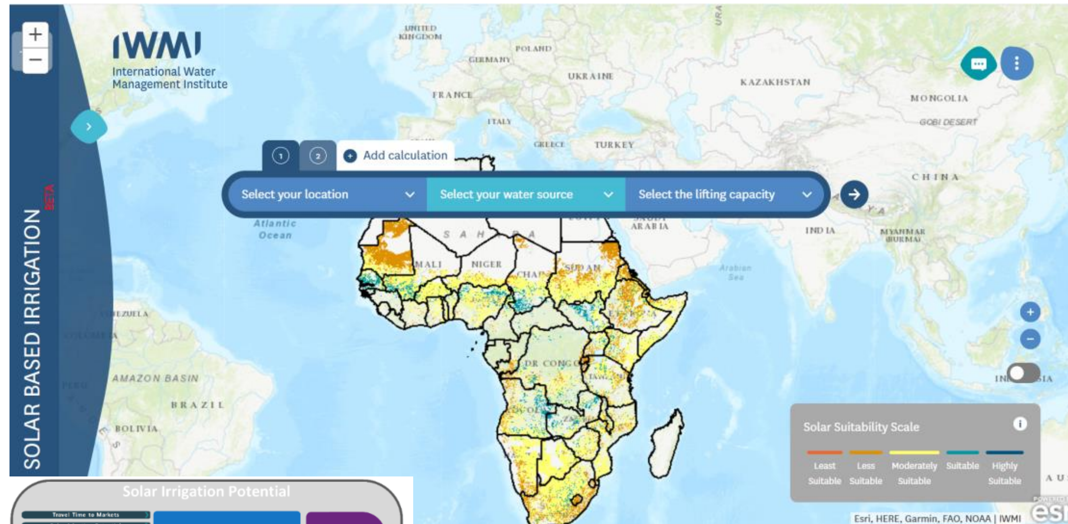
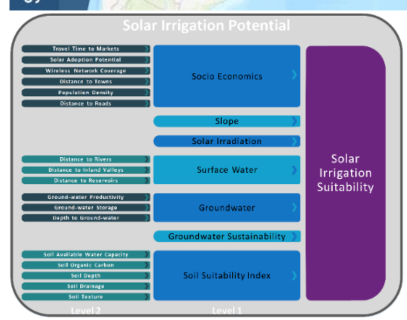
SOLAR IRRIGATION POTENTIAL

Online portal that serves as a decision support tool to guide investments and policy on sustainable solar based irrigation





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http://sip.africa.iwmi.org

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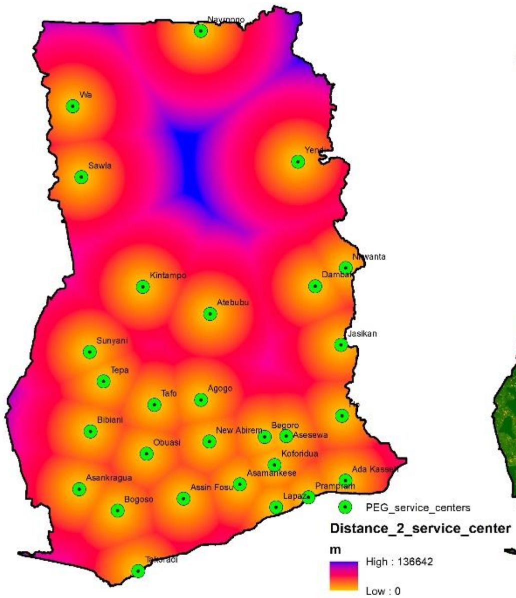
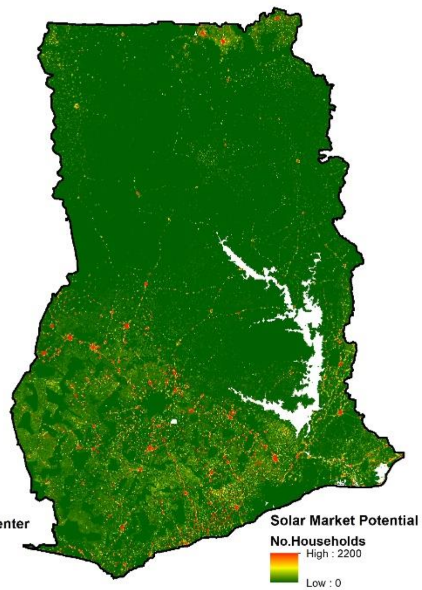
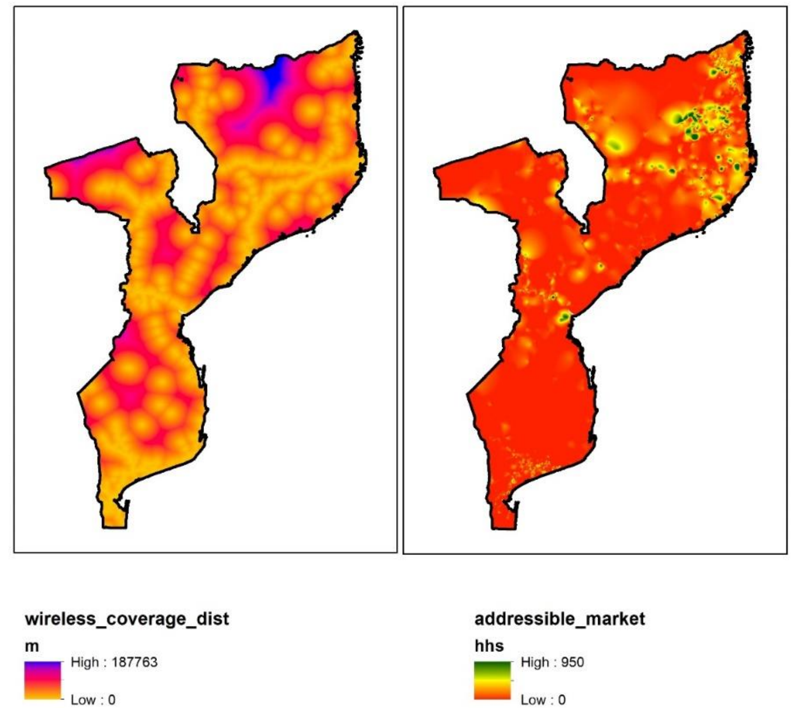
Sustainable scaling requires **private sector to identify market segments in water "rich" environments**

- Used a co-developmental approach with private sectors to identify drivers for niche markets
- Additional information incorporated on:
  - Solar market potential (land ownership, spending power)
  - Electricity grid and coverage
  - Distribution centers

TAILORING THROUGH PRIVATE SECTOR DATA







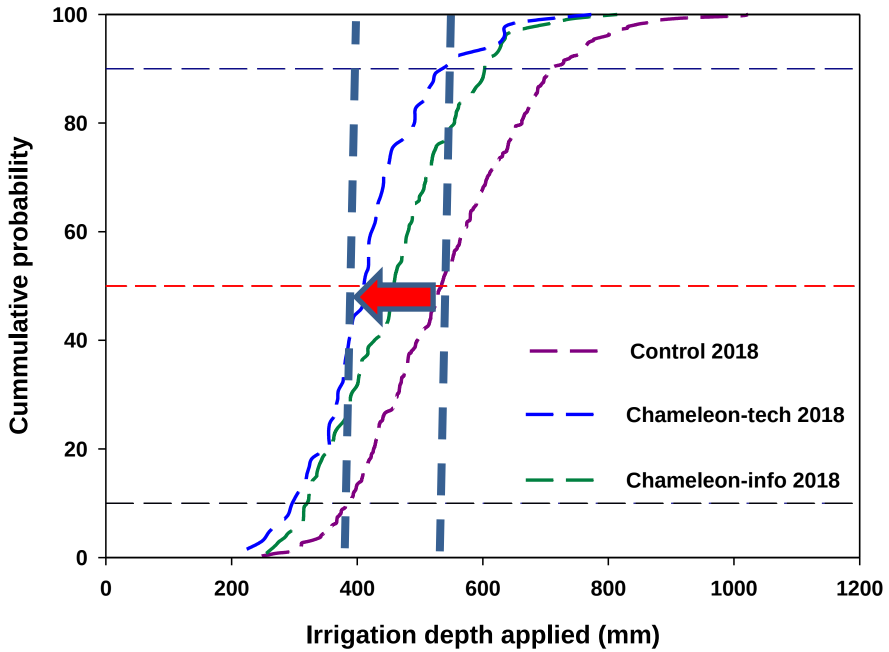
- Distance to Service center
- Solar Market Potential
    - Solar Pump Target profile
    - Agricultural land ownership
    - Spending Power
    - Rural/peri-urban residence

- Wireless Coverage
- Addressable Market (Total households that can afford SHS systems)
- calculated as unelectrified households multiplied by affordability percentage

Sustainable irrigation expansion should include enhancing on-farm water management

- Social learning tools such as wetting front detectors and chameleon sensors strengthen farmers knowledge in water application for vegetables and irrigated fodder
- Use of mobile thermal imaging and UAV to identify water stress

SOCIAL LEARNING TO CHANGE IRRIGATION BEHAVIOUR



Source: Schmitter et al. (2020)

Effects profit through **labor, fuel, yield**

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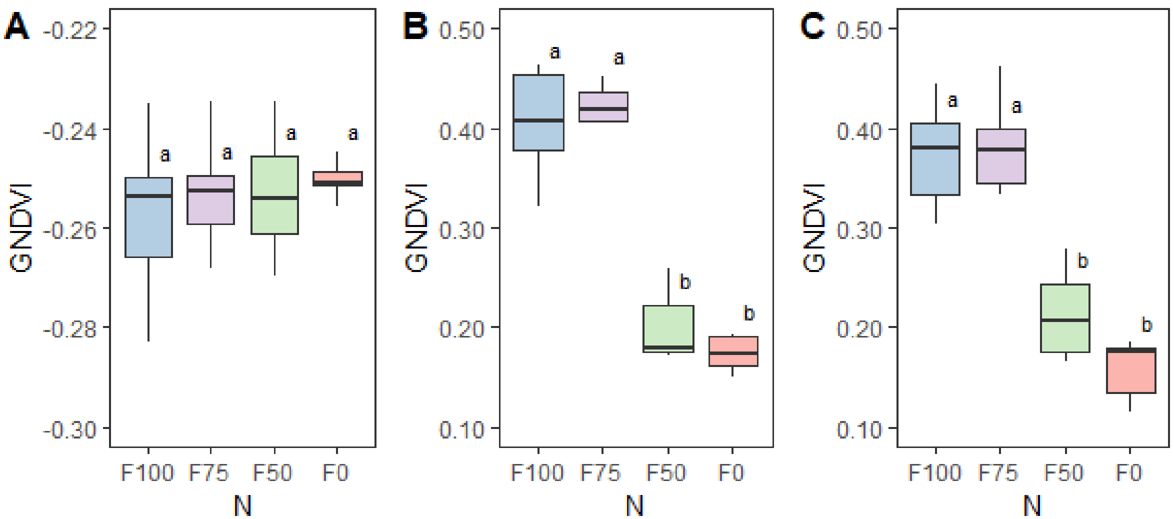
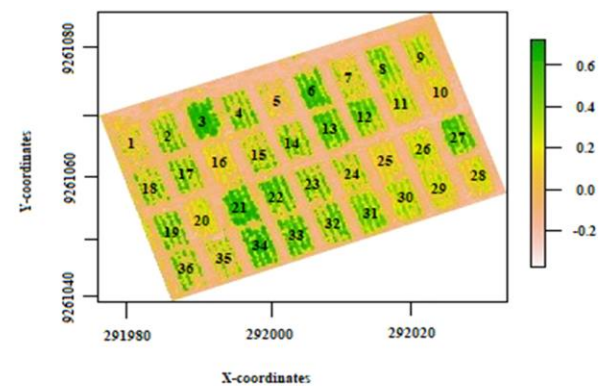
UAV BASED ASSESSMENTS ON WATER AND FERTILIZER USE EFFICIENCY





GNDVI for treatments irrigated with 80% crop water requirements at early (A), vegetative (B) and full vegetative (C) stages of crop development

Source: Reuben et al. (2022)

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Ensuring sustainable expansion requires:

- Identify spatio-temporal variability and suitability : dynamic expansion limits
- Identify addressable markets within expansion limits
- Support behavioral change through social learning

Thank you!