Remote Sensing for Community Driven Applications

Stakeholder Meeting Report
November 18, 2025

Teju Kumar N, Rashmi Krishnamurthy, Dr. Sashikumar N, Raviprakash M, Syamkrishnan P Aryan, Asha Farsana M, Selvamani Sampath, Shanthi Priya, Divyashree K, Sanjay Mallya, Lokappa Nayak, Ganesh Masnur

WATER AND DEVELOPMENT PARTNERSHIP PROGRAMME | IHE DELFT Institute for Water Education under the auspices of UNESCO | Advanced Centre for Integrated Water Resources Management | WELL LABS WATER · ENVIRONMENT · LAND · LIVELIHOODS

Published: February 2026

Authors and Contributors

ACIWRM: Teju Kumar N, Rashmi Krishnamurthy, Dr. Sashikumar N, Raviprakash M

WELL Labs: Syamkrishnan P Aryan, Asha Farsana M, Selvamani Sampath, Shanthi Priya, Divyashree K., Sanjay Mallya, Lokappa Nayak, Ganesh Masnur

Cover Image: Anupam Barman

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Technical Review: Dr. PS Somasekhar Rao, Ashima Chaudhary

Editorial Review: Apuurva Sridharan

Suggested Citation:

Teju Kumar, N., Krishnamurthy, R., Nagarajan, S., Raviprakash M., Aryan, S.P., Farsana M.A., Sampath, S., Shanthi Priya, Karkada, D., Mallya, S., Nayak, L., & Masnur, G. N. (2026). *Remote Sensing for Community Driven Applications: Stakeholder Meeting Report*. Water, Environment, Land and Livelihoods (WELL) Labs, and Advanced Centre for Integrated Water Resources Management (ACIWRM).

About RS4C

The Remote Sensing for Community-Driven Applications (RS4C) project aims to make water and land governance more just, equitable, and sustainable by enabling communities, water managers, and researchers to use reliable data by combining remote sensing, local measurements, and community knowledge. It addresses gaps in data accessibility, capacity, and integration by promoting transdisciplinary collaboration and co-developing data-driven tools that reflect real community needs. Through case studies in Kenya, Ethiopia, West Africa, and India, the project explores how combined data can help communities tackle challenges, such as pollution, invasive species, pastoral resource conflicts, and inequitable water use. Ultimately, RS4C seeks to strengthen community capacity, improve decision-making, and support inclusive water governance. The India case study of the RS4C project focuses on Krishna River basin in Karnataka, jointly implemented by ACIWRM, Government of Karnataka, and WELL Labs, and supported by IHE Delft Institute for Water Education (under UNESCO). These partners bring complementary strengths in RS science, data integration, participatory water governance, and field-based capacity building. Their combined expertise provides a strong foundation for developing RS applications that are technically robust while remaining deeply aligned with the social, geographical, and environmental context of the project area.

About WDPP & IHE Delft

The IHE Delft's Water and Development Partnership Programme, financed by the Dutch Ministry of Foreign Affairs, provided support to this project. The stakeholder meeting was conducted as part of the project. The programme envisions a world where inclusive and diverse partnerships and marginalised knowledge transform the ways we know, use, share, and care for water. To achieve this, the programme funds bold, creative, and transdisciplinary projects that combine research, education and capacity strengthening activities aimed at creating a peaceful, just, and sustainable world.

About ACIWRM

The Advanced Centre for Integrated Water Resources Management (ACIWRM) is the Government of Karnataka's knowledge and capacity-building hub for water governance. It supports departments and stakeholders through policy research, training, data-driven planning, and the promotion of integrated water resource management principles. ACIWRM plays a central role in strengthening participatory irrigation management and enhancing the state's water resilience.

About WELL Labs

WELL Labs is transforming water systems at scale across India through research, partnerships, and collective action. It takes on audacious challenges, tackling complex problems by designing comprehensive solutions that provide large social returns. WELL Labs' work is science-led and community-focused. It addresses the interconnections between water, environment, land, and livelihoods. To create impact at scale, it embeds solutions within governments, works with the private sector, and collaborates with civil society and active citizens. Based in Bengaluru, the organisation is a part of the Institute for Financial Management and Research (IFMR) Society.

Acknowledgments

We extend our sincere gratitude to the farmers, WUCS leaders, community representatives, government officials, researchers, and institutional partners who participated in the 'Remote Sensing for Community-Driven Applications' Stakeholder Meeting. Their insights, lived experiences, and openness to dialogue made it possible to collectively explore how remote sensing technologies can meaningfully support water, soil, crop, and climate decision-making in the Tungabhadra Left Bank Canal command area.

We also thank all stakeholders, including Karnataka Government water resource (KNNL, CADA) and agriculture departments, UAS Raichur and local community organisations for their collaboration, guidance, and active engagement throughout this process. Their commitment to strengthening evidence-based and community-led water governance has been central to shaping this initiative.

We gratefully acknowledge the efforts of team members from ACIWRM and WELL Labs in convening, facilitating, and co-designing this collaborative space, where diverse perspectives could come together as co-creators of actionable and context-sensitive solutions for the region.

This work is supported by IHE Delft Institute for Water Education (under the auspices of UNESCO) and funded by aid from the Government of the Netherlands as part of the RS4C initiative. The views expressed herein do not necessarily represent those of IHE Delft or the Government of the Netherlands.

List of Abbreviations

AWS	Automatic Weather Station
CADA	Command Area Development Authority
D95	Distributary-95
ET	Evapotranspiration
ETa	Actual Evapotranspiration
EVI	Enhanced Vegetation Index
KNNL	Karnataka Neeravari Nigama Ltd.
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
RS	Remote Sensing
RS4C	Remote Sensing for Community-Driven Applications
TLBC	Tungabhadra Left Bank Canal
UAS	University of Agriculture Sciences
WRD	Water Resources Department
WUCS	Water User Cooperative Societies

Stakeholder Meeting Report: Remote Sensing for Community-driven Applications

Date: November 18, 2025

Venue: University of Agriculture Sciences, Raichur

Organisers: ACIWRM and WELL Labs, in collaboration with IHE Delft

Introduction

The Remote Sensing for Community-Driven Applications (RS4C) is a project that aims to bridge the gap between advanced geospatial technologies and the lived experiences of farmers and water managers. Its broader objective is to use remote sensing (RS) data to enable more sustainable, equitable, and evidence-based water management, designed in close alignment with community priorities. On November 18, 2025, a stakeholder meeting on RS4C was held at the University of Agriculture Sciences, Raichur, Karnataka, to discuss how RS technologies can support better water, soil, crop, and climate-related decision-making in Raichur, particularly in the Tungabhadra Left Bank Canal (TLBC) Distributary-95 (D95) command area. The meeting convened key institutional partners, government departments, technical experts, Water User Cooperative Societies (WUCS) members, and community representatives.

Objectives of the Meeting

The stakeholder meeting was designed as a structured roadmap for the collaborative development of community-driven RS applications. The agenda followed a clear, logical sequence, from establishing the context of the region and the project to identifying, validating, and prioritising actionable use cases that address the challenges faced by farmers and other stakeholders. This progression ensured that all discussions remained grounded in field realities while progressing toward clear, outcome-oriented decisions.

The primary purpose of the meeting was to identify, validate, and prioritise feasible RS use cases across water, soil, crop, and climate dimensions through dialogue with institutional partners, WUCS representatives, and community actors. Discussions centred on the key challenges in the above-mentioned dimensions, and on the potential for RS-based insights to support more informed, equitable, and timely decision-making. By the end of the meeting, participants were able to build a shared understanding of viable RS opportunities, develop a prioritised list of use cases for piloting, and agree on the next steps for co-developing and demonstrating selected applications.

Inaugural Session

The meeting began with an inaugural session graced by key institutional representatives. Shri Teju Kumar N from ACIWRM set the context, emphasising the need to integrate scientific evidence with community-led water governance. Mr. M. S. Raviprakash, ACIWRM, welcomed participants and framed the relevance of the RS4C project and introduced the project partners. From UAS Raichur, Dr. A. G. Sreenivas, Dean (PGS), and Dr. M. S. Ayyanagowdar, Dean, College of Agricultural Engineering, highlighted the critical role of RS and farmer-centric research in addressing local agro-hydrological challenges. Mr. Syamkrishnan, WELL Labs, shared the project intent and collaboration vision. Officials from Command Area Development Authority (CADA) and the Irrigation Department also offered brief remarks, underscoring institutional support for the programme. The session opened with a symbolic plant-watering ceremony, establishing a shared commitment to sustainable and evidence-based water management. The agenda and expected outcomes were outlined, and participants introduced themselves.

Figures 1 and 2: Inaugural session

This was followed by a presentation on the potential of RS applications, after which the participants branched out into breakout groups to discuss and examine specific thematic challenges. Group presentations, insight synthesis, and forward-looking reflections concluded the meeting. This structure provided a coherent flow, enabling participants to develop a collective perspective on the critical issues and pathways for RS integration.

The Context

Designing effective, community-driven, technology-enabled solutions requires a clear understanding of the water–agriculture context, from the scale of the river basin to the specific irrigation distributary. This contextual foundation is central to achieving the project's objectives of co-developing interventions that are locally grounded, and of building the capacity of water managers, WUCS, and farmers to use RS-based insights for making land and water management decisions. Accordingly, this was presented to the participants in the meeting. The challenges the project seeks to address are presented across multiple spatial layers: basin, district, canal command, and village-level realities.

Basin-Level Stress: The Tungabhadra River Sub-basin

Tungabhadra is an important tributary of the Krishna river, and flows across Karnataka, Andhra Pradesh and Telangana. The Tungabhadra river sub-basin is chiefly influenced by southwest monsoon, receiving the majority of its water during this season. Covering nearly 30% of the state's geographical area, the sub-basin spans a catchment area of about 39,106 sq. km. Nevertheless, the sub-basin is under increasing hydrological stress, operating at high levels of utilisation; 50%–80% of available water is extracted for irrigation, domestic, and industrial uses. During dry years, utilisable outflows drop close to zero, undermining environmental flows and reducing downstream reliability. This sub-basin-wide scarcity frames the broader vulnerability of regions dependent on Tungabhadra water.

District-Level Paradox: Raichur's Untapped Potential

Raichur district presents a paradox of substantial irrigation infrastructure in contrast to limited irrigation outcomes. Despite the presence of the ~80-year-old TLBC system, one of the largest in the state, only 33% of the district's net sown area (1,557 sq. km of 4,750 sq. km) is irrigated. This sizable gap between infrastructure potential and actual water use reflects challenges in distribution efficiency, timing, field-level conveyance, and the sustained operability of canal networks.

Command-Level Complexity: Distributary 95

The project focuses specifically on D95 of the TLBC, which is managed by five WUCS (four active and one inactive), with a total of 1,112 members. Within this command, irrigation challenges are more complex than a simple head–tail divide. Analysis shows that around 55% of the command area experiences limited or uncertain canal water access, with patterns of scarcity and excess varying sharply even between neighbouring plots. These inequities stem from siltation, seepage, degraded field channels, inconsistent release schedules, and unplanned water withdrawals.

Field-Level Realities: Insights from ePRA, FGDs, and Data Analysis

Field insights from ePRA (electronic Participatory Rural Appraisals) exercises, focus group discussions, and RS-supported analysis, all presented to the participants, reveal a system marked by high variability in water access, soil health, crop stress, and climate vulnerability. Farmers reported recurring issues, such as salinity and waterlogging in head reaches; moisture deficits at the tail; and declining soil fertility, pest and disease outbreaks, erratic rainfall, and frequent input losses due to untimely weather events. Collectively, these factors reduce productivity and increase crop management risks (e.g. crop failures and pest attacks), highlighting the need for continuous monitoring, spatially disaggregated evidence, and decision-support tools that exceed the capabilities of traditional surveys and observational methods.

Together, this multi-layered problem context highlighted four major challenge areas that the RS4C project seeks to address:

1. **Water Management Challenges**
2. **Soil Health Issues**
3. **Crop Management Challenges**
4. **Erratic Rainfall and Extreme Weather Events**

These problem areas formed the basis for the RS use cases, breakout discussions, and pilot design priorities.

Potential of Remote Sensing

Based on literature review and secondary data gathered by the project team, some of the potential RS-based use cases and applications were presented to the participants.

The potential of RS in the TLBC command area lies in the ability of stakeholders to convert large volumes of satellite, drone, and sensor data into actionable insights for water managers, WUCS, farmers, and line departments. As presented in the meeting, RS operates through a clear value chain: raw data, such as rainfall estimates, vegetation indices, and soil moisture, are captured by satellite or drones, after which the data are converted into information layers, like water budgets, irrigated-area maps, soil-salinity hotspots, or crop-stress zones. These layers are then analysed to generate insights that directly support decision-making across the four major problem areas.

- For **water management**, RS enables monitoring of canal flows, identifying siltation or seepage, mapping irrigated and non-irrigated zones, and supporting equitable water scheduling through distributary-level water budgeting.
- For **soil health**, spectral signatures reveal salinity, soil moisture deficits, and nutrient stress. They also help prioritise sites for gypsum application, green manuring, or drainage interventions.
- In **crop management**, Normalized Difference Vegetation Index (NDVI) and drone-based multispectral imagery detect early signs of pest attack, moisture stress, or nutrient deficiency, allowing targeted action and reducing input losses.
- For **climate resilience**, RS-driven rainfall, cloud cover, and soil moisture products, combined with India Meteorological Department (IMD)/Krishi Vigyan Kendra (KVK) datasets, help anticipate dry spells, heavy rainfall, or disease-favourable humidity conditions, informing decisions on sowing, irrigation, spraying, and harvesting.

The flow charts (See annexure 3) demonstrate how these insights can empower multiple actors: help Karnataka Neeravari Nigama Ltd. (KNNL) and Water Resources Department (WRD) in release planning and canal operations; WUCS in water distribution and monitoring; Agriculture Department in advisories; farmers in on-field planning; and researchers in assessing water security and system performance.

Together, these opportunities underscore how RS can help solve long-standing challenges by providing a transparent, evidence-based foundation for more equitable and climate-resilient water and agricultural governance.

Breakout Sessions

The breakout sessions were designed to harness the collective expertise of all participants, from farmers and WUCS members to engineers, researchers, and government officials. The discussions focused on ground-truthing the technological possibilities and co-creating a practical path forward to achieve such possibilities. Participants were organised into four thematic groups: water management, soil health, crop management, and erratic rainfall and extreme weather events. Each group was provided with core questions to guide the discussion:

- What are the specific problems within the theme?
- How can RS help identify or map these issues?
- What are the possible solutions?
- What value can RS add?
- What challenges or limitations exist in adopting RS, and how might they be addressed to ensure practical and scalable application?

Water Management

Discussions in this group revealed that farmers experience highly unequal distribution of canal water, with major concerns around tail-end deficit and inadequate canal maintenance. Participants agreed that RS can help identify patterns of irrigation spread, detect structural weaknesses (i.e. breaches or vegetation growth), and support water allocation decisions by combining rainfall, soil moisture, and evapotranspiration (ET) data. They also discussed how RS could help systematically identify and monitor these problems across the command area. Suggested applications included developing canal command maps to distinguish between irrigated and non-irrigated zones; crop and cropping intensity maps to show where water is being used; and crop stress maps from multispectral drone imagery to detect water stress in the fields. Command-level water budgeting using RS–derived estimates of supply and crop water use, along with farm pond maps, rainfall forecasts, and soil moisture–based monitoring of water delivery, were identified as important tools to understand current inequities and inefficiencies. Furthermore, the group emphasised the need for a transparent evidence base to improve trust between water resource departments/engineers and WUCS.

The group proposed several solution directions that combine better water management with changes in cropping practices: cultivating crops according to canal design and water availability rather than simply growing paddy at the head end; using water more sparingly; cleaning drains; and improving and operating water control structures, such as gates, more efficiently. Participants also mentioned strategically combining rainwater and canal water, and ensuring payment of water-related taxes to support system maintenance.

Figure 3: Breakout discussion Group 1 - Water management challenges

Overall, in this group, RS was considered a key contributor to implementing and tracking these solutions. For instance, soil moisture maps, created with the help of RS, can support water delivery monitoring by showing where and when fields actually receive water. Similarly, RS-based estimates of crop water requirements at the distributary level can inform irrigation planning. Crop maps can help support water cess or tax calculations, and farm pond and surface water maps can show local water availability, especially in head versus tail reaches. Additionally, high-resolution drone maps can be used for last-mile infrastructure assessment. Finally, vegetation indices for crop-wise water productivity, combined with rainfall forecasts, can guide more efficient and equitable water allocation across the canal command.

Soil Health

The soil health group identified a range of degradation problems, including rising salinity, waterlogging near head reaches, overuse of fertilisers in hybrid cotton and jowar, low organic matter, erosion due to faulty bunding, and a lack of mulching practices, such as green manure. Farmers reported difficulty in distinguishing saline from sodic and waterlogged soils.

Accordingly, a set of solutions combining technical measures with changes in agronomic practice and farmer capacity building, was proposed. Furthermore, gypsum application was suggested for sodic soils and installing underground drain pipes was recommended for addressing chronic waterlogging. Farmers expressed willingness to pilot the use of green manure. The group agreed that community-level adoption of mixed cropping and crop rotation, along with moisture conservation techniques and targeted farmer training programmes, would be essential to restore soil health and improve resilience in the command area.

Figure 4: Breakout discussion Group 2 - Soil health related problems

Community participants recognised the role of RS in making these largely invisible soil problems, visible and actionable. To translate RS insights into field decisions, they stressed on the need to build farmer capacity to interpret nutrient and soil maps. RS-based severity maps for salinity, sodicity, and waterlogging, combined with soil moisture anomaly layers and crop maps, can help determine where gypsum application, drainage infrastructure, and soil conservation structures are needed. These maps can be used in farmer training to help participants practice reading colour codes; in linking mapped zones to field conditions; and in jointly planning location-specific soil health interventions.

Crop Management

The crop management group highlighted issues such as labour shortages during peak harvest, recurrent weed growth, nutrient deficiencies, pest attacks (especially in cotton), and declining soil fertility.

To overcome these, farmers follow various methods. For instance, crop diseases are managed through better fertilisers, bio-fortification, and other management inputs; pest control strategies are implemented through the use of sticky traps, solar traps, neem oil, and broader integrated pest management methods; and soil fertility is supported through compost application and crop rotation. However, to sustain yields under increasing stress, participants recognised the need for these measures to be scaled and planned better.

Remote sensing was acknowledged as a tool for the early detection of crop stress through NDVI/Enhanced Vegetation Index (EVI) trends, enabling farmers to intervene before problems escalate. Drone-based crop maps, stress profiles, and app-based advisories were seen as pathways for supplementing traditional observation methods. The Normalized Difference Water Index (NDWI) was highlighted for identifying water-logged areas and for assessing whether crop damage was caused by flood conditions resulting from unprecedented rainfall. However, the group noted that adoption requires simple interfaces, low-cost solutions, and farmer training, as several farmers believed technology might increase expenses without guaranteed returns. Indeed, some small farmers voiced concerns that many crop issues are already visible to the naked eye, and technology adoption would only increase their costs.

Overall, the discussion revealed that farmers are positive about using digital tools, but would need training and capacity-building to use these apps and interpret RS-derived information. It highlighted that RS and app-based solutions must be affordable, accessible, and paired with hands-on training at the farmer level to translate technical capabilities into practical, low-risk decision support.

Figure 5: Breakout discussion Group 3 - Crop management challenges

Erratic Rainfall and Extreme Weather

Farmers in this group described how increasing variability in monsoon onset, intensity, and distribution is disrupting all stages of crop management. While land preparation, sowing, fertiliser application, and irrigation are usually timed to expected rains, delayed onset, early showers, and unpredictable spells lead to wasted inputs, lodged crops, pest and disease outbreaks, and harvest losses when produce in the field is exposed to sudden rain or strong winds.

Experts and participants discussed how RS and weather-based systems can mitigate these risks, making them more predictable and manageable. Automatic weather stations, rain gauges, IMD/KVK datasets, and satellite-derived products for rainfall, soil moisture, cloud cover, and temperature provide continuous tracking of wet and dry spells, while mobile apps and messaging-based alerts give advance warnings of heavy rain, strong winds, or anomalous conditions. This information enables farmers to better schedule sowing, weeding, spraying, and harvesting around high-risk periods.

The group identified a set of practical adaptation strategies, closely linked to these information tools. Farmers and experts suggested adjusting field operations based on weather advisories, ploughing and following other moisture conservation measures during dry spells, and changing crops or varieties to more drought-tolerant or climate-resilient options, depending on early or delayed monsoon onset. Using prior information from IMD and KVK to plan sowing dates, irrigation, and plant protection was considered essential for reducing losses and making more efficient use of limited water resources.

Remote sensing was recognised as a backbone for supporting these solutions. Soil moisture status maps (observed and forecast); rainfall anomaly and potential wet/dry spell information; and temperature and wind data all feed into app-based advisories that give farmers early, location-specific warnings. When interpreted with local knowledge, these datasets can help them avoid applying fertilisers just before heavy rain, protect standing and harvested crops ahead of storms, and plan cropping and field operations more confidently despite erratic weather conditions.

Figure 6: Breakout discussion Group 4 - Erratic Rainfall and Extreme Weather events

Table 1: Summary of breakout group discussions

Problems Identified	How RS Can Identify These Problems	Solutions Discussed	How RS Supports These Solutions
Water Management Challenges: · Tail-end water shortage; head-end wastage · Farm ponds reducing downstream flow · Saline/low-quality groundwater · Canal condition issues	· Irrigated vs. non-irrigated area maps · Canal condition and farm pond maps · Crop stress and cropping intensity maps · Soil moisture–based water delivery monitoring · Rainfall forecasting	· Ensure better canal water distribution and infrastructure repair · Ensure crop choices align with command distribution design · Improve water control structures · Combine rainwater and canal water	· Soil moisture maps for delivery evidence · Crop water requirement (Actual Evapotranspiration [ETa]) for planning · Farm pond and surface water availability maps · Drone imagery for last-mile issues · Water productivity indicators
Soil Health Issues: · Salinity, waterlogging · Excessive fertiliser use · Lack of crop rotation/mixed cropping · Soil erosion; weak bunds · Lack of organic/green manure	· Salinity hotspot and trend maps · Soil moisture anomalies · Soil health layers (nutrient/pH proxies) · Crop rotation and crop pattern maps	· Ensure green manure adoption · Apply gypsum for sodic soils · Implement subsurface drainage · Follow mixed cropping, soil conservation	· Soil health maps to identify nutrient-deficient zones · Salinity maps for targeted treatment · Waterlogging × salinity overlays to find causes · Moisture anomaly maps for conservation planning

Crop Management Challenges: • Labour shortage • Frequent weed growth • Crop diseases and pest attacks (cotton) • Declining soil fertility	• NDVI/EVI for crop health monitoring • NDWI to identify water logged areas • Moisture stress detection • Drone-based crop anomaly detection • Growth stage tracking	• Mechanisation • Better fertiliser management • Soil fertility improvement (green manuring, rotation) • Integrated pest management	• Frequent NDVI/NDWI updates for early stress • Pest/disease risk alerts • Drone maps for precise detection • Weather-linked advisories via mobile apps
Erratic Rainfall and Extreme Weather Events: • Sowing/field operations disrupted by monsoon variability • Fertiliser/irrigation loss due to unexpected rain • Lodging, yield loss from heavy rain/wind • Higher pest/disease incidence in humid spells • Harvest losses (cotton exposure)	• Automatic Weather Station (AWS)/rain gauge data • Satellite soil moisture and rainfall anomaly maps • Cloud cover and flood extent layers • IMD/KVK advisories	• Adjust field operations to advisories • Switch varieties based on monsoon onset • Follow moisture conservation practices • Grow climate-resilient crops	• Soil moisture (current + forecast) • Wet/dry spell identification • Temperature trends for pest risk • Wind warnings for lodging • App-based early warnings and extended forecasts

Implementation Challenges for Remote Sensing

Remote sensing solutions offer strong potential, but also face technical and operational constraints that must be considered in its deployment. Many RS products, such as soil moisture, ET, and rainfall estimates, are limited by coarse spatial resolution and may not capture field-level variability within WUCS. Cloud cover disrupts optical time-series used for crop stress, salinity, or irrigation monitoring, while distinguishing the cause of stress (pest, nutrient, or moisture) remains inherently difficult. Small water bodies, bunds, and soil conservation structures are often undetectable in moderate-resolution imagery, and satellite-derived soil moisture reflects only the top layer of soil, rather than root-zone conditions. Furthermore, early-stage pest or disease symptoms often fall below satellite detection thresholds, and high-resolution drone mapping, though highly accurate, cannot be conducted frequently at scale.

Alongside these technical limitations, implementation challenges were also identified. Farmers and WUCS require simplified, colour-coded maps due to limited interpretation capacity. Furthermore, digital connectivity gaps restrict the timely delivery of advisories. Institutional silos persist across government departments, making coordinated data sharing and joint product development challenging. The participants also raised concerns related to long-term affordability, continuity of services, and the need for local interpreters to ground-truth, contextualise, and communicate RS insights. These challenges underscore the importance of a phased approach that pairs technological refinement with capacity building, institutional integration, and locally anchored delivery mechanisms.

Next Steps: Research and Action Agendas

Research Agenda

- Develop validated RS-based indices for salinity, nutrient deficiencies, and soil moisture applicable to semi-arid canal commands.
- Co-design irrigation water budgeting models integrating rainfall, ET, soil moisture, and canal operation data.
- Build crop-stage and pest/disease risk models calibrated to local varieties using NDVI/EVI temporal profiles.
- Conduct accuracy assessments comparing drone, satellite, and sensor data to determine optimal monitoring scales.
- Test community interpretation of RS maps to inform UI simplification and communication strategies.

Action Agenda

- Pilot RS use cases in selected WUCS with monthly validation meetings.
- Form a multi-departmental RS working group for coordination, data sharing, and product development.
- Train Jal Vigyanis and farmer groups on reading RS maps, using apps, and validating anomalies.
- Create a workflow for generating fortnightly RS products, such as soil moisture, crop stress, water availability, and delivering them via WhatsApp and village notice boards.
- Integrate AWS/rain gauge networks with RS products to enhance hyper-local weather accuracy.
- Plan community field visits to ground-truth salinity, irrigation coverage, and canal-maintenance maps.

Conclusion

The stakeholder meeting marked an important step toward building a shared, community-driven pathway for integrating RS into water, soil, crop, and climate management in the TLBC command area. The discussions revealed not only the depth of challenges across scales, from basin-level scarcity to plot-level inequities, but also the strong willingness among departments, institutions, WUCS, and farmers to engage with new tools that can bring transparency, predictability, and equity in land and water management. Participants collectively recognised RS not as a stand-alone solution, but as a powerful enabler when paired with local knowledge, institutional coordination, and sustained capacity building. The research and action agendas outlined in the meeting provide a clear roadmap for moving from ideas to field-ready pilots, backed by rigorous validation and community participation.

As the RS4C project advances, continued collaboration among government departments, academic partners, WUCS, and local communities will be central to transforming these insights into durable, scalable, and inclusive water governance practices for the region.

Annexure 1: Programme Schedule

TIME	SESSION
10:30 AM – 11:00 AM	Welcome and Introduction
11:00 AM – 11:15 AM	Setting the Context: Learnings from TLBC
11:15 AM – 11:45 AM	Potential of Remote Sensing Applications
11:45 AM – 12:00 PM	Tea Break / Transition to Breakout Groups
12:00 PM – 12:30 PM	Breakout Group Discussions
12:30 PM – 1:00 PM	Group Presentations and Validation
1:00 PM – 1:20 PM	Synthesis and Way Forward
1:20 PM – 1:30 PM	Closing Remarks and Next Steps
1:30 PM – 2:30 PM	Lunch

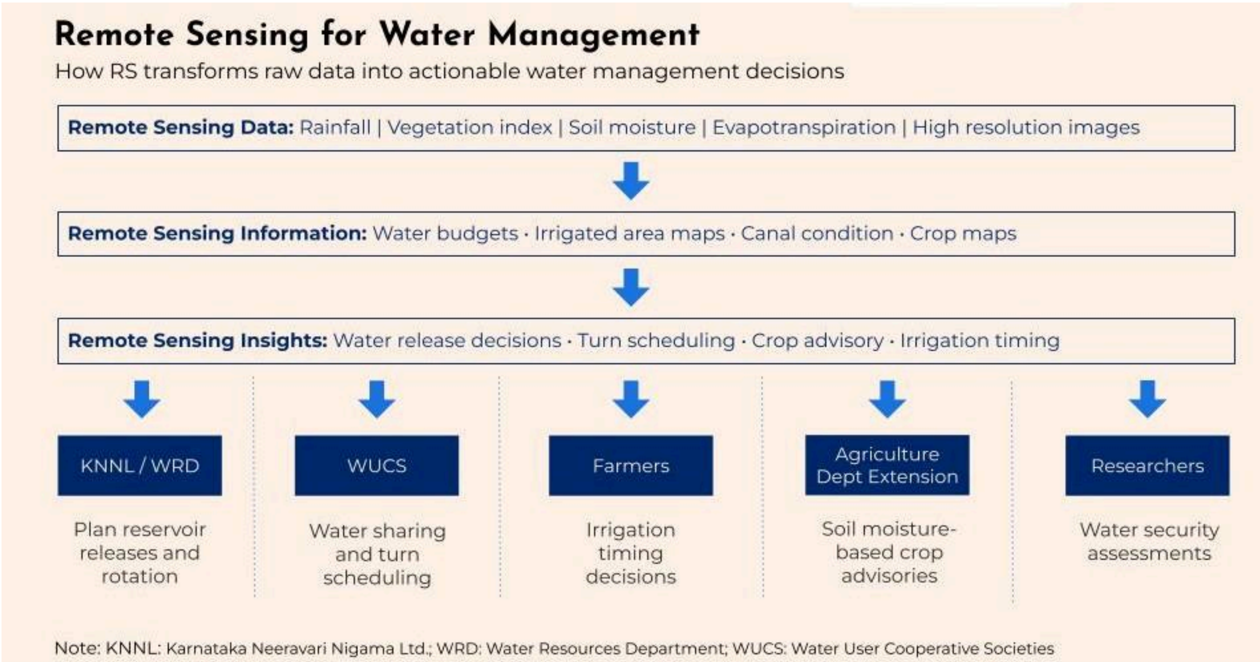
Annexure 2: Participant List

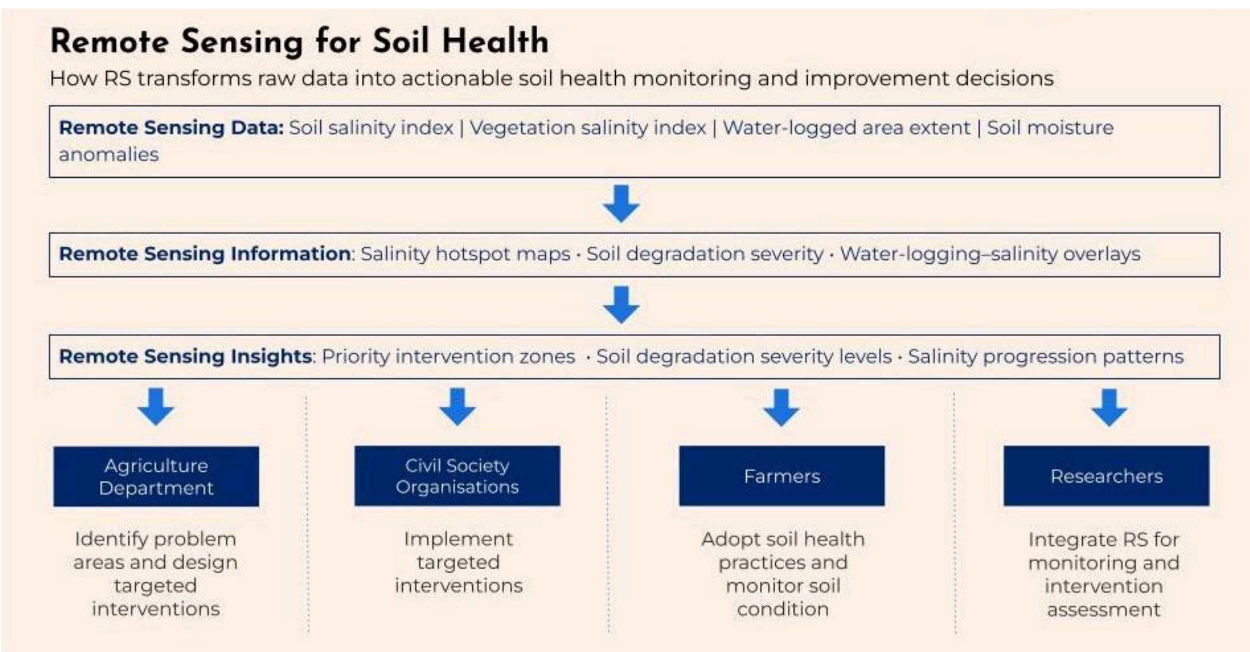
SI NO	PARTICIPANT NAME	DESIGNATION AND ORGANISATION
1	A G Srinivas	Professor and Head, Department of Entomology, UAS Raichur
2	Ameresh	AO (Manvi)
3	Anupam	WELL Labs
4	Asha Farsana	WELL Labs
5	B Maheshwar Babu	Prof, Department of Civil Eng, Raichur
6	Basavaraj	Assistant Executive Engineer (CADA)
7	Basavaraj G	Sajjalasri
8	Chandrashekar	WUCS - 5 (Shakapur)
9	Channabasava	Jagadaguru Samste
10	Deepa	Junior Engineer, KNNL
11	Divya	WELL Labs
12	Eranna	WUCS - 1 (Attanur)
13	Ganesh	WELL Labs
14	Gouramma	Shakapur, Attanur panchayath member
15	Hampamma	National Rural Livelihood Mission
16	Hanumanthraya	WUCS - 3 (Attanur)
17	Ibrahim	WUCS - 2 (Attanur)
18	Kasthuri	UAS Raichur
19	Laxmi/ Vajrudaya Nayak	Machanur, member
20	Lokappa	WELL Labs
21	Mallareddy	KVK Raichur

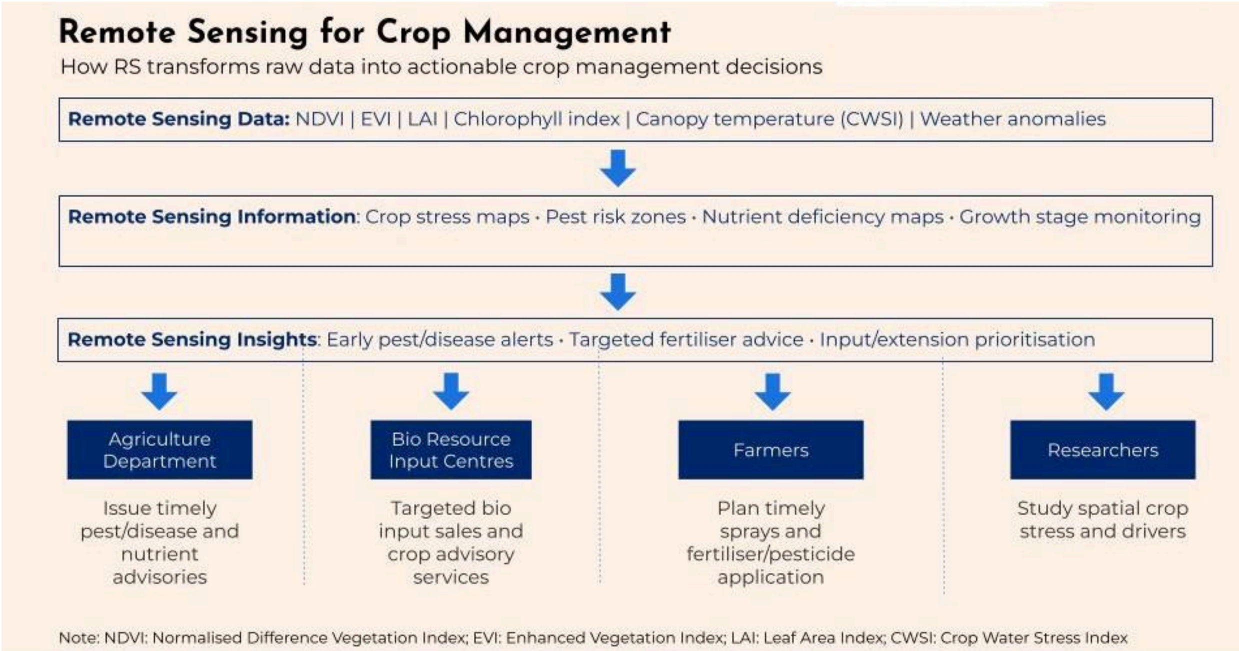
22	Mallikarjuna S Ayyangowdar	Dean (Agricultural Engineering), UAS Raichur
23	Mohmad Nayeendra	CADA
24	Mrutunjaya	-
25	Poojar Narasingraju	AE in Sindhanur (CADA)
26	Rajkumar	Irrigation and Drainage, UAS Raichur
27	Rajshekar M	AEE (CADA)
28	Ram Gouda	Singadidinni
29	Rashmi	ACIWRM
30	Ravi Kumar	Sajjalsari
31	Ravi Prakash M S	WELL Labs
32	Sangeetha	National Rural Livelihood Mission
33	Sanjay Mallya	WELL Labs
34	Sashikumar N	ACIWRM
35	Selvamani	WELL Labs
36	Shanthi priya	WELL Labs
37	Shashidhar	WELL Labs
38	Shivappa Kosigi	Machanur, community
39	Shwetha	National Rural Livelihood Mission
40	Siddappa	AO Sindhanur (CADA)
41	Siddarudha	Junior Engineer
42	Smt Rajeswari	TA KNNL
43	Smt Vijayalaxmi Patil	-
44	Srikant Sajjan	Attanur, community

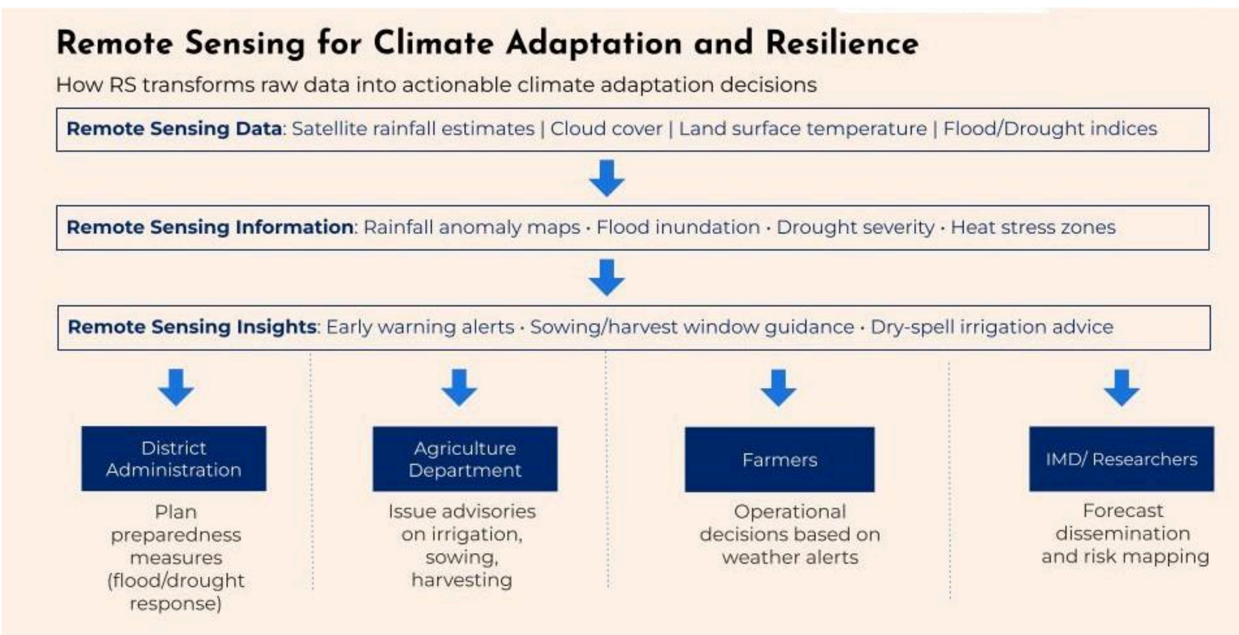
45	Srinivasa Reddy	HOD, I and D Department, UAS Engineering College
46	Sugamma	NRLM
47	Suresh	Junior Engineer
48	Swetha AN	UAS Raichur
49	Syamkrishnan	WELL Labs
50	Tabraiz MH	AE Sindhanur (CADA)
51	Teju Kumar N	ACIWRM

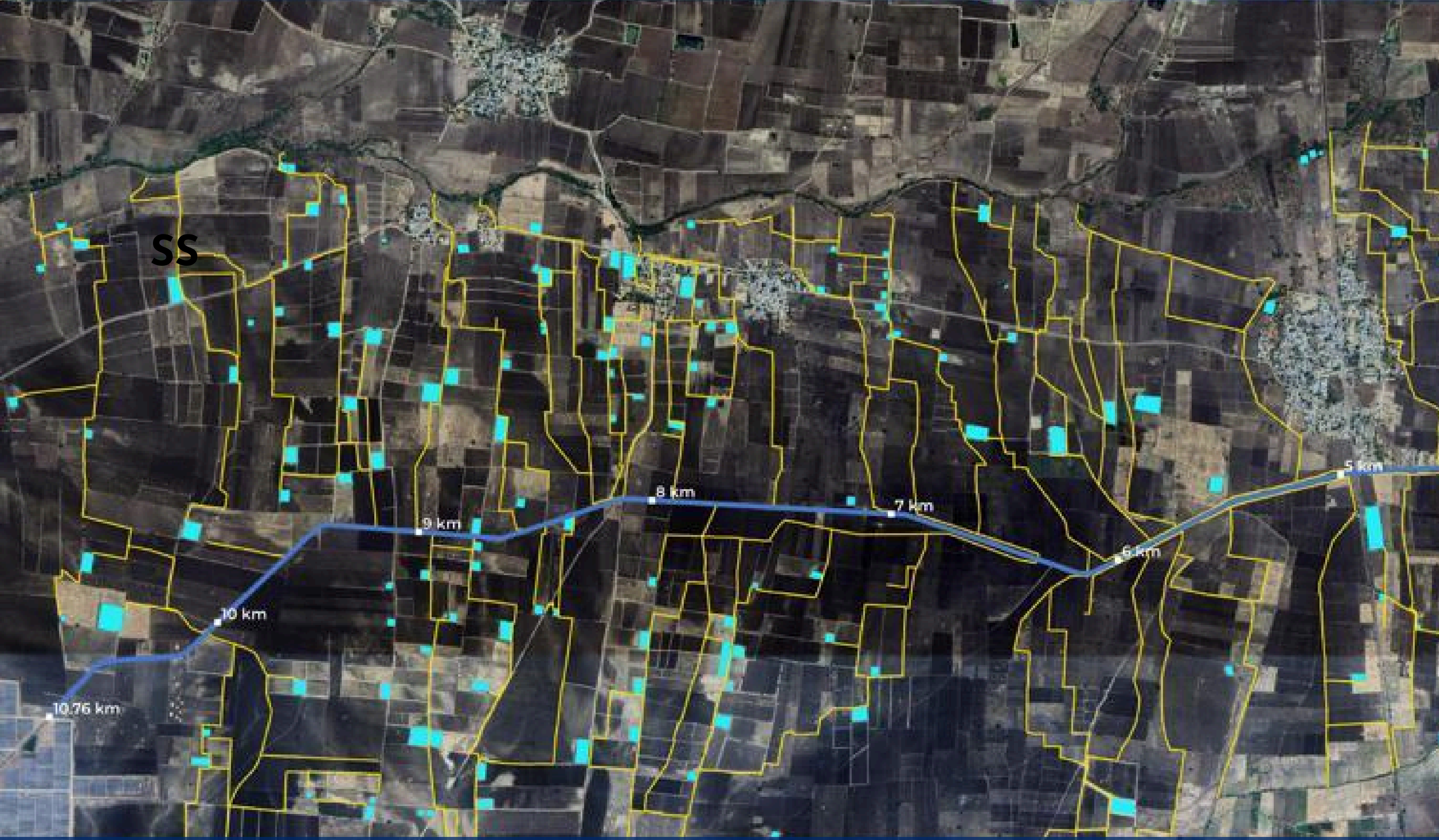
Annexure 3: Remote Sensing Applications - Flow Charts






Remote Sensing for Crop Management
How RS transforms raw data into actionable crop management decisions
Remote Sensing Data: NDVI | EVI | LAI | Chlorophyll index | Canopy temperature (CWSI) | Weather anomalies
Remote Sensing Information: Crop stress maps · Pest risk zones · Nutrient deficiency maps · Growth stage monitoring
Remote Sensing Insights: Early pest/disease alerts · Targeted fertiliser advice · Input/extension prioritisation
Agriculture Department
Issue timely pest/disease and nutrient advisories
Bio Resource Input Centres
Targeted bio input sales and crop advisory services
Farmers
Plan timely sprays and fertiliser/pesticide application
Researchers
Study spatial crop stress and drivers
Note: NDVI: Normalised Difference Vegetation Index; EVI: Enhanced Vegetation Index; LAI: Leaf Area Index; CWSI: Crop Water Stress Index


Remote Sensing for Climate Adaptation and Resilience
How RS transforms raw data into actionable climate adaptation decisions
Remote Sensing Data: Satellite rainfall estimates | Cloud cover | Land surface temperature | Flood/Drought indices
Remote Sensing Information: Rainfall anomaly maps · Flood inundation · Drought severity · Heat stress zones
Remote Sensing Insights: Early warning alerts · Sowing/harvest window guidance · Dry-spell irrigation advice
District Administration
Plan preparedness measures (flood/drought response)
Agriculture Department
Issue advisories on irrigation, sowing, harvesting
Farmers
Operational decisions based on weather alerts
IMD/ Researchers
Forecast dissemination and risk mapping



This work is supported by IHE Delft Institute for Water Education (under the auspices of UNESCO) and funded by aid from the Government of the Netherlands as part of the RS4C initiative.

Reach us at:

welllabs.comms@ifmr.ac.in

https://welllabs.org

https://aciwrm.karnataka.gov.in/en

@WELLLabs_org

Water, Environment, Land and Livelihoods (WELL) Labs

Operating office: WELL Labs, No. 9, First floor, Krishna Road, Basavanagudi, Bengaluru - 560004, Karnataka, India

Registered office: Institute for Financial Management and Research, No. 196, TT Krishnamachari Rd, Alwarpet, Chennai - 600018, Tamil Nadu, India

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