PLANTING KNOWLEDGE, GROWING FUTURES: GIS LITERACY IN RURAL COMMUNITIES (13753)

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SUMMARY

The future we want demands that sustainability, resilience, and equity extend beyond 2030 to include those who feed the world—farmers in remote and rural communities. While geospatial intelligence increasingly shapes global development, rural farmers remain excluded from these advances, lacking access to GIS tools, data, and training. This digital divide limits their capacity to adapt to climate change, manage land resources, and participate in modern agricultural markets.

This paper argues that GIS literacy is a critical driver of resilient communities, food security, and economic empowerment. When farmers are trained to use geospatial data for crop planning, soil and water management, and climate risk assessment, they become informed decision-makers rather than passive recipients of external support. Beyond technical benefits, GIS literacy restores confidence, enthusiasm, and agency among farmers who have long felt left behind by technological progress.

Through human-centered training approaches and participatory mapping, rural farmers demonstrate strong interest and engagement with geospatial technologies when these are presented in accessible and meaningful ways. The paper shows that GIS literacy is not simply a technical intervention but a pathway to social inclusion, economic opportunity, and environmental sustainability.

Empowering farmers with geospatial skills aligns directly with the Sustainable Development Goals and the vision of "The Future We Want." By bridging the digital divide, GIS literacy ensures that rural communities are not excluded from global technological transformation but are positioned as equal partners in shaping sustainable futures beyond 2030.

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1. INTRODUCTION

Sustainable development, resilience, and equitable growth are increasingly dependent on access to information and technology. Geospatial intelligence and GIS (Geographic Information Systems) have transformed how communities manage land, resources, and climate-related risks globally. Yet, many rural farming communities remain excluded from these technological advances, particularly in remote areas where infrastructure is limited but human life thrives. Farmers, who are the custodians of food systems and land management, often lack the tools and knowledge to leverage geospatial data for decision-making, climate adaptation, and market participation.

This digital divide perpetuates vulnerability, reduces productivity, and limits economic empowerment, leaving rural communities at a disadvantage in achieving the Sustainable Development Goals (SDGs) and beyond. GIS literacy among farmers offers a solution: by equipping them with the ability to collect, interpret, and use geospatial information, farmers can make informed decisions on crop planning, soil management, water use, and climate adaptation. This not only strengthens local food security but also positions farmers as equal participants in the global technological landscape.

This paper explores the role of GIS literacy in building resilient communities, improving economic outcomes, and enhancing food security among rural farmers. Through case studies, pilot initiatives, and practical approaches, it demonstrates how empowering farmers with geospatial skills can contribute to sustainable development, climate resilience, and equitable growth beyond 2030. By bridging the technological gap, GIS literacy ensures that no farmer is left behind in shaping the future we want.

2. BACKGROUND / LITERATURE REVIEW

Globally, geospatial technologies and GIS are increasingly recognized as critical tools for sustainable land governance, climate adaptation, and agricultural productivity. In urban and peri-urban areas, access to geospatial data and digital tools has enabled farmers, planners, and decision-makers to optimize resources, respond to climate risks, and connect with markets. However, rural and remote farming communities are often left behind, creating what can be described as “literacy injustice”—a gap not just in access to technology but in the ability to participate fully in the evolving global knowledge economy.

In many rural areas, farmers face multiple barriers: limited connectivity, lack of infrastructure, and minimal exposure to digital tools. Even when technologies are introduced, there is often a gap in understanding, engagement, and support, leaving farmers hesitant or unsure how to integrate these tools into daily decision-making. Yet, when GIS or geospatial concepts are

presented in a meaningful and context-sensitive way, the response is striking: curiosity, enthusiasm, and pride emerge visibly. Their questions and engagement reflect both a deep appreciation of technology and a desire to harness it for tangible outcomes—despite years of systemic exclusion.

Research indicates that digital literacy and GIS education among farmers can significantly enhance decision-making, risk management, and economic empowerment. Studies across Africa and other developing regions have shown that farmers who receive tailored GIS training are better able to plan crops, manage soil and water resources, and respond to climate variability. Beyond technical skills, GIS literacy fosters confidence, agency, and social inclusion, enabling farmers to participate in local and global knowledge networks.

Yet, the human dimension of this "literacy injustice" is often overlooked. The initial hesitation, followed by visible engagement and excitement when technology is introduced, underscores a moral imperative: the world cannot continue to advance while leaving key stakeholders—those who sustain our food systems—on the sidelines. Addressing this inequity requires intentional, context-sensitive training programs that recognize not only technical needs but also the emotional and social dimensions of empowerment.

3. METHODOLOGY / APPROACH

This study adopts a participatory, farmer-centered approach to GIS literacy, emphasizing both technical skill-building and empowerment.

3.1 Selection of Communities and Participants

Rural farming communities were identified based on remoteness, food production significance, and limited access to technology. Farmers of all ages and experience levels were included to ensure a diverse understanding of local challenges and opportunities.

3.2 Training Design and Delivery

The GIS literacy program combines hands-on workshops, mobile and tablet-based exercises, and visual mapping activities. Lessons are framed around real-life agricultural scenarios, including crop planning, soil management, water resource tracking, and climate adaptation strategies. To bridge literacy and technology gaps, facilitators use storytelling, demonstrations, and community mapping exercises, enabling farmers to immediately see the relevance of GIS in their daily lives.

3.3 Engagement and Observation

Throughout the training, farmer reactions are carefully observed. Initial hesitation is common, reflecting years of exclusion from technological advancements. Yet, when practical applications are demonstrated—such as mapping their fields or planning for seasonal rainfall—enthusiasm becomes visible on faces, and questions show deep engagement and curiosity. These responses highlight both the latent potential and the systemic literacy injustice that has previously limited their participation.

3.4 Tools and Data

The program leverages low-cost, mobile-compatible GIS software, open-source mapping platforms, and satellite or local land-use data. Emphasis is placed on usability in low-resource settings, ensuring that the skills gained are sustainable and directly applicable.

3.5 Evaluation

Impact is assessed through pre- and post-training surveys, practical mapping exercises, and follow-up interviews. Metrics include understanding of geospatial concepts, ability to apply GIS tools in decision-making, confidence in using technology, and community-level benefits for planning and food security.

4. RESULTS / DISCUSSION

The implementation of GIS literacy programs in rural farming communities demonstrates significant technical, economic, and social outcomes. Farmers who participated in the training gained the ability to collect, interpret, and apply geospatial data for decision-making, including crop planning, soil and water management, and climate risk mitigation. Even in resource-limited settings, the practical use of low-cost, mobile-compatible GIS tools allowed participants to map their fields, plan planting cycles, and monitor environmental conditions with unprecedented precision.

Beyond the technical skills, the most striking impact is human-centered. Initial hesitation and uncertainty among farmers quickly transformed into visible engagement, curiosity, and pride. Their questions and interactions during training reveal a deep appreciation for technology, coupled with a renewed sense of agency. This demonstrates that the perceived "digital divide" is not due to lack of interest but rather systemic exclusion from accessible learning opportunities—a reality this paper describes as literacy injustice.

Economic empowerment and food security are also notable outcomes. Farmers reported improved planning for seasonal rainfall, better crop yield forecasting, and enhanced access to local markets through mapping of transport routes and supply chains. These practical benefits translate into community-level resilience, reducing vulnerability to climate shocks and fostering self-reliance.

Importantly, GIS literacy positions rural farmers as equal participants in the global knowledge economy, bridging the gap between technological advancement and on-the-ground experience. This shift not only supports sustainable development and the SDGs but also restores confidence and enthusiasm in communities historically overlooked by technological interventions.

5. CONCLUSION & RECOMMENDATIONS

GIS literacy among rural farmers is more than a technical skill; it is a transformative tool for resilience, food security, and inclusive growth. This paper demonstrates that, when provided with accessible, context-relevant training, farmers not only acquire geospatial skills but also regain confidence, agency, and enthusiasm toward technology—revealing the latent potential that systemic exclusion has long suppressed. The visible engagement and curiosity of farmers underscore the urgency of addressing this literacy injustice, ensuring that no community is left behind as the world advances digitally.

Recommendations:

Expand GIS literacy programs to more rural communities, prioritizing areas with limited infrastructure and high food production significance.
Integrate GIS training into national agricultural and extension frameworks, ensuring sustainability and government support.
Foster partnerships among NGOs, tech companies, academia, and local governments to provide training, data access, and ongoing support.
Recognize and address literacy injustice by designing programs that are culturally and contextually sensitive, valuing local knowledge alongside technical skills.
Encourage monitoring and research to track impacts on food security, economic empowerment, and community resilience, creating evidence for policy and scaling initiatives.
Empowering farmers with GIS literacy is a moral and strategic imperative for achieving the SDGs and shaping a future where resilient, sustainable, and equitable growth extends to all communities. By planting knowledge today, we grow the futures of tomorrow.

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BIOGRAPHICAL NOTE

Motselisi Mokhele-Peete is a development practitioner from Lesotho and works in South Africa, specializing in rural GIS literacy, sustainable agriculture, and women farmers' empowerment. She has led community-based programs integrating technology for resilience and food security.

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