Annual Progress Assessment Report on Technical Competency Development in Geospatial-Based Land Use Planning[1]

Project Name: Preventing Forest Loss, Promoting Restoration, and Integrating Sustainability into Ethiopia's Coffee Value Chains and Food Systems

(UNDP-GEF PIMS ID Number: 6304)
Contract No. ET-MoPD-0001



Prepared by Ethiopian Space Science and Geospatial Institute

July 2026
Addis Ababa, Ethiopia

[1] The assessment of the annual increment in the technical competencies of experts in geospatial-based land use planning was conducted among experts who participated in the training from Federal Institutions and institutions in four regional states: Sidama, Oromia, South Ethiopia, and South West Ethiopia.

Contents

1. Background Information 3

1.1 Context and Rationale 3

1.2 The Capacity-Building Journey 3

1.3 Purpose of the Report 4

2. Objective of the Assessment Report 4

3. Annual Progress Assessment on Experts' Geospatial-based Land Use Planning Technical Capabilities 5

3.1 Experts from Federal Institutions 5

3.1.1 Comparison between Original and Refresher Training for Experts' from Federal Institutions 7

3.1.2 Overall Incremental Improvement of Federal Experts 9

3.2 Experts' from Regional Institutions 10

3.2.1 Comparison between Original and Refresher Training for Experts' from Regional Institutions 12

3.2.2 Overall Incremental Improvement of Regional Experts 14

4. Summary, Conclusion and Recommendations 15

4.1 Summary 15

4.2 Conclusions 15

4.3 Recommendations 16

1. Background Information

1.1 Context and Rationale

Rapid population growth, agricultural expansion, infrastructure development, and environmental degradation in Ethiopia have intensified competition for land resources. Effective land use planning (LUP) is critical for sustainable natural resource management, conflict prevention, and economic development. Modern land use planning relies heavily on geospatial technologies (GIS, Remote Sensing, spatial data infrastructure) to support evidence-based decision-making. Despite national policy initiatives, public sector entities, both at the federal level and within regional states such as Sidama, Oromia, South Ethiopia, and South West Ethiopia Peoples' Regional States, have historically faced major constraints:

- **Human Capacity Deficits:** High staff turnover, limited practical exposure to modern Geospatial based Integrated Land Use Planning GIS tools and skill gaps in advanced spatial analytics.
- **Technical & Infrastructure Bottlenecks:** Lack of adequate hardware, software licensing, and standardized geospatial data management systems.
- **Institutional Coordination Gaps:** Disconnected workflows between federal ministries and regional land bureaus.

1.2 The Capacity-Building Journey

To address these gaps, a phased, capacity-building initiative was implemented across federal institutions and the four target regions. This journey was structured into three major milestones:

A. **Baseline Assessment:** Conducted to establish a clear diagnostic benchmark of existing technical skill gaps, and institutional readiness across federal agencies and the four regional states.
B. **First Round Training:** Focused on foundational and core geospatial based integrated land use planning skill sets, introducing standardized methodologies, spatial data handling, satellite imagery interpretation, and introductory spatial planning workflows.

C. **Refresher Training:** Designed to reinforce core competencies, address operational challenges faced in the field post-round 1, introduce advanced spatial analysis, and solidify sustainable institutional workflows.

1.3 Purpose of the Report

This annual progress report evaluates how human competency and technical capacity have evolved from the baseline benchmark through to the completion of the refresher training rounds.

2. Objective of the Assessment Report

To evaluate the annual progress and percentage increase in human and technical geospatial capabilities for land use planning across federal institutions and the Sidama, Oromia, South Ethiopia, and South West Ethiopia Regional States, tracking the trajectory from initial baseline diagnostics to post-refresher training operationalization. The specific objectives are

- Quantify the percentage increase in proficient technical personnel (GIS specialists, land use planners, spatial analysts) post-Round 1 and Refresher trainings across target regions.
- Measure the knowledge retention, practical application, and skill improvement of participants across the two training cycles.
- Identify persistent technical or operational bottlenecks that required targeted interventions during the Refresher sessions.
- Compare progress across federal agencies and the four target regions (Sidama, Oromia, South Ethiopia, South West Ethiopia) to identify unique strengths, regional lag, and customized needs.
- Gauge the extent to which newly acquired skills have been integrated into daily institutional workflows, policy enforcement, and master planning processes.
- Outline actionable strategies to sustain technical gains, mitigate staff turnover risks, and scale up institutional transformation.
- Recommend institutional mechanisms for continuous learning, peer-to-peer knowledge sharing, and long-term geospatial data infrastructure management.

3. Annual Progress Assessment on Experts' Geospatial-based Land Use Planning Technical Capabilities

3.1 Experts from Federal Institutions

Table 1 presents the pre- and post-training levels of understanding reported by participants from Federal Institutions during the original training, focusing on the Geographic Information System (GIS) and Remote Sensing (RS) modules. The comparison provides an indication of the extent to which the training enhanced participants' knowledge and understanding of the two core geospatial components.

Table 1. Pre-and post-training level of understanding during the previous training (original training) for Federal Institutions.

Module	**Pre-training Level of Understanding**					**Post-training Level of Understanding**				
	Excellent	Good	Moderate	Low	Very Low	Excellent	Good	Moderate	Low	Very Low
GIS	29.51	44.26	22.95	0	3.28	57.38	34.43	6.56	1.64	0
RS	0	0	32.26	54.84	12.90	3.23	12.90	51.61	32.26	0

The summary results presented in the above table reveled that the changes in participants' levels of understanding before and after the original training among representatives of Federal Institutions for the GIS and Remote Sensing (RS) modules. The results indicate that the training improved participants' knowledge levels in both modules, with a more pronounced improvement observed in GIS. For the GIS module, participants had a relatively good baseline understanding before the training, with 44.26% reporting good understanding and 29.51% reporting excellent understanding. Following the training, the proportion of participants with excellent understanding increased substantially from 29.51% to 57.38%, while good understanding remained high at 34.43%. Meanwhile, the proportion of participants with moderate understanding declined from 22.95% to 6.56%, and those with very low understanding decreased from 3.28% to zero. This shift demonstrates that the training was highly effective in enhancing GIS competencies among federal institution participants, moving a considerable proportion of participants toward advanced levels of understanding.

For the RS module, participants showed relatively limited prior knowledge before the training. None of the participants reported excellent or good understanding at the pre-training stage, while most participants were categorized under low (54.84%) and moderate (32.26%) understanding levels, with 12.90% reporting very low understanding. After the training, improvement was observed, with 3.23% of participants achieving excellent understanding and 12.90% reaching good understanding. The proportion of participants with moderate understanding increased to 51.61%, while low understanding decreased from 54.84% to 32.26%, and very low understanding was eliminated. These results indicate that the training successfully improved foundational RS knowledge and reduced knowledge gaps, although a considerable number of participants still remained at low and moderate levels.

Overall, the results demonstrate a positive shift in participants' self-assessed levels of understanding following the training, although the magnitude of improvement varied between the two modules. The most notable improvement was observed in the GIS module, where the proportion of participants reporting an excellent level of understanding increased substantially, while the proportion reporting low or very low understanding declined markedly. A similar, although comparatively less pronounced, improvement was observed for the RS module. These findings suggest that the original training contributed to strengthening participants' knowledge and confidence in applying GIS and RS concepts and techniques.

Table 2. Level of understanding after refresher training for Federal Institutions.

Module	**Level of understanding (%) after refresher training**				
	Excellent	Good	Moderate	Low	Very Low
GIS	26.43	53.57	15.71	4.29	0
RS	14.29	40.71	40.71	3.57	0.71

Table 2 presents the level of understanding of Federal Institution participants after the refresher training for the GIS and Remote Sensing (RS) modules. The results indicate that the refresher training successfully maintained and improved participants' technical knowledge, with the majority of participants achieving good to excellent levels of understanding in both modules.

For the GIS module, the majority of participants reported good understanding (53.57%), followed by excellent understanding (26.43%). A smaller proportion of participants were categorized as having moderate understanding (15.71%), while only 4.29% reported low understanding, and no participants fell under the very low understanding category. The dominance of good and excellent understanding levels (80.00% combined) indicates that the refresher training effectively reinforced GIS concepts and practical skills among Federal Institution participants.

For the RS module, participants also demonstrated improved knowledge, with 40.71% reporting both good understanding and moderate understanding, followed by 14.29% with excellent understanding. Only a small proportion of participants remained at the low (3.57%) and very low (0.71%) understanding levels. Overall, 55.00% of participants achieved good to excellent understanding, while the majority of the remaining participants were at the moderate level, suggesting that the refresher training strengthened RS knowledge but that additional practical application and advanced exercises may still be needed to further improve competency.

Overall, the refresher training results demonstrate a positive learning outcome among Federal Institution participants. The high proportion of participants achieving good and excellent understanding, particularly in GIS, confirms the effectiveness of continuous capacity-building activities in consolidating previous knowledge and enhancing technical competencies. The relatively higher proportion of moderate understanding in RS highlights the need for continued hands-on training, real-world applications, and follow-up technical support to further strengthen remote sensing skills.

3.1.1 Comparison between Original and Refresher Training for Experts' from Federal Institutions

To assess the incremental improvement in participants' understanding after the refresher training, the results of the original training assessment (pre- and post-training) were compared with the post-training assessment conducted after the refresher training. The same assessment questions were applied during both training periods, enabling evaluation of knowledge retention, further improvement, and the effectiveness of continuous capacity-building among experts from Federal Institutions. The comparison focused on changes in competency levels for the GIS and Remote Sensing (RS) modules, particularly the progression toward higher understanding categories and the reduction of lower competency levels.

GIS Module: The results of the original training assessment indicate that participants from Federal Institutions had a relatively strong baseline understanding of GIS. Before the training, 73.77% of participants reported Good-to-Excellent understanding, consisting of 29.51% Excellent and 44.26% Good understanding. Following the original training, the proportion of participants achieving Good-to-Excellent understanding increased substantially to 91.81%, with Excellent understanding increasing from 29.51% to 57.38% and Good understanding remaining high at 34.43%. At the same time, participants with Moderate understanding decreased from 22.95% to 6.56%, and Very Low understanding was completely eliminated. These results demonstrate that the original training was highly effective in strengthening GIS knowledge and advancing participants toward higher competency levels.

After approximately one year, the refresher training assessment showed that GIS competency was largely maintained among Federal Institution participants. Following the refresher training, 80.00% of participants achieved Good-to-Excellent understanding, including 26.43% Excellent and 53.57% Good understanding. Although the proportion of Excellent understanding was lower than the immediate post-training result of the original training (57.38%), the proportion of Good understanding increased considerably, indicating a redistribution of participants toward a strong intermediate competency level. Furthermore, no participants reported Very Low understanding, and only 4.29% remained in the Low understanding category.

The comparison demonstrates that the refresher training successfully sustained the GIS knowledge gained during the original training and minimized knowledge degradation over time. The continued high proportion of Good-to-Excellent understanding confirms the effectiveness of repeated training interventions in maintaining GIS technical capacity among Federal Institutions for geospatial-based integrated land use planning.

Remote Sensing (RS) Module: The original training assessment revealed that Remote Sensing was a relatively challenging area for Federal Institution participants before the intervention. At the pre-training stage, none of the participants reported Excellent or Good understanding, while the majority were classified as having Low (54.84%) and Moderate (32.26%) understanding, with 12.90% reporting Very Low understanding. Following the original training, notable improvement was observed, with participants achieving Excellent (3.23%) and Good (12.90%) understanding levels. Moderate understanding increased to 51.61%, while Low understanding declined from

54.84% to 32.26%, and Very Low understanding was completely eliminated. These results indicate that the original training improved participants' foundational RS knowledge and reduced major knowledge gaps, although many participants still required further skill development.

The refresher training resulted in a further improvement in RS competency. After the refresher training, the proportion of participants achieving Good-to-Excellent understanding increased to 55.00%, comprising 14.29% Excellent and 40.71% Good understanding. Compared with the immediate post-training results of the original training, this represents a substantial advancement, particularly in the Excellent understanding category, which increased from 3.23% to 14.29%, and Good understanding, which increased from 12.90% to 40.71%. In addition, the proportion of participants with Low and Very Low understanding decreased considerably from 32.26% and 0%, respectively, after the original training to 3.57% and 0.71% after the refresher training.

These findings indicate that the refresher training effectively addressed the remaining knowledge gaps identified after the original training. The improvement in higher competency categories suggests that continued exposure to RS concepts, practical exercises, and applied examples enhanced participants' ability to understand and apply advanced remote sensing techniques.

3.1.2 Overall Incremental Improvement of Federal Experts

The comparative analysis demonstrates that the refresher training generated significant incremental improvement in technical understanding among Federal Institution participants. The GIS module showed strong knowledge retention, with participants maintaining high competency levels and very limited representation in lower understanding categories. The refresher training further consolidated GIS skills by shifting participants predominantly into the Good understanding category while eliminating Very Low understanding.

The RS module showed a more substantial incremental gain compared with GIS because participants started with relatively limited prior knowledge during the original training. While the original training improved basic understanding, the refresher training resulted in a clear progression from Moderate and Low understanding levels toward Good and Excellent competency levels. The increase in participants achieving Good-to-Excellent understanding from 16.13% after the original training to 55.00% after refresher training highlights the importance of continuous training and practical reinforcement for technically demanding subjects such as remote sensing.

Overall, the findings confirm that refresher training is an effective approach for strengthening long-term capacity development in geospatial-based integrated land use planning. The comparison of assessment results demonstrates not only knowledge retention but also incremental learning improvement, particularly in areas where participants initially had limited experience. Continued professional development, practical applications, and institutional support remain essential to ensure sustained use of GIS and remote sensing technologies in land use planning and decision-making processes.

3.2 Experts' from Regional Institutions

Table 1 presents the changes in participants' levels of understanding before and after the original training for the Geographic Information System (GIS) and Remote Sensing (RS) modules. The results indicate that the training contributed to an improvement in participants' knowledge and understanding, although the magnitude of improvement varied between the two modules. For the GIS module, participants demonstrated a relatively higher level of understanding even before the training, with 36.36% reporting excellent understanding and 39.39% reporting good understanding. After the training, the proportion of participants with excellent understanding increased to 48.57%, while good understanding slightly decreased to 31.43%. At the same time, the proportion of participants with moderate, low, and very low understanding declined from a combined 28.74% before training to 15.50% after training. This indicates that the training effectively strengthened participants' GIS knowledge by shifting many participants from lower understanding categories toward excellent understanding.

Table 1. Pre-and post-training level of understanding during the previous training (original training).

Module	**Pre-training level of understanding**					**Post-training level of understanding**				
	Excellent	Good	Moderate	Low	Very Low	Excellent	Good	Moderate	Low	Very Low
GIS	36.36	39.39	18.18	4.5	6.06	48.57	31.43	11.43	1.21	2.86
RS	0	2.13	40.43	42.55	14.89	0	8.11	43.24	40.54	8.11

For the RS module, the pre-training assessment revealed comparatively lower initial knowledge levels. None of the participants reported excellent understanding, while the majority were

categorized under moderate (40.43%) and low (42.55%) understanding levels, with 14.89% reporting very low understanding. Following the training, a slight improvement was observed, with the proportion of participants reporting good understanding increasing from 2.13% to 8.11%, and moderate understanding increasing from 40.43% to 43.24%. Meanwhile, the proportion of participants with very low understanding decreased from 14.89% to 8.11%. However, a substantial proportion of participants (40.54%) remained in the low understanding category, suggesting that additional practical training and continuous support may be required to further improve RS competencies.

Overall, the findings demonstrate that the original training positively influenced participants' understanding, particularly for GIS where a notable improvement toward higher competency levels was achieved. The comparatively limited improvement in RS indicates that remote sensing concepts and applications may require more intensive hands-on exercises, practical demonstrations, and follow-up capacity-building activities to ensure deeper understanding and skill development.

On the overhand, Table 2 presents the participants' self-reported levels of understanding after the refresher training for the GIS and Remote Sensing (RS) modules. Overall, the results indicate that the refresher training was effective in improving participants' knowledge and technical understanding, with the majority of responses falling within the Good and Moderate understanding categories.

Table 2. Level of understanding after refresher training (Post-training assessment).

Module	**Level of understanding (%) after refresher training**				
	Excellent	Good	Moderate	Low	Very Low
GIS	16.18	42.50	32.56	7.95	0.11
RS	13.24	42.35	35.15	8.97	0.29

For the GIS module, the highest proportion of participants reported Good Understanding (42.50%), followed by Moderate Understanding (32.56%) and Excellent Understanding (16.18%). Only a small proportion of responses were categorized as Low Understanding (7.95%), while Very Low Understanding accounted for only 0.11%. Collectively, 58.68% of participants achieved Good-to-Excellent Understanding, demonstrating a strong level of competency gained through the training.

Similarly, for the Remote Sensing (RS) module, Good Understanding (42.35%) was the dominant category, followed by Moderate Understanding (35.15%) and Excellent Understanding (13.24%). The proportions of Low (8.97%) and Very Low Understanding (0.29%) were minimal. Overall, 55.59% of responses were within the Good-to-Excellent categories, indicating that participants developed substantial knowledge and skills in advanced remote sensing concepts and applications.

Comparatively, the GIS module showed a slightly higher proportion of Excellent Understanding (16.18%) than the RS module (13.24%), whereas the RS module had a slightly higher proportion of participants reporting Moderate Understanding (35.15%). The differences suggest that while both modules effectively improved participants' competencies, some advanced remote sensing topics may require additional practical exercises and follow-up support to further enhance participants' mastery.

In general, the predominance of Good and Moderate understanding levels and the very low proportion of limited understanding demonstrate the overall effectiveness of the refresher training in strengthening participants' technical capacity for geospatial-based Integrated Land Use Planning (ILUP).

3.2.1 Comparison between Original and Refresher Training for Experts' from Regional Institutions

To evaluate the incremental improvement in participants' understanding following the refresher training, the results of the original training assessment (pre- and post-training) were compared with the assessment conducted after the refresher training. The same assessment questions were used during both training events, allowing evaluation of knowledge retention, consolidation, and further improvement among experts from the four regions of Ethiopia (Oromia, Sidama, Southwest Ethiopia, and South Ethiopia). The comparison focused on changes in the proportion of participants achieving Excellent and Good levels of understanding, as well as reductions in Low and Very Low understanding categories.

GIS Module: The original training assessment showed that participants already had relatively good baseline knowledge of GIS, with 75.75% of participants reporting Good-to-Excellent understanding before the training (36.36% Excellent and 39.39% Good). Following the original training, the proportion of participants achieving Good-to-Excellent understanding increased to 80.00%, mainly due to an increase in the Excellent understanding category from 36.36% to

48.57%. At the same time, the proportion of participants with lower levels of understanding (Moderate, Low, and Very Low) declined from 28.74% to 15.50%, demonstrating the effectiveness of the initial training in strengthening GIS competencies.

After approximately one year, the refresher training assessment showed that participants maintained a relatively high level of GIS understanding, with 58.68% achieving Good-to-Excellent understanding (16.18% Excellent and 42.50% Good). Although the proportion of Excellent understanding was lower compared with the immediate post-training assessment of the original training, the refresher assessment showed that the majority of participants remained within the higher competency categories, while Very Low understanding was almost completely eliminated (0.11%). The proportion of participants with Moderate understanding increased to 32.56%, indicating that refresher training helped reinforce fundamental GIS concepts among participants who may have experienced partial knowledge retention challenges over time.

Overall, the comparison indicates that the refresher training contributed to sustaining GIS competency gained during the original training and minimizing knowledge loss over the one-year period. The continued dominance of Good and Excellent understanding categories confirms the effectiveness of repeated capacity-building interventions in maintaining technical skills required for geospatial-based integrated land use planning.

Remote Sensing (RS) Module: The original training assessment revealed relatively limited baseline understanding of Remote Sensing among participants. Before training, no participants reported Excellent understanding, and only 2.13% reported Good understanding, while the majority were categorized as having Moderate (40.43%) and Low (42.55%) understanding. After the original training, improvement was observed, with Good understanding increasing to 8.11%, Moderate understanding increasing slightly to 43.24%, and Very Low understanding declining from 14.89% to 8.11%. However, a considerable proportion of participants (40.54%) remained in the Low understanding category, indicating that RS concepts required continued practice and reinforcement.

Following the refresher training, a substantial improvement in RS competency was observed. The proportion of participants achieving Good-to-Excellent understanding increased to 55.59%, consisting of 13.24% Excellent and 42.35% Good understanding. This represents a considerable

improvement compared with the immediate post-training result of the original training, where only 8.11% of participants achieved Good understanding and no participants reached Excellent understanding. Furthermore, the proportion of participants with Low and Very Low understanding declined substantially from 48.65% after the original training to 9.26% after refresher training. This indicates that the refresher training successfully addressed the knowledge gaps that remained after the initial training, particularly in advanced RS concepts and applications.

3.2.2 Overall Incremental Improvement of Regional Experts

The comparative assessment demonstrates that the refresher training generated an important incremental improvement in participants' understanding, particularly for the Remote Sensing module. While the original training established foundational knowledge and improved participants' competency levels, the refresher training further strengthened knowledge retention, reduced knowledge gaps, and improved participants' confidence in applying advanced geospatial techniques.

The GIS module showed a strong and sustained level of understanding throughout both training phases, with participants maintaining high competency levels and minimal representation in the Very Low category. The RS module demonstrated a more substantial incremental gain, as participants progressed from predominantly Moderate and Low understanding levels during the original training to predominantly Good and Moderate understanding levels after the refresher training.

Overall, the findings confirm that continuous professional development through refresher training is essential for sustaining and enhancing technical capacity in geospatial-based integrated land use planning. The approach of repeating assessments using the same evaluation framework provided evidence of learning progression, knowledge consolidation, and improved readiness of regional experts to apply GIS and remote sensing technologies in land use planning and decision-making processes.

4. Summary, Conclusion and Recommendations

4.1 Summary

The annual progress assessment demonstrates that the Geospatial-based Integrated Land Use Planning (GILUP) capacity-building initiative substantially strengthened the technical understanding of experts from both Federal Institutions and the four target regional states. The assessment compared participants' competency levels before and after the original training and after the subsequent refresher training, using the same assessment framework to examine knowledge retention and incremental improvement. Overall, GIS competencies were relatively strong among participants, while Remote Sensing (RS) represented a more challenging area requiring continued practical reinforcement.

Among Federal Institutions, the GIS module showed strong and sustained performance. Good-to-Excellent understanding increased from 73.77% before the original training to 91.81% immediately after training and remained at 80.00% after the refresher training. In RS, the improvement was more pronounced over time: Good-to-Excellent understanding increased from only 16.13% after the original training to 55.00% following the refresher training. Similarly, regional institutions maintained relatively strong GIS competency, while RS showed substantial incremental improvement, with Good-to-Excellent understanding increasing from 8.11% after the original training to 55.59% after refresher training. These results demonstrate the value of continuous capacity development in reducing knowledge gaps and sustaining technical competencies.

4.2 Conclusions

The assessment confirms that the training and refresher-training approach was effective in building, retaining, and progressively improving geospatial technical capacity for integrated land use planning. GIS competencies were largely retained, while RS demonstrated significant incremental improvement, particularly among participants who had limited initial knowledge. The results also indicate that refresher training is essential for preventing knowledge degradation and strengthening the practical application of geospatial technologies. However, the persistence of

moderate competency levels, particularly in RS, indicates that training alone is insufficient to achieve advanced and sustained institutional capacity.

4.3 Recommendations

Based on the assessment findings, the following actions are recommended:

- Institutionalize continuous professional development through periodic refresher training, advanced modules, and practical competency assessments.
- Prioritize hands-on Remote Sensing training**,** including satellite image processing, interpretation, classification, and applied land-use planning exercises.
- Strengthen post-training technical support through mentoring, peer-to-peer learning, communities of practice, and expert consultation.
- Integrate GIS and RS skills into routine institutional workflows and land-use planning activities to promote practical application and knowledge retention.
- Improve geospatial infrastructure and data management**,** including adequate hardware, software, standardized datasets, and institutional geospatial data-management systems.
- Strengthen inter-institutional coordination between federal agencies and regional land-use institutions to facilitate knowledge sharing, standardized methodologies, and collaborative spatial planning.
- Develop mechanisms for managing staff turnover**,** including institutional documentation, knowledge repositories, and structured handover procedures to safeguard acquired technical capacity.
- Conduct periodic follow-up assessments to monitor competency retention, identify emerging skill gaps, and guide targeted future capacity-building interventions.