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MINISTRY OF ENVIRONMENT

Rwanda's Climate Adaptation Monitoring, Evaluation, and Learning System in the Sectors of Human Settlements and Transport

Report on the MEL program of work (Phase 2)

September 2024



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**Rwanda's Climate Adaptation Monitoring, Evaluation, and
Learning System in the Sectors of Human Settlements and
Transport: Report on the MEL program of work (Phase 2)**

Ministry of Environment, Department of Environmental and Climate
Change, Kigali, Rwanda

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Executive Summary

The Ministry of Environment (MoE) in Rwanda has implemented a monitoring, evaluation, and learning (MEL) system for climate adaptation. This system aims to monitor and enhance adaptation outcomes in the areas of human settlements and transportation as part of Rwanda's nationally determined contribution to address the impacts of climate change. The MEL system tracks progress on seven adaptation indicators:

1. Percentage of the urban population living in informal settlements
2. Percentage of the rural population living in clustered settlements
3. Average share of the built-up area of cities that is open and green space for public use (aligned with the United Nation's Sustainable Development Goals [SDGs])
4. Access to water and sanitation services
5. Percentage of the urban population in areas covered by master plans with stormwater considerations
6. Development of environmental and engineering guidelines for climate-resilient road infrastructure
7. Reduction of the length of roads vulnerable to floods and landslides

These indicators are crucial for assessing and enhancing resilience in these key sectors.

Key Activities and Deliverables

1. **Technical review and analysis:** The project identified data sources, collected indicator data, and tracked progress on nationally determined contribution indicators from 2019 to 2022. This included qualitative data collection through case studies.
2. **Workshops and capacity building:** Three workshops and one capacity-building session were conducted to share knowledge and enhance capabilities among stakeholders.
3. **Peer exchange and meetings:** Interviews and consultations were conducted with various ministries, districts, development partners, and non-governmental organizations (NGOs), and with the private sector. Additionally, representatives from the MoE participated in a peer learning event organized by the NAP Global Network.
4. **Learning, communications, and information sharing:** Two briefing notes were prepared and disseminated. The final report, the case study report on human settlements and transport sectors, and workshop reports are available on the MoE's website.

Key Findings

1. **Clustered settlements:** The assessment of the rural population living in clustered settlements highlighted both benefits, such as improved living conditions and access to infrastructure, and challenges, such as infrastructure stress and increased water demand.
2. **Water and sanitation services:** There has been progress in expanding water distribution and sanitation facilities, resulting in health and welfare improvements. However, infrastructure coverage and consistency remain challenges.
3. **Road vulnerability:** Engineering solutions such as terracing, embankments, and gabions have effectively reduced road vulnerability to floods and landslides. Afforestation and banning plastics have also contributed positively.

Key Learning Points

1. **Enhanced support for clustered settlements:** Development policies need to be accelerated, and additional resources should be allocated for infrastructure development in clustered settlements.
2. **Strengthening water and sanitation infrastructure:** There is a need for increased investments and the adoption of advanced technologies to ensure climate-resilient water and sanitation infrastructure.
3. **Comprehensive vulnerability assessments for roads:** Detailed assessments and a dedicated fund for road maintenance and upgrades are essential for sustaining road infrastructure.
4. **Policy integration and coordination:** Enhanced coordination among government agencies, NGOs, and the private sector is necessary for effective policy integration.
5. **Community engagement and capacity building:** Greater community involvement in planning and implementation, alongside expanded capacity-building programs, is crucial for successful adaptation.

Recommendations

1. **MEL enhancements:** Strengthening the MEL framework is necessary for rigorous data collection and analysis, using digital tools to facilitate better decision making.
2. **Policy implementation:** Implementing the recommended policies will help Rwanda build on its successes and ensure a resilient future for its infrastructure and communities.

Rwanda's Climate Adaptation MEL system in the human settlements and transport sectors has made significant progress in enhancing resilience against climate impacts. However, intensified efforts are required to meet ambitious targets and address ongoing challenges.

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Acronyms

DHS	Demographic and Health Survey
EA	environmental audit
EICV	Integrated Household Living Conditions Survey
ESA	environmental security assessment
ESIA	environmental and social impact assessment
ESMF	environmental and social management framework
ESMS	environmental and social management system
GIS	geographic information system
IISD	International Institute for Sustainable Development
MCA	multi-criteria analysis
MEL	monitoring, evaluation and learning
MININFRA	Ministry of Infrastructure
MoE	Ministry of Environment
NAP-GN	National Adaptation Plan Global Network
NDC	nationally determined contribution
NISR	National Institute of Statistics of Rwanda
OPS	open and public space
RPHC	Rwanda Population and Housing Census
RTDA	Rwanda Transport Development Agency
RURA	Rwanda Utilities Regulatory Authority
SDF	spatial development framework
SDG	Sustainable Development Goal
SEA	strategic environmental assessment
UDM	urban dynamic map

1. Introduction

Rwanda's Ministry of Environment (MoE) implemented its first work program from April 2022 to February 2023. The program focused on operationalizing a framework for monitoring, evaluation, and learning (MEL) for climate change adaptation, with the agriculture sector serving as a pilot test, in line with Rwanda's revised commitments under its nationally determined contribution (NDC). The National Adaptation Plan Global Network (NAP-GN) and the International Institute for Sustainable Development (IISD) provided technical and financial support for its implementation. A MEL system is essential for evaluating the progress and effectiveness of adaptation initiatives. It provides a structured framework for collecting and analyzing data, enabling stakeholders to make informed decisions and improve future strategies. The MEL system tracks implementation and outcomes, and identifies lessons learned and best practices, to support the ongoing improvement of adaptation measures.

In September 2023, the NAP-GN extended its support to the Government of Rwanda for the second phase. This phase emphasized the practical application of the adaptation MEL system and aimed to monitor progress against four adaptation indicators within the human settlements sector and three within the transport sector, as outlined in the NDC.

The overall purpose of this second program was to track the NDC adaptation indicators, improve understanding of the impacts of implementing adaptation actions, and continue to improve the systems for collecting, managing, storing, and analyzing MEL data. This was achieved by:

1. Operationalizing the adaptation MEL system to assess progress on four NDC adaptation indicators in the human settlements sector and three NDC adaptation indicators in the transport sector.
2. Further exploring the impacts and outcomes of the implementation of three prioritized adaptation actions in the agriculture sector, as outlined in the NDC.

Specifically, this program aimed to:

1. Further explore the impacts and outcomes of three additional NDC adaptation actions in the agriculture sector.
2. Measure progress in adaptation for the human settlements and transport sectors based on available data and information.
3. Assess the extent to which the selected indicators for the human settlements and transport sectors address the key objectives of Rwanda's MEL system and identify complementary tools to fill any gaps.
4. Identify next steps needed to further advance the MEL of national adaptation in the human settlements and transport sectors.
5. Share experience and recommendations with relevant government and civil society actors.
6. Develop communications and data visualization materials based on the MEL system.
7. Summarize key lessons learned from the results and offer recommendations for advancing the MEL of adaptation in the NDC priority sectors.

The report is organized into four sections:

- **Section 1** is the introduction. It covers the aims and objectives of the work program.
- **Section 2** reviews the implemented activities and the deliverables.
- **Section 3** provides a review of the tracking of progress on the seven NDC adaptation indicators in the human settlements and transport sectors, and progress made towards expected outputs and outcomes.
- **Section 4** discusses lessons learned and strategic recommendations for the effective operationalization of the adaptation MEL framework in the human settlements and transport sectors, and for advancing adaptation MEL in other sectors and sub-sectors, such as water resources and land.

2. Progress on the Work Program

The work program was executed and delivered effectively, focusing on four key packages: technical reports, workshops and capacity building, peer exchange and meetings, and learning, communications, and information sharing. Each package is described in detail in the following subsections.

2.1 Technical Reports

The technical reports provided comprehensive analysis and insights on MEL adaptation in the human settlements and transport sectors. These reports were the result of rigorous research methodologies, including data collection, analysis, and interpretation. The reports covered the following:

1. Briefing note on *Rwanda's Climate Adaptation Monitoring, Evaluation and Learning (MEL) System in the Agriculture Sector: Case studies on the capacity of storage constructed, use of surveillance tools, and area of land under erosion control measures and used optimally.*¹
2. Briefing note on *Rwanda's Climate Adaptation Monitoring, Evaluation, and Learning System in the Human Settlements and Transport Sectors: Data and information collection and management.*²
3. *Rwanda's Climate Adaptation Monitoring, Evaluation, and Learning System in the Human Settlements and Transport Sectors: Technical report assessing adaptation outcomes.*³
4. Rwanda's Climate Adaptation Monitoring, Evaluation and Learning (MEL) System in the Human Settlement and Transport Sectors: Draft technical report on tracking progress on the adaptation MEL system.
5. *Rwanda's Climate Adaptation Monitoring, Evaluation, and Learning in the Human Settlements and Transport Sectors: Lessons learned.*
6. *Rwanda's Climate Adaptation Monitoring, Evaluation, and Learning in the Human Settlements and Transport Sectors: Proposals for sharing information.*

¹ See: <https://napglobalnetwork.org/resource/rwanda-climate-adaptation-mel-system-agriculture/>

² See: <https://napglobalnetwork.org/resource/rwanda-climate-adaptation-mel-system-human-settlements-transport-sectors/>

³ This technical report was drafted and will be published on NAP Global Network website.

2.2 Workshops and Capacity Building

A series of workshops were conducted to enhance the skills and knowledge of the participants. These workshops were designed to be interactive and practical. The following list describes each one.

1. **Stakeholders' workshop on the MEL of adaptation in the agriculture sector (Phase 2).** This workshop was held on October 25, 2023, and brought together participants from diverse backgrounds, including government institutions, UN agencies, NGOs, and the Private sector (see Appendix A).
2. **Project launching workshop on the MEL of adaptation in the human settlements and transport sectors (Phase 2).** This workshop was held on December 13, 2023, at Ubumwe Grande Hotel. It aimed to launch a project on the MEL of adaptation in the human settlements and transport sectors. It brought together a diverse group of participants, all involved in the human settlements and transport sectors (see Appendix A) to endorse the project's methodology and set anticipated outcomes.
3. **Workshop on the MEL of adaptation capacity-building sessions in the human settlements and transport sectors (Phase 2).** The workshop was held at Grande Ubumwe Hotel on January 25 and 26, 2024. The workshop brought together various stakeholders from government institutions, NGOs, and the private sector (see Appendix A).
4. **Workshop on stakeholders' engagement on environment and natural resources-management information system data collection and NDC reporting:** This was a four-day training (May 28 to May 31, 2024) organized by MoE to update the members of the Measurement, Reporting, and Verification MEL Technical Working Committee on the current progress of NDC interventions. It was facilitated by a MEL adaptation consultant.
5. **Stakeholder workshop to disseminate learning:** The purpose of this workshop, held on August 2, 2024, was to share results from the project, including key lessons to inform MEL in other sectors (see Appendix A).

2.2.1 Peer Exchange and Meetings

The peer exchange and meetings facilitated knowledge sharing and collaboration among stakeholders and with other countries. This package included various activities:

- Beyond formal workshops, **side meetings** were held with some stakeholders that attended the workshops.
- **Interviews** with more than 60 respondents from various organizations, including government institutions such as the Ministry of Infrastructure (MININFRA), the Rwanda Housing Authority, the Rwanda Transport Development Agency (RTDA), the Rwanda Water Resources Board; development partners such as the European Union (EU) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); and NGOs and private sector entities.
- **Field visits** to various sites in different districts (Karongi, Rutsiro, Rubavu, Musanze, Gakenke, and Rulindo) were conducted. (Appendix B provides a map showing more details about certain environmental and infrastructural features in the districts visited during the fieldwork.) The field visits were an opportunity to engage with residents of clustered settlements to collect firsthand accounts of how settlement patterns and water and

sanitation improvement have evolved, the challenges and benefits the residents have experienced due to these changes, and their perceptions of improved living conditions over time. The field visits also helped provide more insights into the planning, implementation, and outcomes of adaptation strategies in terms of reduction of length of roads vulnerable to floods and landslides.

- **Peer learning events:**

- Dr. Aime Tsinda, a MEL embedded consultant within MoE, made an online contribution to the LIFE AR Peer Learning Workshop, organized by IISD and held from October 17 to 19, 2023. The presentation discussed Rwanda's MEL framework in the agriculture sector. It highlighted the challenges faced during implementation and the lessons learned. It also acknowledged that meeting short-term targets does not always result in long-term outcomes. This is evident from the increase in high-erosion areas, despite achieving erosion control targets. Furthermore, the presentation emphasized that effective strategies in agriculture may not be applicable to other sectors due to unique sectoral needs and data availability.
- Dr. Aime Tsinda, along with Brenda Ntaganda, a MEL assistant, participated in NAP EXPO 2024, held in Dhaka, Bangladesh from April 22 to 25, 2024. This presentation focused on Rwanda's experience in developing and implementing its MEL system for adaptation. It highlighted the key measures taken by Rwanda to establish the MEL system for the NAP process, discussed the current state of the MEL system in Rwanda, and addressed the primary challenges faced and overcome by the country.
- Dr. Aime Tsinda contributed to a peer learning session that focused on sectoral MEL for the Andes Resilientes project, which supports three Latin American countries: Bolivia, Ecuador, and Peru. The session showcased Rwanda's experience in developing and implementing its MEL system for adaptation in the agriculture, human settlement, and transport sectors. This session took place online on May 3, 2024.

2.2.2 Learning, Communications, and Information Sharing

This package aimed at disseminating knowledge and fostering continuous learning. It encompassed learning products developed through the work program, which include the two briefing notes that are publicly available through NAP-GN's website. The final report on the work program, the case study report, and workshop reports will be available on NAP-GN and MoE's websites. In addition, the briefing notes, presentations, and training materials were made available to the stakeholders who attended workshops.

The training materials focused on the aims and objectives of MEL of adaptation in the human settlements and transport sectors, national policy frameworks for adaptation, international policy frameworks for adaptation, the proposed system for tracking NDC indicators, institutional arrangements, and reporting and communications.

Each of these elements was meticulously planned and executed to ensure the successful delivery of the work program, contributing to its overall objectives and impact. The details of the main activities and deliverables of the project are summarised in Table 1 and described in this section.

Table 1. Completed activities and actual deliverables

Timelines	Activities	Deliverables
September 2023	<ul style="list-style-type: none"> Briefing note on the assessment of the adaptation outcomes of the three NDC actions in the agriculture sector not explored in the first program of work. Concept note on planning for meeting of MEL oversight body (e.g., membership, terms of reference, agenda). 	<ul style="list-style-type: none"> Briefing note published on NAP Global Network Concept note on planning for the meeting of the MEL oversight body
October 2023	<ul style="list-style-type: none"> Draft technical report on the assessment of progress and outcomes of three adaptation actions at the local level in the agriculture sector. This included case studies and recommendations for the alignment of data and learning on adaptation in the agriculture sector with the update of Rwanda's climate and vulnerability risk assessment. Report on stakeholder workshop to collect information, and validation of the draft technical report. 	<ul style="list-style-type: none"> Technical report Workshop report
November 2023	<ul style="list-style-type: none"> Briefing note on the human settlements and transport sectors that includes the assessment of indicators, data sources, and baseline information for MEL in the human settlements and transport sectors (including gender assessment) as well as strategies for filling any gaps. The assessment will consider the baseline study conducted in 2021 on NDC adaptation indicators. Meeting report from the MEL oversight body. 	<ul style="list-style-type: none"> Draft briefing note
December 2023	<ul style="list-style-type: none"> Report on the project launching workshop in the human settlements and transport sectors that includes approval of the project approach and expected outcomes and a review of the assessment of data sources and baseline information. Briefing note and spreadsheet tool on the initial tracking of the indicators through the collection, organization, and management of transport and human settlements data in the MEL system. 	<ul style="list-style-type: none"> Templates, data spreadsheet Draft briefing note
January 2024	<ul style="list-style-type: none"> Report on the capacity-building session and training materials for stakeholders in the human settlements and transport sectors, including a report and comments on the validation workshop. This should include an overview of the MEL of adaptation, collecting and inputting data, initial data in the transport and human settlements sectors, and using the MEL system for domestic reporting, international reporting, and the policy and planning process to improve the mainstreaming of adaptation into sector plans and the implementation of adaptation actions. 	<ul style="list-style-type: none"> Workshop report

Timelines	Activities	Deliverables
February 2024	<ul style="list-style-type: none"> • Draft technical report on tracking progress on adaptation MEL system in the human settlements and transport sectors. 	<ul style="list-style-type: none"> • Presentation for peer learning event
March 2024	<ul style="list-style-type: none"> • Concept note on assessing adaptation outcomes in the human settlements and transport sectors that provides a framework for undertaking assessment. • Final technical report on tracking progress on adaptation MEL system in the human settlements and transport sectors. • Meeting report from the MEL oversight body. 	<ul style="list-style-type: none"> • Draft briefing note • Training materials and workshop report
April 2024	<ul style="list-style-type: none"> • Draft technical report that includes: <ul style="list-style-type: none"> ○ Assessment of adaptation outcomes in the human settlements and transport sectors. ○ Proposals for sharing information on adaptation outcomes in three sectors (with applicability for other adaptation NDC sectors). 	<ul style="list-style-type: none"> • Revised briefing notes
May 2024	<ul style="list-style-type: none"> • Final technical report that includes: <ul style="list-style-type: none"> ○ Assessment of adaptation outcomes in human settlements and transport. ○ Sharing information on adaptation outcomes (with applicability for other NDC sectors). ○ Learning product (draft and final) that includes lessons learned on how indicators meet the government's aims and objectives, including recommendations. 	<ul style="list-style-type: none"> • Draft case study report • Penultimate versions of three briefing notes
June 2024	<ul style="list-style-type: none"> • Final project report that includes: <ul style="list-style-type: none"> ○ Progress report on achievements (implementation status) against human settlements and transport adaptation indicators. ○ Strategic recommendations on the effective operationalization of adaptation MEL. ○ Learning materials to fill capacity gaps. 	<ul style="list-style-type: none"> • Workshop report • Draft of fourth briefing note
July 2024	<ul style="list-style-type: none"> • Revise the final project report. • Meeting report from the MEL oversight body. 	<ul style="list-style-type: none"> • Final project report • Finalization of four briefing notes or technical reports
August 2024	<ul style="list-style-type: none"> • Workshop and report on the stakeholder workshop to disseminate learning results from the project, including key learning to inform MEL in other sectors. • Finalization of all reports • Handover report on data and reports to the MoE. 	<ul style="list-style-type: none"> • Workshop report • Final project report • Publication of all remaining deliverables (e.g. briefing notes or technical reports)

Source: Authors, based on the IISD statement of work for MEL phase 2, 2023.

3. Tracking of the NDC Adaptation Indicators in the Human Settlements and Transport Sectors: Key achievements

This section focuses on tracking the seven adaptation NDC indicators in the human settlements and transport sectors. It describes the progress made and key activities implemented. The purpose was to monitor these indicators and evaluate data accessibility and the government’s ability to utilize this data. The goal was to gain insights into adaptation progress in the human settlements and transport sectors, and report on it. The briefing note *Rwanda’s Climate Adaptation Monitoring, Evaluation, and Learning System in the Human Settlements and Transport Sectors: Data and information collection and management* provides further explanation of these indicators (MoE, 2024, pp. 4–5).

3.1 Progress Toward NDC 2025 and 2030 Targets

The tracking of the seven adaptation NDC indicators in the sectors of human settlements and transport provided an initial assessment of the implementation of priority adaptation actions set out in the 2020 NDC. Based on this tracking, the indicators were grouped into three categories (human settlements, water and sanitation, and transport) based on achievements to date and forecasted trend analysis.

Table 2. Urban informal settlements

Indicator	Baseline (2019–20)	Target 2025	Target 2030	Actual status (2020–21)	Progress
Percentage of urban population living in informal settlements	61.3% (EICV5)*	Reduce to 47%	Reduce to 35%	61.3% (EICV5)	No reduction observed; efforts need to be intensified

*EICV5 = fifth Integrated Household Living Conditions Survey (National Institute of Statistics of Rwanda [NISR], 2018)

Source: Ministry of Disaster Management, 2015; Ministry of Infrastructure, 2017; NISR, 2018; MoE, 2020; Cook et al., 2020; Gashugi et al., 2021.

Table 3. Rural planned settlements

Indicator	Baseline (2019–20)	Target 2025	Target 2030	Actual status (2020–21)	Progress
Percentage of rural households settled in integrated planned green rural settlements	61.7% (EICV5)	Increase to 80%	N/A	65.4% (RPHC5*)	Showing improvement; additional progress needed to meet 2025 target

*RPHC5 = fifth Rwanda Population and Health Census (NISR, 2023)

Source: NISR, 2018; MoE, 2020; Cook et al., 2020; Gashugi et al., 2021; NISR, 2023.

Table 4. Average share of built-up area of cities that is open and green space for public use

Indicator	Baseline	Target 2025	Target 2030	Actual status	Progress
Average share of built-up area that is open and green space for public use	City of Kigali had >30% public space (2018)	Sustain 30% with qualitative maintenance	N/A	34% (including forests and wetlands), 19.89% (excluding forests and wetlands)	Falling short without including forests and wetlands; enhanced urban planning required

Source: MININFRA, 2021b; MoE, 2020; Cook et al., 2020; Gashugi et al., 2021.

Table 5. Water and sanitation services

Indicator	Baseline (2017)	Target 2025	Target 2030	Actual status (2020–21)	Progress
Percentage of households using an improved water source	87.4%	100% by 2030	N/A	89.2% (EICV6*), 80% (DHS**), 82.3% (RPHC5)	Incremental improvements noted; still short of target
Percentage of households accessing basic sanitation facilities	86.2%	100% by 2030	100% by 2030	89.6% (EICV6), 72% (DHS), 92% (both shared and unshared facilities), 72.1% (not shared) (RPHC5)	Mixed results; significant progress needed to meet target

*EICV6 = sixth Integrated Household Living Conditions Survey (NISR, 2021)

**DHS = Demographic and Health Survey (NISR, MoH & ICF, 2021)

Source: NISR, 2018; MoE, 2020; Cook et al., 2020; Gashugi et al., 2021; NISR, 2021; NISR, 2023; NISR, MoH & ICF, 2021.

Table 6. Percentage of urban population in areas covered by master plans with stormwater considerations

Indicator	Baseline (2016)	Target 2025	Target 2030	Actual status (2020–21)	Progress
Percentage of urban population in areas covered by master plans with stormwater considerations	<20%	Increase to 90%	N/A	Implemented in 16 districts; seven more in progress	Significant progress; continued efforts required

Source: MoE, 2020; Cook et al., 2020; Gashugi et al., 2021; authors.

Table 7. Environmental and engineering guidelines for climate-resilient road infrastructure

Indicator	Baseline	Target 2025	Target 2030	Actual status	Progress
Development of guidelines for climate-resilient road infrastructure	Draft manuals without climate change considerations	Develop comprehensive guidelines	N/A	Numerous guidelines exist	Guidelines developed; challenges in implementation remain

Source: MoE, 2020; Cook et al., 2020; Gashugi et al., 2021; RTDA, 2021a.

Table 8. Reduction of length of road vulnerable to floods and landslides

Indicator	Baseline (2015)	Target 2025	Target 2030	Actual status (2022)	Progress
Length of roads vulnerable to floods and landslides	979 km	To be determined	N/A	Vulnerability assessment confirmed 66% of GIS*-mapped vulnerabilities at moderate to high levels	Vulnerability assessment in progress; specific reduction targets needed

* GIS = geographic information system

Source: MoE, 2020; Cook et al., 2020; Gashugi et al., 2021; RTDA, 2021b.

Table 9. Number of passengers using public transport each year

Indicator	Baseline (2017)	Target 2025	Target 2030	Actual Status	Progress
Implementation of scheduled bus routes and related infrastructure	Urban roads: 421.4 km, feeder roads: 2,060 km	Establish scheduled bus routes, construct urban roads, rehabilitate rural roads, operationalize smart ticketing system	N/A	E-ticketing systems in place, dedicated bus lanes implemented, scheduled bus routes expanded to 14,475 km by 2022–23	Infrastructure improvements noted; further expansion needed

Source: MoE, 2020; Cook et al., 2020; Gashugi et al., 2021; Rwanda Utilities Regulatory Authority [RURA], 2022.

The presentation above provides a concise summary of Rwanda's progress towards its NDC targets in the human settlement and transport sectors. It highlights both achievements and areas requiring further attention. Each indicator is further discussed in the subsequent sub-sections.

3.2 Percentage of the Urban Population Living in Informal Settlements and Percentage of the Rural Population Living in Clustered Settlements

The indicators regarding the percentage of the urban population living in informal settlements and the percentage of the rural population living in clustered settlements are pivotal for tackling essential development challenges within urban and rural settings. They align with established baselines and targets, which highlights their relevance in guiding sustainable development efforts. This alignment supports a strategic and evidence-based approach to improving living conditions and planning interventions, which in turn enhances the effectiveness of policies and programs that address the complexities of urbanization and rural development.

Rwanda’s rapid urbanization, linked to economic growth, is central to Vision 2050’s ambitious goals. Vision 2050 is Rwanda’s long-term development framework designed to transform the country into a high-income, knowledge-based economy by 2050. Launched in 2020, it builds on the achievements of Vision 2020 and aims to accelerate development by promoting sustainable growth, reducing poverty, and enhancing citizens’ well-being. This vision aims to boost urbanization and enhance citizens’ livelihoods through improved settlement strategies, such as building Integrated Development Programme model villages, curbing unplanned settlements, and fostering urban infrastructure development alongside biodiversity conservation to mitigate climate change impacts.

However, a significant proportion of the urban population (61.3%) still resides in unplanned settlements, according to EICV5, with a government target to reduce this to 47% by 2025 (NISR, 2018). Despite the lack of updated figures in EICV6, RPHC5 of 2022 provides insights into housing trends, showing a mix of planned and unplanned urban and rural dwellings (NISR, 2023). The latest data from RPHC5 indicates a prevalence of planned rural settlements in urban areas (42%), spontaneous or squatter housing (25%), and planned urban housing (24%) (NISR, 2023). Isolated housing forms a smaller portion (5%), with other housing types comprising less than 5% (NISR, 2023). In contrast, rural areas are characterized predominantly by planned rural settlements (65.4%) and isolated housing (19%), with other housing types comprising less than 7% (NISR, 2023) (see Table 10).

Table 10. Housing types in urban and rural areas

Housing type	Urban areas (%)	Rural areas (%)
Planned rural settlements	42%	65.4%
Spontaneous or squatter housing	25%	-
Planned urban housing	24%	-
Isolated housing	5%	19%
Other housing types	<5%	<7%

Source: NISR, 2023.

The increase in rural households living in planned settlements from 61.7% to 65.4%, with a goal of reaching 80% by 2025, signifies a strategic shift towards sustainable living in both urban and rural settings. Integrated rural settlements have notably improved the lives of rural Rwandans by providing essential services such as electricity and water, reducing vulnerability to natural disasters, and improving access to public services such as schools and health centres. They also foster optimism about future livelihood improvements, including more employment opportunities and access to financial services and amenities.

Table 11. Status of urban and rural settlements

Indicator	Baseline (2019–20)	Target 2025	Actual status (2022)	Progress
Percentage of urban population living in informal settlements	61.3% (EICV5)	Reduce to 47%	61.3% (EICV5)	No reduction observed; efforts need to be intensified
Percentage of rural households in planned green settlements	61.7% (EICV5)	Increase to 80%	65.4% (RPHC5)	Showing improvement; additional progress needed

Source: NISR, 2018; NISR, 2023.

Rwanda’s National Urbanization Policy was initially created in 2015. Its revision was completed in 2022 and is now awaiting approval. This review focused on updating the policy to reflect current urbanization trends, challenges, and opportunities, including climate change adaptation and mitigation strategies. The policy is structured around four main pillars: coordination, densification, livability, and economic growth. Similarly, the National Strategy for Sites and Services, which aims to provide adequately serviced land for housing, environmental sustainability, and climate resilience, is also awaiting approval.

Despite these significant achievements, the Rwandan urbanization and rural settlement sector faces challenges, including budget limitations, limited private-sector engagement, local government capacity constraints, complex procurement processes with appeals and risk projections that delay projects, and a lack of comprehensive urban data. To address the data gap, the integration of the Spatial Development Framework (SDF) and the Urban Dynamic Map (UDM) in five cities was launched at the Africa Smart Cities Leadership Summit on September 7, 2023.

The SDF and UDM are essential tools for guiding Rwanda’s urban planning and development. They promote sustainable growth and efficient land use in response to the country’s rapid urbanization. The SDF offers a long-term vision for land use, infrastructure, and environmental management, while the UDM tracks and monitors the urbanization process. Together, they support inclusive and environmentally sustainable growth that aligns with Rwanda’s long-term development goals. This initiative includes the training of 183 staff members and efforts to extend the UDM to 22 more districts.

However, the UDM system faces challenges in accurately tracking informal settlements. In rural areas, the lack of a specialized management information system leads to dependence on sole data from the NISR. This dependence underscores a deficiency in thorough monitoring and management of both urban and rural developmental processes, which justifies the necessity for improved data collection and monitoring strategies to tackle the complexities associated with informal settlements and rural development more effectively.

3.3 Average Share of the Built-up Area of Cities that is Open and Green Space for Public Use for All

The indicator “Average share of the built-up area of cities that is open and green space for public use for all” aligns with Sustainable Development Goal (SDG) 11, which aims to make cities and human settlements inclusive, safe, resilient, and sustainable. This indicator assesses the availability of public green spaces in urban settings, which are crucial for sustainable urban development. Understanding the definition of public space in the Rwandan context is crucial for accurately gauging this indicator, as it determines whether these spaces are genuinely accessible to all segments of the population. This definition, rooted in both legal frameworks and the physical delineation of space, ensures that the indicator reflects the realities of Rwanda’s urban landscape, including cultural norms, governance structures, and local spatial planning practices.

Tables 12, 13, and 14 present the critical aspects of the “Average share of the built-up area of cities that is open and green space for public use for all” indicator, which align with SDG 11 and the specific context of Rwanda.

Table 12 outlines the fundamental aspects of the indicator measuring the average share of built-up areas within cities that consists of open and green space for public use for all. This indicator is crucial for assessing the availability and accessibility of green spaces in urban settings. Public spaces are defined as areas that are publicly owned or used by the public without intent to generate profit. They are open and accessible to all segments of the population, fostering inclusivity. The definition of public space in the Rwandan context takes into consideration the unique socio-economic, cultural, and physical conditions of Rwanda. This involves recognizing spaces that, while public, might have specific local uses or characteristics and are therefore not counted in this indicator, including vacant land and public facilities that are not open to the general public.

Table 12. Relevance of built-up area of cities and green space for public use for all

Aspect	Description
Indicator	Average share of the built-up area of cities that is open and green space for public use for all
Alignment with SDGs	SDG 11: Making cities and human settlements inclusive, safe, resilient, and sustainable
Importance	Critical for assessing the availability of public green spaces in urban settings
Definition	Public spaces are defined as areas publicly owned or used, accessible and enjoyable by all without charge or intent to generate profit
Contextualization for Rwanda	Adaptation of the public space definition to fit unique physical, cultural, and socio-economic contexts
Benefits of open and public space (OPS)	Enhances quality of life, reduces crime, fosters inclusivity; contributes to social, economic, and environmental dimensions
Monitoring targets	Ensure universal access to safe, inclusive, and accessible green and public spaces, particularly for women and children, the elderly, and people with disabilities by 2030 (SDG 11.7.1)

Aspect	Description
Exclusions	Privately owned spaces, vacant lands, and public facilities not open to the general public
Rwanda National Land Use Guidelines	Public spaces are accessible and enjoyable by all for free, without a profit motive; includes streets, sidewalks, bike lanes, parks, squares, and recreational areas

Source: Authors.

Table 13 presents the ratio of OPS to the built-up area in selected cities and towns in Rwanda. The key insights from the data show that Kigali City has a built-up area of 18,413.27 hectares, with 3,428.8 hectares dedicated to open and public space. This means that 18.62% of the built-up area in Kigali is dedicated to public space.

Huye has the highest percentage of public space relative to its built-up area, with 49.31% of its built-up space dedicated to OPS, making it an outlier compared to other cities. This could be due to the city’s urban planning focus or available land for public use. Kayonza has the lowest percentage of public space, with only 10.79% of its built-up area dedicated to OPS. This suggests a potential lack of accessible public green spaces, highlighting the need for urban development strategies to address this gap. Table 13 reveals that public space varies significantly across Rwandan cities, which indicates areas where urban planning efforts may need to prioritize increasing the availability of green space.

Table 13. Ratio of OPS versus built-up area in selected cities and towns

City/town	City area (ha)	Built-up area (ha)	OPS area (ha)	OPS to built-up (%)
Kigali City	72,986.51	18,413.27	3,428.8	18.62
Muhanga	6,117.66	1,119.59	195.62	17.47
Huye	4,279	1,403.28	691.99	49.31
Rusizi	4,969.33	708.13	144.69	20.43
Rubavu	8,852.51	18,14.57	416.59	22.96
Musanze	8,377.59	1,314.61	202.7	15.42
Nyagatare	12,138.43	733.52	139.27	18.99
Bugesera	7,318.16	1,163.34	134.72	11.58
Karongi	4,428.58	829.44	158.91	19.16
Rwamagana	5,290.52	1,129.91	189.97	16.81
Kayonza	3,167.51	359.37	38.77	10.79
Gicumbi	111,85.49	507.24	124	24.45
Total	149,111.29	29,496.27	5866.03	19.89

Source: MININFRA, 2021b.

Table 14 provides a comparison between the total OPS with and without the inclusion of wetlands and woodlands, which are significant components of Rwanda's natural landscapes. The key insights from the data show that Kigali City has the largest built-up area at 18,413.27 ha. When wetlands and woodlands are excluded, OPS cover 18.62% of the built-up area. When they are included, OPS rise to 40.56%, indicating that wetlands and woodlands have a significant impact on the total OPS coverage.

Muhanga and Huye show a considerable increase in the percentage of OPS when wetlands and woodlands are included, rising from 17.47% to 22.98% and 49.31% to 54.86%, respectively. Rubavu, Musanze, Nyagatare, and Karongi show no change in OPS percentages, meaning that wetlands and woodlands were either not present or not considered for inclusion in these towns' OPS areas.

The total built-up area across all listed cities and towns is 29,496.27 ha. Without including wetlands and woodlands, 19.89% of this built-up area is classified as OPS. Including wetlands and woodlands increases this percentage to 34.44%, highlighting the importance of these natural features in defining open public spaces. The data shown in Table 14 thus underscores the critical role that wetlands and woodlands play in enhancing urban green spaces and the potential ecological benefits of including them in urban planning.

Table 14. Inclusion vs exclusion of urban wetlands and woodland in OPS

Cities/towns	Built-up area (ha)	OPS (wetlands and woodlands excluded) (ha)	OPS (wetlands and woodlands included) (ha)	% OPS (wetlands and woodlands excluded)	% OPS (wetlands and woodlands included)
Kigali City	18,413.27	3,428.8	7,468.73	18.62	40.56
Muhanga	1,119.59	195.62	257.29	17.47	22.98
Huye	1,403.28	691.99	769.83	49.31	54.86
Rusizi	708.13	144.69	152.75	20.43	21.57
Rubavu	1,814.57	416.59	416.59	22.96	22.96
Musanze	1,314.61	202.7	202.70	15.42	15.42
Nyagatare	733.52	139.27	140.92	18.99	19.21
Bugesera	1,163.34	134.72	236.90	11.58	20.36
Karongi	829.44	158.91	158.91	19.16	19.16
Rwamagana	1,129.91	189.97	189.97	16.81	16.81
Kayonza	359.37	38.77	38.77	10.79	10.79
Gicumbi	507.24	124	124.00	24.45	24.45
Total	29,496.27	5,866.03	10,157.35	19.89	34.44

Source: MININFRA, 2021e.

3.4 Access to Water and Sanitation Services

The indicator “Access to water and sanitation services” is crucial for assessing the availability of fundamental services to a population. The provided baselines and targets may not fully align with the definitions of the Joint Monitoring Programme for water supply and sanitation, which encompasses a broader range of criteria including the quality, accessibility, and reliability of these services. This highlights the need for a more comprehensive approach to setting baselines and targets to accurately reflect and address the needs of the population.

The data from EICV6, DHS, and RPHC5 show varying percentages of households with access to improved water sources due to differences in statistical methodologies. EICV6 reports 89.2% access (NISR, 2021), DHS reports 80% (NISR, MoH & ICF, 2021), and RPHC5 reports 82.3% (NISR, 2023) (see Table 15). Urban households have significantly better access compared to rural households.

Table 15. Access to water services

Source	Year	% households with access to improved water sources	Urban households (%)	Rural households (%)
EICV6	2019–20	89.2%	-	-
DHS	2019–20	80%	96%	77%
RPHC5	2022	82.3%	-	-

Source: NISR, 2021; NISR, 2023; NISR, MoH & ICF, 2021.

EICV6 (NISR, 2021) reports that 89.6% of households have access to improved sanitation facilities, while RPHC5 reports 92% (NISR, 2023). DHS indicates that only 72% have access to improved sanitation, with significant disparities between urban (56.4%) and rural areas (78%) (NISR, MoH & ICF, 2021). See Table 16.

Table 16. Access to sanitation services

Source	Year	% households with access to improved sanitation facilities	% households with basic sanitation (Not shared)	Urban households (%)	Rural households (%)
EICV6	2019–20	89.6%	72.2%	-	-
DHS	2019–20	72%	-	56.4%	78%
RPHC5	2022	92%	72.1%	-	-

Source: NISR, 2021; NISR, 2023; NISR, MoH & ICF, 2021.

Significant achievements have been made in extending and upgrading water supply networks, increasing water production capacity, connecting new customers, and constructing sanitation facilities. However, challenges such as non-functional systems, rising non-revenue water, and disparities between urban and rural areas persist.

3.4.1 Key Achievements in Water Supply and Sanitation (2020–2023)

Significant progress has been made in the realm of water supply and sanitation services over the past three years. During the period of 2020–2021, a total of 1,074.4 kilometres of water supply networks were constructed, extended, and upgraded, thereby providing access for approximately 810,659 individuals. The daily water production capacity increased from 267,660 cubic metres to 322,852 cubic metres per day. Furthermore, an additional 22,346 new urban customers were connected to the water supply networks, giving 89.6% of households access to improved sanitation facilities.

The subsequent year, 2021–2022, saw the continuation of these efforts, with the construction, rehabilitation, and extension of 888.63 kilometres of water supply networks, benefiting 728,739 individuals. Moreover, 36 non-functional rural water supply systems were rehabilitated, and the completion of 200 boreholes was achieved. Progress in sanitation was also noted, highlighted by the construction of 14 permanent toilets and sanitation facilities in various locations. A significant milestone was reached with the initiation of Phase 1 of the Kigali Centralized Sewerage System.

In the period of 2022–2023, the implementation of climate-resilient water supply projects commenced, supported by the Global Climate Fund, to ensure that future water systems remain robust in the face of environmental challenges.

3.4.2 Challenges and Proposed Solutions

Despite these achievements, the sector continues to confront several challenges. One of the primary issues is the existence of non-functional water supply systems, primarily attributable to aging infrastructure. In response to this challenge, rehabilitation and upgrading efforts have been prioritized to restore service efficiency.

Another pressing challenge is the increase in non-revenue water, which refers to water that is produced but not billed, due to losses or theft. Proposed solutions include the implementation of the Non-Revenue Water Strategy, alongside the introduction of smart billing systems, enhanced water management systems, and the installation of pressure meters to mitigate non-revenue water levels.

In urban areas, the limited access to improved sanitation persists as a significant concern. To address this, awareness campaigns are being conducted to promote the construction of improved toilets, particularly in densely populated settings.

Financial constraints affecting the operation and maintenance of water and sanitation infrastructure represent another barrier to progress. Strategies aimed at aligning service costs with available financial resources and securing additional funding for climate-resilient projects are deemed critical for overcoming this issue.

3.5 Percentage of Urban Population in Areas Covered by Master Plans with Storm Water Considerations

The indicator “Percentage of urban population in areas covered by master plans with stormwater considerations” is crucial for urban planning and environmental management. Its efficacy is somewhat undermined by a disconnect between its secondary target—focusing on regular maintenance and upgrading of road and drainage infrastructure—and its established baseline. This gap suggests that while the initial measure provides insight into the extent to which urban populations are included in planning processes that consider stormwater management, the follow-up actions intended to sustain and improve these infrastructures do not directly correlate with the baseline’s parameters.

Rwanda’s Urban Development Strategy, exemplified by Kigali and other emerging cities, is characterized by the implementation of comprehensive master plans. These plans are inclusive of forward-thinking approaches to urban drainage systems, the inclusion of green spaces, and various infrastructural adaptations aimed at effective stormwater management. This situation is a testament to Rwanda’s commitment to environmental sustainability and resilience in the face of climate change.

As of now, master plans incorporating stormwater management have been implemented in 16 districts, including the City of Kigali, out of a total of 30 districts (including the three districts of Kigali) (see Table 17). Further, seven other districts are in the process of formulating their master plans. This illustrates a proactive stance in tackling urban stormwater challenges, addressing critical issues such as flooding, water pollution, and the efficient utilization of stormwater resources. The goal is to ensure that urban development not only aligns with sustainability principles but is also flexible enough to adapt to evolving climate conditions. It also points to a concerted national effort to embed stormwater management into the fabric of urban planning, which underscores Rwanda’s dedication to bolstering urban resilience and sustainability. This highlights the critical role of thorough planning in addressing stormwater impacts and enhancing the overall quality of life in urban settings.

Table 17. Implementation of master plans with stormwater considerations

Indicator	Total # of districts	# of districts with implemented master plans	# of districts formulating master plans
Districts with master plans including stormwater management	30	16	7
City of Kigali (three districts)	3	3	0

Source: Authors.

3.6 Environmental and Engineering Guidelines Developed for Climate-Resilient Road Infrastructure

The indicator “Environmental and engineering guidelines developed for climate-resilient road infrastructure” shows a misalignment with the provided baselines and targets. This divergence indicates a disconnect between the conceptual framework of the indicator, which aims to establish standards for climate-resilient road infrastructure, and the specific benchmarks set to measure progress. If these benchmarks do not adequately reflect the complexities of developing climate-resilient road infrastructure, the indicator’s effectiveness in tracking relevant progress or outcomes is compromised.

In Rwanda, climate-resilient road infrastructure development adheres to a comprehensive set of environmental guidelines to ensure sustainability, resilience to climate change, and minimal environmental impact. These guidelines include various frameworks and assessments, as detailed in Table 18.

Table 18. Environmental and engineering guidelines for climate-resilient road infrastructure

Guideline or framework	Description
Strategic Environmental Assessment (SEA)	Evaluates the environmental impacts of proposed policies, plans, and programs.
Environmental and Social Management Framework (ESMF)	Provides guidelines for managing environmental and social risks in development projects.
Environmental and Social Management System (ESMS)	A systematic approach to managing environmental and social performance in infrastructure projects.
Resettlement Policy Framework	Outlines procedures for addressing resettlement impacts in project areas.
Full Environmental and Social Impact Assessment (ESIA)	Comprehensive evaluation of potential environmental and social impacts of projects.
Environmental Audit (EA)	Reviews and evaluates the environmental performance of projects.
Environmental Security Assessment (ESA)	Assesses potential environmental security risks and mitigation measures.

Source: Authors.

These documents collectively form a holistic approach to road infrastructure development that meets Rwanda’s transportation needs sustainably and resiliently. This integration of environmental considerations with engineering expertise highlights Rwanda’s commitment to sustainable development, climate change mitigation, and adaptation.

The transport sector in Rwanda, guided by these frameworks, has developed specific guidelines to ensure environmental and social protection. The guidelines are crucial for managing the significant negative impacts of transport infrastructure development on communities and the environment. To comply with international and national standards, the RTDA formulated a comprehensive Environmental and Social Procedures Manual for infrastructure projects, including road construction. This manual, aligned with national laws, policies, and development partner requirements, provides a unified framework for assessing and managing environmental and social risks in road construction projects.

Despite these efforts, challenges remain, including poor-quality environmental impact assessments, ineffective integration and implementation of environmental principles, the need for capacity building, insufficient investment in climate-resilient infrastructure, and limited collaboration among stakeholders. Nevertheless, Rwanda’s adherence to these guidelines showcases a progressive stance towards sustainable infrastructure development and offers valuable insights for other nations facing similar challenges.

The development of climate-resilient road infrastructure in Rwanda is supported by comprehensive environmental and engineering guidelines. These guidelines ensure that road infrastructure projects are sustainable, resilient to climate change, and minimally impactful on the environment (see Table 19). Despite challenges such as poor quality of environmental impact assessments and insufficient investment, Rwanda’s commitment to these guidelines demonstrates a progressive approach to infrastructure development (see Table 20). The implementation of the Road Asset Management System by RTDA is a significant step towards efficient management and maintenance of road infrastructure, contributing to the sustainability and resilience of Rwanda’s transport network (see Table 21).

Table 19. Key environmental considerations in road infrastructure development

Consideration	Description
Sustainable development	Ensuring that road infrastructure development aligns with sustainable development goals.
Climate change mitigation	Implementing measures to reduce greenhouse gas emissions and other climate impacts.
Climate change adaptation	Enhancing infrastructure resilience to climate variability and change.
Environmental conservation	Protecting natural habitats, biodiversity, and ecosystems.
Social protection	Mitigating negative social impacts, including displacement and health risks.

Source: Authors.

Table 20. Challenges and solutions in implementing environmental guidelines

Challenges	Solutions
Poor quality of environmental impact assessments	Improve the training and capacity of professionals conducting impact assessments.
Ineffective integration of environmental principles	Enhance collaboration between government agencies, development partners, and stakeholders.
Insufficient investment in climate-resilient infrastructure	Secure additional funding and invest in innovative, resilient infrastructure projects.
Limited collaboration among stakeholders	Establish forums for regular communication and coordination among all parties involved.

Source: Authors.

Table 21. Road Asset Management System overview

Component	Description
Management information system	Systematic tracking of road conditions and infrastructure performance.
Data analysis tools	Tools for analyzing data to prioritize maintenance and repairs.
Resource allocation	Efficient allocation of resources for road development and upkeep.
Sustainability and efficiency	Enhancing the sustainability and efficiency of the road network.

Source: Authors.

3.7 Reduction of the Length of Roads Vulnerable to Floods and Landslides

Road networks facilitate economic activities, access to services (commerce, tourism, education, health), and emergency response. Floods, landslides, erosion, and other extreme weather events can erode, destroy, or obstruct roads, impacting socio-economic activities. In total, Rwanda has 37,898 km of roads, of which 16,437 km are classified roads. Classified roads refer to those that are formally designated and managed by the government or relevant authorities, often categorized based on their function, such as national, district, or feeder roads. Rwanda’s road network density stands at 1.44 km/km², reflecting the accessibility of the transportation system across the country.

The indicator “Reduction of the length of roads vulnerable to floods and landslides” is significant for evaluating the resilience of transportation infrastructure against environmental hazards such as floods and landslides. Its importance lies in providing insights into the effectiveness of measures taken to enhance infrastructure durability and safety in the face of increasing climate-related challenges.

However, the absence of a specific target for this indicator presents a significant challenge in tracking and quantifying progress. Without a defined target, it becomes difficult to measure the extent of improvement. This gap underscores the need to establish clear, measurable targets aligned with this indicator, which are essential for effective monitoring and evaluation and for the strategic planning of interventions to increase the resilience of road infrastructure in the face of climate change.

Nonetheless, Rwanda has undertaken significant efforts to minimize the susceptibility of its road networks to climate-induced hazards such as floods and landslides. This approach includes comprehensive assessments, enhancing infrastructure resilience, managing environmental factors, and adopting climate adaptation strategies. As well, Rwanda has worked to integrate disaster risk management into transport infrastructure planning, which is crucial to maintaining socio-economic service provision and avoiding rising costs associated with natural hazards. These initiatives are integral to Rwanda’s overarching strategy for sustainable development and climate resilience, complementing its Vision 2050 and the Strategic Programme for Climate Resilience.

Key remaining challenges include the poor quality of environmental impact assessments, ineffective integration of environmental principles, the need for capacity building, and limited collaboration among stakeholders. These challenges are urgent due to the escalating risks posed by climate change, including floods, landslides, and other natural hazards, which jeopardize the resilience of transport infrastructure.

To address these concerns, a number of strategic initiatives aim to mitigate the vulnerability of roads to floods and landslides (see Table 22). These initiatives align with key national policies, such as Vision 2050 and the Strategic Programme for Climate Resilience, which emphasize the importance of incorporating disaster risk management into transport infrastructure planning. Such integration is essential for maintaining socio-economic service provision and mitigating the rising costs associated with natural hazards.

Table 22. Efforts to reduce the vulnerability of roads to floods and landslides

Category	Description
Strategic programs	Vision 2050, Strategic Programme for Climate Resilience
Disaster risk management	Integrating disaster risk management into transport infrastructure planning is crucial to maintaining socio-economic service provision and avoiding rising costs associated with natural hazards.

Source: Authors.

Table 23 outlines key findings from a vulnerability assessment conducted to evaluate Rwanda’s road network in the context of climate-related hazards. This assessment, which used GIS vulnerability mapping and ground-truthing methods, was conducted by RTDA in 2021. It identified potential hotspots of road vulnerability based on geomorphological, environmental, and socio-economic factors. It confirmed that primary hazards, including erosion, landslides, and flooding, present severe threats, particularly in the Western, Northern, and Southern Provinces, while drought is regarded as a minor threat. Climate projections extending to 2050 indicate that these vulnerabilities will exhibit regional variations, which must influence future assessments and mitigation strategies.

Table 23. Key findings from vulnerability assessment

Findings	Details
Primary hazards	Erosion, landslides, and flooding (severe threats); drought (minor threat)
Regional exposure	Landslides (Western, Northern, and Southern Provinces), erosion (nationwide), flooding (localized), drought (rare)
GIS vulnerability mapping	Identified potential vulnerable hotspots based on road network, geomorphological conditions, environmental factors, and socio-economic conditions.
Ground truthing	Confirmed 66% of GIS-mapped vulnerabilities with moderate to high levels and 98.6% accuracy.
Climate projections	Varied regional impacts up to 2050 will likely influence future vulnerability assessments.

Source: RTDA, 2021b.

As part of efforts to enhance road infrastructure and mitigate vulnerabilities to natural hazards such as landslides and flooding, a Multi-Criteria Analysis (MCA) was conducted to identify key hotspots across Rwanda. The MCA evaluates technical vulnerabilities within road networks by integrating criteria such as geomorphological conditions, environmental factors, and socio-economic impacts.

This analysis highlighted priority areas where infrastructure is particularly vulnerable, especially in the Western, Northern, and Southern Provinces, where risks from landslides and flooding are significant. In contrast, the Eastern Province and Kigali City, while still at risk, show more moderate vulnerabilities.

One primary section identified for pilot implementation is the Muhanga-Ngororero-Kabaya-Mukamira road corridor. This section was selected for its critical significance to the national transport network and its susceptibility to natural hazards. The pilot project will serve as a testing ground for implementing climate-resilient infrastructure measures for future road development initiatives across the country.

The MCA and subsequent pilot implementation will address current vulnerabilities and inform ongoing and future infrastructure projects to ensure that disaster risk management is incorporated into road planning and development processes.

Rwanda's commitment to reducing the vulnerability of its road networks to floods and landslides is evident through its strategic programs and comprehensive assessments. Establishing clear, measurable targets and improving collaboration among stakeholders will be crucial for further enhancing the resilience of road infrastructure against climate-related challenges.

3.8 Number of Passengers Using Public Transport Each Year

The indicator "number of passengers using public transport each year" is misaligned with its provided baseline and targets. The baseline focuses on the total length of urban and feeder roads, and the targets emphasize the establishment of scheduled bus routes, the construction and rehabilitation of urban and rural roads, route franchising,⁴ and the operationalization of a smart ticketing system. These do not directly correspond to the measurement of public transport usage. Consequently, the indicator does not necessarily reflect the improvements in public transport infrastructure and services, but rather provides a general overview of public transport usage.

According to the latest figures from the RURA for October to December 2022, specific data on the number of passengers using public transportation is not available. Instead, information is provided regarding the number of public bus and minibus companies and cooperatives, as well as the seating capacity for public bus services.

In the fourth quarter of 2022, there was a decline in the number of public transport companies and cooperatives holding licenses. In that same quarter, the total number of vehicles operated by these licensed public transport bus and minibus companies and cooperatives saw a slight reduction of 0.2%, dropping from 2,117 in the third quarter of 2022 to 2,113 by the end of the fourth quarter (see Table 24).

⁴ The term "route franchising" refers to a system in which the government or relevant transport authority grants rights to private companies to operate specific public transport routes through a contractual agreement. These companies are responsible for providing transportation services on the assigned routes, often adhering to a schedule and service standards established by the authority. In return, the companies may receive exclusive rights to operate on certain routes or other incentives. Route franchising helps ensure that bus services are consistently available, efficient, and reliable, as private operators are held accountable for maintaining service quality. This system also encourages competition among operators while allowing the government to maintain oversight and regulate the performance of public transport services.

Table 24. Trend of licensed public transport bus operators and fleet

Operators per license category	Q1 2022	Q2 2022	Q3 2022	Q4 2022
Public bus and minibus companies and cooperatives	38	38	44	43
Fleet for public bus and minibus companies and cooperatives	2,135	2,090	2,117	2,113

Source: RURA, 2022.

In the fourth quarter of 2022, the predominant segment of vehicles deployed for public transport bus services were those with a seating capacity ranging from 20 to 30 seats, accounting for 61.3% of the overall seating capacity (see Tables 25 and 26). Alongside minibuses, the public transport system also included buses with seating capacities between 30 and 50 seats and large buses with capacities exceeding 50 seats. These categories of vehicles are essential for meeting the growing public demand for transportation, especially in urban areas. The trends for vehicle deployment over 2022, as illustrated in Table 25, show that while the number of minibuses decreased, the number of buses and large buses slightly increased in the last quarter of the year, reflecting efforts to boost capacity.

Table 25. Seating capacity for public transport bus service

Vehicle type	Seating capacity range	Q2 2022	Q3 2022	Q4 2022
Minibuses	20–30 seats	546	502	398
Buses	30–50 seats	1,194	1,191	1,295
Large buses	>50 seats	350	424	420

Source: RURA, 2022.

The data in Table 25 provides a clear breakdown of the vehicle types and their corresponding seating capacities, offering an in-depth look at how Rwanda's public transport fleet is composed. The decline in minibuses in the fourth quarter, combined with the slight rise in larger buses, signals a shift toward higher-capacity vehicles to cater to increasing demand.

In addition to public transport trends, Table 26 shows the trends in school bus services. The number of licensed school bus companies remained the same between the third and fourth quarters of 2022, though there was a modest 1.9% increase in fleet size and a 2.9% increase in total seating capacity. Notably, 66.5% of the school bus fleet consisted of large buses (with seating capacities greater than 30 seats), highlighting the sector's focus on using high-capacity vehicles to transport students.

Table 26. Trends in licensed school bus companies and fleet

Category	Q3 2022	Q4 2022	% change
Number of licensed school bus companies	Unchanged	Unchanged	0%
Fleet size	161	164	+1.9%
Large buses (>30 seats)	66.5%	66.5%	0%
Total seating capacity	6,193	6,372	+2.9%

Source: RURA, 2022.

These trends underscore the ongoing efforts to improve transportation services by increasing the number of higher-capacity vehicles. The steady growth in fleet size and seating capacity, particularly in the school transport sector, reflects a continued focus on accommodating more passengers and ensuring reliable service.

Key achievements in public transport

- **Fiscal year 2020/21:** Implementation of new public transport bus routes covering 82.3 km compared to initially planned 25 km, achieving an indicator score of 101.9%.
- **Fiscal year 2021/22:** Cumulative length of scheduled bus routes reached 14,442.14 km, exceeding the target of 14,057 km with an indicator score of 102.7%.
- **Fiscal year 2022/23:** Cumulative length of scheduled bus routes expanded to 14,475 km, surpassing the target of 14,082 km, with a 102.6% indicator score (see Table 27).

Table 27. Cumulative length of scheduled bus routes

Fiscal year	Planned length (km)	Actual length (km)	Indicator score (%)
2020–21	14,032	14,304.2	101.9%
2021–22	14,057	14,442.14	102.7%
2022–23	14,082	14,475	102.6%

Source: MININFRA (2021a, 2022, 2023).

Despite the notable expansion of bus routes in Kigali, challenges persist due to a decrease in the number of buses, leading to increased queues at bus stations. Efforts to expand the bus fleet are underway, including the government’s support for the acquisition of 100 additional buses for Kigali’s fleet to revitalize the public transport sector. Table 28 lists additional infrastructure and service enhancements.

Table 28. Key infrastructure and service enhancements

Initiative	Description
Dedicated bus lanes	Implemented to reduce travel times and improve reliability, with the central business district main roundabout-Kanogo-Rwandex-Sonatube-Giporoso route chosen as a pilot project.
E-ticketing systems	Implemented for transportation, overseen by RURA and the City of Kigali, these systems enhance public transport efficiency.
Government support for bus fleet expansion	The acquisition of 100 additional buses is underway for Kigali’s fleet to address challenges of bus shortages and improve public transport services.
Public transport system overhaul	Completed study for overhauling the public transport system within the City of Kigali, and ongoing investigation for reorganizing intercity and rural area transport systems.

Source: Authors.

Rwanda's public transport system has seen significant improvements and expansions which have enhanced service efficiency, accessibility, and sustainability. However, challenges persist, particularly in aligning the number of passengers using public transport with infrastructure and service enhancements. Establishing specific targets for the number of passengers and improving collaboration among stakeholders will be crucial for further progress in Rwanda's public transport sector.

4. Initial Assessment of Progress Toward the Expected NDC Outcomes in the Human Settlements and Transport Sectors

The progress assessment for Rwanda's NDC within the human settlements and transport sectors reveals a mix of achievements and ongoing challenges.

1. Percentage of urban population living in informal settlements and percentage of rural population living in clustered settlements

Progress achieved:

- **Urban informal settlements:** A significant proportion of the urban population (61.3%) still resides in unplanned settlements, according to EICV5, with a target to reduce this to 47% by 2025 (NISR, 2018). The latest data shows a prevalence of planned rural settlements in urban areas (42%), spontaneous housing (25%), and planned urban housing (24%).
- **Rural clustered settlements:** The percentage of rural households living in planned settlements increased from 61.7% to 65.4% with a goal of reaching 80% by 2025. Integrated rural settlements have notably improved living conditions by providing essential services such as electricity, water, and access to public services.

Assessment: The progress towards achieving the targets for reducing informal settlements and increasing clustered rural settlements is a result of strategic urban and rural planning efforts. The implementation of the Integrated Development Programme model villages and other settlement strategies shows promise. However, challenges such as budget limitations, limited private-sector engagement, and capacity constraints at the local government level need to be addressed to meet the ambitious targets.

Recommendations:

- Accelerate the approval and implementation of the revised National Urbanization Policy and the National Strategy for Sites and Services.
- Increase funding and private sector engagement to support urban and rural settlement projects.
- Improve data collection and monitoring strategies to track progress more effectively.

2. Average share of the built-up area of cities that is open and green space for public use

Progress achieved: The ratio of OPS to built-up areas in 12 selected cities stands at 19.89%, falling short of the 30% target for urban green and public spaces. If wetlands and woodlands were included, this ratio could increase to 34.4%.

Assessment: The current ratio of OPS highlights the need for strategic urban planning to enhance the availability of green and public spaces. This is crucial for improving quality of life, reducing crime, and fostering inclusivity. The study shows that the capital city has better accessibility to OPS compared to secondary cities and district towns.

Recommendations:

- Develop and implement strategies to incorporate wetlands and woodlands into public spaces while adhering to environmental guidelines.
- Enhance urban planning and environmental considerations to increase OPS in cities, aligning with Sustainable Development Goal (SDG) 11.

3. Access to water and sanitation services

Progress achieved:

- **Water access:** 89.2% of households had access to improved water sources in 2019–20 (NISR 2021), with variations in data from different surveys indicating that urban households have better access compared to rural ones.
- **Sanitation access:** 89.6% of households had access to improved sanitation facilities, but significant gaps remain between urban and rural areas. Only 56.4% of the population living in urban areas has access to unshared improved sanitation facilities (NISR, 2021).

Assessment: Significant progress has been made in expanding water and sanitation services, resulting in improved health and welfare. However, disparities between urban and rural areas persist, and challenges need to be addressed, such as non-functional water supply systems and rising non-revenue water due to infrastructure damage and inefficiencies.

Recommendations:

- Increase investments in water and sanitation infrastructure to achieve 100% coverage by 2030.
- Implement smart billing and water management systems and secure funding for climate-resilient water supply projects.

4. Percentage of urban population in areas covered by master plans with stormwater considerations

Progress achieved: Master plans incorporating stormwater management have been implemented in 16 districts, with seven more in the process of formulation.

Assessment: The implementation of comprehensive master plans in urban areas is a proactive approach to addressing stormwater challenges. However, the disconnect between regular maintenance and the established baselines needs to be addressed.

Recommendations:

- Ensure that master plans are regularly updated and maintained to reflect evolving urban stormwater management needs.
- Enhance coordination among government agencies and stakeholders to streamline efforts in stormwater management.

5. Environmental and engineering guidelines developed for climate-resilient road infrastructure

Progress achieved:

- Rwanda has developed comprehensive environmental guidelines for climate-resilient road infrastructure, including various frameworks and assessments such as SEA, ESMF, ESMS, resettlement policy framework, ESIA, EA, and ESA (see Table 18).

Assessment: These guidelines ensure that road infrastructure is sustainable and resilient to climate change impacts. However, challenges remain, such as the poor quality of environmental impact assessments, ineffective integration, and the need for capacity building.

Recommendations:

- Enhance the quality and integration of environmental impact assessments in road construction projects.
- Invest in capacity building for better implementation of environmental guidelines.
- Strengthen collaboration among government agencies, development partners, and stakeholders.

6. Reduction of the length of roads vulnerable to floods and landslides

Progress achieved:

- Significant efforts have been made to reduce road vulnerability to climate-induced hazards. Engineering solutions such as terracing, embankments, gabions, and afforestation have been effective.

Assessment: These measures have improved road safety and reduced travel times, enhancing connectivity and economic stability. However, continuous improvement in road safety measures and infrastructure maintenance is essential to prevent disruptions and enhance economic stability.

Recommendations:

- Conduct detailed vulnerability assessments for road networks to identify critical areas.
- Establish a dedicated fund for the maintenance and upgrading of road infrastructure.

7. Number of passengers using public transport each year

Progress achieved: The implementation of new public transport bus routes and the development of dedicated bus lanes have significantly improved public transport infrastructure. The government has supported the acquisition of 100 additional buses for Kigali's fleet.

Assessment: While the targets aim to improve public transport infrastructure and efficiency, the indicator counting the number of passengers using public transport does not necessarily reflect these specific improvements. A more integrated approach in setting indicators, baselines, and targets is needed.

Recommendations:

- Align the indicators, baselines, and targets more closely with the specific aspects of public transport infrastructure and service improvements.
- Continue to expand and modernize the public transport fleet and infrastructure to meet growing demand.

Overall, Rwanda's efforts towards achieving the expected NDC outcomes in the human settlement and transport sectors show commendable progress. However, intensified efforts and strategic interventions are required to meet the ambitious targets set for 2025 and 2030. Implementing the recommended policies will help address the ongoing challenges and ensure a resilient future for Rwanda's infrastructure and communities.

5. Lessons Learned and Strategic Recommendations

Overall, the objectives of the work program for MEL adaptation in the human settlement and transport sectors were successfully achieved.

5.1 Lessons Learned

1. **Progress tracking:** The progress reports highlight the importance of collecting data consistently and thoroughly. Having accurate and comprehensive data is crucial for evaluating the effectiveness of strategies and identifying areas that need improvement. Progress tracking for Rwanda's NDC in the human settlements and transport sectors will take place annually from this point forward. This regular tracking will allow for continuous monitoring, timely adjustments to strategies, and the achievement of established targets.
2. **Stakeholder engagement and collaboration:** Effective stakeholder engagement that includes local communities, government agencies, and development partners is crucial for successful adaptation measures. Collaborative efforts ensure that diverse perspectives and needs are considered, leading to more sustainable and accepted outcomes.
3. **Technical capacity and knowledge sharing:** Capacity-building workshops and peer exchange sessions have significantly improved the technical skills and knowledge of stakeholders involved in MEL activities. Continuous learning and knowledge sharing are essential for the ongoing improvement of adaptation strategies.
4. **Integration of environmental assessments:** Comprehensive environmental and social impact assessments are necessary to identify potential conflicts and synergies between different adaptation measures. This integration helps in optimizing the benefits and minimizing the negative impacts of interventions such as catchment restoration, flood control, and road construction.
5. **Sustainable funding mechanisms:** Securing sustainable funding remains a challenge. Innovative financing mechanisms, such as leveraging international funds and public-private partnerships, are crucial to support the long-term maintenance and development of resilient infrastructure.
6. **Community involvement:** Engaging local communities is crucial to ensure that adaptation measures are tailored to local needs. This involvement improves sustainability and effectiveness and promotes community support. Regular consultation with community members and stakeholders is recommended to maintain engagement and verify achievements. Conducting annual case studies provides insights into whether achievements are producing expected outcomes. These studies validate the impact of interventions, identify gaps for improvement, and share best practices. This approach ensures that adaptation strategies remain responsive to changing circumstances and community needs.

5.2 Strategic Recommendations

To act on the lessons learned, we recommend that the Government of Rwanda and its partners carry out the following actions:

1. **Enhance technical capacity:** Continue to invest in capacity-building programs for stakeholders at all levels, focusing on advanced technical skills and innovative adaptation practices. This will help in the effective implementation and monitoring of adaptation measures.
2. **Improve environmental impact assessments:** Mandate comprehensive environmental and social impact assessments for all major infrastructure projects. This practice will help identify potential environmental risks and ensure that adaptation measures are environmentally sustainable.
3. **Secure sustainable funding:** Develop and implement innovative financing strategies, including public-private partnerships and international funding mechanisms, to ensure continuous support for adaptation projects. Establishing dedicated funds for maintenance and upgrades can help address budgetary constraints.
4. **Foster integrated planning:** Establish multidisciplinary task forces that include representatives from all relevant sectors to ensure cohesive and integrated planning. This approach will help align adaptation measures with national development goals and prevent conflicting objectives.
5. **Strengthen community engagement:** Increase efforts to involve local communities in the decision-making and implementation processes. This engagement will ensure that adaptation measures are context-specific and enjoy local support, which will in turn enhance their sustainability and effectiveness.
6. **Promote sustainable practices:** Encourage the adoption of sustainable construction practices and technologies, such as eco-friendly materials and designs that minimize environmental impact. Promote practices such as waste segregation, recycling, and composting to reduce the environmental footprint of human settlements.
7. **Strengthen the MEL Framework:** Improve the MEL framework to ensure more robust data collection, analysis, and feedback mechanisms for making real-time policy adjustments and enhancements. Employ digital tools and platforms to boost the accuracy and timeliness of data collection, thereby facilitating improved decision-making processes.
8. **Adopt a cross-sectoral approach:** Incorporate cross-sectoral themes, such as gender equality and disaster risk reduction, into adaptation strategies. This approach ensures that all demographic groups can benefit from adaptation measures while enhancing their resilience to multiple risks. By integrating gender-related perspectives, the inclusivity of adaptation efforts can be improved, and considering disaster risk reduction can help minimize the impacts of climate-related hazards.

Implementing these strategic recommendations will help address the challenges identified and ensure that Rwanda's adaptation measures in the human settlements and transport sectors are effective, sustainable, and resilient to climate change impacts.

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Appendix A. Lists of Workshop Participants

Table A1. List of participants in the workshop on monitoring, evaluation, and learning of adaptation in the agriculture sector (Phase 2)

Date: October 25, 2023, Time: 9:30–13:20, Venue: Ubumwe Grande Hotel, Kigali, Rwanda

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Rwanda's Climate Adaptation Monitoring, Evaluation,
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Source: NAP-GN, first workshop report in the second phase, 2023.

Table A2. List of participants in the project launching workshop on monitoring, evaluation, and learning adaptation in the human settlements and transport sectors (Phase 2)

Date: December 13, 2023, Time: 9:50–13:30, Venue: Ubumwe Grande Hotel, Kigali, Rwanda

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Source: NAP-GN, second workshop report in the second phase, 2023.

Table A3. List of participants in the workshop (Day 1) on monitoring, evaluation, and learning adaptation capacity building session in the human settlement and transport sectors (Phase 2)

Date: January 25, 2024, Time: 10:00–16:30, Venue: Ubumwe Grande Hotel, Kigali, Rwanda

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Source: NAP-GN, capacity-building session workshop report in the second phase, 2024.

Table A4. List of participants in the workshop (Day 2) on monitoring, evaluation, and learning adaptation capacity building session in the human settlement and transport sectors (Phase 2)

Date: January 26, 2024, Time: 9:30–13:40, Venue: Ubumwe Grande Hotel, Kigali, Rwanda

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Source: NAP-GN, capacity-building session workshop report in the second phase, 2024.

Table A5. List of participants in the final workshop on the learning components on monitoring, evaluation and learning for adaptation in the human settlement and transport sectors (Phase 2)

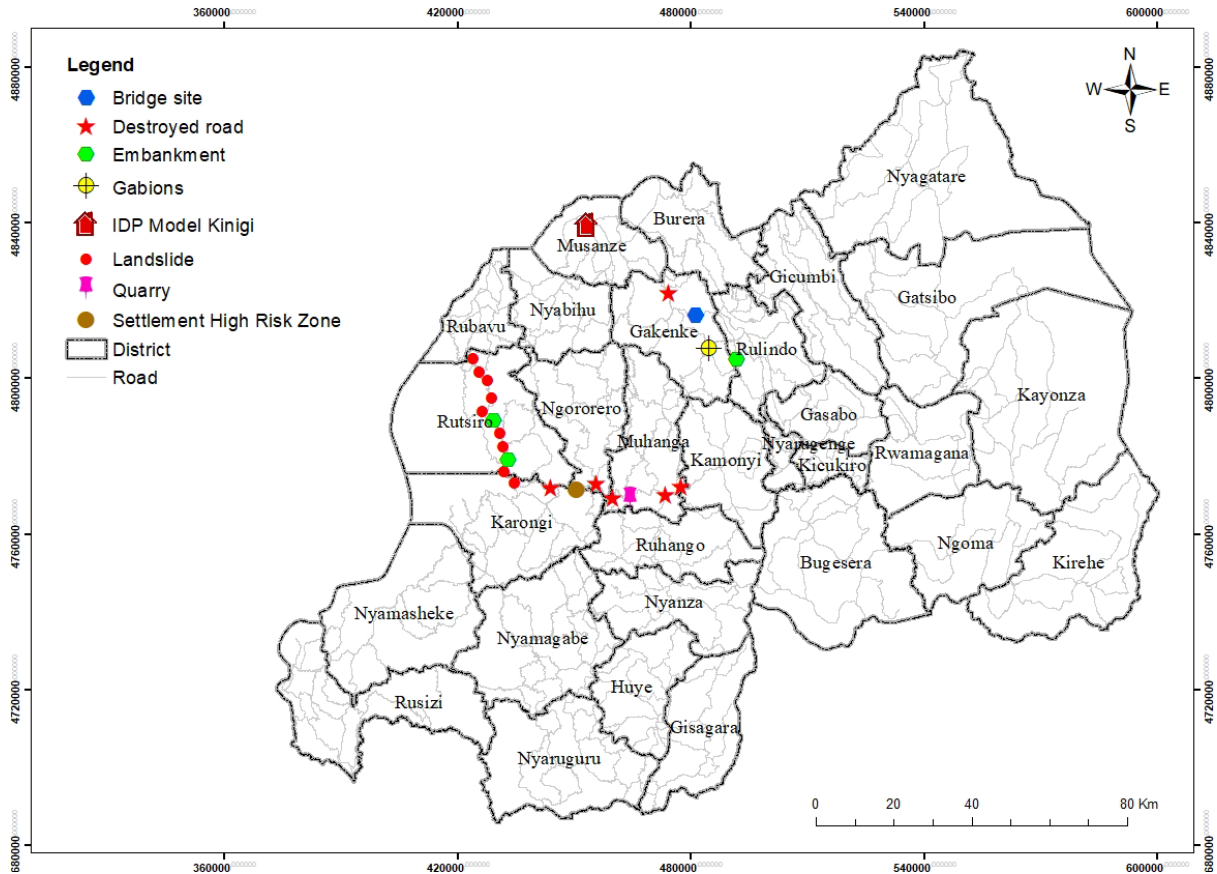
Date: August 1, 2024, Time: 9:30–13:30, Venue: Ubumwe Grande Hotel, Kigali, Rwanda

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Source: NAP-GN, final workshop on the learning components on monitoring, evaluation and learning for adaptation in the human settlement and transport sectors (Phase 2), 2024.

Appendix B. Map of Rwanda

Figure B1. Map of Rwanda showing districts visited and features identified during the assessment of adaptation outcomes in the human settlements and transport sectors



Source: Authors.

Notes

Selected indicators for adaptation outcome assessment

1. The percentage of the rural population living in clustered settlements
2. Access to water and sanitation services
3. Reduction of length of roads vulnerable to flood and landslides

Field visit itinerary (April 2024)

- **April 15:** The field visit commenced in Kigali and proceeded towards Gakenke and Musanze. The day was dedicated to traveling along this route, where the team conducted preliminary observations and engaged in brief interactions with local communities. The day concluded with an overnight stay in Musanze, allowing the team to rest and prepare for the following day's activities.
- **April 16:** On the second day, the team journeyed from Musanze to Rubavu, and then on to Rutsiro and Karongi. This leg of the trip involved extensive travel through regions known for their vulnerability to environmental hazards, such as landslides and flooding. Along the way, the team made detailed observations and took the opportunity to converse with residents to gain valuable insights into their experiences and coping strategies. The day ended with an overnight stay in Karongi, which gave the team time to compile observations and plan for the final leg of the field visit.
- **April 17:** The final day of the field visit involved traveling from Karongi to Muhanga and then back to Kigali. The journey back to the capital offered the team a last chance to observe and document relevant phenomena related to the study's focus on clustered settlements and their susceptibility to natural disasters. The team returned to Kigali in the evening, marking the end of the fieldwork phase.

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