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GEAVET TRAINING PROGRAMME FOR CSA

CLIMATE SMART AGRICULTURE:

NIGERIA

UNIT I.3. USE OF CLIMATE DATA FOR FARM DECISION-MAKING

ENGLISH VERSION

GEAVET Project n° 101129027

Open Educational Resources

PART I – LEARNING MATERIAL

1. Introduction

Climate variability poses increasing challenges to agricultural productivity, sustainability, and food security in Nigeria. Farmers, extension agents, and agricultural planners often face difficulties in interpreting and applying climate information effectively to make informed decisions. To address this gap, this curriculum on Training on Climate Data for Farm Decision-Making is designed to build the capacity of learners to understand, access, analyse, and apply climate data for improved farm planning, resource management, and risk reduction.

The training programme focuses on empowering participants with practical knowledge and digital skills to utilise weather and climate information for decisions such as crop selection, planting dates, irrigation scheduling, pest and disease management, and soil conservation. It aligns with the principles of CSA, basically enhancing productivity, adaptation, and mitigation while promoting resilience to climate shocks. The curriculum will incorporate interactive e-learning modules, case studies from Nigerian and global contexts, and data interpretation exercises using climate platforms such as NiMet Agro-Met services, FAO CLIMWAT, and NASA Power Data Access Viewer.

By the end of the training, participants will be equipped to transform raw climate data into actionable insights that support sustainable farming systems and evidence-based agricultural policies in Nigeria. The curriculum thus serves as a vital tool in bridging the gap between climate science and practical farm decision-making.

2. Climate Data

Climate data refers to systematically collected information about atmospheric conditions over time, including variables such as temperature, rainfall, humidity, wind speed, solar radiation, and evapotranspiration. These datasets, gathered from weather stations, satellites, and climate models, provide valuable insights into both short-term weather patterns and long-term climatic trends.

Figure 3. A typical application for agriculture weather forecasting technology
Source: Intellias (2024)

In agriculture, climate data serves as a foundation for understanding environmental conditions that influence crop growth, soil health, and water availability.

2.1. Relevance of Climate Data and Farm Decision-Making to CSA in Nigeria

In the context of Climate-Smart Agriculture (CSA), climate data is essential for achieving the three main pillars (productivity, adaptation, and mitigation).

- **Productivity:** Farmers can use climate data to determine optimal planting dates, select climate-resilient crop varieties, and manage irrigation and fertilizer schedules more efficiently. For example, rainfall forecasts can guide when to sow seeds, while temperature trends can help in selecting crops suitable for expected growing conditions.
- **Adaptation:** Climate data enables farmers and policymakers to anticipate and respond to changing climate patterns. Through access to seasonal forecasts and early warning systems, farming communities can adjust management practices to minimise risks from droughts, floods, or heat stress, thereby enhancing resilience.
- **Mitigation:** By using climate data to optimise resource use (such as reducing excessive irrigation, avoiding over-fertilisation, and adopting conservation tillage) farmers contribute to lowering greenhouse gas emissions and preserving ecosystem balance.

In summary, climate data enables farmers to make informed decisions that boost productivity, improve adaptation strategies, and promote environmental sustainability. When effectively integrated into farm management, it shifts agricultural planning from a reactive to a proactive approach. This ensures that farming systems in Nigeria remain resilient in the face of climate change.

2.2. Relationship Between Climate Data Use for Farm Decision-Making and Profitable Climate-Smart Agriculture

The effective use of climate data is central to improving the efficiency and success of Climate-Smart Agriculture (Bhatnagar *et al.* 2024; Kabato *et al.* 2025). CSA aims to enhance agricultural productivity, strengthen resilience to climate variability, and reduce greenhouse gas emissions. Climate data such as temperature, rainfall, humidity, solar radiation, and wind information provides the evidence base that enables farmers and policymakers to plan, implement, and monitor agricultural practices that fulfil these goals.

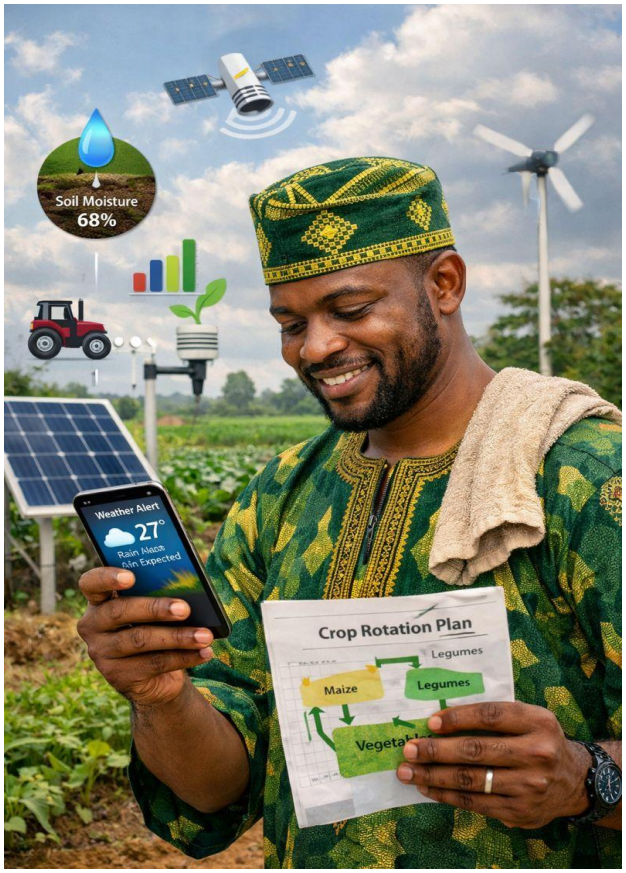

Image 6. A.I. Image Describing the Theme Climate-Smart Decision Aids Productivity

By integrating climate data into farm decision-making, farmers can make timely and informed choices about crop selection, planting dates, irrigation scheduling, pest management, and fertilizer application (Madhuri, 2023). This precision reduces waste, enhances input efficiency, and ensures that resources such as water and nutrients are used optimally. For example, rainfall forecasts can guide irrigation planning, preventing both water stress and over-irrigation, while temperature projections can help determine the best time to plant heat-sensitive crops. These informed decisions increase productivity while reducing environmental impacts, thereby improving CSA efficiency under the productivity pillar.

Furthermore, climate data enhances adaptation efficiency by helping farmers anticipate and prepare for extreme weather events such as droughts or floods. Early warning systems and seasonal climate forecasts help communities adopt preventive measures, such as mulching, water harvesting, and planting drought-tolerant varieties, which reduce vulnerability and maintain yield stability. This data-driven adaptation strengthens the resilience of agricultural systems to climate shocks.

On the mitigation pillar, the use of climate data supports sustainable practices that minimise greenhouse gas emissions. For instance, understanding seasonal temperature and moisture conditions can guide reduced tillage or cover cropping strategies that sequester carbon and prevent soil degradation. Accurate weather predictions also minimise unnecessary mechanisation or fertilizer use, further contributing to emission reduction.

In essence, the relationship between climate data use and CSA efficiency is synergistic: climate data transforms farm management into a more adaptive, resource-efficient, and environmentally responsible process**.** It empowers farmers to transition from reactive to proactive decision-making, ensuring that agricultural systems in Nigeria remain productive, resilient, and climate-smart.

2.3. Inventory for Climate Data Use for Farm Decision-Making System in Nigeria

An effective inventory for climate data use in farm decision-making in Nigeria refers to the structured collection of all essential tools, institutions, technologies, and human capacities required to gather, analyse, and apply climate information for agricultural planning. It serves as the foundation for developing a responsive and sustainable climate information service system that supports farmers, extension agents, and policymakers in making evidence-based decisions under changing climate conditions.

A. Institutional Infrastructure

At the institutional level, several national and regional agencies are responsible for generating and disseminating climate data in Nigeria. The Nigerian Meteorological Agency (NiMet) plays a leading role in collecting, analysing, and distributing weather and climate information through its network of synoptic and agro-meteorological stations. NiMet's Seasonal Climate Prediction (SCP), AgroMet Bulletin, and Climate Watch Updates are key tools supporting farm-level decisions. Other contributors include the Nigerian Hydrological Services Agency (NIHSA), which provides hydrological and flood data; the National Space Research and Development Agency (NASRDA), which supplies satellite-based environmental data; and the Federal Ministry of Agriculture and Food Security (FMAFS), which integrates climate information into agricultural policy and extension programmes.

B. Infrastructure

From a technological and data infrastructure perspective, the inventory comprises weather monitoring equipment, such as automatic weather stations, rain gauges, temperature and humidity sensors, and soil moisture probes, deployed across various agro-ecological zones. In recent years, digital platforms and mobile applications such as NiMet's Farmer's Weather App , NASA POWER Data Access Viewer, FAO's CLIMWAT and CROPWAT, and Africa Climate Policy Centre's Climate Data Portal have enhanced accessibility to real-time climate data. Cloud-based databases and GIS-enabled systems also form a crucial part of the inventory, supporting spatial analysis and climate risk mapping for agricultural planning.

C. Human Resource

The human resource component of the inventory includes trained meteorologists, agricultural climatologists, data analysts, and extension agents who translate raw data into actionable insights. Capacity-building programs are essential for strengthening these skills, especially in data visualisation, interpretation, and communication with end-users. Farmers' cooperatives and agricultural extension networks are also integral to the inventory, acting as intermediaries that disseminate localised climate information in user-friendly formats (SMS alerts, radio advisories, and online dashboards).

D. Digital Infrastructure

Additionally, the digital literacy and communication systems that enable the dissemination of climate data to farmers are vital. Partnerships with telecom providers, NGOs, and private agri-tech firms (such as Hello Tractor**,** Crop2Cash**,** and Weather Impact Nigeria) enhance the delivery of tailored weather advisories and decision-support services to rural communities.

E. Policy and Coordination Frameworks

Lastly, the policy and coordination frameworks supporting climate data management are critical. National policies such as the National Agricultural Technology and Innovation Policy (NATIP) and the National Climate Change Policy (2021–2030) provide the enabling environment for integrating climate information into farm decision-making. Coordination among stakeholders ensures data harmonisation, standardisation, and effective use across sectors.

2.4. Planning and Layout for Climate Data Use for Farm Decision-Making System in Nigeria

Effective planning and layout of a climate data use system for farm decision-making in Nigeria is essential for transforming climate information into actionable insights that enhance agricultural productivity and resilience. Within the context of a national training curriculum, planning and layout involve the systematic design of institutional structures, data collection frameworks, digital tools, and dissemination pathways that ensure climate data flows seamlessly from generation to end-user application at the farm level.

A. Planning Phase: Framework and Strategy

The planning phase focuses on establishing a strategic framework that integrates climate data services into Nigeria's agricultural decision-making system. This process begins with identifying stakeholders such as the Nigerian Meteorological Agency (NiMet)**,** Nigerian Hydrological Services Agency (NIHSA)**,** Federal Ministry of Agriculture and Food Security (FMAFS)**,** NASRDA, universities, and private agri-tech companies. These institutions form a collaborative network for collecting, analysing, and sharing climate data.

A key element in the planning process is the needs assessment—evaluating what types of climate data farmers require (e.g., rainfall, temperature, evapotranspiration, drought risk) and how they prefer to receive it (SMS

alerts, radio, mobile apps, or web dashboards). The plan also involves developing clear data governance policies, ensuring accuracy, consistency, and timeliness of data delivery. Resource allocation planning—covering weather station placement, personnel training, and ICT infrastructure—ensures that data collection and dissemination remain reliable and scalable across Nigeria's agro-ecological zones.

B. Layout Design: Data Flow and System Structure

The **layout** of the climate data system refers to the structural and operational arrangement through which climate data is gathered, processed, and used for farm-level decision-making. This layout typically follows a three-tier model:

- **Data Generation Layer:**
  This includes meteorological and hydrological stations, remote sensing satellites, and field sensors. For example, automatic weather stations installed in states like Kaduna, Oyo, and Cross River collect real-time data on rainfall, temperature, and humidity. These devices send raw data to central servers for processing.

- **Data Processing and Analysis Layer:**
  Here, data scientists and climate experts use digital tools such as ArcGIS, Python-based climate models, or NiMet's Climate Data Management System (CDMS) to analyse patterns, forecast seasonal trends, and assess risks. For instance, monthly rainfall anomalies can be analyzed to project drought likelihood or delayed onset of rains, supporting early warning systems.

- **Data Dissemination and Decision Support Layer:**
  The final stage focuses on delivering actionable information to farmers through platforms like NiMet's Farmers' App, radio advisory services, extension agents, or SMS-based early warning systems. These outputs provide farmers with guidance on planting dates, irrigation timing, and fertilizer management.

Example of Layout and Calculation in Design-Making

Within the curriculum, learners can simulate a climate-informed farm planning exercise using actual or hypothetical data. For instance, assume the rainfall forecast for a region is 500 mm for the growing season, and

maize requires 450 mm for optimal growth. The rainfall surplus can be calculated as:

$$\text{Surplus} = 500 - 450 = 50 \text{ mm}$$

This indicates sufficient rainfall, reducing the need for supplemental irrigation. Conversely, a rainfall deficit (e.g., 400 mm instead of 450 mm) would signal the need for water harvesting or irrigation scheduling. Similarly, temperature projections can guide learners to calculate growing degree days (GDD) to determine crop maturity timelines.

C. Integration with Digital Tools and Climate-Smart Agriculture (CSA)

The planned system layout integrates digital platforms such as NASA POWER**,** FAO CLIMWAT/CROPWAT, and Google Earth Engine**,** allowing participants to analyse climate data online. The curriculum also emphasises linking data interpretation with CSA pillars—productivity (through yield forecasting), adaptation (through early warning systems), and mitigation (through efficient input use).

D. Learning Application and Expected Outcomes

Through interactive online exercises, participants will design prototype layouts of a regional climate data system, specifying equipment, data flow pathways, and communication channels for farmers. They will learn to calculate agro-climatic indicators, interpret data, and generate advisory reports.

In summary, the planning and layout of a climate data use system in Nigeria emphasize coordination among institutions, digital integration, and user-centered information delivery. When effectively implemented, it transforms raw climate data into a practical farm management tool, enhancing Climate-Smart Agriculture (CSA) efficiency, resilience, and sustainability across the country's diverse farming systems.

3. European Case Studies for Nigerian Learners and Farmers on Climate Data Use for Farm Decision-Making

To provide Nigerian learners and farmers with practical insights, several European case studies demonstrate how the effective use of climate data can significantly improve farm decision-making, productivity, and resilience. These cases illustrate how digital climate services, weather-based advisories, and smart farming systems have transformed agriculture under changing climate conditions, thereby offering lessons adaptable to Nigeria's agro-ecological realities.

3.1. Denmark-Climate Data Integration through the AgroData Platform

In Denmark, the AgroData Platform, developed under the Danish Meteorological Institute (DMI) and Aarhus University, provides real-time weather and soil moisture data for precision farming. Farmers access daily and seasonal forecasts through mobile dashboards that help them determine optimal planting dates, irrigation scheduling, and fertilizer application timing. The system combines climate data, soil mapping, and crop modeling to generate tailored advice. (Christensen *et al.,* 2004; Larsen *et al.,* 2021)

Lesson for Nigeria:

Nigerian institutions such as NiMet and NASRDA can adopt a similar approach by integrating weather data with soil and crop databases through mobile-accessible platforms. This can help smallholder farmers in areas like Kano or Benue plan planting and input use based on local rainfall predictions and evapotranspiration rates.

3.2. Spain-Climate-Smart Irrigation under the Andalusian Agroclimatic Network

Spain's **Andalusian Agroclimatic Information Network (RAIF)** collects climate data from over 300 weather stations. The system supports decision-making in irrigation management by providing farmers with evapotranspiration (ET) values, crop water requirements, and drought forecasts. Farmers receive advisory alerts through SMS or an online dashboard, leading to water savings of up to 25% and reduced fertilizer runoff. (Estévez *et al.* 2022; Casas-Castillo *et al.* 2022)

Lesson for Nigeria:

This model aligns with irrigation-dependent regions in northern Nigeria, where integrating localised weather stations and providing ET-based irrigation guidance could enhance water-use efficiency. Agricultural extension officers can replicate the RAIF advisory method using NiMet's local data and mobile communication tools.

3.3. Netherlands- Data-Driven Greenhouse and Field Crop Management

In the Netherlands, Wageningen University and Research (WUR) and the Farmers Data Cooperative (Boerderij Data) use climate and sensor data for precision farming. Farmers use Decision Support Systems (DSS) that combine climate forecasts, humidity data, and crop models to optimise greenhouse temperature regulation, planting density, and pest management.

Lesson for Nigeria:

Nigerian horticultural farmers, especially in peri-urban areas like Lagos and Abuja, can adopt low-cost climate sensors integrated with local weather data to regulate irrigation and temperature in greenhouse vegetable production. This approach can minimize resource waste and boost productivity under changing climatic conditions.

3.4. Italy- Climate Services for Vineyard and Olive Growers

The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) provides a Climate Service for Agriculture that delivers location-specific climate projections for vineyards and olive farms. These data help farmers anticipate heat stress, disease outbreaks, and harvest timing, leading to more sustainable and profitable production. (ENEA 2022; Olive Oil Times 2024)

Lesson for Nigeria:

For Nigeria's tree-crop sector (such as cocoa and oil palm), adopting similar climate-based forecasting tools could help predict pest risks and manage harvest cycles effectively. Such applications can be taught in the online curriculum using open-access modelling tools like the EU Copernicus Climate Data Store.

3.5. Summary of Takeaways for Nigerian Learners

- **Digital Platforms:** Leverage mobile and web-based tools for real-time data access.
- **Localisation:** Adapt European models to Nigerian agro-climatic zones using local weather data.
- **Integration:** Combine soil, climate, and crop data for holistic decision-making.
- **Capacity Building:** Train farmers and extension officers in climate data interpretation.
- **Policy Synergy:** Align local systems with broader frameworks like Nigeria's National Agricultural Technology and Innovation Policy (NATIP).

These European examples provide practical blueprints for Nigeria's online training curriculum. Learners can simulate similar systems using open data from Copernicus, FAO CLIMWAT, and NiMet, fostering a new generation of data-driven, climate-smart farmers capable of adapting to evolving environmental conditions.

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PART 2 - CURRICULUM

Learning Objectives

KNOWLEDGE	SKILLS	ATTITUDES
Students should be able to: ● Identify major sources of climate data (e.g., meteorological stations, mobile apps, online databases). ● Explain basic climate parameters relevant to agriculture (temperature, rainfall, humidity, wind speed, solar radiation). ● Understand how seasonal and daily climate variations influence crop growth, pest dynamics, and soil moisture. ● Recognize the importance of weather forecasts in short-term farm operations. ● Relate historical climate patterns to crop selection and planting schedules.	*Students should be able to:* ● Collect and interpret local climate data using digital and manual tools (e.g., rain gauge, thermometer, hygrometer, weather apps). ● Analyze weather and climate charts to make informed decisions on planting, irrigation, and harvesting. ● Develop a simple farm calendar integrating climate forecasts. ● Use basic data visualization tools (Excel, Google Sheets, or mobile apps) to present climate information for decision-making. ● Evaluate climate risks (e.g., drought, flooding) and suggest adaptive farming practices.	*Students should be able to:* ● Appreciate the role of climate information in sustainable agricultural practices. ● Demonstrate accuracy and attention to detail when handling data. ● Develop a proactive attitude towards using technology for farm planning. ● Value teamwork and communication in group-based data collection and decision-making exercises. ● Exhibit responsibility in applying climate-based decisions to real farm contexts.
Transversal Skills ● **Digital Literacy** ○ Ability to use mobile applications, computer software, and online platforms for accessing and analyzing climate data. ○ Competence in basic data entry, spreadsheet use, and digital communication tools. ● **Problem-Solving and Critical Thinking**		

- Capacity to analyze climate information, identify potential farming risks, and develop adaptive solutions.
- Logical reasoning in selecting appropriate farm operations based on climate trends.

- **Communication Skills**
  - Effective oral and written communication of climate-related findings and farm decisions.
  - Ability to prepare concise reports and present data interpretations to peers or supervisors.
- **Teamwork and Collaboration**
  - Working effectively in groups to collect, analyze, and interpret climate data.
  - Respecting others' viewpoints and contributing constructively to group decisions.
- **Planning and Organizational Skills**
  - Efficient management of time and resources during field or practical sessions.
  - Organizing data collection, record keeping, and task scheduling based on climate information.
- **Adaptability and Flexibility**
  - Adjusting farming plans or learning approaches in response to changing weather and climate conditions.
  - Embracing innovations in data tools and agricultural technologies
- **Ethics and Professional Responsibility**
  - Upholding honesty, accuracy, and accountability when collecting and reporting data.
  - Respecting data privacy, intellectual property, and institutional protocols.

Digital Skills

- **Data Collection and Recording**
  - Using digital thermometers, hygrometers, and GPS-enabled devices for field data collection.
  - Operating automatic weather stations or IoT-based sensors for real-time monitoring of temperature, rainfall, and humidity.
  - Recording data accurately with mobile data collection apps (e.g., Google Form, KoboToolbox, ODK).
- **Data Access and Retrieval**

- Navigating online climate databases and meteorological websites (e.g., World Meteorological Organization, NOAA, or national weather services).
- Downloading and interpreting satellite-based or regional climate datasets.
- Using mobile weather apps for daily and seasonal forecasts.

- **Data Analysis and Interpretation**
  - Entering and processing climate data using Microsoft Excel, Google Sheets, or LibreOffice Calc.
  - Creating simple graphs, charts, and trend analyses to interpret temperature, rainfall, and other parameters.
  - Applying basic statistical functions to compare seasonal variations or evaluate farm decisions.
- **Geospatial and Mapping Tools (Introductory Level)**
  - Using Google Earth, QGIS, or AgroGIS platforms to visualize farm locations and climatic zones.
  - Presenting analyzed data using digital slides, infographics, or data dashboards.
  - Participating in virtual farmer networks or online extension platforms for climate advisory services.
- **Digital Communication and Collaboration**
  - Sharing climate information through emails, cloud storage (Google Drive, OneDrive), or online collaborative tools.
  - Weather forecasting apps for planning irrigation intervals.
  - Mobile calculators for flow rate and pressure loss.
- **Digital Safety and Ethics**
  - Applying data security principles when handling or sharing climate data.
  - Respecting intellectual property, citation, and ethical use of open-access datasets.
  - Maintaining digital hygiene, such as safeguarding passwords and using secure networks.

Green Skills

- **Climate-Smart Decision-Making**
  - Ability to interpret climate data to choose environmentally sustainable farming practices (e.g., adjusting planting dates, crop rotation, or irrigation scheduling).

    - Integrating climate forecasts into farm plans to minimize resource waste and reduce carbon footprint.
- **Sustainable Resource Management**
    - Efficient use of water, fertilizers, and energy based on climate predictions (e.g., irrigating only when necessary).
    - Promoting **soil conservation** by applying data-driven decisions that prevent erosion and degradation.
- **Risk Assessment and Adaptation Planning**
    - Identifying climate-related risks such as drought, floods, or heat stress and developing adaptive farm strategies.
    - Using climate data to guide resilient crop and livestock management practices.
- **Environmental Monitoring and Reporting**
    - Collecting and analyzing climate indicators to monitor environmental changes (rainfall patterns, soil moisture, temperature extremes).
    - Keeping accurate records of environmental performance for sustainable farm audits or certification.
- **Waste Reduction and Recycling Awareness**
    - Applying weather-based planning to reduce post-harvest losses and input waste.
    - Promoting the reuse of organic residues and sustainable composting under favorable climate conditions.
- **Energy and Water Efficiency**
    - Understanding how climate data supports energy-efficient operations, such as solar drying or low-energy irrigation.
    - Practicing water harvesting and storage in response to rainfall variability.
- **Sustainable Technology Use**
    - Applying green digital tools (e.g., remote sensing, mobile weather apps) to optimize farm inputs and reduce emissions.
    - Evaluating technologies for environmental impact before adoption.
- **Ecosystem Awareness and Biodiversity Protection**
    - Recognizing the link between climate stability and ecosystem health.
    - Making farm decisions that protect pollinators, soil microorganisms, and natural habitats.

Implementation plan of pedagogical activities (Scheme of work / Session plan)

Duration: 4 hrs 45 mins				
Description of participants: Secondary school leavers, diploma trainees, or vocational learners with basic literacy and numeracy skills between the ages of 18 and 30 who require hands-on competency-based training on use of climate data for decision making.				
No of Activity	**Timing**	**Training Methods/Activity**	**What do trainers do**	**What do participants do**
1.	35 min	**Introduction and Orientation** briefing on the importance of climate data in farm decision-making	● Introduce course objectives and relevance to sustainable agriculture ● Explain expected outcomes and assessment methods	● Listen and take notes ● Ask questions to clarify understanding
2.	25 min	**Demonstration of Climate Data Tools** (e.g., rain gauge, thermometer, weather apps)	● Demonstrate how to set up, calibrate, and read instruments ● Explain data recording techniques	● Observe demonstrations ● Practice setting up and using tools ● Record sample data in logbooks
3.	35 min	**Demonstration on Data Collection Methods**	● Supervise field groups ● Provide guidance on safety and data accuracy ● Ensure proper use of equipment	● Collect temperature, rainfall, and humidity data ● Record observations in data sheets or mobile apps ● Work collaboratively in teams

4.	45 min	**Data Analysis and Interpretation Session** (using Excel/Google Sheets)	● Guide learners on entering data, generating graphs, and identifying trends ● Demonstrate interpretation of climate charts	● Enter field data on digital platforms ● Create simple graphs/charts ● Discuss observed trends and their implications on farming
5.	25 min	**Developing a Farm Decision Plan** based on analyzed data	● Facilitate group discussions on planning farm activities (planting, irrigation, harvesting) ● Provide templates or examples	● Work in groups to prepare a climate-based farm calendar ● Present decision plans orally or in written form
6.	45min	**Case Study / Scenario Analysis** Using historical climate data for crop selection	● Provide sample datasets or case examples ● Ask guiding questions to stimulate critical thinking	● Analyze given data sets ● Propose suitable crops or practices for each scenario
7.	30 min	**Integration of Green and Digital Skills Workshop**	● Demonstrate use of digital platforms for sustainable farm management (e.g., online weather services)	● Explore digital tools under supervision ● Identify how data use supports

			● Discuss eco-friendly decision-making	sustainable practices
8.	30 min	**Assessment and Reflection Session**	● Assess group presentations, reports, and field logs ● Facilitate reflective discussion on lessons learned and challenges techniques; show repair of leaks	● Present group findings and reflections ● Provide feedback on what they learned and how to improve

Materials (What trainers need to have prepared):

- Instructional and Reference Materials
  - Lesson plan and course outline.
  - Case study examples (printed or digital).
  - PowerPoint slides or posters.
  - Assessment rubrics / evaluation forms.
- Data Collection Instruments
  - Rain gauge.
  - Thermometer (digital or mercury).
  - Hygrometer.
  - Anemometer.
  - Soil thermometer or moisture meter.
  - Measuring tape / field notebook / clipboard.
  - Data sheets or mobile data collection forms.
- Digital and ICT Resources
  - Computers or laptops (one per group).
  - Internet access or mobile hotspots.
  - Weather and climate data apps (e.g., Weather Channel, AccuWeather, FAO CLIMWAT, Meteoblue).
  - Spreadsheet software (Excel, Google Sheets, or LibreOffice Calc).
  - Projector or smartboard
  - USB drives or cloud storage.
- Teaching Aids and Demonstration Materials
  - Charts showing temperature, rainfall, and humidity patterns.
  - Sample farm calendars.
  - Flip charts and markers.
  - Maps (local or regional).

    - Reference books or local climate reports
- Safety and Field Logistics
    - First aid kit.
    - Protective gear (caps, gloves, boots, raincoats).
    - Transportation arrangements (if off-campus).
    - Drinking water and field supervision checklist.
- Administrative and Reporting Materials
    - Attendance register.
    - Group assignment tracker.
    - Feedback and reflection forms.
    - Portfolio folders.

PART 3 – ACTIVITY GUIDE

DESCRIPTION OF ACTIVITIES

1. Introduction and Orientation

The objectives of this activity are to introduce learners to the concept of climate data and its importance in effective farm decision-making. Learners will understand what the term “climate data” entails such as rainfall, temperature, humidity, wind speed, and seasonal patterns and how these factors influence crop production, irrigation planning, soil management, and risk reduction in agriculture.

The activity aims to build learners’ awareness of how climate variability and climate change affect farming outcomes, including planting dates, crop choice, water requirements, pest and disease pressure, and yield stability. Learners will be guided to appreciate the difference between weather and climate, and how short-term and long-term climate information supports proactive rather than reactive farm management.

Additionally, the activity seeks to develop positive attitudes toward the use of data and digital tools in agriculture. Learners will recognize the value of climate information services such as forecasts, advisories, and early warning systems in reducing losses and improving productivity. By the end of the activity, learners are expected to understand why climate data is essential for sustainable farming, climate-smart agriculture, and improved resilience of farming systems under changing environmental conditions.

1. Aim of the activity: To introduce learners to climate data relevance in informed farm decisions.

2. Duration: 35 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Opening and Orientation:** The facilitator welcomes learners and explains the purpose of the session and its relevance to farming decisions.
- **Introduction to Climate Data:** Climate data types (rainfall, temperature, humidity, etc.) are explained using simple examples related to farming activities.
- **Climate Data and Farm Decisions:** The facilitator discusses how climate data influences planting time, irrigation scheduling, crop selection, and yield outcomes.
- **Climate Variability and Risk:** Learners are introduced to climate risks such as droughts and floods and how climate information helps manage them.
- **Interactive Discussion:** Learners share local farming experiences affected by weather or climate patterns.
- **Summary and Key Takeaways:** The facilitator summarizes key points and links the activity to upcoming practical sessions.

References/Sources/Further materials:

None required.

2. Demonstration of Climate Data Tools

This activity is designed to equip learners with practical knowledge and skills to use basic climate data tools for informed farm decision-making. Learners will be introduced to simple field-based instruments such as rain gauges and thermometers, as well as digital tools including weather and climate mobile applications. The activity aims to help learners understand what climate data each tool provides, how the data is collected, and why accuracy is important.

Learners will gain hands-on experience in correctly installing, reading, and recording data from basic instruments. They will also learn how to access, navigate, and interpret information from weather apps, including rainfall forecasts, temperature trends, and seasonal outlooks. Emphasis is placed on linking climate data to practical farm decisions such as planting dates, irrigation scheduling, fertilizer application, and risk management.

The activity also promotes data literacy by encouraging learners to compare data from different sources and assess reliability. In addition, learners will develop confidence in using both traditional and digital tools to support climate-smart agriculture. By the end of the activity, learners are expected to competently use climate data tools, record observations accurately, and explain how climate information supports timely, efficient, and resilient farm management decisions.

1. Aim of the activity: To demonstrate use of basic climate data tools for farm decisions.

2. Duration: 25 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introduction and Orientation:** The facilitator explains the purpose of climate data tools and their relevance to farm decision-making.
- **Demonstration of Field Instruments:** A rain gauge and thermometer are introduced. The facilitator demonstrates correct placement, installation, and reading of each instrument.
- **Hands-on Practice with Instruments:** Learners practice reading rainfall and temperature values and recording observations in simple data sheets.
- **Demonstration of Weather Apps:** The facilitator demonstrates how to access weather apps, check forecasts, and interpret key climate indicators.
- **Learner Practice with Digital Tools:** Learners explore weather apps on their devices and identify information relevant to farming activities.
- **Discussion and Comparison:** Learners compare data from field instruments and apps, discussing accuracy and usefulness.

References/Sources/Further materials:

YouTube. (n.d.).Rain Gauge Weather Lesson. Retrieved December 6, 2025, from https://www.youtube.com/source/fm2kzGYrko4/shorts?bp=8gVCCjYSJwoLZm0ya3pHWXJrbzQSC2ZtMmt6R1lya280GgtmbTJrekdZcmtvNBoLZm0ya3pHWXJrbzQo45Gku7ifzZxA&utm

YouTube. (n.d.).How to use a rain gauge. Retrieved December 8, 2025, from https://www.youtube.com/watch?v=isgfCQpjszk&utm

3. Demonstration on Data Collection Methods

The objectives of this activity are to equip learners with practical skills and understanding of different methods used to collect climate data for agricultural decision-making. Learners will be introduced to both manual and digital data collection methods, including field-based measurements and data obtained from weather stations and mobile applications. The activity aims to help learners understand the importance of accurate, consistent, and timely data collection in guiding farm planning and operations.

Learners will gain hands-on experience in recording climate parameters such as rainfall, temperature, humidity, and wind conditions using simple tools and observation sheets. They will also learn how digital sources provide historical and forecast climate data and how these datasets complement field observations. Emphasis is placed on correct measurement timing, standardized recording formats, and avoiding common errors that can affect data reliability.

The activity further aims to develop learners' ability to organize collected data for later analysis and interpretation. Learners will understand how quality climate data supports decisions related to planting schedules, irrigation planning, pest and disease management, and risk reduction. By the end of the activity, learners are expected to confidently apply appropriate data collection methods and appreciate their role in climate-smart and evidence-based farm decision-making.

1. Aim of the activity: To build skills in collecting reliable climate data for farm decisions.

2. Duration: 35 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introduction and Overview:** The facilitator explains the importance of climate data collection and its role in farm decision-making.
- **Identification of Climate Parameters:** Key parameters such as rainfall, temperature, and humidity are discussed and linked to farming activities.
- **Demonstration of Manual Data Collection:** The facilitator demonstrates how to record climate observations using rain gauges, thermometers, and data sheets.
- **Demonstration of Digital Data Collection:** Learners are shown how to access climate data from weather apps and online platforms.
- **Learner Practice Session:** Learners practice collecting and recording data using both manual tools and digital sources.
- **Data Recording and Organization:** The facilitator demonstrates how to organize collected data in simple tables or logs.
- **Discussion and Feedback**: Learners discuss challenges encountered, and the facilitator provides guidance on improving accuracy.

References/Sources/Further materials:

Short Videos:

YouTube. (n.d.).Basic weather data measuring instruments. Retrieved December 8, 2025, from https://www.youtube.com/watch?v=wMJmUAOpsg8&utm

4. Data Analysis and Interpretation Session

The objectives of this activity are to equip learners with practical skills to analyze and interpret climate data using spreadsheet tools such as Microsoft Excel or Google Sheets. Learners will understand the importance of organizing raw climate data into structured formats to support accurate analysis and informed farm decision-making. The activity introduces basic spreadsheet functions relevant to climate data, including data entry, sorting, simple calculations, and creation of charts and tables.

Learners will develop the ability to analyze climate parameters such as rainfall, temperature, and seasonal trends, and identify patterns that influence planting schedules, irrigation planning, and crop management decisions. Emphasis is placed on interpreting results in a practical farming context, linking numerical data to real-world implications such as drought risk, water availability, and crop stress.

The activity also aims to strengthen learners' digital literacy and confidence in using data-driven tools for agriculture. Through guided exercises, learners will practice translating analyzed data into clear conclusions and simple recommendations for farm actions. By the end of the activity, learners are expected to independently analyze basic climate datasets, interpret findings correctly, and explain how climate information supports efficient, timely, and resilient farm decision-making.

1. Aim of the activity: To develop skills in analyzing and interpreting climate data digitally.

2. Duration: 45 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introduction and Orientation**: The facilitator explains the purpose of climate data analysis and its relevance to farm decisions.
- **Data Entry Demonstration:** The facilitator demonstrates how to enter climate data into Excel or Google Sheets using proper formats.
- **Data Cleaning and Organization:** Learners are shown how to check for missing values, organize columns, and label datasets clearly.
- **Basic Data Analysis:** Simple calculations such as averages, totals, and trends are demonstrated and practiced.
- **Chart and Table Creation**: Learners create simple charts (e.g., rainfall trends, temperature patterns) to visualize data.
- **Interpretation Exercise:** Learners interpret analyzed data and discuss implications for planting and irrigation decisions.
- **Review and Feedback**: The facilitator reviews outputs, corrects errors, and reinforces key lessons.

References/Sources/Further materials:

Short Videos

YouTube. (n.d.).Advanced Climate Data Analysis & Interpretation. Retrieved December 2, 2025, from https://www.youtube.com/watch?v=0JFYbFpaMjU&utm

YouTube. (n.d.).How to Choose Statistical Methods for Climate Data. Retrieved December 2, 2025, from https://www.youtube.com/watch?v=cGZzhW5IhSY&utm

YouTube. (n.d.).Climate Change Data Interpretation (Basics). Retrieved December 2, 2025, from https://www.youtube.com/watch?v=O-5kuF5M4Ew

5. Developing a Farm Decision Plan

The objectives of this activity are to enable learners to translate analyzed climate data into practical and well-informed farm decision plans. Learners will understand how climate information, such as rainfall patterns, temperature trends, and seasonal forecasts, directly influences key farm decisions including crop selection, planting dates, irrigation scheduling, and risk management strategies. The activity emphasizes the importance of evidence-based planning rather than relying solely on traditional practices or intuition.

Learners will develop skills in evaluating analyzed data, identifying opportunities and risks, and selecting appropriate management responses. They will learn to prioritize actions based on climate conditions, resource availability, and farm objectives. The activity also aims to strengthen learners' ability to integrate climate data with local knowledge and agronomic principles to develop realistic and adaptable farm plans.

In addition, learners will improve their communication and planning skills by documenting decisions clearly and justifying them with data. Emphasis is placed on adaptability, sustainability, and climate-smart agriculture practices. By the end of the activity, learners are expected to confidently develop a structured farm decision plan that uses climate data to improve productivity, reduce climate-related risks, and enhance overall farm resilience.

1. Aim of the activity: To apply analyzed climate data in developing practical farm decision plans.

2. Duration: 25 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introduction and Review of Analyzed Data:** The facilitator reviews previously analyzed climate data and explains how it informs farm decisions.
- **Identification of Key Farm Decisions:** Learners identify decisions influenced by climate data, such as planting time, crop choice, and irrigation needs.
- **Risk and Opportunity Assessment:** Learners assess potential climate risks and opportunities based on the data.
- **Decision Plan Development:** Learners develop a farm decision plan outlining actions, timelines, and expected outcomes.
- **Justification Using Data:** Each decision is justified using analyzed climate information.
- **Group Discussion and Feedback:** Learners present plans, receive feedback, and refine their decision strategies.

References/Sources/Further materials:

None required.

6. Case Study / Scenario Analysis

The objectives of this activity are to enable learners to use historical and forecast climate data to make informed crop selection decisions under uncertain weather conditions. Using a real-world scenario from Kaduna State, learners will understand how variability in rainfall onset and temperature trends affects crop suitability, planting windows, and yield potential. The activity builds learners' capacity to analyze long-term climate patterns, compare them with seasonal forecasts, and assess implications for agricultural planning.

Learners will develop skills in interpreting 10 years of historical rainfall and temperature data to identify trends such as delayed onset of rains, changes in rainfall distribution, and increasing temperature extremes. They will learn to relate these trends to crop water requirements, maturity periods, and climate tolerance. The activity also aims to strengthen learners' ability to evaluate seasonal forecasts from NiMet and understand their role in managing climate risk.

Through group-based analysis and discussion, learners will improve critical thinking, problem-solving, and collaborative decision-making skills. By the end of the activity, learners are expected to confidently recommend suitable crops and planting strategies that reduce climate risk, improve resilience, and support climate-smart agriculture in regions experiencing increasing climate uncertainty.

1. Aim of the activity: To apply historical climate data for informed crop selection decisions.

2. Duration: 45 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introduction of the Scenario:** The facilitator presents the Kaduna State scenario, highlighting uncertainty around the 2025 rainy season onset.
- **Review of Provided Climate Data:** Learners examine the 10-year historical rainfall and temperature datasets and NiMet seasonal forecasts.
- **Trend Analysis Exercise:** Learners identify patterns such as average rainfall onset dates, dry spells, and temperature trends.
- **Crop Requirement Matching:** Learners compare climate trends with water and temperature requirements of common crops grown in Kaduna State.
- **Scenario-Based Decision Making:** In groups, learners select suitable crops and justify choices based on analyzed data and forecasts.
- **Presentation and Discussion**: Groups present recommendations and discuss differences in decisions.

- **Facilitator Summary:** The facilitator highlights key lessons on using climate data for crop selection under uncertainty.

References/Sources/Further materials:

NiMet Data Request Page available at https://nimet.gov.ng/datarequest nimet.gov.ng

NiMet "State of the Climate" Reports available at https://nimet.gov.ng/socn nimet.gov.ng
NiMet Seasonal Climate Prediction available at https://nimet.gov.ng/scp

7. Integration of Green and Digital Skills Workshop

The objectives of this activity are to enable learners to integrate green skills and digital competencies in the use of climate data for sustainable farm decision-making. Learners will understand how environmentally responsible farming practices and digital tools work together to improve productivity, resource efficiency, and climate resilience. The activity introduces key green skills such as water conservation, soil protection, and climate-smart agriculture, alongside digital skills including data collection, analysis, and use of mobile and online climate information platforms.

Learners will develop the ability to apply digital tools—such as weather apps, spreadsheets, and simple decision-support tools—to support green farming practices like efficient irrigation scheduling, reduced input wastage, and risk-aware crop planning. The workshop emphasizes the role of data-driven decisions in minimizing environmental impact while maintaining farm profitability.

The activity also aims to strengthen learners' problem-solving, collaboration, and innovation skills through group-based tasks and discussions. Learners will explore real-life farming scenarios and identify opportunities where green and digital skills can be jointly applied. By the end of the activity, learners are expected to confidently combine climate data, digital tools, and sustainable practices to develop responsible, efficient, and climate-resilient farm decision strategies.

1. Aim of the activity: To integrate green and digital skills for climate-informed farm decisions.

2. Duration: 30 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Workshop Introduction and Orientation:** The facilitator explains the concept of green and digital skills and their relevance to modern farming.
- **Overview of Green Farming Practices:** Key green practices such as water efficiency, soil conservation, and climate-smart agriculture are discussed.

- **Demonstration of Digital Tools:** The facilitator demonstrates use of climate data tools, weather apps, and basic data analysis platforms.
- **Group Practical Exercise**: Learners work in groups to apply digital tools to support a green farming decision scenario.
- **Presentation of Group Outputs:** Groups present how green and digital skills were integrated in their decision-making process.
- **Reflection and Feedback Session:** Learners reflect on lessons learned, while the facilitator provides feedback and highlights best practices.

References/Sources/Further materials:
None required.

8. Assessment and Reflection Session

The objectives of this activity are to assess learners' understanding and practical competence in using climate data for farm decision-making, while encouraging reflection on learning experiences and skill development. Learners will demonstrate their ability to collect, analyze, interpret, and apply climate data to real farming scenarios. The assessment component helps identify strengths, knowledge gaps, and areas requiring further improvement.

The activity also aims to promote reflective learning by encouraging learners to evaluate how climate data influences farm decisions such as crop selection, planting dates, irrigation scheduling, and risk management. Learners will reflect on the effectiveness of different climate data tools and digital platforms used during the course, as well as the relevance of green and digital skills in climate-smart agriculture.

In addition, the session supports the development of communication and critical thinking skills through presentations, discussions, and feedback. Learners will gain confidence in explaining their decision-making processes and justifying choices using data. By the end of the activity, learners are expected to have a clear understanding of their learning progress, appreciate the value of climate data in improving farm resilience, and identify ways to apply acquired skills in real-world farming contexts.

1. Aim of the activity: To evaluate learning outcomes and reflect on climate data applications.

2. Duration: 30 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introduction and Session Overview:** The facilitator explains the purpose of the assessment and reflection session.

- **Knowledge and Skills Assessment**: Learners complete short quizzes, practical tasks, or case-based questions on climate data use.
- **Presentation of Learner Outputs:** Learners present analyzed data, farm decision plans, or case study outcomes.
- **Reflection Exercise:** Learners reflect individually or in groups on lessons learned and challenges faced.
- **Group Discussion and Feedback:** The facilitator and peers provide constructive feedback on performance and understanding.
- **Summary and Way Forward:** Key learning points are summarized, and learners are guided on applying skills beyond the course.

References/Sources/Further materials:

None required.