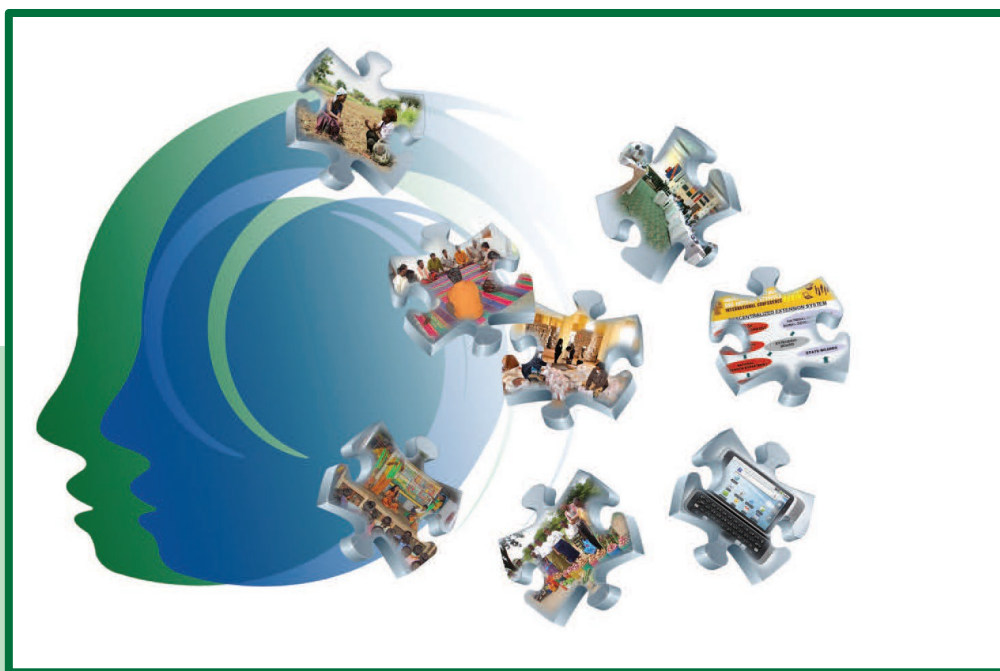


Thematic Module 8: Extension Support for Climate Adaptation and Mitigation



WORKBOOK

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En 2012, GFRAS a développé le document « New Extensionist », détaillant le rôle de l'extension dans un système d'innovation agricole et les stratégies et capacités nécessaires aux niveaux individuel, organisationnel et systémique. Sur la base de ce document, le Consortium GFRAS pour l'éducation et la formation en vulgarisation agricole a été créé pour promouvoir le principe du « New Extensionist » à travers la formation, la révision des programmes et la recherche en vulgarisation.

Le kit d'apprentissage « New Extensionist » (<https://www.g-fras.org/en/knowledge/new-extensionist-learning-kit-nelk.html>) contient plusieurs modules conçus pour l'apprentissage autodirigé, en présentiel ou en mode mixte, et peut être une ressource précieuse pour le personnel de terrain, les gestionnaires et les formateurs. Le module « Soutien à la vulgarisation pour l'adaptation et l'atténuation climatiques » est développé dans le cadre du kit d'apprentissage pour les vulgarisateurs.

Nous remercions tous ceux qui ont participé à l'examen du module, en particulier Malamine Ouattara, Hlami Ngwenya, Nimisha Mittal, et María Auxiliadora Briones. Nous remercions également le Réseau Latino-américain pour les Services de Conseil Rural (RELASER) pour avoir coordonné le développement de ce module.

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Financial support:

This product was made possible through the generous support of the American people through the United States Agency for International Development (USAID). The contents do not necessarily reflect the views of USAID or the United States Government. The contents are the responsibility of GFRAS.

2024



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Module 1: Extension support for climate adaptation and mitigation

PRE-ASSESSMENT

1. Self-assessment questions

After reading through the preface and introduction, complete the following pre-assessment to determine how comfortable you are with the topic of motivation. Rate your knowledge of the topics on a scale of 1 to 5 by circling the corresponding number.

	Question	Self-assessment				
		Low			High	
1.1.	Module outcomes	1	2	3	4	5
1.2.	Module overview	1	2	3	4	5
1.3.	Module objectives	1	2	3	4	5
1.4.	Module introduction	1	2	3	4	5

2. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 2.1. Extension professionals are crucial in helping rural and farming communities adapt to climate change. **True | False**
- 2.2. Participants can promote climate-smart agriculture among farmers after completing the module. **True | False**
- 2.3. Climate change is discussed regarding its impact on agriculture but excludes its effects on rural communities. **True | False**
- 2.4. The module emphasises farmers' vulnerability to climate change and the role of EAS in addressing these vulnerabilities. **True | False**
- 2.5. The module provides case studies exclusively from the local context to illustrate climate adaptation strategies. **True | False**
- 2.6. EAS is discussed as a crucial link between scientific knowledge and practical implementation for farmers. **True | False**
- 2.7. This module aims to equip extension professionals with theoretical knowledge but ignores practical tools for implementation. **True | False**
- 2.8. The introduction highlights the disruptive effects of climate change on weather patterns but excludes its impact on landscapes. **True | False**
- 2.9. The module encourages extension professionals to act as facilitators of climate action among farmers. **True | False**
- 2.10. The training emphasises understanding and applying knowledge through case studies presented during sessions. **True | False**

2.11. The overall objective of the module is to ensure a sustainable agrifood system solely through theoretical discussions. **True | False**

3. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

3.1. Which of the following is a specific objective after completing this module?

- A) Understanding the historical impacts of climate change on agriculture.
- B) Identifying the primary causes of climate change.
- C) Introducing adaptive measures for climate change with international case studies.
- D) Exploring theoretical frameworks for climate adaptation.

3.2. Which outcome does this training primarily aim to achieve?

- A) Memorizing detailed statistics on climate change impacts.
- B) Developing skills to communicate climate change impacts effectively.
- C) Becoming proficient in agricultural techniques unrelated to climate change.
- D) Gaining confidence in guiding farmers through climate adaptation and mitigation strategies.

STUDY UNIT 1: INTRODUCTION TO CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE

Session 1.1: Introduction to climate change

Activity 1.1

4. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 4.1. Heat waves are periods of abnormally low temperatures that break local high-temperature records. **True | False**
- 4.2. Sea level rise primarily results from the cooling of oceans and the melting of glaciers. **True | False**
- 4.3. Polar bears and snow leopards are examples of Arctic animals near extinction due to climate change. **True | False**
- 4.4. Ocean acidification is exacerbated by absorbing excess atmospheric carbon dioxide. **True | False**
- 4.5. Wildfires are controlled fires that help manage ecosystems and prevent larger disasters. **True | False**
- 4.6. Water scarcity has primarily affected South America and has not reached Asia. **True | False**
- 4.7. Climate change does not significantly impact the food web and ecosystems. **True | False**
- 4.8. The pH of the ocean has decreased significantly over the past 200 years due to human activities. **True | False**
- 4.9. Industrial manufacturing processes contribute minimally to greenhouse gas emissions. **True | False**
- 4.10. Deforestation contributes to approximately a quarter of global greenhouse gas emissions. **True | False**
- 4.11. Transportation sectors do not contribute significantly to greenhouse gas emissions. **True | False**
- 4.12. Agricultural practices have no impact on greenhouse gas emissions. **True | False**
- 4.13. Energy consumption in buildings has no effect on greenhouse gas emissions. **True | False**
- 4.14. Consumer lifestyles and overconsumption do not contribute to greenhouse gas emissions. **True | False**
- 4.15. COP 28 is an international summit focused on addressing climate change. **True | False**
- 4.16. The greenhouse effect is derived from the analogy of greenhouses used in cold areas. **True | False**
- 4.17. Weather refers to long-term atmospheric conditions in a specific place. **True | False**
- 4.18. Climate variability refers to natural fluctuations within the climate system. **True | False**

- 4.19. Climate change is solely caused by natural processes and not human activities.
True | False
- 4.20. Vulnerability in the context of climate hazards refers to exposure, capacity, and sensitivity. **True | False**
- 4.21. Resilience refers to the inability of a system to recover from climate-related hazards.
True | False
- 4.22. Climate hazards include natural disasters like earthquakes and tsunamis. **True | False**
- 4.23. Climate sensitivity measures the atmospheric temperature's reaction to various factors.
True | False
- 4.24. Risk refers to the certainty of outcomes in any action taken. **True | False**
- 4.25. Climate response involves proactive measures to mitigate climate change impacts.
True | False
- 4.26. Climate action focuses on reactive measures responding to observed climate change impacts. **True | False**
- 4.27. Mitigation refers to actions taken to reduce greenhouse gas emissions. **True | False**
- 4.28. Adaptation and resilience are interchangeable terms in addressing climate change impacts. **True | False**
- 4.29. Climate finance encompasses funding sources primarily from public channels.
True | False

5. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 5.1. According to the passage, what is the primary contributor to global climate change?
- A) Industrial manufacturing processes
 - B) Agricultural practices
 - C) Burning fossil fuels
 - D) Transportation
- 5.2. Which sector is responsible for emissions from burning fossil fuels to produce energy for manufacturing goods such as cement, iron, and steel?
- A) Energy consumption in buildings
 - B) Industrial manufacturing processes
 - C) Consumer lifestyles and overconsumption
 - D) Transportation
- 5.3. What is a direct effect of the sea level rise mentioned in the passage?
- A) Increased agricultural productivity
 - B) Enhanced freshwater availability
 - C) Harm to communities on islands and near coasts
 - D) Increased biodiversity

- 5.4. Which effect of climate change poses significant health hazards, especially for those with respiratory issues?
- A) Ocean acidification
 - B) Water scarcity
 - C) Wildfires
 - D) Heat waves
- 5.5. What is the primary difference between weather and climate?
- A) Weather refers to atmospheric conditions over a long period, while climate refers to short-term changes.
 - B) Weather is about short-term atmospheric conditions, while climate is the long-term average of weather conditions.
 - C) Weather includes temperature and precipitation, while climate includes only temperature.
 - D) Weather is static and unchanging, while climate changes frequently.
- 5.6. What does climate variability refer to?
- A) Long-term changes in climate patterns due to human activities.
 - B) Natural fluctuations within the climate system over short periods.
 - C) The predictable increase in average temperatures over decades.
 - D) The sudden onset of extreme weather events like hurricanes.
- 5.7. Which of the following is an example of climate action?
- A) Adapting agricultural practices to withstand changing weather patterns.
 - B) Reducing greenhouse gas emissions from agriculture.
 - C) Managing droughts and recovering from extreme events.
 - D) Increasing household water storage capacity.

Session 1.2: Climate change and agriculture

Activity 1.2

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. The anticipated global population increase to 9.7 billion by 2050 highlights the need to increase food production. **True | False**
- 1.2. Changes in weather and climate patterns do not significantly impact farmers or the agriculture sector. **True | False**
- 1.3. The agriculture sector is susceptible to climate change's effects and significantly contributes to it. **True | False**
- 1.4. Greenhouse gases do not include water vapour and ozone. **True | False**
- 1.5. The greenhouse effect is the process by which greenhouse gases trap heat near the earth's surface. **True | False**
- 1.6. Climate change only positively impacts crop yields and food security. **True | False**
- 1.7. By 2050, climate change can potentially lower the yields of major crop types by 17%.
True | False
- 1.8. Increasing CO₂ concentration does not affect crop yield or quality. **True | False**
- 1.9. Climate-smart and climate-resilient agricultural practices can help mitigate the impacts of climate change on food production. **True | False**
- 1.10. A 1°C increase in temperature is estimated to reduce potato crop yields by 20–30%.
True | False
- 1.11. Rising sea levels can lead to saltwater intrusion into freshwater sources used for agriculture. **True | False**
- 1.12. Changing precipitation patterns do not affect water resources in agriculture.
True | False
- 1.13. Soil degradation and erosion are some of the impacts of climate change on soil systems.
True | False
- 1.14. Farmers in the tropics are increasingly vulnerable to extreme weather events like droughts and floods. **True | False**
- 1.15. Climate change does not pose any health risks to farmers. **True | False**
- 1.16. The agriculture sector contributes 22% of GHG emissions globally. **True | False**
- 1.17. Industrial agriculture often relies heavily on fertilisers and pesticides. **True | False**
- 1.18. Livestock production contributes more GHG emissions than the electricity production sector. **True | False**
- 1.19. Sustainable water and land management strategies are essential to mitigate the environmental impacts of agriculture. **True | False**
- 1.20. Climate-smart agriculture involves practices that boost productivity, enhance resilience, and reduce GHG emissions. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. What is one of the negative effects of climate change on crop productivity?
- A) Decreased demand for irrigation
 - B) Decreased risk of wildfires
 - C) Expansion of pests and diseases
 - D) Improved pollination processes
- 2.2. Which agricultural practice contributes 15% of global greenhouse gas emissions mainly due to methane (CH₄)?
- A) Extensive cultivation of rice and corn
 - B) Industrial agriculture
 - C) Livestock production
 - D) Use of synthetic fertilisers and pesticides
- 2.3. Which of the following responses to climate change involves developing crop varieties resilient to climate stressors such as drought, heat, and pests?
- A) Changes in farming practices
 - B) Development of climate-resilient varieties
 - C) Ecosystem services
 - D) Changes in farming approaches

Session 1.3: EAS and climate change

Activity 1.3

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Smallholder farmers have limited capacity to adapt to climate change. **True | False**
- 1.2. EAS stands for Extension and Advisory Services. **True | False**
- 1.3. EAS can help farmers by providing need-based information, training, and resources to improve resilience. **True | False**
- 1.4. EAS only focuses on providing technology and information sharing. **True | False**
- 1.5. Farmers are generally more receptive to advice on climate-smart agriculture when supported by EAS. **True | False**
- 1.6. EAS staff often have close working relationships with urban communities. **True | False**
- 1.7. EAS providers can assist during and after natural disasters by providing relief and rebuilding rural livelihoods. **True | False**
- 1.8. Successful adaptation to climate change requires only behavioural shifts. **True | False**
- 1.9. EAS can use both traditional media and new communication tools to communicate climate information to farmers. **True | False**
- 1.10. EAS contributes to climate change mitigation by promoting practices that reduce the release of carbon dioxide. **True | False**
- 1.11. EAS does not support farmers in accessing voluntary and regulated carbon markets. **True | False**
- 1.12. EAS demonstrates new technologies and practices to promote adaptation and mitigation. **True | False**
- 1.13. Organising training and learning events is not part of the EAS functions. **True | False**
- 1.14. EAS can help enhance access to inputs by organising seed fairs. **True | False**
- 1.15. Public sector EAS in developing countries often have abundant staff and operational funds. **True | False**
- 1.16. Addressing climate change issues requires continuous in-service capacity development for EAS personnel. **True | False**
- 1.17. Climate-smart interventions only need to be implemented at the individual plot level. **True | False**
- 1.18. Multidisciplinary teams are often required to implement climate-smart interventions at the community level. **True | False**
- 1.19. EAS personnel need to respect Indigenous and local knowledge to support climate change adaptation and mitigation. **True | False**
- 1.20. EAS managers need to develop short-term visions for their approach to climate change adaptation in agriculture. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. Which of the following is NOT a session outcome?
- A) Explain why extension and advisory services (EAS) should address climate change
 - B) Discuss the role of EAS in addressing climate change
 - C) Identify the types of crops most affected by climate change
 - D) Discuss the capacities needed to empower the EAS to address climate change
- 2.2. Which of the following is a reason why EAS should address climate change issues?
- A) EAS staff focus primarily on urban communities.
 - B) Farmers are less willing to experiment with climate-smart agriculture if supported by EAS.
 - C) EAS providers often have a thorough explanation of farmers' vulnerabilities and the prevailing conditions under which they operate.
 - D) EAS providers do not understand the social dynamics within and between communities.
- 2.3. Which of the following is a challenge EAS faces when dealing with climate change issues?
- A) The simplicity of climate change interventions
 - B) Immediate visibility of results from restoration measures
 - C) Addressing challenges across different geographic scales
 - D) Lack of need for multidisciplinary teams
- 2.4. Which of the following capacities is needed for EAS personnel to support farmers in addressing climate change?
- A) Expertise in managing urban development projects
 - B) Sensitivity to gender and diversity issues
 - C) Knowledge of stock market trends
 - D) Skills in software development for agricultural technologies
- 2.5. Which of the following capacities is essential for EAS personnel to support climate change adaptation and mitigation?
- A) Conducting local climate change impact and vulnerability assessments
 - B) Implementing urban planning strategies
 - C) Managing social media campaigns for agricultural products
 - D) Developing new varieties of genetically modified crops

STUDY UNIT 2: CLIMATE ADAPTATION

Session 2.1: Introduction to climate adaptation

Activity 2.1

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. The Global Center of Adaptation defines climate adaptation as “taking action to prepare for and adjust to the current and projected impacts of climate change.” **True | False**
- 1.2. The IPCC defines climate adaptation as the process of adjustment to expected climate only, excluding actual climate impacts. **True | False**
- 1.3. Climate adaptation strategies can range from individual efforts to global efforts.
True | False
- 1.4. Changes in government policies do not influence climate adaptation. **True | False**
- 1.5. Technological advances can lead to adaptations that help regions adjust as the environment changes. **True | False**
- 1.6. Climate adaptation strategies do not include engineering and planning efforts.
True | False
- 1.7. Globally coordinated efforts to adapt can help as climate change causes people to migrate to new places. **True | False**
- 1.8. Building seawalls and relocating buildings to higher ground are examples of climate adaptation strategies. **True | False**
- 1.9. Climate adaptation is not necessary for making people and places less vulnerable to climate change impacts. **True | False**
- 1.10. The first step in any adaptation process is assessing impacts, vulnerability, and risks.
True | False
- 1.11. Developing an adaptation plan is unnecessary once risks and negative impacts have been identified. **True | False**
- 1.12. EAS plays a crucial role in implementing adaptive measures and monitoring the adaptation process. **True | False**
- 1.13. An adaptation deficit refers to the limited ability of some countries to adapt to climate change. **True | False**
- 1.14. Low-income countries are more vulnerable to climate variability and future climate change than rich countries. **True | False**
- 1.15. Maladaptation refers to actions that increase greenhouse gas emissions and burden the most vulnerable. **True | False**
- 1.16. Adaptive capacity is the potential or ability of a system to adapt to the effects of climate change. **True | False**
- 1.17. Adaptive capacity does not include learning from previous experiences to cope with future climates. **True | False**

1.18. Resources available for adaptation can be natural, financial, institutional, or human.

True | False

1.19. Adaptation strategies only refer to measures taken by governments to adapt to climate change. **True | False**

1.20. Planned adaptation results from a deliberate policy decision based on awareness of changing conditions. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

2.1. Which of the following is NOT true for climate adaptation?

- A) Climate adaptation strategies range from individual to global efforts.
- B) Changes in government policies fuel some adaptations.
- C) Adaptations occur due to technological advances.
- D) Climate adaptation requires significant financial investments.

2.2. What is maladaptation in the context of climate change?

- A) Actions that enhance greenhouse gas emissions and increase vulnerability
- B) The process of increasing adaptive capacity
- C) Measures that reduce the risks associated with climate change
- D) Developing crop varieties resilient to climate stressors

2.3. What does the concept of "adaptation deficit" refer to?

- A) The ability of high-income countries to adapt to climate change
- B) The limited ability of some countries, regions, or territories to adapt to climate change
- C) Actions that increase greenhouse gas emissions
- D) The enhancement of adaptive capacity

2.4. What is the role of capacity development in climate adaptation?

- A) Increasing greenhouse gas emissions
- B) Reducing the need for adaptation strategies
- C) Enhancing adaptive capacity to cope with climate hazards
- D) Limiting the availability of resources for adaptation

2.5. Which type of adaptation takes place before the impacts of climate change are observed and is also referred to as proactive adaptation?

- A) Autonomous Adaptation
- B) Planned Adaptation
- C) Anticipatory Adaptation
- D) Reactive Adaptation

- 2.6. Which of the following is an adaptation strategy for AgriFood systems to cope with the impacts of climate change?
- A) Increasing the use of synthetic fertilisers
 - B) Developing crop varieties resistant to floods
 - C) Relying solely on traditional farming methods
 - D) Expanding long-distance transportation of food

Session 2.2: Climate adaptation

Activity 2.2

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Climate-smart agriculture aims to increase agricultural productivity while simultaneously addressing climate change and food security. **True | False**
- 1.2. The impacts of climate change on agriculture are consistent across all regions, with no variation in economic, social, or environmental patterns. **True | False**
- 1.3. Adaptation strategies for agriculture can only be effective if they are implemented at the regional and national levels. **True | False**
- 1.4. At the local level, private farms and households can make autonomous adaptation decisions, while at the regional or national level, planned adaptation decisions are made by institutional or governmental authorities. **True | False**
- 1.5. The most severe repercussions of climate change on agriculture are felt primarily at the national level, affecting national policies more than local communities. **True | False**
- 1.6. One of the agricultural adaptation strategies in China includes promoting the large-scale planting of superior crop varieties in suitable areas to bolster resilience against disasters. **True | False**
- 1.7. Farm-based measures for agricultural adaptation are built on the rational personal interests of farmers. **True | False**
- 1.8. Policy-driven adaptation measures are typically based on the individual needs of farmers. **True | False**
- 1.9. Local agricultural communities are more susceptible to the impacts of climate change due to their heavy reliance on the agricultural sector. **True | False**
- 1.10. Reducing food security and aggravating water shortages are some of the most vitally damaging effects of climate change on agriculture. **True | False**
- 1.11. At the national level, autonomous adaptation decisions are more common than planned adaptation decisions. **True | False**
- 1.12. In Europe, changing crop sowing days and growing heat-resistant cultivars are examples of agricultural adaptation strategies. **True | False**
- 1.13. Russia's adaptation strategies include transitioning to minimal or zero tillage technologies to prevent soil erosion. **True | False**
- 1.14. In China, strengthening agricultural infrastructure is not considered an important adaptation strategy for climate change. **True | False**
- 1.15. India's agricultural adaptation strategies include conservation agriculture and changes in agricultural and farming practices as a passive response. **True | False**
- 1.16. In South-central Mexico, the use of coffee agroforestry systems with diversified species of multipurpose trees and shrubs is an adaptation strategy to combat climate change. **True | False**

- 1.17. Natural resource management involves the judicious use of resources found in the natural environment without jeopardising future generations' ability to meet their needs. **True | False**
- 1.18. The mixed home gardens of central highland villages in Sri Lanka, also known as 'Kandyan Forest Gardens', contribute significantly to soil and biodiversity conservation. **True | False**
- 1.19. Strip cropping is an expensive soil conservation technique due to the high costs associated with field preparation. **True | False**
- 1.20. Conservation agriculture practices rely heavily on the use of chemical fertilisers to maintain soil fertility. **True | False**
- 1.21. The likoti method in Lesotho involves digging pits of about 15 × 30 cm in diameter and 15 to 20 cm deep, which are then filled with fertiliser and seeds. **True | False**
- 1.22. Food sovereignty focuses solely on ensuring access to sufficient, safe, and nutritious food. **True | False**
- 1.23. Agroecology promotes using traditional ecological knowledge, innovation, and local resources to transform food production systems. **True | False**
- 1.24. Climate-smart agriculture aims to achieve triple objectives, including sustainably increasing productivity, adapting to climate change, and reducing greenhouse gas emissions. **True | False**
- 1.25. In Chile, a climate-smart rice production system that uses water more efficiently and reduces methane emissions has been validated in farmers' plots. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. Which of the following is NOT a strategy for agricultural adaptation at the local and regional levels?
- A) Crop varieties and management
 - B) Financial schemes
 - C) Water and soil management
 - D) New agronomic practices
- 2.2. Which of the following strategies can be emphasised at the regional and national levels to adapt agriculture to climate change?
- A) Farmer training and knowledge transfer
 - B) Innovative breeding techniques
 - C) Insurance and financial schemes
 - D) New species or hybrids of plants

- 2.3. Which of the following is a specific objective after completing this module?
- A) Understanding the historical impacts of climate change on agriculture.
 - B) Identifying the primary causes of climate change.
 - C) Introducing adaptive measures for climate change with international case studies.
 - D) Exploring theoretical frameworks for climate adaptation.
- 2.4. Which of the following is NOT an agricultural adaptation strategy used in Africa?
- A) Crop diversification
 - B) Planting drought-tolerant varieties
 - C) Conservation tillage
 - D) Changing planting dates
- 2.5. Which of the following is a practice adopted by young women in Sri Lanka's highland region to manage their home gardens sustainably?
- A) Using chemical fertilisers and pesticides
 - B) Strip cropping
 - C) Agroforestry and home gardens
 - D) Monocropping
- 2.6. Which of the following is NOT a principle of conservation agriculture?
- A) Minimum or zero tillage and direct seeding
 - B) Extensive use of chemical fertilisers
 - C) Cover cropping and soil cover with crop residue
 - D) Crop rotation
- 2.7. Which of the following is an objective of climate-smart agriculture (CSA)?
- A) Reducing the use of organic fertilisers
 - B) Promoting monoculture farming practices
 - C) Building resilience and adaptation to climate change
 - D) Eliminating the use of all fertilisers
- 2.8. Which of the following is a benefit of the agroecology practices implemented in Tanzania's drylands?
- A) Increased reliance on chemical pesticides
 - B) Reduction in crop residue use
 - C) Enhanced biodiversity conservation and climate resilience
 - D) Decreased awareness of ecosystem services

Session 2.3: EAS to promote climate adaptation

Activity 2.3

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Strengthening innovation networks is critical to supporting agricultural innovation in adapting to climate change. **True | False**
- 1.2. EAS agencies are not considered key players in helping to strengthen innovation networks for agricultural adaptation. **True | False**
- 1.3. EAS can effectively convey adaptation information to farmers, who may be more willing to adopt it from them rather than from a book or a researcher. **True | False**
- 1.4. Farmers in isolated remote areas are less affected by climate change and do not need the support of EAS. **True | False**
- 1.5. In Bangladesh, the Department of Agricultural Extension (DAE) successfully supported both agronomic and harvesting network development to adapt rice cultivation to flash flooding. **True | False**
- 1.6. Uncertainty in the exact effects and spatial distribution of climate change is a key challenge in adapting agriculture to climate change. **True | False**
- 1.7. Climate models illustrate long-term average temperature and precipitation trends but do not predict specific future weather events. **True | False**
- 1.8. Early identification of adaptation needs allows time to react and plan for various adaptation options. **True | False**
- 1.9. Individuals and households are the least frequent actors in implementing climate adaptation measures. **True | False**
- 1.10. Digital Climate-Informed Advisory Services (DCAS) promote and upscale climate adaptation by integrating climate information into agricultural decision-making. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. Which of the following is an essential role of EAS in climate adaptation?
 - A) Providing financial loans to farmers
 - B) Facilitating the adoption of best adaptation practices
 - C) Selling agricultural products
 - D) Building dams and reservoirs

2.2. Which of the following categories of actors is most frequently involved in implementing climate change adaptation measures?

- A) Government agencies
- B) Individuals and households
- C) Private sector corporations
- D) Academia

2.3. Which of the following is NOT a principle of conservation agriculture?

- A) Minimum or zero tillage and direct seeding
- B) Extensive use of chemical fertilisers
- C) Cover cropping and soil cover with crop residue
- D) Crop rotation

STUDY UNIT 3: CLIMATE MITIGATION

Session 3.1: Introduction to mitigation

Activity 3.1

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Farmers are the primary agents in pursuing sustainable solutions for climate change.
True | False
- 1.2. Climate mitigation refers to efforts to reduce or prevent greenhouse gas emissions and counter the adverse impacts of climate change. **True | False**
- 1.3. Carbon sequestration is the process of increasing carbon dioxide emissions from human activity. **True | False**
- 1.4. The carbon footprint is the total amount of greenhouse gases generated by human actions. **True | False**
- 1.5. Agroforestry is a practice aimed at restoring forested areas by planting trees in previously non-forested areas. **True | False**
- 1.6. The European Union Emissions Trading System (EU ETS) operates based on a cap-and-trade system to reduce greenhouse gas emissions. **True | False**
- 1.7. Alternate Wetting and Drying (AWD) water management in rice fields has been shown to reduce methane emissions without compromising rice productivity. **True | False**
- 1.8. Carbon emission trading is also known as carbon pricing. **True | False**
- 1.9. Carbon Capture and Storage (CCS) involves capturing carbon dioxide emissions from sources like power plants and storing them underground to prevent them from entering the atmosphere. **True | False**
- 1.10. Measures that reduce product losses along food supply chains and consumer food waste do not significantly impact climate change mitigation. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. Which of the following is NOT a method of carbon sequestration?
 - A) Planting trees
 - B) Injecting carbon dioxide into deep oceans
 - C) Burning fossil fuels
 - D) Storing carbon dioxide in underground aquifers

- 2.2. What is the main goal of climate-smart agriculture (CSA)?
- A) Increasing chemical fertiliser use
 - B) Promoting sustainable development while addressing climate change
 - C) Reducing the number of farms
 - D) Enhancing monoculture farming
- 2.3. What does carbon emission trading aim to do?
- A) Increase greenhouse gas emissions
 - B) Create a market for carbon allowances to limit emissions
 - C) Promote deforestation
 - D) Increase fossil fuel usage
- 2.4. Which of the following practices is included in carbon farming?
- A) No-till farming
 - B) Slash-and-burn agriculture
 - C) Increased pesticide use
 - D) Continuous flooding in rice fields

Session 3.2: Climate mitigation

Activity 3.2

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Interventions that reduce the emissions intensity of agricultural production always lead to increased productivity and cost savings for farmers. **True | False**
- 1.2. Sustainable intensification aims to increase agricultural yield while optimising the efficiency of production across social, environmental, and ethical dimensions.
True | False
- 1.3. Improving nitrogen management and production is focused on better matching the nitrogen supply from fertilisers with the nitrogen demands of crops. **True | False**
- 1.4. Enteric fermentation emissions from livestock can be reduced by improving the quality and digestibility of feed. **True | False**
- 1.5. Managing manure to reduce greenhouse gas emissions includes practices such as anaerobic digesters and better timing and application of manure onto croplands.
True | False
- 1.6. Reducing food loss and waste can close the 70% gap of food needed to meet 2050 demand by roughly 22%. **True | False**
- 1.7. In the developing world, food losses mainly occur postharvest due to financial and technical limitations. **True | False**
- 1.8. Beef production is the most resource-efficient meat production per kilo compared to other meats. **True | False**
- 1.9. Urea Deep Placement (UDP) is a fertiliser management technology that increases nitrous oxide emissions. **True | False**
- 1.10. Alternate Wetting and Drying (AWD) in rice cultivation can reduce methane emissions by up to half compared to continuous flooding. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. Which of the following is a demand-side strategy for climate mitigation in the agrifood system?
 - A) Sustainable intensification
 - B) Improving nitrogen management
 - C) Reducing food loss and waste
 - D) Managing manure

- 2.2. What is the primary purpose of the Sustainable Intensification strategy?
- A) To reduce the use of chemical fertilisers
 - B) To increase yield and meet future demand by optimising agricultural production efficiency
 - C) To reduce the population of livestock
 - D) To enhance water management in rice cultivation
- 2.3. What is a key intervention to reduce methane emissions from rice cultivation?
- A) Planting more trees
 - B) Using anaerobic digesters
 - C) Improving water management
 - D) Reducing livestock populations
- 2.4. Which of the following is NOT a method to sequester carbon in agricultural systems?
- A) Retention of crop residues
 - B) Continuous flooding of rice fields
 - C) Agroforestry
 - D) Using biochar
- 2.5. What percentage of food intended for human consumption is estimated to be lost or wasted, according to FAO?
- A) 10%
 - B) 20%
 - C) 33%
 - D) 50%
- 2.6. Which of the following is a specific intervention to reduce consumer food waste?
- A) Increase livestock production
 - B) Revise food date labelling practices
 - C) Promote continuous flooding in rice fields
 - D) Reduce the use of fertilisers
- 2.7. What is a key intervention to curb future demand for beef consumption?
- A) Promote the use of chemical fertilisers
 - B) Increase poultry production
 - C) Implement media and outreach campaigns
 - D) Encourage continuous grazing
- 2.8. What is the purpose of Urea Deep Placement (UDP) technology?
- A) Increase methane emissions
 - B) Improve nutrient use efficiency
 - C) Promote deforestation
 - D) Enhance water use in agriculture

2.9. What is a barrier to the widespread adoption of Alternate Wetting and Drying (AWD) in rice cultivation?

- A) Increased water use
- B) Physical demands of manually placing briquettes
- C) Lack of knowledge about the technology
- D) High cost of implementation

2.10. Which country was mentioned as having a significant opportunity for GHG mitigation through consumption practices?

- A) India
- B) Brazil
- C) China
- D) Australia

Session 3.3: EAS promoting climate change mitigation

Activity 3.3

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Farmers may hesitate to adopt new agricultural practices if they perceive them as risky or requiring significant investments in new technologies. **True | False**
- 1.2. Conservation agriculture involves minimally disturbing the soil, incorporating crop rotation, and using cover crops to improve soil health and reduce GHG emissions.
True | False
- 1.3. Accurately measuring, reporting, and verifying emission reductions from conservation agriculture is straightforward and standardised across regions and countries.
True | False
- 1.4. Establishing a baseline for measuring emission reductions in agriculture can be challenging due to variability in emissions and the lack of consolidated data.
True | False
- 1.5. The Farmer Field School (FFS) approach is explicitly designed to address climate change variability. **True | False**
- 1.6. The MICCA project in Tanzania aimed to integrate climate change adaptation and mitigation into agricultural development activities for smallholder farmers. **True | False**
- 1.7. Farmers in Tanzania reported that adopting Conservation Agriculture (CA) increased their maize yields by more than 100%. **True | False**
- 1.8. Insecure land tenure is not a significant barrier to adopting CA and other CSA practices.
True | False
- 1.9. Contingency planning involves developing measures to respond to current and future climate-related risks. **True | False**
- 1.10. The National Innovations in Climate Resilient Agriculture (NICRA) project in India focuses on enhancing the resilience of agricultural systems to climate variability and change.
True | False
- 1.11. Finger millet is a resilient crop that adapts well to poor soil fertility and prolonged drought conditions, making it an environmentally sustainable choice amid climate change.
True | False
- 1.12. The Low Carbon Coffee NAMA Support Project (NSP) in Costa Rica did not involve any financial support for coffee farms and mills to invest in low-emission practices.
True | False
- 1.13. The NSP's emphasis on capacity building resulted in 24% of registered Costa Rican coffee mills actively measuring their GHG inventories. **True | False**
- 1.14. The Peru Cacao Alliance (PCA) project aimed to discourage illegal coca production by integrating small-scale farmers into a sustainable cacao value chain. **True | False**

- 1.15. Perennial crop expansion contributes to carbon sequestration in soils and tree biomass.
True | False
- 1.16. The PCA project saw no significant increase in cacao yields despite its interventions.
True | False
- 1.17. Digital tools such as mobile phones and applications provide farmers with real-time information and advisory services, helping them adapt to climate change. **True | False**
- 1.18. Digital tools for agricultural extension are explicitly focused on climate change mitigation.
True | False
- 1.19. Farmers in the Koraput district of Odisha, India, adopted the System of Millet Intensification (SMI), which increased millet yields significantly. **True | False**
- 1.20. The value chain approach involves understanding the actors in a product sector, from input suppliers to end-market buyers. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. Which of the following is NOT a principle of Conservation Agriculture (CA)?
- A) Minimum soil disturbance
 - B) Crop rotation
 - C) Use of cover crops
 - D) Extensive use of chemical fertilisers
- 2.2. What is a critical challenge in promoting mitigation strategies among farmers?
- A) Lack of interest in increasing productivity
 - B) Perceived increase in yield risks
 - C) Excessive financial support
 - D) Limited access to traditional agricultural practices
- 2.3. What did the MICCA project in Tanzania aim to integrate into agricultural development activities?
- A) Increased pesticide use
 - B) Climate change adaptation and mitigation
 - C) Conventional farming practices
 - D) Large-scale monocropping
- 2.4. What is one of the critical interventions of India's National Innovations in Climate Resilient Agriculture (NICRA) project?
- A) Promoting slash-and-burn agriculture
 - B) Real-time contingency crop planning
 - C) Reducing livestock populations
 - D) Increasing use of chemical fertilisers

- 2.5. What did the Low Carbon Coffee NAMA Support Project (NSP) in Costa Rica emphasise in addition to sustainable coffee production?
- A) Reducing water use in rice fields
 - B) Building a mitigation component into food security projects
 - C) Providing financial resources for low-emission practices
 - D) Encouraging continuous grazing
- 2.6. Which of the following is an example of a digital tool that helps EAS support farmers with climate-related information?
- A) Plantwise
 - B) Slash-and-burn manager
 - C) Chemical fertiliser tracker
 - D) Pesticide application assistant

SUMMATIVE ASSESSMENT

1. True or False questions

Read each of the statements below carefully and circle the correct answer.

- 1.1. Agricultural practices have no impact on greenhouse gas emissions. **True | False**
- 1.2. Weather refers to long-term atmospheric conditions in a specific place. **True | False**
- 1.3. Climate sensitivity measures the atmospheric temperature's reaction to various factors.
True | False
- 1.4. The agriculture sector is susceptible to climate change's effects and significantly contributes to it. **True | False**
- 1.5. Changing precipitation patterns do not affect water resources in agriculture.
True | False
- 1.6. Soil degradation and erosion are some of the impacts of climate change on soil systems.
True | False
- 1.7. Farmers in the tropics are increasingly vulnerable to extreme weather events like droughts and floods. **True | False**
- 1.8. The agriculture sector contributes 22% of GHG emissions globally. **True | False**
- 1.9. Sustainable water and land management strategies are essential to mitigate the environmental impacts of agriculture. **True | False**
- 1.10. Climate-smart agriculture involves practices that boost productivity, enhance resilience, and reduce GHG emissions. **True | False**
- 1.11. Smallholder farmers have limited capacity to adapt to climate change. **True | False**
- 1.12. Public sector EAS in developing countries often have abundant staff and operational funds. **True | False**
- 1.13. Climate-smart interventions only need to be implemented at the individual plot level.
True | False
- 1.14. EAS personnel must respect Indigenous and local knowledge to support climate change adaptation and mitigation. **True | False**
- 1.15. EAS managers need to develop short-term visions for their approach to climate change adaptation in agriculture. **True | False**
- 1.16. Technological advances can lead to adaptations that help regions adjust as the environment changes. **True | False**
- 1.17. Climate adaptation strategies do not include engineering and planning efforts.
True | False
- 1.18. Developing an adaptation plan is unnecessary once risks and negative impacts have been identified. **True | False**
- 1.19. Adaptive capacity is the ability of a system to adapt to the effects of climate change.
True | False
- 1.20. Adaptation strategies for agriculture can only be effective if implemented at the regional and national levels. **True | False**

- 1.21. Local agricultural communities are more susceptible to the impacts of climate change due to their heavy reliance on the agricultural sector. **True | False**
- 1.22. Natural resource management involves the judicious use of resources found in the natural environment without jeopardising future generations' ability to meet their needs. **True | False**
- 1.23. Strip cropping is an expensive soil conservation technique due to the high costs associated with field preparation. **True | False**
- 1.24. Conservation agriculture practices rely heavily on chemical fertilisers to maintain soil fertility. **True | False**
- 1.25. Farmers in isolated remote areas are less affected by climate change and do not need the support of EAS. **True | False**
- 1.26. Uncertainty in the exact effects and spatial distribution of climate change is a key challenge in adapting agriculture to climate change. **True | False**
- 1.27. Climate models illustrate long-term average temperature and precipitation trends but do not predict specific future weather events. **True | False**
- 1.28. Farmers are the primary agents in pursuing sustainable solutions for climate change. **True | False**
- 1.29. Climate mitigation refers to efforts to reduce or prevent the emission of greenhouse gases and counter the adverse impacts of climate change. **True | False**
- 1.30. Carbon sequestration is the process of increasing carbon dioxide emissions from human activity. **True | False**
- 1.31. The carbon footprint is the total amount of greenhouse gases generated by human actions. **True | False**
- 1.32. Interventions that reduce the emissions intensity of agricultural production always lead to increased productivity and cost savings for farmers. **True | False**
- 1.33. Beef production is the most resource-efficient meat per kilo compared to other meats. **True | False**
- 1.34. Urea Deep Placement (UDP) is a fertiliser management technology that increases nitrous oxide emissions. **True | False**
- 1.35. Alternate Wetting and Drying (AWD) in rice cultivation can reduce methane emissions by up to half compared to continuous flooding. **True | False**
- 1.36. Farmers may hesitate to adopt new agricultural practices if they perceive them as risky or requiring significant investments in new technologies. **True | False**
- 1.37. Conservation agriculture involves minimally disturbing the soil, incorporating crop rotation, and using cover crops to improve soil health and reduce GHG emissions. **True | False**
- 1.38. The Farmer Field School (FFS) approach is explicitly designed to address climate change variability. **True | False**
- 1.39. Insecure land tenure is not a significant barrier to adopting CA and other CSA practices. **True | False**

- 1.40. Contingency planning involves developing measures to respond to current and future climate-related risks. **True | False**
- 1.41. Perennial crop expansion contributes to carbon sequestration in soils and tree biomass. **True | False**
- 1.42. The value chain approach involves understanding the actors in a product sector, from input suppliers to end-market buyers. **True | False**

2. Multiple choice questions

Read each of the following questions carefully and circle the best answer from the options provided.

- 2.1. What is the primary contributor to global climate change?
- A) Industrial manufacturing processes
 - B) Agricultural practices
 - C) Burning fossil fuels
 - D) Transportation
- 2.2. What is the primary difference between weather and climate?
- A) Weather refers to atmospheric conditions over a long period, while climate refers to short-term changes.
 - B) Weather is about short-term atmospheric conditions, while climate is the long-term average of weather conditions.
 - C) Weather includes temperature and precipitation, while climate includes only temperature.
 - D) Weather is static and unchanging, while climate changes frequently.
- 2.3. What is one of the adverse effects of climate change on crop productivity?
- A) Decreased demand for irrigation
 - B) Decreased risk of wildfires
 - C) Expansion of pests and diseases
 - D) Improved pollination processes
- 2.4. Which agricultural practice contributes 15% of global greenhouse gas emissions mainly due to methane (CH₄)?
- A) Extensive cultivation of rice and corn
 - B) Industrial agriculture
 - C) Livestock production
 - D) Use of synthetic fertilisers and pesticides
- 2.5. Which of the following responses to climate change involves developing crop varieties resilient to climate stressors such as drought, heat, and pests?
- A) Changes in farming practices
 - B) Development of climate-resilient varieties
 - C) Ecosystem services
 - D) Changes in farming approaches

- 2.6. What capacities are essential for EAS personnel to support climate change adaptation and mitigation?
- A) Conducting local climate change impact and vulnerability assessments
 - B) Implementing urban planning strategies
 - C) Managing social media campaigns for agricultural products
 - D) Developing new varieties of genetically modified crops
- 2.7. Which of the following is NOT valid for climate adaptation?
- A) Climate adaptation strategies range from individual to global efforts.
 - B) Changes in government policies fuel some adaptations.
 - C) Adaptations occur due to technological advances.
 - D) Climate adaptation requires significant financial investments.
- 2.8. What does the concept of "adaptation deficit" refer to?
- A) The ability of high-income countries to adapt to climate change
 - B) The limited ability of some countries, regions, or territories to adapt to climate change
 - C) Actions that increase greenhouse gas emissions
 - D) The enhancement of adaptive capacity
- 2.9. Which of the following is an adaptation strategy for AgriFood systems to cope with the impacts of climate change?
- A) Increasing the use of synthetic fertilisers
 - B) Developing crop varieties resistant to floods
 - C) Relying solely on traditional farming methods
 - D) Expanding long-distance transportation of food
- 2.10. Which of the following is NOT a strategy for agricultural adaptation at the local and regional levels?
- A) Crop varieties and management
 - B) Financing methods
 - C) Water and soil management
 - D) New agronomic practices
- 2.11. Which of the following is an objective of climate-smart agriculture (CSA)?
- A) Reducing the use of organic fertilisers
 - B) Promoting monoculture farming practices
 - C) Building resilience and adaptation to climate change
 - D) Eliminating the use of all fertilisers
- 2.12. Which of the following practices is included in carbon farming?
- A) No-till farming
 - B) Slash-and-burn agriculture
 - C) Increased pesticide use
 - D) Continuous flooding in rice fields

- 2.13. Which of the following is a demand-side strategy for climate mitigation in the agrifood system?
- A) Sustainable intensification
 - B) Improving nitrogen management
 - C) Reducing food loss and waste
 - D) Managing manure
- 2.14. What is the primary purpose of the Sustainable Intensification strategy?
- A) To reduce the use of chemical fertilisers
 - B) To increase yield and meet future demand by optimising agricultural production efficiency
 - C) To reduce the population of livestock
 - D) To enhance water management in rice cultivation
- 2.15. According to FAO, what percentage of food intended for human consumption is estimated to be lost or wasted?
- A) 10%
 - B) 20%
 - C) 33%
 - D) 50%
- 2.16. What is the purpose of Urea Deep Placement (UDP) technology?
- A) Increase methane emissions
 - B) Improve nutrient use efficiency
 - C) Promote deforestation
 - D) Enhance water use in agriculture
- 2.17. Which of the following is NOT a principle of Conservation Agriculture (CA)?
- A) Minimum soil disturbance
 - B) Crop rotation
 - C) Use of cover crops
 - D) Extensive use of chemical fertilisers
- 2.18. What is a critical challenge in promoting mitigation strategies among farmers?
- A) Lack of interest in increasing productivity
 - B) Perceived increase in yield risks
 - C) Excessive financial support
 - D) Limited access to traditional agricultural practices

Total: 60 marks

POST-ASSESSMENT

1. Self-assessment questions

Complete the following post-assessment to determine how much you have learned and how comfortable you are with the information in this module.

Rate your knowledge of the topics on a scale of 1 to 5 by circling the corresponding number.

	Question	Self-assessment				
		Low		High		
1.1.	The concept of climate change, its causes and effects	1	2	3	4	5
1.2.	The concepts of climate change, adaptation and mitigation.	1	2	3	4	5
1.3.	The main effects of climate change and its consequences on agrifood systems globally.	1	2	3	4	5
1.4.	The factors that cause climate change and the measures that can be taken to adapt and mitigate different agroecological conditions.	1	2	3	4	5
1.5.	How EAS promote adaptation and mitigation strategies among farmers to combat the effects of climate change in different conditions.	1	2	3	4	5

Global Forum for Rural Advisory Services (GFRAS) is about enhancing the performance of advisory services so that they can better serve farm families and rural producers, thus contributing to improved livelihoods in rural areas and the sustainable reduction of hunger and poverty. Rural advisory services help to empower farmers and better integrate them in systems of agricultural innovations.