

## **Module 13: Climate Smart Agriculture (CSA) in Extension and Advisory Services (EAS) in Rwanda**



### **Lecturer Guide**

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# Module 13: Risk Mitigation and Adaptation

## Pre-assessment

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

	Question	Self-assessment				
		Low				High
1	To what extent are you familiar with the concepts of Climate smart agriculture?	1	2	3	4	5
2	Are you able to explain the concept of climate change and its impact on agriculture in Rwanda?	1	2	3	4	5
3	Are you able to identify risks related to climate change?	1	2	3	4	5
4	Are you familiar with the concept of climate, weather, climate change and extreme events?	1	2	3	4	5
5	How comfortable are you with explaining the implication of climate change on food security, agriculture and natural resources?	1	2	3	4	5
6	Are you familiar with the concept of climate information service for Agriculture?	1	2	3	4	5
7	Are you familiar with the linkage between climate change, health and socio economics?	1	2	3	4	5
8	To what extent do you know how to access and use weather and climate information for agriculture?	1	2	3	4	5
9	Are you familiar with the concept of Agriculture Extension advisory services for climate smart agriculture?	1	2	3	4	5
10	How confident are you in using key tools like Participatory Integrated Climate Services for Agriculture (PICSA) in guiding farmers to apply skills related to CSA?	1	2	3	4	5
11	To what extent are you familiar with climate smart agriculture best practices and technologies that can be adapted to smallholder farmers in Rwanda?	1	2	3	4	5
12	Are you able to identify communication channels that can be used to inform farmers about climate smart agriculture?	1	2	3	4	5
13	To what extent are you familiar with the concept of gender mainstreaming in climate smart agriculture?	1	2	3	4	5
14	To what extent are you able to implement and monitor climate smart agriculture practices?	1	2	3	4	5

Answer: Learner's own answer.

# Study unit 1: Introduction to risks, climate science and climate change in Rwandan context

## Session 1.1: Understanding concept of risk, uncertainty and risk management

### Activity 1.1: Individual activity: Risk and uncertainty

Read through the case study below and answer the question that follows.

Imagine that a farmer has two routes to the market; the quickest route being over rough terrain and the longer route being on well-maintained roads and likelihood of traffic congestion. The shorter route will get him to the market before the other vendors, allowing him to increase his sales, but there is the risk that his wagon will not be able to make the journey.

The farmer now needs to consider the following:

- The shorter path has a higher uncertainty as to whether he will make it to the market but the positive outcome of increasing his sales if he takes the risk; and
- The longer route has a lower uncertainty that he will make it to the market but carries the risk that he will sell less.

What would you do if you were in the farmer's position?

*Answer: Learner's own answer.*

### Activity 1.2: Individual activity: The Irish potato famine

The Great Famine in Ireland saw the loss of over 20–25% of the population between 1845 and 1852. Research the topic and identify the risks that lead to the famine as well as vulnerabilities.

*Answer: The following two key aspects need to be addressed in the report:*

- *Risks: Monoculture farming resulted in vulnerability to blight; and*
- *Vulnerability: Tenant system and restrictions on the Irish due to government policy at the time.*

### Activity 1.3: Individual activity: Measuring uncertainty and risk

Read through the scenario below and answer the questions that follow.

Looking at the routes to market example in Activity 1.1, the farmer finds out from his neighbour that the short path was travelled safely in the last month but recent rains may have affected the route. You can now assume a 'possible' uncertainty and assume the outcome as being 'severe' due to the fact that not making it will result in no sales. For the short path a negative outcome is 'very unlikely' and a negative outcome is 'negligible'. You can now rank

the risk of the two options and see that although the farmer could increase his profits, the risk is high and he would be safer taking the short path.

Consider the following changes to the above case and determine the risk for each. Which route would you suggest based on your analysis?

1. Read through the scenario below and answer the question that follows. (2)

*Answer: Short route: Medium/High, Long route: Low. Long route is still favourable.*

2. The long route is undergoing road maintenance, which may result in delays and have a moderate effect on profits. Assume the short route is as stated in question 1. (2)

*Answer: Short route: Medium/High, Long route: Medium/High. In this case the long route may be favourable due to the potential for increased profit.*

**Total: 4 marks**

## Session 1.2: Understanding climate science, and climate change in Rwandan context

### Activity 1.4: Individual activity: Risk perception

Answer the following questions in your own words. Write your answer in the space provided

1. Is the following true or false? If false, correct the statement.

1.1. Climate refers to what is happening in the atmosphere at a given time for a particular place. (2)

*Answer: False, weather refers to what is happening in the atmosphere at a given time for a particular reason.*

1.2. Weather refers to conditions in the atmosphere over a long period of time. (2)

*Answer: False, climate refers to conditions in the atmosphere over a long period of time.*

1.3. A greenhouse gas is any gas in the atmosphere which absorbs and emits heat in the form of thermal radiation. (2)

*Answer: True*

1.4. Vulnerability to climate change is the degree to which a system is susceptible to or unable to cope with the adverse effects of climate change. (2)

*Answer: True.*

1.5. Livelihood vulnerability = (exposure x sensitivity) – adaptive capacity. (2)

*Answer: True.*

1.6. Sensitivity is the ability of a system or household to adjust to climate change. (2)

*Answer: False, adaptive capacity is the ability of a system or household to adjust to climate change.*

**Total: 12 marks**

## Session 1.3: Understanding Rwanda climate and its vulnerability to climate change

### Activity 1.5: Individual activity: Climate change example 1

Changes in temperature and precipitation and their distributions are the key drivers of climate and weather-related disasters that negatively affect Rwandans and the overall economy. The main risks/ impacts that adversely affect the population include droughts, floods, landslides and storms. Discuss the following:

1. How the changes in climate can upset the agricultural patterns in Rwanda? (3)

*Learner's own answer.*

2. Explain how Rwanda is vulnerable to climate change. (2)

*Learner's own answer.*

3. Discuss two socioeconomic factors that can result in climate change. (3)

*Answer: Any two of the following:*

- *building in flood prone areas,*
- *high population density in prone areas,*
- *increased value of assets in flood-prone areas,*
- *poor management of soil erosion*

**Total: 8 marks**

## **Session 1.4: Climate change and agriculture, socio-economics and health**

### **Activity 1.6: Individual activity: Principle of capital and its importance for climate change**

Agricultural production and income are dependent on climate due the direct effect of weather on crop yields. Do some research and discuss the following:

- The relationship between climate change and socio-economics.
- Climate change and capital

*Learner's own answer.*

# Summative assessment: Unit 1

Answer the following questions in your own words. Write your answer in the space provided

1. Name the factors that will affect your ability to identify and evaluate risks. (3)

*Answer: The factors that will affect an individual's ability to identify and evaluate risk are their knowledge, experience, key factors in risk perception. (2 marks for knowledge and experience, additional mark for linking them to risk perception).*

2. Define risk in terms of uncertainty. (3)

*Answer: Uncertainty refers to actions in which the outcome cannot be accurately predicted. Risk is the process of identifying if uncertainty carries the risk of negative outcomes in the form of hazards. (2 marks for the definitions, one additional mark for relating the two terms).*

3. Discuss how the principle of supply and demand can expose farmers to risks. Use an example in your discussion. (3)

*Answer: The demand for products can affect the selling price of crops. This is referred to as supply and demand. Demand for goods can vary seasonally or due to some crops being more valued due to their rarity. (2 marks for defining supply and demand, one additional mark for an example).*

4. What factors should be considered when using statistical data in risk management? (3)

*Answer: You will need to consider:*

- *The correct interpretation of the data;*
- *Whether data is relevant to your context; and*
- *Your ability to assist farmers in understanding what the data means to them.*

5. Is the following true or false? If false, correct the statement. Write your answer in the space provided.

5.1. Risk evaluation is the process of identifying the risks which need to be mitigated. (2)

*Answer: False, risk evaluation is focussed on identifying the level of risk based on outcome likelihood and severity. The definition in question is that for risk assessment and mitigation.*

5.2. Your personal understanding of risk can affect your ability to correctly assess risk. (2)

*Answer: True.*

5.3. Risk assessment by individuals is only possible by risk experts. (2)

*Answer: False, risk assessment even by experts is based on personal experience and knowledge which is not adequate for all contexts. Group-based approach expected.*

5.4. Risk matrixes can be used to measure risks caused by hazards and exposure. (2)

*Answer: True.*

5.5. You can perform a risk assessment as long as you know the severity of the risk. (2)

*Answer: False, both the severity and likelihood are needed.*

6. Socio-economics is important to a farmer when looking at the effects of climate change. Discuss any four types of capital and how the type of capital relates to the farming practice. (8)

*Answer: Marks may be given if the student provides valid exposure prevention methods based on his own experience and knowledge. An example answer is given below.*

- 1. Human capital: Human capital refers to the skills of individuals within a group that are necessary to achieve specific outcomes.*
- 2. Social capital: Social capital refers to the connections and relationships within a group. Groups with high social capital would be able to work well in the case of extreme events, organising relief operations and ensuring that everyone is taken care of.*
- 3. Natural capital: Natural capital refers to the natural resources available to a group. This can include the quality of the soil, water sources, air quality and living organisms.*
- 4. Physical capital: Physical capital refers to man-made items such as buildings, machinery, and other equipment. This can be in the form of warehouses, schools, hospitals, trucks, and farming equipment to name a few.*
- 5. Financial capital: Financial capital refers to both the money available to communities in terms of aid from government or other organisations, and that of the individuals themselves.*

**Total: 30 marks**

# Study unit 2: Understanding adaptation and climate smart agriculture (CSA) in Rwanda context

## Session 2.1: Understanding climate science

### Activity 2.1: Individual activity: Climate science

1. Explain the following terms. Write your answer in the space provided

(10)

Column A	Column B
1. Adaptation	
2. Reactive adaptation	
3. Extreme event	
4. Vulnerability	
5. Proactive adaptation	

Answer:

Column A	Column B
1. Adaptation	<i>Answer: Refers to how you respond to (or prepare for) change within an ecosystem, socioeconomic or political space.</i>
2. Reactive adaptation	<i>Answer: is your immediate response to change. This type of adaptation is often used to regain stability.</i>
3. Extreme event	<i>Answer: atmospheric conditions which are unexpected, unusual or severe</i>
4. Vulnerability	<i>Answer: Degree to which the environment and humans are susceptible to, and unable to cope with, adverse impacts of climate change.</i>
5. Proactive adaptation	<i>Answer: is more likely to reduce long-term damage, risk and vulnerability caused by change.</i>

**Total: 10 marks**

## Session 2.2: Understanding the concept of Climate Smart Agriculture (CSA)

### Activity 2.2: Individual activity: Adaptation challenges

1. Indicate whether the following statements are true or false. Provide a reason if false. Write your answer in the space provided. (10)

1.1. Climate-smart agriculture (CSA) is an approach for developing actions needed to transform agricultural systems.

*Answer: True*

1.2. Compost making and green manuring is an example of Conservation agriculture.

*Answer: False. Compost making and green manuring is an example of Integrated Soil Fertility Mgt (ISFM).*

1.3. Popularization of crop varieties with high nutrition content, trees and other plants is an example of crop diversification.

*Answer: True.*

1.4. Current predictions for sea level, temperature and carbon dioxide increases for 2050 are of low confidence.

*Answer: False. The predictions are of a high to very high confidence level.*

1.5. Global warming suggests that temperatures will increase equally across the globe.

*Answer: False. Refers to average temperatures, some areas may even show decreased temperatures.*

**Total: 10 marks**

## Session 2.3: Overview of select Climate Smart Agriculture best practices and technologies for smallholder farmers

### Activity 2.3: Individual activity: Group participation

1. Draw a line connecting the terms/statements in column A to those in column B that best match said term or statement. (5)

Column A	Column B
1. Conservation agriculture	A. Combinations of trees, crops and/or animals are intentionally designed and managed as a whole unit
2. Agroforestry	B. The tree, crop and/or animal components are structurally and functionally combined into a single integrated management unit
3. Intentional	C. cutting down trees, slash and burn, flood irrigation and forest degradation
4. Integrated	D. The practice has been promoted for their potential to mitigate climate change.
5. Harmful practices	E. Has the potential to contribute to both climate change mitigation and adaptation.

**Total: 5 marks**

*Answer: 1D, 2E, 3A, 4B, 5C*

## Session 2.4: Access and the use of Climate Information Services for Agriculture

### Activity 2.4: Individual activity: The implications of climate change

Read through the case study on the link between malaria and climate change from the Proceedings of the National Academy of Sciences of the United States of America (PNAS) at the following link: <http://www.pnas.org/content/111/9/3286.full.pdf>

1. In your own words describe how climate change has affected malaria distribution. This exercise aims to test your ability to perform independent study and obtain relevant information from complex literature.

*Answer: Learners should indicate the major risk areas of Africa, South America and Southeast Asia. Indicate how climate change specifically temperature variation will drive mosquito breeding patterns and disease distribution (of note is the ability to interpret figure 2 in the linked text).*

## Summative assessment: Unit 2

Answer the following questions in your own words. Write your answer in the space provided

1. Describe the difference between weather and climate. (2)

*Answer: Weather normally refers to current atmospheric conditions such as rainfall and temperature for specific locations whereas climate refers to long term patterns in weather over larger areas.*

2. Describe the difference between adaptive and reactive adaptation. (2)

*Answer: Reactive adaptation is a response to an impact aimed at regaining stability whereas proactive adaptation refers to the process of implementing changes in the present to reduce the impact of future events.*

3. Provide an example of a long term and short term extreme event. (2)

*Answer: Short term: Flash floods, Long term: Drought*

4. What are the two types of adaptation challenges? (3)

*Answer: Adaptation measures aimed at addressing farmer adaptation to extreme events and climate variability in their region and adaptation measures aimed at the future effects of climate change.*

5. Differentiate between Medium-range weather forecasts and short-range weather forecasts. (5)

*Answer: Medium-range forecasts are useful in giving the weather conditions expected for the next seven to ten days. Short-range weather forecasts - These forecasts are issued to cover one to three days. This assists in decisions which may be immediate such as chemical spraying, fertiliser application and frost protection*

6. Is the following true or false? If false, correct the statement.

- 6.1. The seasonal forecast is also referred to as the long-range (climate) forecast. (2)

*Answer: True.*

- 6.2. Effective climate services are part of the enabling environment for the transition to Climate Smart Agriculture. (2)

*Answer: True.*

- 6.3. Short forecasts are useful in giving the weather conditions expected for the next seven to ten days. (2)

*Answer: False, these forecasts are issued to cover one to three days*

- 6.4. Climate change and variation have the same meaning. (2)

*Answer: False, climate variation refers to medium term changes (months or seasons) in weather patterns whereas climate change generally refers to long term process (years) of either increases or decreases in specific conditions.*

6.5. Adaptive capacity is the ability of groups to adapt to climate change. (2)

*Answer: True.*

7. Discuss the importance of climate information services. (4)

*Answer: Climate information services encompass the entire process of procuring climate data for storage and processing it into specific end products for use by different clients within climate-sensitive sectors such as agriculture and health.*

8. Name at least four atmospheric/climate components that will be affected by an increase in average global temperatures. (4)

*Answer: Any four. Carbon dioxide levels, sea level, temperature, rainfall/precipitation, extreme events.*

**Total: 32 marks**

# Study unit 3: Agriculture Extension and advisory services for climate smart agriculture

## Session 3.1: Roles of EAS in building smallholder farmers' resilience to climate change

### Activity 3.1: Individual activity: The role of EAS

1. Describe the role of EAS in disseminating climate smart agriculture practice. (4)

*Answer:*

- *Extension and advisory services can bridge the knowledge gap by providing clarity on Climate Smart Agriculture components and its relevant issues.*
- *They also play a vital role in helping farmers to cope with the diverse impacts of climate change by creating awareness by using appropriate tools to make them aware about different adaptation and mitigation strategies.*

**Total: 4 marks**

## **Session 3.2: Introduction to Participatory Integrated Climate Smart Agriculture**

### **Activity 3.2: Individual activity: PICSA**

1. Discuss the importance of smallholder farmers when it comes to key-security and how PICSA assists farmers in achieving that security. (4)

*Learner's own answer.*

**Total: 4 marks**

## Summative assessment: Unit 3

Answer the following questions in your own words. Write your answer in the space provided

1. Complete the following table by filling in the missing adaptation strategies. You only have to include two strategies for each event. Write your answer in the space provided. (8)

Column A	Column B
Heat waves	
Adaptation to drought	
Flooding	
Wildfires (often noted during heat waves)	

Answer:

Column A	Column B
Heat waves	<p>Answer:</p> <ul style="list-style-type: none"> <li>• <i>Early warning systems based on climate forecast techniques;</i></li> <li>• <i>Creating public infrastructure to address these conditions such as</i></li> <li>• <i>Health care facilities in affected areas and</i></li> <li>• <i>Opening cooling centres;</i></li> <li>• <i>Buildings with climate control where the public can gather to escape the heat; and</i></li> <li>• <i>Public outreach/education approaches to inform the community of available assistance in case of a heat wave.</i></li> </ul>
Adaptation to drought	<p>Answer:</p> <ul style="list-style-type: none"> <li>• <i>Public outreach/education such as</i></li> <li>• <i>Supplying farmers with access to and information about drought resistant crops; and</i></li> <li>• <i>Providing infrastructure to ensure there are additional water reserves stockpiled in case of droughts.</i></li> </ul>
Flooding	<p>Answer:</p> <p><i>Improving infrastructure by:</i></p> <ul style="list-style-type: none"> <li>• <i>Adopting green approaches which reduces the effect of construction projects on the local plants and wildlife and prevents the loss of ground cover;</i></li> <li>• <i>Limiting development in floodplains;</i></li> <li>• <i>Flood plains are areas close to bodies of water, such as rivers or streams, and thus with the greatest risk of flooding</i></li> <li>• <i>Moving existing building to areas above the flood level;</i></li> <li>• <i>Building protective infrastructure such as walls near rivers, storm water drains and dams;. and</i></li> <li>• <i>Preserving/restoring wetlands, as they are important natural ground cover that to reduce the impact of flood water.</i></li> </ul>

Wildfires (often noted during heat waves)	<p><i>Answer:</i></p> <ul style="list-style-type: none"> <li>• <i>Managing vegetation through controlled burning to reduce the amount of old, dry vegetation during dry seasons;</i></li> <li>• <i>Creating wildfire response initiatives such as:</i></li> <li>• <i>Evacuation plans;</i></li> <li>• <i>Fire prevention/control teams;</i></li> <li>• <i>Medical response; and</i></li> <li>• <i>Creating safe zones such as shelters for those escaping wildfires.</i></li> </ul>
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2. Fill in the missing sections in the following list of successful adaptation strategies. Write your answer in the space provided. (5)

Adoption of water and energy ...2.1... practices.

Developing local market systems

- Improving market ...2.2... and the understanding of how markets operate
- This creates a more transparent market environment to assist farmers in understanding the ...2.3... of their crops ...2.4... approaches/training
- To increase efficient use of available resources
- To assist farmers in increasing ...2.5... through new farming practices and crop types (crop diversification), in order to improve resistance to crop price fluctuation

*Answer: 2.1 efficient, 2.2 access, 2.3 value, 2.4 Educations, 2.5 yields*

**Total: 13 marks**

# Study unit 4: Gender and other adaptive options to Climate change

## Session 4.1: Gender mainstreaming in Climate smart agriculture

### Activity 4.1: Individual activity: Gender mainstreaming

Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in any area and at all levels. Do some research and discuss the impact of climate change on gender.

*Learner's own answer.*

## **Session 4.2: Other adaptive options to climate change**

### **Activity 4.2: Practical activity: Adaptive options to climate change**

Use the tools given in this section, or similar ones for your country, to look up information on adaptation strategies to both address current and future risks in farming.

*Learner's own answer.*

## **Session 4.3: Monitoring the implementation of Climate Smart Agriculture practices**

### **Activity 4.3: Practical activity: Design and implement monitoring and evaluation**

Use the tools given in this section, or similar ones for your country, to look up information on how to design and implement monitoring and evaluation for climate smart agriculture practices.

*Learner's own answer.*

# Summative assessment: Unit 4 – Group project

Complete this assessment in groups of three or four.

1. In order to test the skills gained in this module you will be required to select a region from a list provided by your lecturer or one you have identified yourself. You will be required to:

- Identify steps that need to be taken to mainstream gender using principles of climate smart agriculture;
- Identify risks faced by communities in the region;
- Identify current adaptation and risk management strategies in place;
- Suggest additional adaptation and risk management strategies; and
- Present your findings to the rest of the class.

Requirements:

- You will need to apply risk management and adaptation strategies discussed in this course;
- Make use of toolkits
- Be able to gather data from reputable sources such as those included in this module; and
- Communicate the data effectively to the rest of the class using visualisation tools.

**Total: 40 marks**

*Answer: See the assessment rubric below.*

<b>Criteria</b>	<b>Poor (0)</b>	<b>Improvement needed (2.5)</b>	<b>Acceptable (5.0)</b>	<b>Good (7.5)</b>	<b>Excellent (10)</b>
<b>Application of risk management or adaptation strategies</b>	<i>Students failed to show an understanding of risk management and adaptation strategies</i>	<i>Students were able to show the application of learned skills but failed to show competence in their use</i>	<i>Students showed the minimum skill necessary to complete the assessment criteria</i>	<i>Students showed a good understanding of the skills needed to complete the assessment criteria</i>	<i>The students mastered the necessary skills and exceeded lecturer expectations for the assessment criteria</i>
<b>Use of toolkits</b>	<i>Students have failed to incorporate toolkits in the project</i>	<i>Students ineffectively used toolkits</i>	<i>Students showed the minimum necessary skills needed to use toolkits</i>	<i>Students showed competence in the use of toolkits</i>	<i>The students were able to identify the most suitable toolkit and effectively apply it</i>
<b>Data gathering</b>	<i>Poor data used and lack of understanding of collected data</i>	<i>Students data gathering or interpretation fell short of that needed to evaluate risk</i>	<i>Students showed the minimum skill needed to identify and interpret relevant data</i>	<i>Students collected relevant data with minor errors in interpretation.</i>	<i>Students were able to collect and correctly interpret data for the task at hand</i>
<b>Presentation of findings</b>	<i>The students showed poor presentation skills and did not use appropriate visual tools. The class was unable to understand his findings</i>	<i>The students presented findings and used tools but the methods were not sufficient to understand their findings</i>	<i>Students showed adequate ability to present findings and used visual tools. The majority of the class was able to understand his findings</i>	<i>Students were able to convey his findings so that the class could understand it and showed a good grasp of visual tools usage</i>	<i>The students clearly presented the findings of his research and made effective use of visual tools. The presentation could be followed by rural farmers</i>

## Post-assessment

Complete the following post-assessment to determine how much you have learnt.

	Question	Self-assessment				
		Low		High		
1	To what extent are you familiar with the concepts of Climate smart agriculture?	1	2	3	4	5
2	Are you able to explain the concept of climate change and its impact on agriculture in Rwanda?	1	2	3	4	5
3	Are you able to identify risks related to climate change?	1	2	3	4	5
4	Are you familiar with the concept of climate, weather, climate change and extreme events?	1	2	3	4	5
5	How comfortable are you with explaining the implication of climate change on food security, agriculture and natural resources?	1	2	3	4	5
6	Are you familiar with the concept of climate information service for Agriculture?	1	2	3	4	5
7	Are you familiar with the linkage between climate change, health and socio economics?	1	2	3	4	5
8	To what extent do you know how to access and use weather and climate information for agriculture?	1	2	3	4	5
9	Are you familiar with the concept of Agriculture Extension advisory services for climate smart agriculture?	1	2	3	4	5
10	How confident are you in using key tools like Participatory Integrated Climate Services for Agriculture (PICSA) in guiding farmers to apply skills related to CSA?	1	2	3	4	5
11	To what extent are you familiar with climate smart agriculture best practices and technologies that can be adapted to smallholder farmers in Rwanda?	1	2	3	4	5
12	Are you able to identify communication channels that can be used to inform farmers about climate smart agriculture?	1	2	3	4	5
13	To what extent are you familiar with the concept of gender mainstreaming in climate smart agriculture?	1	2	3	4	5
14	To what extent are you able to implement and monitor climate smart agriculture practices?	1	2	3	4	5

*Learner's own answer.*

**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.**