Funded by the European Union

CLIMATE RESILIENCE MESSAGES

TRAINING MANUAL

July 2022

LIST OF ABBREVIATIONS AND ACRONYMS

AEPs	Agro-Ecological Practices (AEPs)
CCOAIB	Conseil de Concertation des Organisations d'Appui aux Initiatives de Base
COP	Conference of the Parties
CRA	Climate Resilient Agriculture
CSO	Civil Society Organisation
EU	European Union
FAO	Food and Agriculture Organization
FBOs	Faith Base Organisations
GHG	Greenhouse gas
GoR	Government of Rwanda
HFC	Hydro fluorocarbons
IEC	Information, Education and Communication
MIGEPROF	Ministry of Gender and Family Promotion
MINAGRI	Ministry of Agriculture and Animal Resources
RAB	Rwanda Agriculture Board
REMA	Rwanda Environment Management Authority
RWH	Rainwater harvesting
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
UNSDG	United Nation's sustainable development goals
VNR	Voluntary National Review

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Mr. Seth Kwizera coordinated the development of the manual under the overall guidance of CCOAIB and the CRA project's partners like OXFAM, DUTERIMBERE, MINAGRI, REMA and Districts of Nyamagabe, Nyaruguru, Kirehe and Nyagatare.

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1. Background

About CRA project

The Rwandan CSOs engage in Climate Resilient agriculture and sustainable energy initiatives (CRA project) is the EU funded project and implemented by a consortium led by CCOAIB and comprising of OXFAM Germany, OXFAM UK in Rwanda and Duterimbere NGO. The project will last for three years starting from 15th October 2020. It is implemented in Kirehe and Nyagatare districts in Eastern province, Nyamagabe and Nyaruguru districts in Southern province. The overall objective of the project is to contribute to strengthening Rwandan CSOs to perform their roles as independent development actors working towards climate resilient, sustainable agriculture and energy sectors.

Rationale/purpose of this handbook

The development of this handbook as a training module aims to gather key climate change and resilience messages to be used by the project target groups' capacity building through training sessions, community campaigns and other interactions with stakeholders, especially smallholder farmers including women and youths. These harmonized climate resilient messages included in this training module are developed in simple language easily understandable by lay men and constitute a useful tool for training, mobilization and advocacy engagements. It may be used by various stakeholders in civil society, private and well as public sectors to increase awareness of their constituencies on climate change effects and required climate resilience actions. The focus of this training module is climate resilient agriculture and agro-ecology.

About climate change

Rwanda's economy depends directly upon its land, water and biodiversity resources which are negatively affected by climate change. Climate change refers to long-term shifts in temperatures and weather patterns. Since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas. Burning fossil fuels generates greenhouse gas emissions trapping the sun's heat and raising temperatures. Examples of greenhouse gas emissions that are causing climate change include carbon dioxide and methane. Destroying land cover and forests can also release carbon dioxide.

It is worth noting that changing climate affects everyone, but it is the world's poorest and those in vulnerable situations, especially women and girls, who bear the brunt of environmental, economic and social shocks. The CRA project recognises that men, women, and young people are affected by climate change in different ways. Their varying gender and age-related roles within households and in society mean that environmental impacts affect them in different ways. As a result, men, women and young people are likely to have different priorities when it comes to responding to climate change. Women and young people in particular are key to long-term social and economic development; it is imperative to capture their voices, priorities and knowledge for effective climate change responses. Their needs are often marginalized because of social and cultural factors that reinforce structural inequalities, and their effective participation in public or community engagements is limited, regardless of the successful policies in place. Rwanda understands well that building sustainable future entails harnessing the knowledge, skills and leadership of women in climate action.

The purpose of this module is to provide guiding message on climate resilient agriculture to be used during campaigns and engagement with various stakeholders on climate change matters.

2. Definition of key terms

- ***Climate change:*** change of climate that is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, and that is in addition to natural climate variability observed over comparable time periods" (UNFCCC, 1992).
- **Agroecology:** Agroecology is a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems. It seeks to optimize the interactions between plants, animals, humans and the environment while also addressing the need for socially equitable food systems within which people can exercise choice over what they eat and how and where it is produced (FAO 2021)
- ***Climate Resilient Agriculture***: Climate resilience is a fundamental concept of climate risk management. In this context, resilience refers to the ability of an agricultural system to anticipate and prepare for, as well as adapt to, absorb and recover from the impacts of changes in climate and extreme weather (FAO 2021)
- **Climate Mitigation:** Action taken to stop climate change by reducing the amount of greenhouse gasses in the atmosphere
- ***Climate Adaptation:*** Action taken to deal with climate change impacts and reduce the effects on lives, livelihoods and ecosystems

3. Overview of climate change

3.1.Global overview

The planet's climate has constantly been changing over geological time, with significant fluctuations of global average temperatures.

However, this current period of warming is occurring more rapidly than any past events. It has become clear that humanity has caused most of the last century's warming by releasing heat-trapping gases—commonly referred to as greenhouse gases—to power our modern lives. We are doing this through burning fossil fuels, agriculture and land-use and other activities that drive climate change. Greenhouse gases are at the highest levels they have ever been over the last 800,000 years. This rapid rise is a problem because it is changing our climate at a rate that is too fast for living things to adapt to.

Climate change involves not only rising temperatures, but also extreme weather events, rising sea levels, shifting wildlife populations and habitats, and a range of other impacts.

There is an overwhelming scientific consensus that global warming is mostly man-made: climate scientists have come to this conclusion almost unanimously.

One of the biggest drivers by far is our burning of fossil fuels – coal, gas and oil – which has increased the concentration of greenhouse gases – such as carbon dioxide – in our atmosphere. This, coupled with other activities like clearing land for agriculture, is causing the average temperature of our planet to

increase. In fact, scientists are as certain of the link between greenhouse gases and global warming as they are of the link between smoking and lung cancer.

This is not a recent conclusion. The scientific community has collected and studied the data on this for decades. Warnings about global warming started making headlines back in the late 1980s.

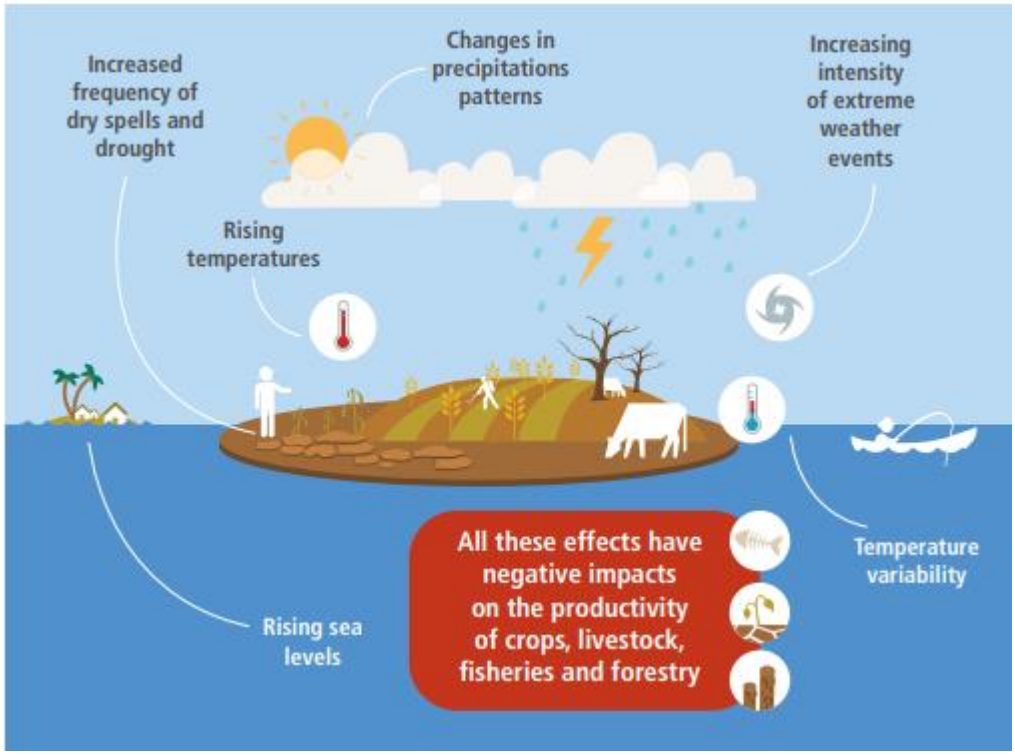
In 1992, 165 nations signed an international treaty, the UN Framework Convention on Climate Change (UNFCCC). They have held meetings annually ever since (called "Conference of the Parties" or COP), with the aim of developing goals and methods to reduce climate change as well as adapt to its already visible effects. Today, 197 countries are bound by the UNFCCC.

Climate change affects plants and animals in a variety of ways: directly or indirectly, by changing their natural equilibrium inside. Understanding the effects of climate change on ecosystems is important to the design of policies and adaptation strategies.

Bearing in mind that climate impacts are highly site-specific, some of the possible effects of climate change on agro-ecosystems reported by agricultural producers include:

- Increased variability and unpredictability of weather and climate events: for example, changes in seasonal rainfall variability, high rainfall variations such as longer dry periods, higher or lower temperatures, heat waves and others
- Changes in timing of seasons: for example, some areas are witnessing an earlier arrival of spring that affects the lives of migratory animals; but also planting periods and wet seasons start late or finish early
- Dry spells that affect crops at different points in the growing season
- Alteration in land suitability for agricultural production or grazing
- Increased intensity of extreme weather events such as sudden downpours and windstorms, droughts, floods, cyclones
- Increased pest and disease outbreaks

Table: climate change effects on agriculture



Source: FAO, 2016c.

3.2.International convention to mitigate climate change

a. United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) established an international environmental treaty to combat "dangerous human interference with the climate system", in part by stabilizing greenhouse gas concentrations in the atmosphere. It was signed by 154 states at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992.

b. **Paris Agreement/COP21?**

To tackle climate change and its negative impacts, world leaders at the UN Climate Change Conference (COP21) in Paris reached a breakthrough on 12 December 2015 (the Paris Agreement). The Agreement includes commitments from all countries to reduce their emissions and work together to adapt to the impacts of climate change, and calls on countries to strengthen their commitments over time.

c. **Kigali Amendment to the Montreal Protocol**

The Kigali Amendment to the Montreal Protocol is an international agreement to gradually reduce the consumption and production of hydro fluorocarbons (HFCs). The Montreal Protocol was originally created to preserve and restore the ozone layer, and it worked. The Protocol was an agreement between participating countries to phase out certain ozone depleting gases. HFCs were used to replace the substances banned in that agreement because they have zero impact on the ozone. However, HFCs are powerful greenhouse gases that contribute to climate change, so this amendment adds HFCs to the list of chemicals that countries promise to phase down.

3.3.Climate change in Rwanda

Climate change affecting the World, Rwanda is also being a victim, Global changes in temperature and precipitation and the regional distribution of those changes are the primary drivers affecting climate-related hazards such as floods, landslides and droughts that have struck Rwanda in recent years with devastating effects on the population. From the livelihoods of rural populations to food security in urban areas, agriculture, transportation, communication, energy, health, water, and institutional systems on which populations depend have failed in some cases (loss of lives and property in extreme cases).

National efforts to mitigate and adapt to climate change

According to the 2015 household survey conducted by REMA, the country's sensitivity to climate change is high, and its adaptive capacity is low.
The national household vulnerability index shows us that vulnerability is located in all part of the country, though the overall level of exposure to climate change impacts are greatest in Eastern Province, due to:

- Change in the temperature and heat episodes,
- Shift in rainfall start dates and,
- Change in the amount of rainfall.
- Overall levels of sensitivity to climate change impact is highest in Southern Province due to:

- Lower family income levels,
- Less diversity in household incomes,
- Higher levels of dependency within the household,
- Less use of water catchment,
- Less irrigation of fields and dependent on rain fed agriculture,
- Low soil fertility and greater changes in the natural environment.

In combination, considering exposure, sensitivity and adaptive capacity, the vulnerability of Eastern Province is the highest.

According to 2019 Rwanda Voluntary National Review (VNR) report under UNSDGs:

- the Government of Rwanda (GoR) is among the countries, which have ratified the United Nations Framework Convention on Climate Change (UNFCCC), and
- One among the first countries to sign and ratify the Paris Agreement COP21 as well as ,
- Kigali amendment to the Montreal protocol.

This demonstrates its willingness, being a responsible member of the global community, to seek and achieve global solutions on climate change

3.4.Climate change in four selected districts

a. Kirehe

The District has climatic intervals of 4 seasons per year making it possible to make 2 annual harvests on the same pieces of land. Agriculture is strongly dependent on the seasonal climatic changes, primarily with regard to rain. The main reason of targeting Kirehe is because of the existing organic farming efforts of farmers (pineapple) as well as the vulnerability of its people to climatic changes especially unexpected heavy rainfalls and localized floods.

b. Nyagatare

The district is a semi-arid district with few water sources and experiences long drought seasons, small quantity of rains which are very weak (827mm/year) and very unpredictable to satisfy the needs of households, agriculture and livestock. As of recent, Nyagatare has strangely started to experience unexpected heavy rainfalls causing soil erosion and rivers siltation due to rainwater mismanagement, deforestation and degradation of gallery forests. Nyagatare is targeted by the proposed project because of the challenges of climatic changes it is facing.

c. Nyaruguru

The district is the most southerly in Rwanda along the Burundian border. It is mountainous, with very acidic soil which doesn't allow growing staple crops without the use of intensive fertilisers. Nyaruguru district has a higher percentage of poor people with poverty figures increasing (the 5th Households Living Conditions Survey shows that poverty in Southern Province went up from 38.4 to 41.1% between 2013 and 2017). The CRA project targets Nyaruguru district because of their already vulnerable situation which is being exacerbated by effects of climate change. Targeting Nyaruguru is also in line with the country's efforts to focus on lifting the district out of poverty.

d. Nyamagabe

The climate of Nyamagabe is humid tropical and moderated by the effect of high altitude. Nyamagabe District is among the regions in the country with the highest rainfall. Nyamagabe soils are generally acidic in nature with a pH ranging from 3.6 - 5. This implies a very poor soil which is saturated with aluminium implying its low agricultural productivity unless organic and mineral fertilizers are added. The demographic pressures and the economic transformations have influenced the agricultural system of Nyamagabe causing major land use changes, reduction of availability of manure and eventually leading to land degradation and erosion, particularly in fields of the poorest households and in regions of vulnerable soils

4. Climate resilient agriculture

4.1.Agro-ecological practices

Agro ecology is the application of ecological principles to the interactions between human beings and their environment, as well as to their consequences, with the goal of minimizing the negative effects of certain human activities. It aims at protecting the environment, ensuring the sustainable renewal of the natural resources (water, soil, biodiversity, etc.) necessary for production and making sparing use of non-renewable resources. By gradually eliminating the use of chemicals, it strives toward implementing organic farming, thus contributing to improving the health of farmers and consumers alike.

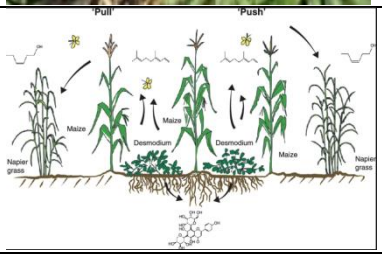
Agroecological practices combine technical solutions reconciling productivity, reduced pressure on the environment and the sustainable management of natural resources. All this is ensuring a balance between human beings, farming and nature.

Key Agro-ecological principles:

- Enhance the recycling of biomass, with a view to optimizing organic matter decomposition and nutrient cycling.
- Strengthen the resilience of agricultural systems through enhancement of functional biodiversity, by creating habitats for natural enemies of pests.
- Provide the most favourable soil conditions for plant growth, particularly by managing organic matter and by enhancing soil biological activity.
- Minimize losses of energy, water, nutrients and genetic resources by enhancing conservation and regeneration of soil and water resources and agrobiodiversity.
- Diversify species and genetic resources in the agro-ecosystem over time and space, at the field and landscape level.
- Enhance biological interactions and synergies among the components of agrobiodiversity, thereby promoting key ecological processes and services

Examples of Agro-Ecological Practices (AEPs):

AEP	Meaning	Image/illustration

Crop rotation	Planting different crops sequentially on the same plot of land to improve soil health, optimize nutrients in the soil, and combat pest and weed pressure	
Organic fertilizers/compost	Fertilizer that is derived from organic sources, including organic compost, cattle manures, poultry droppings and domestic sewage.	
Terracing	Terracing is an agricultural practice that suggests rearranging farmlands or turning hills into farmlands by constructing specific ridged platforms to decrease water flows and prevent soil erosion	
Rainwater harvesting	Rainwater harvesting (RWH) is the collection and storage of rain, rather than allowing it to run off. Rainwater is collected from a roof-like surface and redirected to a tank, cistern, deep pit (well, shaft, or borehole)	
Small-scale irrigation	Irrigation is the agricultural process of applying controlled amounts of water to land to assist in the production of crops, as well as to grow landscape plants and lawns, where it may be known as watering. Agriculture that does not use irrigation but instead relies only on direct rainfall is referred to as rain-fed.	
Agroforestry	Agroforestry is the combination of agricultural and forestry technologies to create integrated, diverse and productive land use systems. Agroforestry in combination with terraces is necessary to reduce erosion, and increase the infiltration.	
Mulching	Mulching is a long-established horticultural practice that involves spreading a layer of material on the ground around plants to protect their roots from heat, cold, or drought or to keep the fruit clean.	
Push and pull	Push–pull technology is an intercropping strategy for controlling agricultural pests by using repellent "push" plants and trap "pull" plants. For example, cereal crops like maize or sorghum are often infested by stem borers. Grasses planted around the perimeter of the crop attract and trap the pests	

Intercropping	Intercropping is characterized as production of two or more different crop species at same time on the same piece of land. Intercropping is one of the most effective methods in agricultural production with a long history. It is known as the achievement of a high and stable production that not only raises complementary products in the area but also reduces the harmful effects of diseases and pests, prevents pollution and results in effective use of resources	

4.2.Climate resilient practices

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
EXTREME HEAT	Heat tolerant crops (e.g. millet, sorghum) or crop varieties	• Promote crops and/or crop varieties with a higher heat tolerance and/or optimal heat range. • Enhance yields in areas where temperatures are expected to exceed heat thresholds that are harmful to existing cropping systems.
	Short cycle varieties	• Reduce the effect of heat stress at key phenological phases (germination and flowering) and improve final yields. • Reduce plants' exposure to heat by shortening the growing cycle. • Reduce the total water requirements during the growing season.
	Optimizing crop calendars	• Optimal crop calendars based on historical climate data and seasonal forecasts support decision-making, avoiding heat stress conditions at crop's sensitive phenological phases, and increasing yields. Strategic use of Early warning system from RAB
STRONG WINDS	Windbreakers	• Rows of trees can protect crops by breaking strong winds, reducing soil erosion, increasing crop yields, and protecting livestock from heat and cold conditions.
COLD, FROST & HAIL	Frost protection (e.g. plant row covers, mulching,)	• Soil covering with mulching and/or other materials increases the surface temperature. This is most applicable for small farms (e.g. gardens), where other protection methods are unavailable
	Early warnings	Alerts and advisories tailored to farmers' needs forecasting potential frost times support decision-making on frost damage, while considering farmers' traditional knowledge and management practices.

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
	Optimizing crop calendars	• Select crop practices based on timing of sensitive stages and critical damage temperature relative to the probability and risk of sub-zero temperatures. • For annual field and row crops, it is important to determine the planting date for minimizing the potential of subzero temperatures. Field and row crops can be planted in protected environments and be transplanted to the field after the risk of frost has passed. • For deciduous and subtropical crops, it is important to detect critical temperature thresholds at early growing stages.
	Hail protection nets and greenhouses	• Reduce crop damage and loss by buffering the impact of hail on crops. • Protection from bird predation.
DROUGHT	Agroforestry	• Through carbon sequestration, agroforestry has the potential to offset greenhouse gas (GHG) emissions from the agricultural sector. • Root systems stabilize the ground and reduce soil erosion. • Improves soil health by increasing soil organic matter, nutrient availability and microbial activity. • Leaves from trees enrich the soil and help keep soil moisture, contributing to efficient and self-sufficient use of water. • Other co-benefits of agroforestry include: sustainable firewood, timber, fodder for animal feeding, and medicinal uses. Fodder trees can also be grown as a substitute or supplement to a basal diet including crop residues.
	Agronomic practices (e.g. weeding, harrowing, grafting, mulching)	• Weeding and defoliation reduce soil water losses from plant transpiration. • Cover crops reduce soil erosion by increasing soil organic matter, water, air, and nutrient availability. • Harrowing (breaking the soil into small fragments) can prevent the loss of land moisture by evaporation. • Grafting techniques can reduce yield losses caused by drought. • Hydroponics with re-circulating water systems can reduce water losses. • Covering the soil with crop residues (mulching) in combination with no-tillage reduces the exposure of crops to heat-stress conditions. It also increases soil moisture by reducing direct soil evaporation.
	Terracing	Reduces soil erosion, increases macronutrient deposition and infiltration by reducing surface runoff.

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
	Drought tolerant crops (e.g. sesame, millet, sorghum)	• Crops with low water requirements reduce evapotranspiration losses during photosynthesis by rapidly closing their stomata and maintaining leaf water potential and photosynthetic rate. • Enhance food production during the dry season when food insecurity levels are highest.
	Drip irrigation systems	• Increase water-use efficiency by providing sufficient water according to the crop. • Reduce soil erosion and macronutrient losses from leaching. • Promote weed control as water is locally applied. • Reduce the risk of diseases that occur under damp conditions.
	Programmed irrigation	• Uses water resources more efficiently and avoids permanent wilting point as well as field capacity. • Reduces losses from direct evaporation by providing water when evaporation rates are lowest (dawn and/or dusk). • Promoting irrigation at dawn and dusk reduces direct soil evaporation, making better use of water resources.
	Small scale reservoirs	• Increase water availability to counteract the impacts of drought shocks. • Provide supplemental irrigation on rainfed fields.
	Reuse of treated waste water, desalinated water	• Brings additional nutrients to the plants and enhances yields. • Increases water use efficiency and promotes sustainable withdrawal and supply of freshwater to address water scarcity.
LAND DEGRADATION AND GREENHOUSE GAS EMISSIONS	Agronomic (e.g. sub-soiling)	• Sub-soiling can break possible hard pans and improve soil aeration. • Introduction of root crops (e.g. horseradish) for deep root penetration and soil structure improvement.
	Early sowing, vigorous, and strong root crops	• Reduce the impacts of excess water at early growing stages. • Cultivars with a higher geotropic root angle (roots that develop horizontally) exploit a soil zone that is less saturated with water.

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
	Crop rotation and crop association	• Increase soil fertility as each crop has different nutrient requirements and plant-soil dynamics. • Increase crop yields with the diverse nutrient availability. • Reduce soil erosion and prevent nutrients from being washed away by wind or water (through an increase in crop cover). • Limit concentration of pests and diseases and lower selective pressure on pathogens (as each crop has different pathogens). • Reduce fertilizer use and associated pollution by improving nutrient cycling. • Increase soil carbon sequestration.
	Mulching	• Increases soil moisture by reducing losses from direct evaporation. • Reduces weed growth by keeping light from reaching the soil surface. • Moderates soil temperatures by keeping the soil warmer during cold nights and cooler in hot days. • Reduces irrigation requirements by reducing losses from direct evaporation.
	Bio-fertilizers	• Application of living organisms to seeds, plant surfaces and/ or soil. • Reduce the environmental impacts (from volatilization and leaching) from chemical fertilizers which have a high macronutrient concentration. • Improve nutrient availability for plants and increase yields.
PESTS AND DISEASES	Biological control	• Natural enemies (insects) are introduced in the environment and can sustain themselves by feeding from pests affecting the crop. • Use beneficial entomopathogens to reduce the need for chemical pesticides. • Reduces the need for chemical fertilizers, as well as herbicides and pesticides.
	Crop rotations	Limit concentration of pests and diseases and lowers selective pressure of pathogens (as each crop has different pathogens).
	Bio-pesticides (e.g. insecticide for hornworms, mildews)	• Can be used as a fungicide and pesticide. • Reduce the environmental impacts as they are organic and biodegradable. • Do not create “death zones” that can kill beneficial insects. • Reduce the negative effect on human health associated with chemical pesticides.
	Integrated Pest Management (IPM)	• Sampling, scouting and monitoring systems for a proper early identification of pests.

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
		• Plant quarantine and 'cultural techniques' e.g., removal of diseased plants, and cleaning pruning shears to prevent spread of infection. • Association with other plants that deter insects, e.g. lemon grass, can reduce pests on leafy vegetables, e.g. relay intercropping of tomatoes and cabbage. • Beneficial fungi and bacteria are added to horticultural crops vulnerable to root diseases. • Resistant crop varieties and grafting to suppress insect pest management. • The use of anti-insect nets limits the spread of pests. • Removal of weeds that are host of pest and diseases.

Livestock farming practice

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
DROUGHT AND HEAT	Water reservoirs and basins	• Optimize water resources by reducing the exposure to drought and heat-stress conditions. • Limit the movement of cattle and reduce overgrazing. • Reduce transhumance time by placing water along transhumance corridors.
	Adapted cattle breeds, heat tolerant breeds (e.g. gyr cattle in the tropics)	• Use of breeds with lower water intake requirements can reduce animal mortality and optimize the use of water resources. • Reduce animal mortality by minimizing animal's exposure to drought and heat stress conditions.
	Shelter (e.g. agroforestry, barn, stables)	• Shelterbelts can reduce the exposure of livestock to heat-stress conditions and therefore reduce animal mortality.
LAND DEGRADATION	Rotational grazing	• Increases forage production by minimizing overgrazing of some plants in the pastureland. • Improves soil fertility and reduces soil compaction, which in return increases water absorption. • Allows a higher number of animals to feed on the same surface. • Improves animal management during droughts and prevents animals from eating all the forage before the arrival of rains.
	Ex-closures	• Reduce pressure on natural resources (hay and water) by supporting the regeneration of native species. • Minimize land degradation from soil compaction.

HAZARDS	PRACTICES	DESCRIPTION AND ADAPTATION/MITIGATION BENEFITS
	Silvopastoral systems (trees and livestock)	• Incorporating trees into grazing land enhances carbon storage above and below ground. • Improve cattle's diets with complementary tree by-products. • Improve soil fertility and natural fertilizers. • Limit the expansion of weeds through periodical grazing. • Diversify farm income losses.
	Sustainable management strategies	• Reduce enteric CH_4 emission by extending the lactation period, reducing the number of animals, improving nutrition and grassland management, animal breeding, and promoting alternative livestock systems.
	Manure Management	• Use manure for biogas production and as bio-fertilizer. • Shortens storage time in farms, reduces CH_4 emissions.
	Nutritional strategies	• Reduce enteric CH_4 emission through plant breeding, improvement of forage quality, diet supplementation (including concentrate, oil, and tannic acid), enzymes and probiotics, and diet modification. Grass or leaves from specific trees that reduce CH_4 emissions may also have unintended undesirable effects, such as reduction in N in the manure that is used as a fertilizer.
ANIMAL DISEASES	Vermin control measures (e.g. flies, rats, fleas, cockroaches)	Promote animal health and reduce mortality. For instance, installing door sweeps, store feed bags on pallets, screening materials, caulk, vermin traps and disinfectant are among the most effective measures for controlling/preventing and/or eliminating the presence of pests in the animal's environment.
	Managing livestock	Improves livestock feed. For instance, through feed ration improvement, residues valorization, supplementary forage sources, and additional wood production.
	Adequate animal spacing	Reduces probability of disease outbreak.

5. Role of key players

Policymakers

- Ensure updated nationally determined contributions (NDCs) and Adaptation Communications include climate resilience actions and are aligned with Sustainable Development Goal (SDG) targets.
- Integrate climate risk and resilience into COVID -19 recovery and build -back -better programmes and investments.
- Promote policy coherence for climate -resilient transport, trade, tourism, fisheries and aquaculture for sustainable development
- Integrate climate resilience measures in cross -sectoral plans and policies.

Private Sector

- Adopt low-carbon technologies to reduce GHG emissions during processing
- Recycle waste
- Efficiency use of available resource

NGOs/FBOs

- Enhance advocacy of CRA
- Follow up to ensure advocated issues are addressed
- Awareness rising to citizens on climate resilience and AEP initiatives as well as effects of climate change.
- Design development projects that are sensitive to climate change and promotion of AEP among targeted communities.
- Disseminate climate change and AEP related policies to local populations

6. Way forward

- Increase community participation in Rwanda's NDCs implementation:
- Reduction of greenhouse gas emissions from all agriculture and non-agricultural sources has to be prioritized. The introduction of neem-coated urea is one such policy intervention
- Structured training is essential to build confidence in stakeholders and sensitise them to understand the climate change events
- Harmonised proxy-extension on agro ecology
- Fine tuning the gap between current management practices and essential agro-advisories
- Promote CRA practices beyond districts where the CRA project operates
- Implementing CRA across the country is the need of the hour
- Flagship farmer-oriented programmes are needed to improvise skills in agriculture and allied sectors
- Collaboration between farmers, research institutions, funding agencies, governments, and non-government organisations and private sectors combine strengths to promote CRA