Agricultural TVET College

Small Scale Irrigation Development

Level II

MODEL TTLM

Learning Gide #04

Unit of Competence: Observe and Report on Weather

Module Title: Observing and Reporting on Weather

LG Code: AGR SSI2 04 0816

TTLM Code: AGR SSI2 TTLM04 1218V_2

Nominal Duration: 40 Hours

Instruction Sheet # 1	Unit	Observe and Report on Weather
	Module	Observing and Reporting on Weather
	LO#1-3	

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Check weather and climate information
- Carry out preventative action
- Monitor weather and climate

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Check and determine weather and climate information based on likely conditions.
- Familiarize changed weather and climate situations
- Make report to supervisor of anticipated impact of weather and climate.
- Determine preventative action according to the known effects on livestock, crops and work tasks.
- Implement actions to minimize loss and damage
- Document and record relevant information according to enterprise requirements

Learning Activities

1. **Read the specific objectives of this Learning Guide.**
2. **Read the information written in the "Information Sheet"**
3. **Accomplish the "Self-check".**
4. **If you earned a satisfactory evaluation proceed to the next "Information Sheet". However, if your rating is unsatisfactory, see your facilitator for further instructions or go back to Learning Activity.**
5. **Submit your accomplished Self-check. This will form part of your training portfolio.**
6. **Read and Practice "Operation Sheets".**
7. **If you think you are ready proceed to "Job Sheet".**

8. **Request you facilitator to observe your demonstration of the exercises and give you feedback.**

Information sheet # 1	**Unit**	**Observe and Report on Weather**
	Module	**Observing and Reporting on Weather**
	LO#1	**Check weather and climate information**

1.1: Checking Weather and Climate Information

1.1.1: Introduction:

Pre-discussions:

What is the difference between weather and climate?

The difference between weather and climate is that

- **Weather** consists of the short-term (minutes to months) changes in the atmosphere. Most people think of weather in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, wind, and atmospheric pressure, as in high and low pressure.
  In most places, weather can change from minute-to-minute, hour-to-hour, day-to-day, and season-to-season.
- **Climate**, however, is the average of weather over time and space. An easy way to remember the difference is that climate is what you expect, like a very hot summer, and weather is what you get, like a hot day with pop-up thunder storms .and is the condition of the atmosphere at a particular place over a short period of time.

In short;

- The difference between weather and climate is a measure of time. ***Weather*** is what conditions of the atmosphere are over a short period of time, and ***climate*** is how the atmosphere "behaves" over relatively long periods of time.
- The science **meteorology** studies weather, while **climatology** studies climate; both are atmospheric sciences.

Some scientists define climate as the average weather for a particular region and time period, usually taken over 30-years. It's really an average pattern of weather for a particular region. When scientists talk about climate, they're looking at averages of precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail storms, and other measures of the weather that occur over a long period in a particular place.

For example, after looking at rain gauge data, lake and reservoir levels, and satellite data, scientists can tell if during a summer, an area was drier than average. If it continues to be drier than normal over the course of many summers, than it would likely indicate a change in

the climate. Whereas **climate** refers to the **weather** pattern of a place over a long period, long enough to yield meaningful averages.

1.1.2: Factors that affects weather and climatic conditions

There are several elements that affect the weather condition. These factors are;

- The temperature,
- The wind,
- The air moisture,
- The cloudiness and rain and
- The atmospheric pressure.

The climate of any particular place is influenced by a host of interacting factors. These includes

- Latitude
- Elevation
- Nearby water
- Ocean currents
- Topography
- Vegetation, and
- Prevailing winds.

The global climate system and any changes that occur within it also influence local climate.

1.1.3: How these factors determine likely conditions:

- ☞ The temperatures of the atmosphere naturally change. This change in the temperature affects the weather condition in a particular place and time. The temperature begins to rise after the sunrise and it will begin to fall before the sunset.
- ☞ Air moisture also affects the condition of the weather. The oceans, the lakes, the rivers as well as the other water forms and the land naturally perform evaporation. The water vapor due to evaporation goes into the atmosphere (this time the water vapor is called as moisture).
- ☞ Clouds and Rain are other factors that affect weather condition. The clouds are made up of tiny water droplets that are suspended in the air. Clouds form because of three conditions; enough water vapor in air, low temperature that will condense the vapor and the tiny particles in where the water vapor condenses. The clouds will eventually fall back to the ground in time in the form of rain.
- ☞ The atmospheric pressure also affects the weather. A gaseous substance in the atmosphere exerts pressure on every part of the earth's surface. The pressure that is exerted by the atmosphere is called as the atmospheric pressure.

1.1.4: How can we get weather information?

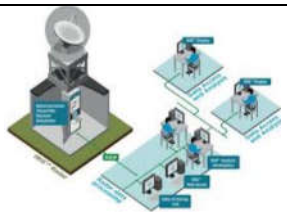
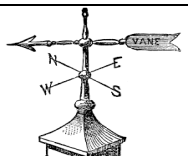
a) Directly from recorded data

To predict the weather, we need to measure and record the weather. If you want to know the weather is like tomorrow, it's pretty important to know what the weather was like today and yesterday. Knowing the average weather on a particular day of the year is also useful.

Collecting data every day can show you patterns and trends, and help you figure out how our atmosphere works.

Data Collection Devices

Some of the kinds of equipment used to measure the weather information include thermometers, radar systems, barometers, rain gauges, wind vanes, anemometers, transmissometers, and hygrometers.

Collection Devices		Purpose
Thermometers		- Used measure the temperature by allowing a liquid inside the thermometer to expand as it gets hotter and contract as it gets cooler.
Radar systems		- Used to create maps of rain and snow and measure the motion of rain clouds. This works by bouncing radio waves off the clouds and measuring how long it takes for them to return.
Barometers		- Used to measure the pressure in the atmosphere. Pressure is how thick the air is: how much air can be found in a particular volume.
Rain gauges		- Used to measure the amount of rainfall
Wind vanes		- Used to indicate wind direction

Anemometers		- Is an instrument that measures wind speed and wind pressure.
Transmissometer		- Is a measuring instrument used to determine the matric water potential (soil moisture tension) in the vadose zone.
Hygrometers		- Is an instrument which measures the **water** vapor of the atmosphere.

b) From forecasting mass medias:

Weather information can be sourced from the radio and television forecasting, and newspapers:

c) From communication medias:

This may include;

- Internet,
- Email
- Fax,
- Telephone e.t.c

1.1.4: Checking weather and climate information

Weather and climate information requires basic qualities. And the quality system is controlled by the involvement of three main steps: These steps are

i. **Monthly sums checks:-** Upon the completion of the data entry for all stations, the first step is a check of the monthly sums of each data element. The spreadsheet's monthly sums of the daily maximum and minimum temperature, precipitation and snowfall are compared with any sums that may have been entered by the observers on their monthly forms.

ii. **Internal consistency checks:-** The second step in the checking information process is checking for internal inconsistencies among the daily data values of each station. A spreadsheet macro copies the daily data for each station, one station at a time, into a spreadsheet are a series of formulas which are displayed.

☞ For the cross-checks regarding temperature, there is no tolerance for any of the following inconsistency.

- Current day maximum temperature less than current day minimum.
- Current day 'at-observation' temperature less than current day minimum.
- Current day maximum temperature less than current day 'at-observation' temperature.
- Current day maximum temperature less than previous day's 'at observation' temperature.
- Previous day 'at-observation' temperature less than current day minimum.

iii. **Daily spatial checks**:- The most time-consuming aspect of the data entry and quality check process is the spatial editing of the data. In the spatial analysis, all stations are divided into three different groups on the basis of their observation times.

1.2 Familiarizing changed weather and climate situations

Climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change affects agriculture in a number of ways, including through

- ✓ Changes in average temperatures,
- ✓ Rainfall, and climate extremes (e.g., heat waves);
- ✓ Changes in pests and diseases;
- ✓ Changes in atmospheric carbon dioxide and ground-level ozone concentrations;
- ✓ Changes in the nutritional quality of some foods; and changes in sea level.

Climate change is already affecting agriculture, with effects unevenly distributed across the world. Future climate change will likely negatively affect crop production in low latitude countries, while effects in northern latitudes may be positive or negative.

How will climate change affect the water cycle?

Climate change intensifies this **cycle** because as air temperatures increase, more **water** evaporates into the air. Warmer air can hold more **water** vapor, which can lead to more intense rainstorms, causing major problems like extreme flooding in coastal communities around the world.

1.3 Anticipating likely impact of changes in weather and climate.

Agricultural production is always subjected to risks associated with climate variability. Producers are often at the mercy of natural forces they cannot control, especially changes in rainfall from season to season and year to year.

Producers can use weather and climate information to reduce production risk, increase resource use efficiency and the profitability of agricultural operations.

Depending on the decision to be made, either short-term weather forecasts or seasonal climate outlook can be incorporated into their decision-making process together with other important factors such as commodity prices, government programs, and consumer preference.

1.3.1 How can weather and climate forecasts help in making decisions on the irrigated agriculture?

Producers make decisions every day on an irrigation field, and while many of them are not affected by the weather or climate, conditions change dramatically when crops are on the ground or even before that.

Seasonal climate outlooks can also help in deciding about crops, varieties, crop insurance coverage levels and marketing. However, unlike short-term forecasts, farmers are normally not in the habit of actively seeking seasonal climate forecasts for use in management decisions.

In the long run, the climatic change could affect agriculture in several ways:

- ✓ *Productivity*, in terms of quantity and quality of crops
- ✓ *Agricultural practices*, through changes of water use (irrigation) and agricultural inputs such as herbicides, insecticides and fertilizers.
- ✓ *Environmental effects*, in particular in relation of frequency and intensity of soil drainage (leading to nitrogen leaching), soil erosion, reduction of crop diversity.
- ✓ *Rural space*, through the loss and gain of cultivated lands, land speculation, land renunciation, and hydraulic amenities.
- ✓ *Adaptation*, organisms may become more or less competitive, as well as humans may develop urgency to develop more competitive organisms, such as flood resistant or salt resistant varieties of rice.

1.3.2 Effects of Climate Change on Agriculture

Agriculture is strongly influenced by weather and climate. While farmers are often flexible in dealing with weather and year-to-year variability, there is nevertheless a high degree of adaptation to the local climate in the form of established infrastructure, local farming practice and individual experience.

Climate change can therefore be expected to impact on agriculture, potentially threatening established aspects of farming systems but also providing opportunities for improvements.

- **Direct impacts of climate change on agriculture**

  (a) Changes in mean climate

  (b) Climate variability and extreme weather events

  (c) Extreme temperatures

  (d) Drought

  (e) Heavy rainfall and flooding

  (f) Tropical storm

- **Impacts of weather and climate change on Irrigation and Rainfall**

Changes in climate may also impact the water availability and water needs for agriculture. If temperature increases and more sporadic rainfall events result from global warming, it is possible that irrigation needs could increase in the future.

However, part of this increase may be due to changes in the frequency of tropical storms. Plants growing in a high carbon dioxide environment may have lower water needs. In addition, widespread increased humidity will slow transpiration, further reducing the need for water.

1.4: Making report to supervisor.

1.4.1: Observation and reporting data from weather stations

Observation and reporting of the weather which may help you selecting the type of data you require. Observation of weather data may be the;

- Monthly
- Daily
- Hourly
- Half hourly, and
- Minute frequency options represent the most typical reporting schedules within broader reporting ranges.

1.4.2: Observing impacts

So far, the effects of regional climate change on agriculture have been relatively limited. Changes in crop phenology provide important evidence of the response to recent regional weather and climate change.

Phenology is the study of natural phenomena that recur periodically, and how these phenomena relate to climate and seasonal changes.

1.4.3: Reporting data from weather stations

At the majority of locations, manual and automatic weather stations (AWSs) send data frequently. Some provide data every minute, while others report on an hourly basis.

The reported data to supervisors are essential to provide data for the respected institutional and organizational forecasting, warning, and information services, as well as providing data for the Bureau's climate database.

SELF CHECK #1	**Unit**	**Observe and Report on Weather**
	Module	**Observing and Reporting on Weather**
	LO#1	**Check weather and climate information**

Name: _____ **Date:** _____

Directions: **Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.**

1. What is the difference between weather and climate? (4 pts)

   ……
   ……..
   ……
   ……..

2. Describe the **impacts of climate change on agriculture**? (8pts)

   ……
   ……..

……
……
……..……

3. Write the three main steps used to check the quality of weather and climate data? (3pts)

……
……..……
……..

Note: **Satisfactory rating - 8 points and above Unsatisfactory - below 8 points**

You can ask your teacher for the copy of the correct answer

Operation sheet #1	**Unit**	**Observe and Report on Weather**
	Module	**Observing and Reporting on Weather**
	LO#1	**Check weather and climate information**

Project title: <u>Checking quality of weather and climate information</u>

➢ **Objectives:** To develop candidate's practical skill, and critical knowledge in Checking quality of weather and climate information.

Tools, equipment and resources required:

- Spreadsheet temperature data
- Calculator
- Pencil

Procedures:

- Collect the recorded data of weather (temperature) data from the surrounding station or agency:
- Conduct checking of the quality of the recorded data using the internal consistency checks.
- Give the feedback/recommendation for the recorded information

Precaution:

- Be take care the risk of dust which may be accumulated on the documented materials.

Quality Criteria:

- ✓ Be careful for the tearing or damage of spreadsheet data
- ✓ Give back the materials back to the appropriate place.

Lap Test	Practical Demonstration

Name: _____ Date: _____

Time started:_____ Time finished:____

Instructions:

☞ You are required to perform the following activity:

- ✓ Task_1: Collect the recorded data of weather (temperature) data from the surrounding station or agency:
- ✓ Task_2: Conduct checking of the quality of the recorded data using the internal consistency checks.
- ✓ Task_3: Give the feedback/recommendation for the recorded information.

Information sheet # 3	**Unit**	**Observe and Report on Weather**
	Module	**Observing and Reporting on Weather**
	LO#3	**Carry out preventative action**

Introduction

Preventive action: action to eliminate the cause of a potential non-conformity or other undesirable situation.

- Proactive actions, such as risk assessments, failure modes and effects analysis, must be taken to identify potential non-conformities.
- The development of work instructions, documented procedures, training is examples of actions that are performed to prevent non-conformities.
- Other activities that are regularly carried out and are part of the preventive action process are audits, management reviews and inspections.

2.1 Information and advice is promptly disseminated to relevant personnel.

Information and advice is promptly disseminated to relevant personnel about the weather condition of the staff members or other staff and colleagues, owners and managers, and neighbors.

The effectiveness of a given dissemination strategy depends on factors such as the characteristics of the innovation, the target audience and the information channel.

The strategy that works well for transmitting general information to the masses may be inappropriate for communicating specific research findings to policy makers. The strategy that works well for diffusing technological innovations among organizations may not be compatible with dissemination strategies linked to the development of third world countries.

The information channels around which to strategize range from

- ✓ mass media to mass mailings,
- ✓ from print media to electronic media,
- ✓ From telephone contacts to face-to-face contacts.

Purposes include informing, educating, and selling. The ultimate purpose may be to change attitudes and behaviors. Target audiences may include varied ethnic or minority groups. On the other hand, targeted audiences may include a given socio-economic level, educational level, or special interest category. No one channel assures success of the innovation. The usefulness of each channel varies for differing innovations, for differing stages in the innovation process, and for soft vs. hard technology transfer.

I. Mass media

Mass communication includes electronic and print media.

The advantages and disadvantages of each form of mass communication provide guidance for selecting the best medium to fit the intended audience and the dissemination purpose.

A. Effectiveness areas of electronic media

- ✓ Radio
- ✓ Television
- ✓ Tele text& Videotext
- ✓ Videocassettes/discs
- ✓ Internet like you tube, face book….

B. Effectiveness areas of print media

- ✓ Newspapers
- ✓ Magazines and Journals
- ✓ Newsletters
- ✓ Books
- ✓ Comic

2.2 Determining preventative action on livestock, crops and work tasks

Preventative actions of observing and reporting on weather data may include:

- Provision of shelter,
- Shedding animals,
- Covering fodder,
- Moving fodder,
- Firefighting equipment,
- Auxiliary power supplies,
- Moving stock,
- Securing equipment and buildings,
- preparing fire breaks and assured water supply,
- Rescheduling work tasks,
- Operating sprinklers in order to cool animals in extreme heat.

2.3 Actions to minimize loss and damage are implemented.

What is loss and damage?

Sudden and slow-onset events of climate change – such as floods, hurricanes, sea level rise and desertification – cause harm in developed and developing countries alike. Conceptually, loss and damage arises when the adverse effects are not avoided through mitigation and adaptation (e.g. the impacts exceed adaptive capacities). loss and damage involves the development of approaches to address the effects of such events on the most vulnerable developing countries, who are recognized as bearing disproportionate costs from climate change, having both contributed the least to the problem and the least capacity to manage its negative impacts.

Mitigation measure to minimize loss and damage

Mitigation measure to minimize loss and damage of agricultural are suggested for reducing greenhouse gas emissions from farming practices. These are tried and true practices that often result in higher yields and fewer inputs. We provide solution suggestions in these areas are:-

- Agro forestry
- Crop production
- Livestock production

1. **Agro forestry**

Trees can be extremely valuable resources to farmers, although over the last couple decades many trees have been torn down on the Prairies to enlarge fields.
When trees are grown together with crops and livestock, as **an integrated production unit,** numerous benefits can be observed. Trees have been shown to indirectly **increase crop yields**, improve **soil and water quality**, increase **biodiversity**, reduce greenhouse gas **(GHG) emissions**, and increase carbon (C) **sequestration.**

Trees, shrubs, or bushes act as **natural buffers**, filtering the air and water, reducing blowing wind, and even minimizing the spread of air-born crop diseases and pests. These plants can be easily incorporated onto your farm and are **aesthetically pleasing** as well.

The actions to minimize weather or climate change related to agro forestry are:-

- Shelterbelts
- Riparian buffers
- Alley cropping
- Woodlots

Trees, shrubs, or bushes act as **natural buffers**, filtering the air and water, reducing blowing wind, and even minimizing the spread of air-born crop diseases and pests. These plants can be easily incorporated onto your farm and are **aesthetically pleasing** as well.

Plant shelterbelts

Shelterbelts consist of one or more rows of strategically planted trees and/or bushes. Traditionally, shelterbelts were found around farmyards to shelter farm buildings and livestock, but they are also now used along highways or between fields. The trees help **reduce wind**, limit soil **erosion** and nutrient loss, control and **trap blowing snow** and **conserve water**.

Crop yields can increase with the use of shelterbelts. Trees physically **protect young plants and reduce moisture losses** by protecting crops from drying winds. A 20% yield increase was observed for alfalfa planted beside a shelterbelt.

Shelterbelts can also help fight climate change because they **remove carbon dioxide (CO_2) from the atmosphere and store it as carbon**.

Despite the numerous benefits of shelterbelts, **trees compete with crops for water and nutrients**, and increase the amount of **shade**. With increasing equipment size and growing value of crops, Prairie farmers continue to push down shelterbelts to expand field size and increase land available for crop production.

Plant riparian buffers

Riparian buffers consist of trees, shrubs or grasses planted between cultivated crop land and a **waterway**, such as a river, pond, or dugout. The main benefits of these buffers are to **filter surface run-off** before it enters the water, to protect water edges from **erosion**, and to **sequester C**. Run-off may contain sediments, nutrients, and/or pesticides, which can be damaging to the water quality and the animals that live there. Without adequate buffering areas, nutrient and sediment filtering cannot take place which encourages the **eutrophication** (algal blooms) and **sedimentation** of local waterways.

Consider alley cropping

Alley cropping is a form of tree production that mixes trees with agricultural crops. The trees are planted in widely spaced rows with **agricultural crops in alleys between the trees**. The shelterbelts minimize soil erosion and nutrient loss, trap snow, and create warmer microclimates for crops.

Diversify into agro woodlots

Growing trees is becoming a popular way of bringing marginal land or small, irregular shaped sections of land into production. **Fast growing wood crops**, such as hybrid poplars, provide environmental benefits to the land, increasing soil organic matter and creating oxygen. Trees have high rates of nutrient uptake and can store large amounts of C. Biomass from the trees can be used as timber or as an alternative fuel (**bioenergy**).

2. Crop production

Changes to agricultural practices are critical to climate change adaptation. A focus needs to be on the implementation of farming practices that develop soil health, exercise sustainable nutrient management and encourage environmental sustainability.

There are practical on-farm techniques that can be implemented to help reduce GHG emissions. Management practices such as conservation tillage, crop rotation selection or type of fertilizer used can promote long-term soil productivity while maintaining water quality and preserving profitability.

The actions to minimize weather or climate change related to crop production are:-

1. Manure fertilizer
2. Nutrient management
3. Soil management
4. Synthetic fertilizer

1. ***Manure fertilizer****:* - is such a volatile substance, many nutrients are easily lost and contribute to the high levels of nitrous oxide (N_2O) in the atmosphere. We suggest some manure management adaptations that can further reduce GHG emissions from agriculture:
   a. Manure testing: - **Manure testing should be done routinely** to determine the amount of plant-available nutrients, particularly N and P.
   b. Application equipment calibration:-
      - ✓ **For liquid manure**, this can be done with drag-line or tanker application systems equipped with flow-rate monitors.
      - ✓ **Spreading of solid manure** is harder to accurately control. **Manure testing** should be done prior to application and spreading rates based on **manure phosphorus levels**. Manure spreaders should be properly maintained to ensure uniform spreading. **Uniform spreading** will lower risk of nutrient loss to the environment and is important for optimal crop response.

   c. Winter spreading:- Winter manure application should be eliminated to **prevent manure runoff at spring-thaw** and to reduce spring-thaw N2O emissions.

2. Nutrient management

Sustainable nutrient management revolves around the non-excessive use of synthetic or natural fertilizers. This practice benefits both the farmer and the environment when proper techniques

are used. Improving the efficiency of fertilizers should lower application rates and costs, while reducing the amount of nutrients that can be lost to the environment through leaching, de nitrification, or volatilization.

Of the four major nutrients (nitrogen-N, phosphorous-P, potassium-K, and sulfur-S) applied as synthetic fertilizer, **N is the nutrient most easily lost**. Nitrogen causes the most environmental damage and economic loss to the farmer.

- ✓ Soil testing
- ✓ Fertilizer application
- ✓ Fertilizer incorporation
- ✓ Fertilizer application timing
- ✓ Precision Farming

3. Soil management

A balanced mixture of **minerals**, **organic matter**, living **organisms**, plant **roots**, **water** and **gases** are **ingredients for a healthy soil**. When soil components are in healthy **equilibrium**, nutrients will be available to provide **food** for the crop and micro-organisms alike. Natural **nutrient cycling** will limit the need for farmers to apply excess amounts of **fertilizers** and keep nutrients in forms that are good for the environment. Soil with a wide diversity of soil organisms and nutrients will be more productive and **sequester carbon** (C) from the atmosphere.

The **quality of soil** is essential to efficient crop production and environmental health because it plays many key roles for the ecosystem: Soil contributes to agro-ecological health by

- ✓ **Supporting plant growth**
- ✓ **Controlling water loss**, use, and cleanliness
- ✓ Acting as a **recycling system** by decomposing plant and organic residue
- ✓ Providing **habitats** to small mammals, reptiles, and micro-organisms
- ✓ Strongly influencing the **cycling of gases** between the soil and the atmosphere

One of the best indicators of soil quality is **earthworm populations**. Earthworms increase soil fertility and improve soil physical properties. Worms create burrows that act as **water drainage tunnels**, **aerate** the soil and create **pathways for crop roots** to reach deeply stored nutrients. **A minimum of 5 earthworms in a shovelful of soil** under cool, moist soil conditions indicates a good worm population in agricultural systems. Other large soil organisms in a healthy soil include **nematodes** and **insects**, or micro-organisms, such as **bacteria**, **fungi** or **algae** that live in the soil water and provide nutrients to plant roots. In agricultural systems, specific forms of **nitrogen (N)** and **carbon (C)** are the **culprits** that **create atmospheric greenhouse gases**. Farming practices have increased the amount of C and N cycling in the environment, leading to greater amounts of **carbon dioxide (CO_2)** and **nitrous oxide (N_2O)** in the atmosphere. Limited nutrients stay in the soil system, lessening soil organic matter and plant available N forms in the soil. Awareness of the **cycling of these two nutrients** is important to understanding how crop production can reduce GHG emissions.

- ✓ Nitrogen

- ✓ Carbon
- ✓ Conservation tillage
- ✓ Crop rotations
- ✓ Soil cover
- ✓ Crop residue
- ✓ Soil drainage
- ✓ Marginal land
- ✓ Organic farming

3. Livestock production

Climate change is now inevitable, **sustainable agricultural practices are critical to climate change adaptation**. A focus needs to be on the implementation of farming practices that limit or reduce direct and indirect greenhouse gas (GHG) emissions from livestock production. Modifications to current practices will be necessary with environmental sustainability as the top priority.

Livestock produce the largest amount of **methane** (CH_4) in Manitoba. The gas is produced both directly and indirectly by animals.

- ✓ Animals **directly** produce emissions in the form of burps, a product of **enteric fermentation**.
- ✓ **Indirect emissions** are a result of **manure storage** practices. Manure storage and spreading **also** releases **nitrous oxide (N_2O)**, another potent GHG.

Manitoba's agriculture is in a good position to influence GHG emissions, because farming practices can be modified to **become part of the climate change solution**. There are practical on-farm techniques that can be implemented to help reduce GHG emissions from livestock production. Management strategies can include **improving pasture and forage quality**, using **efficient feed rations** to lower fermentation losses, following proper **manure storage and spreading** regulations and enhancing carbon (C) sequestration and storage on pastures.

- ✓ Managing feed
- ✓ Manure management
- ✓ Pasture and grassland management

2.4. Adjusting and Revising Livestock, horticultural works

Climate change will affect livestock production and consequently food security. Livestock production will be negatively impacted (due to diseases, water availability, etc.), especially in arid and semiarid regions. In addition, climate change will affect the nutritional content of livestock products, which are one of the suppliers of global calories, proteins and essential micronutrients. Conversely, livestock production also influences climate change. Deforestation due to expansion of pasturelands and croplands for livestock production contributes .However; the feed production stage contributes the greatest fraction (almost half) of GHG emissions across the complete livestock production process. It is expected that this stage will further increase its contribution due to intensification of livestock production. Meanwhile, enteric fermentation is the largest GHG contributor in the animal production stage. Therefore, if

livestock numbers continue to increase and feeding practices are not changed, global emissions due to livestock production will continue to increase.

Impact of climate change on livestock

a. Quantity and quality of feeds

Quantity and quality of feed will be affected mainly due to an increase in atmospheric CO_2 levels and temperature. The effects of climate change on quantity and quality of feeds are dependent on location, livestock system, and species.

b. Water availability

Wate***r*** availability issues will influence the livestock sector, which uses water for animal drinking, feed crops, and product processes. To address this issue, there is a need to produce crops and raise animals in livestock systems that demand less water or in locations with water abundance.

c. Livestock diseases

The effects of climate change on livestock diseases depend on the geographical region, land use type, disease characteristics, and animal susceptibility. Animal health can be affected directly or indirectly by climate change, especially rising temperatures. The direct effects are related to the increase of temperature, which increases the potential for morbidity and death. The indirect effects are related to the impacts of climate change on microbial communities (pathogens or parasites), spreading of vector-borne diseases, food-borne diseases, host resistance, and feed and water scarcity.

d. Heat stress

Heat stress on livestock is dependent on temperature, humidity, species, genetic potential, life stage, and nutritional status. Livestock in higher latitudes will be more affected by the increase of temperatures than livestock located in lower latitudes, because livestock in lower latitudes are usually better adapted to high temperatures and droughts

Heat stress decreases forage intake, milk production, the efficiency of feed conversion, and performance. Warm and humid conditions cause heat stress, which affects behavior and metabolic variations on livestock or even mortality. Heat stress impacts on livestock can be categorized into feed nutrient utilization, feed intake, animal production, reproduction, health, and mortality.

e. Biodiversity

Livestock and plants will be highly affected by climate change and biodiversity loss. These breeds and species cannot be replaced naturally; therefore, future work that studies the inherent genetic capabilities of different breeds and identifies those that can better adapt to climate conditions is vital.

f. Agro-ecological zones

g. Food security

Research is needed on assessments for implementing adaptation measures and tailoring them based on location and livestock system.

- ✓ Livestock production and management systems
- ✓ Breeding strategies
- ✓ Farmers' perception and adaptive capacity

Climate change affect horticultural production

Climate change will affect horticultural production in a number of ways, and the effects will depend on location, soil type, crop type and management. These changes will alter profitability and financial risk associated with horticultural enterprises, particularly in areas at the margins of enterprise suitability.

How can you adapt to climate change?

A drier climate will reduce the availability of water and increase cost of water for horticulture. To successfully adapt to climate change, managers will need to improve irrigation practices. Where the cost of water increases, it may be possible to change the crop or enterprise type and improve the financial return per unit of water used.

Changes in water availability may be less of an issue for new and expanding irrigation area. Matching crop type to climatic area will be increasingly important, particularly for long-lived perennial crops.

There are many ways for horticulture crop to adapt to the climate changes are described below.

- Use best-adapted crop species and varieties
- Improve water harvesting and storage
- Improve irrigation efficiency
- Grow crops under shelters or greenhouses
- Manage higher temperatures
- Improve plant water use efficiency

Self-Check 2	**Written Test**

Name: _____ **Date:** _____

Directions: ***Answer all the questions listed below.***

1. Write the way of dissemination of weather data to the relevant personnel?(5pt)
2. Write and explain the preventative action to the change of weather?(5pt)

3. Write and explain the action to minimize loss and damage are implemented on climate change based on agricultural suggestion?(5pt)
4. Write the impact of climate change on Livestock, horticultural or crop management program?(5pt)

Note: **Satisfactory rating – 20 points** **Unsatisfactory – below 20 points**