PROJECT TOOLKIT

# Green Eco-Lab


Open Space

Crossing Borders

CISU CIVIL SOCIETY IN DEVELOPMENT

# What's Inside:

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# Acronyms and Abbreviations

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|---|---|
| **GHGs** | Greenhouse Gases |
| **NDC** | Nationally Determined Contribution |
| **NDP III** | National Development Plan 3 |
| **OSC** | Open Space Centre |
| **SDGs** | Sustainable Development Goals |

# Who is the toolkit for?

This Eco-Lab Toolkit has been designed by the Open Space Center (OSC) to support facilitators and teachers to equip young people in schools (12-18 years) and young people out of school (18- 35 years) with the knowledge and skills to engage in climate adaptation actions and practices. This toolkit uses the terms "youth" and "young people" to refer to people between 12 and 35 years old.

The development of this toolkit is instrumental in empowering young people with knowledge and skills to address the main issue of climate change. Climate change, as we know it, is reshaping the world young people have inherited and they will bear the costs in the coming decades. However, young people especially those in underserved/ rural communities are often excluded from taking on participatory and leadership roles to address climate-related challenges and further engage in decision-making towards adaptation and mitigation practices.

## OBJECTIVES

- To help you understand climate change and how it affects you and your community, currently and in the future.
- To empower you to come up with and implement innovative solutions to build climate adaptive capacity in your school/community to address climate change effects.
- To empower a young person to appreciate the broader climate change adaptation strategies and sectors within Uganda.

## EXPECTED PROGRAM DELIVERABLES

- Young people in schools/communities can understand climate change, how it impacts communities, and what climate vulnerabilities are.
- Young people can understand how local (environmental, social, and economic) conditions can protect communities or expose them to the impact of climate change.
- Young people can understand the need to build climate resilience and what the key features of a climate-resilient community are.
- Young people and their local schools/communities can readily utilize information on climate adaptation to devise practical solutions to address some of the negative impacts of climate change.


MODULE ONE

# Foundational Principles of Climate Change

# 1.0 Understanding climate change

Climate change is the significant long-term change to normal weather patterns as a result of changes in the atmosphere. Weather refers to conditions over short periods, in certain geographical areas, whereas climate refers to long-term regional or even global conditions. Climate change is about the abnormal changes to the climate and how these affect the planet.

Climate change is caused by human-induced greenhouse gas emissions above what the environment can naturally cope with. Greenhouse gases (GHGs) include carbon dioxide and methane. Although carbon dioxide is part of a natural cycle, humans are releasing carbon dioxide into the atmosphere in large quantities through the use of fossil fuels (by using oil and gas, for example). Carbon dioxide is a natural heat trap, and trapping too much heat is not a good thing.  If the earth's surface heats up too much, this disrupts this natural cycle and causes changes to the climate. In turn, we experience climate impacts in our everyday lives.

## 1.1 Common definitions used in climate change

To better understand how climate change affects us and our community, there is a need to appreciate relevant scientific terminology relating to climate:

- Weather describes atmospheric conditions at a particular place in terms of air temperature, pressure, humidity, wind speed, and precipitation.
- Climate is often defined as the weather averaged over time (typically, 30 years).
- Climate Variability refers to variations in the mean state of climate on all temporal and spatial scales beyond that of individual weather events. Examples of climate variability include extended droughts, floods, and conditions that result from periodic El Niño and La Niña events.
- Climate Change refers to shifts in the mean state of the climate or its variability, persisting for an extended period (decades or longer). Climate change may be due to natural changes or persistent anthropogenic changes in the composition of the atmosphere or land use.
- Vulnerability to the impacts of climate change is a function of exposure to climate conditions, sensitivity to those conditions, and the capacity to adapt to the changes. Adaptations are actions taken to help communities and ecosystems moderate, cope with, or take advantage of actual or expected changes in climate conditions.
- Climate change adaptation human systems, climate change adaptation refers to the process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities. In natural systems, it refers to the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

- Climate change mitigation refers to human interventions to reduce emissions or enhance the sinks of greenhouse gases (such as forests or wetlands).
- Exposure: The nature and degree to which a system is exposed to significant climate variations. Sensitivity: Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct or indirect.
- Potential Impact: All impacts that may occur given a projected change in climate, without considering adaptation.
- Adaptive Capacity: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.
- Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. This means that changes to the environment (caused by climate change) begin to have negative (adverse) effects on you and your community.

*For example, a drought in your area means you are unable to gather water, which in turn means that you are unable to water your food garden and your vegetables may die. You have less or no vegetables to eat or sell.*

## 1.2 What does it mean to be climate vulnerable?

Being climate vulnerable means that you and your community are at risk of experiencing or feeling changes to your climate that affect your community and way of life. For example, a drought in the area can affect your ability to get water from the tap and you may not have another source of water. Only having one source of water makes you vulnerable to pollution, insufficient access, etc.

Vulnerability can also be a result of demographic factors such as age and gender. For women and men, vulnerability to climate change can be a result of gender roles. There are gendered differences in responsibilities, household Labor, how people use their time, and food security. There are also differences when it comes to access to, and control over, land, secure housing, money, information, credit, education, and health - all of which are not readily accessible to women. Women are also more likely to be subjected to violence. Social norms compound these constraints by restricting women's freedom of movement, choice, and voice. Water, energy, and food shortages, caused in part by climate change, result in time-consuming Labor and increased costs for women and girls because they have to travel further and pay more to collect these resources.

## 1.3 What does it mean to take climate action?

Taking climate action means that you or your community start to do things such as creating awareness, becoming more innovative, using the law, participating in decision-making processes, or organizing your community to respond to either your vulnerabilities or respond to the effects that you already experience relating to climate change. For example, to make sure that your local water sources are not polluted and can provide water for vegetable gardening, you ask the local municipality to clean up a local stream and ban the use of polythene bags dumped in water sources Or, you ask the local municipality to dig a borehole in your area.

## 1.4 What are the impacts of climate change in our schools/communities?

The Potential impacts of climate change on communities are vast. It is important to note that every community or society has a different level of sensitivity and vulnerability to climate change. The direct effects of climate change can be observed by rising maximum and/or minimum temperatures, rising sea levels, ocean temperature, changing rainfall patterns, increase in (heavy) precipitation, drought, etc., and in return lead to more climate-related hazards. The effects of these changes on humans and the natural environment can be seen in e.g. increased hunger and poverty as a result of failed harvests due to droughts/extreme rain; Health risks as a result of heatwaves; Increased pests from a change in temperature; Loss of biodiversity, as flora and fauna, cannot adapt to a new climate reality. Other potential effects include:

- Drought: Droughts in agricultural areas might result in food shortages or increases in the price of food. Furthermore, school-going children and adolescents are at a greater risk of mal-nourishment and poor nutrition as a result of food shortages.
- Irregular rainfall patterns: Water availability due to changes in rainfall patterns means longer and more extreme periods of drought or flooding.
- Flooding of homes and neighbourhoods may predispose your home/community to waterborne diseases, drowning, sanitation issues, etc.
- Effects on crops: Severe droughts will affect crops, livestock, and the livelihoods of farmers and ultimately cause food insecurity.
- Heat stress: Besides the effect of heat waves on crops and animals, heat stress in humans results in lower productivity and fertility, as well as negative impacts on the immune system.
- Bodily health: Air pollution will result in more breathing problems.
- Food insecurity can lead to hunger and malnutrition, along with water scarcity and poor water quality. The spread of more or different diseases may result due to changes in climate such as humidity or heat.

## 1.5 Uganda's climate change adaptation context/ strategy

In the year 2016, Uganda like many countries across the globe ratified the Paris Agreement, a legally binding document on climate change whose overall goal is to limit global warming to 1.5 degrees Celsius by the end of this century. The Implementation of the Paris Agreement on climate change required that countries across the globe submit national climate action plans, known as NDCs, each reflecting a reasonable degree of ambition to achieve the global goal of climate action.

To actualize this agreement, Uganda submitted its first Nationally Determined Contribution (NDC) in 2016, which outlined a 5year journey of the country's performance and emerging issues relating to the goal of the Paris Agreement. Recently, Uganda updated its Nationally Determined Contribution (NDC) for the years (s) 2020 to 2030 which highlights the country's climate adaptation strategy through sectoral adaptation that is closely linked to global commitments stipulated under the Paris Agreement, 2030 Agenda for Sustainable Development (SDG13), Sendai Framework for Disaster Risk Reduction 2015–2030, and post-2020 Global Biodiversity Framework.

The NDC update process was conducted simultaneously with the formulation of the Long-Term Low Emissions Development Strategy (LTS) to ensure the alignment of long-term climate change strategies with short and medium-term climate actions to represent Uganda's contribution and the fair share of domestic effort to transition to a low-carbon and climate-resilient economy shortly.

The adaptation component of this updated NDC covers 13 sectors including agriculture, forestry, energy, health, ecosystems (wetlands, biodiversity, and mountains), water and sanitation, fisheries, transport, manufacturing, industry, mining, cities and built environment, disaster risk reduction, tourism, and education, highlighting 48 priority adaptation actions and 82 indicators with targets for 2025 and 2030.

## 1.6 Uganda's policy frameworks for climate change adaptation

Uganda's Vision 2040 is the country's ambitious long-term development blueprint. The vision recognizes that climate change affects all sectors of the economy. As such, the vision provides for the integration of climate change governance into development planning. It aims to transform Uganda from a predominantly low-income country to a competitive upper-middle-income country. The country has so far developed 3 consecutive National Development Plans (NDP) to implement Vision 2040.

The NDP III's Program 9: Natural resources, environment, climate change, land and water management recognizes the importance of addressing climate-related disasters by promoting inclusive, climate-resilient, and low-emissions development at all levels.

Uganda developed the National Climate Change Policy in 2015 to guide efforts towards achieving Vision 2040 and moving towards low-carbon development. The policy aims to ensure that stakeholders address climate change impacts and causes through appropriate measures while promoting sustainable development and a green economy. The policy emphasizes climate change adaptation as the top priority for Uganda, given that the country's greenhouse gas emissions are still relatively very low, and yet the country is experiencing climate change risks, impacts, and vulnerabilities.

## 1.7 Climate change risks to Uganda's development sectors

Climate risks have posed serious threats to Uganda's key development sectors, such as agriculture, water resources, fisheries, tourism, and health, which are dependent on and sensitive to climate variability and change. Young people in Uganda (who constitute 78% of Uganda's population) are among the most affected, with worsening droughts and flooding exacerbating pre-existing socioeconomic challenges such as youth underemployment, food insecurity, and inadequate social protection.

## 1.8 Climate adaptation

Climate adaptation aims to lower the risks that result from climate change, as people adapt their physical environment, houses, lifestyles, livelihoods, and ways of working. Adaptation measures can be planned or put in place spontaneously to deal with immediate impacts. These adaptation measures can include large-scale infrastructure changes such as defending buildings and homes against rising sea levels or improving the quality of roads to better handle hot temperatures.

Adaptation measures can also be behavioral, such as encouraging people to use less water or encouraging farmers to plant different crops. Adaptation is a shared responsibility amongst governments, businesses, households, communities, and individuals. Therefore, climate adaptation is a response to potential impacts of climate change that can help reduce a community's vulnerability (i.e. the true measure of how at risk a community is). Climate adaptation helps individuals, communities, and organisations deal with the effects of climate change that cannot be avoided by taking practical actions and strengthening their resilience.

As part of Uganda's adaptation planning processes, in 2016, Uganda communicated her first NDC with an adaptation component; in 2017, the Strategic Program for Climate Resilience (SPCR) was developed; in 2018, formulated a National Adaptation Plan for the Agriculture Sector (NAP Ag) and in 2021, initiated a process for the preparation of an Adaptation Communication.

Uganda is moving towards medium-to-long-term planning for adaptation. Since 2021, the country has initiated the formulation of the National Adaptation Plan (NAP) to strengthen adaptation planning, governance, and coordination; develop tools for adaptation planning; and secure finance for adaptation. The country has established a National Adaptation Technical Working Group to guide and support the NAP process and overall adaptation planning.

### 1.8.1 Young people and climate adaptation

Young people are not just victims of climate change, they are also valuable contributors to climate action. They are agents of change, entrepreneurs, and innovators. Whether through education, science, or technology, young people are scaling up their efforts and using their skills to accelerate climate action. Young people have an important role to play in shaping how we respond to and prepare for the increasing impacts of our changing climate. Their engagement in what is rapidly becoming an existential dilemma is vital, not just for their futures but for the planet. Empowering young people with education, when grounded in practical exercises that benefit local communities directly, is a powerful tool for transformation.

## 1.8.2 Case studies on young people' role in climate action-facilitators guide

This section highlights how young people across the globe are taking part in climate action. Reference can be made to these case studies through videos on some of their inspirational work and climate change efforts.

**CASE STUDY 01**

Two youth activists Elizabeth Wathuti and Archana Soreng and the winner of the #MyClimateAction contest Ewi Stephanie Lamma demanded urgent action from world leaders amid the worsening climate crisis.

Video: https://media.un.org/en/asset/k1o/k1of9uge4m

**CASE STUDY 02**

Greta Tintin Eleonora Ernman Thunberg is a Swedish environmental activist known for challenging world leaders to take immediate action for climate change mitigation.*[1]*

Thunberg's climate activism began when she persuaded her parents to adopt lifestyle choices that reduced her family's carbon footprint. At age 15, Thunberg began skipping school on 20 August 2018, vowing to remain out of school until after the national Swedish election in an attempt to influence the outcome. She protested outside the Swedish parliament where she called for stronger action on climate change by holding up a Skolstrejk för climate (School Strike for Climate) sign and handing out informational flyers.

Video: https://bit.ly/3MHIBKG

**CASE STUDY 03**

Climate Adaptation Have You Heard About The Boy Who Harnessed The Wind?

Video: https://bit.ly/3QYPQQY

This film is adapted from a true-life account by William Kamkwamba and Bryan Mealer. This is the synopsis from Wikipedia:2 "Born in Kasungu, Malawi, William Kamkwamba is a young schoolboy who comes from a family of farmers who live in the nearby village of Wimbe.

CASE STUDY 03

William also dabbles in fixing radios for his friends and neighbors and spends his free time looking through the local junk-yard for salvageable electronic components. Although he is soon banned from attending school due to his parent's inability to pay his tuition fees, William blackmails his science teacher (who is in a secret relationship with William's sister) into letting him continue attending his class and have access to the school's library where he learns about electrical engineering and energy production.

By the mid-2000s, failing crops due to drought and the resulting famine had devastated William's village, leading to riots over government rationing and William's family being robbed of their already meager grain stores. People soon begin abandoning the village, and William's sister elopes with his former teacher to leave her family "one less mouth to feed". Seeking to save his village from the drought, William devises a plan to build a windmill to power an electric water pump that he had scavenged earlier.

William builds a small proof of concept prototype which works successfully, but to build a larger windmill, William requires his father, Trywell, to give permission to dismantle the family bicycle for parts, which is the only bicycle in the village and the family's last major asset. His father believes the exercise is futile destroys the prototype and forces William to toil in the fields. After William's dog dies of starvation and hope seems lost, William's mother, Agnes, intervenes and urges his father to reconsider. William and his father reconcile after William buries his dog. With the help of his friends and the few remaining members of the village, they build a full-size wind turbine which leads to a successful crop being sown. Word of William's windmill spreads and he is awarded a scholarship to attend school, ultimately receiving a degree from Dartmouth College."

*Can you identify what actions were taken by William and his friends to make the community more resilient?*

*[1] "It's an existential crisis. Listen to scientists" BBC. 23 April 2019. Archived from the original on 14 August 2019. Retrieved 31 August 2019.*

## 1.8.3 The bigger picture-climate resilient schools and communities

### WHAT DOES IT MEAN FOR YOUR SCHOOL/COMMUNITY TO BE CLIMATE RESILIENT?

A climate-resilient community has representative bodies or structures to assist in climate action. Works together to support each other and collectively respond to the damaging effects of climate change. Has common climate values and ways of working to address its impacts. For example, a community that shares responsibilities, or has different skills and resources that are shared.

## 1.8.4 What is climate adaptation?

Climate adaptation deals with reducing the impacts of climate change and enhancing the resilience of humans and socio-ecological systems. Community-based adaptation is a set of climate change adaptation activities developed in partnership with at-risk schools/communities to promote local awareness of, and appropriate and sustainable solutions to, current and future climatic conditions.*[2]* Community-Based Adaptation (CBA) interventions aim to improve the capacity of local communities and individuals to adapt to climate change. This approach emphasizes building the adaptive capacity of the poorest and most marginalized people.

## 1.8.5 Adaptation education for climate action

### CAN OUR LOCAL SCHOOLS PLAY A ROLE IN CLIMATE ADAPTATION?

Educational institutions can play an instrumental role in local-level climate adaptation and resilience building. Schools create spaces for peer learning, innovative ideas, and community awareness, and implement practical solutions. Sharing knowledge, best practices and concrete experiences on how to engage younger generations in climate adaptation is fundamental to scale-up action.

Drastic climate change, for example, heavy rainfall, and drought leading to famine inhibits children's ability to attend school and the ability of families to sustainably provide food for their communities. These livelihood losses ultimately contribute to school dropouts. To cope with economic losses, young people either join the Labor force with their parents or support domestic activities so that parents can pursue paid work. Economic deprivation, malnutrition, hunger, and health issues posed by climate change also affect children's education globally.*[3]*

*[2] Global Centre on Adaptation- Youth leadership for climate Action-module 2.*
*[3] Global Centre on Adaptation Report 2021.*


MODULE TWO

# The Green Eco-Lab Project for Climate Adaptation Education & Practices

The Green Eco lab project is a 5-month pilot project that will be implemented in rural schools/communities. The project will establish a unique Green Eco-Lab that will suffice as a unique 'learning and demonstration center for climate knowledge sharing and skills building so that students can become climate resilient, and therefore help their families adapt to an uncertain climate and related disasters.

**Adaptation education through the Eco-Lab project will:**

- Establish an Eco-Lab as an adaptive infrastructure where the entire school community can learn, practice, and come up with innovative solutions to address climate change.
- The project will empower youth with general education that builds adaptive capacity by reducing inequalities and adaptation learning support to create climate change Ambassadors.

Through the Green Eco-Lab project, increased awareness and inclusion of climate change education in school curricula will also support the enhanced engagement of children and young people in climate resilience building within their communities, to drive adaptation action as climate change Ambassadors.

## 2.0 The Green Eco-Lab Project

The Green Eco-Lab project seeks to strengthen climate change adaptation practices in underserved communities and schools in Uganda by building the capacity of young people (both male and female) to come up with practical solutions to support climate adaptation at the grassroots level in their communities. Additionally, through the establishment of a Green Eco-Lab as an in-school training and experimentation hub, young people in school will be able to increase awareness of climate change and the need for climate adaptation through evidence-based solutions realized through conducting experiments around air quality, weather variability, soil, biodiversity, and water resources.

The Green Eco-Lab project directly addresses the challenge of climate variability which poses serious threats to Uganda's key development sectors as highlighted in the Nationally Determined Contribution (NDC). Some of these sectors include agriculture, water resources, fisheries, tourism, and health, which are dependent and sensitive to climate variability and change. In Uganda, the effects of climate change have turned the seasons around with the country experiencing unpredictable shorter or longer rains and harsher droughts in many parts of the country. Young Ugandans – who constitute 78% of the population – are among the most affected victims with worsening droughts and flooding exacerbating pre-existing socioeconomic challenges such as youth underemployment, food insecurity, and inadequate social protection.

The Green Eco-Lab project is also heavily anchored on addressing climate change impacts such as food insecurity and malnutrition among school-going students. In most cases, school-going students in underserved communities are required to take food (beans/maize) to their schools at the start of the school term to support the school administration with food to last an entire school year. Local households (more than 1.5 million) in Uganda depend majorly on agriculture as a means of livelihood through which they meet their food, health, and education costs for their school-going students. In case of disaster and extreme weather events, schools have served as shelters where communities converge and access support. Young people, schools, and practical local innovations are therefore game changers in any efforts in Uganda geared toward coping with the effects of climate change and its impact.

## WHAT IS THE GREEN ECO-LAB?

The Green Eco-Lab will serve as a learning center on innovative climate change adaptation practices, agricultural practices, and demonstrations of evidence-based solutions to climate change. The lab is an adaptative infrastructure"/ an in-school training and experiment hub where young people (boys and girls) will undertake training and practical experiments around air quality, weather variability, soil, biodiversity, and water resources.

## TABLE 1 BELOW SUMMARISES SOME OF THE ACTIVITIES AND FOCUS AREAS OF THE ECO-LAB

| Laboratory Component | Description/ Experiment parameters | Related Climate Change Effects Focus | Climate Change Adaptation and Solutions for Incubation | Uganda's Broader Adaptation Sector |
|---|---|---|---|---|
| Air Quality | Matter sensors to measure air quality | Air pollution, green gas emissions | Ecosystem restoration, cycling, alternative transport systems, waste management | Forestry and land use |
| Weather Variability | Temperature, humidity, rain, heat island, rain PH | Extreme weather events | Climate resilient infrastructure, green spaces, early warning systems | Forestry and land use |
| Local Biodiversity | Indigenous crops, insects/ pests, butterflies, birds, and mammals | Loss of biodiversity and extinctions, crop productivity | Ecosystem restoration, early warning systems, vertical farming, organic farming | Agriculture |
| Water Resources and Quality | Salinity, biological properties, chemical components, water sources, filtration | Water pollution and flooding | Water reuse systems, rainwater harvesting systems, flood control, water purification and filtration, waste management | Water and sanitation |
| Soil Quality | Salinity, biological properties, chemical components, water retention, fertility, types, organic carbon | Soil erosion, soil degradation, soil fertility | Ecosystem restoration, tree planting, long-term planning, waste management | Agriculture |

## HOW WILL THE GREEN ECO-LAB PROMOTE CLIMATE CHANGE ADAPTATION EDUCATION IN THE SCHOOL AND COMMUNITY?

- The Green Eco-Lab will improve the uptake and sustainability of the adaptation process and develop a strong sense of ownership within a community. This will be realized through action days where young people in schools alongside their community will showcase their innovative practices to help build climate adaptation.
- The Green Eco-Lab will enhance communities' awareness and understanding of climate change and uncertainty to create responsive plans and facilitate more flexible and context-appropriate decisions regarding climate-related issues and challenges.
- The Green Eco-Lab will provide new knowledge and understanding of climate adaptation practices to existing community agricultural structures and farmer groups.

The pilot phase for the Green Eco-Lab project will run for 5 months. During this phase, the project will be centered on 3 main adaptation sectors that align with Uganda's Nationally Determined Contribution.

The Eco-Lab activities will focus on:

- The Agricultural Sector
- Water and Sanitation
- Energy


MODULE THREE

# Climate Adaption through the Agricultural Sector

Agriculture is an important part of Uganda's economy and over 71.8% of the land area is under cultivation. Subsistence farming covers the largest portion as compared to commercial cultivation.*[4]* The country's agricultural productivity trends show a mixed picture, with increasing maize, rice, millet, simsim, cassava, and sweet potato yields and decreasing cotton, coffee, and banana yields, as well as increasing cattle, sheep, goats, and poultry numbers and products, and a gradual decline in fish stocks (Situation Analysis Study for Agriculture Sector 2020). Generally, agricultural productivity is declining due to increasing soil degradation. Additionally, the majority of African youth live in rural areas and engage in agriculture.*[5]* The agricultural sector will be particularly hit by climate change, and yet it is the leading sector for synergies across development and climate action, delivering simultaneously on Sustainable Development Goals, national growth and food security goals, and climate adaptation and mitigation. National economies, however, do not appear to be well-equipped to rise to the challenge, a situation that could result in devastating consequences for the continent's youth. Local adaptation efforts and youth-led as well as community-based actions are crucial in complementing national initiatives to build the resilience of the enormous population at risk.

## 3.0 Training in Climate Smart Agriculture (CSA) for students and community members

Climate-smart agriculture (CSA) embodies a blend of innovations, practices, systems, and investment programs that are used to mitigate against the adverse effects of climate change and variability on agriculture for sustained food. Food crop production under various climate change scenarios requires the use of improved technologies that are called climate-smart agriculture to ensure increased productivity under adverse conditions of increased global temperatures, frequent and more intense storms, floods, and drought stresses. The training in Climate Smart Agriculture (CSA) will demonstrate practical innovative community organic gardening, researching organic farming effectiveness in terms of yields and viability, and equipping students and community farmers with transformational skills from traditional farming methods to contemporary organic farming techniques.

**RATIONALE:**
Climate Change has the potential to threaten food production and food security, especially in vulnerable regions. One major area where the impact of climate change is expected to be very significant in threatening the very existence of humanity is the estimated effect of climate change on agriculture. Agriculture is the major source of income and livelihood for an estimated 70% of the poor and vulnerable people who live in rural areas with limited resources often times without access to basic technologies.*[6]*

*[4] FAO, 2016.*
*[5] The State and Trends in Adaptation Report 2021.*
*[6] World Bank Report, 2016.*

**MATERIALS NEEDED:**

Seeds of different types of plants suitable for the target beneficiary's climate, such as beans, and maize, organic fertilizers, such as compost, manure, or green manure; organic pesticides, such as neem oil, garlic spray, or chilli pepper spray; gardening tools, such as spades, hoes, rakes, watering cans, etc.; vertical farming structures, such as wooden frames, plastic bottles, or PVC pipes.

**ACTIVITY PROCEDURE:**

- Choose a suitable site for the garden, preferably with good sunlight, water access, and soil quality.
- Prepare the soil by removing weeds, rocks, and other debris. Add organic fertilizers to enrich the soil and improve its structure.
- Plant the seeds according to the instructions on the package or the guidance of an expert. Make sure to space them properly and water them regularly.
- Monitor the growth of the plants and check for any signs of pests or diseases. Apply organic pesticides as needed to control the infestation and prevent further damage.
- Harvest the crops when they are ripe and ready. Enjoy the fresh and healthy produce or sell them at a local market.
- For vertical farming, use vertical farming structures to create layers of planting space on a wall or a fence. Fill the containers with soil and plant the seeds of crops that can grow vertically, such as lettuce, spinach, kale, tomatoes, etc.
- Follow the same steps as above for watering, pest control, and harvesting.

**EVALUATION:**

- Compare the yields and quality of the organic crops with those of conventional crops grown with chemical fertilizers and pesticides.
- Survey the students and farmers who participated in the activity to assess their knowledge, attitude, and practice of organic farming.
- Measure the environmental impact of organic farming by calculating the carbon footprint, water footprint, and soil health indicators.

## 3.1 Adaptation through locally grown food and community meal events

In many local communities in Uganda, there is a lack of awareness, skills, and readiness to adopt alternative crops such as vegetables which may provide additional income while helping to reduce the burden on the forests. As a way of preparing students to be climate adaptation ambassadors and change makers who learn about climate impacts, as well as the importance and skills needed for vegetable farming, the school conducts a vegetable farming competition among different classes. Every class is given a patch of land to cultivate vegetables. Students receive a variety of vegetable seeds and compost from their parents, and the school is also planning to make its compost.

Towards the end of the growing season, the students will harvest their produce, sell it, or cook a community meal. Teachers guide students throughout the process, and the school has allocated time to work in the garden as part of their curriculum.

During this time, children are responsible for taking care of their plots through watering, fertilizing with manure, etc. During the school year, the students and teachers as well as the community members are involved in this project. The project helps the children, their families, and the whole community to better understand how climate change is impacting their lives and helps them to develop greater resilience through locally grown food which may help in meeting their needs for a balanced diet while reducing damage to the forest.

## 3.2 Seedling and tree planting (ecosystem restoration)

This activity will focus on supporting students to understand the concept and benefits of ecosystem restoration as a nature-based solution for climate change mitigation and adaptation.

**MATERIALS NEEDED:**
Seeds, water, soil, nursery bed, shovel, or trowel.

**ACTIVITY PROCEDURE:**

- Introduce the topic of trees and their benefits to the environment and humans. explain how trees provide oxygen, food, habitat, shade, beauty, and other services. You can also ask the students to share their favorite trees and why they like them.
- Explain the process of germination and how seeds grow into plants. Describe the parts of a seed, the conditions needed for germination, and the stages of seedling development. You can also show some examples of seeds from different fruits or nuts and ask the students to identify them.
- Have the students collect seeds from fruits or nuts that they eat at home or in school. You can also provide some seeds for them to choose from. Ask the students to wash and dry the seeds and label them with their names and the type of fruit or nut they came from.
- Have the students soak the seeds in water for a day or two, depending on the type of seed. explain why soaking helps speed up germination and what factors affect the soaking time. You can also have the students measure and record the weight and size of the seeds before and after soaking.
- Have the students plant the soaked seeds in pots with soil. explain how to prepare the soil, how deep to plant the seeds, how much water to give them, and where to place them for optimal growth. You can also have the students make predictions about how long it will take for their seeds to sprout and what they will look like.

- Have the students observe and record the growth of their seedlings over several weeks. explain how to measure and record the height, number of leaves, color, and shape of the seedlings. You can also have the students compare and contrast their seedlings with those of their classmates and discuss what factors might cause differences in growth.
- Have the students transplant their seedlings into a suitable location when they are ready explain how to select a location that matches the environmental needs of the tree species, how to dig a hole and place the seedling in it, how to fill in the hole and tamp down the soil, how to water and mulch the seedling, and how to stake and protect it from animals and weather. You can also have the students name their trees and make signs or tags for them.
- Have the students reflect on their learning experience and share their feelings about planting a tree. explain how planting a tree helps improve biodiversity, ecosystem services, climate change mitigation, community pride, and personal health. You can also have the students write or draw about their tree-planting experience or make a presentation to other classes or groups.

MODULE FOUR

# Climate Adaption through Water and Sanitation

Uganda has a large water resource, both surface, and groundwater. However, national access to safe water stood at 67% in 2020, with access in rural areas at 68% and urban areas at 70.5%. About 43% of households have only limited or no access to safe drinking water (Figure 2-6). In rural areas, this is over 51%. Due to seasonal and inter-annual variability in rainfall, and limited storage capacity, particularly in rural areas the availability of water for productive purposes is also limited and uncertain.

For sanitation, only 20% of the population has access to basic sanitation services and 45% of the population has no hand washing facilities at home which presents a significant health risk.

## 4.0 Water reuse and rainwater harvesting

This activity will primarily be focused on designing and implementing a water harvesting and purification system for the school and the community, as well as conducting experiments on different methods of water purification using natural materials.

**MATERIALS NEEDED:**
Rainwater (or tap water), dirty water (made by adding soil or food coloring to tap water), two large plastic bottles with caps, sand (washed), gravel (washed), activated charcoal (crushed), cotton balls or fabric (washed), scissors or knife, funnel, measuring cup, clear glass or plastic cups, thermometer, pH paper or meter, turbidity meter or tube, coliform bacteria test kit.

**ACTIVITY PROCEDURE:**

- For the water harvesting system, choose a suitable location for the rainwater collection tank, preferably near the roof of the school building. Install a gutter along the edge of the roof and connect it to a down spout that leads to the tank. Make sure the tank is clean and has a lid to prevent contamination. You can also add a first flush diverter to divert the first flow of rainwater that may contain dust and debris.
- For the water purification system, cut one of the plastic bottles in half and invert the top half into the bottom half. This will be your filter container. Use a funnel to fill the top half with layers of sand, gravel, charcoal, and cotton in this order. Make sure each layer is about 2-3 cm thick and covers the entire surface of the bottle. Leave some space at the top for pouring water.
- Pour some rainwater (or tap water) into a measuring cup and record its volume, temperature, pH, turbidity, and coliform bacteria count using the appropriate instruments or kits. These are your initial water quality parameters.
- Pour the water slowly into the filter container and collect the filtered water in a clear glass or plastic cup. Record its volume, temperature, pH, turbidity, and coliform bacteria count using the same instruments or kits. These are your final water quality parameters.

- Compare the initial and final water quality parameters and calculate the percentage change. A higher percentage change indicates a more effective filter.
- Repeat steps 3-5 with different combinations of filter materials, such as sand only, sand and gravel, sand, and charcoal, etc. Compare the results and determine which combination is the most effective in purifying water.

**EVALUATION:**

- Evaluate the performance of the water harvesting and purification system by measuring its capacity, efficiency, reliability, cost-effectiveness, and environmental impact.
- Evaluate the effectiveness of different methods of water purification using natural materials by comparing their results with those of conventional methods such as boiling or chlorination.
- Evaluate the benefits and challenges of implementing water reuse systems/ rainwater harvesting systems for schools and communities in Uganda.
- Discuss how water reuse systems/rainwater harvesting systems can contribute to ecosystem restoration by reducing water scarcity, pollution, and wastage.
- Explore ways to improve and sustain your water reuse systems/rainwater harvesting systems in Uganda.

## 4.1 Modern irrigation systems

In this activity, the focus is to create a mini-irrigation project to provide water to improve crop harvests in the demonstration farm in case the school and community have a problem with dry weather conditions despite it being near a water system or not.

**MATERIALS NEEDED:**

A water source, such as a well, or rainwater tank; irrigation pipes, such as PVC pipes or drip lines; irrigation fittings, such as valves, connectors, and sprinklers; tools, such as a shovel, a wrench, and tape measure.

**ACTIVITY PROCEDURE:**

- Discuss how irrigation projects can contribute to ecosystem restoration by enhancing soil health, biodiversity, carbon sequestration, and water conservation.
- Choose a suitable site for the demonstration farm, preferably with good soil quality, sunlight exposure, and crop selection. Prepare the land by clearing weeds, rocks, and other debris. Add organic fertilizers to enrich the soil and improve its structure.
- Choose a suitable water source for the irrigation project, preferably with adequate water quantity and quality.
- Select an irrigation system for the demonstration farm based on the crops, soil, and climate. Options include surface (furrow or basin), sprinkler (overhead or center pivot), or drip (micro-sprinklers or emitters). Ensure the system provides the correct water amount at the right time and place.

- Install the irrigation pipes and fittings according to the irrigation system design. Connect the pipes to the water source using valves and connectors. Attach sprinklers or drip emitters to the pipes using connectors and clamps. Make sure the pipes and fittings are leak-proof and durable.
- Test the irrigation system by opening the valves. Check for any leaks or blockages in the pipes and fittings. Adjust the pressure and flow rate of the water according to the crop needs and soil conditions. Monitor the soil moisture and crop growth using indicators such as color charts.
- Maintain the irrigation system by cleaning the pipes and fittings regularly to prevent clogging and corrosion. Replace any damaged or worn-out parts as needed. Monitor the water level and quality of the water source and adjust accordingly.

**EVALUATION:**

- Evaluate the performance of the irrigation project by measuring its efficiency, effectiveness, reliability, cost-effectiveness, and environmental impact.
- Evaluate the impact of the irrigation project on crop production, income generation, food security, and livelihood improvement for the school and community.
- Evaluate the challenges and opportunities of implementing irrigation projects for smallholder farmers in Uganda.
- Explore ways to improve and sustain your irrigation project in the community.

## 4.2 Solid waste management

### ORGANIC SOLID WASTE MANAGEMENT

Organic waste comes from something that was once living, either plant or animal. It is biodegradable and will decompose naturally on its own. Organic waste serves an important role in the environment. Organic waste fuels microbes and minerals in the dirt, allowing new plants to grow and new dirt to be formed. Organic solid waste management can support the production of organic fertilizers for the school/community gardens thereby minimizing pollution from non-biodegradable artificial fertilizers.

### INORGANIC SOLID WASTE MANAGEMENT

Inorganic waste comes from unnatural products, such as plastic and other non-organic materials. It does not decompose readily and can be harmful to the environment in the decomposition process. Recycling programs exist as an effort to safely dispose of many inorganic products. Inorganic waste is non-biodegradable and can exist within the ecosystem for very long. Burning of plastics and other non-biodegradable compounds emits greenhouse gases such as that ultimately contribute to global warming.

1. Re-use of Plastics for urban farming practices.
2. Re-use plastics to make products such as beads, curtains, waste bins, etc.

MODULE FIVE

# Climate Adaption through the Energy Sector

The majority of the greenhouse gases that blanket the Earth and trap the sun's heat are generated through energy production, by burning fossil fuels to generate electricity and heat.

Fossil fuels, such as coal, oil, and gas, are by far the largest contributor to global climate change, accounting for over 75 percent of global greenhouse gas emissions and nearly 90 percent of all carbon dioxide emissions. To avoid the worst impacts of climate change, emissions need to be reduced by almost half by 2030 and reach net zero by 2050. Alternative sources of energy such as solar energy and the use of biogas can be effective ways through which communities preserve the environment, reduce deforestation, and minimize pollution through burning fossil fuels.

## 5.0 Manufacturing of biogas

In this activity, the focus is to make biogas by fermenting organic waste and collecting the gas produced.

**MATERIALS NEEDED:**
Organic waste, such as food scraps or animal manure; water; large plastic bottle with cap; pipes, such as a straw or a rubber tube; balloon; tape, Light bulb, electric wires, Gas cooking Plate.

**ACTIVITY PROCEDURE:**

- Discuss how biogas making can contribute to waste management and ecosystem restoration by reducing landfill waste, energy consumption, and air pollution.
- Collect organic waste from your school, home, or community. You can use any biodegradable material, such as fruit peels, vegetable scraps, eggshells, coffee grounds, tea bags, etc. Avoid using meat, bones, dairy products, or oily foods as they may cause bad odor or slow down the fermentation process.
- Cut or shred the organic waste into small pieces using scissors or a knife. The smaller the pieces, the faster they will decompose. Be careful not to cut yourself and wear gloves if possible.
- Fill the plastic bottle about half-way with water. Add the organic waste to the bottle until it is almost full. Leave some space at the top for the gas to expand. Screw the cap tightly on the bottle.
- Make a small hole in the cap using a nail. Insert one end of the pipe into the hole and seal it with tape. Make sure the pipe is long enough to reach outside the bottle. Attach the balloon to the other end of the pipe and secure it with tape.
- Place the bottle in a warm and dark place, such as a closet or a cabinet. The ideal temperature for biogas production is between 25°C and 35°C. Avoid exposing the bottle to direct sunlight or cold air as they may inhibit the fermentation process.

- Wait for about two weeks for the biogas to form. You will notice bubbles rising in the bottle and the balloon inflating as the gas fills it up. The biogas is mainly composed of methane and carbon dioxide, which are flammable and odorless gases.
- When the balloon is fully inflated, carefully remove it from the pipe and tie a knot to prevent the gas from escaping. You can use the biogas as a fuel for cooking, heating, or lighting. Be careful not to puncture or ignite the balloon near any open flame or spark.

## 5.1 Making energy saving cooking stoves

The goal of this activity is to make energy-saving cooking stoves that use less charcoal or firewood and produce less smoke and emissions.

**MATERIALS NEEDED:**
Metal drum or bucket, metal sheet, metal rods, metal mesh, metal cutter, metal drill, metal rivets, metal hammer, charcoal, or firewood.

**ACTIVITY PROCEDURE:**
- Cut the metal drum or bucket into two parts: a lower part that will be the base of the stove and an upper part that will be the lid of the stove. You can use a metal cutter or a hacksaw to do this. Make sure the lower part is deeper than the upper part.
- Cut a circular hole in the center of the lid that is slightly smaller than the diameter of your cooking pot. This will be the opening where you will place your pot on the stove. You can use a metal drill or a punch to make the hole.
- Cut a rectangular hole in the side of the base that is about 10 cm wide and 15 cm high. This will be the opening where you will insert your fuel into the stove. You can use a metal cutter or a chisel to make the hole. Cut four metal rods that are about 20 cm long and bend them into L-shapes. These will be the legs of the stove that will support it above the ground. You can use a metal hammer or a vise to bend the rods.
- Attach the legs to the bottom of the base using metal rivets or screws. Make sure they are evenly spaced and aligned with the edges of the base. You can use a metal drill or a punch to make holes for the rivets or screws.
- Cut a circular metal sheet that is slightly larger than the hole in the lid. This will be the heat diffuser that will distribute the heat evenly to your pot. You can use a metal cutter or scissors to cut the sheet.
- Cut four small holes near the edge of the heat diffuser and insert four short metal rods through them. These will be the handles that will help you lift and lower the heat diffuser on the stove. You can use a metal drill or a punch to make the holes and bend the rods into U-shapes.

- Cut a square metal mesh that is slightly smaller than the diameter of the base. This will be the grate that will hold your fuel above the ash and allow air to flow through it. You can use a metal cutter or scissors to cut the mesh.
- Place the grate inside the base and align it with the fuel opening. You can use metal rivets or screws to secure it to the base if needed.
- Place some charcoal or firewood on top of the grate and light it with a match or a lighter. Wait for it to burn until it forms glowing embers.
- Place the heat diffuser on top of the lid and align it with the hole in the lid. You can use metal rivets or screws to secure it to the lid if needed. Place your cooking pot on top of the heat diffuser and cover it with a lid if possible. Adjust the amount of fuel and air by opening or closing the fuel opening with a metal sheet or a brick.

**EVALUATION:**

- Conduct a simple experiment and compare it with a traditional stove.
- You can measure how much fuel, time, and money you use to cook the same amount of food on both stoves. You can also measure how much smoke, emissions, and heat they produce. By doing this, you can see how your energy-saving cooking stove can help you save resources, reduce costs, and improve your health.
- You can also see how your energy-saving cooking stove can contribute to ecosystem restoration by reducing deforestation, greenhouse gas emissions, and indoor air pollution.


# 6.0 Conclusion

## HAVE YOU LEARNED SOMETHING NEW?

This toolkit identifies a range of adaptation efforts through the Green Eco-Lab Project in schools with community engagement. The activities highlighted in this toolkit focus on adaptation and resilience and highlight that young people are leading the way towards climate adaptation action and are instrumental in reducing the impacts of climate change. In addition, adaptation education highlighted in this toolkit is contextualized to address local climate change impacts that learners can easily connect with to build the knowledge and skills needed to create a climate change ambassador.

# Annex:
# Facilitators' Session Flow Plan/Guide

TABLE 1: ECO-LAB TOOLKIT MODULE GUIDE

| Module | No. of Session(s) | No. of Hours | No. of Students |
|---|---|---|---|
| Foundational principles of climate change | 2 | 8 | **30** |
| The Green Eco-Lab | 1 | 4 | |
| Adaptation through the agricultural sector | 3 | 10 | |
| Adaptation through Water and Sanitation | 2 | 10 | |
| Adaptation through the energy sector | 2 | 8 | |
| **Total** | **10 sessions** | **40 hours** | |

# Annex:
# Facilitators' Session Flow Plan/Guide

## TABLE 2: MODULE/SESSION FLOW PLAN

| Module | Topics/Areas of Discussion | Method of Delivery | Connection (context with the local environment) | Session Deliverables |
|---|---|---|---|---|
| Understanding Climate Change | **Definitions:** Climate action, Climate vulnerability, Impacts of climate change, Climate resilience, and Uganda's climate change context | 1. Information sharing sessions on climate change impacts<br>2. Climate change stories through group discussions<br>3. Videos on climate change and its impacts<br>4. Case studies and references to scenarios on climate action<br>5. Games (Climate fresk) | Refer to the local climate change patterns and their impacts<br><br>**a. Linkage to quality of life**<br>• Drought & Food security<br>• Floods & access to basic social services (1) Education, 2) Health and SRHR)<br><br>**b. Linkage to Development livelihoods/ income sources**<br>• Livelihoods (destruction of farms and animals)<br>• Transport & Jobs<br>• Housing | • Pooling personal experiences of climate change<br>• Exploring the social impacts of climate change<br>• Understanding the basic science of climate change<br>• Past changes and future scenarios (exploring uncertainty) |
| Climate Change Risks and Climate Adaptation | Adaptation Education | 1. Practical activities and demonstrations<br>2. Case studies at local, national, regional, and global levels | 1. Sustainable water retention practices such as modern irrigation and water harvesting<br>2. Water Sanitation and Hygiene Practices including menstrual health management outcomes<br>3. Agricultural practices such as growing drought-resistant species, vegetables, Smart Agriculture, and Soil testing<br>4. Waste management practices - reusing of polythene and plastics in the environment | • Understanding adaptation and mitigation<br>• Linking climate change adaptation and disaster risk reduction<br>• Establishment of modern irrigation or water harvesting technologies in the school<br>• Collective group projects on gardening and soil testing<br>• Individual projects on the reuse of plastics in the environment. Linking these practices to soil conservation and Smart Agriculture |


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