

The Environment and Green Economy

About the WAGES Project:

The West Africa Governance and Economic Sustainability in Extractive Areas (WAGES) Project is a five-year project implemented by a consortium of the World University Service of Canada (WUSC) and the Centre for International Studies in Cooperation (CECI).

WAGES operates in mining areas in three countries; Guinea, Ghana and Burkina Faso. In Ghana, the project is being implemented in the Prestea-Huni Valley and the Wassa East Districts of the Western Region. The Project's key components are local governance and sustainable and inclusive economic growth, and regional knowledge-sharing on best development practices in mining areas.

The project will identify and focus on the development of key economic subsectors (palm oil, rice, and cassava) within the two districts through an inclusive market systems approach. The ultimate goal of the WAGES project is to 'Enhance socio-economic benefits from extractives industries for communities, especially women and youth, living in West Africa'.

Booklets in this Series:

The Environment and Green Economy

Environmental Risks and Opportunities in the Cassava Subsector

Environmental Risks and Opportunities in the Palm Oil Subsector

Environmental Risks and Opportunities in the Rice Subsector

Theme: Strengthening Capacity of Citizens and Local Authorities on Green Economy and Environmental Sustainability



Global Affairs
Canada

Affaires mondiales
Canada

The Environment and Green Economy

Theme: Strengthening Capacity of Citizens
and Local Authorities on Green Economy
and Environmental Sustainability

Written and Designed by: Chang, S. A.,
WAGES Green Economy Advisor
(2017-2018)

World University Services of Canada © 2018

This booklet may be reproduced in part or in full, and distributed or otherwise transmitted in any form or by any means with the expressed permission from the World University Services of Canada (WUSC), Ghana and of the West African Governance and Economic Sustainability in Extractive Areas (WAGES) Project. This booklet is written in the hopes that it will serve as a useful tool for development and encouraging sustainability in Ghana and elsewhere.

Printed in
Accra, Ghana

Printed in Accra
May, 2018

Cover Image:

*Untouched pool in Ankasa – Ghana.
Francesco Veronesi, December 2014.*

Emelia Ayipio Asamoah
WAGES Country Coordinator

Steven Chang
WAGES Green Economy Advisor
Steve.chg3@gmail.com

World University Services of Canada (WUSC)
124 Haatso-Atomic Rd, Haatso
Accra, Ghana
+233 30 251 1029

Forward from the Author

Hello and thank you for taking the time to read this booklet. This booklet was prepared by myself, Steven Chang, the Green Economy Advisor for WAGES as part of a series of booklets on the environmental, economic, and development issues selected sub-sectors.

For myself, it has been an incredible experience and opportunity to see firsthand the unique challenges facing entrepreneurs and business owners in the project area. In response, I set out to record the basics of Green economy and environmental sustainability in the sectors WAGES works most closely with. These booklets are intended to serve as a platform for Training Service Providers and other WAGES partners to sensitize and educate beneficiaries on the basics of Green Economy and environmental sustainability.

It is my sincerest hope that these booklets can serve as a useful guide for both WAGES staff and partners, and the hard-working men and women of the Prestea-Huni Valley and Wassa East Districts on various environmental topics relevant to their communities. If even a single person discovers a clever way to green their home, business, and community, then this work will not have been in vain.

Thank you!

Steven Chang
WAGES Green Economy Advisor
World University Services of Canada

Executive Summary

West African Governance and Economic Sustainability in Extractive Areas Project is run by a joint consortium of the World University Services of Canada (WUSC/EUMC) and the Centre for International Studies in Cooperation (CECI) in Ghana, Guinea, and Burkina Faso. In Ghana, the WAGES project works closely with local partners and stakeholders to deliver sustainable local economic development to mining-impacted communities.

Towards sustainable local economic, this booklet written as part of a series of booklets about the environment, Green economy, and sustainability. (1) *The Environment and Green Economy* is to inform and provide information on topics related to the environment and the Green Economy.

This booklet is divided into Four (4) sections:

Section 1 The Environment:

- Environmental Cycles, the Water, Nutrient and Carbon Cycles.
- Environmental Footprint

Section 2 Environmental Risks:

- Climate Change, Land Use Change and, Waste and Pollution.

Section 3 Green Economy:

- The Environment, Society and The Economy;
- The Green Economy;
- Supporting a Green Economy

Section 4 Additional Information

This booklet is intended to serve as a starting point for Training Service Providers (TSPs) to understand the complex environmental systems that underlay agriculture, development, and humans' interaction with the environment. *The Environment and Green Economy* and serves as the basis for improving environmental awareness and sustainability in the Palm Oil, Rice, and Cassava subsectors. The information contained within this booklet will help improve the understanding and larger systems at work in agriculture and agro-business.

It may be advisable to begin training beneficiaries with Section 3: The Green Economy, then use the information in the remaining sections to answer questions, provide fuller explanations of the environment, and generally sensitize WAGES beneficiaries towards sustainability.

Acronyms and Abbreviations

BOD	Biological Oxygen Demand
Ca	Calcium
CECI	Centre for International Studies in Cooperation
CFC	Chlorofluorohydrocarbons
CH4	Methane
CO2	Carbon Dioxide
COD	Chemical Oxygen Demand
Cu	Copper
DO	Dissolved Oxygen
GHG	Greenhouse Gas
H2O	Water
K	Potassium
Ma	Manganese
Mg	Magnesium
MOFA	Ministry of Food and Agriculture
MSW	Municipal Solid waste
N	Nitrogen
N2O	Nitrous Oxides
O2	Oxygen
P	Phosphorus
PAH	Polynuclear Aromatic Hydrocarbons
PPE	Personal Protective Equipment
S	Sulphur
TSS	Total Suspended Solids
UN	United Nations
UNEP	United Nations Environmental Programme
VOC	Volatile Organic Carbon
WAGES	West African Governance and Economic Sustainability in Extractive Areas
WUSC	World University Services of Canada

Table of Contents	Pg.	List of Figures	Pg.
Forward from the Author	ii	Figure 1) Water, Carbon, and Nutrients cycle through different environmental compartments.	2
Executive Summary	iii	Figure 2) The water cycle.	4
Acronyms and Abbreviations	iv	Figure 3) Illustration of the limiting nutrient problem.	5
Table of Content	v	Figure 4) The Nutrient Cycle.	6
List of Figures	vi	Figure 5) Diagram of Sinks and Sources of Carbon.	8
Glossary	vii	Figure 6) The Carbon Cycle.	10
Section 1: The Environment	1	Figure 7) Imbalanced Carbon Cycle, caused by human impacts.	11
Environmental Cycles	2	Figure 8) Basic Diagram of the Greenhouse Effect and Climate Change.	15
The Water Cycle	3	Figure 9) Molecular structures of common Greenhouse Gases	17
The Nutrient Cycle	5	Figure 10) Diagram of Land Use Change of Forests and Wetlands into new land uses.	19
The Carbon Cycle	7	Figure 11) Agro-chemicals and fertilizers can runoff into local waterways, causing eutrophication.	24
Environmental Footprint	12	Figure 12) Comparison of Waste and Pollution.	25
Section 2: Environmental Risks	13	Figure 13) Solid and Liquid Waste Examples	26
Climate Change	13	Figure 14) Organic and Inorganic waste examples.	26
Land Use Change	19	Figure 15) Solid organic, liquid organic, solid inorganic and liquid inorganic waste examples.	27
Waste Products and Pollution	25	Figure 16) Diagram showing three main components to understanding pollution risks.	28
Chemical Pollution	32	Figure 17) Point versus Non-point Pollution	29
Section 3: Green Economy	37	Figure 18) Diagram of Point and Non-point pollution sources.	30
The Environment, Society and Green Economy	37	Figure 19) Basic diagram of runoff occurring after application of agro-chemicals.	33
The Green Economy	47	Figure 20) Basic Diagram of a pollutant bio accumulating in an aquatic food web	34
Supporting a Green Economy	54	Figure 21) The economy is the total of all the goods and services the business in the community	38
Section 4: Additional Resources	59	Figure 22) The economy exists within and as part of a Society. Societies include many aspects of governance, culture, technology, and markets.	40
		Figure 23) The Economy, Society and the Environment are within and a part of the Environment	41

Figure 24) The Environment provides Natural Resources that the Economy and Society use to produce into goods and services for consumption.	42	Compartment	A compartment is a division of the environment, such as water, air, rocks and minerals (Hydrosphere, atmosphere, lithosphere)	1
Figure 25) Environmental outcomes are the impacts that a Society and Economy has on the Environment	45	Condensation	The process of water vapor collecting into clouds in the atmosphere.	3
Figure 26) The three outcomes of The Green Economy.	48	Deforestation	The total or near-total removal of trees from a given area, leading to substantial environmental degradation.	22
Figure 27) Building social equality, improving human well-being, and reducing environmental risks, are all part of a Green Economy.	49	Economy	Encompasses all production of goods and services, and the flow of money.	38
Figure 28) Green Economies need the support of Businesses, local governments, and communities and individuals to grow and be successful.	55	Environment	Encompasses all of Society and the Economy, provides natural resources and is affected by environmental outcomes.	1, 41

Glossary

	Pg.			
Anthrosphere	1	Environmental Outcomes	The impact on the Environment from the Economy and Society producing goods and services for consumption.	44
An environmental compartment that accounts for human settlements like villages, towns, communities and cities, with all the infrastructure and buildings included.		Environmental Footprint	The cumulative impact of an individual or business on the environment, is smaller or bigger depending on the choices and practices of the individual or business	12
Atmosphere	1	Eutrophication	The process by which excess chemical fertilizers cause damage to natural aquatic and wetland ecosystems	24
An environmental compartment that accounts for air, weather, clouds, and the sky.		Evaporation	The process by which heat and energy from the sun evaporates water into the Atmosphere.	3
Beneficial Ecosystem Services	19	Evapo-transpiration	The process by which forests and plants emit water vapor into the Atmosphere.	3
Services provided to society and economy provided by the environment, like water attenuation and animal habitat.		Greenhouse Gas	Specific types of gases that absorb heat and light in the atmosphere. The largest and most important are Carbon Dioxide, Methane, Nitrous Oxides, and Chlorofluorohydrocarbons.	16
Bioaccumulation	33	Groundwater	Water that is stored deep underground and takes many years to move across a landscape. Groundwater feeds boreholes and wells.	4
The environmental process by which pollutants and toxins increase in concentration through aquatic food chains		Hydrosphere	An environmental Compartment that accounts for all the water in lakes, rivers, oceans, and groundwater.	1
Biosphere	1	Inorganic	Being manufactured or processed in such a way that the material wont decompose, or material that is not made from organic matter.	26
An environmental compartment that accounts for all microorganisms, plants, animals, and humans.				
Carbon Cycle	7			
Describes how carbon moves through different environmental compartments and changes into different forms.				
Carbon Dioxide	7, 16			
A Greenhouse gas and plays a very important role in Climate Change.				
Chlorofluorohydrocarbons	17			
Potent, but well-regulated, kind of Greenhouse Gas.				
Climate Change	13			
The result of an increasing Greenhouse Effect, resulting in long-term changes to the climate and natural environment.				

Land Use Change	The process of natural forest or wetland being converted into other uses like farming, development, or mining.	19	Sink	A place where carbon is stored for long periods of time, such as the oceans, atmosphere, in forests and fossil fuels.	7
Lithosphere	An environmental Compartment that accounts for rocks, minerals, and soils.	1	Society	Society is made up of markets, technologies, science, policy, values, and infrastructure. Society encompasses the Economy, and exists as part of the Environment.	40
Macro Nutrient	The most necessary nutrients for plant growth. Often Nitrogen, Potassium and Phosphorous.	5	Source	A place or process that releases carbon from places of storage to the atmosphere.	8
Methane	CH4, A carbon-based greenhouse gas that comes from decomposing waste, converting wetlands into farms or other uses, and manure.	17	Transportation	The environmental process by which water, in the form of clouds, is moved throughout the atmosphere, usually driven by weather patterns and air currents.	3
Micro Nutrient	Minor nutrients needed for plant growth like Calcium, Magnesium, Manganese, Copper, Sulphur	5	Waste	Any matter that is left over and has no further use to an individual or business after a production or refinement process.	26
Natural Resources	Organic or inorganic materials provide by the environment for production and consumption by the Economy and Society.	42	Water Cycle	The environmental cycle by which water is moved through various environmental compartments and changes in form.	3
Nitrogen	A Macro Nutrient, needed for leafy green growth.	5			
Nitrous Oxides	N2O, a nitrogen based greenhouse gas that comes from producing and using NPK fertilizers, burning waste, and decomposing organic waste.	17			
Nutrient Cycle	The environmental cycle in which macro nutrients, NPK, micro nutrients, and organic matter cycle through various environmental compartments.	5			
Organic	Being organic in nature, and easily decomposes into the environment.	26			
Phosphorous	A Macro Nutrient, helps with structural development of the plant and root systems	5			
Pollution	Any material that has serious chemical properties, is dangerously concentrated in the environment, and remains in the environment long enough to cause problems.	27			
Potassium	A Macro Nutrient, helps with structural development of the plant and root systems	5			
Precipitation	The environmental process by which water in the Atmosphere is returned to the Lithosphere, usually through rain.	4			
Runoff	The environmental process through which water moves overland and underground, carrying chemicals and other contaminants with it.	4			

Section 1: The Environment

The Environment is highly complex, intricately-designed and finely-tuned to support a planet-wide ecosystem, with billions of different kinds of plants, animals, and peoples in every corner of the Earth. The Environment is the source of nearly all natural resources that humans and animals depend on for survival and growth, and is the physical setting for all of mankind's development (pg. 41).

The Environment is difficult to describe with one word, given how broad and expansive the environment is. To better understand what the environment is it's useful to divide the environment into **compartments** or spheres, through which all matter and energy in the world move. Some of these compartments are very distant from Ghana and West Africa, nonetheless, every individual is, in some way, connected to much larger environmental cycles.

The Hydrosphere accounts for all the water, including rain and clouds, lakes, rivers and wetlands, oceans and groundwater, and the polar ice caps.

The Lithosphere accounts for the non-living rocks and minerals, soils and geologic cycles;

The Biosphere accounts for all living things, bacteria and microorganisms, plants, animals and humans.

The Atmosphere accounts for the air and regions between space and the surface of the earth. The atmosphere is very chemically complex and small changes in the chemistry can lead to dramatic changes.

The Anthrosphere is a special environmental sphere specifically designated because of human development. The Anthrosphere accounts for human settlements like villages, towns, communities and cities, with all the infrastructure and buildings included.

The different compartments of the earth, the **spheres**, are connected to each other by chemical and physical interaction between the spheres.

For example:

- The Water Cycle moves water through the Hydrosphere, Atmosphere, and Lithosphere.

- The Carbon Cycle moves carbon through the Atmosphere, Lithosphere, and Anthrosphere.
- The Nutrient Cycle transfers carbon, nitrogen, phosphorous and other elements through the Geosphere, Atmosphere and the Biosphere.

Environmental Cycles

An Environmental Cycle is a natural process in which elements and matter move continuously through different *compartments* of the environment (see Figure 1). The elements and matter can change form, such as from a liquid to a gas such as melting ice, or change from a solid to a gas when something is burned.

Natural environmental cycles are the underlying force behind rain and groundwater; nutrient cycles are the basis for agriculture and farming. Changes carbon cycle is why Climate change is a major concern today. Humans are dependent on many natural environmental cycles for 'Beneficial Ecosystem Services' (pg. 19), and the provision of natural resources for Economies and Societies (42).

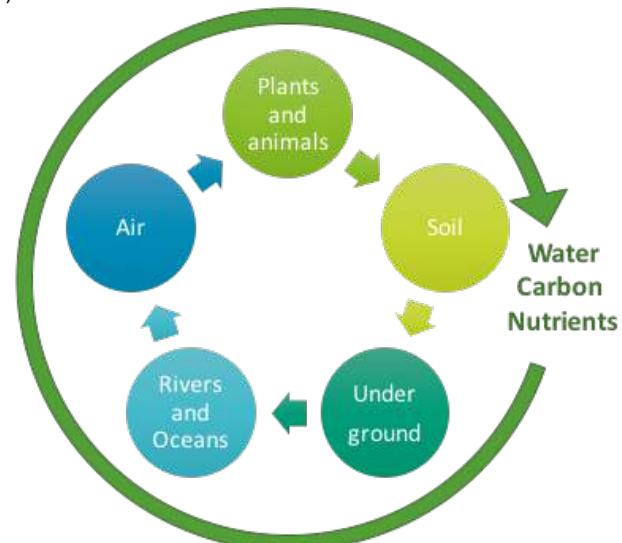


Figure 1) Water, Carbon, and Nutrients cycle through different environmental compartments..

Three Environmental cycles are especially relevant to Ghana and the Western Region:

- **The Water Cycle** (below) is the basis for how rain, groundwater, and human societies interact.
- **The Carbon Cycle** is relevant to Climate change, where human Greenhouse Gas Emissions (pg. 7) and Land Use Change (19) are the primary drivers of climate change today.
- **The Nutrient Cycle** (pg. 5) describes the underlying cycles behind agriculture, how nitrogen potassium, phosphorous and organic matter move through the environment.

The Water Cycle

The Water Cycle describes how water moves through environmental compartments. Water can move through the lithosphere as groundwater, through the atmosphere as water vapor and rain, through the hydrosphere as lakes, rivers and oceans, and water is an important part of life, where plants and animals depend on water every day.

Water changes form as it moves through and between different compartments of the environment. In each compartment, water plays an important role in the environment. The water cycle can be simply understood as the following six stages or processes (see Figure 2).

1. **Evaporation-** Energy and heat from the sun warms oceans and evaporates the water. The water vapour from the oceans drifts upward from the Hydrosphere into the Atmosphere.
2. **Evapotranspiration-** Plants and forests naturally emit water from their leaves and from soils. Evapotranspiration is the combination of **evaporation** from soil and **transpiration** from plants. This is how water moves from the Biosphere to the Atmosphere.
3. **Condensation-** Water vapour from the oceans and from forests accumulate into large clouds that we can see from the surface of the Earth.
4. **Transportation-** The water in the weather and clouds are driven all over the by wind and air currents. Massive weather patterns that span entire continents are how the Earth distributes heat and energy from the equator.

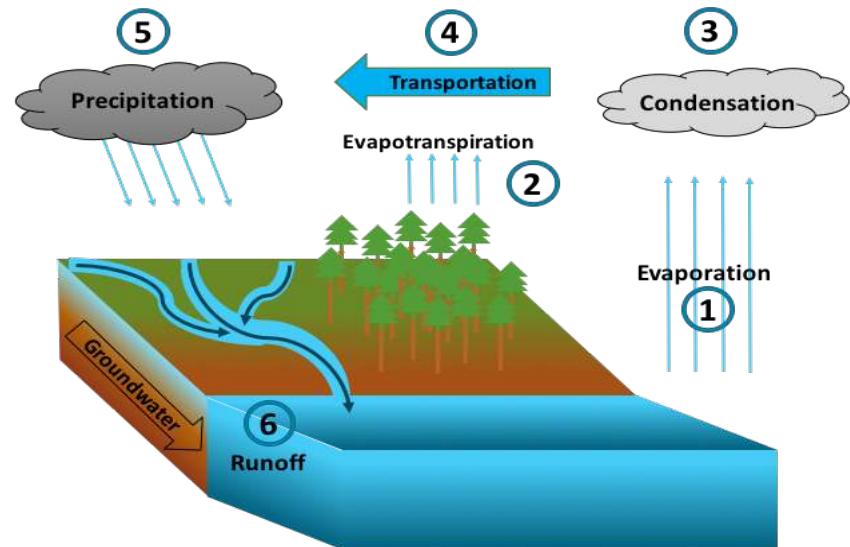


Figure 2) The water cycle.

5. **Precipitation-** Under the right local conditions, the water contained in clouds becomes rain, or precipitation. This is how the water moves from the Atmosphere back to the Lithosphere.
6. **Runoff-** During and after the rains come, the water flows downhill towards lakes, rivers, and eventually the ocean. You can see 'runoff' when little rivers form in the road or on farm land. Rain also seeps into the ground where it can be absorbed by plants (Lithosphere to the Biosphere) and become groundwater (Atmosphere to Lithosphere).

Groundwater is an important stage in the water cycle, as it is the largest store of freshwater in the world, and water can remain in the ground for hundreds and even thousands of years before it is brought up to the surface.

It might be common knowledge that wells and boreholes depend on groundwater, but rivers, and many lakes and ponds are also the result of groundwater. Wetlands, or swampy areas are a specific instance in which the water table, the height that the groundwater can reach, is at or above ground level.

The Nutrient Cycle

The Nutrient Cycle describes how plant nutrients, like Nitrogen (N), Phosphorous (P), and Potassium (K) move through environmental compartments. Carbon, while not necessarily a 'nutrient' in the same way as NPK, is still a critical building block for all plant and animal life. Plants photosynthesize and use Carbon Dioxide (CO_2) as an ingredient in sugar and plant tissue. Plants also depend on organic matter in the soil to retain healthy micro bacterial populations, and retain nutrients and waters in the soil for plants to use (See Figure 4).

Nitrogen is needed for leafy green growth; potassium and phosphorous help with structural development of the plant and root systems. However, each species of plant use these primary nutrients at different rates and different ways. Other important nutrients that are needed in much smaller quantity are called 'micro nutrients', such as Calcium (Ca), Magnesium (Mg), Manganese (Ma), Copper (Cu), are also needed for plant growth.

As a rule, plants can only grow as much as the 'limiting nutrient' allows. This means that whenever a single plant nutrient, be it NPK, Ca, Mg, Ma, Cu or any other nutrient, is low, the plants will respond with limited growth as well.

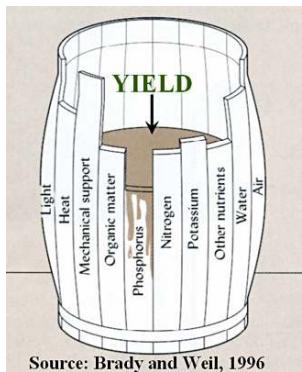


Figure 3) Illustration of the limiting nutrient problem.

to improving crop yields. Additionally, the production and use of chemical

A good analogy is a barrel with sides of different lengths. The water level in the barrel (the plant yield), will only be as high as the lowest side (plant nutrient) (see Figure 3).

Chemical fertilizers are often seen as a quick solution for larger yields and faster growth. However, the over-reliance on chemical fertilizers has important implications for long-term sustainability. Chemical fertilizers can runoff into the environment, causing eutrophication (pg. 32), and diminish the importance of using organic fertilizer as a more holistic solution

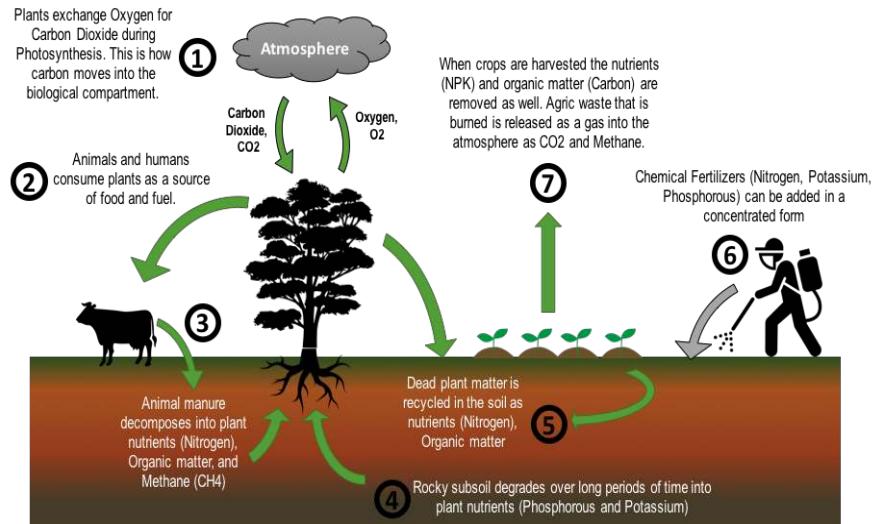


Figure 4) The Nutrient Cycle.

fertilizers, especially nitrate-based fertilizers, is a significant source of greenhouse gas emissions (pg. 17) and a driver of climate change.

1. Plants and the atmosphere exchange carbon dioxide (CO_2) and Oxygen (O_2) during photosynthesis. This is how carbon is generally transferred from the atmosphere (CO_2) into the lithosphere and Biosphere (as Organic Matter).
2. Animals and humans consume plants, along with the carbon, nitrogen, and other nutrients that the plant had absorbed.
3. Animals excrete manure. Overtime, and with the help of microorganisms in the soil, the manure breaks down and 'decomposes' into the soil. This process can be controlled and improved through composting (pg. ##). The decomposition process, especially with large-scale animal rearing operations, releases methane (CH_4), a potent greenhouse gas (#).
4. The rocky subsoils break down into mineral plant nutrients, Phosphorous (P), Potassium (K) and other important micro nutrients. Overtime the soil above will naturally incorporate the Phosphorous and potassium, making it more available to plants .

5. Plants and agricultural crops shed agric residue like leaves and branches, or peels, stalks, and other waste from agro-processing. When properly composted, these agric and plant residues and recycle their plant nutrients into the soil.
6. African soils are very thin and very fragile, and generally do not sustain constant farming without organic inputs. Chemical fertilizers are a quick way to apply concentrated nutrients to the soil, but this is a very unnatural process, and much of the fertilizer can be lost without organic matter to hold it in place (pg. 32)
7. When crops are harvested, the carbon, nitrogen, and any other plant nutrients are removed as well. The residues are also removed during harvesting, and can either be restored to the soil or released as a greenhouse gas when burned or left to decompose in a pile.

The Carbon Cycle

The Carbon Cycle describes how carbon (C), an important element for all life in earth, moves through the environment. Carbon comes in many forms and is very important to humans, plants, and animals alike. Carbon can be found as:

- **Organic carbon** – Plants, animals, humans are partly made from organic carbon;
- **Fossil Fuels** – Carbon-based fuels deep underground, like coal, gas, and petrol;
- **Greenhouse Gases** - Carbon dioxide (CO₂) and methane (CH₄), are carbon-based greenhouse gases that form because of burning fossil fuels (pg. 16).

Carbon Sinks

Carbon moves through an environment in different forms in short term cycles, and very long-term cycles. ‘Sinks’ are places where Carbon is stored in various forms for very long periods of time – thousands to millions of years (See Figure 5).

- Oceans absorb a certain amount of Carbon Dioxide (CO₂), in balance with the CO₂ in the atmosphere. Carbon Dioxide becomes part of sea shells (Calcium Carbonate, CaCO₃). But too much CO₂ turns the oceans more acidic (Carbonic Acid, HCO₃⁻), and increased temperatures from climate change dramatically and dangerously affect the oceans’ chemistry.

- Forests are vast sinks of carbon created through photosynthesis, plants convert CO₂ to the basic building blocks of all plant matter. Forests have existed on the Earth millions of years, always exchanging and regulating Carbon with the atmosphere.
- The atmosphere has always contained some amount of Carbon Dioxide, but very small change in the concentration of CO₂ in the atmosphere seriously affect the climate. This is what we are seeing today with climate change. Sharp and steady increases from global CO₂ emissions, has already begun to damage fragile and ancient environmental cycles.
- Fossil fuels are natural sinks for carbon that formed millions of years ago. Forests from before there were humans became buried deep in the earth and slowly transformed into the fuels we use today. Oil companies extract this ancient carbon as crude oil and coal, now releasing it into the atmosphere as greenhouse gases, plastics products, and gas.

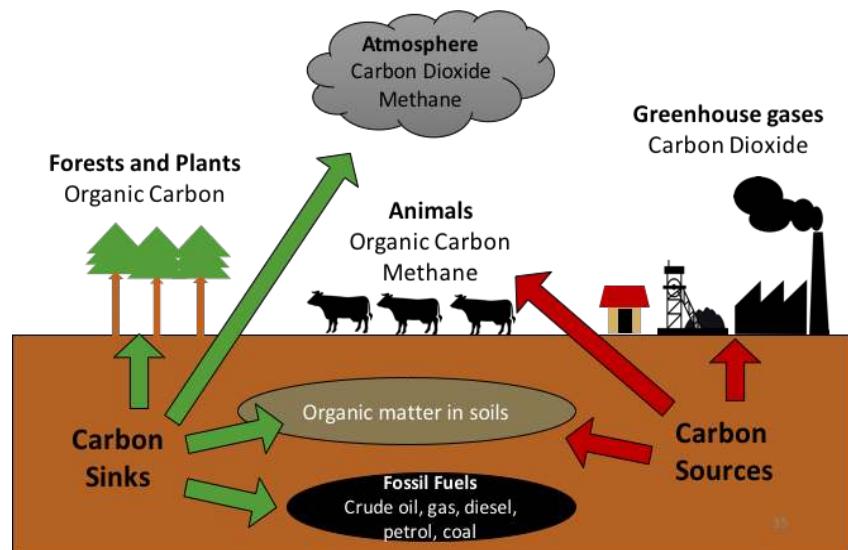


Figure 5) Diagram of Sinks and Sources of Carbon.

Soils and fertile land are an important sink for carbon, though not for as long as time as in other natural sinks. Organic matter from dead and decomposing plants is mixed into the mineral soil, and is absorbed by new plants, season after season.

Carbon is one of the building blocks for all of life, plant and animals alike. When living things die and decompose they exchange their carbon with the environment, through burial, or decay. Burning organic matter turns the carbon into a gas, or tilling organic matter into the soil returns the carbon to soil. This is a very short term cycle, given a much longer geologic time scale of millions of years so life, and living things, aren't considered 'sinks' for carbon (see Figure 5).

Carbon Sources

Places and activities that release carbon from 'sinks' into much shorter-term cycles with the environment are called '**Sources**'. Some natural things can be sources and sinks, and humans can have an important role in changing sources and sinks (see Figure 5).

- Burning fossil fuels such as oil, gas, petrol, diesel and coal converts the carbon, stored as these fuels, into greenhouse gas - methane and carbon dioxide and many other gases. The greenhouse gases rise into the atmosphere and contributes to increasing climate change.
- Animals, especially commercial animals like cattle, covert plant-based foods into methane (CH_4) during digestion, and expel the methane in their manure or when they release gas. Large-scale commercial animal operations are the worst offenders.
- Land use change, especially when wetlands and other swampy areas are changed and converted suddenly release significant amounts of methane from the soils. Cutting down trees and causing deforestation also causes soils to lose organic matter as greenhouse gases like carbon dioxide.

Due to the major technological advancements in society and the global demand for cheap energy in the form for fossil fuels, humans have disrupted much older natural cycles. The significant and dangerous impact on the natural carbon cycle is the conversion of Fossil Fuels that had been underground, into gases that are now in the atmosphere. This is, along with other human activities has created a dangerous cycle of environmental damage (see Figure 6)

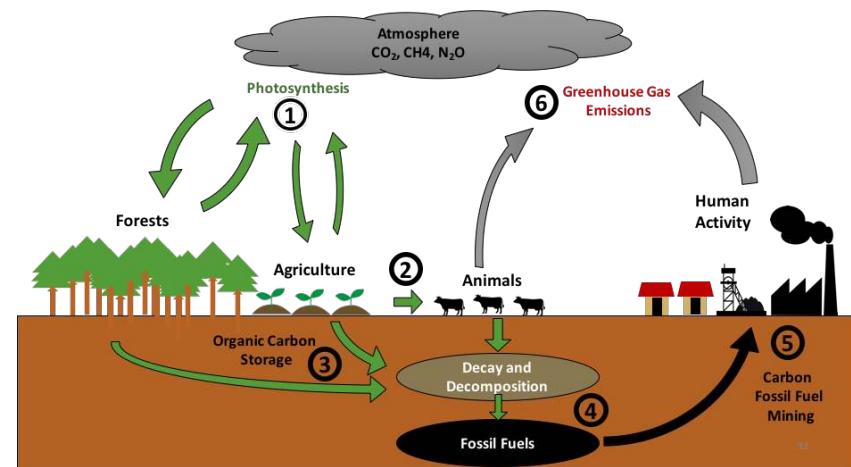


Figure 6) The Carbon Cycle.

Figure 6 shows a simplified carbon cycle and adjacent, a pictorial illustration of how human activities are influencing carbon emissions.

1. Carbon in the atmosphere, like CO_2 , is exchanged with trees and plants during photosynthesis. Plants take in CO_2 , and emit Oxygen and water vapor.
2. Plants and trees are consumed by animals and humans as food and fuel, and die and decompose into the environment.
3. When plants or animals die, the carbon in their bodies (as well as nitrogen and other nutrients), are stored in the ground.
4. Decay and decomposition of organic carbon can release some methane into the atmosphere. The carbon and nitrogen from trees and plants is recycled into the soil in a natural way.

Trees and plants that have been buried underground over millions of years are chemically transformed into fossil fuels like coal, gas, and crude oil. Humans take carbon out of the ground when we extract fossil fuels for use in development.

5. After humans have extracted fossil fuels from the ground and burn them to power our cars, electrical grids, and industrial factories.
6. The carbon is released into the atmosphere as CO₂ and CH₄, along with other greenhouse gases. This is the primary driver of global climate change.

Humans have had an astonishing impact on the Carbon Cycle. Many factors have contributed and are still contributing to the drivers of climate change. Global demand for fossil fuels, farming land, land for livestock, and production of trash and waste has risen sharply in the last few decades. At the same time, deforestation, pollution and greenhouse gas emissions is higher than ever.

The imbalance in the carbon cycle is one of the principle drivers of Climate Change .The combined effects of humans on the environment that has lead to a small change to the atmosphere, leading to large changes to the climate. Compare Figure 6, a balanced carbon cycle, with Figure 7, an imbalanced carbon cycle.

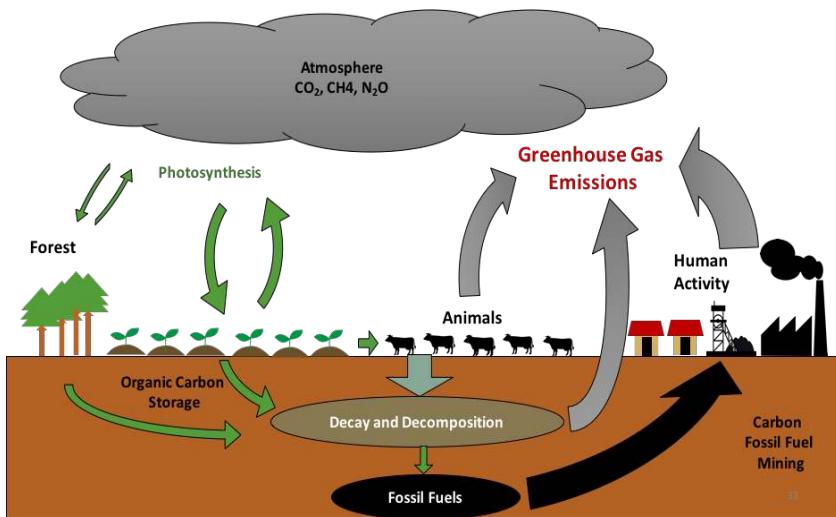


Figure 7) Imbalanced Carbon Cycle, caused by human impacts.

Environmental Footprint

Like a regular footprint in sand or dust, an Environmental Footprint is the mark left behind on the environment (or climate) by an individual or business. It is a measure of how much environmental damage or protection a person provides to the environment.

Causing unnecessary pollution, wasting natural resources, burning waste products instead of recycling them and other unsustainable activities make a person's or businesses' Environmental Footprint bigger.

Being efficient and mindful with natural resources, taking responsible and active steps to prevent waste and pollution, using sustainable alternative fuels and incorporating green principles into the business makes a persons' or businesses' Environmental Footprint smaller. It is best to have as small of an Environmental Footprint as possible, to cause little or no damage to the environment.

To 'see' one's Environmental Footprint, we need to look at everyday choices about fuel, waste, business practices, personal responsibility, and active measures to reduce one's Environmental footprint and be more sustainable.

- Activities release greenhouse gases and use of fossil fuels (i.e. oil, petrol, gas, diesel, coal), mineral fertilizers (i.e. Nitrates and ammonia), or burning waste should be kept to a minimum.
- Wasting natural resources, or being inefficient with natural resources can increase an Environmental Footprint, especially when the business uses resources like timber, firewood, charcoal or water.
- Being careless with waste products, like dumping and disposing waste in the bush, or not using appropriate waste management facilities like refuse containers or recycling, can cause pollution and increase the Environmental footprint.

Finding ways of reducing the need for as much fuel, reducing transportation, minimizing how much plastic trash is created, or organic farming can all reduce greenhouse gas emissions.

- Improving efficiency with natural resources and minimizing waste are also useful ways of reducing one's Environmental Footprint.
- Recycling waste products for use in the business or for another person's business can be a good way of reducing waste pollution and reducing an Environmental Footprint.

- Using sustainable practices like composting instead of chemicals, being responsible with refuse, reducing how much plastic you use in everyday situations can reduce the Environmental Footprint.
- Incorporating Green Economic Principles into the business, being aware of one's Environmental Footprint, and taking advantage of Green Economic Opportunities can also decrease the size of an Environmental Footprint.

Section 2: Environmental Risks

Environmental risks, like Climate Change and Land Use Change, are the direct result of human activity all over the world. Collectively, the overuse of natural resources, the general irresponsibility with Greenhouse Gas emissions, and the mismanagement of many kinds of waste and pollution have led to many problems.

It is important to realize that individuals, businesses and governments alike are directly reliant on the environment (p. 41), and that the continued unsustainability of the economy and society will have dramatic and lasting consequences.

Climate Change

One of the most important environmental risks in Ghana and for the world is Climate Change. Climate change by itself is a very complex subject, where scientists all over the world still do not fully understand what is causing climate change, or how fast approaching the effects are. Nonetheless, climate change is taking place today at an increasingly alarming rate.

This section will address:

1. The Basics of Climate Change as a physical and environmental process;
2. Greenhouse Gases, a major component of changing the climate;
3. The Effects of Climate Change, described as long-term uncertainties for the whole of West Africa and Ghana;

If you have not already done so, reading the Carbon Cycle section will be useful for understanding this section (pg. 7).

The Basics of Climate Change

Climate change is the result of an increasing 'Greenhouse Effect', caused by human activities. The acceleration of the Greenhouse Effect is principally driven by a steadily increasing buildup of **Greenhouse Gases (GHG)** (pg. 16) in the Earth's atmosphere. In natural circumstances, without modern human influence, the Greenhouse Effect allows the Earth to retain enough heat to support living things. Without the Greenhouse effect, the Earth would be a cold and barren rock in space.

Many human activities accelerate the forces causing climate change:

- The use of **Fossil Fuels** in developed countries and developing countries is emitting large amounts of greenhouse gas into the atmosphere (pg. 16);
- **Global Land Use Change**, and the degradation of natural environments for human purposes, decreases the earth's resilience to change and degrades environmental systems (pg. 19)
- Severe **Deforestation** in many of the world's most important forests, including in Ghana, is reducing carbon storage in trees and underground and emits greenhouse gases (pg. 22).
- **Increased use of synthetic chemical fertilizers** and increased industrial agriculture contributes to the release of many greenhouse gases from the soil and from chemical production (pg. 32).
- **Large-scale animal rearing operations** and decomposing waste produces significant amounts of methane, contributing to climate change (pg. 16).

Greenhouse Effect

1. The Sun provides energy to the earth in the form of heat and light, which we can feel and see in everyday life. Some of this heat and light is absorbed by the Earth's surface, warming the planet, and some of the heat and light reflects off the Earth back out to space (Figure 8).
2. Greenhouse gases absorb some of the reflected heat, sending it back to the Earth, providing additional heat. This natural balance, between absorbing and reflecting heat and light from the Sun is the 'Greenhouse Effect', which allows life to be possible on Earth. The energy that reaches the earth's surface also drives photosynthesis and plant growth. Sunlight evaporates the oceans which makes clouds and drives global weather patterns. (Figure 8).

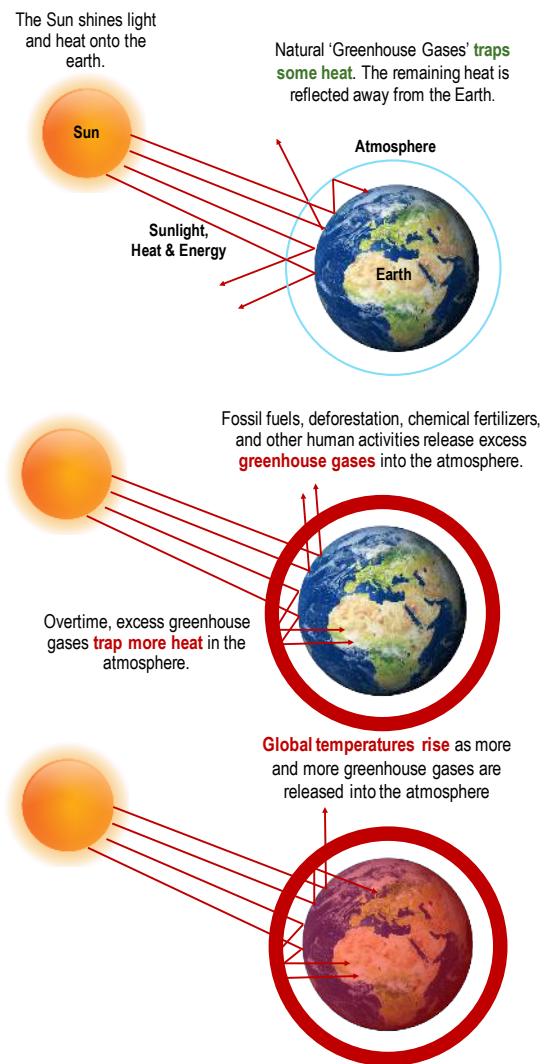


Figure 8) Basic Diagram of the Greenhouse Effect and Climate Change.

3. The increasing Greenhouse Effect we are experiencing today is due to higher concentrations of Greenhouse Gases in the Earth's atmosphere (see Greenhouse Gases). More greenhouse gases in the atmosphere means that more heat and light, reflected off the Earth, is being absorbed and retained. (see Figure 8).

Modern human activities, emit greenhouse gases into the atmosphere and reduce the ability of the earth to regulate the amount of greenhouse gases it can absorb. Large forests can take in and transform greenhouse gases (CO_2) and convert it into plant material during photosynthesis. Trees and forests also emit water vapor through their leaves (called *Evapotranspiration*), stabilizing local weather patterns. However, as more and more forest lands are destroyed, the ability to capture and safely store greenhouse gases is diminishing.

Greenhouse Gases

Only certain gases in the earth's atmosphere absorb the heat and light (energy) that is reflected off of the Earth. These gases are: Water Vapor (H_2O), Carbon Dioxide (CO_2), Nitrous Oxides (N_2O), Methane (CH_4) and Chlorofluorohydrocarbons (CFCs). These five gases are responsible for causing the natural Greenhouse Effect, and are dangerously increasing the rate of Climate Change (see Figure 8).

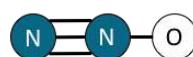
Greenhouse gases (GHGs) come from many different sources, both natural and man-made. The man-made sources of greenhouse gas emissions are what is causing climate change. Man-made emissions of greenhouse gases are from burning fossil fuels (cars, trucks and motorbikes), producing and using agricultural fertilizers, commercial animal producing operations, and other daily human activities.

- **Water vapor (H_2O)** is a natural greenhouse gas and comes from evaporating seawater and emission from forests.
- **Carbon Dioxide (CO_2)** is released from burning fossil fuels (cars, machines, generators, coal burning etc.), from deforestation, and land use change.

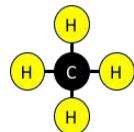
- Carbon dioxide (CO_2)



- Nitrous Oxides (N_2O)



- Methane (CH_4),



- Chlorofluorohydrocarbons (CFCs)

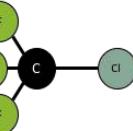


Figure 9) Molecular structures of common Greenhouse Gases.

- **Methane (CH_4)** is a much more powerful greenhouse gas but is far less abundant in the atmosphere. Decomposing waste in landfills, large-scale livestock operations; rice cultivation and other agricultural operations.
- **Nitrous Oxide (N_2O)** is produced from commercially-used soils, commercial and organic fertilizer use, burning fossil fuels and from burning biomass (agric waste).
- **Chlorofluorohydrocarbons (CFC)** are a minor, but very powerful GHG that comes from and industrial factories. The use of CFCs is tightly regulated by national and international laws.

Compared to major industrialized cities and countries, rural areas and underdeveloped countries do not contribute nearly as many greenhouse gases as industrial countries like the USA, or Europe. However, practices like burning waste, deforesting native trees, failing to replant forests after timber harvesting, and bad agronomic practices can all contribute to increasing GHGs, or diminishing the ability for nature to sustainably manage GHGs.

The Effects of Climate Change

The loss of carbon storage in trees due to deforestation, and over use of fossil fuels for producing fertilizer, industry, and driving global development has lead to a sharp rise in the amount of CO_2 and other greenhouse gases in the atmosphere. What this means is not certain, but the general trends are:

- On average, the world will become warmer. Some areas will become much hotter, while other areas might not. Ghana and other West Africa nations may start to see more desertification, such as can be seen in Northern Ghana today.

- Changing weather patterns will make some areas dryer, and other areas much wetter. This means that the rainy season may not provide the same rainfall it did in generations past. This could also mean that rain could become much heavier, causing serious flooding.

This will affect agriculture, where some plants may respond well to increasing CO_2 . Other commercial crops may fail entirely in certain areas that are no longer suited for that crop.

- As the polar ice caps melt, global sea levels will rise, affecting coastal cities and communities all over the world, including Takoradi, Cape Coast, Accra, and Tema. Coastal storms, like hurricanes could increase in intensity and frequency in these coastal cities.

Land Use Change

Land Use is concerned with how and for what purposes land is used and the transition from one type of land use to another, whether farming, irrigation, tourism, housing development, waste dumping or left in its natural state. Land Use Change is a basic part of development and culture where, for centuries, man has used the environment to produce food, structures, settlements and communities (see Figure 10).

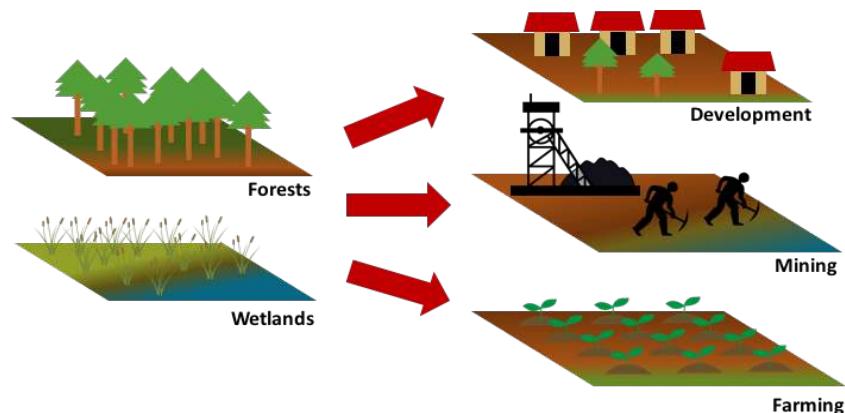


Figure 10) Diagram of Land Use Change of Forests and Wetlands into new land uses.

The concern today is that mankind has changed the land in ways that are becoming irreversible and have serious and lasting consequences on the environment and for Climate Change. Globally, mankind is changing land faster than it ever has in history. With more than 7 Billion people on this Earth, the demand for natural resources, land, food, water and fuel has caused planet-wide change to delicate natural systems.

Beneficial Ecosystem Services

Natural environments provide an abundance of 'ecosystem services', which are benefits that we as humans enjoy and rely on for daily activities:

- Rainforests play an important role in regulating the local weather; protect soils from nutrient depletion and erosion; and provide abundant habitat for many animals and plants. Wood and timber are an important fuel source and building material all over the world. Many cultures and peoples place personal and spiritual value in forests for providing a pleasant environment (pg. 4).
- Rivers and wetlands help provide rain and flood control; removes toxins and chemicals from the water; are an important source of fish and other resources; and are critical habitats for aquatic plants and animals.
- The oceans are important for coastal cities to provide electricity, food and other natural resources; oceans regulate global weather patterns and is responsible for managing fluctuations in large-scale environmental systems; and oceans are an important cultural and social component of many communities all over the world.
- Groundwater can be safely stored for long periods of time, providing water relief during dry seasons (pg. 4).
- Plants and Animals are sources of medicine, remedies, food, spiritual power, and important genetic diversity.

With the environment naturally providing so many benefits to humans, the threat of Land Use Change is clear. Changing the use lands for non-natural purposes, threatens Earth's ability to provide free ecosystem services. The loss of any ecosystem service will require humans to either adapt to life without the ecosystem service, or devise new ways of obtaining the service without the environment.

Farming and Land Use Change

The transition from natural forest land to agricultural land is not inherently unsustainable. However, extensification (expanding land to increase crop yields) rather than intensification (increasing crop yields without expanding land), utilizing inorganic farming practices, over-use of chemical fertilizers, weedicides, and pesticides and other unsustainable farming practices contribute to degrading and destroying native forest lands.

- Clear cutting forests to make room for more and larger farms will degrade landscapes that once housed native plant and animal species, reducing the suitability of the land to support healthy natural environments for plants and animals.
- The loss of biodiversity will decrease the ability of the natural environment to resist the effects of environmental and climatic change, and decrease the genetic wealth of the area;
- Increasing farmland divides forests into patches and fractures the landscape, reducing the suitability of the land to support healthy natural environments for plants and animals (pg. 19).

Wetlands and Land Use Change

Wetlands are typically low-lying areas with swampy or waterlogged soils, shallow ponds, or interlacing streams and rivers. Wetlands are an important and often underappreciated natural landscape, and play a vital role in hydrological (water) cycles, habitat provision, ecological stability and other beneficial ecosystem services.

- During the rainy season, floods and excess water are retained by wetlands, preventing damage to houses, farms or other structures.
- Water that goes through natural wetlands are cleaned of many kinds of pollution including metals from mining (mercury), mineral fertilizers and sediment.
- Wetlands are also important habitats for birds, frogs, insects, and many other kinds of wildlife that make up the environmental ecology.

Wetlands, because of the quality of land, are often converted to rice farms or other kinds of land use. Draining the wetlands to prepare the land can diminish the role of wetlands in protecting an environment and providing ecosystem services. Animals that once lived and depended on the wetland are pushed out or killed, reducing the environments ecological diversity and sustainability. Rapidly changing wetlands from their natural state to a rice farm or other use, methane is often released in significant quantities.

It will be necessary to convert some wetlands into farm to provide jobs and development to the community. But farmers who have converted wetlands need to be aware of the risks in doing so.

Expanding, or extensification, of farm land to produce more crops is not as good as learning to increase yields without changing more natural land (.). Farmers must be responsible for the changes they bring to an environment and work to ensure that ecosystem services are maintained and protected for the sake of the environment, society, and economy.

Deforestation

Deforestation is a special case of Land Use Change. Deforestation is the near-complete or complete removal of trees and forests in an area, and total conversion to non-forest purposes, like farming, mining and development. In Ghana, as much as 1/3 of forests lands have been lost since the 1990's, and forests are continuously lost at a rate of 2.19% annually. If these trends continue, deforestation cause a severe loss of important ecosystems and benefits to Ghana.

- Deforested land is more prone to erosion of topsoil due to rain and wind. The erosion, along with mining or other human activities, can cause rivers to become choked with too much dirt and soil, resulting in sediment pollution (pg. 23).
- Deforestation can also fracture and break apart local habitats for native bird, insect, plant and animal species. Forests that were once continuous, allowing for the free movement of native animals, are split into smaller sections and quickly eroded away, harming native animal and plant populations.
- Forests play important and complex roles in managing and stabilizing local weather conditions, nutrient cycles and soil development, social and communal functions, and Timber products support many different livelihoods (pg. 5).
- Forests are a major carbon sink (pg. 7), and the loss of forests could accelerate the negative effects of climate change, especially at the local level.

Addressing nationwide deforestation in Ghana is a complex challenge, requiring coordination and cooperation at national, regional and local levels. Increasing awareness of sustainable farming practices, protecting and strengthen nearby forests, improving fuel efficiency and reducing wood and charcoal use, reducing

unsustainable timber mining, and development of environmentally-friendly livelihoods like forestry tours and tree planting are important steps to mitigating and averting deforestation.

Soil Degradation

Soils, especially for agriculture, are complex mixtures of mineral soils and clay, beneficial bacteria and other microorganisms, organic carbon, plant nutrients like nitrogen, phosphorous and potassium. These all come together to allow plants to grow well, producing food and commercial crops. The layer of soil that can support plants is very thin and very fragile. This 'topsoil' sits on top of very hard clay and rock that is not suitable for agriculture.

Topsoil can be disrupted and destroyed by irresponsible and unsustainable farming practices, which often means new land will be needed. The constant search for new land drives deforestation and other land use changes.

- Over tilling, or disrupting, the soil can spread organic matter and bacteria too thinly among the mineral soil, or disturbing the natural balance of soil contents or bury the soil in poor-quality clay.
- Removing plants can expose the soil to rain and wind, which can carry the top soil and leave only the barren rocky clay beneath.
- Soils can lose plant nutrients and organic matter when crops are grown without replenishing the organic matter and nutrients. Chemicals can temporarily replace plant nutrients, but this does little to improve the organic matter content, or soil stability. Chemicals can also be washed out of the soil because of the rain, and runoff or leaching into ground water (pg. #).
- Over irrigation can lead to soils becoming salty. Natural salt in the water is left behind when the water evaporates, degrading the quality of the soil.
- Soils in low-lying areas that are prone to flooding can become waterlogged, where too much water prevents air from reaching the roots. This can cause crops to rot, releasing methane and other greenhouse gases.

Eutrophication

Eutrophication is when a body of water, like a lake, stream or river becomes polluted with mineral fertilizers and plant nutrients.

1. Rain, irrigation or groundwater can transport nitrogen (N) or phosphorous (P)-based fertilizers, significant amounts of animal manure, or high concentrations of organic matter into nearby waterways.
2. The nutrients in the water cause excessive growth of green algae.
3. Natural bacteria in the water consume and decompose the dying algae, which uses oxygen in the process. As more algae die and are consumed the water becomes devoid of oxygen in the water (dissolved oxygen), causing stress and possibly death to aquatic plant and animal life.
4. In the long term, eutrophication can cause significant damage to wetland ecologies, rivers or lakes (see Figure 11).

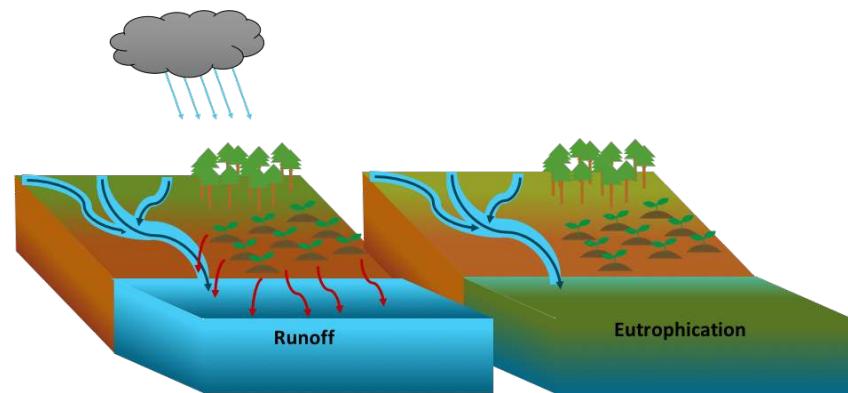


Figure 11) Agro-chemicals and mineral fertilizers can runoff into local waterways, causing eutrophication.

Waste Products and Pollution

Waste products and pollution from human activities are another serious environmental risk. However, it is important to distinguish between ‘waste products’ from ‘pollution’. While waste products and pollution are very closely related in Ghana and elsewhere, they are two different environmental risks. Waste products can become pollution if managed poorly, but pollution is caused by many other things.

Waste versus Pollution

Waste, by itself, is not always pollution or a pollutant. Pollution is not always due to waste or poor waste management. Waste can become pollution if it is not managed well, such as burning or careless dumping of waste. Waste products can be dangerous to the environment or human health by decaying and causing unsightly nuances, bad or foul smells and be a breeding ground for mosquitos and other pests.

Pollution is a much broader category. Waste can be pollution, but pollution can also be caused by inefficient processing, by wasting fuel and emitting greenhouse gases, causing unnecessary noise and dust, or producing fumes and smoke from machines. Different kinds of pollution effect the environment differently, and some kinds of pollution can be very dangerous to humans and animals (see Figure 12).

WASTE	POLLUTION
<ul style="list-style-type: none"> Waste is a by-product from a production process; Waste is not necessarily pollution, but waste can become pollution if it isn't managed well; Waste can be dangerous to environmental and human health. 	<ul style="list-style-type: none"> Pollution is anything that causes environmental damage, degradation, or deterioration; Pollution can be waste products that are managed poorly; Pollution can be dangerous to environmental and human health.

Figure 12) Comparison of Waste and Pollution.

Waste Products

Waste products are by-products of agro-industrial and manufacturing process. Natural resources are consumed during production and final products are sold in the market. The remaining by-products, that no longer have use to the business, are considered ‘waste’.

Waste can be solid or liquid. Solid wastes generally include scrap metals, plastic, waste rock, agric residues, etc. Liquid wastes are generally wastewater, press water, excrement and animal manure, palm oil sludge (see Figure 13).

Solid Waste	Liquid waste
<ul style="list-style-type: none"> Scrap metal; Plastic; Mine waste rock; Agric residue; 	<ul style="list-style-type: none"> Wastewater; Human excrement; Animal manure; Palm oil sludge;

Figure 13) Solid and Liquid Waste Examples

Waste products can also be Organic or Inorganic. Organic waste is not manufactured or chemically produced; naturally decomposes into the environment; and is usually a waste product from agriculture or agro-processing. Inorganic waste is from manufactured products and usually don't decompose into the environment (see Figure 14).

Organic Waste	<ul style="list-style-type: none"> is not manufactured or chemically produced; naturally decomposes into the environment; Is usually from agriculture or other natural source.
Inorganic Waste	<ul style="list-style-type: none"> Is manufactured or chemically produced; Does not naturally decompose into the environment;

Figure 14) Organic and Inorganic waste examples.

	Solid Waste	Liquid Waste
Organic waste	Solid Organic Waste Palm Fibres Kernel Shells Coconut Husks Rice Husks Groundnut Shells Sawdust Cassava Peels	Liquid Organic Waste Palm Oil Mill Effluent Animal Manure Cassava Washing Water Human Feces and Urine
Inorganic waste	Solid Inorganic Waste Mining waste Scrap Metal Plastic containers Used Rubbers Used bottles and sachets Used batteries Spent Tyres	Liquid Inorganic Waste Agrochemical Runoff Salon wastewater Used motor oil Industrial wastewater Mining wastewater

Figure 15) Solid organic, liquid organic, solid inorganic and liquid inorganic waste examples.

This gives four types of waste: Solid organic waste, Liquid Organic Waste, Solid Inorganic Waste and Liquid Organic Waste (see Figure 15).

Pollution

Pollution is any product, object, or force in an environment that damages, degrades, or otherwise diminishes the natural environment. Pollution can be caused by businesses and waste products, by individuals, and by natural disasters and other natural events.

The dangers of pollution to the environment and humans depend on three key features: Chemical Properties, Concentration of the Pollutant, Duration of the Pollutant in the Environment. Understanding these three key features is important to understanding if a waste product is causing pollution, and how serious the threat of the pollution is to both the environment and to human health (see Figure 16).

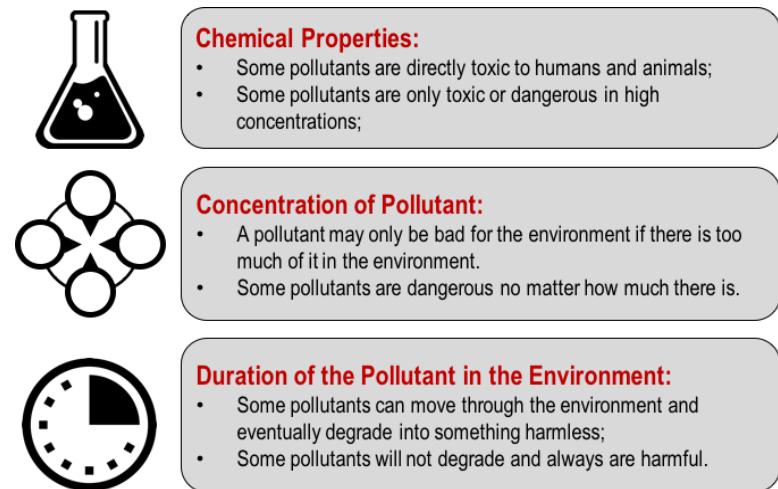


Figure 16) Diagram showing three main components to understanding pollution risks.

- The **Chemical Properties** of waste products and pollutants are important for determining their risks. Pollutants that are chemically designed to kill pests or weeds (pesticides and weedicides) pose a direct threat to native plants, animals and insects if the chemicals can spread, uncontrolled, into the environment. Noise and lights aren't kinds of chemicals, so pose a smaller risk, but still are pollution.
- The **Concentration of the Pollutant** or waste product are also important for understanding the risk of pollution. Small amounts of a waste product or pollutant over a large area, poses a much smaller risk than a large amount of a waste product or pollutant in a small area.
- The **Duration of the Pollutant** in the environment is another key factor for pollution risks. If the waste product or pollutant is organic, solid or liquid, then eventually the waste product will decompose. If the waste product or pollutant is inorganic, solid or liquid, then the waste product or pollutant will not decompose into the environment, creating a lasting problem. Agro-chemicals, especially weedicides and pesticides, are very durable in the environment, are nearly impossible to clean-up, and will not decompose into the environment.

Point versus Non-Point Pollution

The severity of pollution also depends on 'Point Sources' or 'Non-Point Sources'. Point Sources are identifiable and singular sources of pollution - It is obvious where the pollution is coming from and why it is causing a problem, and is often easily fixable with the right approach. Non-point pollution is not from a single, well-defined point. The pollutant, usually liquid, comes from a large area of land or water and is not caused by a single person or activity. Rather there are many persons or factors that each contribute a small part of a much larger overall problem.

Understanding the difference between point and non-point pollution is important to understanding the nature of the pollution, and making the right steps to correct or mitigate the pollution (see Figure 17, 18).

Point Source Pollution	Nonpoint Source Pollution
Pollution can be traced to a single, identifiable point in the environment.	Pollution cannot be traced to a single, identifiable point.
Point source pollution can be fixed or prevented easily with different management practices or technology.	Nonpoint pollution cannot easily be fixed due to its spread-out nature.
Examples: <ul style="list-style-type: none"> A single artisanal gold mine dumping wastewater into a river. A factory dumping waste into the river through a single pipe. 	Examples: <ul style="list-style-type: none"> Agro-chemicals leaking into the river from several farms. Many individuals burning waste at different places in a community.

Figure 17) Point versus Non-point Pollution

Waste Pollution

Indiscriminate dumping waste products into the environment is an unsustainable and irresponsible practice that can cause pollution of the air, soil and water nearby. Different kinds of waste, solid or liquid and organic or inorganic, will affect the environment different ways and cause different kinds of pollution.

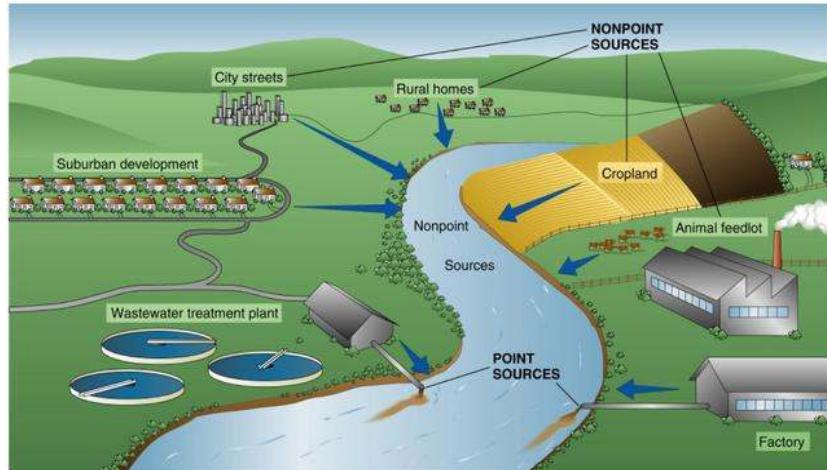


Figure 18) Diagram of Point and Non-point pollution sources.

Organic Waste Pollution

Simply because the waste is 'organic' and 'natural' does not mean that these kinds of waste are harmless. Yes, with enough time, the waste products will disappear, but poor management and long-term dumping will become pollution very quickly. Organic wastes, when dumped in large piles and allowed to sit with no other use, can become breeding grounds for mosquitos which transmit malaria and other diseases, for mice and rats that are pests, and insects like flies and gnats. The smell of decomposing waste can also create foul odors and an unsightly mess, which degrades the environment for the community.

Solid organic waste, like coconut shells, palm fibres, sawdust, and other kinds of waste are usually disposed of by burning them. This releases smoke and fumes that nearby community members breath in, causing harm and polluting the air. When waste products aren't burned for any productive use, like cooking or boiling, the energy that could have been provided as heat and fire, is wasted.

Liquid organic wastes, like palm oil mill effluent (POME) and cassava wastewater, are also potentially dangerous to the environment. These liquid wastes contain large amounts of Organic matter, which can cause eutrophication to nearby water bodies (pg. 24).

Inorganic Waste Pollution

Inorganic waste, like plastics, foam packaging, metal, rubber, electronics, motor oil and auto mechanic fluids, agro-chemicals, rock and sediment, are all inorganic. Meaning that they will not readily decompose into the environment. The buildup of these kinds of waste is evident in most parts of Ghana. Trash and refuse litters nearly every street, river, lake, and natural environment. This kind of pollution degrades the beauty and quality of the environment.

Solid inorganic waste products take hundreds or thousands of years to disappear completely. This means that if the waste is not effectively managed in a formal landfill, it will cause unsightly pollution and a risk to animals who might eat the trash, mistaking it for food.

Liquid inorganic waste products like motor oil, salon and beauty parlor waste water has chemicals in them that are unnatural in the environment. These chemicals may not always breakdown and can build up in an environment. The pollution can spread from the soil to the water, to groundwater, and bioaccumulate in animals, contaminating food and water sources for communities. Chronic, or long-term, exposure to these chemicals can have serious health effects over time (see Bioaccumulation).

Burning Waste

Burning waste or trash is a common practice in Ghana. Both organic waste, from processing agricultural crops, and inorganic waste like plastic and other household trash releases smoke, greenhouse gases, and harmful chemicals.

Burning wood and biomass fuels, like charcoal and dried plant matter does release greenhouse gases. However, for most rural areas the contribution overall is small. Nonetheless, understanding that if there is a useful way of burning organic waste products, as a cooking or heating fuel, this is better than burning waste to simply get rid of it.

Burning inorganic waste, like plastic, rubbish, tyres and other trash releases many toxic and hazardous chemicals. Burning inorganic refuse, plastic trash and other waste releases fine particles, polychlorinated dibenzo dioxins (PCDDs) and polychlorinated dibenzo furans (PCDFs); and polyaromatic hydrocarbons (PAH), including known cancer-causing carcinogens such as benzo(a)pyrene.

These inorganic chemicals are known to be highly toxic and cancerous, especially to women and children. Long term chronic (long-term) exposure to these

chemicals can lead to serious health problems later in life. Young children and the elderly are susceptible to chronic pulmonary (breathing) illness from the release of chemicals and particulate matter from burning waste. Chemicals like dioxins, furans, and PAHs are linked to immune, respiratory, endocrine, and reproductive system damage and cancer.

Whenever possible, waste should be disposed of in a sustainable manner or burned away from homes and where people are working to prevent health impacts from air pollution.

Chemical Pollution

Waste products, poor management of agro and industrial chemicals and unintended release of pollutants into the nearby environment can all cause pollution.

Potential pollutants include:

- Excess chemical fertilizers,
- Pesticides,
- Weedicides,
- Liquid organic and inorganic waste products,
- Human and animal feces,
- and other materials.

Agro-Chemical Pollution

Agro-chemicals, like fertilizers, pesticides and weedicides can move through the environment, via water and rain. This process, called 'Runoff', can allow agro-chemicals to environment, potentially causing negative environmental outcomes.

Chemicals can be transported by wind and rain and irrigation. Chemicals can flow into surface water or sink into the ground where they're transported by groundwater. Neither groundwater and surface water are localized to a single area - chemical pollutants can move long distances to other communities causing environmental risks through water pollution (pg. 4; see Figure 19).

Chemical Herbicides/Weedicides and Pesticides

Agro-chemicals, designed to kill insects and other pests, can reach the environment through runoff and leaching into nearby soils and streams. Rain and

wind can transport chemicals from the farm into the surrounding rivers and groundwater. Once agro-chemicals reach a water body, like groundwater or a river, they are very costly and almost impossible to clean up.

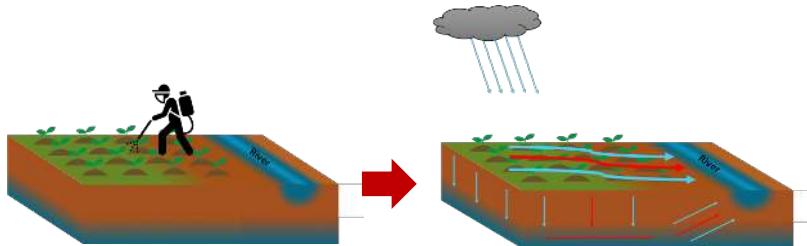


Figure 19) Basic diagram of runoff occurring after application of agro-chemicals.

Chemical pesticides and herbicides can be highly toxic to native birds, fish, beneficial insects, and non-target plants and other food crops. Many chemical pesticides and herbicides are very persistent in the environment, meaning that they can remain unchanged for weeks, months, and even years after application, though concentrations are relatively low.

Human Health Risks of Agro-chemicals

Concentrations of chemicals can increase through natural processes called 'Bioaccumulation'. Bioaccumulation occurs when certain types chemicals, including pesticides and herbicides, as well as mercury from galamsey, can accumulate in animals and fish.

Chemicals can attach themselves to small bits of organic matter and debris in the water. Small organisms and insects in the water will absorb the chemicals or eat the small bits of organic matter. Small fish then will eat the insects, concentrating the chemicals in their bodies and fat tissue. Larger fish eat the smaller fish and other well as the insects, slowly increasing the concentration of chemicals in their bodies. Humans who eat the fish are the final consumers of the chemicals. Some of the chemicals will pass through the body without harm, some of the chemicals will not (see figure 20).

Dietary exposure to chemicals is considered 'chronic' exposure, or exposure to small amounts of chemicals through food over a long period of time. It is worth mentioning that the concentrations are often very small, and pose a very small risk to humans. Nevertheless, the more chemicals that are used, the more chemicals

are in the environment.

In the worst cases, acute, or immediate and high concentration exposure to agro-chemicals, through eating accidental ingestion of chemicals, exposure by inhalation during spraying, or having the chemicals come into contact the eyes and skin has been linked to many health problems such as:

- Rashes
- Dizziness
- Dizziness
- Headaches
- Nausea and Vomiting
- Immune system suppression
- Neurotoxicity
- Birth Defects
- Cancer

It is important to always practice good management of agro-chemical and encourage more organic farming methods as sustainable alternatives to chemicals. Good agro-chemical efficiency and utilizing Personal Protective Equipment can help prevent over-use of chemicals, accidental chemical spills in the environment, and reduce human exposure to harmful chemicals.

Chemical Fertilizers

The soils of the Western Region are highly weathered, acidic and often leached of important plant nutrients for optimal crop growth. Farmers apply chemical fertilizers to offset naturally low nutrient concentrations in the soil. While there is no inherent danger in applying chemical fertilizers, bad management practices such as:

- Over-application,

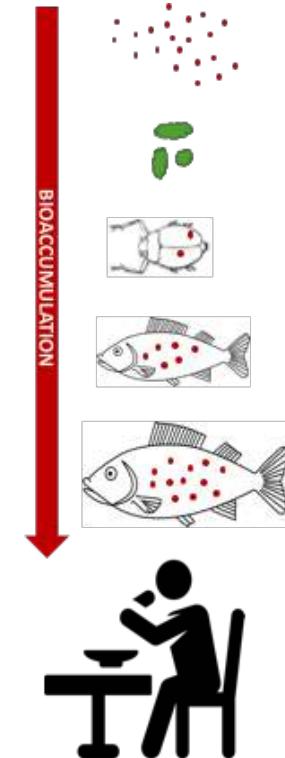


Figure 20) Basic Diagram of a pollutant bio accumulating in an aquatic food web

- poor timing,
- ineffective application techniques,
- using inappropriate chemical fertilizers,
- and improper storage of chemicals can lead to pollution of the surrounding environment.

Rainfall, irrigation, and ground water movement can transport excess chemical fertilizers into nearby streams and lakes and result in eutrophication. Eutrophication is a reduction or depletion of dissolved oxygen (DO) in surface waters caused by sudden blooms of algae in response to nutrient runoff. Eutrophication of freshwater can negatively impact the environment by killing fish and other aquatic life that local communities depend on for food (see Eutrophication).

Other Kinds of Pollution

Besides waste and chemicals, there are other kinds of pollution that can have a negative effect on the environment.

- **Sediment Pollution:** Sediment pollution is when a very large amount of sediment, clay, or dirt is mixed into the river. This sediment prevents light from reaching the aquatic plants, places stress on fish and other aquatic animals and degrades the quality of water for use by the community.

Galamsey mining, especially on or near rivers cause sediment on the riverbed to be disturbed and cloud the water, turning it brown. Sediment can also come from nearby land that recently been cleared for farming when heavy rains come and wash the fragile topsoil away.

- **Thermal Pollution:** Thermal pollution is a specific type of water pollution where wastewater that has been heated or cooled for industrial purposes is dumped into the environment. Wastewater that is too hot or too cold can dramatically and quickly change the temperature of the natural river or lake. This can cause damage to aquatic ecosystems and kill wildlife.
- **Noise Pollution:** Constant or very loud noises from blasting is considered noise pollution. This can be disturbing to many people and animals. If the noise, like blasting music, is near the bush, the noise can disturb and stress the animals.

- **Light Pollution:** Bright lights near to the bush can be distracting and disorienting to nocturnal (nighttime) animals. Some nocturnal animals can be confused or scared of the lights, stressing them.
- **Littering:** Waste disposal is a bad practice and can amount to pollution and serious environmental damage. But throwing garbage out the car window, or leaving it by the side of the road is littering. It makes the whole community look like a dump and degrades the beauty of the environment. Plastics will not simply decompose and disappear within our lifetimes. Any plastic that litters the environment and is not collected will be in the environment for many years.

Section 3: Green Economy

Environment, Society and the Economy

Understanding the relationship between the environment, society, and the economy.

Pre-teaching information

About this Module:

This module will introduce you to the Environment from a systems point of view. This will not address scientific or naturalistic aspects of the environment, but rather focus on how the environment encapsulates a society and economy, and the relationships between the environment, society and the economy.

This module is designed to teach a few key concepts:

- 1) The economy is the total of all the goods and services the business in the community. The Economy is part of a Society, and a Society is within an Environment.
- 2) All kinds of businesses depend on various natural resources to produce goods and services for society and the economy. Society and the economy can affect *how natural resources are used*.
- 3) Environmental outcomes from a Society and Economy producing goods and services can be positive or negative. Business owners, local, National, an International Governments, and Individuals can change negative environmental impacts.

Before you Begin:

This module works best when the instructor starts with a blank flipchart, or other visual demonstration method. Draw the following graphics (Fig. 1, 2, 3, 4) as you go, explaining each new component of the graphic piece by piece. This will help participants understand the material better and will serve as a visual reference for the following information in this lesson.

The Economy

The economy is the condition of a country or region in terms of the production and consumption of products (goods) and services, as well as the supply and flow of money. This includes all small-, medium- and large-scale enterprises in a community, district, or region depending on the scale of interest.

Economies can be local, encompassing only businesses nearby or businesses in a certain community. Economies can be regional, including many different local economies. Economies can be global, with entire nations trading goods and services. In any case, the 'Economy' is the goods and services, the businesses and laborers, and the money that is exchanged between them.

- 'Services' include might include driving, accounting, marketing, training Services, cleaning, hospitality, preaching, or other act or service.
- 'Goods' include items for sale, like food, gold and minerals, agricultural crops, commercial products, raw or finished industrial goods, etc.

The 'Economy' comprises all business, farms, or other enterprise. This includes all micro-, small-, medium-, and large-scale businesses. It is true that larger businesses have more influence on society or the environment, but even smaller businesses are part of a much larger whole (see Figure 21).

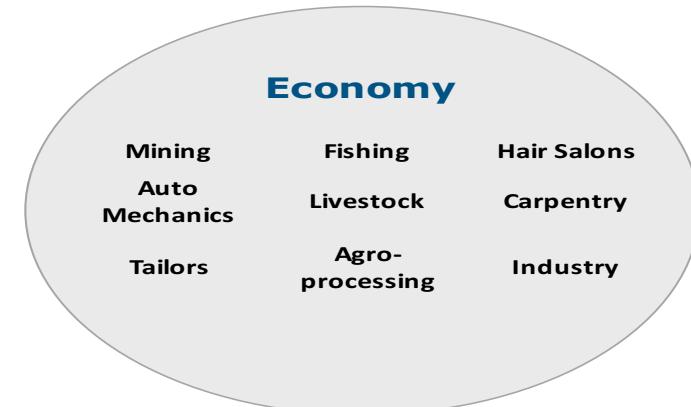


Figure 21) The economy is the total of all the goods and services the business in the community

Society

A society is made of many individual people and families living together in an orderly community or village. There are many important components to a society: Markets, Values, Science, Policy, Infrastructure, and Technology.

- Markets** – Markets are where buyers and sellers are together and can do business with each other.
- Values** – Values are what is important to an individual or business. Businesses value profits, good prices for their products and services, good relations with suppliers and consumers.
- Science** – Science and scientific discoveries allow new products to be created, technologies produced to improve business efficiency and connects businesses to consumers through the internet and digital communications.
- Policy** – Policies set by the government determine taxes, which businesses are supported for growth and which are not. Policies make it easier or harder for certain businesses to grow.
- Infrastructure** – Roads, electricity connection, internet, and water supply are all things that help an economy deliver products and allow a society and economy to function.
- Technology** – Machines and technological equipment help a business operate faster and with more quality control. They allow work to be done more efficiently and with less mistakes or errors.

Markets, Values, Science, Policy, infrastructure, and technology all come together in a society to allow an ‘Economy’ to develop and thrive. That is to say, without a society, there would be no economy. Similarly, changes to a societal component will affect how an economy functions, sometimes just for an individual or sometimes an entire community economy (see Figure 22).

**** An ‘Economy’ exists within and as a part of a ‘Society’.** **

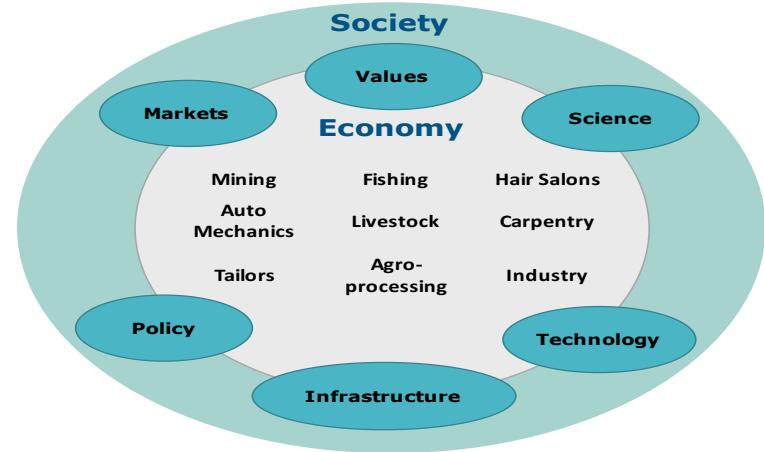


Figure 22) The economy exists within and as part of a Society. Societies include many aspects of governance, culture, technology, and markets.

Optional Engagement Question:

Ask the participants how **Markets, Values, Science, Policy, Infrastructure and Technologies** allow an economy to grow or develop or how the participants utilize or interact with any of the above categories in their business or enterprise

- **Answers:** Answers will vary but should involve how the participants interact with the components of a ‘Society’ and demonstrate the link to an ‘Economy’.
- **Changes to district policies** or law make it harder or easier to start a business or pay taxes.
- **New technologies or machines** make my job more efficient, easier, and faster.
- **Better roads and electricity** help me bring my products to the market to sell.
- People’s businesses pollute the environment because they don’t **value the environment and being sustainable**.

The Environment

An environment is any natural or man-made area. It is the location and setting for any society and economy to exist in. Societies grow and develop within and parallel to their environments, using natural resources like minerals, timber and freshwater to develop new settlements, new societies, and new economies.

Because Society and the Economy exist within an environment, they can influence the environment in many ways. Society depend on natural resources from the Environment, and the Economy distributes the natural resources to various sectors and businesses to create and manufacture any good or product for sale. These products circulate through Society, being used, eaten, processed, or resold, producing waste and using fossil fuels. Today, too much greenhouse gas emissions, destruction of important natural environments, and overusing natural resources is leading to very serious and dramatic changes to the Earth.

Changing global and local environments will force societies and economies to adapt. If there are changes to the environment, those changes will affect society and the economy. Without a healthy and productive environment, society and the

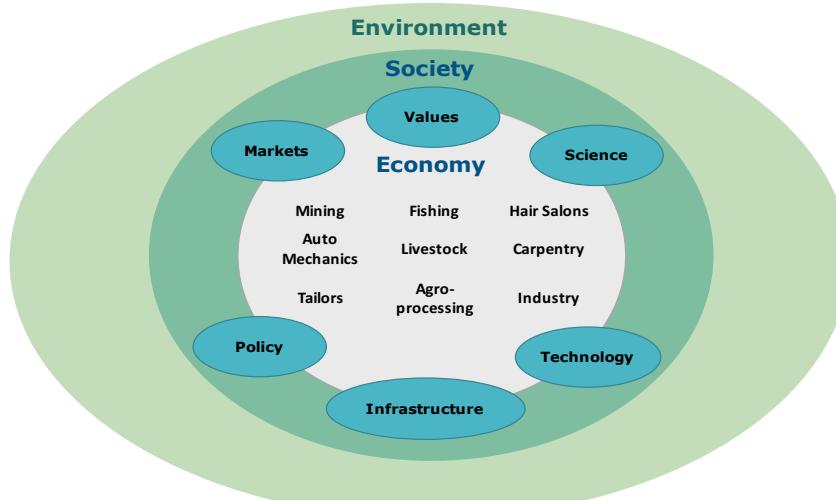


Figure 23) The Economy, Society and the Environment are within and a part of the Environment

economy wouldn't exist in the same way it does today. Climate change, land use change, and other environmental challenges are threatening the long-term sustainability of the environment, and its' capacity to support Society and the Economy (see Figure 23).

**** Societies and The Economy exist within an 'Environment, changes to the Environment will change Society and the Economy' ****

Natural Resources

Natural Resources are any natural materials that are used or collected from the environment and transported, processed, and re-sold through society and the economy as goods and services. These natural resources can be mined from the earth, harvested from the soil, cut from the forest or fished from the oceans (see Figure 24). For example:

- Manufacturing industries need mineral ore that must be mined;
- Carpenters and manufacturers rely on timber and wood from forests;
- Caterers and cooks rely on wood and fossil fuels for heating and energy;

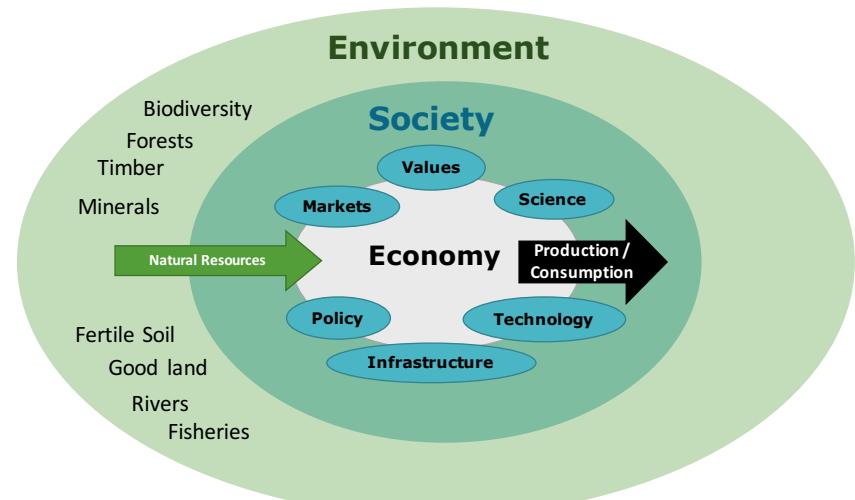


Figure 24) The Environment provides Natural Resources that the Economy and Society use to produce into goods and services for consumption.

- Fossil fuels like coal, gas, and petrol are mined from the Earth and used to generate electricity and power for cities, cars, and homes;
- Fish from the oceans and rivers are a major source for food for billions of people in the world, unsustainable fishing practices will deplete entire species of fish.
- Farmers need access to high quality land, plant nutrients, and water to produce commercial and household crops;
- Computers and phones that connect our businesses rely on many different metals and plastics made from rare earth minerals and fossil fuels.

Aside from natural resources that provide the inputs to the Economy, 'Beneficial Ecosystem Services' also play a vital role in keeping a functional society.

- Biodiversity** – the diversity of plants and animals in an environment. The diversity of plants and animals protects the environment from dramatic changes, provides many different plants for human uses.
- Fisheries and coastal areas** – Coastal areas with fish provide food and livelihoods for many people who live on the coast. Fish from the ocean are an important food for many people.
- Forests** and other natural environments can be spiritually or culturally important. Nature also provides spaces for people to relax and find peace in their daily lives. Forests help regulate local weather, safely store greenhouse gases in their plant material, provide habitat for thousands of plant and animal species; help regulate the circulation of plant nutrients in soil, and offer many different medicinal and spiritual plants.
- Wetlands** and low-lying swamps are important for regulating rain and floodwaters. They also naturally cleanse water of many different chemicals and toxins, storing them safely in the soils until the wetland is disturbed. Rivers are also a very important source of freshwater for all kinds of uses in businesses and houses.
- The Climate** and seasonal weather patterns are dependent on fragile environmental systems that mankind is changing. Changing weather will change the seasonal changes that make agriculture possible in much of Africa.

Markets, values, science, policies, infrastructure, technology in society and the economy determine how the natural resources are used by the economy. Policies can implement pollution thresholds and limits; communities can learn to value sustainability, encouraging better business practices; infrastructure like solar panels and renewable electricity systems can revolutionize communities' dependence on natural resources (See Figure 24).

**** All kinds of businesses depend on various natural resources to produce goods and services for society and the economy. Society and the economy can affect how natural resources are used****

Environmental Outcomes

The effects of Society and the Economy on the Environment are Environmental Outcomes. Environmental Outcomes aren't always, but unsustainable practices, and irresponsible use of natural resources will have consequences. However, practicing sustainability as an individual, household, business, community or society can lead to improving the condition of the environment.

Environmental outcomes describe what happens to an environment after natural resources are used. These can be positive environmental outcomes, meaning good things for the environment, or negative environmental outcomes.

Positive Environmental Outcomes:

- Recycling businesses remove plastic pollution from the community environment.
- Treating waste products, or finding ways of reprocessing waste products from the business reduces waste pollution;
- Replanting two new trees for every tree that is cut will ensure forests will survive in the long-term;
- Rehabilitating land for mining by replanting plants along riverbanks and slopes will prevent soil erosion and encourage the return of animals;

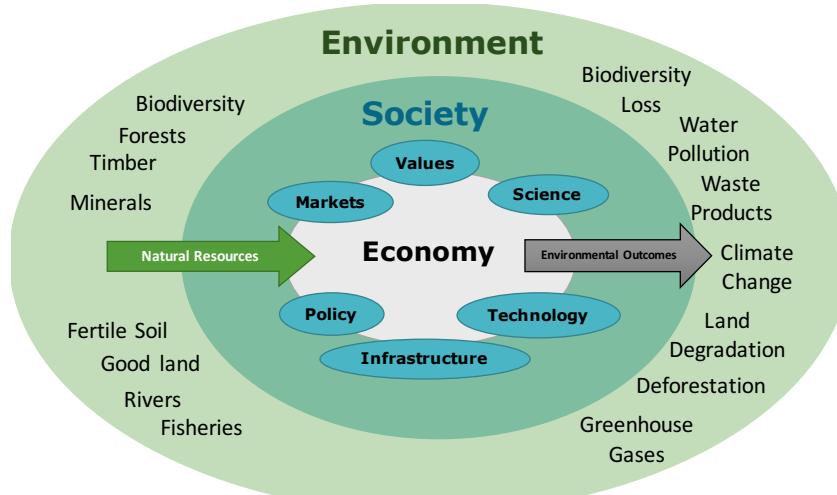


Figure 25) Environmental outcomes are the impacts that a Society and Economy has on the Environment

Negative Environmental Outcomes:

- Small-scale miners destroy forests and farm land during mine operations;
- A palm oil mill lets the Palm Oil Mill Effluent run into the river without treatment;
- Carpenters buy trees from a saw miller that does not replant trees after cutting;
- Mechanics burn old batteries and motor oil, releasing toxins into the air and environment;
- Large-scale fishing operations over harvest a fish colony, diminishing its ability to restore itself

In Ghana and globally, many negative environmental outcomes have already been caused by society and the global economy. Many of these challenges will affect the whole planet, regardless of whether a country has contributed to the environmental outcomes (see Figure 25).

Optional Engagement Question:

Have the participants reflect on how different parts of **Society or the Economy** affect the **Environment**. Consider the following:

- How can District policies and resource management affect resource use and environmental outcomes?
- What kinds of business by-products, like waste and pollution, can affect the environment?
- How does an individuals' values in business like caring for the environment and sustainable business practices, affect the environment?
- How can the 'market' (as in the global assemblage of buyers and sellers) affect the environment?
- What kinds of technologies are used in the economy that produces more or less pollution or waste, can these technologies reduce negative environmental outcomes?

The Environment, Society, and the Economy – Key Lessons

1. The economy is the total of all the goods and services the business in the community. The Economy is part of a Society, and a Society is within an Environment.
2. All kinds of businesses depend on various natural resources to produce goods and services for society and the economy. Society and the economy can affect *how natural resources are used*.
3. Environmental outcomes from a Society and Economy producing goods and services can be positive or negative. Business owners, local, National, an International Governments, and Individuals can change negative environmental impacts.

The Green Economy

Pre-teaching information

About this Module:

The 'Understanding the Green Economy' Module incorporates Green Economy into what participants have learned about the environment, society, and the economy. This module is designed to teach the following key concepts:

- A Green economy incorporates three components: **Building Social Equality, Improving Human Well-Being, and Reducing Environmental Risks;**
 - Building Social equality includes **equity between men and women, and the youth;**
 - Improving human well-being includes improving the **environment, incomes, and living conditions** for everyone in the community;
 - Reducing Environmental Risks means **preventing damage to the environment** like pollution and degradation, and **improving resource efficiency.**
- These **three components** must be incorporated into the Economy, Society, and the Environment for a Green Economy to grow and be successful.

Before you Begin:

This module works best when the instructor starts with a blank flipchart page. Draw the following graphic (pg. ##) as you go, explaining each new component of the graphic piece by piece.

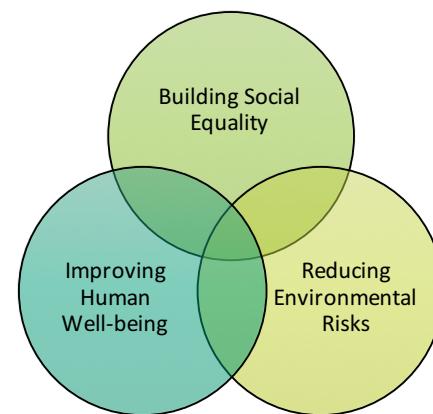
****This module also uses the graphic from: The Environment, Society, and the Economy.****

An Introduction to the Green Economy

Green Economy emerged from the United Nations Conference on Sustainable Development Rio +20 (2012) and has become a globally important strategy for sustainable development. The Green Economy is a conceptual framework to coordinate the actions of International, National, Regional, and local Governments, businesses, and individuals towards a more sustainable future

The goal is to incorporate sustainable development strategies to accomplish national development agendas, by actively repairing and restoring the environment and limiting environmental damage. Like with 'Development', Green Economy seeks to improve the livelihoods of the poor and marginalized in society. Simply put, the Green Economy has three main outcomes for an economy, society, and environment (see Figure 26, 27):

- **Building Social Equality** between women and men; building opportunities for the youth; improving incomes for the poor.
- **Improve Human-well-being** and creating healthier living areas for people; using natural resources sustainably so the next generation can use them.
- **Reducing Environmental Risk** –preventing deforestation; Reducing pollution in the environment; recycling waste products instead of dumping.



"A Green Economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities"
-United Nations Environmental Program (2011)

Figure 26) The three outcomes of The Green Economy.

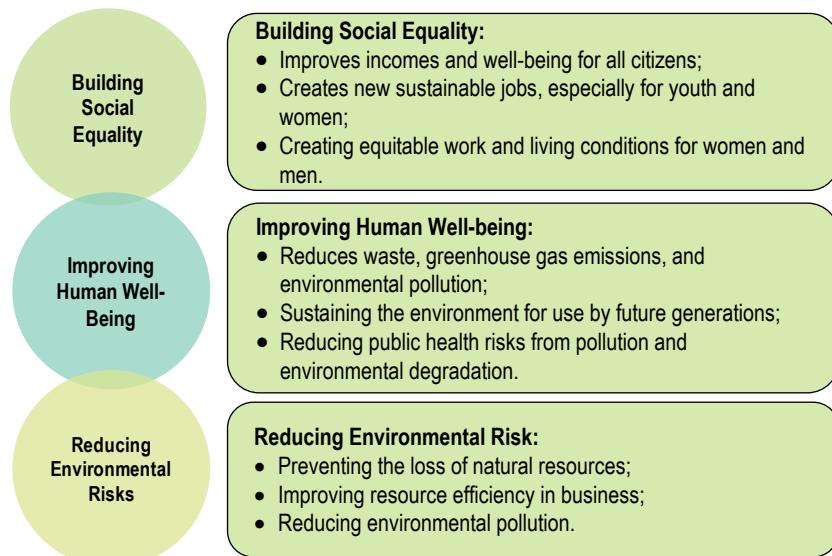


Figure 27) Building social equality, improving human well-being, and reducing environmental risks, are all part of a Green Economy.

Green economy is different than just 'Sustainability' or 'Economic growth.' Though these are important parts of what a Green Economy seeks to accomplish, a Green Economy is about holistic growth that appeals to society, the environment and the economy (See Figure 27).

Ghana, as well as many other Nations have begun to understand the pressing nature of climate change, and the immediate need for more sustainable economies, societies, and environments. Establishing and supporting the Development of a Green Economy requires cooperation from all levels of government, from businesses and enterprises of all sizes, and from individuals in their unique capacity.

Principles of Green Economy

The Green Economy Coalition, established in 2012 the Nine Principles of a Green Economy in collaboration with NGOs, research institutions, UN organizations, businesses and trade workers' associations. (Green Economy Coalition, 2012). These Nine Principles outline the most important aspects of cultivating a Green Economy:

The Sustainable Principle – A green, fair, inclusive economy is a means to deliver sustainable development. A Green Economy addresses all three dimensions (environment, society, economy) and develops policies and solutions that seek the best results across all of them.

The Justice Principle- A green, fair and inclusive economy supports equity between countries and generations. Green Economy respects human rights and cultural diversity, supports gender equality, and respects the rights of indigenous people to land, territories and resources.

The Dignity Principle – A green, fair and inclusive economy creates genuine prosperity and wellbeing for all. A Green Economy alleviates poverty, provides food security and universal access to basic health, education, sanitation, water, energy, and other essential services. This includes providing dignified self-empowerment and education of women, and recognizing the contributions of unpaid work.

The Earth Integrity, Planetary Boundary and Precautionary Principle A green economy restores lost biodiversity, invests in natural systems, and rehabilitates those that are degraded. It recognizes the dependency of society on the environment and does not overstep ecological boundaries. This includes reducing pollution, increasing efficiency, respecting all forms of life, applies the precautionary principle, and promotes balance between ecological and social relations.

The Inclusion Principle – A green economy is inclusive and participatory in the decision-making process, incorporating transparency, sound science and engagement of relevant stake holders. It empowers citizens and promotes tolerance of all religious views and lifestyle choices. Green Economy gives equal opportunity to, and advocates for the rights of, women and men, poor and low skilled workers, indigenous peoples and ethnic minorities.

The Good Governance and Accountability Principle – A green economy is accountable to citizens and stakeholders. It upholds transparent governance, international human rights standards and environmental agreements.

The Resilience Principle – A green economy contributes to economic, social, and environmental resilience. It supports the development of social and environmental protection systems, and adaptation for extreme climate events. It promotes sustainable and diverse economies suited to local skills, capacity, and context.

The Efficiency Principle – A green economy incorporates sustainable consumption and production, incorporating the true costs of social and environmental externalities. It prioritizes renewable energy and renewable resources, supports a polluter pays principal for businesses, and promotes zero waste and resource efficient business models.

The Intergenerational Principle – A green economy invests for the present and the future. This means promoting conservation of resources and the quality of life in the long term. This requires long-term, scientifically-sound decision making, and equitable education at all levels for children.

Incorporating Green Economy

For a Green Economy to grow and benefit communities, new markets, values, science, policies, infrastructure, and technologies must be incorporated into the Economy, Society, and the Environment.

In an Economy

- Building social equality means working to improve incomes and profits for businesses and creating new and sustainable jobs that men and women can work in without discrimination;
- Decreasing waste from business, improving sustainable natural resource use, and protecting the environment from negative effects of business can save the planet for our children, improving their human well-being;

- Preventing pollution from the business, using more efficient practices to reduce resource consumption, and practicing good environmental practices can reduce environmental risks and improve the natural environment

In a Society

- District Assemblies and community organizations can incorporate new policies and planning to sustainably develop communities;
- Businesses can encourage new job creation in sustainable industries, and train employees in good and sustainable practices in the business;
- Incorporate new values into society like preventing illegal and indiscriminate refuse dumping, and cleaning the environment for future generations;
- Build new infrastructure to facilitate a growing Green Economy, like access to solar panels for electricity, or natural biogas for fuels.

In an Environment:

- Incorporating new science into community planning, to plan for climate change can protect society from changes and hardship;
- Promoting businesses to take active steps to repair the environment, like planting new trees, cleaning up rubbish and trash, and practicing legal and environmentally good waste management practices;
- Develop new markets for sustainable products, like bamboo crafts, that are not destructive for the environment and natural resources.

**** For a Green Economy to be successful, businesses, governments, and citizens must incorporate new values, technology, science, policies, and infrastructure into the economy, society, and the environment****

Supporting a Green Economy

Optional Engagement Activity: (30-minute group activity)

Have the participants reflect on what Reducing Environmental Risk, improving human well-being, and building Social Equality means for the economy, society, and the environment.

You can divide the participants into three groups:

- 1) How can businesses incorporate the three components of Green economy (Improving social equality, improving human well-being, and reducing environmental risks) into the '**Economy**'?
- 2) How can businesses incorporate the three components of Green economy (Improving social equality, improving human well-being, and reducing environmental risks) into '**Society**'?
- 3) How can businesses incorporate the three components of Green economy (Improving social equality, improving human well-being, and reducing environmental risks) into '**The Environment**'?

Allow each group 10-15 minutes to discuss the question and present a three part answer, explaining what they see as the Economy/society/environment and their ideas of how a business can incorporate 'building social equality, improving human well-being, or reducing environmental risks.

Groups may be provided with a large sheet of paper or other communication material to aid their explanation to the group.

****Presentations should last about 3-5 minutes each for a total activity time of 30 minutes.****

For the instructor: Pre-Teaching Information

About this Module:

This module, 'How to Support Green Economy' is designed to inform participants of a few ways that Businesses, Governments and District Assemblies, and Communities and Individuals can support the growth and development of a Green Economy.

This module is designed to teach the following key concepts:

- Green Economy must be supported by **Businesses, Government and District Assemblies, and Communities and Individuals**
- **Businesses** can support Green Economy by incorporating green practices and products.
- **Governments and District Assemblies** can support Green economy through policy planning and supporting sustainable practices, education, and businesses.
- **Communities and Individuals** can support Green Economy by incorporating sustainability in the home, participating in DA meetings and consultations, and supporting green businesses.

This module works best when the instructor starts with a blank flipchart page or (if possible). Draw the following graphic as you go, explaining each new component of the graphic piece by piece. This will help participants understand the material better.

For a Green economy to develop, Businesses, Governments and District Assemblies and Communities and individuals all can contribute to growing a Green Economy. Cooperation between these three groups is important for green growth (See Figure 28).

- **Businesses** rely on individuals and demand for certain products when deciding what to sell and how to produce different products. Government policies can support or hinder the development of sustainable businesses.
- **Governments and District Assemblies** can support policies that protect natural resources from degradation, support green businesses that are starting, inform communities of sustainable practices, invest in green infrastructure.
- **Communities and Individuals** can support green businesses by buying from businesses that practice sustainability, by disposing of household waste in sustainable ways, and petitioning the local government to support Green Economy.

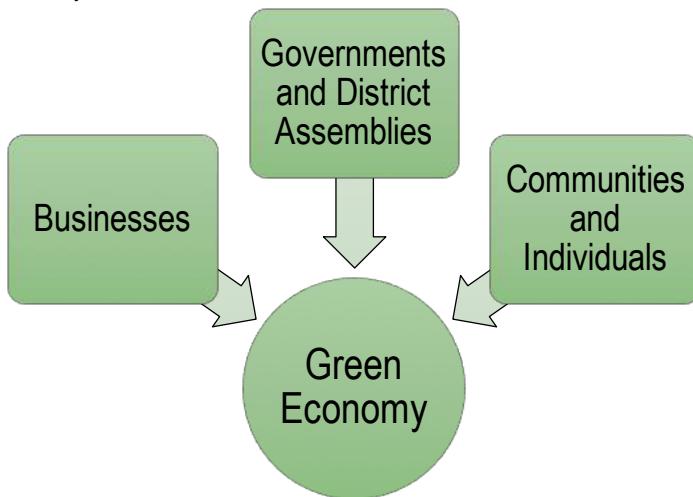


Figure 28) Green Economies need the support of Businesses, local governments, and communities and individuals to grow and be successful.

Business and Green Economy

- **Integrating new values** into business like environmental sustainability and resource efficiency. Businesses should value being sustainable just as much as economic growth and profit. Business owners should be proud of making their business green and environmentally friendly
- **Reducing waste** from the business and protecting the environment from hazardous and toxic waste Businesses should find ways of re-using and reducing waste. This keeps the environment from being polluted when the waste is dumped and can provide additional sources of income.
- **Incorporating new science and technology** into the business to make it more sustainable and efficient. Incorporating new technologies into the business, or creating new side businesses can be an effective way of reducing waste and improving incomes. New jobs for women and youth can be created which will grow the economy.
- **Developing new markets** for sustainable products and services. When new technologies and business are developed, the markets for new products will develop too. The products from these new businesses can be sold to other businesses to create new opportunities.
- **Petition the government** to support Green Economy and invest in Green Infrastructure Speak with local politicians to encourage them to support Green Economy and green investment for the community.

Optional Engagement Question:

Have the participants suggest an example or an idea about one of the following:

- A new technology in a business that can reduce waste or increase efficiency;
- A new market that can be developed for sustainable products;
- New values that a business can incorporate into its operations (like sustainability/ being green).

Answers will vary, but should focus on using the concepts of Values, markets, technology, infrastructure, and policies (Lesson 1) and todays lesson about growing a green economy.

Governments, District Assemblies and Green Economy

- Incorporating sustainable policy and planning into district development agendas. It's important that governments work towards long-term sustainability by planning for sustainable growth.
- Investing in green Infrastructure like solar panels, clean energy, transportation, agric and environmental extension support, and waste management. This kind of investment can support businesses and individuals to incorporate their own green practices.
- Coordinating and cooperating with private businesses to support green growth, especially mining companies who contribute to the economy of the region. Coordinating with businesses, collecting taxes and supporting policies that help businesses incorporate sustainable business practices, can be an effective way to grow a green economy.
- Providing education about the environment, sustainability, and green practices supports entrepreneurs to incorporate environmental considerations into their lives and businesses.

Communities and Individuals and Green Economy

- Ensuring that children go to school and better their education can be a way to ensure that they receive knowledge to better their lives and environments. If individuals also petition for environmental education can ensure that children receive a proper environmental education.
- Participating in Government decisions, attending District assembly meetings, and voicing concerns about the environment and Green economy encourages the District Assemblies to make sustainable decisions. If you don't speak up, the government can't listen.
- Practicing sustainability in the home by purchasing sustainable products and properly disposing of household waste can develop a culture of good environmental practices in the community. Being a good example to neighbors helps build a green economy.
- Encouraging family and friends to purchase products from sustainable businesses can create new markets for green products and encourages people to continue to incorporate sustainable practices into their businesses.

Optional Engagement Question:

Ask the participants why it is important to ensure children go to school in order to support a Green Economy. Ask the participants what role children have in helping a Green Economy grow.

→ Answers will vary, but should focus on how children are the future generations who will have to live with the consequences of today's actions. Children need to be educated about the economy, society, and the environment to better prepare for a changing world.

Supporting a Green Economy - Key Lessons

- Green Economy must be supported by **Businesses, Government and District Assemblies, and Communities and Individuals**.
- **Businesses** can support Green Economy by incorporating green practices and products.
- **Governments and District Assemblies** can support Green economy through policy planning and supporting sustainable practices, education, and businesses.
- **Communities and Individuals** can support Green Economy by incorporating sustainability in the home, participating in DA meetings and consultations, and supporting green businesses.

Section 5: Additional Resources

Books <ul style="list-style-type: none"> Green Economy UN - A Guidebook to the Green Economy https://sustainabledevelopment.un.org/content/documents/GE%20Guidebook.pdf Green Economy Coalition http://www.greeneconomycoalition.org/ UN Green Economy Scoping Study – Ghana http://www.un-page.org/files/public/ghana_ge_scoping_study_low_res.pdf UN Green Economy Fiscal Policy Analysis – Ghana http://www.greengrowthknowledge.org/sites/default/files/downloads/resource/Green_Economy_Fiscal_Policy_Analysis%20_Ghana_UNEP.pdf UN Green Economy Assessment Report – Ghana http://www.un-page.org/files/public/ge_ghana_assessmentreport_web.pdf Green Economy and Sustainable Development: Bringing Back the Social http://y2u.be/O5IBwrJcUOk 	Online Resources <ul style="list-style-type: none"> Climate Change The Human Impact of Climate Change: Personal Stories from Somalia, Ghana, and Kenya http://y2u.be/Bg9GXLoLpiQ Climate Change Explained http://y2u.be/lfHogDujXw 	Online Resources <ul style="list-style-type: none"> National Climate Change Adaptation Strategy – Ghana, UNEP and UNDP http://www.adaptation-undp.org/sites/default/files/downloads/ghana_national_climate_change_adaptation_strategy_nccas.pdf Climate Change, Effects and Impact on the Ghanaian Economy, Ghana Web (Sept 30, 2014) https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Climate-Change-Effects-and-Impact-on-the-Ghanaian-Economy-328061 Effects of climate change on forests in Africa: Why Ghana must protect her forest cover, Government of Ghana http://www.ghana.gov.gh/index.php/media-center/features/2633/effects-of-climate-change-on-forests-in-africa-why-ghana-must-protect-her-forest-cover
Online Resources <ul style="list-style-type: none"> Growing Green Economies http://y2u.be/m9AS6KT7a5Y Green Economy - A Tool for Sustainable Development http://y2u.be/0uR3mil-voY 	Videos <ul style="list-style-type: none"> Farming with compost in Africa (Ghana) http://y2u.be/yM0HMI3qWHA Quick compost for west Africa http://y2u.be/Um07cEViUFU Black Gold: The Secrets of Compost, Garden Africa http://y2u.be/byNnJ1KRWDU 	Videos <ul style="list-style-type: none"> Composting
Videos <ul style="list-style-type: none"> Deforestation in Ghana http://y2u.be/do7Kkvgx1zk Deforestation Effects on Climate https://youtu.be/Nc7f5563azs Deforestation 	Videos <ul style="list-style-type: none"> Deforestation in Ghana http://y2u.be/do7Kkvgx1zk Deforestation Effects on Climate https://youtu.be/Nc7f5563azs Deforestation 	Wikipedia <ul style="list-style-type: none"> Deforestation

		Environmental Cycles	Greenhouse Gases
Wikipedia		https://en.wikipedia.org/wiki/Biogeochemical_cycle	EPA Webpage
	The Water Cycle	http://y2u.be/al-do-HGulk	Videos
Videos	The Carbon Cycle	http://y2u.be/nzImo8kSXiu	
	Nutrient Cycles	http://y2u.be/L2yb1ERU9p4	
		Eutrophication	Soil Degradation and Conservation
Wikipedia		https://en.wikipedia.org/wiki/Eutrophication	UN FAO Webpage
	Eutrophication explained	http://y2u.be/KJ6QijuAPuU	Videos
Videos	What Is Eutrophication	http://y2u.be/6LAT1gLMPu4	
		Land Use Change	Waste and Pollution
Wikipedia		https://en.wikipedia.org/wiki/Eutrophication	UN FAO Webpage
	How Does Land Use Change Affect It? - The Water Cycle	http://y2u.be/-xNP2Y6Sr0Q	Videos
Videos	The Effects of Land Use on Ecosystems	http://y2u.be/dRVHm3jvsQo	

		Note Page
Videos	Pollution Non-point source and Point Source http://y2u.be/RVkHwV39BFs	
	Understanding Bioaccumulation http://y2u.be/fdTV3F9k1A	
	The Unintended Consequences of Pesticides http://y2u.be/p2xR5EK8m7I	
	Recycling in Accra: Ghana's 'waste to wealth' ambition http://y2u.be/dxD4FqRBJVQ	
	Making profit from plastic waste collection & recycling in Ghana http://y2u.be/k-K5psKRzyE	
Online Resources	Fuel Briquette Making	
	Briquette Making Demonstration for small scale entrepreneurs: http://y2u.be/ft1dkSRIKQk	
	How to make charcoal briquettes from agricultural waste: http://y2u.be/Lql63IEg3MM	
Books	Fuel from the fields: Charcoal from Agricultural Waste: https://ocw.mit.edu/courses/edgerton-center/ec-711-d-lab-energy-spring-2011/wind-micro-hydro/MITEC_711S11_read5_fuel.pdf	
	A review on production, marketing and use of fuel briquettes. Asamoah, B.; Nikiema J.; Gebrezgabher, S.; Odonkor Njenga, M. 2016. <i>A review on production, marketing and use of fuel briquettes.</i> Colombo Sri Lanka; International Water Management Institute (IWMI) CGIAR research Program on Water, Land and Ecosystems (WLE). 51p. (Resource Reuse and Recovery Series 7) doi: 10.5337/2017.200	

Note Page