

Workplace Environmental Management

WEEK 5 – Rwanda's Natural Environment

University: Rwanda Polytechnic – IPRC Tumba

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Objectives

At the end of this topic students will be able to:

- Understand the Environment of Rwanda in general
 - Understand the components Rwanda's Natural Environment with the following considerations:
 - ✓ Relief
 - ✓ Climate
 - ✓ Vegetation
 - ✓ Hydrology
 - ✓ Wetlands
 - ✓ Forests
 - ✓ Protected areas.
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5.0 The overview of Rwanda

- Rwanda is a country located in Africa continent.
 - It is in Central Africa between latitudes 1°04' and 2°51' south and longitudes 28°45' and 31°15' east.
 - Rwanda's surface area is 26,338 km².
 - The average population as of 2022 was estimated to be around 14 million of people at a growth rate of 2.3% (2022 General Population Census of Rwanda, National Institute of Statistics of Rwanda, Government of Rwanda, 2022.)
 - Rwanda is a hilly country also called “a country of thousand hills” with so many mountains at an altitude averaged to 1700 meters above sea level with the highest mount Kalisimbi at 4507 meters above the sea level.
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5.0 The overview of Rwanda cont'd

- Rwanda has four seasons namely short and long rain season and short and long sun season.
 - Rwanda neighbors four countries: Burundi in south, DR Congo in West, Uganda in North and Tanzania in East.
 - The country is landlocked and the population survives by agriculture activities.
 - The country had a sad story of Genocide against Tutsi in 1994 where more than 1 million were killed.
 - The environment of Rwanda that we are going to discuss in this session is mostly after 1994 though some other facts may enrich our discussion.
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5.0 The overview of Rwanda cont'd

- Rwanda's major problem related to the environment is the fast-growing population which affect the natural resources like land water and others.
 - Some of the results being land degradation, soil erosion, decline in soil fertility, deforestation, wetland degradation, loss of biodiversity and in the end; pollution.
 - The above dictates the evaluation towards sustainable development while conserving the natural environment of the country with the following few listed measures: environmental policies, environmental impact assessments for new activities, and many more.
 - To this end, the goal being to link biophysical and socio-economic considerations.
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5.1 Rwanda' Relief

- The term relief may be defined as “the variations in elevation and slope of an area of the Earth’s surface”.
 - Rwanda’s relief is characterized by its hilly and mountainous terrain, with an average altitude of around 1700 meters.
 - The highest point is Mt. Karisimbi, standing at 4507 meters above sea level.
 - Rwanda is often called the “country of a thousand hills” due to its varied topography, with altitudes ranging from 900 m to 4507 m.
 - The Rwandan relief is characterized by high altitude, which decreases towards the western and eastern extremities.
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5.1 Rwanda' Relief cont'd

- The eastern part of the country is flat with altitude below 1500 meters.
 - Rwanda's relief provides mild and cool climate influenced by its altitude.
 - Rwanda is divided into 6 physiographic regions namely: Congo-Nile Crest, central plateau, Eastern plateau, volcanic region (Birunga), rift valley and Bugarama plain. (Does the global warming modify the local Rwandan climate?, S. M. Henninger, *Nat. Sci.*, vol. 5, 2013.)
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5.1.1 Congo-Nile crest

- The Congo-Nile crest is a highland that divide between the waters of river Congo to the west and waters of river Nile to the East.
 - It is an extensive area of about 160 km in length (from north to south) and 20 to 50 km wide. It is found in one part of Nyamagabe, Karongi, Rutsiro and Nyabihu districts and all the Ngororero and Nyaruguru districts.
 - It lies between altitude of 1200 m (pass or col of Rugabano) in Karongi, the lowest point and 3000 m found at mount Muhungwe in Nyabihu District which is the highest point non-volcanic above the sea level.
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5.1.2 Central plateau

- The central plateau is also known as high plateau. It is higher in Northern Province where it is called the highland of Buberuka with altitude between 2000 and 2500 m (Gicumbi and Burera). This region moves from the Eastern slope of the Congo Nile Crest up to the border of Kigali.
 - It covers areas such as Kamonyi, Muhanga, Nyanza, Ruhango, Huye, Gisagara, Rulindo, and Gicumbi.
 - In this region, the landscape is characterized by flat topped hills that are separated from each other by a wide range of river valleys.
 - It lies between altitudes 1500 to 2500 m above the sea level, and it covers more than half of the country (over 80 km wide).
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5.1.3 Eastern plateau

- This relief region neighbors the central plateau extending in all the Eastern Province of Rwanda up to Uganda and Tanzania frontiers.
 - The eastern plateau is also called low plateau.
 - The lowland areas found in this part are largely dominated by marshes, rivers and lakes.
 - Several small hills with flat and elongated tops with gentle slopes are also the main distinct features in this region.
 - The region has an altitude varying between 1000 and 1500 m above the sea level.
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5.1.4 Volcanic region / Birunga region

- The volcanic region as suggested by its name, it is associated with the presence of volcanic ranges, hence the name volcanic region.
 - This region covers about 90 kilometres from north to west including the highland areas in the north in Gicumbi District. This region is found in the Northwest of Rwanda and lies between 3000 to 4507 m above the sea level.
 - This region extends in Eastern part of DR Congo and Southwest of Uganda creating a beautiful scenery chain of volcanoes.
 - Some volcanoes are still active; others are dormant while others are in extinct state. (Parc national des volcans. Plan de zonage, G. Rwanyiziri and E. Kayijamahe, 2005, page 1–135.)
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Major volcanoes in Rwanda

- **Karisimbi (4507 m)** is classified as a complex volcano and the highest of all volcanoes in Rwanda having crater lake of about 120 m in diameter, crystals that resemble shells hence the name Karisimbi which means white shell.
 - **Bushokoro/Bisoke (3711 m)** is a complex volcanic cone. Due to its past volcanic activity, it is classified as dormant volcano, and it has the biggest Crater Lake among volcanoes in Rwanda.
 - Bisoke and Karisimbi are volcanoes which are found in the boundary between Rwanda and DR Congo.
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Major volcanoes in Rwanda cont'd

- **Sabyinyo (3634 m)** presents at the top necks of resistant rocks that resemble teeth hence the name Sabyinyo due to its slopes and crater have been badly eroded by surface run off and streams.
 - Sabyinyo is the oldest and most extinct of all the volcanoes in Rwanda. It lies on the border between Uganda, DR Congo and Rwanda. It doesn't have any crater lake. The slopes of Mount Sabyinyo are habitat to the endangered mountain gorillas.
 - **Gahinga (3474 m)** this volcano lies between Muhabura and Sabyinyo. It is one of the smallest and the dormant volcano in Rwanda and estimated to be the smallest in the Virunga chain. This volcanic mountain is situated on the border of Rwanda and Uganda. It is known that at the peak there is a swampy caldera measuring about 180 meters wide. It has got a small crater lake.
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Major volcanoes in Rwanda cont'd

- **Muhabura, standing at 4,127 m** above sea level makes it the second highest mountain in all five mountains of Birunga mountain ranges behind Karisimbi Mountain.
 - Muhabura is the most visible volcano throughout the whole of Rwanda especially when the sky is clear.
 - This volcano is the youngest of all the volcanoes in Rwanda.
 - It is a dormant and has a crater lake of about 100 m in diameter.
 - It is found on the border between Rwanda and Uganda.
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The views taken by NSHIMIYIMANA Arcade



5.1.5 The rift valley region

- A rift valley is a linear shaped lowland between several highlands or mountain ranges created by the action of a geological fault. Rift valley is found in the west and Southwestern part of Rwanda.
 - It contains Lake Kivu, the biggest Lake of Rwanda. The depression /rift valley or graben is practically surrounded by the highland with the steep slopes. The rift valley lies between 1460 m and 3000 m of altitude.
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5.1.6 The plain of Bugarama

- It is the lowest and hottest area of the country lying on altitude of 900 m above sea level. This plain is made up of sedimentary rocks located in the extreme Southwest of Rwanda.
 - This means that this plain exists on the old alluvial deposits of sedimentary rocks laid down by sediments from river Rusizi and its tributaries like river Rubyiro.
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5.2 Climate of Rwanda

- The climate is defined as the average weather conditions of an area in terms of temperature, atmospheric pressure, wind direction and wind speed, moisture, cloudiness and precipitation.
 - Due to its high altitude, Rwanda enjoys a tropical temperate climate.
 - The average annual temperature ranges between 16 and 20° C, without significant variations. Winds are blowing with a speed of 1-3 m/s.
 - Rwanda's climate varies with altitude, resulting in different climate zones across the country.
 - The lower-lying areas have a warmer climate, while the higher altitudes are cooler.
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5.2 Climate of Rwanda

- The mountainous regions, such as the Virunga Mountains in the northwest, experience cooler temperatures and more rainfall.
 - Climate change is a major driver of environmental change and poses a serious challenge to future economic development.
 - Rwanda has a unique climate influenced by its elevation and geographical position. The country's climate is generally temperate, characterized by mild temperatures and two distinct rainy seasons alternating with two dry seasons. (Rwanda's Climate : Observations and Projections, R. McSweeney, M. Cole, J. N. Semafara, and R. Washington, no. July, p. 32, 2011.)
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5.2 Climate of Rwanda cont'd

- **Temperature:** Due to its high altitude, Rwanda enjoys relatively mild temperatures throughout the year. The average temperature ranges from 14°C to 27°C (57°F to 81°F), with cooler temperatures experienced at higher altitudes, particularly in the mountainous regions. (Climate Risk Country Profile: Rwanda, W. B. Group, Rwanda, 2006.)
 - **Rainy Seasons:** Two rainy seasons: long rainy seasons from March to May and the short rainy season from October to November characterized by frequent and heavy rainfall, which is vital for the country's agriculture.
 - **Dry Seasons:** Occurring from June to September and from December to February. During these periods, the weather is generally dry, with sunny days and cooler nights. These seasons are ideal for outdoor activities and tourism.
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5.3 Vegetation of Rwanda

- Natural vegetation refers to the plants that grow in a given area without human influence. This type of vegetation is not planted, they grow on their own.
 - The specific examples of natural vegetation in Rwanda include Nyungwe Forest, Gishwati Forest, Mukura Forest, Birunga Bamboo Forest and moorland as well as Akagera grasslands.
 - The natural vegetation cover in Rwanda occupies about 15% of the general land area leaving the remaining part of the land area of the country under other activities such as farming and different socio-economic activities.
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5.3 Vegetation of Rwanda cont'd

- The natural vegetation in Rwanda is represented by:
 - Around lake Kivu is found lush mediterranean vegetation.
 - Birunga region has bamboo, moorland, and small patches of forests.
 - Akagera national park contains savana woodlands, bushlands, grasslands, acacia among others
 - Nyungwe, Gishwati and Mukura Forests have montane forest with various tree species.
 - Eastern region frequents low altitude savana, swamp and grasslands.
 - Wetlands are found in Akagera, Akanyaru and Lake shores with special vegetation.
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Pictures taken by NSHIMIYIMANA Arcade during a visit for a student in Industrial Attachment (on the left) and during a retreat (on the right).



5.4 Hydrology of Rwanda

- Country of Rwanda is characterized by its hilly and mountainous terrain, which greatly influences its hydrology.
 - The country's hydrology is shaped by its rainfall patterns, topography, rivers and lakes.
 - Rwanda hydrological network is divided into two main river basins: Nile Basin covering 67 % of the Rwandan territory and draining 90 % of the country's waters and the Congo basin covering 33 % of the Rwandan territory and draining 10 % of the country's water.
 - The pluviometry varies between 800 and 2000 mm per year with 1200mm in average. (Hydrological Monitoring in Rwanda, Rwanda Water Resource Portal, 2019.)
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5.4 Hydrology of Rwanda cont'd

- Water resources monitoring networks are capturing hydrological data from rivers and lakes (Discharge, Water level fluctuation, water velocity); Lake Kivu, Bulera and Mugesera lakes and other small lakes in eastern province Ground water are in the exercise of continuous monitoring.



5.4 Hydrology of Rwanda

Rainfall Patterns: The average annual rainfall ranges from 800 mm to 2000 mm, with higher rainfall amounts in the western and northwestern regions due to orographic effects. The two rainy seasons, contribute significantly to the country's water resources.

Topography and Drainage: The hilly and mountainous terrain influences drainage patterns. The country's rivers and streams flow from the mountainous regions towards the low-lying areas and eventually drain into the major lakes, including Lake Kivu and Lake Victoria.

Rivers: The major rivers include the Akagera, which forms part of the eastern border with Tanzania, and the Nyabarongo, which is the longest river countrywide. They play a crucial role in providing water for irrigation, hydroelectric power generation, and domestic use.

5.5 Wetlands in Rwanda

- Wetlands play a vital role in maintaining water resources and are part of the green infrastructure of healthy catchments.
 - They protect water quality, maintain water supplies by replenishing rivers and streams during the dry season, and more importantly, reduce the risk of flooding, sequester carbon and play many critical roles in Rwandan ecosystems.
 - In addition, Rwandan wetlands offer habitat for a vast array of biological diversity that cannot survive elsewhere.
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5.5.1 Wetlands status in Rwanda

- Wetlands are classified according to characteristics such as soil type, vegetation, hydrology and climate zone. Approximately 10.6% of Rwanda's surface area is covered with wetlands.
 - The biggest wetlands are floodplain wetlands of low altitude associated with major lakes such as Lake Cyohoha, Rweru, Mugesera, Nasho, and rivers such as Nyabarongo, Akanyaru, Mukungwa, Base, Nyabugogo, among others.
 - In Rwanda, wetlands continue to play an essential role in supporting all development for sustainable development.
 - They provide water storage, flood buffering, nutrient removal, and water purification as well as erosion control.
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5.5.1 Wetlands status in Rwanda cont'd

- Despite their importance, some wetlands in Rwanda face pressure from inappropriate forms of agriculture (uncontrolled fertilizers and pesticides), soil erosion, peat extraction, illegal mining, illegal infrastructure, pollutants from industrial wastewater discharge (organic waste, pathogens and heavy metals) among others.
 - Wetlands degradation and pollution has a significant impact on water quality and quantity.
 - The declining capacity for wetlands to provide critical ecosystem services has resulted in increased flooding – and attendant damage to infrastructure, lives, reduced productivity, and silting of water bodies.
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5.5.1 Wetlands status in Rwanda cont'd

- Climate change, coupled with population growth, are additional threats to wetlands and freshwater resources.
 - Therefore, sustainable practices which support healthy wetlands to perform their functions and provide goods and services to sustain human life, are therefore coming to the fore.
 - Rwanda has shown commendable political will and taken tangible actions to address wetlands degradation and unsustainable use of water resources.
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5.5.2 Wetlands protection status in Rwanda

- Rwanda recognizes the importance of wetlands and the need to manage them proactively. For example, current legislation classifies wetlands for total protection, or non-protection.
 - The latter category is further divided into those with status of use under specific conditions, and those with a status of use without conditions.
 - All illegal activities in wetland must be avoided in short term and long term required working together so that other unsustainable activities operating within wetlands come to an end.
 - Achieving these goals will only be possible with the involvement of all partners and stakeholders. We are working with local government authorities to ensure the true value of wetlands to our socio-economic development is understood and we act accordingly.
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5.6 Forests in Rwanda

- Forests of Rwanda occupy now about 724,695 ha of the total country land (30.4 percent) of which 387,425 hectares (53.5 %) are plantations and 130,850 hectares (18.1%) are natural mountain rainforests, 161,843 hectares are wooded savannah (22.3 percent) and 43,963 hectares are shrubs (6.1 percent). Bamboo stands occupy only 613 hectares.
 - The country receives high rainfall that is able to support large forests. Originally when the population of Rwanda was very small, most of the country was covered with forests. In 1960 the area under forest was about 6 340km² and 2010 it reduced to 2 575 km² including planted forests. As population increases, demand for land for cultivation increases declining the land under forests. Recent 20% of the total area is forest and also protected.
 - Two types of forests in Rwanda are natural and planted with each a uniqueness.
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5.6.1 Natural forests

- These are found in the protected reserves which are in places that have not been affected by very serious exploitation. The largest natural forest in Rwanda is Nyungwe Forest.
 - Rwanda's natural forests are primarily found in the country's mountainous regions and national parks. These forests are rich in biodiversity, hosting a variety of plant and animal species, including endemic and endangered species.
 - Rwanda is home to several national parks that protect its natural forests and wildlife. One of the most famous is Volcanoes National Park, known for its population of endangered mountain gorillas. Other national parks, such as Nyungwe National Park and Akagera National Park, also play a crucial role in conserving Rwanda's natural heritage.
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5.6.1 Natural forests cont'd

- Challenges: Despite their importance, Rwanda's natural forests face various threats, including deforestation, illegal logging, and encroachment for agriculture and settlement. Climate change is also a growing concern, affecting the health and resilience of these forests.
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5.6.2 Planted Forests

- In response to these challenges, Rwanda has implemented reforestation and afforestation programs to expand its forest cover.
 - Planted forests, including agroforestry systems and commercial plantations, are being established to restore degraded land, provide timber and fuelwood, and enhance ecosystem services.
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5.7 Rwanda Protected Areas

- Rwanda is renowned for its stunning natural landscapes and rich biodiversity, which are preserved in several protected areas across the country. These areas play a crucial role in promoting tourism, and supporting local communities. These protected areas are (Financing the sustainable management of Rwanda's protected areas, O. Banerjee et al., 2018).

- **Volcanoes National Park:** In the northwest of Rwanda, famous for its population of endangered mountain gorillas. It is part of Virunga Massif conservation area, which spans Rwanda, Uganda, and DR Congo. The park is also home to golden monkeys and a variety of bird species.

- **Nyungwe National Park:** In the southwest of Rwanda, a biodiversity hotspot, home to a vast tract of montane rainforest. The park is renowned for its primate species like chimpanzees and colobus monkeys, as well as its rich birdlife. It also features a canopy walkway offering panoramic views of the forest.

5.7 Rwanda Protected Areas

- **Akagera National Park:** In the east of Rwanda, characterized by its savannah plains, lakes, and wetlands. The park is home to a diverse array of wildlife, including elephants, lions, giraffes, and hippos offering unique safari experience and is a testament to Rwanda's commitment to conservation.
 - **Gishwati-Mukura National Park:** Established in 2015, one of Rwanda's newest protected areas. It comprises two separate forests, Gishwati and Mukura, which are important for their biodiversity and conservation value. The park is home to chimpanzees, golden monkeys, and a variety of bird species. Gishwati and Mukura forests, serve as important habitats for wildlife and contribute to the country's conservation efforts.
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Thank you for your good attention
Q&A

References

- Does the global warming modify the local Rwandan climate?, S. M. Henninger, 2013.
 - Parc national des volcans. Plan de zonage, G. Rwanyiziri and E. Kayijamahe, 2005.
 - Rwanda s Climate: Observations and Projections, R. McSweeney, M. Cole, J. N. Semafara, and R. Washington, 2011.
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