

Analyzing the Distribution of Vegetation Zones and Mountain Gorillas in Virunga National Park

How are abiotic factors, vegetation zones, human activity, and distribution of mountain gorillas linked?

Overview

Students use a map to analyze and contrast variations in abiotic factors at three locations within Virunga National Park and explain how these factors influence the distribution of vegetation zones. Then students deduce the location that provides habitat for critically endangered mountain gorillas and think about why gorillas are not present in similar vegetation zones across the park.

For the complete activity with media resources, visit:

<http://nationalgeographic.org/activity/analyzing-distribution-vegetation-zones-and-mountain-gorillas-virunga-national-park/>

Partner



Directions

1. Engage students' interest through a comparison of their immediate ecosystem, the Amazon rain forest, and the Sahara desert.

Ask students to identify characteristics of the biome in which they live (e.g., temperature, precipitation, vegetation, and animal diversity). Have students compare the general characteristics of their biome with those of the Amazon rain forest and Sahara desert. Ask: *How does the average annual precipitation likely differ between these areas? How might the amount of precipitation affect the amount or type of plants growing in each area?* Then project the MapMaker Interactive Abiotic Factors in Virunga National Park on a screen and select the bookmark Precipitation in the Amazon and the Sahara. During this time, if students are unfamiliar with the MapMaker Interactive, point out some of the basic features like the legend on the side of the map and the bookmarks at the bottom of the map. Also practice zooming in (+) and out (-), and note how this changes the map scale. Select the magnifying glasses for the Amazon rain forest and then the Sahara desert. Have students compare average rainfall and images of each area. Emphasize geographic distance between each area. Confirm that in this example, the area receiving more rainfall (i.e., the Amazon), has greater plant growth. This will demonstrate a connection between the abiotic and biotic factors of biomes. Reinforce the connection between abiotic and biotic factors using a local, personally relevant example (e.g., precipitation and vegetation differences across their state or region). Tell students they will evaluate how abiotic factors can influence plant diversity even within a single national park.

2. Identify the vegetation zones of three locations based on an analysis of abiotic factors.

Introduce students to the national park by projecting the Virunga National Park bookmark in the MapMaker Interactive. Select the Base Maps tab and then rotate through the Nat Geo, Satellite, and Terrain base maps. Invite students to make observations of the park based on the different base maps, with special focus on noticeable differences across the park. Distribute the Vegetation Zones of Virunga National Park worksheet. Divide students into pairs, each pair with a computer, to complete Part 1: Abiotic Factors and Vegetation Zones of the worksheet using the Virunga National Park map. After students have completed Part 1, review the relationship between elevation and temperature. Ask: *How does elevation seem to be related to temperature? What causes this relationship?* (Answer: In general, as

elevation increases, temperature decreases due to changes in air pressure. As elevation increases, air pressure decreases, which allows air to expand. Fewer gas molecules then bump into each other, causing the air to cool.)

3. Explain how variation of abiotic factors can influence the types of vegetation zones that form at different locations.

As a class, confirm the type of vegetation zone found at each location based on students' answers to Part 1 of the worksheet. Project the map, Virunga National Park. Ask: *Based on the three locations, what type of relationship exists between the average precipitation and the type of vegetation zone? Why would rain influence vegetation zone?* (Answer: As precipitation increases, plant biomass, or the amount of living material per unit area, increases. As a result, increased precipitation is related to denser vegetation zones. This is because plants need water for the processes of transpiration and photosynthesis, which result in plant growth.) Ask: *What type of relationship exists between temperature and vegetation zone? What type of relationship exists between elevation and vegetation zone? Why would temperature and elevation influence vegetation zone?* (Answer: As elevation increases, temperature decreases. In general, rates of photosynthesis increase with increasing temperatures up to a certain point. Lower temperatures reduce the rates of photosynthesis, limiting plant growth. As a result, higher elevation and lower temperature are related to less dense vegetation zones.) The discussion will encourage students to begin thinking about the relationship between abiotic factors and vegetation type. Have students return to the same pairs to complete Part 2: Influences of Abiotic Factors. Invite students to share their explanations in a class discussion.

4. Deduce which vegetation zone is most likely mountain gorilla habitat.

Distribute the Mountain Gorillas of Virunga National Park worksheet. Invite a student to read aloud the introduction. Have students work in new pairs to complete Question 1 of the worksheet. Then project the Map of Vegetation Types of Greater Virunga Landscape handout for all students to see. Have students use this map to complete the remainder of the Mountain Gorillas of Virunga National Park worksheet. After students have completed the worksheet, have them share their answers in a group discussion. Highlight the different issues that may prevent mountain gorilla populations from utilizing similar vegetation zones throughout the park.

5. Draw general conclusions about the influence of abiotic and anthropogenic factors on vegetation zones and animal distributions.

Invite students to discuss how abiotic factors influence vegetation zones, and therefore the presence or absence of animals. Ask: *Why is the area around Mount Mikeno montane forest, rather than savanna or alpine?* (Answer: Higher elevations result in lower temperatures, preventing savanna. High levels of precipitation and fertile soils allow for more plant life, preventing alpine zones.) Remind students that the same variations influence biomes on a global scale. Ask: *How does the type of vegetation influence the animals found in the area?* (Answer: Animals will be found in areas that meet their dietary and habitat requirements. For example, the mountain gorilla requires the dense vegetation of a montane forest.) Ask: *How can human activity influence vegetation zones and animal distribution?* (Answer: Land can be cleared for other uses, which eliminates necessary habitat for animals. Animals can be poached.) Invite students to discuss why it may be important to protect Virunga National Park. Draw students' attention to the Map of Vegetation Types of Greater Virunga Landscape. Conclude the activity by reiterating how the diversity of vegetation zones throughout Virunga National Park, as seen on the map, is a result of variations in abiotic factors, which can differ significantly even across small distances. This diversity of vegetation zones allows for an incredible diversity of animal species. Protecting Virunga National Park from negative human activities is critical to the conservation of its many rare, endangered, and endemic species.

Informal Assessment

Check for students' understanding of concepts and ability to collect, interpret, and communicate information by attending to their thinking during discussions and assessing their worksheets with the answer keys provided.

Extending the Learning

- Have students read "The Battle for Africa's Oldest National Park" in order to learn more about the human activities threatening Virunga's mountain gorillas. Summarize the primary threats and propose possible solutions. Ask students to discuss how the threats to mountain gorillas are similar or different compared to those experienced by wildlife in their own country.
- Have students predict how the vegetation zones throughout Virunga National

Park will likely shift in the future due to climate change, given increasing average global temperatures and changing precipitation levels. Over the past century, for example, vegetation has begun moving up mountain slopes (i.e., toward higher elevations) where temperatures are cooler. However, plant migration tends to take time since seeds are usually dispersed by wind or animals, and some plant species have slower growth rates. Climate change will also cause some areas to become drier or wetter, thereby altering an abiotic factor important for determining vegetation zones. Ask students to predict what might happen to the mountain gorilla population if the types of plants they eat are unable to migrate to more suitable habitats.

- Have students read “Zoologist Dian Fossey: A Storied Life With Gorillas.” Identify Dian Fossey’s specific area of gorilla research and draw similarities between Fossey’s work and that of Jane Goodall, who studies the social interactions of chimpanzees. Highlight Fossey’s use of novel research methods (e.g., she engaged gorillas rather than sitting and observing their behavior). Then ask students to outline, in general, the possible advantages and disadvantages of using novel research methods to further scientific understanding, citing examples where possible.

Objectives

Subjects & Disciplines

Geography

- General

Science

- Biology
- Ecology

Learning Objectives

Students will:

- use MapMaker Interactive to compare and contrast mean annual precipitation,

- elevation, and temperature at three locations within Virunga National Park
- identify the type of vegetation zone at three locations based on variations in abiotic factors
- explain how abiotic factors influence the distribution of vegetation zones
- deduce which location mountain gorillas inhabit based on dietary and habitat requirements

Teaching Approach

- Learning-for-use

Teaching Methods

- Brainstorming
- Discussions
- Inquiry
- Research
- Writing

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Information, Media, and Technology Skills
 - Information, Communications, and Technology Literacy
- 21st Century Themes
 - Environmental Literacy
- Critical Thinking Skills
 - Analyzing
 - Applying
- Science and Engineering Practices
 - Analyzing and interpreting data
 - Constructing explanations (for science) and designing solutions (for

engineering)

National Standards, Principles, and Practices

National Geography Standards

- **Standard 1:**

How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

- **Standard 8:**

The characteristics and spatial distribution of ecosystems and biomes on Earth's surface

Common Core State Standards for English Language Arts & Literacy

- **CCSS.ELA-LITERACY.RST.9-10.1.:**

Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

- **CCSS.ELA-LITERACY.SL.9-10.1:**

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others's ideas and expressing their own clearly and persuasively.

ISTE Standards for Students (ISTE Standards*S)

- **Standard 3:**

Research and Information Fluency

Next Generation Science Standards

- **HS-LS2-6.:**

Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Preparation

What You'll Need

Materials You Provide

- Pencils

Required Technology

- Internet Access: Required
- Tech Setup: 1 computer per small group, Presentation software, Projector

Physical Space

- Classroom

Setup

Students will participate in whole class discussions and paired work, which will require a physical space that allows for uninhibited transitioning between activities.

Grouping

- Heterogeneous grouping

Other Notes

This activity is intended to be conducted in two 50-minute class periods. Day 1: Students explore the map, analyze variations in abiotic factors, and construct an explanation about the influence of abiotic factors on the distribution of vegetation zones (Steps 1-3). Day 2: Students deduce the vegetation zone that provides habitat for mountain gorillas and consider why mountain gorillas do not inhabit all areas of the park with this vegetation type (Steps 4-5).

Resources Provided: Websites

- [MapMaker Interactive: Abiotic Factors in Virunga National Park](#)

Resources Provided: Handouts & Worksheets

- [Vegetation Zones of Virunga National Park](#)
- [Vegetation Zones of Virunga National Park Answer Key](#)
- [Mountain Gorillas of Virunga National Park](#)
- [Map of Vegetation Types of Greater Virunga Landscape](#)
- [Mountain Gorillas of Virunga National Park Answer Key](#)

Background & Vocabulary

Background Information

Virunga National Park, a UNESCO World Heritage Site, covers 7,800 square kilometers (3,000 square miles) and is the oldest national park in Africa. The park is located along the eastern edge of the Democratic Republic of Congo in the center of Africa's Albertine Rift. Tectonic activity produced a chain of eight volcanoes known as the Virunga Massif, which runs through the southern section of the park. Mounts Nyamuragira, Nyiragongo, and Mikeno are among the seven volcanoes located fully or partially within the park. The park is bordered by Rwanda and Uganda to the east.

Even within the relatively small area, certain abiotic factors vary considerably across Virunga National Park. Elevation above sea level ranges from 680 meters (2,230 feet) to over 5,000 meters (3 miles) due to the presence of volcanoes. Annual rainfall also varies considerably, with some areas receiving as little as 500 millimeters (20 inches) of rain each year, and others as much as 3000 millimeters (118 inches). The park contains an immense diversity of vegetation types, or zones, from savannas and marshland to montane forests and lava plains. As a result, it also has a remarkable diversity of animal species. Many of these species are classified as rare, endangered, or endemic species, like the okapi (*Okapia johnstoni*) and mountain gorillas (*Gorilla beringei beringei*). Only about 700 individual mountain gorillas remain in the wild and nearly one quarter live within the boundaries of Virunga National Park.

The exceptional biodiversity of the park is constantly threatened by human activity within and around the area. Militia members and poachers operate within the park. While there is little direct poaching of mountain gorillas, they can be caught by traps set for other animals. Habitat loss is another threat to mountain gorillas. Inside and around Virunga National Park wild habitat is converted to agricultural land and areas for livestock. Trees are also illegally cut down and burned in order to produce charcoal. The high demand for charcoal which is used for heating and cooking has led to widespread illegal logging and habitat loss.

Prior Knowledge

["Recognition and understanding of ecosystem diversity on a global scale (i.e., biomes)", "Basic understanding of plant biology, primarily the general processes of transpiration and photosynthesis", "Basic knowledge of abiotic factors and their variability, including precipitation, elevation, and temperature", "Understanding that various human activities have endangered species through habitat degradation and loss", "Ability to collect and analyze evidence from multilayered maps and data points", "Ability to construct explanations using scientific reasoning that is supported with evidence"]

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
abiotic	<i>adjective</i>	lacking or absent of life.
biodiversity	<i>noun</i>	all the different kinds of living organisms within a given area.
classify	<i>verb</i>	to identify or arrange by specific type or characteristic.
ecosystem	<i>noun</i>	community and interactions of living and nonliving things in an area.
elevation	<i>noun</i>	height above or below sea level.
endemic species	<i>noun</i>	species that naturally occurs in only one area or region.
photosynthesis	<i>noun</i>	process by which plants turn water, sunlight, and carbon dioxide into water, oxygen, and simple sugars.
precipitation	<i>noun</i>	all forms in which water falls to Earth from the atmosphere.
savanna	<i>noun</i>	type of tropical grassland with scattered trees.
soil fertility	<i>noun</i>	capacity of soil to sustain plant growth.
transpiration	<i>noun</i>	evaporation of water from plants.
variation	<i>noun</i>	difference.
vegetation	<i>noun</i>	all the plant life of a specific place.

Term	Part of Speech	Definition
vegetation zone	<i>noun</i>	altitude, soil, and precipitation region in which a plant best survives.

For Further Exploration

Websites

- [Wildlife Conservation Society: Albertine Rift](#)
- [Virunga National Park: About Virunga National Park](#)
- [UNESCO: Virunga National Park](#)
- [World Wildlife Fund: Virunga: Protecting Africa's Oldest National Park](#)
- [National Geographic: Virunga Gorillas](#)
- [National Geographic News: The Battle for Africa's Oldest National Park](#)
- [National Geographic News: Congo Gorilla Killings Fueled by Illegal Charcoal Trade](#)
- [National Geographic News: Dian Fossey: A Storied Life With Gorillas](#)



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