



Physical Geography CONTENT GUIDE FOR EDUCATORS

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**Education &
Children's Programs**

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Overview

The **physical landscape** of any continent or region on Earth is composed of those features of the natural environment that serve as the essential background for human activity. Landscapes, therefore, often have more than just scientific appeal or meaning for people. They may be seen as having religious or political significance, or they may be seen as objects of beauty, for example. The physical features of any landscape are created by processes that include forces that work in the **atmosphere, lithosphere, hydrosphere, and biosphere** and thereby give a set of characteristics to the place in which they are found. Like any continent, Africa's physical geography is unique and the result of complex physical forces, as well as the interaction of humans and their environments.



Kongou Falls, Gabon

Key Terms in this Guide

Absolute location – defined by precise points on a geographic grid system using coordinates such as latitude and longitude; answers the question “where” and identifies the location

Climograph – type of graph used to display temperature and precipitation data of climatic types; a climograph for a particular place usually displays monthly average temperature as a line and monthly average precipitation as a bar

Fault – a fracture in the crustal rock involving displacement of the rock on either side of the break, or **fault plane**. A **normal fault** is a result of tension and rifting. The fault plane separates a block that has remained stationary from one that has dropped down. Normal faults may exist in a set of roughly parallel faults so that there is a down-dropped block (**graben** or **rift valley**) between two uplifted blocks.

Landform – a specific feature that forms part of the overall shape of Earth’s surface. *Tectonic activity*, including volcanism, folding, and faulting, derives its energy from within the Earth, usually occurs at plate boundaries as they break apart and collide with one another, and is a dominant process in building landforms.

Landscape – a region of associated landforms

Relative location – indicates a position in reference to something else

Rifting – the pulling apart of Earth’s crust that creates faults

Watershed – the land area that is drained by a river and its tributaries; it is separated from other watersheds by higher land known as a **drainage divide**. Watersheds exist at different scales and may be nested within one another.

Location

A basic and fundamental tenet of geography is that *location matters*. Location is the “*where* element” of geography. It helps us understand the way in which things are distributed in space. Locations are expressed in either absolute or relative terms.

Historically, since about 250 B.C., geographers have been concerned with answering the fundamental question of *where* on Earth things and places are located in absolute and relative terms. Knowing what is found in particular places and the human and physical characteristics of these places enables us to build an understanding of the ways in which space and place connect. Geographers may ask *why* phenomena—any attribute of the physical or cultural landscape—are located in particular places, the processes that affect their location, and how places are related and connected. Is there a pattern to the locations? Of equal value: Where are phenomena *not* located?

Key geographic questions:

*What is the **absolute location** of Africa as a continent? (To define the absolute location of a continent—which can be determined by its latitudinal and longitudinal extent—look at the grid coordinates of its boundaries.)*

*What is the **relative location** of Africa to other continents? (This question may have many correct answers.)*

What is the significance of Africa’s location to the physical environment?

Key facts:

- Africa is located in all four hemispheres: Eastern, Northern, Western, and Southern.
- Africa’s absolute location affects its climate. The continent is in the tropical and sub-tropical zones.
- East Africa is located at the boundary between tectonic plates. This affects the development of the East African topography.

Topography

Topography is characterized by features such as these:

- Elevation
- Relief
- Orientation
- Aspect (direction a slope faces)
- Slope gradient
- Slope length
- Curvature of Earth

Some landscapes are sites of events that remind us of our history and become objects of patriotism. Some are sites of religious significance. Sometimes, landscapes are seen as objects of beauty, painted and set aside in preserves and parks for our enjoyment.

Key geographic questions:

What are the topographic regions of Africa?

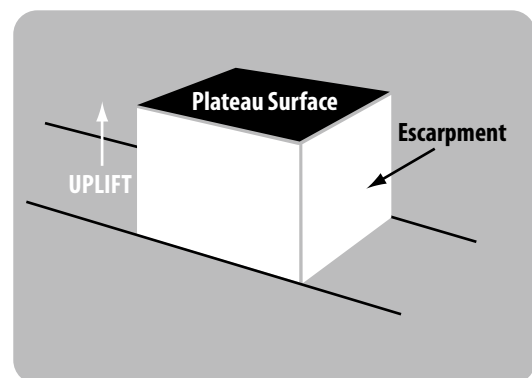
What are the characteristics of the topographic regions of Africa?

What processes account for the development of specific topographic features in particular locations?

In what ways is the topography of Africa similar to and different from other continents?

Key facts:

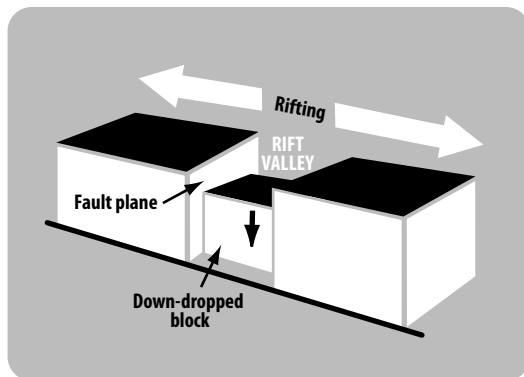
- The African continent is primarily an uplifted **plateau**. The African **escarpment** lies in close proximity to the coast and contributes to rapids on rivers and hampers transportation routes.



Topography Key facts con't.

- The continent displays shallow basins with rivers in watersheds or drainage basins.
- While it is unusual for a continent not to have a backbone mountain system, Africa has few mountains. Mountains affect local weather and climatic conditions and provide source regions for surface waters; and volcanic mountains contribute to fertile soils.

- The Great Rift in East Africa is one of the best examples of rift-valley topography in the world. The **tectonic** process of **rifting** or **tension** creates a set of **faults**.
- Africa has a narrow coastal plain backed by escarpments. Coastal plains provide the settlement location for much of the world's population.
- Africa has a difficult shore characterized by a narrow continental shelf; reefs, rocks, and submerged bars; and very few good natural harbors.



Climate, Vegetation, Soil, Animals

Climate is composed of the following weather variables averaged over time:

- Moisture (precipitation, condensation, and humidity)
- Temperature
- Pressure
- Winds

The values of these variables for a given place are determined by **climatic controls**, which include the following:

- Latitude
- Continentality
- Ocean currents
- Pressure systems
- Prevailing winds
- Elevation
- Surface topography
- Vegetation cover

One of the most commonly used classification systems to define **climate regions** (the Köppen system) uses values of temperature and precipitation to define climate regions.

Key facts:

- The spatial distributions of climate, soils, and vegetation are correlated worldwide. This spatial correlation suggests that natural/physical processes are all closely interrelated.
- Climate is dictated by the receipt of energy, and influences the type of vegetation, soil, and animals found in a region, as well as the available water supply.
- Heat is produced at the surface of the Earth by sunlight (shortwave electromagnetic radiation) that is converted to heat energy (long-wave radiation). The distance between the Earth and the sun has little effect on heat production at the surface of the Earth. Instead, heat production is due to the following:
 - a. Angle of the sun's rays
 - b. Length of exposure (number of daylight hours) to sunlight
 - c. Albedo (reflectivity)

- The impact of climate on **soils** in Africa can be summarized as follows.

Equatorial Rain Forest

Oxisols: Very old, highly weathered soils of low latitudes; aluminum and iron oxides, low nutrients; 99 percent of ecosystem nutrients in living biomass

Transitional

Ultisols: Tropical with accumulation of clay; can be used for agriculture with the aid of fertilizers and lime

Dry Tropical

Aridisols: Soils of dry climates, loss in organic matter, nutrients accumulate at surface, low clay or humus, rapidly lose nutrients when watered

- The impact of climate on **life-forms** can be summarized as follows.

Rain Forest

Minimum migration, life at many levels of ecosystem, many specific niches, animal pollinators

Wet/Dry

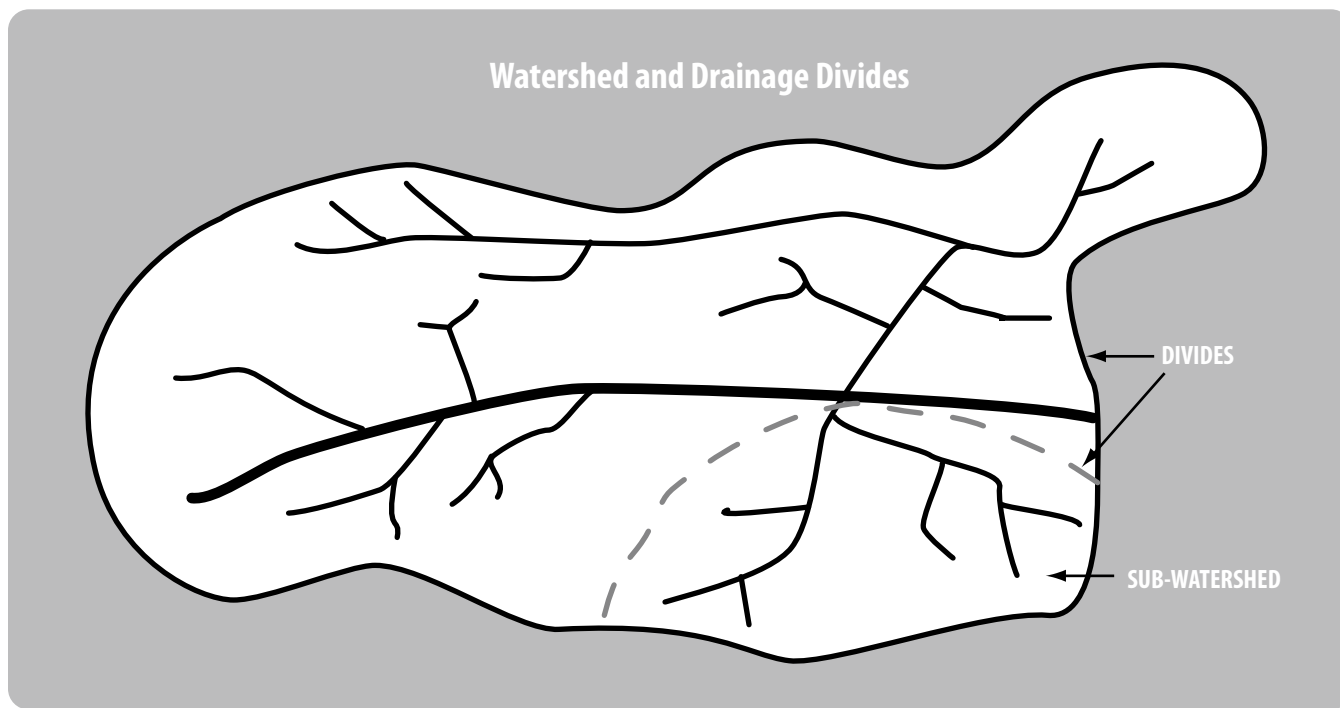
Fosters migration of first order consumers and many higher tropic-level consumers, insect and wind pollination

Dry

Extreme adaptation to specific niches, insect pollination is common, often specialized

Rivers and River Basins

Water moves across Earth's surface through organized networks of channels, known as **rivers** or **streams**. Although the flow of water may be seasonal, the channels and the networks remain, and are organized into drainage networks. These networks are an integral part of **drainage basins** or **watershed** systems, which function as physical regions.



Watersheds play a critical role in the natural functioning of Earth's environment. Physically, they integrate the surface water runoff into organized drainage nets. Economically, they play a critical role as sources of water, food, hydropower, recreational localities, and transportation routes. Ecologically, watersheds provide habitats for a wide range of flora and fauna.

Throughout history human settlement has been drawn to rivers and **river valleys** since alluvial material from deposition along some rivers creates fertile soils for agriculture. For example, 95 percent of Egypt's rapidly growing population lives within the narrow watered strip along the Nile River Valley. The first developments of sedentary agriculture and urbanization began in the great river valleys of the world, among which are the Nile, Indus, Hwang Ho, and Tigris-Euphrates systems. In virtually all agrarian and industrial societies, river valleys, and especially floodplains, are among the most attractive yet hazardous environments for settlement.

A central concept of **management** and **conservation** of rivers and watersheds is planning for human use that is the least disruptive and damaging to the natural systems. In whatever manner the river and watershed system is utilized, those uses affect the entire watershed and even areas beyond the watershed. Thus, use in one state or country may be affected by decisions made in another state or country.

Individual rivers have different physical characteristics along their courses and create many of the landforms and landscapes within watersheds. Thus, the particular use of a river system is influenced by the nature of the individual river, the nature of the topography associated with the river, and where within the watershed one is located. African rivers often have unusual courses, waterfalls, and rapids, and some lack deltas at the shore.

Key geographic questions:

Where are the river basins (watersheds) located on the continent of Africa?

What are the characteristics of rivers and their watersheds on the African continent?

What significance might the characteristics have for the use of the river?

Key facts:

- Water is transferred into the atmosphere by **evaporation** and **evapo-transpiration**. Following **condensation**, water reaches the surface of a watershed as precipitation, where it may follow one of several paths:
 - a. Interception by vegetation
 - b. Infiltration into the soil
 - c. Percolation into the groundwater
 - d. Surface retention and storage (lakes, ponds, puddles, reservoirs, etc.)
 - e. Runoff
 - f. Streamflow or rivers

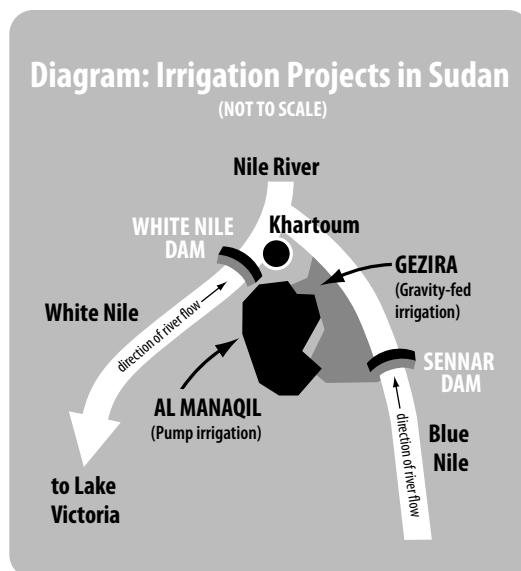
ATTENTION EDUCATORS:

Student Activity: Rivers and Watersheds of Africa (pp. 13–14), demonstrates the locations, characteristics, and significance of Africa’s watersheds. Materials required: student atlas, base map of Africa (page 16 of this Guide), color pencils/markers, transparency—base map of Africa, transparency markers

Student Activity: Irrigated Land as a Percentage of Cropland (p. 15), asks how and why irrigated land as a percentage of cropland might be correlated with other factors such as water resources, cultural aspects of water usage, and demographic characteristics. Materials required: access to Internet or printouts of the Natural Resources Conservation Service (NRCS) U.S. Map: Percentage of Cropland in Irrigation, 1997, at <http://www.nrcs.usda.gov/TECHNICAL/land/meta/m5301.html>

Rivers and River Basins Key facts, cont'd

- The rivers within a watershed may have different degrees of flow.
 - Permanent** or **perennial** rivers exist in well-watered areas and flow throughout the year.
 - Ephemeral** rivers carry water during and immediately after some rainfall event and are dry most of the year.
 - Intermittent** rivers are also dry through part of the year but flow when the groundwater is high enough; they also flow during and immediately after a rainfall event or snowmelt. Many of the smaller streams of North Africa are intermittent streams.
 - Exotic** rivers are permanent rivers that do not gain water along their courses. The Nile River is an example of an exotic river—the sources of the Nile are in the more watered highland areas, while the main course of the river flows through desert regions of the Sudan and Egypt.
- In-stream Water Use** is the in-channel, or non-withdrawal, use of water. Examples include:
 - Hydroelectric power generation
 - Fish and wildlife management
 - Transportation—requires rivers to be navigable
 - Recreation
- Off-stream Water Use** is water withdrawn or diverted from the stream channel. In many cases a high percentage of off-stream water is returned to the stream but with some aspect of its quality changed. For example, most of the water withdrawn for power plant cooling is returned, but at a higher temperature. Examples include:
 - Irrigation and other agricultural needs (primary use of water in Africa)
 - Municipal, industrial and power plant cooling
- Egypt has historically relied on the Nile to provide the water needed to support human habitation, including irrigation agriculture. Sudan also diverts water from the Nile to support an expanded irrigation cultivation of cotton for commercial export. The diagram below indicates the irrigation projects of Sudan. Note that this is a diagram, not a map.



Activity: Rivers and Watersheds of Africa

Rivers, organized in watersheds (or drainage basins), provide vital resources for human activity and use. As a physical region, a watershed's boundary may overlap the boundaries of other types of regions, especially political ones. The nature of the river system within a watershed affects the potential human use of the system.

Where are the river basins (watersheds) located on the continent of Africa?

1. On the base map, draw and label the major rivers of the African continent.
2. Draw the boundaries of the watersheds of each major river system.
3. Which regions of Africa do and do not lie in a major watershed region? What might account for the distribution pattern of rivers and watersheds?

Activity: Rivers and Watersheds of Africa (page 2)

What are the characteristics of rivers and their watersheds on the African continent?

What significance might the characteristics have for the use of the river?

4. Select one watershed and examine the characteristics of the major river and its tributaries within the watershed, noting source, course, and final discharge area.
5. Your answer:

What is the relationship of the watershed as a region to political regions of Africa? What are the implications for control of water?

6. For the selected watershed, mark the course of the river with a different color every time it crosses a political border into a different country.
7. How many segments did you color?
8. Your answers:

AFRICA: Political Boundaries



Online Resources

Physical Geography of Africa Content Guide: Online Resources

RELATED LINKS:

National Geographic Guides for Educators: The Geographic Perspective

Written for educators, these National Geographic content guides offer background on and real-world examples of the geographic perspective, and how it can be applied across the curriculum.

Geographic Perspective: Content Guide for Educators (PDF)

<http://www.nationalgeographic.com/xpeditions/guides/geogpguide.pdf>

Examples of ways educators can apply the geographic perspective across the curriculum to enhance students' examination of complex issues that arise from human interaction with the environment

Africa: Physical Geography Content Guide for Educators (PDF) (this guide)

<http://www.nationalgeographic.com/xpeditions/guides/physicalafricaguide.pdf>

Explores ways of teaching physical geography—specifically, of Africa—to students, including location, topography, climate, vegetation, and rivers. Developed for *Geography Action!* 2006: Africa.

Africa: Human Geography Content Guide for Educators (PDF)

<http://www.nationalgeographic.com/xpeditions/guides/humanafricaguide.pdf>

By exploring the cultural landscape of a place, educators can help students understand how people learn and integrate culture—something unique to humans. Developed for *Geography Action!* 2006: Africa.

Africa: Contemporary Issues Content Guide for Educators (PDF)

<http://www.nationalgeographic.com/xpeditions/guides/contempafricaguide.pdf>

How educators can use the geographic perspective to infuse numerous kinds of contemporary issues—in this instance, issues in Africa—into their curricula. Developed for *Geography Action!* 2006: Africa.

Africa Multidisciplinary Educator Guide (PDF)

<http://www.nationalgeographic.com/xpeditions/guides/multidafricaguide.pdf>

This guide offers K–12 educators dozens of resources for teaching about Africa across the curriculum when something new and interesting is needed. Grouped into four grade bands, the guide lists lesson plans, interactive features, and more that can be used to teach science, social studies, Language Arts, art, and more. Developed for *Geography Action! 2006: Africa*.

Brock Brown’s Geographical Summary of Earth as a Natural/Physical Environmental System and Humans Interacting with the System (PDF)

<http://www.nationalgeographic.com/xpeditions/guides/geogsummary.pdf>

This thought-provoking essay explores the Earth’s dynamic energy/matter system and how humans impact that system through the use of technology. Dr. Brown is an Associate Professor of Geography at Texas State University—San Marcos.

CIA: The World Factbook

<https://www.cia.gov/cia/publications/factbook/index.html>

Maps and country profiles with information about location, geographic coordinates, climate, terrain, land use, irrigated land, and much more

Climate Controls: World Climographs

<http://cwx.prenhall.com/bookbind/pubbooks/lutgens3/medialib/abcontrol/pages/question.html>

World map with associated climograph for selected locations

My Wonderful World

<http://www.mywonderfulworld.org>

Give kids the power of global knowledge with resources from this National Geographic-led campaign—backed by a coalition of major partners—to expand geographic learning in school, in the home, and in the community.

National Drought Mitigation Center for Kids: Maps, Climographs, and Other Graphs

<http://www.drought.unl.edu/kids/maps.htm>

Discussion about and links to climographs of selected U.S. and world cities using interactive maps

National Geographic on Africa

<http://www.nationalgeographic.com/africa/>

Explore Africa with classroom resources, interactive features, photographs, Web sites for kids, and more.

NATIONAL GEOGRAPHIC: Africa MegaFlyover

<http://www7.nationalgeographic.com/ngm/megaflyover/>

Follow Michael Fay's aerial survey of Africa through dispatches, photos, a forum, and more.

National Geographic EdNet

<http://www.ngsednet.org>

The National Geographic free online site for educators—a one-stop shop for education news, resources, discussion, and more

National Geographic EdNet: Classroom Companion Africa Resources

http://www.ngsednet.com/community/resource_uploads/250_08172005_2891.pdf

Comprehensive list of National Geographic resources on Africa

National Geographic: *Geography Action!* 2001: Rivers

<http://www.nationalgeographic.com/geographyaction/rivers/>

K–12 river resources include activities for educators and students, conservation activities, and an interactive river system.

National Geographic: *Geography Action!* 2003: Habitats

<http://www.nationalgeographic.com/geographyaction/habitats/>

K–12 resources on six habitats—cities and suburbs, desert and tundra, forests, fresh water, oceans and coasts, and prairies—include games and activities, photo galleries, lessons for educators, conservation activities, and more.

National Geographic: *Geography Action!* 2006: Africa in 3–D

<http://www.nationalgeographic.com/geographyaction/>

National Geographic's annual K-12 conservation and awareness program focused on Africa in 3-D in 2006, the first of a five-year, round-the-world curriculum series.

National Geographic Online

<http://www.nationalgeographic.com>

Photos, videos, daily news, interactive features, maps, world music, and more, as well as resources for educators and kids

National Geographic: People and Places: Africa

http://www3.nationalgeographic.com/places/continents/continent_africa.html

Regional and country profiles, fast facts, maps, flags, music, photos, news and many other related features

South Hill Education Centre: World Climates

http://southhill.vsb.bc.ca/Departments/Humanities/Geography/Kyle/Notes/2_Atmosphere/Climographs/WorldClimates.html

Climographs of low-, mid-, and subtropical, and high-latitude climates around the world

University of Pennsylvania: African Studies Center

<http://www.africa.upenn.edu>

Up-to-date resources for K–12 teachers include lessons, country pages, images, maps and flags, and links to sites about African anthropology, population, women’s studies, and more.

PHYSICAL GEOGRAPHY OF AFRICA RELATED LESSON PLANS:

National Geographic: Xpeditions Lesson—How’s the Weather—in Africa?! (Grades K–2)

<http://www.nationalgeographic.com/xpeditions/lessons/04/gk2/pgafrika1.html>

Students describe and compare how weather affects human activity in two places on opposite sides of the world. Students first identify the seasons and weather in their community and compare how the weather of northern Africa impacts human activities there. Students conclude that the impact of weather on human activities is a common thread in human communities all over the world.

National Geographic: Xpeditions Lesson—Topography of Africa (Grades 3–5)

<http://www.nationalgeographic.com/xpeditions/lessons/03/g35/pgafrika2.html>

Students will study some of Africa’s diverse landscape and investigate how its features impact the available water supply, food sources, and population distribution. Three countries are highlighted in different locations with distinctive landforms: Algeria in North Africa, Ethiopia in East Africa, and the country of South Africa. From the Sahara desert to the Great Rift Valley to the South African veld, students will compare topographical features and their effect on each country’s physical and human environments.

National Geographic: Xpeditions Lesson—Navigating the Niger (Grades 6–8)

<http://www.nationalgeographic.com/xpeditions/lessons/14/g68/pgafrika3.html>

Students will research the Niger River, paying particular attention to the Niger Delta, and will consider how the ecology of the river is being compromised, and what possible effect this may have, both regionally and globally.

National Geographic: Xpeditions Lesson—Seeing the Human Impact on Africa: What Can You Learn From a Plane? (Grades 6–8)

<http://www.nationalgeographic.com/xpeditions/lessons/01/g68/africaplane.html>

Students analyze several maps of Africa to see where the greatest levels of human impact can be observed. They look at photographs from different parts of Africa showing both its human and natural landscapes, and consider what these images might look like from the air.

National Geographic: Xpeditions Lesson—Climographs: Temperature, Precipitation, and the Human Condition (Grades 9–12)

<http://www.nationalgeographic.com/xpeditions/lessons/15/g912/pgafrika4.html>

Students learn about how to read, analyze, and construct climographs. They also practice matching climographs to locations in the United States and in Africa, and discerning climate patterns and making some predictions about their effects on humans in different places in Africa.

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Diagram page 8: © Brock Brown



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