


Cultures of Innovation: Intersection of Social Studies and STEAM **in East Africa, Summer of 2023**

Curriculum Units

These lesson plans will contribute to teaching various topics through an African centered approach crafted by the educators participating in the Fulbright Hays Group Projects Abroad in Kenya. Please use the resulting lesson plans as you see best in your classroom or learning environment.

**The content of these curriculum units were developed under a grant from the Fulbright-Hays [Group Projects Abroad \(GPA\)](#), [U.S. Department of Education](#) in partnership with the [Center for African Studies](#) at the University of Pittsburgh. However, this content does not necessarily represent the policy of the Department of Education, or the Center for African Studies and you should not assume endorsement by the Federal Government.*



Ethnobotany in Kenya and the United States

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Curriculum Title:

Ethnobotany in Kenya and the United States

Lesson Authors:

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Grades Levels:

6-8 (adaptations can be made for 5th or 9-12 students)

Focus:

Students will learn about the field of ethnobotany. Using a case study of Kenya, students will learn the importance of indigenous place-based knowledge about the environment and how locals make use of native and naturalized plants for food, medicine, rituals/ religious practices, and everyday practical use. Students will then use this new knowledge to study local plant use in the United States and complete an ethnographic inquiry project focused on their own family and community's use of plants.

Subject/ Courses:

Biology, Social Studies

National & PA Standards/ Eligible Content:

The following list of standards can be related to lessons taught using this curriculum unit and is intended to be used as a general guideline. Teachers may browse the standards and pick the ones most useful to them in emphasizing certain themes and connecting to their existing curricula.

National Council for the Social Studies (NCSS) Standards:

Culture (I.A): Students will learn how culture shapes the ways people perceive, experience, interpret, and evaluate the world.

Change and Continuity (II.A): Students will examine how cultures change and how they remain the same over time.

Places and Regions (III.A): Students will analyze the characteristics and purposes of regions.

Personal Identity (V.B): Students will explore factors that shape personal identity.

Individuals, Groups, and Institutions

(VI.A): Students will investigate how institutions influence people, and how people influence institutions.

Global Interconnections (IX.A): Students will examine the relationships and interdependence of the global community.

Civic Engagement (X.A): Students will explore the rights and responsibilities of citizens.

Next Generation Science Standards (NGSS):

LS2.A: Interdependent Relationships in Ecosystems Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

LS4.D: Biodiversity and Humans Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (*secondary*)

5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Common Core Standards (Reading, Writing, Speaking, & Listening):

CCSS.ELA-LITERACY.W.5.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

CCSS.ELA-LITERACY.RI.5.1: Quote accurately from a text when explaining what the text says explicitly.

CCSS.ELA-LITERACY.SL.5.1: Engage effectively in a range of collaborative discussions.

PA K-12 STEEL Standards

3.4.6-8.B Analyze and interpret data about how different societies (economic and social systems) and cultures use and manage natural resources differently.

3.4.6-8.E Collect, analyze, and interpret environmental data to describe a local environment.

Pennsylvania State Learning Objectives

PA Science Standards:

Standard - 3.1.7.A1 Describe the similarities and differences of physical characteristics in diverse organisms.

Standard - 3.1.8.A8 Explain mechanisms organisms use to adapt to their environment.

Standard - 3.1.7.B5 Compare and contrast observable patterns in the physical characteristics across families, strains and species.

Standard - 3.4.6.A1 Identify how creative thinking and economic and cultural influences shape technological development.

Standard - 3.4.6.B3 Interpret how societal and cultural priorities are reflected in technological devices.

Standard - 3.4.8.B2 Compare and contrast decisions to develop and use technologies as related to environmental and economic concerns.

Standard - 3.4.6.D2 Use computers appropriately to access and organize and apply information. *Standard - 3.4.8.E2* Describe how biotechnology applies the principles of biology to create commercial products or processes.

Standard - 4.1.7.A Describe the relationships between biotic and abiotic components of an ecosystem. Compare and contrast different biomes and their characteristics.

Standard - 4.1.7.D Explain how biological diversity relates to the viability of ecosystems.

Standard - 4.1.8.D Use the theory of natural selection to examine the causes and consequences of extinction.

Standard - 4.3.7.A Explain how products are derived from natural resources. Describe the process of converting raw materials to consumer goods. Differentiate between renewable and nonrenewable resources

Standard - 4.3.7.B Explain the distribution and management of natural resources. Differentiate between resource uses: conservation, preservation, and exploitation.

Standard - 4.4.6.A Explain how different plants and animals in the United States have specific growing requirements related to climate and soil conditions.

Standard - 4.4.7.B Describe the economic importance of agriculture to society.

Standard - 4.4.7.C Investigate resources, their relation to land use, and their impact on the food and fiber system.

Standard - 4.4.7.D Identify the positive and negative effects of technology used in agriculture and its effects on the food and fiber system and the environment over time.

Standard - 4.5.6.D Identify reasons why organisms become threatened, endangered, and extinct. *Standard - 4.5.7.A* Describe how the development of civilization affects the use of natural resources. Compare and contrast how people use natural resources in sustainable and non-sustainable ways throughout the world.

Standard - 4.5.7.C Explain how human actions affect the health of the environment. Identify residential and industrial sources of pollution and their effects on environmental health.

Importance:

Ethnobotany allows students to better understand natural resources and the sustainable use of them in community practices. It teaches an understanding and appreciation of native biodiversity and provides insight into the importance of caring for our surrounding environment. Ethnobotany in Kenya teaches students the importance of indigenous, place-based knowledge and promotes understanding of East African culture. The ethnography-based project assessment allows students to get hands-on experience in research and teaches them the importance of exploring and sharing human knowledge.

Vocabulary:

Ethnobotany: The study of how people in a particular place make use of native plants.

Indigenous Knowledge: The understanding, skill, and beliefs developed by native people who have lived in their ecosystem for a long time.

Native Plants: Plants that occur naturally in a particular region or ecosystem, without human intervention

Naturalized Plants: Non-native plants that have been introduced to an ecosystem, but can successfully live and reproduce without harm.

Ethnography: The study of an individual culture in order to understand something from their point of view.

Essential Questions:

1. What is ethnobotany? Why is it important?
2. How do people in Kenya use local plants? How do people in the US use local plants?
3. What is indigenous knowledge? Why is it important to us?
4. What is ethnography? Why is it a useful tool to find answers in our community?
5. What are the similarities and differences between the way people in Kenya and people in the US use local plants?

Objectives:

1. Students will define ethnobotany and its role around the world as a means of protecting and sustainably utilizing the environment.
2. Students will reflect on Indigenous knowledge in Kenya.
3. Students will practice basic ethnographic techniques as a means to gather local knowledge.
4. Students will make claims regarding the similarities and differences between plant use in Kenya and in the US based on hands-on research.
5. Students will create and defend a value claim of ethnobotany and indigenous knowledge in our modern global world.

Duration:

3-7 lessons (depending on how lessons are combined or spread out. Related materials can be used to expand lessons.)

Materials:

1. An Introduction to Ethnobotany (slides, <https://docs.google.com/presentation/d/1KUTOWM8ghWy2mSRIW7PgdfpzSRCPCIMuo5m4rRjn20/edit?usp=sharing>)
2. Case Study 1: Kenya (slides, <https://docs.google.com/presentation/d/169QyszXxLZMQJaj2TaEZVZL62tcQ8fMOKqTNthYDo8M/edit?usp=sharing>)
3. Case Study 2: Ethnobotany in Kenya (slides, <https://docs.google.com/presentation/d/1dhbrn4xNj8ONLjxlaFCSc8jqMTr0ZGviKxc47y5EdrM/edit?usp=sharing>)
4. Supplementary Video: Dr. Peter Gichiri, Kenya Indigenous Knowledge (video: <https://vimeo.com/869940841?share=copy>)
5. Exploring Medicinal Plants: A Cross-Cultural Journey Ethnographic Project (PDF, <https://docs.google.com/document/d/16R3Swyw-Rx82p5IIoOR1kd9i5A5WazTr4I0kNk1jxus/edit?usp=sharing>)

- a. Phase 1: Introduction to Medicinal Plants
 - b. Phase 2: Medicinal Plants of Kenya
 - i. Supplementary Video: Mwanja Peter Ngila Julius explains plant use in Kenya (video: <https://vimeo.com/869940208?share=copy>)
 - c. Phase 3: Ethnography of Community Medicinal Practices
 - d. Phase 4: Final Project Creation
 - e. Phase 5: Final Project Exhibition
6. (Forthcoming/ teachers create for their own contexts) Case studies 3 & 4: e.g., Pennsylvania & Ethnobotany in Pennsylvania. (Teachers can focus on their own local region and make connections between the info from Kenya in Case Studies 1 and 2 above.

Unit Overview:

1. Start unit with *An Introduction to Ethnobotany* slides. This presentation will introduce the concepts of ethnobotany, indigenous knowledge, the basic biology of plants (native vs. naturalized), and ethnography. Connections will be made to previous knowledge and to everyday life. The presentation includes discussion questions, supplementary videos, and ideas for an optional check your knowledge game.
2. *Case Study #1: Kenya* is a presentation that introduces students to the country Kenya, located in East Africa. Topics explored include: history overview, political geography, topography, biomes, ecosystems and habitats, and cultural background of the country. This presentation includes discussion questions.
3. *Case Study #2: Ethnobotany in Kenya* is a presentation that explores five plant species found in Kenya. Each plant species is explored through its physical characteristics and local use. Indigenous knowledge from local tribes is cited in each plant's uses. This presentation gives students a first-hand look at ethnobotany and includes discussion questions. It only scratches the surface and can be used as a starting point to spark deeper research into indigenous knowledge about plants in Kenya and for comparative research into ethnobotany in one's own region.

4. *Exploring Medicinal Plants: A Cross Cultural Journey* is a hands-on ethnographic project and includes a unit assessment. Students will take the knowledge gained from the unit and apply it to creating their own ethnobotany project utilizing basic ethnographic skills such as interviewing and participant observation. Students will conduct ethnographic research within their own communities in order to learn about local plant use. Students will make claims regarding US and Kenyan plant use, and argue the value of ethnobotany. They will present their findings in a final project format.

Assessment:

Students will complete a project-based learning assessment to show that they have mastered the knowledge taught in this unit. The assessment will encourage students to engage in basic ethnographic research skills in order to learn about a plant of their interest in Kenya and in their local ecosystem. Students will practice basic text research and basic ethnographic research to explore ethnobotany. Students will use their research to compare and contrast biological features of plant species in different ecosystems, and compare and contrast the cultural knowledge and practices of plants. Students will present their research findings in an appropriate final project format that accurately conveys their research and makes a value claim regarding ethnobotany.

Related Materials & Furthering Knowledge:

Video: Mwanja Peter Ngila Julius explains plant use in Kenya (video link:

<https://vimeo.com/869940208?share=copy>)

- Mwanja Peter Ngila Julius from the Kiambethu Tea Farm in Limuru Town, Kenya explains local plant use.

Video: Dr. Peter Gichiri, Kenya Indigenous Knowledge (video link:

<https://vimeo.com/869940841?share=copy>)

- Dr. Peter Gichiri from St. Paul's University in Limuru, Kenya explains his personal connection to Indigenous knowledge in Kenya and the importance of preserving Indigenous knowledge about plants and nature in all communities.

Food, Land and People (website link: <http://www.foodlandpeople.org/>)

- Food, Land and People is a nonprofit that educates students, teachers, and citizens about the interrelationships between food, resources, and people.

Pennsylvania Department of Conservation and Natural Resources (website link:

<https://www.dcnr.pa.gov/Conservation/WildPlants/Pages/default.aspx>)

- Pennsylvania government information on wild plants in the region, with links to native plant information and growing tips.

Further ideas for cross curricular connections:

Social Studies: Explore the history and culture of Kenya and its tribes more deeply. Compare how ethnobotanical knowledge may be similar and different across different tribes.

ELA: Find literature and poetry about the importance of plants in our lives. Have students write their own works exploring these themes.

Science: Delve into the evolutionary rationale behind why plants create compounds which affect animal physiology, and the biochemistry behind the mechanics of such effects. Explore how biologically-derived molecules are used as starting points for creating commercial drugs in the pharmaceutical industry.

Science/ visual arts: Teach students nature journaling and botanical illustration techniques to hone observational skills. Use nature journaling to document specimens of plants in your setting and compare them to botanical illustrations of plants from Kenya and elsewhere.

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Reference List

Alzohairy, M.A. (2016). Therapeutics Role of *Azadirachta indica* (Neem) and Their Active Constituents in Diseases Prevention and Treatment. *Evidence-Based Complementary and Alternative Medicine*. <https://doi.org/10.1155/2016/7382506>

[Center for International Forestry Research (Cifor)] (2014, May 13.) *Prunus africana: A Reality Check* [Video]. YouTube. <https://www.youtube.com/watch?v=WmoSPOEFvMY>

Countries in the World by Population (2024). (2023, July 16). Worldometer. <https://www.worldometers.info/world-population/population-by-country/>

Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

Glynn Llywelyn Isaac, Barbara Isaac (1977). *Olorgesailie: archeological studies of a Middle Pleistocene lake basin in Kenya*. University of Chicago Press. p. Xiii.

Hall, J.B.; Sinclair, Fergus L; O'Brien, Eileen M. (2000). *Prunus Africana – A Monograph*. Bangor: University of Wales. ISBN 1-84220-048-8.

(J. M. P. Ngila, personal communication, July 14, 2023)

Kenya Country Summary. (2024, June 2). The World Factbook. <https://www.cia.gov/the-world-factbook/countries/kenya/summaries/>

Mohammad Amzad Hossain. (2019). A review on *Ficus sycomorus*: A potential indigenous medicinal plant in Oman. *Journal of King Saud University – Science*. 31(4), 961-965. <https://doi.org/10.1016/j.jksus.2018.07.002>

Nonjinge, S. (2006, Oct.). *Prunus africana*. *PlantZAfrica*. <https://pza.sanbi.org/prunus-africana>

Pencil Cactus Care. (n.d.) Greenry Unlimited. <https://greeneryunlimited.co/pages/pencil-cactus-care>

Prashant Y. Mali, Shital S. Panchal, *Euphorbia tirucalli* L.: Review on morphology, medicinal uses, phytochemistry and pharmacological activities, *Asian Pacific Journal of Tropical Biomedicine*, Volume 7, Issue 2017, Pages 603-613, ISSN 2221-1691, <https://doi.org/10.1016/j.apjtb.2017.06.002>

Prunus africana. (2023, July 2). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Prunus_africana&oldid=1163075232

Prunus africana: A Reality Check. (2014). CIFOR-ICRAF. <https://www.cifor-icraf.org/knowledge/video/v=WmoSPOEFvMY/>

Samantha Balaton-Chrimes (2021) Who are Kenya's 42(+) tribes? The census and the political utility of magical uncertainty, *Journal of Eastern African Studies*, 15:1, 43-62, <https://doi.org/10.1080/17531055.2020.1863642>

Shinkafi, S. A. and Abdullah, H. (2018). Antifungal activity and phytochemical analysis of *Ficus Sycomorous* leaf extract on *malassezia glubosa*. *Advances in Plants & Agricultural Research*, 8(6), 432-436. <https://doi.org/10.15406/apar.2018.08.00362>

Spalding, M. D., Fox, H. E., Allen, G. R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A., & Robertson, J. (2007). Marine Ecoregions of the World: A Bioregionalization of Coastal and Shelf Areas, *BioScience*, 57(7), 573–583. <https://doi.org/10.1641/B570707>

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Newebcreations <https://maps-kenya-ke.com/kenya-tribes-map>

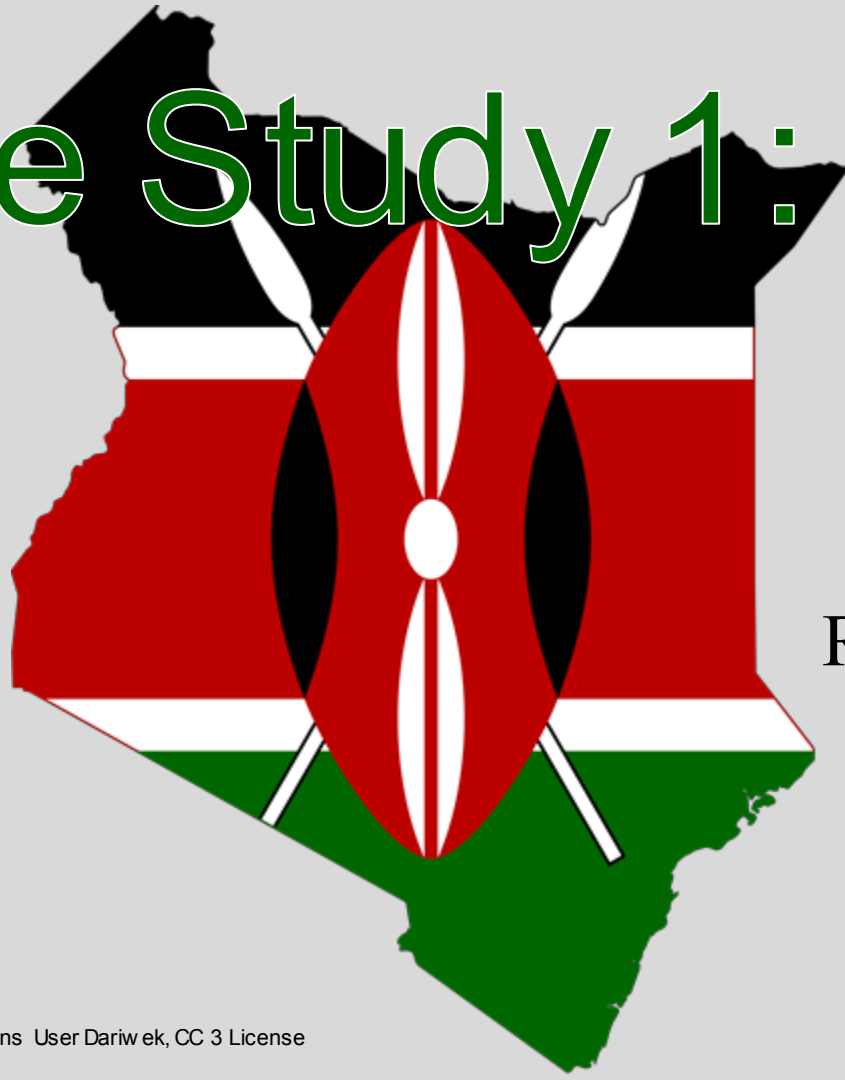
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Appendix A: Lesson Slideshows

Case Study 1: Kenya



Rebecca Daugherty,
Alex Dragon, &
Kimberly Safran

Karibu Kenya! (Welcome to Kenya)

Kenya is a country in East Africa

- It is the 7th most populous country in Africa (26th in the world) at 55.1 million people in 2023. ¹
- Hominids (prehistoric human relatives) lived in Kenya as far back as 2.5 million years ago, during the Pleistocene Epoch!²
- Kenya became an independent Republic in 1964, ending 74 years of British colonial rule. Its current constitution was adopted in 2010 and its form of Government is a Presidential republic. ³
- Its official languages are Swahili and English, and its people also speak many different native languages or “mother tongues” of their tribes.
- Kenya has “42(+)” tribes, depending on what person, census, or other reference you consult—many groups have sub-divisions that have been classified differently in different censuses. Regardless, there are numerous cultural groups all with unique and overlapping languages, cultural traditions, histories, foods, and styles of dress.

1. <https://www.worldometers.info/world-population/population-by-country/>

2. Glynn Llywelyn Isaac, Barbara Isaac (1977). *Olororgesailie: archeological studies of a Middle Pleistocene lake basin in Kenya*. University of Chicago Press. p. Xii.

3. <https://www.cia.gov/the-world-factbook/countries/kenya/summaries/#geography>

4. Samantha Balaton-Chrimes (2021) Who are Kenya's 42(+) tribes? The census and the political utility of magical uncertainty, *Journal of Eastern African Studies*, 15:1, 43-62, DOI: [10.1080/17531055.2020.1863642](https://doi.org/10.1080/17531055.2020.1863642)



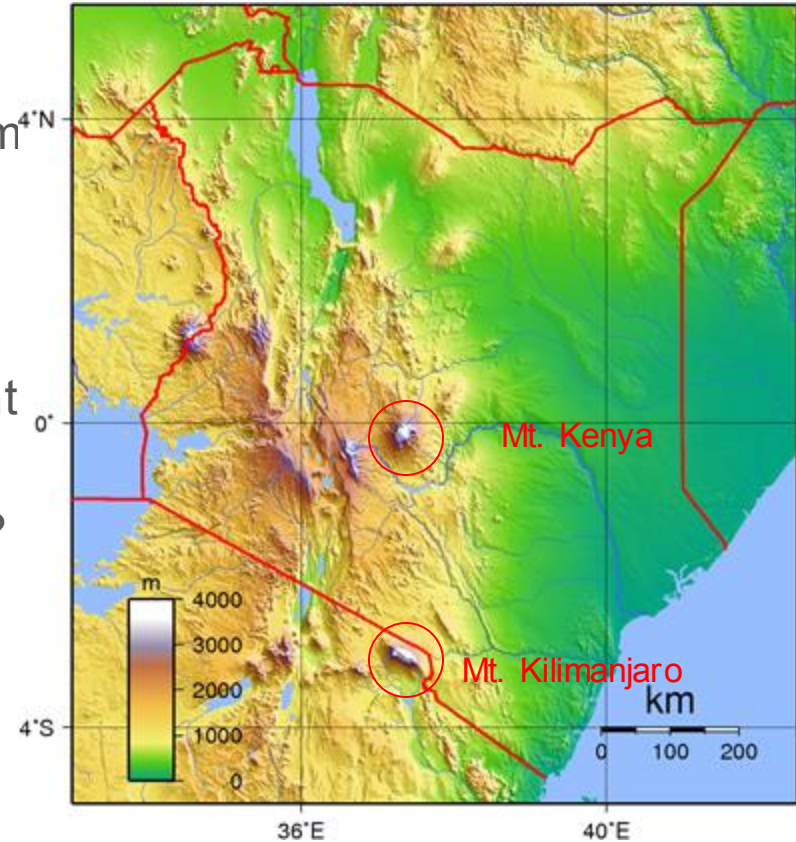
Kenya - Geography - Political

- Kenya is situated on the equator and borders South Sudan, Ethiopia, Somalia, Uganda, and Tanzania. It borders the Indian Ocean to the east and borders part of Lake Victoria on the West.
- Kenya has 47 counties. It's capital city, is Nairobi. Other prominent cities by population are Mombasa, on the coast; Nakuru; Eldoret; and Kisumu.



Kenya - Geography - Topography

- Kenya's topography varies in elevation from sea level at its eastern coast to 5,197 m above sea at the Peak of Mount Kenya.
- Mt. Kenya is the tallest mountain in Kenya and the second-tallest in Africa, after Mount Kilimanjaro in Tanzania.
- Can you find these mountains on the map?



Kenya - Geography

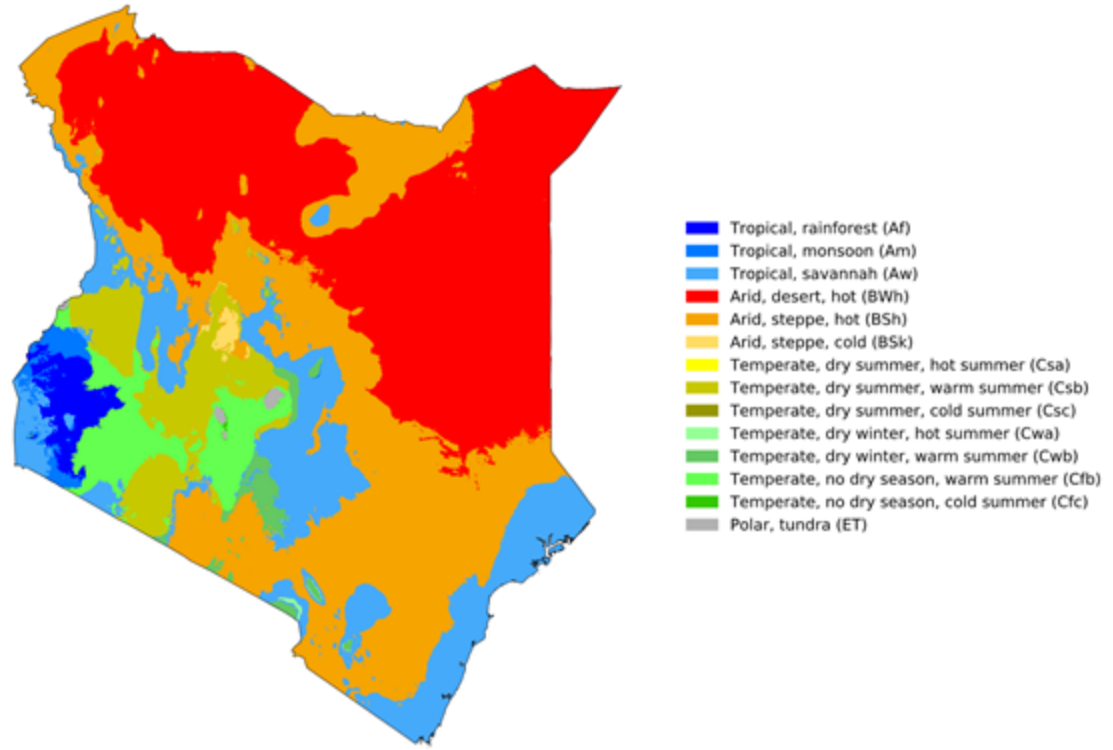
- The Kenyan Rift Valley, the Eastern arm of the East African Rift, (colloquially referred to as the “Great Rift Valley”) passes through Kenya. This is a geologically active area where tectonic plates are moving apart, leading to thinning of the earth’s crust and geothermal and volcanic activity.
- Some of these volcanoes are still active.
- Many lakes in this region are alkaline, also referred to as “soda lakes.” They provide important habitats to many birds like flamingos and white pelicans, and also provide economic resources and opportunities such as mineral resources, geothermal power, and ecotourism.



Kenya - Geography - Climate and biomes

- Kenya has diverse ecoregions: tropical and subtropical forests; grasslands, savannas, shrublands; deserts; mangroves; lakes; and coral coasts.¹

Köppen-Geiger climate classification map for Kenya (1980–2016)



1. <https://academic.oup.com/bioscience/article/57/7/573/238419>

Ecosystems

An **ecosystem** is a geographic area which includes all of the biotic (living) and abiotic (nonliving) factors in an environment which interact.



By Danijel Mihajlovic - <https://thenextcrossing.com/the-ultimate-guide-to-the-masai-mara-safari/>, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=96024077>



Ray Manila, Spotted Hyena vs Grant's Zebra, Maasai Mara, CC BY 2.0

- List the of the biotic and abiotic factors you can see in these photos from the Maasai Mara ecosystem in southwest Kenya.
- List some others you cannot see pictured, but are likely to be in this ecosystem too.

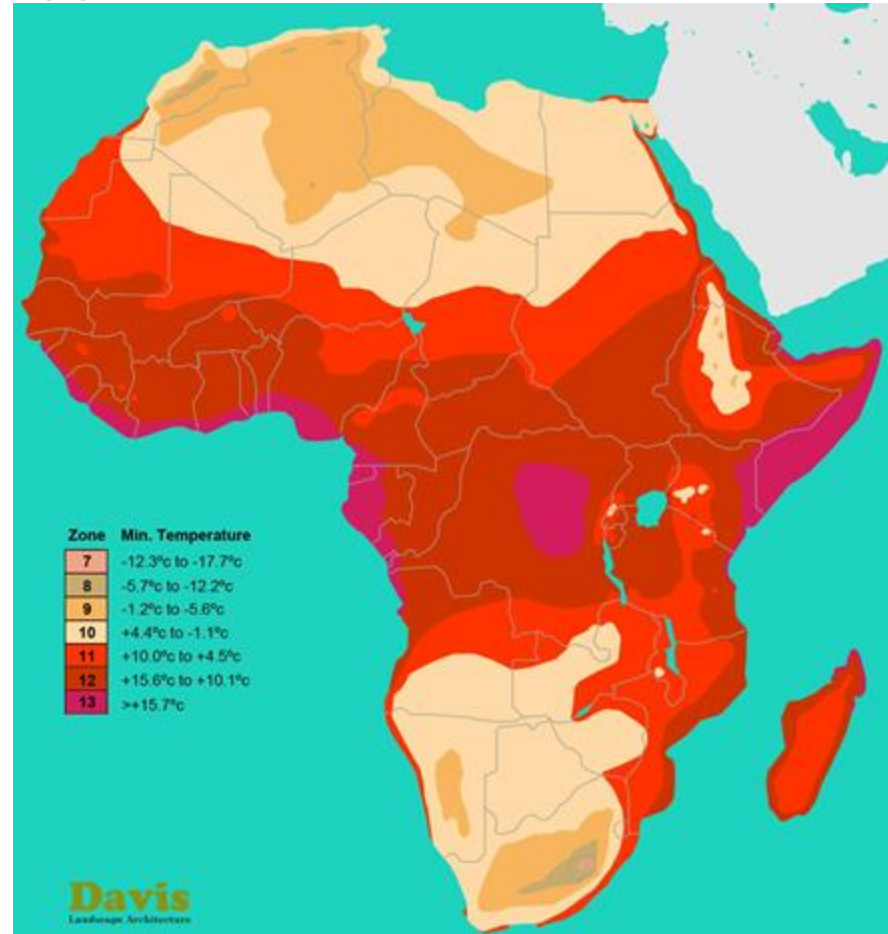
Ecosystems and plant communities

The following factors and more will influence which plants can grow in a particular habitat.

- Temperature
- Humidity
- Elevation
- Light levels
- Soil type
- Soil moisture
- Other organisms

This map (from Davis Landscape Architecture firm) displays zones for which plants can survive based on the average lowest temperature.

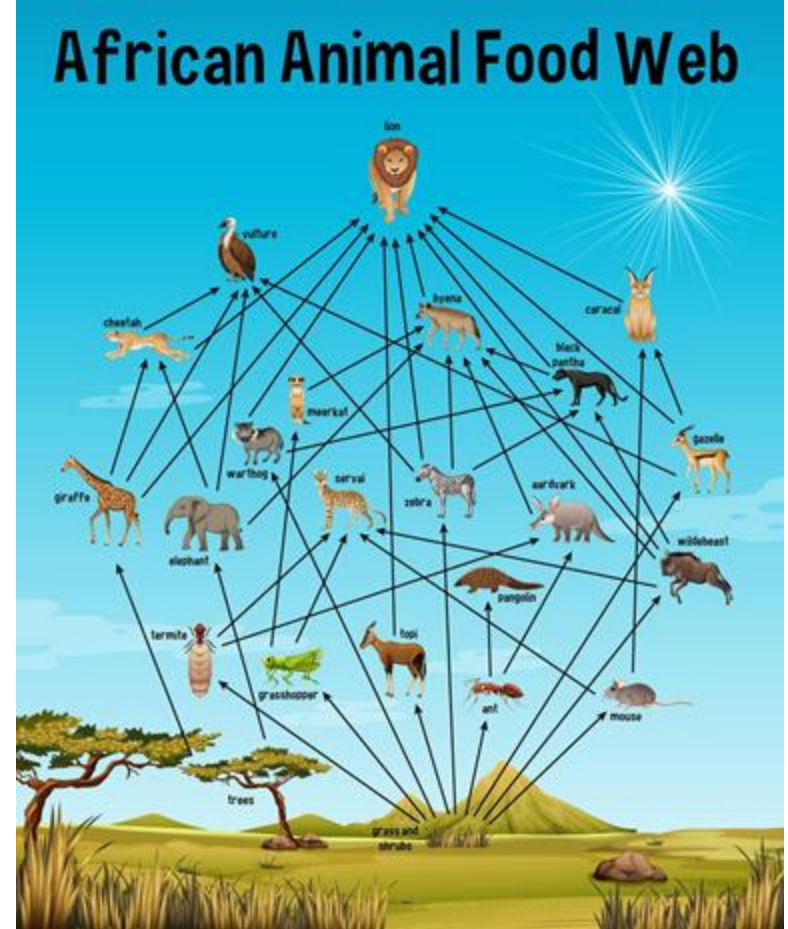
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Plants are primary producers in ecosystems

In an ecosystem, we can trace the flow of energy through the system - a food web or trophic web. Plants make their energy using sunlight in the process of photosynthesis. We call them **primary producers**, because the other organisms in the food web depend on the energy they produce.

- How are carnivores like lions dependent on plants?



There are other reasons plants are important

List other uses that humans use plants for, other than for food energy.

- Medicines
 - Could be chewed or made into teas, pastes, ointments and more, depending on the plant type
- Construction
 - E.g. bamboo poles, grass thatched roofing
- Fibers and textiles
 - E.g., weaving baskets from grass or bark, linen from flax, cotton
- Producing pigments and dyes
- Spices
 - Used more for their pleasant tastes (and sometimes preservative qualities) than for the calories added.
- For aromas
- For decoration
- Ritual/religious use
- More?
- We will focus primarily on the medicinal use of plants.



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Kenya - cultural background

- As far back as the 1st century CE, communities of ironworkers and fisherman were established on the East African Coast.
- Arab traders began interacting with the people in this region in the port cities of Mombasa, Zanzibar, and Malindi.
- This brought the influence of Islam as well as the Arabic and Persian languages into East Africa. Furthermore, there was influence from India and further societies engaged in this trade network.
- The Swahili language was developed as a *lingua franca*—a common language shared by people with different native languages to communicate. It is still used in this way today across East Africa.



The Swahili Coast Region

Kenya - cultural background



As previously mentioned, Kenya is ethnically diverse, with 42(+) distinct tribes.

Compare to how Americans may celebrate their ancestry, whether they are indigenous, have ancestors who immigrated here, or are recent immigrants. Kenyans will know their tribe, learn its language (“mother tongue”) and unique customs, histories, foods, musical traditions, art styles, and dances, though they are all still Kenyans.

Kenya - cultural background

Per the CIA World Factbook, the most populous tribes in Kenya are (2019 est.):

Kikuyu 17.1%

Luhya 14.3%

Kalenjin 13.4%

Luo 10.7%

Kamba 9.8%

Somali 5.8%

Kisii 5.7%

Mijikenda 5.2%

Meru 4.2%

Maasai 2.5%,

Turkana 2.1%

[non-Kenyan 1%]

other 8.2%



Wangari Maathai, environmental and political activist and the first African woman to win a nobel prize, is from the Kikuyu Tribe.

By Kingkongphoto Wangari Maathai 2004
Nobel Peace prize winner, CC BY-SA 2.0,



Mukhisa Kituyi, politician and UN Secretary-General of the UN Conference on Trade and development from 2013-2021, is from the Luhya tribe.

By UNCTAD -
<https://www.flickr.com/photos/53390373@N06/10995927343/>, CC BY-SA 2.0,
<https://commons.wikimedia.org/w/index.php?curid=58796547>



William Ruto, the fifth and current (2023) president of Kenya, is from the Kalenjin tribe.

By Quirinale.it, Attribution,
<https://commons.wikimedia.org/w/index.php?curid=129618207>

Kenya - cultural knowledge

- As with cultures all around the world, some of the knowledge that will be passed down in Kenyan families and tribes is the knowledge of how the plants in their local regions can be used for various purposes.
- The knowledge of many tribes will overlap, but they will also have unique information based on their own cultural and geographic histories.
- Do you think it is important to continue communicating this type of knowledge to future generations? Why?



Julius Ngila explains some of the uses of the *Dracaena* plant to tourists in Kiambu County.

Photo by Alex Dragon - may reuse with attribution.

Discussion questions

1. What similarities do you notice between Kenya and your home? In terms of geography? Ecosystems? Culture?
2. This was a very brief overview. What else are you curious about now that you have learned a bit about Kenya?
3. Do people in your family or community use plants for medicine, textiles, construction, pigments, ritual uses, or spices, or anything else besides food? How?
4. Who in your family or community might know more about traditional uses of plants?
5. How do the climates and ecosystems of Kenya compare to your region? You can return to [slide 8](#) to review the major climates and ecosystem types in Kenya. Predict what the means for how similar or different the plants will be in your home vs. in Kenya.

Case Study #2 - Ethnobotany in Kenya

Rebecca Daugherty, Alex Dragon, & Kimberly Safran

Plants & Uses

- As of October 2023, this slideshow is a starting point. We plan to continue adding to and refining this work.
- We will present 5-6 plant species of interest to begin a comparative study of traditional uses of plants and their uses in Kenya with students' home regions.
- The binomial names and biological descriptions we present here are based on Western scientific sources. The knowledge of traditional uses in Kenya may come from a few different sources, primarily from Kikuyu and Luhya communities. Some personal communications were used as a starting point for further research. Western scientific research is at time cited to complement and expand on our sources of traditional knowledge and serve as a starting point for student research.
- Special thanks to:
 - **Julius Mwanja Peter Ngila**, who shared information with the authors at the Kiambethu Tea Farm
 - **Solomon Kita Atswenje**, Kenya Wildlife Services, who shared information in Kakamega Forest
- Key Print Reference:

Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

Plants and Uses - *Muiiri*

Name in Kikuyu Language: Mũiri

Scientific name: *Prunus africana*, synonym *Pygeum africanum*

English common names: Red Stinkwood, African cherry

Description: Tallest hardwood in the genus *Prunus*² (up to 25 m) with a spreading crown. Only grows in mountainous areas of Africa. Dark brown, fissured bark breaks into characteristic scaly, oblong pattern.³ Leathery leaves with red stalks, cream-colored flowers, and 2-lobed fruits which are red to purple-black when ripe.⁴

Ritual Healing:

Stem & bark used for medicine against liver disease, indigestion, meat allergy treatment. Also used to treat cattle disease *ndigana* (anaplasmosis). Bark used for prostate medicine, which has led to concerns around unsustainable harvesting.⁵

Ritual use: Hard wood used to make mortar, *ndĩrĩ* and for furniture and construction.



By Marco Schmidt [1] - Own work, CC BY-SA 2.5,
<https://commons.wikimedia.org/w/index.php?curid=1843764>

¹Prashant Y. Mali, Shital S. Panchal, *Euphorbia tirucalli* L.: Review on morphology, medicinal uses, phytochemistry and pharmacological activities, Asian Pacific Journal of Tropical Biomedicine, Volume 7, Issue 2017, Pages 603-613, ISSN 2221-1691, <https://doi.org/10.1016/j.apjtb.2017.06.002>.

²Per Wikipedia citation: Hall, J.B.; Sinclair, Fergus L; O'Brien, Eileen M. (2000). *Prunus Africana – A Monograph*. Bangor: University of Wales. ISBN 1-84220-048-8.

³ <https://pza.sanbi.org/prunus-africana>

⁴Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

⁵ <https://www.cifor-icraf.org/knowledge/video/v=WmoSPOEFWMY/>

Plants and Uses - Pencil Cactus

Name in Kikuyu Language: Kariaria

Scientific name: *Euphorbia tirucalli*

English common name: Pencil Cactus

Description:

A succulent bush or tree (not a true cactus) of semi-arid environments growing 6-10 m in height.^{2, 3} The thin branches terminate in small new leaves.^{1,3} All parts contain milky latex.¹

Ritual Use:

Break off leaves, rip open. Inside is white milky latex that can be used as glue. The latex is also used against toothache, hemorrhoids, epilepsy, snake bites, and cough.¹ Also used to quickly establish boundary hedges around homesteads.

The latex is irritating to the human eye, but can be treated with human milk.

Other names: ndarũ, nyanjoe

¹Prashant Y. Mali, Shital S. Panchal, *Euphorbia tirucalli* L.: Review on morphology, medicinal uses, phytochemistry and pharmacological activities, Asian Pacific Journal of Tropical Biomedicine, Volume 7, Issue 2017, Pages 603-613, ISSN 2221-1691, <https://doi.org/10.1016/j.apjtb.2017.06.002>.

² Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

³ <https://greeneryunlimited.co/pages/pencil-cactus-care>



Photo by Rebecca Daugherty - may reuse with attribution.



Plate from book Francisco Manuel Blanco, Public Domain 1.0

Plants and Uses - Neem Tree

Name in Kikuyu Language: Mũarubaini

Scientific name: *Azadirachta indica*

English common name: Neem, Margosa, Indian Lilac

Description: Introduced from India, but widespread in Kenya, especially on the coasts. Grows to about 18 m and has clusters of cream-white flowers and oval-shaped, greenish-yellow fruits.

Ritual Healing: The tree is said to cure 40 diseases, which gives it the Swahili name “mwarubaini” (“arobaini” = “forty”). These include malaria.¹ Neem has anti-inflammatory, antiarthritic, antipyretic (fever-reducing), hypoglycemic (blood-sugar lowering), anti-stomach ulcer, antifungal, antibacterial, and antitumor activities.² Also cultivated for shade.¹ Neem oil can act as an insecticide and can also be toxic to humans.



By Uncle Bash007 - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=108966215>

¹ Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

² Alzohairy MA. Therapeutics Role of *Azadirachta indica* (Neem) and Their Active Constituents in Diseases Prevention and Treatment. *Evid Based Complement Alternat Med*. 2016;2016:7382506. doi: 10.1155/2016/7382506. Epub 2016 Mar 1. PMID: 27034694; PMCID: PMC4791507.

Plants and Uses - *Mūkūyū*

Name in Kikuyu Language: Mūkūyū

Scientific name: *Ficus sycomorus*

English common name: Sycamore fig, fig-mulberry

Description:

A spreading deciduous tree up to 20 m tall with yellowish bark and milky latex in all parts. Leaves are round and rough on both surfaces. The figs, called nguyu, are produced in clusters from the trunk and branches, and turn red when ripe. They are edible and also a food source for birds and monkeys. This tree is found in areas with a high water table or near water.¹

Ritual Healing: The milky latex is used to treat toothache pain. Bark is used to treat liver ailments and diarrhea.¹

Crude extracts from this tree “showed significant activity against CNS [central nervous system], ANS [autonomic nervous system], cardiovascular system, [reproductive] system, different infections, [gastrointestinal tract] problem[s], various inflammation, diabetics and cancer.”² Mūkūyū has also been used to treat parasites and as a painkiller.³

It is among the sacred trees of the Agikūyū people; sacrifices to god were occasionally performed under this tree. It is also the sycamore tree mentioned in the Bible in Luke 19:4¹, and its medicinal uses are mentioned in the Quran in the chapter “Tin” (“Fig”).²



Images from source 2, open access.

¹ Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

² Mohammad Amzad Hossain. *A review on Ficus sycomorus: A potential indigenous medicinal plant in Oman*. Journal of King Saud University - Science, Volume 31, Issue 4, 2019, Pages 961-965, ISSN 1018-3647, <https://doi.org/10.1016/j.jksus.2018.07.002>.

³ Shinkafi, S. A. and Abdullah, H. (2018). *Antifungal activity and phytochemical analysis of Ficus Sycomorus leaf extract on malassezia globosa*. Advances in Plants & Agricultural Research. eISSN: 2373-6402. <https://medcraveonline.com/APAR/antifungal-activity-and-phytochemical-analysis-of-ficus-sycomorus-leaf-extract-on-malassezia-globosa.html#:~:text=The%20bark%20of%20Ficus%20sycomorus,management%20of%20high%20blood%20pressure.>

Plants and Uses - Mũgumo

Name in Kikuyu Language: Mũgumo

Scientific name: *Ficus thonningii*

English common name: wild fig, strangler fig

Description: A spreading evergreen tree usually 15 m high with a short trunk that branches a few meters from the ground. Branches often have hanging roots. Has milky latex in all parts. Round fruits occurring in pairs are called ng'umo.¹

It is an epiphyte, a plant which lives on another, and will envelope and strangle its host.¹

Ritual Healing:

Bark fiber can be used for string and cord making.¹

However, this tree is ceremonial and considered sacred by the Kikuyu people.^{1,2}

Important initiation ceremonies, other religious ceremonies, and prayers were held under Mũgumo trees.^{1,2} Traditionally, Kikuyu people may not damage the tree or use it for firewood or other purposes.²



Julius Ngila sharing knowledge about a Mũgumo tree.



A Mũgumo tree strangling another tree in Kakamega Forest.

Photos by Alex Dragon - may reuse with attribution.

¹Gachathi, M. (2007). *Kikuyu Botanical Dictionary, Revised Second Edition: A Guide to Plant Names, Uses and Cultural Values*. Tropical Botany

²(J. M. P. Ngila, personal communication, July 14, 2023)

Discussion questions

1. Where do you get most of the medicine that you use?
 - a. Where do you think its ingredients come from/how is it made?
 - b. How is this similar or different to the medicinal uses mentioned about these plants?
2. Does your family or community use any plants in similar ways to the ones presented here?
 - a. If yes, discuss and share some of those plants and uses.
 - b. If no, why do you think we do not have similar knowledge about our local plant species?
3. Where would you go to find out more about traditional and medicinal uses of plants in your region? What sources and people would you consult?
4. Biology & chemistry connections: Why do you think plants produce substances that can have healing effects on humans?
5. Do you see importance in preserving and passing on knowledge about the traditional uses of plants? Explain why you think this way.