EACLIPSE - East Africa Climate, People, Livestock & Savanna Ecosystems

Time:
Two to three 50-minute periods, with homework assignments before and after lesson.

Summary:
In this lesson, students will use the "kite framework" to understand the complexities of human-environment interactions.

Materials:
Computer with internet access
Projector
PowerPoint presentation: Analyzing Human-Environment Interaction using the Kite Framework
Student handouts and answer sheets:
- Background paper on Maasai herders
- Blank kite framework
- Unintended consequences discussion questions
- Unintended consequences answer sheet
Kenya Sustainability Example

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Analyzing Human-Environment Interaction using the Kite Framework

Objectives

Students will be able to
- analyze human-environment interactions in the East African savanna using the kite framework
- make predictions about unintended consequences that could result from actions taken in the East African savanna using a kite timeline
apply what they have learned to a real scenario from Kenya

Background

Climate change is the result of complex human-environment interactions. Human activities can cause damage to the environment in different ways, including contributing to the rise in the greenhouse gases that are causing climate change. In order to understand the human side of human-environment interaction, we need to understand how and why people choose to engage in particular activities. The choices people make and the options they have are influenced by political, social-cultural, economic, and environmental factors.

One way to represent human-environment interaction is through the "kite framework". This model can be used to help students grasp the complexity of the interactions among all of the different elements that influence people's decisions. In addition, the kite framework can be represented as a timeline to show interactions and change over time. This lesson will give students the opportunity to examine human-environment interactions in greater depth and to apply their understandings to predicting possible unintended consequences of different actions taken in the East African savanna in the context of a changing climate.

Vocabulary

Social
Cultural
Economic
Political
Development
Sustainability

Procedure

1. Begin with a brief discussion with students to activate their prior knowledge.
In Lesson 1, we looked at how people interact with the environment by looking at the human-land-climate system. We talked about how people need to make decisions about their livelihood and land use because of climate change, but we did not look at all of the factors that can affect those decisions. In order to consider these factors, we need to know a little more about the people who live in the savanna.

2. Have students read and highlight the Background Paper on Maasai Herders. (This can be assigned as homework ahead of time.)

Optional: If you wish to provide students more background information on the people of the savanna, have students read chapters 3 and 4 of the free down-loadable Kenya E-Book available at www.clip.msu.edu.

Optional: If you wish to provide students with more background on the geography of East Africa, use the free lesson plans from Exploring Africa http://exploringafrica.matrix.msu.edu (Unit Four: Regional Perspectives, Module Nineteen: East Africa, Activity Two: The Geography of East Africa).

3. Show the first three slides of the PowerPoint presentation.

4. Write "environment" above "humans" on the board with a two-way arrow between them. Under humans, make three arrows pointing down to three columns labeled political, social-cultural, and economic.

Ask students: Think about life in the East African savanna. What might affect whether a person decides to keep livestock, plant crops, or look for a job? As students make suggestions, group them under the three categories. When they are unable to provide more ideas of their own, provide the following examples on post-it notes and have students take turns placing them under the appropriate category and saying what the effect might be (for example, if my wealth is measured by how many cattle I have, I am more likely to want to continue to have livestock).

Examples:
Social-cultural:
My family has always had cattle
I know how to herd cattle, but I don't know how to farm
My wealth is measured by how many cattle I have
I don't want to stay in one place to farm--I want to be able to move
Many farmers have moved into the area, the population is increasing

Political:
My children are now required to attend school, so they need to stay in one place
We no longer have access to some of our grazing lands because they became part of a national park
The government is giving people land for farming where we used to graze
The government gave me the rights to a piece of land but I can't leave if I want to keep it
The government has asked herders to limit the number of cattle in their herd

Economic:
I don't have enough money to buy seed
I can't earn enough money herding or farming to support my family
The government is providing loans to buy seeds
I sold my cattle so I have a lot of money right now
I can make some extra money in the tourist industry

We know that people's decisions have an effect on the environment, and that the environment has an effect on what options people have. The kite framework helps us look at all of these elements at

the same time and see how they interact.

5. Continue the PowerPoint presentation.

Extension 1: The Michigan Kite Example could be made into a full lesson by having students work in groups to find out the information to fill in the Great Lakes Kite Framework (environmental, social-cultural, economic, and political elements).

Extension 2: After completing the lesson, students could compare the Great Lakes ecosystem to the East African savanna ecosystem (a middle school science goal).

6. Pass out the blank kite framework to students. Have them try to put the different factors in the right categories. Discuss their answers as a class.

7. Continue the PowerPoint presentation.

8. Hand out the Unintended Consequences discussion questions to students.
Have students answer the questions about unintended consequences and human-environment interaction, then share their answers and discuss.
What could happen to herders if…
- the government puts aside more land to protect wildlife?
- the government gives more land in the savanna to farmers?
- all children are required to attend school?
- herders are encouraged to settle and farm?

What could happen to the savanna ecosystem if…
- the government gives more land in the savanna to farmers?
- herders are encouraged to settle and farm?
- herders switch to drought-resistant livestock?
- boreholes are drilled to provide more water?

What do these unintended consequences tell us about human-environment interaction?

9. Pass out the Kenya Sustainability Example and have students read, highlight, and respond to the reflection prompts. (This can be done as homework.)
1. Briefly explain how these policies and outcomes relate to the kite framework.
2. 2. Make one suggestion for a different policy approach and explain why you think it might be more sustainable for people and the environment.

10. Discuss the outcomes of the policy choices in this real-life example.
Have students relate those choices and outcomes back to the kite framework and make one suggestion for a different approach. Share students' answers.

11. Conclusion: In this lesson, you learned to use the kite framework to understand human-environment interactions, make predictions, and you applied what you learned to the Kenya Sustainability example. In the next lesson, you will learn about strategies people may use to adapt to climate change in the East African savanna.

Assessment

- Were students able to fill out kite framework accurately for the East African savanna?
- Were students able to answer questions about possible unintended consequences and understand their relationship to human-environment interaction?
- Were students able to relate the Kenya Sustainability Example to the kite framework and suggest a different approach?

Web Resources

East Africa:
Kenya E-Book www.clip.msu.edu.
Exploring Africa Curriculum
http://exploringafrica.matrix.msu.edu.

Great Lakes:
US Environmental Protection Agency (EPA)
www.epa.gov/greatlakes

Great Lakes Information Network (GLIN)
Lessons and information on environmental issues in
the Great Lakes
www.great-lakes.net/teach

Project Websites:
EACLIPSE (East Africa Climate, People, Livestock &
Savanna Ecosystems) www.eaclipse.msu.edu

CLIP (Climate Land Interaction Project)
www.clip.msu.edu

LUCID (Land-Use Change, Impacts, and Dynamics)
www.lucideastafrica.org

CASID Occasional Paper No. 10 "Framework for
Environment and Development: The Kite" by David J.
Campbell and Jennifer M. Olson, Department of
Geography, Michigan State University.

Song:
Michigan Song by Joe Reilly (song about the Great
Lakes) available at www.joereilly.org/music.html.

Maasai herd - cattle in background, goats & sheep in foreground (Photo: David Campbell)

THE MAASAI

The term Maasai refers to those people who speak the Maa language. They include pastoral people (herders), such as the Maasai and Samburu, who traditionally depended upon the products of their cattle, sheep, and goats for their survival. It also refers to the more settled farmers such as the Wa-Arusha of Tanzania. The Maasai had occupied much of the Rift Valley and adjacent highlands by about 600 years ago. In Kenya and Tanzania, they continue to occupy parts of the Rift Valley, which they were assigned by the British.

Maasai Social Structure

The Maasai have maintained strong traditions while also being willing to adapt to new ideas when they saw them to be to their advantage. The Maasai are organized into clans and into age sets. The clans are associated with territories over which each has primary claim. The age sets are a male institution which cuts across clans. Age sets represent the organizational hierarchy of the Maasai. In their teens, boys are initiated and become morans, warriors. When a new set of warriors is initiated, the existing warriors become junior elders, and the existing junior elders become senior elders. It is the senior elders that govern the group.

Changes in Maasai Culture

Many in East Africa and beyond see the Maasai as having resisted modernization and as continuing a traditional way of life. The British colonial government and the Kenyan and Tanzanian governments since independence lamented the Maasai's apparent hold on tradition and refusal to enter the modern world. The proud Maasai warrior in traditional dress and hair painted in red ocher is one of the most enduring images of East Africa, sought by tourists and promoted by tourist advertising. In reality, the Maasai maintain much of their tradition, but they are also altering their way of life to meet the demands of modern Kenya. Even under the British, they were quick to welcome veterinary improvements, such as vaccinations against hoof and mouth disease and dipping to get rid of ticks. Education and modern health care are widely accepted. Their diet includes more grains and vegetables than in the past, and many Maasai cultivate crops. Increasing numbers are moving to towns, and in Nairobi and Dar Es Salaam (the capitals of Kenya and Tanzania) young Maasai specialize as security guards, cashing in on the warlike reputation of the moran.

Herders

Maasai herders (also called "pastoralists") graze their livestock (cattle, sheep, goats, and more recently camels) over large areas of the East African savanna. Traditionally, these herders are nomadic, following their livestock and making temporary settlements where they are grazing their livestock. Different clans have claims on different areas, but will

negotiate with another clan if one clan does not have access to enough land to feed their livestock. All members of the family have jobs to do, even young children. Girls help to gather firewood, carry water, and take care of the youngest children while boys are given responsibility for herding animals at a very young age.

Land Issues: Herders and Farmers

Over time, the lands available to herders have been restricted, and it has become increasingly difficult for herders to access the amount of land they need to support their herds. Some land has been granted to farmers from other areas, some land has been given to herders who have begun to settle and farm. Once land is set aside for farming there a conflict between the needs of herders and farmers. Livestock that get into farmland can destroy whole fields, and must be kept out, even if there are no fences around that land. It can be difficult for herders to keep their livestock out of farmland, and devastating for farmers who may lose their crops to livestock. After the harvest, the relationship between herders and farmers can be beneficial. Livestock can be allowed to eat the remains of the crops, such as maize stalks, cleaning the field, and leaving behind fertilizer in the form of manure.

Land Issues: Herders and Wildlife

In the Rift Valley, large areas of land have been set aside for wildlife. Tourists from all over the world travel to Kenya and Tanzania to see elephants, lions, giraffes, zebras, rhinos, hippos, and other savanna wildlife. While these protected habitats are critical for the survival of these species, they also take land away from herders. Herders' access to land set aside for wildlife varies. Some wildlife areas allow no access at all, others allow herders to graze their livestock, but not live there, and still others allow for herders to live within the area. In addition, there are "wildlife corridors", areas in the savanna where wildlife passes through to get from one wildlife area to another. Areas set aside for wildlife restrict how much land herders have available for their livestock, and how easily they can get from one grazing area to another (if they are not allowed to pass through a protected area). Areas that are shared with wildlife may have less of the grasses the livestock need because they are also being grazed by wildlife.

Safety Issues: Herders, Farmers, and Wildlife

Apart from the land issues, herders and farmers both have to live with the dangers presented by sharing territory with wildlife. Wild animals do not stay inside of the areas set aside for them. They move from place to place looking for food and water, migrating large distances. Elephants and other animals can destroy crops by eating them and by trampling fields as they walk through. Lions, hyenas, and other carnivores can kill livestock. Elephants can also destroy homes and attack people, as can lions. One place where people, livestock, and wildlife are likely to meet is where there is a source of water. Water is scarce in the savanna, and often a single water source is shared by all. Many homes do not have water, and people walk to a water hole or river to carry water to use at their home, making it hard for them to avoid meeting up with wildlife sharing the same water source.

Herders and the Savanna Ecosystem

The savanna ecosystem is very fragile. The soils are poor in nutrients, and the lack of reliable rains means that it is challenging to grow crops in the savanna. Even under the best growing conditions, savanna soils are easily degraded by continued farming. Grazing is in many ways the best land use for this kind of ecosystem, just as the dry areas in the western United States are suitable for cattle ranching. Depending on conditions (rainfall and vegetation), herds can be moved to graze where there is suitable grass, and moved on before they eat down to the roots and damage the ecosystem. If livestock are kept too long in one area, they can overgraze the vegetation, which may not be able to recover.

(Adapted from the Kenya E-Book by David Campbell and Sheba Onchiri, available at www.clip.msu.edu.)

Unintended Consequences

Policies are made to try to improve the situation in the East African savanna. While many policies bring about positive changes, they can also have unintended consequences. Using your knowledge of the East African savanna human-land-climate system, write at least one possible unintended consequence of the following changes:

What could happen to herders if…

the government puts aside more land to protect wildlife?

the government gives more land in the savanna to farmers?

all children are required to attend school?

herders are encouraged to settle and farm?

What could happen to the savanna ecosystem if…
the government gives more land in the savanna to farmers?

herders are encouraged to settle and farm?

herders switch to drought-resistant livestock?

boreholes are drilled to provide more water?

What do these unintended consequences tell us about human-environment interaction?

Policies are made to try to improve the situation in the East African savanna. While many policies bring about positive changes, they can also have unintended consequences. Using your knowledge of the East African savanna human-land-climate system, write at least one possible unintended consequence of the following changes:

What could happen to herders if…
> the government puts aside more land to protect wildlife?
> Less land for herders to graze their livestock; herders may have to switch to farming (if land is available) or try to find jobs elsewhere.
> Wildlife populations may increase, posing a greater threat to people, crops, and livestock.
> the government gives more land in the savanna to farmers?
> Less land for herders to graze their livestock; herders may have to switch to farming (if land is available) or try to find jobs elsewhere.
> all children are required to attend school?
> Herders cannot migrate with their livestock—may be forced to settle or leave part of the family behind to stay with children in school.
> Herders do not have the labor needed to herd all of their animals (children take responsibility for herding at a young age)—may need to hire people to care for their livestock, or may not be able to have as many animals.
> herders are encouraged to settle and farm?
> More farming puts more pressure on the fragile savanna ecosystem. Soils may become degraded to the point that they can no longer support farming.
> Herders are forced to change their traditions and lifestyle. Herders may need assistance learning how to farm.

What could happen to the savanna ecosystem if…
> the government gives more land in the savanna to farmers?
> Savanna land is fragile, not well suited for farming—may cause degradation of the land.
> Vegetation cleared to make farms may change the local ecosystem, resulting in less ground cover and moisture retention.
> herders are encouraged to settle and farm?
> Savanna land is fragile, not well suited for farming—may cause degradation of the land.
> Vegetation cleared to make farms may change the local ecosystem, resulting in less ground cover and moisture retention.
> herders switch to drought-resistant livestock?
> Livestock that are more resistant to drought (goats, sheep, camels) can eat vegetation that cattle cannot digest. They eat the drier, tougher grasses, and leaves off of bushes and trees. They also tend to eat all the way down to the roots of grasses and eat all of the vegetation, whereas cattle leave some vegetation intact. If drought-resistant livestock are grazed for too long in one place, they can leave the vegetation denuded and cause further degradation.
> boreholes are drilled to provide more water?
> More people may move to the area because of the reliable water source, putting more pressure on the ecosystem.

What do these unintended consequences tell us about human-environment interaction?
Policies that are made to help people sometimes have unintended consequences that negatively affect the environment. Policies that are made to help the environment sometimes have unintended consequences that negatively affect people.

Kite Framework

Political

Social-Cultural

Economic
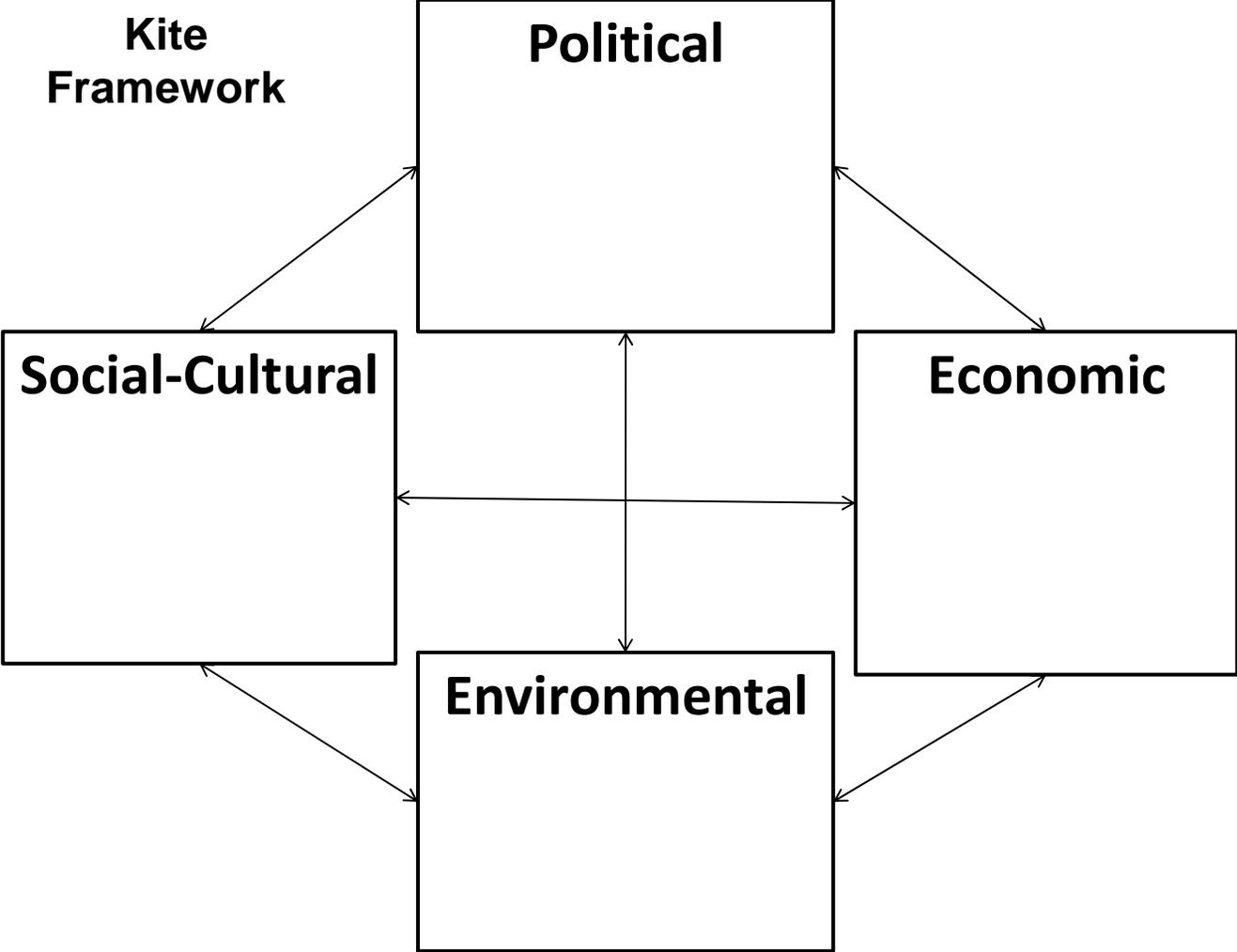
Environmental

Sometime decisions are made to try to improve environmental sustainability without looking at all the elements of human-environment interaction. Without considering all of the elements in the kite framework (environmental, social-cultural, political, and economic), there can be some unfortunate consequences, with results that are not sustainable for everyone involved.

The following is an example related to population and resources in Kenya.

In Kenya, large areas have been set aside as national parks and the revenues from tourism provide a major portion of Kenya's foreign exchange earnings. Adjacent to many of the parks are lands grazed by the livestock of herding people, the Maasai. Since colonial times, a frequent criticism of herding people has been that they overgraze these lands. The dominant belief has been that the herders keep too many livestock and the objective of the government has been to reduce animal numbers. Government policy has thus sought to make the environment more sustainable. We can look at three different policy scenarios which have been proposed to achieve this objective:

Scenario One

The government first promoted destocking through encouragement of sales of livestock. It then added a policy of granting land titles to encourage landowners to manage their land better. Neither policy succeeded in reducing numbers because no alternative to livestock was available to meet the economic needs of the population.

Objective: Reduce overgrazing to create a sustainable environment.

Policy: Limit number of livestock, grant land titles.

Assumptions: The problem was a purely local one, related to management practices among the Maasai. The solution, therefore, lay in altering elements of the Maasai system, in particular reducing livestock numbers and encouraging private land ownership.

Policy outcome: The policies of livestock reduction and increased private ownership, during a period of high population growth, proved ineffective since no alternative economic opportunities were offered. The problem definition and solution were confined to the local pastoral system. Save the grass but lose the people.

Scenario Two

Objective: Reduce overgrazing for a sustainable environment

Policy: Promote alternative economic opportunities for the population

Assumptions:
1. Opportunities exist in livestock industry (meat/tanning), wildlife and tourism
2. The economic system can be decentralized to provide employment at the local level in activities other than herding
3. Large-scale producers, such as tour operators and slaughterhouse owners, will not interfere in the implementation of the policy although some may lose economically.
Outcome: The local economy would be diversified and more people supported outside the subsistence production. The grazing pressure would be reduced while more people would find employment. Save the grass and the local people.

The second scenario has been partially implemented. Some revenues from wildlife-related tourism are being directed towards communities living adjacent to the National Parks. However, the degree of linkage with the local herding economy has been limited. The concept of broad-based decentralized economic development has not been accepted. Rather, the third scenario, discussed below, has prevailed.

Scenario Three

Objective: Reduce overgrazing for a sustainable environment.

Policy: Promote alternative economic opportunities for the population. Rearrange land laws so that the large scale producers and the wealthy elite can buy rangeland, produce beef and receive the wildlife-related revenues.

Outcome: Save the grass, enrich the rich and marginalize the poor.

In all three cases we strive for a sustainable environment but the policy choices for that objective are very different. The policies result in competing groups gaining access to the land and to other economic opportunities. We have to recognize that the goal of environmental sustainability cannot be divorced from social-cultural, political, and economic elements.

This is why it is important to look at the issues addressing all of the elements in the kite framework, which will make it necessary to ask question such as:

Who will benefit from development?

Who defines the objectives?

Who determines policy?

How will policies designed to protect the environment affect people?

How will policies designed to help people affect the environment?

How can policies be designed to be socially and environmentally sustainable?

Adapted from: CASID Occasional Paper No. 10 "Framework for Environment and Development: The Kite" by David J. Campbell and Jennifer M. Olson, Department of Geography, Michigan State University.

Reflection: discuss the following points on a separate sheet of paper:

1. Briefly explain how these policies and outcomes relate to the kite framework.

2. Make one suggestion for a different policy approach and explain why you think it might be more sustainable for people and the environment.