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How can sharing knowledge better explain land use changes in Ethiopia?

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Abstract

When you think about environmental issues, you probably think about science. How does science explain the problem? How can we use science to create a solution? Yet if we only think like scientists, we may miss important details. That is why we need to share knowledge with people who have different perspectives.

We shared knowledge with local residents near the Guassa grassland in Ethiopia to discuss how land use had changed over time. They described how they use the land and the benefits it provides. Using satellite technology, we created maps of the area. We then shared these maps with the people of Guassa. Together, we found a link between soil problems and land use changes. We also determined how different management strategies affect land use. Because we shared knowledge with the local residents, we created a more complete picture of what is happening in Guassa.

Introduction

Ecosystem conservation is an important but difficult task. That's because people need local ecosystems for their **ecosystem services** (benefits). But overuse of these services can negatively affect the organisms that live in these ecosystems. So, how do we balance the needs of people and wildlife?

The scientific community describes environmental impacts using data. They also use what they know to identify possible solutions. But the people who live in the area often have a better understanding of the ecosystem. After all, they experience it every day! That is why it is important for both scientists and local communities to work together. When they do, we have **knowledge co-production**. By sharing their different viewpoints and learning from each other, scientists and local residents create a more detailed picture of the problem. It also means they can develop a more successful and fair solution.

The Guassa Community Conservation Area in Ethiopia is a grassland. People from nine **kebeles** live around it and have managed it successfully for hundreds of years. Guassa supports many species. The most well-known is the Gelada monkey. Many endangered species, such as the Ethiopian wolf, also make their home there. Guassa provides the kebeles with many ecosystem services. For example, the people make Guassa grasses into rope, construction material, and **roof thatch**.

Our study used knowledge co-production in Guassa to investigate the causes and consequences of environmental change. Could local residents provide a new perspective on what happened in Guassa?

The Gelada monkey is one example of wildlife found in the Guassa Conservation Area in Ethiopia. The males are really spectacular.

Photo: Cara Steger

Methods

Land classes

We interviewed people in small groups to determine the different ways that they use the land. We called these different uses **land classes**. Examples of land classes include farmland, native forest, and protected grasses. Participants discussed how these land classes changed over time. Then, they marked the location of each land class on a map (Figure 1).

Ecosystem services

We asked the groups to list the ecosystem services of each land class. Then they ranked these benefits in order of importance. Using a computer program, we analyzed the groups' rankings to see how well they agreed which services were most important.

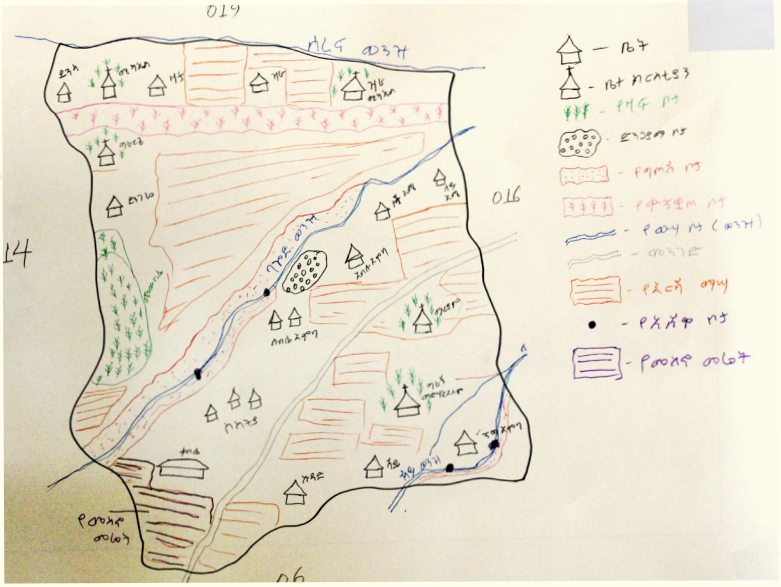
Changes in land use

Next, we used **remote sensing** to collect land cover information. We also went to Guassa to collect ground information on where the different land classes are located and what they look like. Using both data sets, we created a land-use map. We also collected satellite images from 1985 to the present to compare how land use changed over time. Finally, we used satellite and **rain gauge** data to determine changes in rain levels during the same period.

Co-production workshops

We asked local residents for feedback about the land use map, rain data, and land-use change images. This was to make sure they were in agreement. We asked them to suggest explanations for the changes shown in the data.

Figure 1:
People from one kebele drawing a map, pictured right, showing the location of different land classes.



Results

Land classes

Local people from the nine kebeles identified ten different land classes. The satellite images showed that farmland is the largest land class. They showed that water and built-upon areas are the smallest.

Ecosystem services

Most of the identified ecosystem services are **provisioning** services: products from the ecosystem that people can use. The most important ecosystem service from each land class was consistent across all kebeles for seven land classes. But the most important service from the native forests caused disagreement. Some groups saw the most value in selling the forest wood. Others thought wood was more important for making household tools.

Local people also identified different services provided by grazing land and protected grasses. These are two different kinds of grassland. They told us that different kinds of grasses grow there, providing different types of ecosystem services.

→ Changes in land use

The kebeles agreed about many of the land-use changes over time. But changes in farmland, native forests, and shrublands were different across kebeles. Water changes also varied: surface water decreased but groundwater increased (Table 1).

Which land classes saw an increase?

Land Class	Type of Change
Bare land	↑
Constructed areas	↑
Farmland	Varied based on kebele
Grazing land	↓
Native forests	Varied based on kebele
Plantation forests	↑
Protected grasses	↓ then ↑
Shrublands	Varied based on kebele
Stone	↑
Water (groundwater)	↑
Water (surface)	↓

Table 1:
Changes in land class based on satellite image analysis and conversations with local residents.

Discussion

Our satellite images showed that land use around Guassa changed in different ways. Local people identified **soil erosion** as the reason for many of these changes. Losing the soil exposed more rock, thereby increasing stone and decreasing available farmland. Erosion also explained the loss of surface water resources as it blocked streams from flowing. Some people then drilled wells to access groundwater. The people said **soil fertility** was also a problem, although the effects on farmland differed. A decrease in spring rain has also made farming more difficult.

The changes in protected grasses showed the importance of conservation management practices. The government removed Guassa land ownership from local people. This meant they could not protect the grasses using their traditional practices. The amount of protected grasses decreased because people no longer worked together. When the kebeles regained control over their land, the grasses started to grow again.

The satellite maps told us that changes in land cover had occurred but not why, or how they affected the people. Local people filled in these knowledge gaps, but they needed the satellite maps to help them remember. That is why it is important for scientists and local residents to share knowledge. With better understanding, we can prepare for future environmental change.

Conclusion

Our research demonstrates how knowledge co-production can improve our understanding of environmental changes. Sharing knowledge helps us fill in gaps from only looking at the issue from one perspective. Knowing why things changed in the past can help make better decisions in the future.

You can also use knowledge co-production! Start a conversation at your school or in your community to discuss any current problems. Include all the different people involved, not just those who want change. Listen to all the different perspectives. Then work together to find the best solution for everyone.

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Glossary of Key Terms

Ecosystem services – the benefits an ecosystem provides to people. There are different types of ecosystem services. In addition to provisioning, there are regulating, supporting, and cultural ecosystem services. Regulating and supporting services are processes that keep things comfortable and healthy for human life. Cultural services are benefits that enhance our enjoyment of life.

Kebele – an administrative unit in Ethiopia, made up of many villages or communities.

Knowledge co-production – a research approach that brings together people with different perspectives to learn together and create new knowledge about problems and potential solutions.

Land class – a category of land cover or use. For example, forests or urban areas.

Provisioning – a type of ecosystem service that includes products that can be directly used by a person in their everyday life. For example, food and fresh water.

Rain gauge – a device used to collect and measure rain levels at a given location.

Remote sensing – the process of detecting and monitoring changes in an area using images from satellites or aircraft.

Roof thatch – a type of roof covering, usually made of thick bundles of grass.

Soil erosion – water and wind remove the top layer of soil, which is the layer with the nutrients that plants need to grow.

Soil fertility – the ability of soil to grow plants for farming.

Check your understanding

1. How is our study in Guassa an example of knowledge co-production?
2. How do management practices affect the use of Guassa grasses?
3. Why is soil erosion a concern in the Guassa region of Ethiopia? How does it impact the people in the kebeles?
4. If you were to create a land use map of your area, what land classes would you include?
5. Think about the ecosystem that you live in. Create a list of five ecosystem services that this ecosystem provides. Then rank them in order of importance.

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