Mental models: understanding the causes and consequences of climate change

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by PETRA TSCHAKERT and REGINA SAGOE

Mental models and their purpose

Climate change is a complex issue, and many lay people, not only those in the developing world, have difficulties grasping what exactly causes changes in the climate system and what the consequences of these changes may be. Yet, understanding the basic dynamics is important for adaptation decision-making. In other words, if one doesn't understand what to adapt to, choosing the most appropriate and timely proactive strategies and trade-offs becomes problematic, if not impossible.

In the context of the USAID-funded collective Climate Change Learning and Observatory Network Ghana (CCLONG), we have used mental models as a visual tool that allows various stakeholders to depict how they understand drivers and impacts of climatic changes.[1] Four researchers, including three students, from the Regional Institute for Populations Studies at the University of Ghana, the main partner on the CCLONG project, were trained to construct and discuss such mental models with community members, agricultural extension agents, and district-level policy makers in Ghana. This participatory tool provides an opportunity to make visible the connections between local and global factors (drivers) that shape changes in rainfall and temperature patterns as they have been observed at the local level. At the same time, the concept maps permit outside agencies such as researchers and NGOs to identify potential knowledge gaps that then can be filled in ways that enhance not only placed-based understandings of complex processes but, ultimately, adaptive capacity.

The process

We have employed mental models with nine farming/fishing communities, 20 agricultural extension agents, and 12 governmental representatives at the level

[1] Mental models are described as psychological representations of 'problems' in the form of conceptual maps of ideas. See Bostrom *et al*. (1992 and 1994) and Zaksek and Arvai (2004).

Photo: Regina Sagoe

Participants add a factor to their mental model, Xedzodzoekope, Kwahu North, Ghana.

Box 1: Expressions for climate change

In Ghana, there is no one expression in the local dialects of Twi, Ewes, Nafaara/Banda, or Kusaal that captures the notion of climate change; hence, a short descriptive term is needed. In Xedzodzoekope, we used *XeXeame fe totro* (Ewe dialect), in Bawku East, *Tinga sameya* (Kusaal dialect), in Tain District, *Wangra chine* (Nafaara/Banda dialect), in MemChemfre, *Reyifi fe totro* (also Ewes dialect but a slightly different notion of climate change), and in Akyemfour, *Ewuim nsakraye* (Twi dialect).

of district assemblies in three project areas in Ghana:

- Kwahu North (including the communities of MemChemfre, Xedzodzoekope, and Akyemfour and the district capital Donkorkrom);
- Wenchi and Tain Districts (villages of Buoku, Asuano, and Bofie, as well as the town of Wenchi); and
- Bawku East (communities of Kaadi, Denugu, and Pusiga).

Between July 2007 and July 2008, a total of 18 mental models were produced with:

- large groups of up to 30 people, both men and women, during community focus group discussions; and
- small groups, pairs, or individuals, especially in the case of policy makers and extension agents.

Step one

The activity starts with a brief conversation or revisiting of previous discussions on climate change. Participants either draw a symbol to represent climate change or write in their local language on a large post-it note. This central post-it note is placed in the middle of a large sheet of paper and serves as the starting point for the mental model activity. Since there is not always an expression for 'climate change' in the local language, a short description, agreed with community members, may be needed (see Box 1).

Step two

Participants are then asked to identify all factors and processes that they believe cause climatic changes. Each factor is written or drawn onto a separate post-it note, and placed on the left-hand side of the sheet. A chain of effects or processes can be identified by linking specific causes through arrows. We ask participants to distinguish between factors and processes that are brought about by people and those that are outside of human control.

Step three

When all causes (drivers) are identified, participants are encouraged to identify the consequences of these changes, both for people and the environment, and add them to the right-hand side of the sheet. These consequences or impacts may be positive and desirable or negative and harmful. Again, each impact or effect is written or drawn on a separate post-it note. Additional arrows should be added between factors that are related to each other.

Step four

Once the entire mental model is completed, the last step is to reflect upon strategies that people currently use or have

Photo: Regina Sagoe

A pictorial mental model, Kaadi, Bawku East, Ghana.

Photo: Petra Tschakert

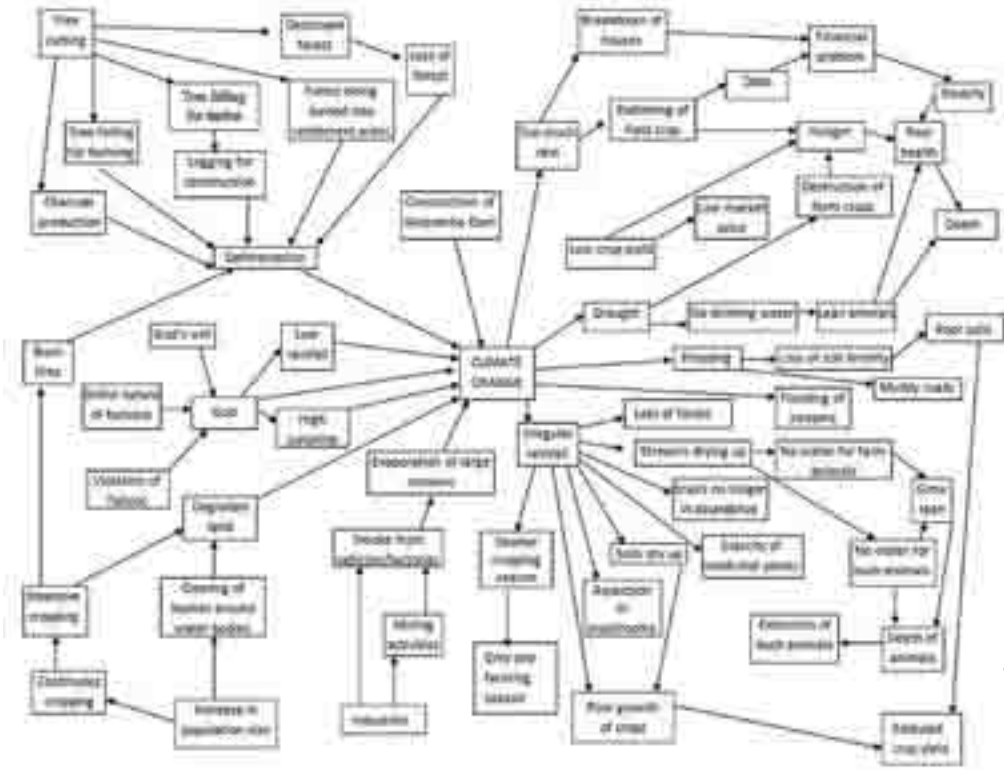
The coordinating director at the district assembly working on a mental model, Donkorkrom, Kwahu North, Ghana.

used in the past to:
• reduce the negative impacts of climatic changes; and
• enhance the desirable consequences of change.

What do mental models tell us?

Interestingly, most participants at the community level first cited God or Allah as being responsible for changes in rainfall patterns. These changes are typically believed to be connected to some sinful behaviour of humans. In the absence of good communication and awareness-raising tools and material on climate change, people in Ghana's rural areas rely on their own frames of reference to justify processes that they do not fully understand or that are beyond their control. The second most-often elicited causes were local deforestation due to industrial logging and small-scale charcoal production, intensive cropping and land degradation, and bushfires. Only in rare cases could participants link locally observed changes in rainfall patterns with larger-scale drivers, such as emissions (referred to as 'smoke') from cars and industries. However, most community members believed that these drivers were all home-grown and that emissions from factories and vehicles as far as Europe or the US could not possibly influence the climate in Ghana.

This overemphasis on local-level drivers of climatic changes, we believe, is largely rooted in the old desertification discourse. Over the last 25 years, rural populations in West Africa were told over and over again that they were responsible for the devastating droughts in the 1970s and 1980s due to poor land management practices, including the cutting of trees, bushfires, and dwindling fallow periods. Many community-level participants are convinced that these practices have resulted in fewer and fewer trees. In their minds, fewer trees can no longer effectively 'catch' or trap the clouds through their high-reaching canopy, which causes shortages in rainfall. Today's environmental villains mentioned during the mapping activity were charcoal producers, bush hunters, farmers during land preparation, and herders setting fires for new pastures. While attempts to improve and enforce environmental regulations at the local level are both laudable and crucial for sustainability, repeated blaming of local mismanagement distracts from much larger problems, most of them originating in the North. Excessive fossil-fuel burning, large-



Aggregate mental model from communities in Kwahu North, Wenchi/Tain, and Bawku East.

scale industrialisation, and extensive tropical deforestation continue to remain outside of rural people's empirical radar.

Not surprisingly, we found that agricultural extension agents and governmental officials were generally better informed about, and could more readily comprehend, these global linkages. For instance, there was a broader understanding of the role of gases, pollution, and vehicle emissions in global warming. Some knew about greenhouse gases such as chlorofluorocarbons in old refrigerators and methane from livestock. Others cited volcanic eruptions as contributors to climate change. There was, however, some confusion regarding the difference between climate change and ozone depletion. One agricultural extension agent was absolutely convinced that climate change was caused by spaceships that drive holes into the ozone layer and hence allow more sun rays to reach the earth.

With respect to consequences of climate change for people and the environment, all participants listed negative impacts first. These were roughly evenly split between drier, wetter, and more unpredictable conditions for agricultural activities, resulting in lower crop yields, hunger, poor health, and potentially death. On the positive side, people envisioned more fish and increased availability of drinking water under wetter climatic conditions. Extension agents and governmental representatives also stressed sea-level rise and flooding, migration, and species extinction. Surprisingly, the large majority of strategies that participants proposed to deal with observed changes focused on planting trees, constructing drainage systems and dams, storing food, and preventing deforestation and bushfires. What most participants did not mention, not even extension folks and policy makers, was the need for better climate forecasts. Preparing for climatic extremes and

embracing some of the uncertainty involved in projections is at the core of successful adaptation. Much more needs to be done to increase awareness on this front.

Advantages of mental models

Participatory mental modelling can be used in both literate and illiterate contexts. The colour post-it notes and markers keep track of every element that is mentioned and, hence, make the entire activity very transparent. At the same time, mistakes can be easily corrected by moving the post-it notes on the paper. How much information emerges during the mapping and the deliberation depends on the skill of the facilitator in terms of how well s/he encourages participants to identify specific reasons for and links between empirical observations. Depending on the detail of the discussion, the activity may last up to three hours.

The mental model has proven to be an exceedingly helpful tool to make apparent the complexity of climatic changes. It not only allows local stakeholders to engage in sometimes heated discussions about who is responsible and accountable for these changes; it also encourages participants to think about the possible control and predictability of the consequences. As long as people retain a fatalistic attitude – often because they lack access to appropriate information materials and wider communication channels and platforms about climate change – community-based adaptation will continue to be an enormous challenge, especially among the most vulnerable populations. Even if subsistence farmers, herders, and fishermen have no control over most larger-scale driving forces (such as emissions from cars and industries in the North), a better understanding of the mechanisms behind these drivers of change can enhance confidence in anticipating future changes. The maps developed by agricultural extension officers at district level are proving useful in monthly trainings organised for their field assistants who give technical assistance to farmers.

Such conceptual maps are also highly useful for facilitating the merging of different knowledge bases. While community members and other local stakeholders lay out how they believe climatic changes occur, they typically request more detailed information from outside 'experts'. Although extension agents and governmental employees tend to know more about climate change, their knowledge revealed some major gaps as well. Hence, researchers or NGO staff carry a significant responsibility, especially if the level of community awareness is very low. The situation becomes tricky, however, when participants presume that a more detailed understanding of causes and consequences of climatic changes will allow 'experts' to predict when the next rainy season will start and how long it will last, and whether or not there will be a drought. This, of course, is not possible. What is crucial is that outside researchers or facilitators admit where their knowledge ends while complementing and/or correcting community perceptions, without overwhelming less informed individuals with complex details.

While such conceptual mapping represents a tool that can be easily employed as a stand-alone activity, we strongly recommend that it be complemented by an awareness-raising exercise, during which misconceptions can be addressed and corrected. This is best achieved through collective learning activities such as workshops, radio programmes on local FM stations, or hands-on experiments like simple rainfall monitoring that encourage community members to grapple with the complexities of climate change and move from observations to adaptive actions (see e.g. Awuor and Hammill, this issue).

In the CCLONG project in Ghana, we have used the results from these mental models to prepare Open Days on climate change in 2009 in two district capitals, Donkorkrom and Wenchi. Our aim was to explain greenhouse gases, atmospheric circulation patterns, and climate projec-

tions in a way that added to people's conceptual maps and could boost their capacity for adaptation. So far, even seasonal climate forecasts are barely accessible to rural decision makers in Ghana. Much more needs to be done to effectively communicate content, interpretation, and limitation of short-term forecasts and longer-term, down-scaled projections. This also implies better collaboration between researchers, meteorological agencies, NGOs, media people, and rural extension services. The USAID-funded Open Days were a much-appreciated effort in the right direction.

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CONTACT DETAILS
Dr Petra Tschakert
Assistant Professor
Department of Geography Alliance for Earth Sciences Engineering and Development in Africa (AESEDA)
315 Walker Building
Pennsylvania State University
University Park
PA 16802
USA
Email: petra@psu.edu
Tel: +814 863 9399
www.geog.psu.edu/people/tschakert

Regina Sagoe
PhD student, Regional Institute for Population Studies (RIPS)
University of Ghana
PO Box Lg 96, Legon
Ghana
Phone: +233 21 500274
Email: rsagoe50@gmail.com

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