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Investigating local sustainable environmental perspectives of Kenyan community members and teachers

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Efforts to conserve and preserve the environment in developing or marginalized locales frequently involve a one-way transfer of knowledge and materials from a source in a more developed location. This situation often degenerates into a short-term donor project which risks little to no long-term impacts on local or indigenous relationships with the environment. One of the main reasons for this risk is that, often times, the ‘solution’ to the environmental issue is not constructed (or even co-constructed) in concert with local voices and, because these solutions are necessarily embedded in perspectives external to local contexts, there are real and practical limitations to the solutions. In other words, the process of creating solutions for issues faced in significantly different geopolitical and social contexts is often itself unsustainable. George Glasson, Ndalapa Mhango, Absalom Phiri and Marilyn Lanier (2010) explored how agricultural practices of African elders may contribute to the sustainability of the environment and culture in Africa. Through their work, they uncovered how merging worldviews and hybridizing knowledge and language can be leveraged to create a space where environmental sustainability can occur. This study extends this work by employing decolonizing methodologies to address the research question: how and to what extent do Kenyan teachers and community members perceive the environment and the notion of environmental sustainability?

Meaningful and participatory engagement on the part of local communities in addressing their own issues has been shown to be important in the process of arriving at long-term resolutions of those issues. Thus, this project engaged community members in an economically and environmentally fragile region (the Narok district in Kenya) through an interdisciplinary, and integrative approach of collecting digital photographs and captions to understand environmental sustainability from their perspective. Narok District, endowed with such natural resources as the Mau Forest and the Maasai Mara National Reserve, faces the results of destructive environmental practices such as deforestation, insufficient waste management, and water pollution which have contributed to drought and hardship in the surrounding valleys. The Mara River, the only perennial river in the transboundary ecosystem, is often the only source of water for grazing animals during the dry season. Increasing water demands from agriculture, industries, and growing human populations are likely to reduce its availability for migratory species. During the temporary 1993 drought, nearly 400,000 wildebeest and uncounted other species died due to water shortages in the river. Even if the seasonal rains are late, it causes huge devastation to the area. In 2006, the delayed rains caused widespread drought in the area, disrupting the annual migration, destroyed crucial watersheds, and disrupted livelihood for the Maasai (United Nations Environment Programme, 2009). (See Figure 1 for pair of images comparing lush vegetation in 2005 to the dry, brown landscape in 2006.

[INSERT FIGURE 1a and 1b HERE]

Figure 1. A pair of images of the Maasai Mara and Serengeti borders. Left represents 2005. Right represents 2006.

This type of destruction is echoed in the voices of our participants, as the following quote suggests:

You see out of all this deforestation, due to all this cutting down of trees. First of all, the rate of the desertification is going to quickly increase which of course is going to add up to the current rate of global warming. I mean water catchment areas are going to reduce. It is affected in the Mau Forest when there was so much cutting down of trees because of charcoal and farming and we will see that the migration in 2009, the wildebeest migration from Serengeti to the Mara was affected because there was so much water in Mara River. Again, there was a long drought during that time...and people are affected [because] water is actually the basic need, [but] also the wildlife and the livestock are affected. Human settlements are affected. ...People fight for natural resources. And maybe have a little in my own piece of land and so many other people who need water they come and fetch that water, conflict starts. So lack of all this I guess is going to result in trouble. (Susan, interview, 17 October 2012)

The post-colonial challenges Kenyans encounter further complicates these environmental issues. Colonial history dates to the 1880s from an establishment of Germany over coastal possessions and then the arrival of Imperial British East Africa Company, which eventually (after several disputes) built a railway from Kenya to Uganda. The railway brought an influx of Indians, which provided some of the labor for the construction of the railway. During the early 20th century, the central area of Kenya was settled by the British and became a wealthy farming area for coffee and tea. By the 1930s, over 30,000 white settlers lived in this area and gained a large political voice due to controlling the market economy. The settlers imposed taxes, banned the Kikuyu from growing of coffee, and prohibited the tribe from living on the land. They displaced the 1 million Kikuyu people, a nomadic tribe who lived as itinerant farmers. Unable to live in their traditional ways, they moved to the cities in attempt to survive. By the 1950s, the white population was almost 80,000. Between 1952 and 1959, the Mau Mau Uprising (also known as the Emergency) occurred when the Kikuyu rebelled against the British rule resulting in large governmental changes. Most notably, the Swynnerton Plan was created. The objective was to adjudicate land for families to provide people with income through farming. However, this land consolidation program had repressive political objectives. In the words of the Special Commissioner for Central Province, "Thus land consolidation was to complete the work of the Emergency: to stabilize a conservative middle class, based on the loyalists; and, as confiscated land was to be thrown into the common land pool during consolidation, it was also to confirm the landlessness of the rebels."(Anderson, 2005)

Despite this, the Swynnerton plan proposals were accepted, although removal of racial and political barriers was recommended. With these modifications in place, the land settlement plan was established. The Kikuyu were forced to change their indigenous ways of life as they had no land or political power. Regardless, Kenya moved towards independence in 1957, and on December 12, 1963 became independent and formed the first constitution of Kenya. These land

adjudication practices had implications for other nomadic tribes in Kenya including the Maasai tribe.

Situating the study

The context of this study is Narok County, which lies in the southern part of Rift Valley in Kenya. The major city in the district is Narok town, with a population of approximately 40,000 (Central Bureau of Statistics, 2009). The primary cultural influence in the district is Maasai, a pastoral indigenous group whose nomadic culture has been infringed upon over the years by aforementioned land adjudication practices. In the Mau forest and Maasai Mara National Reserve, more than one million acres of forest have been cleared for land development and fuel. This deforestation has destroyed crucial watersheds, ecosystems, and wildlife as well as sacred lands of the Maasai people (Glasson et al., 2010). Although the government has attempted to address this problem by limiting the land that pastoral communities such as the Maasai people can utilize for animal grazing, Shelton Davis (1993) uncovered these land adjudication practices do not attend to the indigenous ways of pastoral living by the Maasai, which created a dis-engagement towards sustainability and sustainability education. Thus, the purpose of our study is to re-engage the local communities by creating an interdisciplinary, integrative approach similar to the approach Thomson's and Glasson and his colleague's work to enhance sustainability and to sustainability education. The authors acknowledge that this purpose is situated among a larger political conversation in which there are many sides. In this paper, we seek to contribute to that conversation and create an argument for why sustainability education should be taken up by the larger public. When the public as a whole—rather than a small group of environmental specialists—attempt to change policy, then government officials are more likely to take broader and bolder action.

This research study investigates the perspectives of community participants on the environment and sustainability with the purpose of sharing these understandings among local groups to generate a locally constructed meaning of environmental conservation and sustainability. It is the researchers' aim that through locally constructed meanings of environmental hazards and conservation, the Maasai community will transform their relationship with their environment and begin to construct and enact sustainable alternatives to destructive environmental practices. Attaining this objective, we believe, will contribute towards our long-term goal of increasing access for local and diverse populations to the field and discourse of environmental sustainability in order to co-construct meaningful and sustainable alternatives to environmentally destructive practices. Our work builds upon Norman Thomson's (2010) work in Kenya. Thomson documented indigenous knowledge and culture by interviewing indigenous elders about their knowledge of their environment. He sought to open the dialogue between western modern science and indigenous knowledge by recording historical and cultural knowledge about the environment. While Thomson's work was specifically situated on snakes, his implications for science education in Kenya are broad in scope. Specifically, his work suggests students who attend schools where indigenous elders are a part of the formal education, are more knowledgeable about environmental knowledge. Despite the calls from the national government to produce students who are critically aware of their environment, indigenous knowledge continues to be discounted and devalued through the science curriculum, texts and exams. Moreover, Thomson's work employed decolonizing methodologies in that he positioned the local people as contributors of knowledge. We employ similar strategies in this study—

positioning our participants as collaborators of this work. Through Thomson's work, we witness the ways in which indigenous knowledge has an important and valuable role in education and posit that through an examination of environmental perspectives we can see the ways in which knowledge systems can be seen as complementary.

Perspectives on indigenous knowledge and western modern science

We have reached a time in society where we can no longer afford to make comparisons between different kinds of knowledge in Western and non-Western cultures. It is simply not productive to raise questions about the status of knowledge. Rather, we must acknowledge that multiple knowledges exist and that it is incumbent upon all cultures to contribute in meaningful ways to the development and environmental sustainability of our global community. Moreover, it ought to be a shared responsibility. –William C. Kyle, 1999, p. 260

The dichotomies between western modern science (WMS) and indigenous knowledge systems (IKS) have been propagated for years in academia. Perhaps it was Thomas Kuhn's (1962) understanding that science undergoes "paradigm shifts" rather than linear, continuous movements that helped WMS view IKS as a valid form of scientific inquiry. This valuing of indigenous knowledge in the scientific community can be viewed as a paradigm shift that has nudged at what is constituted as science. Despite this valuing of indigenous knowledge over the past 20 years, Stanford Zent (2009) remarks that it has yet to find a secure place in the science education community. In contrast, some western scientific communities are now recognizing the benefits and overlapping nature of IKS and WMS. Tim Ingold discusses the two accounts—science and indigenous knowledge and seeks to understand the relationship between the two. As an anthropologist, he argues the two accounts are "perfectly compatible" (2000, p. 14) despite the notorious distinction that science purports neutral, value-free, evidence-based descriptions of the physical world while indigenous knowledge is based on the cultural meanings that humans derive. Again, it is helpful to lean on Kuhn's discussion that scientific paradigms are incommensurable—thus being argued from different sets of criteria. "Though each may hope to convert the other to his way of seeing science and its problems, neither may hope to prove his case. The competition between paradigms is not the sort of battle that can be resolved by proofs." (Kuhn, 1962, p. 143) Regardless, the two paradigms are often pitted against each other in science education literature. Here, in our work, we seek to broaden the dialogue about what is permitted to represent science.

Indigenous knowledge stretches the Western-dominated conversation about what constitutes knowledge and how knowledge is constructed. As IKS incorporate language, culture and history when teaching science and documenting what constitutes knowledge, consequently, throughout this study we challenged ourselves to validate the participants' knowledge, which is inclusive of their language, culture and history. In this study, we use the term indigenous knowledge to mean a dynamic way of describing knowledge that is connected to place and culture. Indigenous knowledge is not static but dynamic process anchored to a local way of knowing. However, in order for indigenous knowledge systems to continue, we need people with the ability to embrace local ways *and* science (Battiste, 2008). It is with this view of balancing science and IKS that we approach our study.

The concept of IK in science education often refers to acquisition of knowledge and practices that are developed by groups with long histories of intimate relationships with their environment. This base of knowledge is part of a cultural system that encompasses native languages, naming and classification systems, utilization of resources, rituals, spirituality, and worldviews. Indigenous science relates to the science knowledge of long-resident, usually oral culture peoples, as well as the science knowledge of all peoples who as participants in culture are affected by the worldview and relativist interests of their home communities. A well-documented branch of indigenous science, known to biologists and ecologists as traditional ecological knowledge (TEK), focuses on the science that is highly localized and socialized. This knowledge is often described as a frame of knowledge and a subset of that is Traditional Ecological Knowledge (Cajete, 1999). TEK, though difficult to disconnect from the larger IKS, is a way to understand the complexity of social relationships between a particular groups of indigenous people in their community. Therefore, the knowledge is accumulative and ongoing. In the literature, it is generally used to denote the worldviews of indigenous peoples. Therefore, we will follow this demarcation created in the extant literature and will use IK to mean the knowledge and worldviews of indigenous communities and TEK to focus on localized knowledge. It is, however, important to note that from indigenous point of view the two objects, TEK and IK are the same.

We also understand by even making these demarcations we are contradicting ourselves—these demarcations were created by western-thought. We acknowledge there are anthropologists such as Bruno Latour who posit that society is a-modern and that distinctions between nature and society were created by modernists. Thus, he contends, if we have never been modern than these dualities of nature and society are false. He calls for a reframing of scientific work to be a “parliaments of things,” in which natural and social phenomena are viewed together. In this way, fields are not dichotomized but hybrid forms. Perhaps Latour’s view influences our work in that as we are attempting to broaden the circles that define science, he would argue that there are not the circles that define IKS from WMS—we, as westerners, created them.

Regardless, these disputes of a universal standard science are critical because the definition of science is a de facto “gate keeping” device for determining what can or cannot be included in a school science curriculum. When western modern science (WMS) is defined as universal, it displaces other ways of knowing. WMS can displace pragmatic local indigenous knowledge that does not conform to formal aspects of the “standard account.” For example, indigenous knowledge often includes the use of oral tradition, cultural artifacts, music and dance, as science knowledge.

Although these modes of teaching science are accepted among current pedagogical recommendations (often labeled as “equitable” or “culturally-relevant”), they are not accepted as science (Omolewa, 2007). In most science classrooms around the globe, WMS is taught at the expense of indigenous knowledge. However, because WMS has been implicated in many of the world’s ecological disasters, and because the traditional wisdom component of TEK is particularly rich in time-tested approaches that foster sustainability and environmental integrity, it is possible, as Gloria Snively and John Corsiglia (2001) describe it, the universalist “gatekeeper” can be seen as increasingly problematic and even counterproductive. There is no mistaking the hegemonic hold on scientific knowledge. Over the course of the last century, fields of science and technology permitted some of the most destructive behaviors often at the expense of the environment. And as William Kyle(1999) underscores the western scientific

approach has not solved the key issues of our times while raising the standard of living for only a fraction of the world's population at the expense of others.

There is a massive body of international literature that explores the relationship between IKS and WMS. The nature of these types of knowledge underlies much of the debate—and much time has been spent in classifying whether this type of knowledge can be labeled as “scientific”. Perhaps with Kuhn's (1970) “scientism” attitude, which challenged an objective science and legitimized challenging positivism thought inherent in WMS, created a more prominent place for IKS science education. However, William Cobern (2000) argues that rather than categorizing knowledge as science or not, science education should be about *reasoning*. The more interesting question is not whether [X] is a belief or knowledge, but what are the justifications or reasons one holds for thinking that [X] is true or valid?” (p. 235-6). He explains, “This does not mean that scientific knowledge should be devalued, but that if students' beliefs are ignored, the students may become less interested in considering scientific knowledge as valid at all.” (p. 235-6)

Methodology

The approach used in this study is a qualitative study of representative stakeholders' environmental perspectives. The rationale behind a qualitative study is to gain an understanding of perspectives in ways that cannot be captured through quantitative research methods such as surveys or controlled experiments. Further, previous work in Kenya and with indigenous peoples suggests that qualitative research methods that position the participant as a part of the research process mimic the ways in which local knowledge is shared (Thomson, 2010).

Specifically, our principal qualitative method included Photovoice created by Caroline Wang and MaryAnn Burris (1997). Photovoice is a methodological tool by which researchers provide cameras to participants so that they may document issues important to them through photography. It uses the nearness of the visual images to provide evidence and to promote an effective, participatory means of sharing expertise and knowledge. Then the participants write narratives about the photographs to explain the images. Lastly, the participants are engaged in the theme-building process during the analysis phase of the research study. In this way, the participants transition between the roles of researcher and participant throughout the study. We adapted this methodological tool by using Smartphones equipped with cameras so the participants could email the photographs and narratives to the researchers in order to receive many photovoice images and narratives over an extended period of time.

In this study, we were interested in the participants' perspectives of environmental sustainability. Therefore, we found our methodology to be guided by a phenomenological approach of qualitative inquiry for several reasons. First, phenomenological methods are effective at bringing to the fore the perceptions of the participants from their perspectives which often results in challenging structural or normative assumption. Second, this approach is based in a paradigm of personal knowledge and subjectivity—which is powerful for understanding people's interpretations of the world. Third, phenomenological approaches can overlap with other qualitative approaches such as photovoice, which seeks to describe a phenomenon in the broadest sense of the word by utilizing unconventional methods (Moran, 2002). In this sense, we chose to utilize a data collection method of photovoice that shaped a *view from somewhere*—in this case the view from the *experiencer* and to interrogate the ‘objective view from nowhere’ understanding of things.

Phenomenology claims to offer a holistic approach to the relation of objectivity and experiences occurring in time and space. Our work specifically draws on Maurice Merleau-Ponty's (1945) work, in that we maintain scientific knowledge is built on a world as it is perceived. Moreover, we felt the use of photographs embodied the way Merleau-Ponty saw phenomenology, which was to capture the phenomenon of study (here, environmental perceptions) as it was lived.

Moreover, we connect Merleau-Ponty's work to Ingold's in the way they view the intersection of humans and the world. Merleau-Ponty calls this intersection 'chiasmic' meaning humans and their world in itself are so intertwined and interwoven that they must be conceptualized together. Similarly, Ingold discusses these ideas when viewing the relationship between humans and environment. As he suggests, there should be "but one indivisible totality" (p. 19). By using the principles of phenomenology to guide our understanding of other's perceptions and Ingold's conceptions of the fluidity of humans and the environment, we shift the authority back towards the participants, and begin to challenge the ways in which our environment viewed in concert with humans.

Participants

As noted before, the study focused on the Narok District in Kenya, which includes the Maasai Mara National Park. This area has several types of schools: day schools, boarding schools, and training schools. The day and boarding schools are for elementary and secondary students typically in different buildings. The training schools are 1 or 2 year programs for students who do not attend secondary school or attend secondary school but do not attend university. The training schools tend to be focused around one area of study.

In order to obtain a variety of views, we recruited participants from the following different types of schools (day, boarding, elementary, secondary) situated near the Maasai Mara National Park: Maasai community members (n=3), teachers from Mata Day School¹ (n=11), teachers from Kwaeki Primary school (n=10), faculty from Suswa Teachers Training College (n=7), teachers from Tamoo Day School near the Maasai Mara National Preserve (n=2), and teachers from the Community School at the Maasai Mara National Preserve (n=6). The total number of participants is 39—consisting of 23 females and 16 males. The Mata Day School is a co-educational primary school on the campus of Kenya University. The Kwaeki Primary School is a co-educational elementary boarding school in the city of Narok. Suswa Teachers Training College trains pre-service teachers and is affiliated with NUC. Tamoo Day School is a co-educational primary day school. The community school at the Maasai Mara National Preserve is a boarding school for secondary students that train students within 1-year duration to become tour guides at the Maasai Mara conservancies. The Maasai community members live in the Narok area and are not affiliated with the primary day or boarding schools but work for a variety of conservancies in the Maasai Mara. Table 1 provides additional background information on the schools including type of school, location, and year established, number of students and teachers.

[INSERT TABLE 1]

¹ Pseudonyms are used for the participants' names and schools.

The recruitment process consisted of the following procedures: 1. We contacted the major university² in the area describing our research study and asked for help in recruiting principals, teachers, and community members in the local area. 2. We then contacted the recommended principals from seven schools (2 day schools, 3 boarding schools, 1 community school at the Mara, and 1 teacher training college). 3. We received responses from the five schools mentioned. 4. Next, we contacted 10 community members and received responses from 3 of the community members. Our goal was to recruit a diverse set of teachers in terms of educational background, ethnicity, employment location and experience. Given our small sample size, we recognize it is not representative of the population rather a sub-sample of it. Table 1 provides background information into the participants in the study, which includes a pseudonym, self-identified ethnicity, profession, place of employment, and educational background.

[INSERT TABLE 2 HERE]

Methods

The participants were engaged in the Photovoice over several months—capturing images that represent the guiding terms in this project (i.e., nature, sustainability, environment, conservation, and preservation) and wrote narratives describing the meaning of the images to them. While the research team selected the original guiding terms as a beginning to our conversation with the participants. We discussed these terms with the participants and encouraged them to view these words as starting point. As such, in the data, the participants documented broad ideas surrounding these terms. Each participant emailed between 1 to 2 pictures and narratives a week for a total of 308 pictures.

The photovoice data collection occurred in two phases: 1. A photovoice workshop and project and, 2. Focus group sessions. The goal of phase 1 is to allow the participants to document through photographs, what guiding terms mean to them in the form of a photograph and to write a narrative about the picture. The goal of phase 1 is to hold discussion sessions in which the participants are able to construct narratives for the photographs. The goal of Phase 2 was to develop emergent, co-constructed, shared understandings of the key terms. This paper focuses only on phase 1 of the data collection.

The photovoice workshop occurred over two weeks in May 2012. During the workshop, we taught the participants how to use specific functions of the Smartphones that were unfamiliar such as using the camera-phone, email, and web surfing. Workshops are an effective technique to begin a discussion and promote trust between the participants and researchers, thus increasing the likelihood the participants will have ‘buy-in’ to the project (Lamb, Taylor, Burkardt, & Ponds, 1998). We provided time for the participants to practice taking pictures and writing narratives and then as a group we viewed the pictures and narratives and began discussing the practice pictures and narratives. Following this workshop, participants relayed images and narratives received from their phones via email to the researchers over the course of several months.

Analysis

The researchers analyzed the digital images and the accompanying narratives for themes. The researchers’ role in this crucial component of the Photovoice method is to facilitate

² We have a well-established relationship with this university and have been working with them on several projects over the past three years.

conversation, storytelling, and reflection on pictures taken by participants, and then to codify the emergent themes generated by collective discussion. We conducted open viewing in team analysis as recommended by Malcolm Collier (2001) and Johnny Saldaña (2013) in which the photos and narratives were viewed in context with their cultural circumstances. Open viewing analysis is advantageous in forming patterns particularly when studying a culture that is not your own (Collier, 2001).

Each team member viewed the images individually. During this time, the group members began asking broad questions to guide their initial coding such as, “How is environment being portrayed?” or “What is unique and/or similar about the ideas of environmental sustainability depicted?” and created a list of codes from this initial analysis (See column 1 in Table 2). We utilized Johnny Saldaña’s (2013) definition of a code, “is most often a word or a short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data,” (p. 3), to guide this step of analysis. Next, the group discussed the initial codes of the photographs and narratives. During this time, we agreed upon a list of codes and initial themes (See column 2 in Table 2). Then we coded the data individually using the codes (which ultimately became sub-themes; See column 3 in Table 2) and initial themes as a guide. Then Author 1 compared this round of codes from all of the researchers for differences. Finally, we met to discuss these differences and come to consensus about the themes and sub-themes (See columns 3 and 4 in Table 2). After this analysis, the research team returned to Kenya to discuss the analysis with the participants and conduct member-checking. The final sub-themes and themes represent ideas after the member-checking step.

[INSERT TABLE 3 HERE]

Results

During our analysis, we discovered two major themes emerged. These themes describe the ways the participants perceived their environment and represent the balance the participants are trying to maintain with their environment in order to co-habit. These perceptions included the ways humans are helping or hurting the environment. Other times they described the environment as disconnected from human impact and would describe it as “nature”. Similarly, the participants discussed the complex ways in which they struggle with modernization. These ideas include how they navigate traditional practices, what modernization means for them, and how they see their role in as a part of a larger system.

How do we co-habit?

Respondents discussed the ways in which humans find balance with their environment. These practices included the descriptions of incompatibility between the two when discussing potential or actual human destructive practices— and ways of coalescence—human induced environmentally friendly activities. They simply discussed nature as a part of this co-habitation when discussing natural forces (i.e. winds, rain) while other times they discussed the beauty or presence of nature as a way for humans and environment to co-exist.

Potential or Actual Human Destructive practices. Below are some examples of participants’ images and narratives that capture Potential or Actual Human Destructive practices. Martha (see Figure 2) describes human destructive practices and even names them such. Using her picture of the barren land and the narrative she wrote, she describes the “*possible causes and impacts of desertification to living things*” and labels the impacts as “*are very much great.*” Although

Martha describes some of the implications of the human destructive practices, she does not offer alternatives to activities such as overstocking.

[Insert Figure 2 here]

Figure 2. Gilda's (May 7, 2012) picture of causes of desertification naming human destructive practices. Her narrative was:

“Having looked at this geographical scene, I decided to explain the possible causes and impacts of desertification to living things. As you have a keen observation to this picture, you will hardly see any growing (green matter) which is an indicator that this region has become bare and infertile. The possible causes might be fire outbreaks, destructive human activities, overstocking, soil erosion among others. Its impacts are very much great. There will be little life if any in such geographical regions. Insects (e.g. bees), man, wild and domestic animals all suffer from lack of food and homes due to lack of vegetation cover. Deaths occur as a result of it, poverty is experienced by man, crimes and civil wars will rapidly take place.”

In Celeste's picture (see Figure 3), she documents actual human destructive practices with her picture of the plastic waste piled in a way that will have impacts on “flora and fauna”. Unlike Martha, Celeste offers a suggestion of “paper bag packaging” instead of the plastic disposal. In this way, Celeste is beginning to offer an environmentally significant behavior (Stern, 2000) in that she is thinking about changing behaviors by transitioning from plastic to paper bags.

[Insert Figure 3 here]

Figure 3. Celeste's picture (June 1, 2012) documenting the impacts on the flora and fauna. Her narrative was *“I took this picture because it illustrates an effect of plastic packaging, it's not enough that plastic is not biodegradable, the mode of disposal is wanting. Paper bag packaging would be helpful to the environment; consequently, to flora and fauna”*.

Human-induced environmentally friendly activity. In addition to describing the human destructive practices, participants also described human-induced environmentally friendly activities. Here, the respondents mentioned positive practices that human beings engage in, in order to co-exist with environment. In the examples below, the participants describe the human actions as having pro-environmental intentions (Stern, 2000). For example, Gilda describes how tree planting by children, could lead to the creation of *“home to birds and other living things.”* Here, she names the act of planting trees, which contributed to the beauty of the area (see Figure 3).

[Insert Figure 4 here]

Figure 4. Gilda's picture (May 8, 2012) of trees planted by children. Her narrative was, *“I took this picture to show how the children planted trees and how they look natural with the long grass its Beautiful to conserve it, as it home to birds and other living things.”*

In this sub-theme, human-induced environmentally friendly activities, the participants documented the ways humans are enacting positive change on the environment. Gilda (Figure 4) mentions direct environmental change—actions that directly cause environmental impact.

Nature. In this sub-theme, the participants described the challenges and successes trying to balance human needs with the needs of the environment. They often described the ways the nature impacted human beings. Often this was in form a positive impact but they also described negatives of finding this balance. Gloria, a teacher at the Community School at the Maasai Mara, described the challenges of navigating the balance between humans and wildlife. In her narrative, she stated both a positive and negative implication of this situation by stating that the noise is sweet but also destructive to her teaching. She does not offer a suggestion for solving this problem, instead she poses a question, “*How do we go around this?*”

[Insert Figure 5 here]

Figure 5. Gloria’s picture of bird’s nests in a tree outside her classroom window. Her narrative was, “*The birds make sweet noise but sometimes the noise is destructive when class is in progress. How do we go around this?*”

Below Paul (see Figure 6) also remarks on the nature of the “*beautiful wildflowers.*” Here, he is not pointing to a human-induced action that led to the beauty. Instead, he talks about the rains that helped to create flowers. Thus, Paul is not describing an action that needs to be taken to create this beauty but nonetheless his narrative describes the ways in which we co-habit with the nature (rains and flowers). This theme is important because it does not require active involvement or behavior change—it solely focuses on the existences of these forces of nature.

[Insert Figure 6 here]

Figure 6. Paul’s picture (May 15, 2012) of wildflowers at the guiding school. “*This picture was taken around koyaki guiding school. With the rains around this time, the area is now covered with beautiful wildflowers*”

How do we modernize?

In the theme, *how do we modernize?*, respondents discussed the ways in which they are trying to modernize. These practices included the descriptions of navigating the process of respecting traditional practices, the implications on human beings as they modernize, and how they are making connections to the system as a whole during this process.

Navigating the process of respecting traditional practices. In this sub-theme, participants described the challenges and successes of the process of modernization. Here, we are not equating modernization with progress or improvement. Instead we are documenting the ways in which the participants’ overwhelmingly described some of their current issues with the environment and how those issues closely related to problems of globalization. Notably, the participants described the importance of being able to navigate the process of respecting traditional practices. For example, Seth’s narrative (see Figure 7) describes the critical issue of cattle management while noting the complexity of the issue as it relates to indigenous community, the Maasai. Similarly to Gloria (Figure 5), Seth does not offer a specific resolution to this issue however he poses a question, “*...just how do we strike the viable optimal level of cattle numbers and grazing arrangements.*” Here, he understands the importance of cattle to the

Maasai but is demonstrating the challenges of modernization that are occurring—there is not enough open land for grazing.

[Insert Figure 7 here]

Figure 7. Seth's Photovoice of cattle grazing in a field. His narrative is, *"I took this picture because cattle is the most important Maasai asset, source of food and pride, cattle are also often blamed for causing soil erosion and at high density may cause wildlife declines. Grazing management is perhaps the biggest challenge to pastoralists, conservationists and government officials working to secure livelihoods in pastoral lands, but just how do we strike the viable optimal level of cattle numbers and grazing arrangements"*

Eileen's photovoice documents one of the major challenges for Kenya—finding an alternative source of fire for cooking (see Figure 8). The picture depicts donkeys carrying sacks of charcoal that are sold for traditional stoves called jikos. Here, she does not offer an alternative but simply suggests there is that the need for an alternative source of fuel for cooking. This issue is terribly complex in that it address a very personal part of everyday life—cooking. By asking Kenyans to use a different fuel source, we would be asking them to change their cultural traditions. In this regard, conservationist need to understand the ways in which cultural traditions can enhance diversity on earth and not to create conflicting strategies for dealing with protecting the earth and protecting culture.

[Insert Figure 8 here]

Figure 8. Eileen (May 12, 2012) of donkeys carrying charcoal. Her narrative was, *"These are donkeys carrying sacks of charcoal for sale. I took this to show how human activities contribute in destroying environment solution alternative source of fire."*

Implications on humans. In this sub-theme, the participants describe certain implications on human beings as a result of modernization. The ideas represented in this theme describe some of the indirect outcomes of modernizing our world. Below Clara's picture (see Figure 9) of stagnant water is a reminder of major health issues in Africa, which tied to challenges in modernization and environmental sustainability.

[Insert Figure 9 here]

Figure 9. Clara's picture of stagnant water (May 13, 2012). Her narrative was, *"This is a picture of stagnant water. It is a health hazard. When left unattended it causes diseases like cholera, bilharzias, and is also a common breeding ground for mosquitoes that spread malaria."*

Historically, environmental impact has been a result of humans seeking physical comfort, status, reduced labor and so on—but here, Daniel documents the challenges of modernization which leads to health risks (see Figure 10). He calls on the government to help to protect the environment but he does not address how Kenya will continue to modernize to address some of the other challenges it faces.

[Insert Figure 10 here]

Figure 10. Daniel's picture (May 17, 2012) of walls built by stones from quarries. His narrative was, *"I took this photo because it the link between insecurity and environment is not often appreciated. In urban areas all over Kenya each resident uses up to 3,600 feet of building stones to make a perimeter wall to keep thieves away. The quarries made by the excavators to provide stones are a health risk and destroy land since no rehabilitation is done afterwards. By ensuring security this walls are unnecessary and governments can help protect the environment."*

Making connections to the system as a whole. In this sub-theme, participants made connections to the larger system. For example, they often described some of the impacts of human behavior on the environment and listed the ways in which certain actions lead to other unintended consequences. Dunlap and his colleagues (2000) describe this as a paradigm in human actions and the environment are inextricably connected. We noticed that participants described this connection as almost a snowball effect, in that, one action inevitably led to another effect, and so on. As such, Jacob's picture of a wood pile and narrative below exemplifies this when he states, *"which in turn will lead to the following: lack of rains, lack of homes for wildlife, rapid soil erosion..."* Here, Jacob is articulating the potential problems of deforestation and connecting it to a much larger situation (see Figure 11).

[Insert Figure 11 here]

Figure 11. Jacob's picture (May 21, 2012) of a woodpile. *"This activity (felling trees for fire woods) greatly affects environments in that it creates desertification which in turn will lead to the following: lack of rains, lack of homes for wildlife ,rapid soil erosion ,lack of fruits, high temperatures, lack of tourism activities, crimes, poverty and deaths of mankind and other animals."*

Francis (see Figure 12) makes similar connections in his picture of construction near a cliff. In contrast to Jacob's description of one action having a tremendous impact on humans (i.e. crime and poverty), Francis simply asks the questions of why this construction is occurring. Unlike Jacob, he is not offering definitive statements about the impacts of modernization, instead he wonders if there is a rational answer (population pressure) or if construction is occurring without much thought into the impacts (human negligence).

[Insert Figure 12 here]

Figure 12. Francis's photo (May 7, 2012) of construction near a cliff. *I was walking next to a cliff adjacent to the main river named after Narok town. What is evident is construction coming up. The danger of mass wasting and rocks failing in a catastrophe in the offing of this the result of population pressure or human negligence?*

Discussion

Recently local communities across the globe are encouraging positive, citizen-driven environmental practices. That said, we agree with W. Neil Adger and his colleagues (2001), and believe environmental change at the local level is largely illegible because of the larger dominant discourse from policy makers and government officials. This rhetoric is almost entirely dominated by the belief that environmental issues are solvable through globally-coordinated action—as documented during the Stockholm Conference in 1972, Club of Rome in 1973, the World Conservation Strategy in 1980, Rio in 1992, Johannesburg in 2002, and the present day

Earth Summits. The motivations for this rhetoric are varied and include economic and cultural globalization (those in control of the global “solutions” will advance financially and influence culture worldwide) or a new paradigm that is driven by the interests to colonize and create a global system, which extracts from pieces that are locally controlled.

Dismantling this dominant rhetoric is difficult and requires a political forces that rejects of the top-down government approach that mandates and enforces specific actions that are often counter to what the local communities value. In his book, *Blessed Unrest*, Paul Hawken (2007) discovered over two million organizations work toward ecological sustainability and social justice worldwide—most are occurring on a very small scale in classrooms, homes, and backyards. He calls this movement, “the largest social movement in history that no one saw coming” and carefully connects it with an ideology focused on improving life through social, economic, and environmental justice. The transition to sustainability requires more than developing a stable economy, technological advancements, or institutions. It requires social movement for change that celebrates cultural diversity so that knowledge and understanding from the affected communities is not lost. These ideas are connected to our long-term goal of enacting change to inform science education to protect cultures (particularly indigenous). We find this important because, as noted in our findings, the participants place contextual, cultural and indigenous value on ideas of environment and sustainability with their photovoice pictures and narratives. The two major themes, *how do we co-habit?* and *how do we modernize?* captured the ways in which the participants perceive the environment and sustainability. The following discussion will deconstruct the participants’ perspectives about environment and sustainability.

Overwhelmingly, in the theme, *how do we co-habit?*, the participants describe the ways in which they find balance/imbalance with their environment. These practices included descriptions of incompatibility between the two when discussing potential or actual human destructive practices— and ways of coalescence—human induced environmentally friendly activities. At times, they simply discussed the nature as a part of this co-habitation when discussing natural forces (i.e. winds, rain) while other times they discussed the beauty or presence of nature as a way for humans and environment to co-exist. Such a finding is consistent with environmental conservation literature. However, the use of this metaphor is criticized by researchers such as Richard Ladle and Lindsey Gillson (2009). They argue the “*balance of nature*” notion is challenging because it provides a static representation of ecological systems, which does not reflect the complexity and dynamics of the environment. Corrine Zimmerman and Kimberly Cuddington (2007) note that if people do not have a fixed definition for the balance of nature, they are unable to make a distinction between the concept and its causes, and often perceive the balance of nature as a real phenomenon rather than a metaphoric description of the environment. In our study, the participants did point to specific causes such as pollution, overgrazing, etc (see Figures 2, 3, and 4) and pointed to specific human destructive activities. In this way, the participants do consider the flux of nature and understand the effects of humans on balance.

Problematizing this balance is Ingold’s work on the difference between nature and the environment. He contends the world can only be ‘nature’ without humans inhabiting it—and ‘environment’ is actually in relation to humans and therefore is always viewed from the human perspectives. Just as the participants struggled with how we as humans co-habit, Ingold attempts to replace the dichotomy of nature and culture with a “genuine ecology of life.” (p. 16). To do this, he invalidates the ranking of science over indigenous thought. Ingold draws on work from two very different views of Claude Lévi-Strauss and Gregory Bateson. For Lévi-Strauss ecology

means the world outside and the mind is equal to the brain. For Bateson, the boundaries are not present—both the mind and environment are related and this ecology of mind (Ingold replaces mind with “life”) is the relation between the two. Ingold’s work is helpful for our understanding for several reasons. First, it helps us to understand environment is fundamentally historical and cultural. Second, by delineating nature from environment we avoid seeing ourselves as beyond the world and thus somehow able to intervene on its processes. Last, is the understanding that environments are continually changing through the activities of human beings and thus environment is a process. In this sense, we can reframe the struggle the participants described with trying to balance of humans and the environment. Perhaps instead of viewing this as a challenge- we can reframe it as Ingold suggests and come to understand that it *is* the environment.

By doing this, we can resist the need to struggle with the balance/imbalance and see the environment as a process—we argue by doing so we can avoid the “wicked problems” rut as first suggested by Charles West Churchman (1967). Environmental issues are classic examples of wicked problems in that they are complex, unique and their solutions require behavior, political and often ideological shifts. Here, in our work we take the collaborative approach to solving these wicked problems, which includes engaging all stakeholders to create a common approach. We recognize our work only represents the beginning of this conversation and are working towards engaging a wider-range of community members.

Throughout the process, the participants documented negative ways in which humans influence the environment and represent an environmental consciousness—a feeling of responsibility towards maintaining/improving the environment. These human destructive practices mentioned above address some of the challenges noted by the participants. We saw these practices as connected to the overall theme, *how do we co-habit?* in that these practices represent some of the challenges of enacting environmentally sustainable actions. For example, although Celeste mentioned the use of paper bags instead of plastic bottles as an alternative method of packaging, her suggestion does not address the larger issue represented in her picture and narrative—disposal. This represents a level of environmental consciousness that addresses one of the direct issues at hand but does not extend beyond that.

In other examples, the participants illustrate the role they see the nature playing in co-habitation. This reasoning is not new. In fact, Peter Kahn and Stephen Kellert (2002) demonstrate the reasons people value nature can be anthropocentric (how the environment affects humans) and biocentric (the nature has moral standing that is independent of its value as a product for human). Here, we have seen both types of reasoning present in the photovoice narratives—Paul’s photovoice (Figure 8) represents biocentric reasoning while Gloria’s (Figure 7) represents an anthropocentric view. Stewart Barr (2003) documented these types of understandings are important. For example, those who believed in the intrinsic importance of nature were more likely to act sustainably (i.e. reducing waste), as were those who saw some human priority in decision-making on the environment. Altruistic behavior documented throughout our findings did not mention much gain (although Martin notes a potential monetary gain for rotational grazing).

In the theme, *how do we modernize*, the participants articulated the ways in which they are trying to navigate traditional practices considered and make connections to larger systems. There are notable parallels between the persistence of biodiversity and of cultural and linguistic diversity, and numerous studies that demonstrate cultural knowledge is fundamental to the conservation of the environment. In this respect, we are broadening the way in which

“environment” and “nature” is defined—we are asking to move beyond the physical environment, which Ingold would call “nature” to include the social, cultural and historical perceptions, or the “ecology of life.” (Ingold, 2000, p. 16). This includes preserving indigenous ways of living and knowing and creating a collaborative approach to maintaining diversity on earth.

One of the most critical aspects of environmental sustainability is negotiating the issues of modernizing. As William Adams and Sally Jeanrenaud (2008) point out, “there is one planet, of finite size, and that human demands on it [can] not rise indefinitely”. (p. 8) They propose the question, “how do we devise strategies for society that will allow a peaceful, equitable, fulfilled human future: a humane future for a diverse earth?” (p. 11) Often modernization is seen in opposition to environmental sustainability. Even with the term ecological modernization, people tend to associate sustainable modernization with intense regulation that in the end may not have the results scientists are claiming (Adams & Jeanrenaud, 2008). Therefore, it was interesting to see the ways in which our participants discussed the ways in which they are modernizing which included navigating the process of respecting traditional practices, the implications on humans and the contextual solutions.

If we re-examine what we mean by modernization, we must return to Latour’s critique of this idea. Latour resists the notion of modernization stating we have never really been modern and suggests by using such terminology we are denoting a “break in the regular passage of time and designates a combat in which there are victors and vanquished” (p. 10). Instead, according to Latour, we act upon the context and the people (relationships) and reinstate the symmetry of things. In this way the fluidity is restored, and there is no divide between nature and society. Perhaps these ideas are connected most closely to the way our participants discussed balance between humans and nature. Although even here, Latour would argue the distinction between the two is inaccurate.

Overall, throughout the documentation of the participants’ perceptions of environmental issues in their community, we discovered the environmental issues they discussed were not unusual—deforestation, water quality, waste disposal, erosion among others. However, what is important to note is that these are the issues the participants named. By documenting local perspectives, we are enacting decolonizing methodologies. As we move from understanding environmental perspectives to encouraging sustainable actions in a cross-cultural setting, we situated the participants as knowers. To quote Smith (1999):

Indigenous people across the world have other stories to tell which not only question the assumed nature of those [common sense/taken for granted western academic] ideas and the practices they generate, but also to serve to tell an alternative story: the history of Western research through the eyes of the colonized. These counter-stories are powerful forms of resistance, which are repeated and shared across diverse indigenous communities, (p. 2)

Implications for science education

Now we return to the long-term goal of this study to inform science education. In this study, we documented environmental perceptions that included local understandings, indigenous knowledge, and ways to navigate traditional practice through decolonizing methodologies. We recognize it is not enough to only conduct research using decolonizing methodologies. With this work, we advocate a place-based curriculum. Place-based curriculum problematizes colonization and the political and historical implications of colonization. As we look to the ways

decolonization has informed education we see a trend in deconstruction, deschooling, de-centering. However, as we examine the ways in which science education can be strengthened by decolonizing research, we look to a second educational goal, reinhabitation. This term suggests, “the need to reimagine and recover an ecologically conscious relationship between people and place.” (Greenwood, 2013) By combining decolonization and reinhabitation, we make room for cultural learning, unfamiliar practices, and reclaim the ways of living that are more environmentally sustainable. Thus, decolonization and reinhabitation are aligned in the same goals for place-conscious education which move beyond a methodology for making learning more appropriate and significant but a “philosophy for a more personal, cultural and ecological consciousness, renewal and, creativity “ (Greenwood, 2013). Perhaps the most important aims of critical pedagogy of place is “that can help bridge the negligent and unproductive divide between the environment and culture in practice” (p. 96). Decolonization and reinhabitation serve as principles to guide the many approaches to learning. There are other ways of closing the gap, but the advantage of place-specific education is that it is guided by cultural and ecological perspectives and aligned with epistemological and ontological workings of decolonization and reinhabitation which ignites a way of maintaining (or creating) ways of knowing as they pertain to place. This way of knowing is not culturally fixed and place-conscious education makes room for these changes in knowledge—thus creating space for both the place and its inhabitants and future generations.

Tensions and Struggles

Throughout this work, we struggle. In our attempts to employ decolonizing methods to understand others perspectives of the environment, we make the choices of what to include, which leads to what is valued. Can any work that leads to publication for academic benefit, be considered a decolonizing methodology? Kagendo Mutua and Beth Blue Swadener (2004) write, “...decolonizing research is a messy, complex, and perhaps impossible endeavor”(p.7). Yet, we attempt in the following section, to describe the way we conducted this research because we believe it is worth pursuing. These tensions and struggles are not just ours—other scholars seek to challenge dominant approaches for how science is defined and constructed—and so we follow their lead. Guidelines for conducting decolonizing cross-cultural research exist. For example, Beth Blue Swadener, Margaret Kabiru, and Anne Njenga (2000) make suggestions for decolonizing research. These include participant collaboration, purposeful research that benefits the community in which it is conducted, incorporates an evolving idea of culture, context-specific research, compensation of local collaborators, participation in community in ongoing ways, studying the language and cultures, sustained time in cultural context (through repeated visits or longer time in setting), and finally making the findings relevant and available.

First, we sought to be collaborative during all steps of this process. We purposefully designed this study to include data sources and procedures that would be inclusive to our participants. The data collection procedures were created to provide the participants with control over the types of images and stories they told. After our data analysis, we returned to Kenya and met with the participants and discussed our themes with them. They informed our final coding steps (see Table 3 columns 4, these themes were developed through discussions with the participants). As we plan our future work, we will analyze the data with the participants. Second, this research seeks to ultimately inform the science curriculum that will be re-organized using these ideas. Third, we attempted to document an evolving notion of culture. This is important because as our work documents, there is a blending of WMS and local knowledge

within their environmental perspectives. In these communities, it could not be completely separated and therefore at times it seemed as if Indigenous Knowledge was no longer unique—it is a part of Western Modern Science and the way they viewed their environment. Fourth, our work was context-specific in the methodological plan that relied on images and narratives from the participants—thus situating all of the work in the place of participants. This work would have not looked the same if the context differed. Fifth, we provided the participants with a smartphone and minutes for usage for 1 year. Sixth, this is a sustained research effort from this research team and our university. We have developed strong ties with universities and students. Both our home university and the Kenyan university are participating in study abroad experiences with dozens of graduate students from the area attending our university graduate programs. Seventh, the research team attempted to communicate in Kiswahili and Kimaasai in perfunctory ways. We acknowledge that as our collaborative efforts continue, we need to make this a priority so that our participants and collaborators could code-switch with us. Eighth, the research team visits this area on regular basis with goals to spend a sustained amount of time in the area. Ninth, we have plans to return to Kenya during the summer and host an interactive mobile exhibit of the photographs and narratives collected. The participants will guide community members through the exhibit explaining the process and their environmental perspectives. The community members will be given cameras to document their own views thus building on the perspectives documented in this study. In this way, the information is both relevant and available to the community member.

Despite these efforts we still have struggles with this work. One collective struggle is with *who* initiates the research. Clearly, one decolonizing act would be for the work to be initiated by the communities—but must it be initiated by the communities to be considered decolonizing? If we as scholars initiate the work, does that mean it will not have value for the communities? We acknowledge we are uniquely positioned to offer ourselves to engage in desired projects. The way that we handled this struggle was what we believe is a decolonizing act. We note the majority of the decolonizing projects place Indigenous peoples (researchers) at the center of this work; however, decolonizing projects – if they are to be sustained – require political and intellectual allies working together to generate continued dialogue in cross-cultural contexts. It is our hope that through these collaborations, the work will no longer necessitate us as outsiders but that the participants will take over the work. Additionally, one recommendation that we are working towards is having participants as co-authors of this work. None of our participants were interested in this process however we acknowledge that it is likely we did not explain this process clearly. It is our goal that this paper will serve as example of our work.

Significance of study

Though this project is not the first to recognize the importance of authentic engagement of local key stakeholders to environmental sustainability, this is the first project, to our knowledge, that applies this insight to a context in sub-Saharan Africa—and, in particular, to such widely recognized ecologically rich areas as the Maasai Mara. The irony of the contrast between the universally recognized ecological importances of sub-Saharan Africa with the lack of attention of sustainability education to local populations in sub-Saharan Africa is, itself, not sustainable. That is, we can no longer afford to acknowledge the value of the ecology in sub-Saharan Africa but do little to facilitate its continuation through a method demonstrated to work in other contexts—authentic, democratic engagement of local communities. Thus, this project challenges the current discourse regarding sustainability in sub-Saharan Africa (a discourse focused on agricultural

education and sustainability education in academic contexts) by identifying, valuing, and including local perspectives regarding the environment and sustainability in efforts to conserve and preserve natural resources.

Furthermore, as science educators, we would ultimately like to inform science education in Kenya. One major challenge of Kenyan education is the nationally standardized syllabi and multiple-choice examinations that are insensitive to and often lacking local scientific knowledge. Valuing and incorporating the indigenous perspectives of environment have been the focus of Kenyan science education for decades. As a Kenyan scientist, Mutai Korir-Koech, stated “one of the most challenging objectives of education is to produce people who are critically aware of their environment (1999: 180 as cited in Thomson 2010). Similarly, the Ministry of Education, Science and Technology of Kenya (2005a; 2005b) proposed an educational system that maintained cultural heritage of Kenyans. To do this, Kenyan policy makers need to transform the current post-colonial school structure and curriculum that reinforces the colonial power through curricula heavily based on the British system. Currently, John Ng’Askike (2011) notes there is no mention of cultural knowledge in the Kenyan science curriculum. Even worse, Caroline Dyer (2006) observed Kenyan education even teaches nomadic children to view their culture as barbaric, primitive and the reason for failing in schools. This cultural deficit approach assumes that certain groups are intellectually inferior to others, particularly to the groups in charge (colonizers). Cultural Deficit Theorists view culture outside of Euro-American as inferior and cater to highly Eurocentric perspectives. According to Douglas Foley (1997), the cultural deficit theory often blames the students for failing and rarely addresses that teachers and schools are failing to teach. By dismantling this post-colonial curriculum and the cultural deficit approach to teaching, Kenyan teachers would be able to infuse local environmental perspectives back into their classrooms.

Thus, this study sought to understand local perceptions of the environment and sustainability of Kenyan teachers and community members. This project has implications for informing science education to combat these traditions of subjecting students to a science curriculum that demotes Kenyan cultural heritage and lifestyle. By incorporating local knowledge such as the ideas discussed in this paper into Kenyan science education, Kenyans can reach one of most challenging objectives of education which is to produce children who are fundamentally aware of their environment.

Conclusion

This paper builds on the work of Thomson (2010) who documents knowledge, learning and narratives in Kenya. Thomson’s work called for “science educators to have an opportunity to become active participants with regard to real global concerns for extinctions: cultural, language, and biological.” (p. 112). Here, we authenticate the local understandings of community members and teachers on the topics of environment and sustainability. Throughout this paper, we highlight the understandings as assets to this community. It is our hope that this work will lead to action and by validating this knowledge as such, that this community will be able to move this discussion towards enacting sustainable acts. This community demonstrated complex understandings including navigation of traditional practices, made connections to a larger system, and describing positive ways in which humans influence our environment. We feel this work is critical to document one way to motivating the community towards including this knowledge system in their schools and conversations about sustainable acts. As Seyni Koutche, former Niger President remarked:

Africa has been searching for a model of development. Extrapolations from the experience of other countries, or direct transplants, are often seized on because they seem to provide easy answers. In either case, an essential factor is neglected: the traditions and customs, so powerful in Africa, on which we have forged our civilization. (Timberlake, 1986)

In this study, we call for a revitalization of knowledge and power in this community. And we posit that with that revitalization, context-dependent solutions will follow.

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Note I.

In the summarized results reference #35 is actually two different references not one as listed.

II. UNEP (2009) info from doc.:

For bibliographic and reference purposes this publication should be referred to as:

UNEP (2009), "Kenya: Atlas of Our Changing Environment."

Division of Early Warning and Assessment (DEWA)

United Nations Environment Programme (UNEP)

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Nairobi 00100, Kenya

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III. Central Bureau of Statistics. (2009). *Republic of Kenya*

I only found Kenya National Bureau of Statistics, but I don't know if this is what was used versus what was listed.