Agriculture and Human Values
https://doi.org/10.1007/s10460-018-9878-0

"We like insects here": entomophagy and society in a Zambian village

Valerie J. Stull[1] · Mukata Wamulume[2] · Mwangala I. Mwalukanga[3] · Alisad Banda[4] · Rachel S. Bergmans[5] · Michael M. Bell[6]

Accepted: 23 July 2018

Abstract
Entomophagy—the practice of eating insects—has been touted as a means to combat undernutrition and food insecurity globally. Insects offer a nutritious, environmentally friendly alternative to resource-intensive livestock. But the benefits of edible insects cannot be realized if people do not choose to eat them. We therefore examine the social acceptability of edible insects in rural Zambia, where entomophagy is common but underexplored. Through a village case study, we show that edible insects are not valued equally, are understood socially, and seem to reflect and reinforce social values. We utilize grounded theory and ethnographic methods, including semi-structured interviews, focus groups, and observation to examine collective entomophagy beliefs. While we expected to see differentiation in perceptions across groups based on kinship, we demonstrate that social values related to class, urbanism, gender, and age emerge as more germane explanations for entomophagy perceptions, reflecting their social weight. By expanding on current apperception of entomophagy behavior, our findings inform future research and efforts to promote entomophagy through minilivestock farming. Systems designed to maximize output, minimize labor, and highlight benefits are more likely to be widely accepted. We do not anticipate tribal association will be the primary limitation on minilivestock adoption in this context.

Keywords Entomophagy · Food security · Food sovereignty · Edible insects · Minilivestock · Zambia

Abbreviation
FGD Focus group discussion

Introduction

"We like insects here," Mr. Fanwell tells us. "*Nshonkonono* (green cone-headed grasshopper) is my favorite. Found during the rainy season. We get out the wings. After that, we put it in the pan with oil. We just fry. It tastes nice." Fanwell, a gentle, warm-hearted community leader, is known to eat insects, like most residents of Kazoka village, Zambia.

✉ Valerie J. Stull
vstull@wisc.edu

Mukata Wamulume
mukata60@yahoo.com

Mwangala I. Mwalukanga
mwangalamwalukanga@gmail.com

Alisad Banda
alisadbanda@gmail.com

Rachel S. Bergmans
rbergs@med.umich.edu

Michael M. Bell
michaelbell@wisc.edu

[1] Center for Sustainability and the Global Environment, Nelson Institute for Environmental Studies, University of Wisconsin-Madison, 1710 University Ave., Madison, WI 53726, USA

[2] Institute for Economic and Social Research, University of Zambia, Lusaka, Zambia

[3] Development Studies Department, University of Zambia, Lusaka, Zambia

[4] Lutheran Health & Development, Lusaka, Zambia

[5] Department of Psychiatry, School of Medicine, University of Michigan, Ann Arbor, USA

[6] Center for Integrated Agricultural Systems, Department of Community and Environmental Sociology, University of Wisconsin-Madison, Madison, USA

Published online: 03 August 2018

For him, insects are a tasty source of *ndiyo* (the nutrient-dense relish served alongside the staple food, *nshima*, a stiff corn-based porridge). "We find them in the bush," he says with a broad smile. "My wife cooks them for me. They are good food!" Although Fanwell does not eat insects daily—he only consumes them when they are readily available in nature—he suggests people in Kazoka might suffer if they disappeared.

Kazoka is not unique. Insect consumption—also called entomophagy—has been historically practiced across Africa, Asia, and the Americas (Bodenheimer 1951; Defoliart 1995). And there is good reason for humans to eat insects; edible species generally contain all essential amino acids and both mono- and poly-unsaturated fatty acids, while also being rich in micronutrients. Common species contain 40–75% protein by dry weight (Verkerk et al. 2007), B vitamins (Schabel 2010; Rumpold and Schlüter 2013a), and ample iron (DeFoliart 1992). As such, entomophagy has been proposed as one way to decrease iron and zinc deficiency in developing countries (Christensen et al. 2006) and improve global food security. Over 1900 edible species have been identified (van Huis et al. 2013), and more than 500 species are eaten in 40 different African nations (Jongema 2014). In Zambia, 84 edible species have been documented and are consumed country-wide (Jongema 2014). Caterpillars such as the mopane worm (*Imbrasia belina*) garner generous market prices and contribute to livelihoods as an important source of both income (Rebe 1999; Stack et al. 2003; Ghazoul 2006; Wessels et al. 2006; Makhado et al. 2014) and nutrition in some regions (Onigbinde and Adamolekun 1998; Glew et al. 1999; Headings and Rahnema 2002; Madibela et al. 2008; Kwiri et al. 2014; Siulapwa et al. 2014).

Nutritional and economic gains from edible insects could boost food security, but such benefits depend in part on the year-round availability and accessibility of insects. In Kazoka, all insects consumed are harvested from the wild, and most are available only seasonally. Insect cultivation, or minilivestock farming, has been offered as a means to increase access to edible insects consistently—thereby enhancing food security and household nutrition year-round. Insects are an abundant natural resource (van Huis et al. 2013); however, the vast majority (~92%) consumed globally are wild-harvested (van Huis 2013; Rumpold and Schlüter 2013b; Jongema 2014) and often only seasonally available, as is the case in Zambia. Some insects can be reared using organic side streams, adding value to (and recycling) biomass not edible for humans or livestock (van Huis et al. 2013). Entomophagy expert and pioneer Arnold van Huis said it best and bluntly in 2015: "If edible insects are promoted as food, and feed, they need to be farmed" (van Huis 2015). Farmed insects come with the added benefit of yielding a drastically lower environmental impact than traditional livestock (Collavo et al. 2005; Oonincx et al. 2010; van Huis et al. 2013). While minilivestock cultivation is promising, its feasibility depends on social acceptance. If minilivestock is socially acceptable and people do opt to participate, communities that engage in household-level production could also experience gains in control over their own food resources and ultimately their food sovereignty.

The nutritional, environmental, and economic implications of edible insects have been explored in the bourgeoning entomophagy literature. Recent studies have also investigated: consumer perceptions of edible insects in contexts where they are not traditionally consumed (Caparros Megido et al. 2014); disgust, perceptions, and cultural factors that impact entomophagy adoption (Wood and Looy 2000); as well as how negative perceptions of entomophagy in the West influence global food policy and practice (Looy and Wood 2015). Nevertheless, relatively little research has explored social perceptions of, and lived experiences with edible insects in diverse contexts where they are already readily consumed. Insects for food and feed could serve to boost food security (van Huis 2013), but purported benefits cannot be realized if people do not *choose* to continue to eat insects, eat more of them, or participate in production. The purpose of this study is to determine perceptions of edible insects and entomophagy behavior in one case community and to assess how lived experiences with and beliefs about edible insects may impact future efforts to promote entomophagy. Untangling current perceptions of edible insects is also critical to understanding the viability of minilivestock farming, which may have important implications for both food security and food sovereignty. A secondary aim of the study was to determine if tribal or ethnic identity was a primary determinant of modern entomophagy perceptions or behavior in the community, as has been previously reported in the Zambia-focused literature (Silow 1976).

In this paper, we show that in Kazoka, beliefs about edible insects reflect values across Zambian society; community members see differences between people transcribed on differences between insects. We expected to observe differences in perceptions of entomophagy evident across tribal lines. Our findings run contrary, however, as social perception instead varied along other social lines: class, location, gender, and age. By examining perceptions in Kazoka, we also uncovered a clear connection between social beliefs and variations in the desirability of certain edible insects. Here, we explore entomophagy and evaluate social perceptions of edible insects to ultimately discuss implications for future efforts to promote entomophagy.

Context

Kazoka is a small village in Shibuyunji District, located 70 km west of the capital city, Lusaka (Mubanga et al. 2015). Here, 51 distinct households are separated by fields

and gentle hills. During the 100–140 day crop growing season (Saasa 2003), villagers cultivate maize, vegetables, groundnuts, and cotton. A large white Food Reserve Agency (FRA) shed serves as a central community meeting point. The FRA purchases maize from smallholders at a fixed price (see bottom left image of Fig. 1 below). Almost all Kazoka residents sell into this program.

Despite the relative abundance of agricultural resources, Kazoka is poor and food insecure. Farmers are stressed by late onset rains and reduced yields due to climate change. Educational obtainment is low, and many residents participate in piecework, a form of rural labor whereby individuals work on other people's farms to earn in-kind payments or cash (Whiteside 1999; Cole and Hoon 2013). Piecework is especially common during the 'hunger season,' from January to March during the intermediary period between harvests. Reliance on piecework has been linked to poverty (Cole and Hoon 2013) and regarded as both a coping strategy (Devereux 1999; Whiteside 1999) and a measure of household vulnerability to food insecurity (Kerr 2005).

Zambia, like much of Southern Africa, is at a crossroads of development. Not only is agrarian life fusing with modern technology, but culture is evolving, and economies are shifting. We selected Kazoka village for three reasons. First, the village is uniquely positioned as both rural and heavily influenced by the urban. Access to the city is relatively easy, and residents regularly interact with Zambians from vastly different backgrounds. Second, Kazoka is home to people who consume numerous insects but don't regularly participate in the insect trade. This reality alone is not significant; however, Kazoka is emblematic of a new space for entomophagy research. Most research to-date focuses on caterpillar consumption in central and northern Zambia (Silow 1976; Mbata et al. 2002). Third, Kazoka is an ethnically diverse and economically progressing village. Thanks to its proximity to Lusaka, Kazoka is an amalgam of people from various tribes, 12 that we encountered during our research. It sits at the apex of ethno-linguistic integration. Some residents now have metal roofs, solar electricity, and bicycles. Others remain without these luxuries. Social perceptions of edible insects are likely shifting as well, influenced by the village's diverse population.

By virtue of the colonial emphasis on mining that drew populations to central mining regions, Zambia is one of the most urbanized countries in sub-Saharan Africa today. This urbanization results in frequent interactions between the nation's diverse peoples, including at least 73 ethnolinguistic groups (Taylor 2006). Diversity, fused with urban blooms, has undoubtedly created a melting pot of the traditional with the modern, whereby groups mix across social, linguistic, and professional lines (Taylor 2006). Thus, Kazoka is emblematic of Zambia's cultural coalescence and evolution. Kazoka is predominately home of the 'Bantu Botatwe' (three people/three persons) (Ahmed 1996), including the Tonga, Ila, and Lenje—but the village has members of other tribes as well. Note that while use of the term 'Bantu Botatwe' is sometimes contested by scholars (Colson 1996), and is often viewed as a simple linguistic delineation (Torrend 1931; de Luna 2008), it can also be used to describe three similar but separate ethnic groups broadly (Macola 2011; Shoup 2011; Larmer 2016).

Fig. 1 Images of Kazoka village (from top left: dry maize stalks; top center: man and son plowing; top right: traditional hut; bottom left: aerial view including white FRA shed, Source: Google maps (Google Earth 2014); bottom right: Kazoka household)

We employ the term to match our informants' self-identification, including both separation and interconnectedness among the Bantu Botatwe.

Methods

This article is based on ethnographic fieldwork conducted between September 2015 and May 2016. Data were collected via semi-structured interviews, focus group discussions (FGDs), informational meetings with leaders and experts, observation, and secondary research. For semi-structured interviews, we recruited participants using non-probability, relational, and theoretical sampling. Questions were pre-determined, but respondents were encouraged to add substance and redirect the interview if they so desired. Epistemologies of the 'insect' category were murky, as some could not differentiate insects from other small edible animals. Thus, it was both useful and necessary to employ a loose method of *photo-elicitation* (Collier 1957), prompting interviewees to comment on images (Bignante 2010) that triggered memories and evoked "deeper elements of human consciousness" than words could alone (Harper 2002).

Early in our research we struggled to discuss the broad category 'edible insects,' finding no existing local terminology to talk about insects as a food group. Local classifications instead designate insects as either edible (with a specific name) or generic (all insects, including those that are not edible, called *vidoyo*). Thus, we carefully selected the phrase *vidoyo va kudya/tudoyo twa kudya* (food insects, insects for eating) to discuss the wide-ranging category. Others have also struggled to identify appropriate language in edible insects research, and more descriptive terminology is needed. Even the term 'entomophagy'—used by Western researchers to distinguish the practice of eating insects—may be off-putting to some (Looy et al. 2014) and could reflect bias by researchers who do not consume insects in their own cultures (Evans et al. 2015). It was important that the study team not assume participants who eat (any) insects consider themselves 'entomophogists'; thus, broad inclusive language, instead of categorical terminology, was employed to encourage honest feedback from respondents. The cultural and linguistic implications of entomophagy terminology in field research deserve further scrutiny.

Recognizing that perceptions are not molded in a vacuum (Marshall and Rossman 2010), we used FGDs to consider how people collectively understand a phenomenon and create meaning around it (Waterton and Wynne 1998), examine routes by which meaning is mutually assembled (Culley et al. 2007), and determine food perceptions (Threlfall 1999; Barrios and Costell 2004). FGDs can also provide a safe, encouraging environment (Kitzinger 1995; Denscombe 2010), while not discriminating against those who are not literate. As FGDs in cross-cultural research can be problematic (Esposito 2001), we reviewed question guides with local experts before administering, organized single-gender discussions (Winslow et al. 2002), recruited participants with the help of community leaders, and utilized visual aids.

Interviews and FGDs were conducted in a mixture of two to three languages including: English, Nyanja, Sala, and/or Tonga with help of a translator. While most respondents understood basic English, the majority preferred to use their first language. Nyanja, which is quickly becoming the lingua franca of Lusaka, was particularly useful as a means of communication. (The lead researcher was studying Nyanja at the time of this research, and both translators are fluent in Nyanja and proficient in Sala and Tonga.) Our field research team always involved one Zambian translator and the primary researcher, a young white American woman, with off-site support from two other Zambian colleagues. To ensure culturally appropriate community entry, we met with village leadership to seek approval prior to initiation. We obtained human research ethical approval from the Humanities and Social Sciences Research Ethics Committee (HSSREC) at the University of Zambia (UNZA), as well as the Education and Social/Behavioral Science Institutional Review Board (IRB) at the University of Wisconsin-Madison, USA.

Data analyses

Qualitative field data collection and analyses were centered on a grounded theoretical approach involving simultaneous data collection and analyses (Charmaz and Mitchell 2007; Orne and Bell 2015), as well as principles of 'interactionism' (Thorne 2000). Accordingly, we applied analytical memo writing and thematic analysis (Braun and Clarke 2006), using first manual 'open coding' (Orne and Bell 2015) during data collection and later 'focused coding' (Orne and Bell 2015) using NVivo© qualitative software. We used an inductive strategy for coding, while also analyzing data at the latent, not semantic, level to identify and examine underlying ideologies, assumptions, and social conceptualizations of edible insects rather than focusing on specific word choice (which may be altered during translation).

Participants

Participants were primarily small-scale and subsistence farmers living in Kazoka. We conducted 40 semi-structured interviews (24 women; 16 men) with respondents from 35 different households, two single-sex FGDs with community members (10 men; 12 women), and numerous informational meetings with community leaders. Furthermore, we completed nine interviews with Zambian experts in entomology, nutrition, community development, and agriculture. Table 1

depicts the demographic details of Kazoka participants—our key informants for this paper.

Analyses and findings

These are "the insects we eat here," one older man tells us, listing each. He doesn't directly associate them with his tribe. Instead, he relates them to a place—his home. "I learned to eat these from the people here," another woman tells us, also avoiding the word tribe. Tribe is an important component of identity for many Zambians. Even the existing literature exploring entomophagy in Zambia organizes trends succinctly by tribe (Silow 1976). However, Kazoka residents rarely distinguished insect consumption *within the village* on the basis of tribe or ethnicity alone. Mixed tribe households (Bantu Botatwe or other) are common in Kazoka and some children experience cultural 'diffusion,' while being exposed to traditions hailing from both parents. Sporadically, respondents did call out tribe as justification for not participating in entomophagy. One man stated, "Some of these insects go with the tribe. Like for us the Tongas, we say we don't eat insects." However, behaviors within the community contradicted this assertion. Among respondents who self-identified as Tonga, most (9/11) ate insects and most (7/11) ate more than one species.

Additionally, we found that edible insects are not viewed as a uniform, homogenous food group in Kazoka. Rather, insect desirability appears to align with how each insect is ranked compared to other insects. The existence of categories of edible insects supports our finding that insects are understood socially with differences between insects reflecting differences in society. We demonstrate a hierarchical theory of the social arrangement of edible insects observed in Kazoka in Fig. 2.

Table 1 Demographic characteristics of study participants from Kazoka village

Focus group discussions and interviews		Interviews only	
Total number of participants		Highest education level (grade)	
Total	52	Range	
Male	24 (46%)	Male	4–10
Female	28 (54%)	Female	0–11
Respondent age		Average	
Range		Male	7.2
Male	19–94	Female	5.7
Female	23–79	Household size	
Average		Range	1–14
Male	43.8	Average	6
Female	42.4		

While we anticipated that variation in entomophagy would occur predominately across tribal lines, our findings revealed a more complex social understanding of edible insects. Indeed, perceptions of insects subtly reflect social values of class, location, gender, and age. We discuss these findings below. The hierarchical arrangement of edible insects suggests that future minilivestock farming may need not overcome tribal custom as much as it must involve careful attention to how cultivation methods and the species farmed align with social values.

Entomophagy and class

Differentiation between socioeconomic classes in Zambia is becoming more pronounced. The country has progressed from low- to middle-income, thanks to a recovery in growth. Between 2000 and 2014, Zambian Gross National Income per capita increased from $330 to $1770 (World Bank 2018). This increase was due in part to amplified copper output, export, and price since 2004 (CIA 2010). Nevertheless, many have been left behind and remain in poverty. Perceptions of entomophagy in Kazoka are closely aligned with beliefs about socioeconomic class and reflective of these trends. We found that as a whole, edible insects are not simply viewed as a food for the lower class, but represent a number of foods that are both revered and scrutinized by villagers.

Patricia is 38 and of medium build and height. She wraps a brightly colored *chitenge* (traditional cloth) around her waist. She's holding a giant grasshopper in her hand, and with a youthful smile tells us, "this one, it tastes nice." She confesses, "when the season for the *ntete* (grasshoppers) arrives, sometimes we do not eat any other relish so the *ntete* really helps us […] also *inswa* (winged termites)." (Note that in Zambian culture, a relish is served with most meals and typically contains essential nutrients that are absent in high-carbohydrate, low-protein *nshima*. Relishes are a key component of traditional cuisines across the African continent, and while definitions vary, insects are often included (McCann 2009). Zambian relishes are always served with *nshima*. To an outside observer, traditional relish might resemble a main dish in Western culture, but its status as a secondary dish highlights the cultural importance of *nshima* (Taylor 2006).) "Others cannot eat because of pride," she says, "because of the way they are dressed." Like many in the community, Patricia scoffs at wealthy Zambians who wear expensive clothing and have a propensity to disdain *ntete*. She finds comfort and comradery in her Kazoka identity; there is a sense that people here are realistic and not too 'good' to eat insects. Less than 10% of study participants do not eat insects; instead of feeling belittled by the practice, the majority laugh at those in higher classes who might not participate.

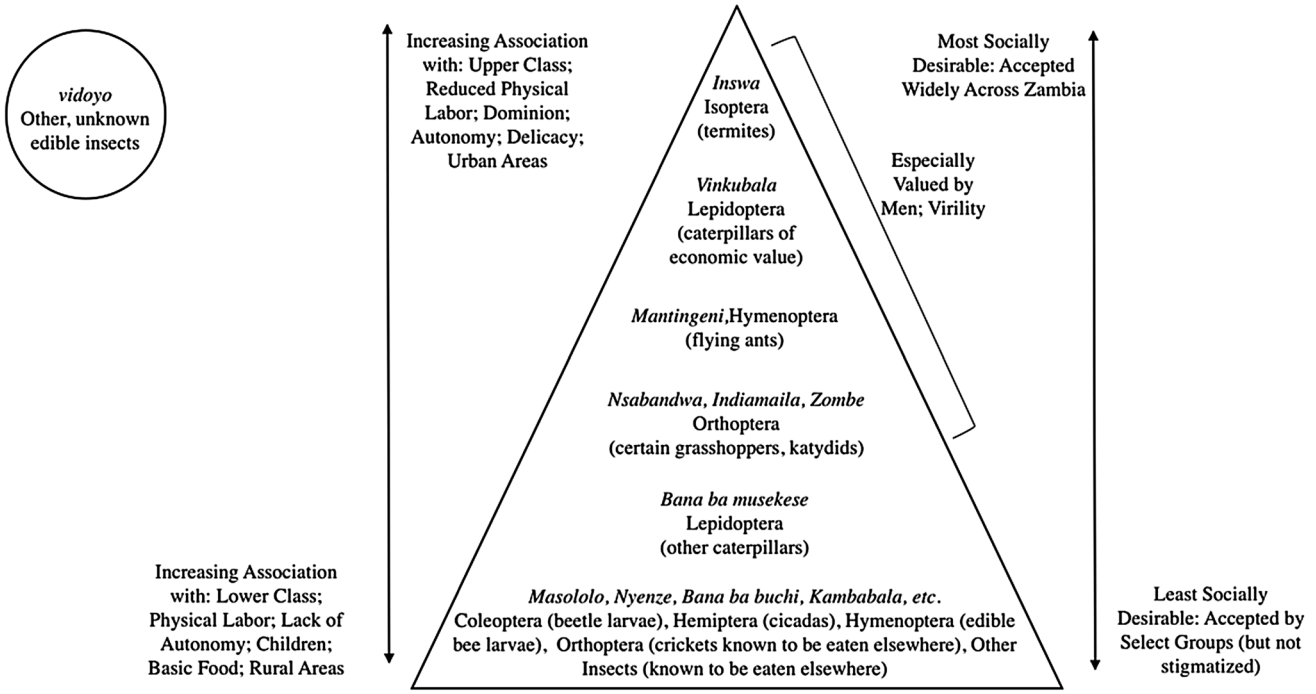

Fig. 2 Non-tribal social arrangement of edible insects in Kazoka village (Note: local names listed in Sala.)

Edible insects associated with poverty but not stigmatized

Villagers shared graciously with a white researcher from America throughout the study. No one was particularly shy to talk about entomophagy, and questions were met with enthusiasm, indifference, or humor, rather than shame or fear, demonstrating general tolerance for the practice. Most residents shared the straightforward assertion that "if he or she eats it, it is fine," meaning that all known edible insects are socially allowable, even if not personally preferred. Insects are advantageous because they are *food*. One man explained "they are important because we use them as relish." Other cited benefits included: nutritional gains, availability when other relish is scarce, flavor, low-cost, and reduced need for cooking oil.

Notwithstanding the advantages, Kazoka residents are acutely aware that other Zambians (especially the wealthy) and Westerners often associate entomophagy with poverty and lower class, or do not consider insects food. They are not wrong, as in popular Western culture, insects are depicted as an inferior food group favored by the poor (Beiser 2014). Entomophagy faces prejudice in some contexts where insects are associated with hunger and unavailability of other meat or fish (Owen 1973); similarly, educated city dwellers develop a view of insects as "pest and a nuisance" thanks to modernization and changing attitudes that see entomophagy as belonging "to the past" (Jacob et al. 2013). Excluding certain species (see next section), Kazoka residents share the belief that entomophagy is a result of poverty. Some respondents were blunt about these realities; "we eat because of problems, we lack relish," a middle-aged woman stated. "If relish becomes scarce, I go to look for them [insects]," another man confirmed. This local perception presents a dichotomy. Insects are simultaneously desirable *and* inferior. During this study, entomophagy was never criticized *within* the community, but there remained an understanding that the practice is associated with poverty.

Nevertheless, social stigma is not attached to entomophagy in Kazoka; residents were unfailingly positive about the food value of edible insects. Still, insect consumption is not a point of pride either. Insects are deemed a second or third tier relish option, ranked below both meat and vegetables by most. "As compared to meat, these [insects] are not regarded as very important," a young man stated. This is further evidenced by our observations of inconsistent insect consumption, even when available. Personal preference for the accessible species is one contributing factor, but it is also probable that insect consumption is not preferred when other food options are abundant. With the exception of *inswa*, no respondents stated or implied that they would choose insects *in lieu* of other foods; insects are instead a welcome supplement. Regardless, insects are indeed consumed with greater frequency than meat by low income villagers, and sometimes they are pursued with vigor. Catching insects while tending to cattle is popular. For example, if one

sees a tasty insect while out with their cattle, they might be prone to snag and eat it, even if there is no paucity in household food supply.

The admissibility of entomophagy and lack of stigma was further explained in terms "majority practice" and an absence of judgment. One man who did not consume any edible insects himself elucidated, "I have never seen anyone judging another person because the majority of people eat, as compared to us who do not eat. We are a few." Common were broad sweeping declarations about entomophagy in Kazoka. From statements such as "everyone collects, everyone" to "everyone eats" the consensus was clear. This unanimous perspective rests on a link between entomophagy and free will. "If you want to eat, you eat, if you don't, you don't," an older woman claimed. "Why should you be embarrassed?" Kazoka residents feel free to eat insects or to refrain; it is an individual decision. We observed intra-household variation in consumption habits confirming this narrative.

Views on uses for edible insects further support our finding that insects are associated with poverty but not stigmatized in Kazoka. When considering group events, such as weddings, Kazoka residents were not agreeable to the idea of serving insects for several reasons. First, insects are not traditionally a wedding food. This status is reserved for chicken or beef, and cereals like rice. Second, Kazoka residents recognize that outsiders may or may not want to consume insects. Typically, insects are not served to guests for fear of rejection. One woman explained, if "they are relatives like the ones we live with here, we can give them [insects], but those from afar … we cannot serve them …" This appears to result from the proximity of edible insects to poverty, even though Kazoka residents would find the foods acceptable.

A young man declared that while people "would want to eat [insects]" at a wedding the "ones hosting the party […] feel ashamed to serve the insects because they think that people would start questioning to say even if it is hunger, can they honestly serve insects?" Another woman used similar language about a wedding, "People would be surprised that even if it is hunger, how they can serve insects?" Anxiety around appearing impoverished is pervasive. One man explained that serving insects to a large diverse group might make someone "look poor." Another respondent explained that people "do not talk openly" about insects, as "some might not eat because some they feel shy to eat them in public and yet at home they eat."

The lack of stigma but lingering association between entomophagy and poverty in Kazoka is not altogether surprising bearing in mind the relative insignificance of insects in both the local economy and traditions. Unlike other groups in Zambia that equate edible caterpillars with deep-seated cultural beliefs, money, and prosperity, the insect species endemic to Kazoka are, excluding *inswa*, less valuable to the Zambian public. On multiple occasions, Mr. Fanwell insisted that he passes on knowledge about edible insects to his children. "Yes," he reinforced, "I do teach them. I tell them that this one must be eaten." But like so many others in Kazoka, Fanwell's cultural and personal ties to entomophagy are peripheral. Although he learned "from the ancestors" what insects are edible, entomophagy is not linked with robust traditions. The production and consumption of sour milk, for example, is prominent in Kazoka and directly linked to cattle husbandry with cultural importance to the Tonga and Ila people. *Munkoyo*, also called *chibwantu* (a maize-based, fermented beverage) is also celebrated and readily shared with guests from near and far. Insects are not celebrated in the same traditional sense.

The local association of entomophagy with poverty, but lack of stigma is relevant considering the undeniable role of globalization and Western influence on modern food choices (FAO 2004). As Gene DeFoliart argued, Western attitude is important, and bias against insects as food can lead to a gradual reduction in entomophagy (DeFoliart 1999). An upsurge in the acceptability of insects as food in Western societies may have a positive impact elsewhere. It may not only encourage continued insect consumption but also endorse minilivestock as a legitimate agricultural practice (Looy et al. 2014). The growing global entomophagy movement, particularly in Europe and the United States that embraces edible insects, may support the idea that insects are desirable rather than substandard. Cultural adaptation and evolution will undoubtedly influence the acceptability of entomophagy in Kazoka and other contexts moving forward.

Hierarchical differentiation of edible insects

While entomophagy is not stigmatized in Kazoka village, perceptions of edible insects are not homogenous. Insects vary in taste, availability, and even appeal. Of course personal preference plays a role, as with all foods, but the desirability of edible insects in Kazoka is intertwined with broader beliefs about the insects themselves and with delineations that reflect class differentiation in Zambian society. Insects that are most desirable are associated with upper class values and behaviors. They are tied to money and social acceptability. Those insects that are least desirable, but still consumed, are associated more closely with labor, lack of autonomy, and poverty. As shown in Fig. 2, insects not known to be edible exist outside of the realm of consideration.

All Zambians, regardless of class, know *inswa* (by various names). *Inswa* is considered a delicacy across Zambia and Southern Africa and has diverse utility as food, animal feed, and medicine (Figueirêdo et al. 2015). In Kazoka, several villagers happily consume *inswa* while avoiding all other insects. Of the five interviewees who only consumed

only one insect type, four ate *inswa* exclusively. In Zambia, even University students and upper-class urbanites enjoy termites from time to time (field notes).

The popularity of *inswa* is predicated on three primary entomological realities. First, the insects are savory and delicious, thanks to high fat content, more than 40% by dry weight (Siulapwa et al. 2014). (Several respondents complained that it was very tempting, but ultimately unpleasant to overeat termites, and as one woman warned, eating more than a "handful" at a time will "give you diarrhea.") Second, the insects are rare. Coming just once per year in droves, *inswa* emergence is a bit like Christmas in the West; it is a greatly anticipated and celebrated event. One man insisted that people "feel very, very happy, especially about *inswa* when it comes!" Third, the sheer ease with which *inswa* can be harvested in bulk makes it a dietary surplus, unlike other insects, which can require extensive effort to harvest in volume. *Inswa* is by far the easiest edible insect to catch in bulk. After the first heavy rains millions of winged reproductives ("alates") exit termite mounds and fly. They are attracted using a light/torch at night, and after collision quickly fall to the ground where they are swept into containers, which are then filled with water. Typically, they are roasted or dried the next day and eaten as relish or as a snack. One needn't leave home to catch termites, and they are popular across Zambia. In years with a smaller *inswa* harvest, people are disappointed.

Due to popularity and demand, termites are sold in urban centers and rural towns. The nearby town of Nampundwe houses multiple vendors selling *inswa* at harvest, and shortly thereafter while dried insects are still palatable. In Kazoka, *inswa* was the only insect that villagers reported sharing readily with one another and guests, both during the harvest and afterward. One woman recalled that "they [termites] are easy to catch. If some neighbors collect a lot, you just go and ask from them and they will give you."

Edible insects and autonomy

Despite the general acceptance of all insects eaten in Kazoka, the particular social predilection for termites ostensibly stems from their universal appeal, and the apparent lack of an association between termite consumption and labor. Labor includes the time and effort required to go out into the bush to hunt for and collect food, which is less socially desired than buying food. While some women complained that catching other edible insects required too much energy, no one made such claims about *inswa*. Rather, the appearance of winged termites each year offers a convenient, delicious, and nutritious food option that is available to everyone in the village without excess effort. This is especially relevant given their timely arrival during the "hunger season." Wealthy and poor Zambians alike eat and collect *inswa* without reservation; the process takes little time or effort and yields ample benefits.

Both leisure and reduced physical labor are associated with economic freedom or autonomy. We found that insects more closely connected with autonomy are more desirable in Kazoka than insects associated with labor (e.g., beetle larva and cicadas) (see Fig. 2). While favored by some, these species are rarely eaten by most. In contrast to local knowledge about *inswa*, knowledge about bottom tier insects is not ubiquitous. A few respondents explained that *masololo* (beetle larva) were not found in Kazoka anymore, but others disagreed, even showing us trees and dead wood where the beetles lived. Significant effort is required to harvest both cicadas and beetles in bulk. For *masololo*, one must observe the tree over time, and cut it open to remove larva, often only a few at a time. Even one woman who was particularly fond of *masololo* emphasized that "when we lack relish, we go looking for masololo to eat with *nshima*." Beetle larvae are not sold in urban markets and their consumption is unknown by many city-dwellers in the country. *Chenze* (cicadas), on the other hand, are caught one at a time using a stick with sap on the end. They are speared out of trees, usually by young boys, which takes substantial time and effort. Cicadas are small once the wings are removed. An older woman explained, "there is nothing much that one can benefit from them," referring to both food value and economic benefits. Hence, there are few incentives to catch cicadas.

Class implications for insect agriculture, a blank slate

Associations between edible insects and class are relevant to the future of entomophagy and insect agriculture. Admittedly, we hoped to uncover genuine enthusiasm for edible insects and strong cultural support. What we found instead was an intricate array of perceptions—parsed by social valuations. Compared to regions where insects are crucial to rural livelihoods (Makhado et al. 2014) and nutrition (Siulapwa et al. 2014), edible insects are almost an afterthought in Kazoka. Residents could not recall stories, myths, or salient traditional beliefs about them. This differs from the Bisa people of northern Zambia that retain traditional ecological knowledge of insect lifecycles (Mbata et al. 2002) and use customary regulation to manage forests. In Central and Muchinga Provinces, locals believe inappropriate human behavior negatively influences caterpillar populations (field notes). In Bemba tradition, the *amatebeto* wedding ceremony often directly involves cooking edible insects (Taylor 2006). An equivalent ceremony is not practiced in Kazoka.

The lack of longstanding insect traditions, as well as previously mentioned associations with poverty and labor, are relevant to the future of minilivestock. The absence of robust cultural ties to edible insects may make it harder for

the community to envision the genuine benefits of farmed insects. Similarly, globalization, as well as urbanization of the country writ large, are likely influencing behaviors, attitudes, and beliefs about food and agriculture in Kazoka. This phenomenon is not unique to Zambia, as evidenced by the westernization of developing-country food systems and the shift in dietary preferences propagated by globalization of culture and agricultural commercialization (Cannon 2002). Even beyond globalization and commercialization, urbanization and population growth are known to dramatically affect diets (Johns and Sthapit 2004). Regardless, a shortage of strong mythologies may open the door for new social beliefs about edible insects to emerge and take hold. In this way, Kazoka may be receptive to insect farming. The focus of future farming efforts should be on identifying the appropriate species and method of cultivation, rather than overcoming barriers with stigma.

Entomophagy and location

On the surface, Zambian wealth appears to be concentrated among urban residents who drive cars and own houses. (There are, of course, examples to the contrary.) As such, urbanism is closely related to class, and one maps onto the other. But we found that the social perceptions of Kazoka residents included specific attention to urban and rural divides.

As mentioned previously, a cultural nomenclature for "edible insects" collectively does not exist in Kazoka. This is likely because all insects are not created equal, in a social or culinary sense. It is not that a person eats "edible insects" but rather that he or she eats *inswa* or *vinkhubala*. Naming appears to be a catalyst for insect desirability. Insects not named and recognized as edible are not food, and therefore not desirable. By further teasing out underlying assumptions about rejected edible insects, we found that insects are ranked, hierarchically, according to their broad social acceptability in Zambia, including urban and rural areas, the ease with which they are harvested, and their economic value (in addition to flavor). Figure 2 depicts these findings.

Inswa is by far the most valued and popular insect in Kazoka village. Perceptions of other insects below *inswa* are stratified and ordered again by what appears to be associations with social acceptance outside of Kazoka (specifically in urban areas, or "town"), time and effort required to catch them, as well as economic value. Flavor also certainly plays a role, but we did not find this to be the most substantial social justification for consumption or perception. The second grouping of insects below *inswa* seems to include caterpillars that can be sold. Caterpillars can be expensive, and they are the most commonly sold insects at urban markets. City-dwellers admitted to buying caterpillars from particular high-quality vendors because of the delicious taste. There is even a market for caterpillar sales to Zambian expatriates living abroad.

Grasshoppers or locusts sit in the next tier. One man noted that termites and caterpillars (mopane caterpillars) are frequently sold at bars in town, but that *ntete* (grasshoppers) are not because "they would feel embarrassed to sell them in a bar." When probed as to why a retailer might hesitate to sell grasshoppers, the man noted that unlike *inswa*, which can be "caught from home," for *ntete, zombe*, and *vidiza* (locusts) one must "go to the bush to collect them, so there is that inferiority complex that comes with idea of having to go into the field just to go and look for them." Theoretically, city dwellers do not have the opportunity to go insect collecting in the bush because the city infrastructure does not allow it. They are able to purchase food at one of the numerous local shops in town.

Popular caterpillars normally maintain higher market prices than all other edible insects and can also be found on occasion at local bars. Unlike other parts of Zambia where insect harvest and sales are important components of household income and hence livelihoods (Mbata et al. 2002), no one in Kazoka sells insects on a regular basis or relied on them for household income. Interestingly, however, residents perceived caterpillars, especially two species not found in Kazoka, as being a very important food source. Almost universally, caterpillars were cited as the most economically valuable insect, and prices for standard volumes of dried caterpillars were well known. Caterpillars are a staple of the diet for many Bemba speaking people (Malaisse 1997), and caterpillar dishes are nearly synonymous with Zambian cuisine. Yet, the frequency with which Kazoka residents consume caterpillars is dictated in part by the availability of funds to purchase them. One caterpillar species is found within Kazoka and consumed by many residents, but its economic and social value is much lower, possibly due to lack of a market outside the area (Fig. 2). Perhaps due to their economic value, in addition to their pleasing flavor, some grasshoppers are also immensely popular in Kazoka. *Nsabandwa* (green cone-headed grasshoppers) in particular is beloved, and it can be sold in urban markets, but the insects flourish mostly near rivers and in wetter areas. Nearby villages adjacent to the river prosper in years when these insects are abundant, but no one in Kazoka is a regular merchant.

According to Durkheim, the power of society originates from its moral authority, not coercive power. We are, therefore, persistently pushed to surrender to rules of thought and behavior that we did not devise nor desire (Durkheim 2008). Some respondents clearly favored insects more associated with lower class behaviors for reasons of flavor or availability. But the belief that insects more associated with urban areas (and upper class) were the most important was ubiquitous. Edible insects are organized by way of esteemed

progress or success. Kazoka residents were happy, outspoken consumers of *inswa* and *vinkhubala*, insects that are also frequently consumed by richer city dwellers. But more wealthy, urban Zambians were unlikely to consume insects more associated with rural poverty. Even a member of the research team admitted to eating some insects during youth and while living in rural areas, but as a professional living in Lusaka, he abandoned those behaviors. Other members of the research team consumed caterpillars and termites, but were reticent to eat grasshoppers, cicadas, and ants.

Perceptions of edible insects in Kazoka seem to mirror hierarchies across people in society, where the rich, wealthy, and urban are at the top, synonymous with lifestyles (and insects) that require less physical labor. Wealthier people can easily purchase food, do not experience hunger, and are perceived to live a life of luxury and autonomy. Insects on the bottom of the pyramid, however, are associated with lower class and synonymous with increased labor, rural areas, lack of autonomy (an inability to buy what one wants), and also children.

As can be seen in Fig. 2, insects with the greatest social desirability are not defined by their tribal significance. Nor are insects grouped as a uniform, homogenous food type. Instead, subtleties in perception cut across insect types and are associated with social values. This ranking system suggests that future minilivestock farming must involve careful attention to cultivation methods and species type. While it is unclear exactly how household insect cultivation might be perceived, the stratification of insects suggests that species type, labor required, and potential markets will impact adoption.

Entomophagy and gender

Entomophagy motivations in Kazoka also vary by gender. Cultural factors certainly determine whether or not particular insects are regarded as edible, but on a personal level consumption is complicated by one's sense of identity. Kazoka residents expressed strong associations between their identities—as women or men of a certain age—and their interest in and motivation to consume or collect insects. Other facets of identity, such as religious affiliation and tribe, were also important, but emerged as significantly less tightly entwined with insect consumption behavior than anticipated.

Mr. Fanwell, a devoutly religious man, disavowed the following claims—assuring the research team that there is no link between insect consumption and gender or sexuality. But other informants suggest that similar to attitudes about other foods, such as *nshaba* (groundnuts), specific properties in certain insects can boost a man's sexual performance. For some, insect consumption is therefore linked with masculinity and virility. Mostly, these tales were brought forth by younger men. One man (age 24) noted that *chipumi* (green caterpillars) are "just supposed to be for men because there is some energy that we gain from them… like when they are about to sleep with a woman." During a FGD with only men, two slightly younger participants (ages 27 and 46) asserted that if eaten raw, *mantingeni* (flying ants) "give energy" for "nighttime activities" to men.

Consensus on the issue was nearly split by age. Many younger men asserted that these properties are important or expressed non-verbal agreement with the claims, as the research team witnessed during the FGD. (Most older men were indifferent to these comments, but some showed outright disagreement.) One reason for the association between insects and improved sexual performance appeared to be salt content. For example, another male respondent stated that "Salt is very important to a man. Even groundnuts have lots of salt. No wonder we are encouraged to eat groundnuts. Anything with salt makes men active in bed. All of them [insects] have salt." These same respondents also noted increased thirst and a sense of health or vitality associated with eating certain insects. For example, one young man stated that when eating caterpillars, "I feel good … and I usually have appetite for water. I can even finish 2.5 liters of water, I feel healthy."

Young men also reported snacking on insects while drinking beer at local shebeens or even bars in town. "If you drink and eat *inswa* at the same time, you get drunk less," one man reflected, suggesting that an alcohol moderating effect is a perceived benefit. Traditionally, alcohol consumption is acceptable for men only, as married women are expected to remain home if or when their spouses go out to drink (Taylor 2006). We suspect that the lead researcher's gender and age may have influenced the willingness of men to discuss the association between insect consumption and male potency. Younger men were less timid to share about this issue. The age differential may also signify shifting perceptions within the community.

Not a single woman in Kazoka mentioned the potential for any edible insect to influence sexuality, even when probed. Social taboos around sex, especially discussing it with an outsider, could have influenced these results or they could stem from simple lack of knowledge as to the male beliefs. Women remarked on and spoke at length about the nutritional quality of insects more often than men, vocalizing their value as a source of nutrition, especially during pregnancy and for child growth. One woman stressed that "pregnant women crave for *vinkhubala* (caterpillars) and it is important for them to eat them so they can prevent weakness in their bodies and also, the insects make the fetus in the womb to become strong and to grow properly."

For women, a familiar refrain is that good mothers eat healthy food when pregnant, so entomophagy is worthwhile. One woman insisted, "When I was pregnant for my baby … whenever I'm in Soweto market, I would make sure that I get

caterpillars, even when I had little money, I would buy just a little." Direct nutritional benefits of other specific insects were rarely mentioned, but when probed, many women agreed that all insects consumed in Kazoka provide nutrition or energy. An older respondent who was formerly a traditional birth attendant recognized the high fat value of *mantingeni* (flying ants) and cited this as a reason to not eat these insects "very often." Women also reported craving for insects, especially caterpillars and grasshoppers. Men who did mention the nutritional assets tended to focus generically on "body building" potential and their universal "goodness" for health. Collectively, however, only about half of all interview participants could comment on why insects are healthy to eat, though all respondents agreed that they are; the only time it is bad to eat insects is if one is allergic. (Villagers did report a few known cases of mild allergic reactions.) Enhancing community knowledge of nutritional gains from insects through education for both men and women may incentivize some to farm insects, as they will better understand the health benefits of doing so.

When asked to categorize the various types of *ndiyo* (relish), men and women reported dissimilar classifications. Unanimously, men grouped types of relish into three distinct sets: (1) those that are found in the bush, (2) those that are kept/reared, and (3) those that are farmed (vegetables). All edible insects were listed in category 1, and the men insisted that all three categories are important for their diets, but that vegetables are the most important and common relish. When asked about the impact of losing access to edible insects (e.g., if they disappeared completely), men noted that it would hurt, but they would also be able to easily select relish from other categories. One man stated that, "we can suffer, but if that which is found in the bush is no longer available, people will change to those found in the garden because that is what we do even now and does not completely finish."

Women, on the other hand, categorized relish based on dish preparation and how certain food items fit in with other food items in a meal. Women identified between five and eight categories of relish, but still isolated insects from other foods. When asked about this, the reason given was cooking time (insects may cook faster or slower than other foods, so they are typically an addition to a meal, not the main component). Women stressed that a loss of insects would mean an unfortunate lack of available relish more often than men, in part because women are responsible for selecting and preparing relish on a daily basis (see below). Women also frequently used the word *mavuto* (suffering/problems/challenges) to describe how the vanishing of insects would impact their lives. Note that we recognize dynamics of power at play in this research. Despite efforts to explain the research objective, it is possible that the lead researcher, a foreign white woman, was thought to be in a position to help alleviate or address problems faced in the village; this could have led to exaggerations in claims of insect importance. Similarly, women are typically responsible for securing relish, so the loss of this food source might weigh more heavily on them than on men.

In general, labor responsibilities differ between men and women in Kazoka. While men are primarily responsible for planting, ploughing with cattle, digging pit latrines, caring for animals, clearing trees, and maintaining the integrity of thatched roofs, many of these tasks are required sporadically. Some men also seek employment outside the village. Women have daily, time consuming tasks including cooking, cleaning, fetching water and firewood, harvesting relish, caring for children, and at certain times of year planting seed and weeding. One man admitted that, "Weeding is for everyone at home, but then again women are the ones that do the weeding." A woman disclosed that in times of hardship, "It gets so bad sometimes that you go to your friend and do some piece work, so you can have some maize for *nshima*. Some men feel embarrassed to go and do the work, so you as a woman, you do everything." During a women's FGD, someone also noted that "Nowadays things have changed, the women are the ones that act as providers instead of the men," suggesting that the women in Kazoka may feel as though their workload has increased in recent years.

Encouraging residents to collect and consume more insects may put an undue burden on daily labor requirements, particularly for women in food insecure households. Thus, such recommendations should be carefully deliberated, and programs should be vetted by local women before implementation. Farming insects may be more readily embraced by men and women as opposed to increased wild-harvesting given that the current harvesting structure relies predominately (but not exclusively) on children and women (see more details below).

Entomophagy and age

Other than *inswa*, which are generally harvested by families, most edible insects are collected by individuals. While men and women both reported collecting insects, it is children who spend the most time and energy gathering them in Kazoka. We observed young girls catching *mantingeni* (flying ants) from holes near termite mounds and small children chasing locusts. Local boys roll large drums across grass to catch *ntete* (grasshoppers), and participant after participant reaffirmed that children *tenga* (get/take) more insects. One man explained that, "Children is the most [that collect insects], because they are very interested. They like to run. They just keep it like they are playing. Like it is a game." Another woman admitted that "… the children are more energetic than us [adults]," suggesting that insect collection can take significant time and energy—resources

children have in abundant supply. Nearly all male respondents affirmed that they participate in insect harvest/collection, themselves, but observations suggest that women, who are traditionally responsible for cooking household meals, collect more insects than men; women are typically liable for finding, procuring, or harvesting relish for daily meals. One young woman said clearly, "Here, women are the ones that look for relish." Several edible insects are reportedly found most abundantly "in the bush," so men and young boys come across them while looking after cattle. Collection patterns may vary by insect species, but on the whole, women carry more burden when it comes to harvest and preparation as they are responsible for cooking for the family. (In one rare instance, a man shared that he liked eating insects more than his spouse did, and therefore he regularly participated in the collection and cooking of those insects, motivated by his personal preference.)

Engaging children, as well as women (but not at the exclusion of men) may be particularly helpful in generating successful minilivestock farming systems. If insect farming is 'fun' children might be more prone to participate. Women, on the other hand, may be motivated to farm insects if labor requirements are low and they provide an accessible and tasty relish.

Discussion and conclusions

Edible insects in society

Where consumed, edible insects provide nutrients and also occupy a traditional space in food culture. But the values people hold for edible insects are even more expansive; insects perform an intellectual and speculative function, serving as elements of a structure of thinking that reinforces social values. Individual views on the edible insects all together are quite consistent across Kazoka. As Fanwell proclaims, "they are good food!" Everyone agrees. But there is also recognition of differences in the value of these insects. Some are sold in markets, others collected in bulk. Some are difficult to catch and less nutritious. Fanwell goes on to say, "in Zambia, here, they [insects] make us." Both thinking about and reflecting on social life are worthwhile activities; they explain what humans do, why, and why it matters. The act of thinking about and categorizing insects in Kazoka, no matter how intentional, will undoubtedly inform future adoption or rejection of minilivestock.

We selected Kazoka village as the case site for this study in part because of its diversity and location. Kazoka is close to the city, but rural. The population is diverse with numerous tribes living together, and we anticipated differences in perceptions of entomophagy evident across tribal lines. Our findings run contrary, however, as social perception instead varied along other social lines: class, location, gender, and age. Edible insects function as a means of social understanding, whereby villagers comprehend differences across society in the way they observe differences between insects. Notably, we observe that this 'mapping' by class, location, gender, and age is a stronger predictor of entomophagy perceptions than kinship alone. The insects consumed in Kazoka are tethered to beliefs about the roles of individuals and groups within Zambian society, the stratification of labor, and the overarching aim or goal of poor rural peoples of economic independence.

Like all animals, insects maintain organized relationships and operate within frameworks useful for our associative and conceptual thinking. Insects differ from each other by species, phenotype, behavior, and lifecycle. As such, they resemble humans in that they are arranged across various relationships. Lévi-Strauss recapitulates that "the animal world is thus thought of in terms of the social world" (Levi-Strauss 1963)—and while he was speaking specifically of the resemblances between animals and human ancestors, we notice that variation among edible insects provides associative potential. Not all insects are viewed equally; insect value can be plotted against societal differences.

What resulted from this study was an unexpected finding. Edible insects are understood socially, and are not, as a whole, valued equally in Kazoka. Insect desirability rests in social beliefs about the values of the specific insects—and this rubric mimics socioeconomic differences across Zambian society. These findings have important implications for food security, food sovereignty, and the potential value of minilivestock farming moving forward.

Implications for food security and food sovereignty

Tackling food insecurity in Kazoka and elsewhere requires innovative and culturally appropriate tactics. "The rains come late," Mr. Fanwell observes, and local harvests are often poor, leaving people hungry. As another resident put it, "The problems are many. Sometimes we fail to find money for relish, cooking oil is also expensive. Sometimes when you have *nshima* in the afternoon, you sleep on an empty stomach because there is no relish." The problems are severe. Chronic undernutrition plagues about 45% of the Zambian population (WFP 2015) and contributes to 52% of deaths in children under five (CSO et al. 2009; WHO 2014). Identifying cheap sources of high-quality, sustainable protein is essential to combat malnutrition and address pressures on agriculture including population growth (UNDESA 2015), mounting food demand (Tilman et al. 2011), and climate change (Lobell and Field 2007).

Edible insects have gained fervent support by the United Nations (UN) as a cheap, high quality protein source (van Huis et al. 2013) that could help resolve modern nutritional

challenges without further stressing natural resources. They require considerably less land, water, and feed to survive and thrive (van Huis et al. 2013), thanks to their high feed-conversion ratio (Collavo et al. 2005), large edible body percentage (Nakagaki and DeFoliart 1991), and ectothermic thermoregulation. Insects also emit fewer greenhouse gases by a factor of about 100 (Oonincx et al. 2010). In some regions, insects are accessible and affordable (Illgner and Nel 2000)—even offering consumers cheaper protein than conventional sources (Raksakantong et al. 2010; Klunder et al. 2012; van Huis et al. 2013). Insect agriculture could further improve access year-round.

Edible insects are not as essential to the lives of Kazoka residents as they are to other groups who depend on them for income or annual food. And yet, they do matter. Fanwell recognizes their nutritional value. He enjoys the taste and wants his children to eat them too. From this research, it is clear that Kazoka residents perceive insects as more than just food. The subtle differences in how insects are valued demonstrates that they are not lumped together into one group. Instead, they reflect the modern Zambian society and resemble everyday social values. These social reflections connect entomophagists to one another, through a line of kinship that is broader than tribal lineage. "We like insects here," Fanwell asserts, and the collective identity of the village is solidified. No one in Kazoka is judged, stigmatized, or ostracized for partaking of insect foods. Entomophagy is not so much a product of tribe here as it is a collection of beliefs related to class, location, gender, and age.

Put simply, this research shows that edible insects are understood socially, but not strictly across kinship lines; among the Bantu Botatwe in Kazoka, entomophagy reflects beliefs about society and differentiation among groups of people. The importance of social differentiation is reflected in how insects are categorized. As such, edible insects cannot be grouped uniformly. Efforts to promote consumption must consider aspects related to class, urbanism, gender, and age. Our findings suggest that tribe *alone* is not necessarily a good predictor entomophagy broadly. Social factors influencing diet are complicated, and the sharing of tribal knowledge suggests there is mixing or confluence of historical traditions. Some Kazoka residents eat certain cicadas (*nyenze*), so one man explained, "here what happens is, as Sala's here in Kazoka, we eat that which we are talking about: *nsabandwa* (green cone-headed grasshopper). That other one, *nyenze* (cicadas), we do not eat it as much here, but the Solis from Chongwe are the ones that eat it. It is from them that we knew it is edible, so some people eat." But despite adoption of cicadas as a permissible food, they were ultimately ranked at a lower socially desirable level than other insects because of their high labor requirements, low yields, unsubstantial body mass, and association with children, limited autonomy, and rural livelihoods.

The way forward for entomophagy in Kazoka must consider social perceptions of insects. Ethnic mixing and tribal integration could help make room for adoption even by new groups, outside of traditional tribal customs. The selection of appropriate insect species will be paramount. Future efforts must be carefully crafted to fit in with existing social perceptions of edible insects such that they give local people control over insects as food and promote food sovereignty. This is not to say entomophagy efforts cannot be disruptive in nature, rather that attracting early adopters of new entomophagy behaviors and cultivation methods can be smoother if programs are molded around existing food culture.

Another important consideration for entomophagy will be the consistent enforcement of policies to protect ecosystems, to promote sustainable insect harvest (Syampungani et al. 2009), and/or to guide sustainable production methods. Deforestation, forest fires, overgrazing, and illegal collection all contribute to ecosystem damage and declines in caterpillar populations (Munthali and Mughogho 1992). Conservation by-laws will need to be reinforced by traditional leaders, and historical examples of traditional oversight exist in Zambian communities where bush burning, as well as opening and closing dates for collection, are controlled (Holden 1991; Chidumayo and Mbata 2002). Regulation enforcement is necessary and precarious, given the strong financial incentives to harvest insects and shifting oversight. Insect agriculture could be utilized to minimize destruction from unregulated and unsustainable insect harvest. We suggest that Kazoka residents be involved in decision and policy making surrounding edible insects to ensure policy compliance.

Given our findings in Kazoka, we postulate that minilivestock has the potential to help alleviate food insecurity while promoting food sovereignty only if successfully integrated with social acceptability in mind. To promote suitable minilivestock farming methods, we suggest the following considerations: start farming with insect species (or their close relatives) that are already consumed; consider gender and include nutrition education/sensitization along with promotion efforts; design minilivestock farming technologies that consider labor and output. Labor required to farm minilivestock should be carefully moderated so as to not add undue burden on women, in particular, who often carry a heavy load of daily tasks in rural areas. Additionally, engaging children with skills training around insect cultivation may be beneficial. Farming insects as a new income generating activity has the potential to displace underlying associations between insects and poverty simply by demonstrating economic benefits. This will require a feasible future market or a surefire existing market—just as mopane caterpillars enjoy today—capitalizing on the multiple uses for insects (e.g., human food, poultry

and fish feed, other value-added products, and fertilizer or frass). Building off two seminal research studies that explored the nutritional quality and production potential of edible insects in Zambia (Ghaly 2009; Siulapwa et al. 2014), additional research is needed to investigate the exact mechanisms by which insect agriculture can be successful in the Zambian context. This work should include species selection, technology development, and yields (including nutritional output) of year-round production. Pilot initiatives that monitor social acceptability and feasibility of minilivestock production will be useful in determining utility for Kazoka, while also providing insight into efforts to modify and replicate programs elsewhere.

Potential avenues for minilivestock cultivation may include cooperative production efforts, household or individual farming, as well as school projects. Minilivestock initiatives, like all development efforts, should be implemented with caution and include full participation and collaboration with target communities. As this research shows, social perceptions of entomophagy may be complicated and will require evaluation in each context. Careful attention should also be paid to the potential for minilivestock cultivation to amplify existing social injustices. Current minilivestock projects, such as cricket farming via the 'Flying Foods Project' in Kenya and Uganda (Flying Food Project 2017), and palm weevil cultivation by Aspire Food Group in Ghana (Aspire 2017), are good examples of successful small-scale minilivestock farming. In tandem with our findings, lessons learned from these organizations may be applicable to Zambia or other regions of sub-Saharan Africa in the future.

On the last day of our work in Kazoka, Mr. Fanwell takes the lead researcher to a large field on the edge of his land. The maize has turned brown, an indication that the dry season has arrived. This is "my life," Mr. Fanwell says, pointing to the fuzzy boundaries of the field. He reaches down and snatches a bright yellow grasshopper off the ground before it flies away. "If these insects could be more available," he murmurs, "we would like it … too much."

Acknowledgements The authors extend special thanks to the Kazoka community for their willingness to participate in this study. We are grateful to Dr. Claire Wendland for her support and useful observations on earlier drafts of this paper. We also appreciate the very helpful comments from the two reviewers. The paper is much stronger thanks to your input. This work was supported by Fulbright US Student Award.

References

Ahmed, C. 1996. Before Eve was Eve: 2200 years of gendered history in East-Central Africa PhD Dissertation, Department of History. Los Angeles, CA: University of California.

Aspire. 2017. About us. http://www.aspirefg.com/about-us.aspx. Accessed 28 Jun 2017.

Barrios, E. X., and E. Costell. 2004. Review: Use of methods of research into consumers' opinions and attitudes in food research. *Food Science and Technology International* 10 (6): 359–371.

Beiser, V. 2014. Are bugs the secret weapon to fighting world hunger? Takepart archive. http://www.takepart.com/article/2014/07/09/getting-poor-people-eat-bugs-might-actually-be-good-idea. Accessed 29 March 2017.

Bignante, E. 2010. The use of photo-elicitation in field research. *EchoGéo* (11).

Bodenheimer, F. S. 1951. *Insects as human food: A chapter of the ecology of man*. The Huage: W. Junk.

Braun, V., and V. Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3 (2): 77–101.

Cannon, G. 2002. Nutrition: The new world disorder. *Asia Pacific Journal of Clinical Nutrition* 11: S498–S509.

Caparros Megido, R., L. Sablon, M. Geuens, Y. Brostaux, T. Alabi, C. Blecker, D. Drugmand, É. Haubruge, and F. Francis. 2014. Edible insects acceptance by Belgian consumers: Promising attitude for entomophagy development. *Journal of Sensory Studies* 29 (1): 14–20.

Charmaz, K., and R. G. Mitchell. 2007. Grounded theory in ethnography. In *Handbook of ethnography*, eds. P. Atkinson, S. Delamont, A. Coffey, J. Lofland, and L. Lofland, 160–174. London: Sage.

Chidumayo, E. N., and K. J. Mbata. 2002. Shifting cultivation, edible caterpillars and livelihoods in the Kopa area of northern Zambia. *Forests, Trees and Livelihoods* 12 (3): 175–193.

Christensen, D. L., F. O. Orech, M. N. Mungai, T. Larsen, H. Friis, and J. Aagaard-Hansen. 2006. Entomophagy among the Luo of Kenya: A potential mineral source? *International Journal of Food Sciences & Nutrition* 57 (3/4): 198–203.

CIA. 2010. Zambia. In *The world factbook 2010 edition*. Washington, DC: Potomac Books.

Cole, S. M., and P. N. Hoon. 2013. Piecework (Ganyu) as an indicator of household vulnerability in rural Zambia. *Ecology of Food and Nutrition* 52 (5): 407–426.

Collavo, A., R. H. Glew, Y. S. Huang, L. T. Chuang, R. Bosse, and M. G. Paoletti. 2005. House cricket small-scale farming. In *Ecological implications of minilivestock: Potential of insects, rodents, frogs and snails*, ed. M. G. Paoletti, 519–544. Enfield: CRC Press.

Collier, J. J. 1957. Photography in anthropology: A report on two experiments. *American Anthropologist* 59 (5): 843–859.

Colson, E. 1996. The Bantu Botatwe: Changing political definitions in southern Zambia. In *The politics of cultural performance*, eds. D. J. Parkin, L. Caplan, and H. J. Fisher, 61–80. Providence: Berghahn Books.

CSO, Ministry of Health (MOH) [Zambia], Tropical Diseases Research Center (TDRC), University of Zambia, and Macro International Inc. 2009. *Zambia demographic and health survey 2007*. Calverton: CSO and Macro International Inc.

Culley, L., N. Hudson, and F. Rapport. 2007. Using focus groups with minority ethnic communities: Researching infertility in British South Asian communities. *Qualitative Health Research* 17 (1): 102–112.

de Luna, K. M. 2008. Collecting food, cultivating persons: Wild resource use in Central African Political Culture, c. 1000 B.C.E. to c. 1900 C.E. PhD dissertation, Department of History. Chicago: Northwestern University.

DeFoliart, G. R. 1992. Insects as human food: Gene DeFoliart discusses some nutritional and economic aspects. *Crop Protection* 11 (5): 395–399.

Defoliart, G. R. 1995. Edible insects as minilivestock. *Biodiversity & Conservation* 4 (3): 306–321.

DeFoliart, G. R. 1999. Insects as food: Why the western attitude is important. *Annual Review of Entomology* 44 (1): 21.

Denscombe, M. 2010. *The good research guide: For small-scale social research projects*. Maidenhead: McGraw-Hill/Open University Press.

Devereux, S. 1999. Making less last longer: Informal safety nets in Malawi. Institute of Development Studies discussion paper no. 373.

Durkheim, E. 2008. *The elementary forms of religious life*. English edition: Cladis, M. S. (trans: Cosman, C.). Oxford: Oxford University Press.

Esposito, N. 2001. From meaning to meaning: The influence of translation techniques on non-English focus group research. *Qualitative Health Research* 11 (4): 568–579.

Evans, J., M. H. Alemu, R. Flore, M. B. Frøst, A. Halloran, A. B. Jensen, G. Maciel-Vergara, V. B. Meyer-Rochow, C. Münke-Svendsen, S. B. Olsen, C. Payne, N. Roos, P. Rozin, H. S. B. Tan, A. van Huis, P. Vantomme, and J. Eilenberg. 2015. 'Entomophagy': An evolving terminology in need of review. *Journal of Insects as Food and Feed* 1 (4): 293–305.

FAO. 2004. Globalization of food systems in developing countries: Impact on food security and nutrition. FAO food and nutrition paper no. 83. Rome: Food and Agriculture Organization of the United Nations.

Figueirêdo, R. E. C. R., A. Vasconcellos, I. S. Policarpo, and R. R. N. Alves. 2015. Edible and medicinal termites: A global overview. *Journal of Ethnobiology and Ethnomedicine* 11 (29).

Flying Food Project. 2017. Flying food project. http://www.flyingfoodproject.com/. Accessed 1 Jan 2017.

Ghaly, A. E. 2009. The use of insects as human food in Zambia. *OnLine Journal of Biological Sciences* 9 (4): 93–104.

Ghazoul, J. 2006. Mopane woodlands and the mopane worm: Enhancing rural livelihoods and resource sustainability. Final technical report (no. R 7822), DFID.

Glew, R. H., D. Jackson, L. Sena, D. J. VanderJagt, A. Pastuszyn, and M. Millson. 1999. *Gonimbrasia belina* (Lepidoptera: Saturniidae): A nutritional food source rich in protein, fatty acids, and minerals. *American Entomologist* 45 (4): 250–253.

Google Earth. 2014. December 6 Kazoka village. 15°28′20″S 27°54′03″E. https://earth.google.com/web. Accessed 18 Apr 2016.

Harper, D. 2002. Talking about pictures: A case for photo elicitation. *Visual Studies* 17 (1): 13–26.

Headings, M. E., and S. Rahnema. 2002. The nutritional value of mopane worms, *Gonimbrasia belina* (Lepidoptera: Saturniidae) for human consumption. In *Presentation at the ten-minute papers: Section B*. Ohio: Ohio State University.

Holden, S. 1991. Edible caterpillars—A potential agroforestry resource? *Food Insect Newsletter* 4 (2).

Illgner, P., and E. Nel. 2000. The geography of edible insects in sub-Saharan Africa: A study of the mopane caterpillar. *Geographical Journal* 166 (4): 336–351.

Jacob, A. A., A. F. Emenike, A. Kayode, O. Olusegun, A. Uzoma, and K. Q. Rukayat. 2013. Entomophagy: A panacea for protein-deficient-malnutrition and food insecurity in Nigeria. *Journal of Agricultural Science* 5 (6): 25.

Johns, T., and B. R. Sthapit. 2004. Biocultural diversity in the sustainability of developing-country food systems. *Food and Nutrition Bulletin* 25 (2): 143–155.

Jongema, Y. 2014. List of edible insects of the world (April 1, 2014). Worldwide species list. http://www.wageningenur.nl/en/Expertise-Services/Chair-groups/Plant-Sciences/Laboratory-of-Entomology/Edible-insects/Worldwide-species-list.htm. Accessed 13 Dec 2016.

Kerr, R. B. 2005. Informal labor and social relations in northern Malawi: The theoretical challenges and implications of ganyu labor for food security. *Rural Sociology* 70 (2): 167–187.

Kitzinger, J. 1995. Qualitative research. Introducing focus groups. *BMJ* 311 (7000): 299–302.

Klunder, H. C., J. Wolkers-Rooijackers, J. M. Korpela, and M. J. R. Nout. 2012. Microbiological aspects of processing and storage of edible insects. *Food Control* 26 (2): 628–631.

Kwiri, R., C. Winini, P. Muredzi, J. Tongonya, W. Gwala, F. Mujuru, and S. Gwala. 2014. Mopane worm (*Gonimbrasia belina*) utilisation, a potential source of protein in fortified blended foods in Zimbabwe: A review. *Global Journal of Science Frontier Research: D Agriculture and Veterinary*, 14(10).

Larmer, M. 2016. *Rethinking African politics: A history of opposition in Zambia*. Burlington: Ashgate Publishing Company.

Levi-Strauss, C. 1963. *Totemism*. (English edition: trans: Needham, R.). Boston: Beacon Press.

Lobell, D. B., and C. B. Field. 2007. Global scale climate–crop yield relationships and the impacts of recent warming. *Environmental Research Letters* 2 (1):014002.

Looy, H., and J. R. Wood. 2015. Imagination, hospitality, and affection: The unique legacy of food insects? *Animal Frontiers* 5 (2): 8–13.

Looy, H., F. V. Dunkel, and J. R. Wood. 2014. How then shall we eat? Insect-eating attitudes and sustainable foodways. *Agriculture and Human Values* 31 (1): 131–141.

Macola, G. 2011. Harry Mwaanga Nkumbula and the formation of ZANC/UNIP: A reinterpretation. In *Living the end of empire: Politics and society in late colonial Zambia*, eds. J.-B. Gewald, M. Hinfelaar, and G. Macola, 27–66. Boston: BRILL.

Madibela, O. R., K. K. Mokwena, S. J. Nsoso, and T. F. Thema. 2008. Chemical composition of Mopane worm sampled at three sites in Botswana and subjected to different processing. *Tropical Animal Health and Production* 41 (6): 935–942.

Makhado, R., M. Potgieter, J. Timberlake, and D. Gumbo. 2014. A review of the significance of mopane products to rural people's livelihoods in southern Africa. *Transactions of the Royal Society of South Africa* 69 (2): 117–122.

Malaisse, F. 1997. *Se nourir en foret claire Africaine: Approche ecologique et nutritionnelle*. Gembloux: Les Presses Agronomiques de Gembloux.

Marshall, C., and G. B. Rossman. 2010. *Designing qualitative research*. 5th ed. Los Angeles: Sage.

Mbata, K. J., E. N. Chidumayo, and C. M. Lwatula. 2002. Traditional regulation of edible caterpillar exploitation in the Kopa area of Mpika district in northern Zambia. *Journal of Insect Conservation* 6 (2): 115–130.

McCann, J. C. 2009. *Stirring the pot: A history of African cuisine*. Athens: Ohio University Press.

Mubanga, K. H., B. B. Umar, J. Muchabi, and C. Mubanga. 2015. What drives smallholder farmers' crop production choices in central Zambia? Lessons from the 2012/2013 agricultural season. *Journal of Agricultural Studies* 3 (2): 1–16.

Munthali, S. M., and D. E. C. Mughogho. 1992. Economic incentives for conservation: Beekeeping and Saturniidae caterpillar utilization by rural communities. *Biodiversity & Conservation* 1 (3): 143–154.

Nakagaki, B. J., and G. R. DeFoliart. 1991. Comparison of diets for mass-rearing *Acheta domesticus* (Orthoptera: Gryllidae) as a novelty food, and comparison of food conversion efficiency with values reported for livestock. *Journal of Economic Entomology* 84 (3): 891–896.

Onigbinde, A. O., and B. Adamolekun. 1998. The nutrient value of Imbrasia belina Lepidoptera: Saturnidae (madora). *The Central African Journal of Medicine* 44 (5): 125–127.

Oonincx, D. G., J. van Itterbeeck, M. J. Heetkamp, H. van den Brand, J. J. van Loon, and A. van Huis. 2010. An exploration on greenhouse gas and ammonia production by insect species suitable for animal or human consumption. *PLoS ONE* 5(12).

Orne, J., and M. Bell. 2015. *An invitation to qualitative fieldwork: A multilogical approach*. New York: Routledge.
Owen, D. F. 1973. *Man's environmental predicament: An introduction to human ecology in tropical Africa*. London: Oxford University Press.
Raksakantong, P., N. Meeso, J. Kubola, and S. Siriamornpun. 2010. Fatty acids and proximate composition of eight Thai edible tericolous insects. *Food Research International* 43 (1): 350–355.
Rebe, M. 1999. The sustainable use of mopane worms as a harvestable protein source for human consumption: Local perceptions. Master's thesis. Department of Agriculture. Pretoria: University of Pretoria.
Rumpold, B. A., and O. K. Schlüter. 2013a. Nutritional composition and safety aspects of edible insects. *Molecular Nutrition & Food Research* 57 (5): 802–823.
Rumpold, B. A., and O. K. Schlüter. 2013b. Potential and challenges of insects as an innovative source for food and feed production. *Innovative Food Science & Emerging Technologies* 17: 1–11.
Saasa, O. S. 2003. Agricultural intensification in Zambia: The role of policies and policy processes (Marcro Study). The Department of Human Geography, Lund University. http://www.keg.lu.se/en/sites/keg.lu.se.en/files/a9.pdf. Accessed 10 Mar 2016.
Schabel, H. G. 2010. *Forest insects as food: A global review*, 37–64. Rome: RAP Publication 2010/02, Food and Agriculture Organization of the United Nations.
Shoup, J. A. 2011. *Ethnic groups of Africa and the Middle East: An encyclopedia*. Santa Barbara: ABC-CLIO.
Silow, C. A. 1976. *Edible and other insects of mid-western Zambia: Studies in ethno-entomology II*. Uppsala: Almqvist & Wiksell.
Siulapwa, N., A. Mwambungu, E. Lungu, and W. Sichilima. 2014. Nutritional value of four common edible insects in Zambia. *International Journal of Science and Research* 3 (6): 876–884.
Stack, J., A. Dorward, T. Gondo, P. Frost, F. Taylor, and N. Kurebgaseka. 2003. Mopane worm utilisation and rural livelihoods in Southern Africa. *Presented at the international conference on rural livelihoods, forests and biodiversity*. Bonn, Germany.
Syampungani, S., P. W. Chirwa, F. K. Akinnifesi, G. Sileshi, and O. C. Ajayi. 2009. The miombo woodlands at the cross roads: Potential threats, sustainable livelihoods, policy gaps and challenges. *Natural Resources Forum* 33 (2): 150–159.
Taylor, S. D. 2006. *Culture and customs of Zambia*. Westport: Greenwood Press.
Thorne, S. 2000. Data analysis in qualitative research. *Evidence Based Nursing* 3: 68–70.
Threlfall, K. D. 1999. Using focus groups as a consumer research tool. *Journal of Marketing Practice* 5 (4): 102–105.
Tilman, D., C. Balzer, J. Hill, and B. L. Befort. 2011. Global food demand and the sustainable intensification of agriculture. *Proceedings of the National Academy of Sciences of the United States of America* 108 (50): 20260–20264.
Torrend, J. 1931. *An English-vernacular dictionary of the Bantu-Botatwe dialects of Northern Rhodesia*. Natal: Gregg.
UNDESA. 2015. World population projected to reach 9.7 billion by 2050. https://www.un.org/development/desa/en/news/population/2015-report.html. Accessed 8 Feb 2016.
van Huis, A. 2013. Potential of insects as food and feed in assuring food security. *Annual Review of Entomology* 58 (1): 563–583.
van Huis, A. 2015. Edible insects contributing to food security? *Agriculture & Food Security* 4: 20.
van Huis, A., J. van Itterbeeck, H. Klunder, E. Mertens, A. Halloran, G. Muir, and P. Vantomme. 2013. Edible insects: Future prospects for food and feed security (FAO forestry paper no. 171). Food and Agriculture Organization of the United Nations http://www.fao.org/docrep/018/i3253e/i3253e00.htm. Accessed 1 June 2014.
Verkerk, M. C., J. Tramper, J. C. M. van Trijp, and D. E. Martens. 2007. Insect cells for human food. *Biotechnology Advances* 25 (2): 198–202.
Waterton, C., and B. Wynne. 1998. Can focus groups access community views? In *Developing focus group research: Politics, theory and practice*, eds. R. Barbour, and J. Kitzinger, 127–143. London: Sage.
Wessels, D., M. Member, M. Potgeiter, A. Gardiner, J. Ghazoul, and J. Pearce. 2006. Mopane woodlands and the mopane worm: Enhancing rural livelihoods and resource sustainability (final technical report no. R 7822). DFID. http://r4d.dfid.gov.uk/PDF/Outputs/Forestry/R7822-FTR.pdf. Accessed 5 Dec 2015.
WFP. 2015. Zambia. United Nations World Food Programme. https://www.wfp.org/countries/zambia/overview. Accessed 16 Aug 2015.
Whiteside, M. 1999. Ganyu labour in Malawi and its implications for livelihood security interventions: An analysis of recent literature and implications for poverty alleviation. Malawi: Oxfam International Programme in Malawi. https://pdfs.semanticscholar.org/63a5/0187582b1ca5e467b14a84e8f0469e3505ae.pdf. Accessed 1 Jan 2016.
WHO. 2014. Comprehensive analytical profile: Zambia. African health observatory and United Nations World Health Organization. http://www.aho.afro.who.int/profiles_information/index.php/Zambia:Index. Accessed 8 Feb 2016.
Winslow, W. W., G. Honein, and M. A. Elzubeir. 2002. Seeking emirati women's voices: The use of focus groups with an Arab population. *Qualitative Health Research* 12 (4): 566–575.
Wood, J. R., and H. Looy. 2000. My ant is coming to dinner—Culture, disgust, and dietary challenges. *Proteus* 17 (1): 52–56.
World Bank. 2018. Zambia GNI per capita, Atlas method (current US$) [Data]. https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=ZM. Retrieved 3 May 2018.

Valerie J. Stull, PhD, MPH is a researcher at the University of Wisconsin-Madison in the Center for Sustainability and the Global Environment. Dr. Stull completed her Fulbright research in Zambia. Currently, her interdisciplinary work focuses on food security, food sovereignty, linkages between agriculture and human health, and examining edible insects as an alternative protein source requiring fewer inputs. That could promote healthy people and healthy environments.

Mukata Wamulume is a Research Affiliate at the Institute of Economic and Social Research (INESOR) which is the social science research wing of the University of Zambia. He has more than 22 years research experience working for INESOR as a Research Fellow and was the longest serving Assistant Director on record for a period of 8 years. Mr. Wamulume is an expert in both quantitative and qualitative research methods.

Mwangala I. Mwalukanga is a graduate of the Development Studies department at the University of Zambia. She has worked on numerous Zambian focused research projects and has experience in qualitative methods. Ms. Mwalukanga is interested in sustainable business models and corporate social responsibility.

Alisad Banda is a Program Manager with Lutheran Health and Development Programs in Zambia. Mr. Banda is a graduate of the University of Zambia (Ridgeway Campus) in Social Work and holds a diploma in Public Health from Chainama College of Health Science. He is currently studying at the University of Lusaka and has interests in community epidemiology and nutrition.

Rachel S. Bergmans, PhD, MPH, is a National Institute of Mental Health postdoctoral fellow at the University of Michigan Medical School, Department of Psychiatry. Dr. Bergmans' research examines

social and environmental determinants of mental health across the life course. Her current work focuses on the influence of social disadvantage and nutritional status on depression and suicide.

Michael M. Bell, PhD, is the Director of the Center for Integrated Agricultural Systems at the University of Wisconsin-Madison, USA. He is also a professor in the department of Community and Environmental Sociology, the Nelson Institute for Environmental Studies, the Religious Studies department, and the Agroecology Program. Dr. Bell's research focuses on a wide range of topics, including issues of agroecology, community, culture, development, economy, environment, gender, participation, place, and social justice.