ASSESSMENT / EVALUATION



Assessment on Availability of African Indigenous Leafy Vegetables in Malawi and Zambia

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CRS CATHOLIC RELIEF SERVICES

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Table of Contents

List of Tables

Acknowlegements

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Abbreviations

AILV	African indigenous leafy vegetables
AVRDC	World Vegetable Center
CCFLS	Community-led Complementary Feeding and Learning Sessions
CRS	Catholic Relief Services
FFP	Food for Peace
MAWA	Nyanja word meaning “tomorrow”
SARO	Southern Africa Regional Office
UBALE	United in Building and Advancing Life Expectations

1. BACKGROUND

Catholic Relief Services' (CRS) Southern Africa Regional Office (SARO) aims to transform the lives of poor, marginalized households in the region through CRS' *Pathway to Prosperity* conceptual framework (Recover, Build and Grow). With an emphasis on Agricultural Livelihoods and Health, SARO targets improved health and nutrition status during a child's first thousand days, as well as that of the pregnant and lactating mother. SARO's integrated and sequenced set of interventions assist vulnerable rural households to systematically and sustainably exit from poverty with improved health and nutrition.

Since mid-2014, SARO has been monitoring the likelihood of an El Niño event that could threaten the livelihoods and health of households in Southern Africa. Recent forecasts predict that El Niño will continue into the first quarter of 2016; suppressed rainfall is likely over many countries in the region during the coming year. This will result in decreased food production and availability and will threaten the health and nutrition of households[1]. SARO is taking steps to support households in coping with this situation, including conducting an assessment of the preference and availability of drought-resistant African indigenous leafy vegetables (AILVs) in two of SARO's country programs, Zambia and Malawi. Several AILV species have been recognized for being more drought resistant and nutritious than introduced vegetables[2]. In addition, research in other African countries have shown that indigenous vegetables are often preferred by local communities over introduced vegetables for a range of qualities such as taste, availability, and perceived health effects[3]. By identifying and promoting local indigenous vegetables, SARO will assist communities in mobilizing their local resources to help combat the threat of El Niño and help to further food security efforts in the region. SARO plans to work with the World Vegetable Center (AVRDC)[4] on distributing AILV seed kits and training on cultivation and food preparation to promote the consumption of nutrient-rich AILVs through nutrition programming such as Community-led Complementary Feeding and Learning Sessions (CCFLS). CCFLS is a CRS-owned approach that uses peer-to-peer support to improve dietary diversity and consumption of locally available nutrient-rich foods to prevent undernutrition.

The objective of this assessment in selected regions of Malawi and Zambia was to:

- assess types and availability of drought-resistant AILVs in each country;
- assess households' AILV preferences per country;
- identify, collect, and describe at least two recipes per country, utilizing the preferred AILV, suitable to complement young child, pregnant and lactating women diets during a drought;

1 Anyadike, O. (2016) Southern Africa's food crisis in numbers. *IRIN Humanitarian News and Analysis.* http://www.irinnews.org/report/102391/southern-africa-s-food-crisis-in-numbers

2 Shackleton, C. M., Pasquini, M. W., & Drescher, A. W. (Eds.). (2009). *African Indigenous Vegetables in Urban Agriculture.* Routledge.

3 Towns, A. M., Potter, D., & Idrissa, S. (2013). Cultivated, caught, and collected: Defining culturally appropriate foods in Tallé, Niger. *Development in Practice*, 23(2), 169–183.

4 The World Vegetable Center: http://avrdc.org/

- assess availability of AILV seeds in local market;
- contribute to an increase in staff knowledge about AILVs and their relevance to nutrition; and
- assess availability and commission AILV seeds from the AVRDC to supply CRS Seed Fairs in the selected countries.

Image 1: Mawa project volunteers near Chipata, Zambia. (AM Towns/CRS)

2. METHODOLOGY

2.1. PROJECT AREA DESCRIPTIONS

In Zambia, the assessment focused on identifying the AILV preferences of communities supported by the Mawa project, a five-year USAID-funded Feed the Future project (2012–2017) aiming to improve food and economic security for 21,500 households across 19 agricultural camps in Chipata and Lundazi districts in the Eastern Province (*Mawa* is a Nyanja word meaning "tomorrow."). In addition to CRS, the Mawa project brings together Caritas Chipata, Women for Change, Golden Valley Agricultural Research Trust, and University Research Company in a consortium to provide a package of services aimed at increasing and diversifying agricultural production for nutrition and markets, improving household health and nutritional status, and increasing incomes and productive assets.

In Malawi, the assessment focused on identifying AILV preferences of beneficiaries that were being supported by UBALE (United in Building and Advancing Life Expectations), a five-year USAID Food for Peace (FFP) funded project. UBALE brings together Save the Children, the Chikwawa Diocese, and CARE, aiming at increasing the food security of vulnerable households, improving the nutrition of children under two years as well as pregnant and lactating mothers, and strengthening the disaster risk management of communities. The project targets to support 248,200 households in 284 communities in the southern districts of Malawi (Blantyre, Chikwawa, and Nsanje).

3. ASSESSMENT SCHEDULE

With a team of combined CRS and Mawa/UBALE project staff, we carried out this AILV assessment for two weeks in November and December 2015 using qualitative and botanical methodologies.

The qualitative methods included market vendor interviews, focus group discussions, and key informant interviews in each country. In Zambia, we visited two agricultural camps in the Chipata District, one agricultural camp in Lundazi, and a main vegetable market in Chipata, resulting in six focus group discussions, six key informant

interviews, and three market vendor interviews (Table 1). In Malawi, we visited two villages and two markets in the Chikwawa District, resulting in four focus group discussions, two key informant interviews, and four market vendor interviews.

TABLE 1. QUALITATIVE METHODS FROM ZAMBIA AILV ASSESSMENT

FOCUS GROUP DISCUSSIONS (6)	KEY INFORMANT INTERVIEWS (6)	MARKET INTERVIEWS (3)
• 1 Chiteu camp fathers • 1 Chiteu camp mothers • 1 Kwenje camp fathers • 1 Kwenje camp mothers • 1 Chimwala camp fathers • 1 Chimwala camp mothers	• 3 health promoters (female) • 1 nutrition supervisor (male) • 1 ag supervisor (male) • 1 nutrition volunteers group (3 male, 8 female)	• 2 Chipata market (female) • 1 Kwenje market (female)

TABLE 2. QUALITATIVE METHODS FOR MALAWI AILV ASSESSMENT

FOCUS GROUP DISCUSSIONS (4)	KEY INFORMANT INTERVIEWS (2)	MARKET INTERVIEWS (4)
• 1 Dwanya village mothers • 1 Dwanya village fathers • 1 Mwananjovu village mothers • 1 Mwananjovu village fathers	• 1 community leaders of Dwanya (6 male, 1 female) • 1 Ministry of Health surveillance • assistant (male)	• 2 Nkathe market (female) • 2 Nsangwe market (female)

After the focus groups and key informant interviews in each village, we were escorted by a community leader into the gardens, fields, and surrounding areas to photograph each of the AILVs cited by the community. For those plants that were not yet in season, we gathered botanical descriptions from the informants. After the market interviews, we purchased two to three bundles of plants from each participating vendor. Referring to local flora resources (*Zambian Plants: Their Vernacular Names and Uses, Field Guide to Important Arable Weeds of Zambia, Flora of Zambia* (www.zambiaflora.com), *PROTA* (www.prota4u.info), and *Useful Plants of Malawi*), we then used the photographs and market plants to identify each cited plant to a species level.

The remaining plants were identified by the National Herbarium & Botanic Gardens of Malawi in Zomba with assistance from botanists at Kew Botanical Gardens (UK) and Naturalis Biodiversity Center (NL). After identifying the most commonly cited plants, we searched for the documented nutritional properties of each species using the 2009 *Zambia Food Composition Tables*[5], AILV data from AVRDC, and AILV data from Bioversity International[6].

5 National Food and Nutrition Commission (2009). *Zambia Food Composition Tables*. Fourth Edition.

6 Bioversity International. http://www.bioversityinternational.org

4. PROJECT MAWA FINDINGS (EASTERN PROVINCE, ZAMBIA)

4.1. COMMUNITY PERCEPTIONS OF AILVS

Image 2: The flowers of *kachilube* are combined with ground nuts and consumed as a relish in the Mawa project areas. (AM Towns/CRS)

In all communities in the Mawa project areas, participants responded very favorably to their indigenous vegetables. The most frequently cited vegetables were the leaves of wild herbs and ground climbers, which were used as relishes (a side dish) and the staple dish of *nzima*, the traditional corn porridge. The three communities unanimously agreed that everyone in the community eats AILVs, known as *ndeyo zamasamba in Ngoni* (roughly translated as "green relish vegetables"). The most frequent responses to why people liked these vegetables included: taste, availability, affordability (often free), and perceived health effects (including [1] provides the body with vitamins; [2] provides blood; [3] prevents disease; [4] gives energy; and [5] are nutritious). One of the participants in a fathers' focus group discussion stated that he "was tired of eating the traditional foods" and wanted exotic seeds to plant in his garden. The rest of the participants, key informants, and market vendors were overwhelmingly positive about the plants. The agricultural and nutrition supervisors that worked for Mawa were particularly interested in having more information to promote AILV consumption. There were no observed differences between AILV preferences between men and women in the Mawa assessment. During the plant photography exercise at the end of each day of focus groups, the community leaders pointed out several additional wild plants that were consumed but not mentioned in the focus group discussions, such as the leaves of the baobab tree (*Adansonia digitata*) and the flowers of *kachilube/chirube* (Image 2), an unidentified species of the Fabaceae family. Although not the primary focus of this assessment, respondents also mentioned the consumption of mushrooms, boowa in Ngoni, as a commonly consumed wild edible.

The key informants influential in the Mawa project regions recognized the benefits in promoting AILV consumption, but were generally unaware of past projects that had incorporated them. The only informant who was aware of a past project in Chipata suggested that it had struggled due to the general trend of a preference for "modern" vegetables. Another informant suggested that given the strong seasonality of wild AILVs, most programs did not think their promotion was necessary. Some suggested barriers to consumption included (1) (seasonal) availability; (2) lack of access to AILV seeds; (3) distance needed to travel to collect wild AILVs; and (4) lack of knowledge of preparation, particularly around the use of soda. One key informant shared, "The new generation cannot cook these vegetables because they have lost interest in them. They mostly cook *lumanda* [*Hibiscus acetosella* leaves] and *chigwada* [manioc leaves, *Manihot esculenta*]. They do not grow groundnuts on a large scale hence these vegetables are not often cultivated because most of them are cooked with groundnuts."

4.2. PREFERRED AILV SPECIES

A total of 36 distinct local plant names were cited by the participants in the Zambia assessment (Supplementary Table 1). We narrowed the list down to six species of African indigenous vegetables from the Mawa project region based on the most frequent responses from participants (Table 3). Out of all plants cited in the assessment, the herb *Hibiscus acetosella* (*lumanda* or *limanda* in Chewa and Ngoni) was the most commonly cited, closely followed by the wild climber (*Adenia gummifera*) known as *mulozi* in Ngoni. The vegetables were classified locally based on whether or not they had an okra-like (slimy) texture, known as *telele* in Ngoni. There were a variety of local plants that all fell under the telele category: *tindingoma, zumba*, and white okra, among others. These plants transect various scientific genera (*Abelmoschus, Hibiscus, Corchorus,* and *Crotalaria*), making it difficult to have direct Latin name correlations for each plant without formal botanical voucher specimens.

TABLE 3. HOUSEHOLD PREFERENCES OF AILV SPECIES IN MAWA PROJECT AREA (ZAMBIA)

LATIN NAME	ENGLISH NAME	LOCAL NAME (LANGUAGE)	GROWTH STATUS	DESCRIPTION	HIGH NUTRIENT CONTENT*
Adenia gummifera	monkey rope	*mulozi* (Ngoni)	wild	climber	unknown
***Amaranthus* spp.**	wild spinach; amaranth	*bondwe/ bonogwe* (Chewa)	both	herb	calcium, iron, ascorbic acid[7], protein, vitamin A[9]
Ceratotheca sesamoides	false sesame	*katate* (Ngoni)	wild	herb	protein, calcium[8]
Cucurbita maxima	pumpkin leaves	*chibwabwa* (Chewa/Ngoni)	cultivated	ground climber	fresh: calcium, protein, vitamin C; dried: protein, iron[9]
Hibiscus acetosella	cranberry hibiscus	*lumanda/ limanda* (Chewa/Ngoni)	both	herb	unknown (see text for related species)
Ipomoea batatas	sweet potato leaves	*kalembula/ kolowa* (Chewa/ Ngoni)	cultivated	ground climber	ascorbic acid, iron[7]

***Only those nutrients with "high" scores from sources are included in the table. See the text for full nutrient contents.**

7 Lin LJ, Hsiao YY, Kuo CG. 2009. Discovering indigenous treasures: Promising indigenous vegetables from around the world. *AVRDC – The World Vegetable Center Publication* No. 09-720. AVRDC – The World Vegetable Center, Shanhua, Taiwan. 317 p. http://203.64.245.61/e-book/ebook1.htm

8 Fasakin, K. (2004). Proximate composition of bungu (*Ceratotheca sesamoides* Endl.) leaves and seeds. Biokemistri 16(2):88–92.

ADENIA GUMMIFERA (HARV.) HARMS

The species *Adenia gummifera* is a climber that grows wild and is known by the English name "monkey rope" and the Ngoni name *mulozi* (Image 3A). It was the second most commonly cited AILV from our assessment but was not sold on the markets we visited. No nutritional information was found on the leaves, although there were several studies on its medicinal uses.

AMARANTHUS SPP. *(THUNBERGI, VIRIDUS)*

Amaranthus is the genus of very commonly consumed herbs across sub-Saharan Africa known as "wild spinach" or "amaranth" in English (Image 3B). The Chewa name *bondwe* or *bonogwe* refers to several species, including *A. thunbergi* and *A. viridusi*. Bonogwe is sold on the market place in bundles for 1–2 ZMK each, which is less than $0.17[10]. According to AVRDC, amaranth leaves contain high folic acid, calcium, iron, and ascorbic acid, medium levels of beta-carotene and riboflavin, and 2–4% protein content in the shoots[7]. The 2009 *Zambia Food Composition Tables* (ZFCT) report the following composition per 100 grams of fresh amaranth leaves (no species indicated): 54.4 food energy (ME) cal, 4.7 g protein, 0.5 g fat, 1.8 g crude fiber, 498 mg calcium, 26.7 mg iron, and 7,868 ug vitamin A.

CERATOTHECA SESAMOIDES ENDL.

The wild herb *Ceratotheca sesamoides* is called "false sesame" (English) or *katate* (Ngoni). Although not present on the Chipata vegetable market, it was sold as a bundle in a more rural market for $0.17 (Image 3C). A proximate composition study showed that the leaves had low soluble carbohydrates and fat in addition to substantial amounts of protein (29.35–29.85%) and total ash (9.38–11.13%)[8]. The ZFCT reports the following composition per 100 grams of fresh *C. sesamoides* leaves: 65 food energy (ME) cal, 5.25 g protein, 0.45 g fat, 0.63 mg calcium, 16.69 mg iron, 0.11 mg zinc, and 59.25 mg vitamin C.

CUCURBITA MAXIMA DUCHESNE

Pumpkin leaves (*Cucurbita maxima*) were one of two exclusively cultivated AILVs that were frequently cited in our assessment (Image 3D). Although the Herbarium confirmed that *C. maxima* was the most commonly consumed species of pumpkin, several other species are commonly consumed in the region including *C. pepo* and *C. moschata*. Known as *chibwabwa* in Chewa/Ngoni, they were sold by nearly every vegetable market vendor we encountered for $0.17 a bundle. Fresh pumpkin leaves are rich in calcium, protein, and vitamin C. Dried leaves are high in protein and iron and moderately high in vitamin C[9]. The ZFCT reports the following composition per 100 grams of boiled *C. pepo* leaves: 48 food energy (ME) cal, 3.23 g protein, 0.47 g fat, 0.46 mg calcium, 5.6 mg iron, 0.12 mg zinc, and 10.32 mg vitamin C.

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9 Mingochi, D. S., & Luchen, S. W. S. (1997). Traditional vegetables in Zambia: Genetic resources, cultivation and uses. *Promoting the Conservation and Use of Underutilized and Neglected Crops* (IPGRI). http://www.bioversityinternational.org/fileadmin/bioversity/publications/Web_version/500/ch20.htm

10 As of February 2, 2016, 1 Zambia Kwacha (ZMK) = $0.08

Image 3A: *mulozi* (AM Towns/CRS)

Image 3B: *bonogwe* (AM Towns/CRS)

Image 3C: *katate* (AM Towns/CRS)

Image 3D: *chibwabwa* (AM Towns/CRS)

Image 3E: *limanda* (S Nordin/ NeverEndingFood)

Image 3F: *kalembula* (A Banda/CRS)

HIBISCUS ACETOSELLA WELW. EX HIERN

Hibiscus acetosella, known by its Chewa/Ngoni name as *lumanda* or *limanda* was the most frequently cited and most appreciated AILV in our assessment (Image 3E). Known as "cranberry hibiscus" in English, it is an herb that grows wild but was also reported to be cultivated. A bundle of lumanda at the market ranged from $0.08 to $0.40 depending on the season. One female participant described lumanda as having an especially soft (tender) texture to consume. Although we did not find documented nutritional properties for *H. acetosella*, the young shoots of the closely related *H. sabdariffa* are high in riboflavin and medium in beta-carotene, vitamin E, ascorbic acid, calcium, and iron. They have a protein content of 3.3%[7]. The ZFCT reports the following composition per 100 grams of boiled lumanda leaves (no species is listed): 85 food energy (ME) cal, 13.82 g protein, 1.42 g fat, 0.55 mg calcium, 21.1 mg iron, 0.01 mg zinc, 28.93 mg vitamin C.

IPOMOEA BATATAS (L.) LAM.

The leaves of sweet potato (*Ipomoea batatas*), known locally as *kalembula* or *kolowa* (Chewa/Ngoni), are from the ground climber that is cultivated for its tuber (Image 3F). They are commonly sold on the market for $0.40 a bundle. According to AVRDC, the leaves have high ascorbic acid and iron, medium levels of beta-carotene and riboflavin, low calcium, and a 3.2% protein level[7]. The ZFCT reports the following composition per 100 grams of boiled sweet potato leaves: 125 food energy (ME) cal, 8.53 g protein, 1.75 g fat, 1.34 mg calcium, 31.67 mg iron, 0.16 mg zinc, and 65.16 mg vitamin C.

4.3. DROUGHT RESILIENCE AND CULTIVATION PRACTICES

Concerning drought resilience and water requirements, respondents commented that wild AILVs typically grow only in the rainy season. Although they are rain-fed, most participants reported that they did not need a lot of water, and that they still grow even if there is not a lot of rain. Cranberry hibiscus was highlighted as a plant that does not need a lot of water. Monkey rope was mentioned as a (wild) plant that grows year-round. Focus group participants unanimously agreed that AILVs (including cultivated ones) are not a lot of work compared to exotic garden vegetables, which rely on rain-fed irrigation.

Image 4: A *chikwati* storage ball is a traditional method of preserving AILV leaves for year-round consumption in the Lundazi region. This ball was filled with *limanda* leaves. (AM Towns/CRS)

4.4. SEED AVAILABILITY AND PLANT PRESERVATION

Only the seeds of cultivated AILVs (pumpkin and cowpea) were reported to be collected, saved, and sold on the local markets. This information was confirmed by our own observations at the market. Amaranth seeds were reported to be sold at local seed distribution centers in Chipata. At the time of this assessment, the seed distributors reported that they were sold out of the seeds. One nutrition advisor informant shared that earlier in the Mawa project, two types of amaranth seeds were shared with beneficiaries. He informed us that they were well received. Respondents did not mention transplanting AILVs closer to home or collecting seeds of wild plants to grow in their gardens. The seeds of cultivated vegetables were generally reported to be available year-round.

In the Mawa project areas where we worked, respondents reported the consumption of both fresh and dried AILVs. The majority of participants, particularly women, described a process of drying plants on mats in the sun and then storing them in grain sacks in their home. There were no major pests problems reported with this method, although several women cautioned that drying the plants in the sun could affect the nutritional qualities of the plants. One women's focus group stated that if the leaves become very dry and brittle after storage, then they pound them into a powder before cooking.

One traditional method of plant preservation that was observed in the Lundazi region was the use of a storage ball known as *chikwati* in Chewa/Tumbuku (Image 4). The storage ball was made from large leaves, wrapped in twine, and hung from the rafters of one's home. A key informant in the Lundazi region informed us that the cranberry hibiscus leaves she stored in her storage ball lasted for one year. A second type of plant preservation was described using a clay pot—the leaves were stored in the clay pot sealed with a plastic bag over the top with a tie. This method was not observed in either region we visited.

5. UBALE FINDINGS (SOUTHERN REGION, MALAWI)

5.1. COMMUNITY PERCEPTIONS OF AILVS

Like the participants in Zambia, beneficiaries of UBALE reported that everyone in the household consumes AILVs. However, we observed more reservation in overall enthusiasm for discussing AILVs, especially those that grew wild. Nevertheless, the consumption of relishes as an accompaniment to nzima was a common way of eating foods, most frequently with cultivated AILVs. The majority of respondents reported consuming the vegetables due to good taste, source of vitamins, availability/affordability, and because there are no other sources of relish (such as meat or fish). The leaves were also reported to be appreciated due to their texture (being "soft" when eaten). There were no observed differences between AILV preferences among men and women in the UBALE assessment.

One woman who was not a part of the focus group discussion but was observed processing wild greens in front of her home, expressed embarrassment when asked if we could take her photo. She exclaimed, "You want to take a picture of me to take back to America and make fun of the food we eat." After assuring her that we came to learn about communities' preferences of traditional vegetables for their promotion, she disclosed the name of the plant she was processing: denje. The English name for denje is "Jute mallow" *(Corchorus olitorius)*, which is a well-known AILV with extremely high levels of beta-carotene; high to extremely high iron, high folic, riboflavin acid, and ascorbic acid; medium to high calcium; and medium vitamin E, with a protein content of 4.5%.7 This experience highlighted one of the dominating perspectives on traditional vegetables in the region where we worked: Indigenous plants, especially wild ones, have a negative stigma with some populations. It also highlighted to necessity to further assess and promote these vegetables given their documented nutritional quantities. Anecdotal information about the historical context influencing nutrition habits of Malawians offered one explanation regarding the hesitancy to speak openly about traditional food consumption: It was tied to several political campaigns in which traditional Malawian foods (particularly wild sources) were made to seem old fashioned and unfit for advanced Malawian society.

In one community we visited, we noticed a divide between the focus group discussions with mothers and fathers and a focus group discussion with elders. The parent generation cited mainly cultivated indigenous vegetables, and were particularly fond of pumpkin leaves. However, the grandparent generation cited several wild indigenous vegetables, and included many comical names and stories. One person even commented, "Yes, they like relishes very much; between fish and tovey [Ceratotheca sesamoides; same as Image 3C], they will eat tovey." This group of individuals reported being grateful for what the previous CRS project WALA taught about using moringa, and pointed out that UBALE could help with knowledge of other plants; it should promote "the old ones, too, not just the modern ones."

One of the key informants echoed this generational difference: "The young ones don't consume them to a high extent; these days the vegetables are rarely found." He suggested that the plant populations are decreasing because farmers clear all land

for maize production. If they had more information about the documented nutritional properties, they could promote them and teach people how to use them again. The other informants mentioned individual's own beliefs and preferences as a barrier to consumption—some claim to have diarrhea after eating certain plants. In the case of moringa, which is prepared with soda, "the hospital discourages the use of soda, so people no longer eat it."

5.2. PREFERRED AILV SPECIES

Participants from the UBALE project area assessment listed a total of 16 distinct local names for AILVs (Supplementary Table 2). The seven most frequently cited species include three that are exclusively cultivated, three that are collected in the wild, and one that is both cultivated and wild (Table 4). Although cultivated plants were among the most commonly cited by participants, the wild creeper punde was also among the top three.

TABLE 4. HOUSEHOLD PREFERENCES OF AILV SPECIES IN UBALE PROJECT AREA (MALAWI)

LATIN NAME	ENGLISH NAME	LOCAL NAME (CHECHEWA)	GROWTH STATUS	DESCRIPTION	HIGH NUTRIENT CONTENT*
***Amaranthus* ssp.**	amaranth	*bonogwe*	both	herb	calcium, iron, ascorbic acid[7], protein, vitamin A[9]
Bidens pilosa	blackjack	*chisoso*	wild	herb	beta-carotene, ascorbic acid[7]
Cleome gynandra	spider plant	*luni*	wild	herb	ascorbic acid, beta-carotene, folic acid calcium[7 9]
Cucurbita maxima	pumpkin leaves	*nkhwani*	cultivated	ground climber	fresh: calcium, protein, vitamin C; dried: protein, iron[9]
Ipomea eriocarpa	wild sweet potato	*punde*	wild	ground climber	unknown (see text for related species)
Moringa olifera	moringa	*sangoa*	cultivated	tree	beta-carotene, vitamin E, riboflavin, iron, folic acid; extremely high ascorbic acid[7]
Vigna unguiculata	cowpea leaves	*chitambe*	cultivated	ground climber	vitamin E, folic acid, calcium

*Only those nutrients with "high" scores from sources are included in the table. See the text for full nutrient contents.

Image 5A: *bonogwe* (AM Towns/CRS)

Image 5B: *chisoso* (S Nordin/ NeverEndingFood)

Image 5C: *luni* (AM Towns/CRS)

Image 5D: *nkhwani* (AM Towns/CRS)

Image 5E: *punde* (AM Towns/CRS)

Image 5F: *sangoa* (A Banda/CRS)

Image 5G: *chitambe* (AM Towns/CRS)

Images 5A-G: Most commonly cited African Indigenous Leafy Vegetables in UBALE project areas (Malawi)

AMARANTHUS SSP.

Like the participants from Zambia, the communities interviewed in the UBALE project area frequently listed *bonogwe* as an indigenous vegetable (Image 5A). Various species of *Amaranthus* grow wild, and along river edges year-round. Bonogwe was found on the market for 30 MWK per bundle, equivalent to $0.04[11]. According to AVRDC, amaranth leaves are high in folic acid, calcium, iron, and ascorbic acid, and contain medium levels of beta-carotene and riboflavin, with a 2–4% protein level in the shoots[7]. The ZFCT reports the following composition per 100 grams of fresh amaranth leaves (no species indicated): 54.4 food energy (ME) cal, 4.7 g protein, 0.5 g fat, 1.8 g crude fiber, 498 mg calcium, 26.7 mg iron, and 7,868 ug vitamin A.

11 As of February 2, 2016, 1 Malawi Kwacha (MKW) = $0.0014.

BIDENS PILOSA L.

The species *Bidens pilosa* is an herb that grows wild and is known as "blackjack" in English and *chisoso* in Chechewa (Image 5B). Blackjack is high in beta-carotene and ascorbic acid, medium in vitamin E, and low in calcium and iron[7]. The ZFCT reports the following composition per 100 grams of boiled blackjack leaves: 89 food energy (ME) cal, 8.29 g protein, 0.91 g fat, 0.69 mg calcium, 13.13 mg iron, 1.36 mg zinc, and 0.42 mg vitamin C. One community was knowledgeable about chisoso, but claimed that it did not grow in their area. It was not reported to be sold on the market.

CLEOME GYNANDRA L.

Spider plant (*Cleome gynandra*) is another herb commonly known and consumed across sub-Saharan Africa (Image 5C). Known as *luni* in Chechewa, it was not sold on the market. The leaves of spider plant are extremely high in ascorbic acid; high in beta-carotene, folic acid, and calcium; medium in iron; and low in vitamin E, with a protein content of 4%[7 9]. The ZFCT reports the following composition per 100 grams of boiled spider plant leaves: 64 food energy (ME) cal, 5.48 g protein, 0.59 g fat, 0.53 mg calcium, 6.65 mg iron, 0.15 mg zinc, and 40.43 mg vitamin C.

CUCURBITA MAXIMA DUCHESNE

Also like in Zambia, pumpkin leaves (*Cucurbita maxima*) were frequently cited in our assessment. It is exclusively cultivated and known as *nkhwani* in Chechewa (Image 5D). They were sold by nearly every vegetable market vendor we encountered for $0.04–0.07 a bundle. Fresh pumpkin leaves are rich in calcium, protein, and vitamin C. Dried leaves are high in protein and iron and moderately high in vitamin C[9]. Pumpkin leaves also referred to species *C. pepo* and *C. moschata*. The ZFCT reports the following composition per 100 grams of boiled *C. pepo* leaves: 48 food energy (ME) cal, 3.23 g protein, 0.47 g fat, 0.46 mg calcium, 5.6 mg iron, 0.12 mg zinc, 10.32 mg, and vitamin C.

IPOMEA ERIOCARPA R. BR.

Wild sweet potato leaves (*Ipomea eriocarpa*) was mentioned by nearly all participants, second to only pumpkin leaves. Known as *punde* in Chechewa, it was one of the few wild plants to be sold on the market ($0.04). It was reported to grow year-round, particularly in low marshy areas, and was observed to be covering the ground at the time of this assessment (Image 5E). A closely related species, *I. aquatic*, is documented to have medium to high ascorbic acid; medium beta-carotene, vitamin E, folic acid, iron, and calcium; and low riboflavin, with a protein content of 2.5%[7].

MORINGA OLIFERA LAM.

Known by the name of its genus, "moringa" (or *sangoa* in Chechewa) was the only tree among the preferred species to be listed by the participants from Malawi (Image 5F). It was not reported to be sold on the market. Community leaders in one of the focus groups credited its acceptance and use by the community to the former CRS project WALA. The leaves have extremely high ascorbic acid; high levels of beta-carotene, vitamin E, riboflavin,

iron, and folic acid; and medium calcium with a protein content of 4%[7]. The ZFCT reports the following composition per 100 grams of boiled moringa leaves: 89 food energy (ME) cal, 10.05 g protein, 1.59 g fat, 0.51 mg calcium, 3.52 mg iron, 0.45 mg zinc, and 1.44 mg vitamin C.

VIGNA UNGUICULATA (L.) WALP.

Like pumpkin leaves and moringa, cowpea leaves (*Vigna unguiculata*) were a frequently listed cultivated vegetable. Known as *chitambe* in Chechewa, it is a ground climber that was sold on the market for $0.04 a bundle (Image 5G). According to AVRDC, cowpea leaves are extremely high in beta-carotene; high in vitamin E, folic acid, and calcium; medium in ascorbic acid; and low in iron, with a protein level of 3–4%[7]. The ZFCT reports the following composition per 100 grams of boiled cowpea leaves: 22 food energy (ME) cal, 2.21 g protein, 0.36 g fat, 0.2 mg calcium, 5.72 mg iron, 0.04 mg zinc, 16.88 mg vitamin C.

5.3. DROUGHT RESILIENCE AND CULTIVATION PRACTICES

When prompted about the drought resilient properties of AILVs, participants from the focus groups affirmed that the plants grew well with limited water; responses included: (1) they are found when there is no water; (2) all are resistant to dryness—even when it's very dry, they still persist; (3) in the dry season, they grow in the marshes, the rest of the year in the garden; and (4) they are found even in dry season. The noted exception was mushrooms, which require a lot of water to grow. Moringa and wild sweet potato leaves were noted to be "always green even with no water." One mothers' focus group responded that they "make sure that they are available year-round"—in the rainy season they are found everywhere and in the dry season they grow them (cultivated) along the river.

When asked about the workload associated with AILVs, respondents agreed that exotic vegetables (cabbage, Chinese greens, etc.) required much more work; responses included: (1) it is more tiresome to plant the others; (2) these ones are easier to grow, exotic ones are more involved; (3) wild indigenous vegetables grow on their own, exotic ones need to be watered every day; and (4) indigenous ones are easy to grow and take care of, the other ones need to be weeded/fertilized, etc. No AILVs except for moringa were reported to be transplanted. One women's focus group and one market vendor reported sometimes broadcasting amaranth seed to encourage growth.

5.4. SEED AVAILABILITY AND PLANT PRESERVATION

No participants reported collecting or selling AILV seed, except for the cultivated species (pumpkin, cowpeas). In addition to saving pumpkin seeds, most participants reported also preserving pumpkin, cowpea, and wild sweet potato leaves. Both pumpkin and cowpea leaves are dried on a mat and then stored in sacks in the house. For the leaves of wild sweet potato, the leaves are separated from the stems, boiled quickly, dried in the sun, and stored in a sack for times of vegetable scarcity. There were no reports of dried leaves suffering damage, or use of chemicals, but rodents were a problem for stored pumpkin seeds. One participant in the elder leaders' focus group summarized the need to dry vegetables: "The wise woman cooks the dried ones; a small amount of dried leaves becomes a lot of food when cooked. [By drying vegetables,] the wise women keeps her family far from hunger."

5.5. SALE OF AILVS ON LOCAL MARKETS

Like the Zambian market vendors, women selling AILVs in Malawi reported that both men and women purchase the plants on the market. Plants are always sold fresh (Image 6). All of the market vendors cultivated and collected their own produce to sell at the market. One vendor mentioned that she harvests along the river edge in the dry season.

The price of each AILV was dependent upon its availability; in the rainy season, a bundle of plants drops to the equivalent of $0.03; in the dry season, it goes up to $0.07 per bundle. Another vendor reported that the prices fluctuate depending on the prices of other goods; for example, "when salt or soap go up, the price of vegetables goes up, too." Participants in the focus groups also reported selling cultivated AILVs from their gardens at the local market for $0.04 per bundle.

Image 6: A woman in the Chikhwawa region of Malawi selling fresh wild sweet potato leaves at market. (AM Towns/CRS)

5.6. AILV CONSUMPTION BY PREGNANT WOMEN/CHILDREN UNDER TWO AND RECIPES

All participants confirmed that pregnant women consume AILVs. Every focus group from the UBALE project areas mentioned that pumpkin leaves were especially important for pregnant women, due to their (perceived) high nutrient value. Several women said that they alternated between different vegetables from day to day. Children under the age of two were also reported to consume AILVs, as an accompaniment to the corn porridge. For infants aged six months to one year, the mothers and fathers described two ways to make sure their children eat AILVs: (1) grind the leaves and add to porridge (Image 7); and (2) take water from vegetables and pour on porridge. Both mothers and fathers named moringa and pumpkin leaves as especially important vegetables for young children to eat.

To prepare the traditional vegetables, participants described either boiling the leaves (as described by the Mawa participants) or frying the vegetables. Boiling included the following process: Women take the plant from the garden,

Image 7: One community prepared a display of AILVs in advance of our arrival, including moringa leaves. The green powder is an example of how moringa is prepared for children aged six months to one year: The leaves are dried, pounded, and then added to porridge. (AM Towns/CRS)

separate the leaves and cut them into pieces, wash in a colander basket, cook with a small amount of water (being sure not to overcook). Some people mentioned adding tomato or onion. The plants are cooked for about 5–10 minutes, depending on the texture of the leaves. Vegetables such as cowpea leaves take longer due to their thicker texture. Wild sweet potato leaves and amaranth are prepared by rolling the leaves between the hands to remove the white sap, drying the leaves in the sun for 10–15 minutes, and frying with tomato and onions. Either vegetable could also be prepared with milk: Place the milk on the fire, add the leaves and tomato and cook for a few minutes. One focus group discussion reported that the village's soil was not good for groundnuts, thus one needed to buy them from the market if they were included in a recipe. It was not clear to the assessment team if the participants were referring to aflatoxins, but this was likely the case. Some women reported being afraid to cook one of the most commonly cited vegetables, luni, because if improperly cooked, it resulted in a sour taste. Most of the women reported having eaten it in the past and liking it, but did not do so themselves because they had problems cooking it.

6. RECOMMENDATIONS

6.1. METHODOLOGICAL CONSIDERATIONS FOR FUTURE ASSESSMENTS

Given the observed role that AILVs play in the diets and livelihoods of assessment participants in both Malawi and Zambia, and the similarities of the findings with plant preference and use across other African countries,2 this type of research is highly relevant in other CRS projects. CRS country programs should consider incorporating indigenous food and vegetable assessments more regularly into Development Food Aid Program (DFAP) preparation and other proposal planning, as well as current and ongoing nutrition, agriculture, and food security projects.

Future assessments can be improved by spending at least two weeks in each CRS Country Program project. Carrying out this assessment in both the Mawa and UBALE project areas in the two-week period resulted in clear patterns of preferences and perspectives from focus group participants, but it also resulted in limited opportunities to gather the perspectives of all stakeholders, particularly different generations. More time should be set aside for key informant perspectives, given the variation of responses from the key informants we interviewed. Ideally, data collection would take place over four days, plus two days for travel, two days for preparation/debriefing, one day at a regional herbarium for plant identification, and one makeup day in case of unforeseen circumstances. We recommend continuing to collaborate with the local herbaria to ensure the accurate identification of plants.

Future AILV assessments should ideally be carried out later in the rainy season, as several of the (wild) vegetables had not yet sprouted in late November and early December. Although the urgency of identifying preferred AILV species in this time period was necessary in order to have a timely response to El Niño, waiting until later in the rainy season would result in fewer unidentified species (see Supplementary Tables 1–2). In addition, since the focus groups and key informant interviews coincided

with the beginning of the rainy season, several people were not able to participate in the assessment since they were actively involved in field preparations and planting.

An ideal data collection team would consist of an interviewer (local language proficient), one interpreter, and one note taker (TDY lead). Our work in Zambia was not ideal given the size of the group (four people) that went out in the field; the note taking was insufficient and there was not enough time for clarification of responses. The Malawi work proceeded much more smoothly with a three-person team.

Lastly, the size of the focus group discussions should be more clearly communicated and enforced. Some of our focus groups had more than 10 people, which would have resulted in richer data if these discussions had been divided into two groups so all participants were able to share their perspectives. Furthermore, as evidenced by our work with a focus group of village elders in Malawi, additional focus groups should be added to account for generational differences: one for the grandmothers and one for the grandfathers. Although this was initially the suggested methodology, we had to scale back the number of focus group discussions due to our limited timeframe.

6.2. AILV RECOMMENDATIONS FOR BOTH PROJECT AREAS

6.2.1. AGRICULTURAL ASPECTS

With the exception of amaranth seeds, in both the Mawa and UBALE project areas, the seeds of wild AILVs were not commonly collected, sown, or sold on the market. With CRS' proposed collaboration with AVRDC, many of the seeds of the plants can be acquired through AVRDC's customized seed kits and training activities. Project beneficiaries can also be stimulated to collect and spread wild seeds, and transplant favorite plants in gardens and spaces closer to their homes. The home cultivation of AILVs can be a low-input way to improve household nutrition and food security, provide a source of additional income, and help to conserve botanical and nutritional diversity[12] [13]. Although participants confirmed that the plants were resilient to low rainfall, it should be made clear that "drought resistance" has been based on community perceptions, and not demonstrated in field trials. These perspectives can be used to inform future studies by universities or agricultural research institutes, but more rigorous verification is needed to provide documented evidence of the water requirements and adaptability of the plant species identified in this report.

6.2.2. FOOD PREPARATION ASPECTS

Concerning food preparation, there are three main areas of recommendations: the use of soda, men's roles, and AILV preservation. Both projects should deliver nutrition education to address the negative impact of "soda" (sodium bicarbonate) use. However, as several participants were already aware of its negative effects yet

12 Cousins, S. R., & Witkowski, E. T. F. (2015). Indigenous Plants: Key Role Players in Community Horticulture Initiatives. *Human Ecology Review*, 21(1), 59.

13 Freedman, R. L. (2015). Indigenous wild food plants in home gardens: Improving health and income with the assistance of agricultural extension. I*nternational Journal of Agricultural Extension*, 3(1), 63–71.

still reported using it regularly, behavior change interventions should be careful to deliver a clear nutrition message while remaining sensitive to local traditions. As mentioned by a participant in the UBALE area, some community members completely abandoned moringa when instructed to no longer use soda in its preparation. Given the lack of variety in the basic recipe for AILVs, introducing alternatives to soda or more variation in recipes may make alterations to food preparation more acceptable. As a part of their seed kits, AVRDC also offers training on vegetable preparation; this training may entail culturally appropriate messaging that includes alternatives to soda. Food preparation training should include men, as the fathers involved in our assessment were knowledgeable on recipe preparation. Market vendors also reported that men regularly purchase plants on the market, indicating their influence on home consumption of AILVs. Lastly, the local custom of AILV preservation through drying and storage should be encouraged to ensure access to leafy vegetables year-round, with nutrition messages including techniques to safely preserve plants without nutrient loss or damage.

6.2.3. NUTRITIONAL ASPECTS

Many of the most commonly cited species in the assessment have documented nutritional properties, yet additional studies are needed to assess the bioavailability of the nutrients for human consumption. This lack of information remains a barrier to their promotion[14]. Laboratory studies were out of the scope of this assessment, but collaborating with local universities could enable research on nutrient availability and bioavailability, as well as consumption studies to determine if the quantity of vegetables that are consumed by the target populations are sufficient to impact malnutrition. Limited information on the consumption patterns of AILVs is available[15]. A recent study in DR Congo showed that wild foods were insufficiently consumed to positively impact nutrition security or meet dietary needs[16]. CRS UBALE staff identified Lilongwe University of Agriculture & Natural Resources (formerly known Bunda College of Agriculture) as a potential partner for future studies related to nutrition.

6.3. SPECIFIC RECOMMENDATIONS FOR MAWA PROJECT

The majority of participants from the Mawa project area deeply cherished and continued their traditional practices of AILV consumption. Information on the preferred AILV species nutrient qualities should be shared with Mawa agriculture and nutrition supervisors, as they were particularly enthusiastic and supportive of AILVs. Including the agricultural supervisors can help to link wild AILVs to nutrition and encourage the collection of seeds and transplanting of AILVs. Given the strong food culture surrounding AILVs in the communities where we worked, there is currently

14 Uusiku, N. P., Oelofse, A., Duodu, K. G., Bester, M. J., & Faber, M. (2010). Nutritional value of leafy vegetables of sub-Saharan Africa and their potential contribution to human health: A review. *Journal of Food Composition and Analysis*, 23(6), 499–509.

15 Smith, F. I., & Eyzaguirre, P. (2007). African leafy vegetables: Their role in the World Health Organization's global fruit and vegetables initiative. *African Journal of Food, Nutrition and Development,* 7(3).

16 Termote, C., Meyi, M. B., Djailo, B. D. A., Huybregts, L., Lachat, C., Kolsteren, P., & Van Damme, P. (2012). A biodiverse rich environment does not contribute to a better diet: A case study from DR Congo. *PLOS ONE*, 7(1), e30533.

a supportive environment to further AILV promotion. These efforts can also be reinforced by mobilizing local resources, particularly the work of Sylvia Banda from Sylvia Food Catering in Lusaka.

Out of the six preferred AILVs from the Mawa project assessment, *Adenia gummifera* is the only species that did not have any known nutritional properties. The remaining five species (*Amaranthus spp., Ceratotheca sesamoides, Cucurbita maxima, Hibiscus acetosella, Ipomoea batatas*) had documented nutritional properties from multiple sources. Each of these plants are also already being promoted as a part of the resources available to CRS' Complementary Feeding and Learning Sessions (CCFLS), specifically the 2009 *Zambia Food Composition Tables*. We recommend completing a literature review on the nutritional properties of the remaining 31 plants from this assessment (Supplementary Table 1) and working with local universities and research institutes to add additional plants to the ZFCT.

6.4. SPECIFIC RECOMMENDATIONS FOR UBALE PROJECT

One of the strongest themes to come out of the assessment in Malawi was the social stigma surrounding AILV consumption. Overcoming this barrier, particularly against wild species, is one of the most critical actions that UBALE can take in promoting AILV consumption. Research from South Africa has shown that the abandonment of indigenous vegetables was brought on by a combination of factors including the introduction of exotic vegetables, historical policies, stigma, changes in lifestyle, and habitat loss. The researchers suggest that one of the keys of overcoming the neglect of these vegetables is the generational transfer of indigenous knowledge[17]. This conclusion was echoed by the elders who participated in our focus group discussions: They recognized their critical role in sharing their knowledge of "old foods."

Image 8: Working to overcoming the social stigma of wild AILV foods through nutrition education is a critical action UBALE can take to promote their consumption. (AM Towns/CRS).

There may be a role for this generation in CRS' nutrition programming such as the CCFLS; village elders can inform on AILV identification and preparation, helping to overcome some of the barriers related to AILV consumption. A research study in India showed the positive effect of traditional environmental knowledge education

17 Dweba, T. P., & Mearns, M. A. (2011). Conserving indigenous knowledge as the key to the current and future use of traditional vegetables. *International Journal of Information Management,* 31(6), 564–571.

programs on youths' perceptions, knowledge, and use of indigenous plants[18]. Likewise, a study in Cameroon highlighted that knowledge and positive attitude towards the nutritional value of wild foods positively influenced their consumption, underscoring the need to invest in awareness campaigns[19]. These studies bring to light the influence that projects such as UBALE can have on communities' perceptions and consumption of AILVs. The local permaculture farm, Never Ending Food, is an excellent local resource for supporting this effort.

Six of the seven preferred AILVs from the UBALE assessment (*Amaranthus ssp., Bidens pilosa, Cleome gynandra, Cucurbita maxima, Ipomea eriocarpa, Moringa olifera,* and *Vigna unguiculata*) have documented nutritional properties. These plants are already promoted as a part of the resources available to CRS' CCFLS, specifically the 2009 *Zambia Food Composition Tables*. As with Mawa, we recommend reviewing the literature of known properties of the remaining nine plants (Supplementary Table 2) and working with local universities and research institutes to determine the nutritional values of more plants, particularly wild species, to improve nutrition education materials.

7. SUPPLEMENTARY TABLE 1: PLANTS CITED IN ZAMBIA AILV ASSESSMENT

PREFERRED	LOCAL PLANT NAME	LANGUAGE	ENGLISH NAME	FAMILY	SPECIES	DOMESTICATION STATUS	PLANT PART
	bata	Ngoni	amaranth	Amaranthaceae	*Amaranthus* sp.	wild, cultivated	herb leaves
•	bondwe /bonogwe	Chewa	wild spinach	Amaranthaceae	*Amaranthus* sp.	wild, cultivated	herb leaves
	boowa	Ngoni	mushroom (generic)	N/A	N/A	wild	fungus
	chekwechekwe	Tumbuka	okra	unidentified	unidentified	N/A	herb leaves
	chibomba	Ngoni	N/A	unidentified	unidentified	N/A	herb leaves
•	chibwabwa	Chewa/ Ngoni	pumpkin	Cucurbitaceae	*Cucurbita maxima* Duchesne	cultivated	climber leaves
	chigwada	Tumbuka	wild cassava / cassava tree	Euphorbiaceae	*Manihot esculenta* Crantz, *Manihot carthaginensis* subsp. *glaziovii* (Müll.Arg.) Allem	cultivated	tree leaves
	delele	Ngoni	white okra	Malvaceae	cf. *Abelmoschus esculentus* (L.) Moench	cultivated	herb leaves
	imphwa	Chewa	wild eggplant	Solanaceae	*Solanum* sp.	wild	fruit

18 Cruz-Garcia, G. S., & Howard, P. L. (2013). "I used to be ashamed." The influence of an educational program on tribal and non-tribal children's knowledge and valuation of wild food plants. *Learning and Individual Differences,* 27, 234–240.

19 Fungo, R., Muyonga, J. H., Kabahenda, M., Okia, C. A., & Snook, L. (2016). Factors influencing consumption of nutrient rich forest foods in rural Cameroon. *Appetite*, 97, 176-184.

SUPPLEMENTARY TABLE 1

PREFERRED	LOCAL PLANT NAME	LANGUAGE	ENGLISH NAME	FAMILY	SPECIES	DOMESTICATION STATUS	PLANT PART
	irape	Chewa	rape	Brassicaceae	*Brassica* sp.	cultivated	herb leaves
	kachele	Ngoni	wild fig	Moraceae	*Ficus thonningii* Blume	wild	tree leaves
	kachilube/chirube	Ngoni	N/A	Fabaceae	unidentified	N/A	flowers
•	kalembula/kolowa	Chewa / Ngoni	sweet potato	Convolvulaceae	*Ipomoea batatas* (L.) Lam.	cultivated	climber leaves
	kamganlethengele	Tumbuka	N/A	unidentified	unidentified	N/A	herb leaves
	kamuelele	Ngoni	N/A	Portulacaceae	*Portulaca foliosa* Ker Gawl.	wild	herb leaves
	katambasele	Tumbuka	N/A	unidentified	unidentified	wild	climber leaves
•	katate	Ngoni	false sesame	Pedaliaceae	*Ceratotheca sesamoides* Endl.	wild	herb leaves
	katukula	Tumbuka	N/A	Violaceae	*Hybanthus enneaspermus* (L.) F.Muell.	wild	herb leaves
	kolowa thengo	Ngoni	forest sweet potato	Convolvulaceae	*Ipomoea eriocarpa* R. Br.	wild	climber leaves
•	lumanda/limanda	Chewa / Ngoni	cranberry hisbiscus	Malvaceae	*Hibiscus acetosella* Welw. ex Hiern	wild, cultivated	herb leaves
	malubeni	Ngoni	mulberry	Moraceae	*Morus alba* L.	cultivated	tree leaves
	monjane	Ngoni	N/A	unidentified	unidentified	N/A	herb leaves
	mpapa dende	Tumbuka	zebrawood	Fabaceae	*Brachystegia spiciformis* Benth.	wild	tree leaves
	mtambethengele	Tumbuka	N/A	unidentified	unidentified	wild	herb leaves
	mukubikubi	Tumbuka	N/A	Cucurbitaceae	*Cucumis* sp.	cultivated	climber leaves
•	mulozi/mlozi	Ngoni	monkey rope	Passifloraceae	*Adenia gummifera* (Harv.) Harms	wild	climber leaves
	mutambe	Ngoni	cowpea	Fabaceae	*Vigna unguiculata* (L.) Walp.	cultivated	herb leaves
	ngolole	Ngoni	N/A	Cucurbitaceae	*Coccinia* sp.	wild	climber leaves
	nkasi	Tumbuka	velvet beans	Fabaceae	*Mucuna pruriens* (L.) DC.	cultivated	beans
	nyamusisi	Ngoni	N/A	unidentified	unidentified	N/A	shrub leaves
	nyazongo/chisoso	Ngoni	blackjack	Asteraceae	*Bidens pilosa* L.	wild	herb leaves
	nyolonyolo	Tumbuka	N/A	Pedaliaceae	*Sesamum angolense* Welw.	wild	herb leaves
	phulu phulu	Tumbuka	N/A	Fabaceae	*Ormocarpum* sp.	wild	tree leaves
	tindingoma	Ngoni	wild okra	Malvaceae	*Corchorus olitorius* L	wild	herb leaves
	zobala	Tumbuka	N/A	unidentified	unidentified	N/A	tree leaves
	zumba	Ngoni	okra	various	*Crotalaria, Hibiscus, Abelmoschus* ssp.	wild	herb leaves

8. SUPPLEMENTARY TABLE 2: PLANTS CITED IN MALAWI AILV ASSESSMENT

PREFERRED	LOCAL PLANT NAME	LANGUAGE	ENGLISH NAME	FAMILY	SPECIES	DOMESTICATION STATUS	PLANT PART
	dudwa	Chechewa	sessile joyweed, dwarf copperleaf	Amarantheceae	*Alternanthera sessilis* (L.) R.Br. ex DC.	wild	climber leaves
•	bonogwe	Chechewa	amaranth	Amarantheceae	*Amaranthus* ssp.	wild, cultivated	herb leaves
•	chisoso	Chechewa	blackjack	Asteraceae	*Bidens pilosa* L.	wild	herb leaves
	tobwe	Chechewa	false sesame	Pedaliaceae	*Ceratotheca sesamoides* Endl.	wild	herb leaves
•	luni	Chechewa	spider plant, cat's whiskers	Cleomaceae	*Cleome gynandra* L.	wild	herb leaves
	denje	Chechewa	jute mallow	Malvaceae	*Corchorus olitorius* L.	wild	herb leaves
	matondo	Chechewa	wild mango	Fabaceae	*Cordyla africana* Lour.	wild	fruit
•	nkhawni	Chechewa	pumpkin	Cucurbitaceae	*Cucurbita maxima* Duchesne	cultivated	herb leaves
	mwamuna aligone (namwali aligone)	Chechewa	gallant soldier; translation: "the husband is sleeping"	Compositae	*Galinsoga parviflora* Cav.	wild	herb leaves
	kolowa	Chechewa	sweet potato	Convolvulaceae	*Ipomoea batatas* (L.) Lam.	cultivated	herb leaves
•	punde	Chechewa	wild sweet potato	Convolvulaceae	*Ipomoea eriocarpa* R. Br.	wild	herb leaves
	chigwada	Chechewa	cassava tree	Euphorbiaceae	*Manihot esculenta* Crantz, *Manihot carthaginensis* subsp. *glaziovii* (Müll.Arg.) Allem	cultivated	tree leaves
•	sangoa	Chechewa	moringa, horse radish tree	Moringaceae	*Moringa oleifera* Lam.	cultivated	tree leaves
	nkaka	Chechewa	local cucumber	Cucurbitaceae	unidentified	N/A	climber leaves
	chibonzwa	Chechewa	N/A	unidentified	unidentified	wild	herb leaves
•	chitambe	Chechewa	cowpea	Fabaceae	*Vigna unguiculata* (L.) Walp.	cultivated	herb leaves

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