European Research Council

Culture and Environment in Africa Series **18**

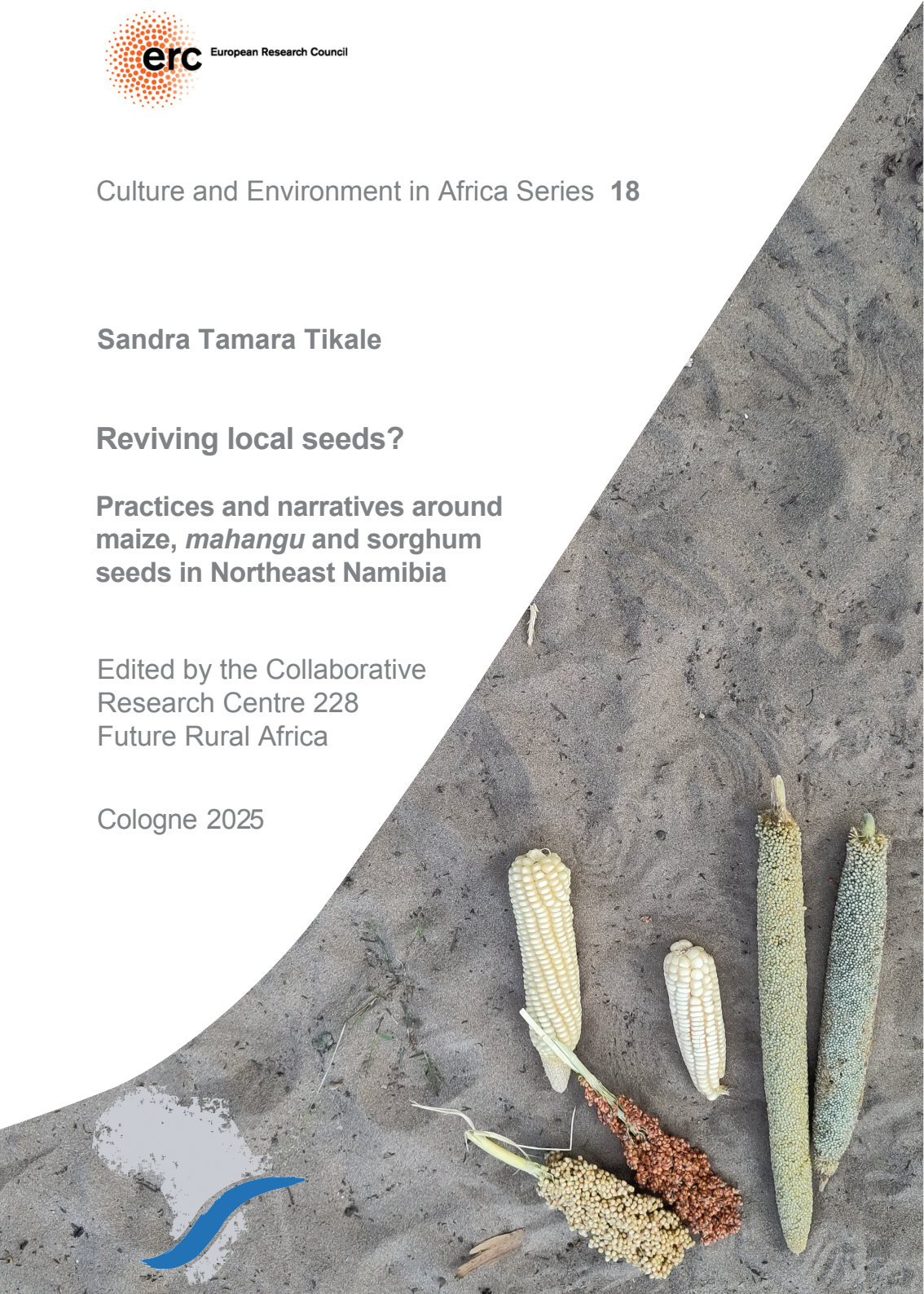
**Sandra Tamara Tikale**

# Reviving local seeds?

## Practices and narratives around maize, *mahangu* and sorghum seeds in Northeast Namibia

Edited by the Collaborative Research Centre 228 Future Rural Africa

Cologne 2025



**Sandra Tamara Tikale**

# Reviving local seeds?

## Practices and narratives around maize, *mahangu* and sorghum seeds in Northeast Namibia

CULTURE AND ENVIRONMENT IN AFRICA SERIES

Edited by the Collaborative Research Centre 228

Future Rural Africa

Issue 18

2025

## Preface

Agricultural production in rural Africa changed rapidly in the past decades. The comprehensive change of crops, particularly the transition from sorghum/millet to maize cultivation has changed agricultural production but also marketing of agricultural produce and food consumption comprehensively. In Namibia's northeast this transformation occurred during the second part of the 20th century and was closely tied to labour migration and the adoption of ploughing. Despite the fact that maize nowadays is the major crop, millet and sorghum are still significant. In the face of climate change, many experts and also some farmers claim that despite ist wide use maize may be more vulnerable to climatic perturbation than native crops and millet and sorghum may be the more promising crops for the 21st century. Moreover, the region is famous for its many sorghum and millet varieties. This is where Sandra Tikale's MA thesis sets in: how are seeds of different crops handled, selected and exchanged and how are local seeds handled differently than store bought seeds? What role do NGOs and ministerial offices play in the selection and dissemination process and how do they link crop selection to climate change issues? Sandra Tikale did two months of fieldwork in rural Zambezi Region, in the Region's capital Katima Mulilo and on seed-focussed workshops in the wider region. In an ethnographically engaged and highly reflected manner she engages in conversations with local farmers on seed selection. Tikale also travels with her interlocutors and with NGO staff and gets to know discussions on seeds between various actors. In this way, the reader gets an in-depth insight on how seeds and seed varieties have become key topics of rural engagements with the global climatic crisis.

Michael Bollig

## Acknowledgements

This thesis is based on ethnographic research in Namibia, and I would like to thank the Namibian farmers who have welcomed me in their fields and homes for their kindness, openness and patience. It has been an honour to meet you and learn from you, and I hope that this thesis represents your seeds in your interest. All other interlocutors I want to heartily thank as well for sharing their stories, opinions and humour.

My research was generously funded by the Collaborative Research Center TRR 228 Future Rural Africa, which is conducted by the University of Cologne and the University of Bonn. I would like to thank my supervisor Prof. Dr. Michael Bollig for this opportunity and his great support. Moreover, my thanks go to the team of Future Rural Africa, the team of the research centre Rewilding the Anthropocene and the team of the non-governmental organization Namibia Nature Foundation who have supported, stimulated and enriched my research in countless ways. Finally, I want to thank my co-students, family and friends for their endless support.

Bangkok, December 14, 2024

Sandra Tamara Tikale

## Abbreviations

| | |
|---|---|
| AGRA | Alliance for Green Revolution in Africa |
| AMTA | Agro-Marketing and Trade Agency |
| AOCC | African Orphan Crops Consortium |
| FAO | Food and Agriculture Organization of the United Nations |
| GIZ | German Corporation for International Cooperation |
| MAWLR | Ministry of Agriculture, Water and Land Reform |
| MSP | Multiplier Support Programme |
| NAB | Namibian Agronomic Board |
| NBRI | National Botanical Research Institute |
| NGO | Non-governmental organization |
| NNF | Namibia Nature Foundation |
| NRWA | Namibian Rural Women Assembly |
| NSA | Namibia Statistics Agency |
| NUS | Neglected and underutilized species |
| SDA | Seventh-day Adventist |
| WSN | Women Solidarity Namibia |
| WWF | World Wide Fund for Nature |

Table of Contents

## 1. Introduction

In the Zambezi Region in Northeast Namibia most cereal cultivation is conducted by small-scale subsistence farmers who rely on rain to water their crops (Kiesel et al. 2022:142). However, rainfall has been anything but reliable in recent years. The last two cropping seasons have given alarming evidence of this.

In the 2022/2023 season, most Namibian regions received below average and erratic rainfall which was interrupted by long dry periods with high temperatures (Tjatindi 2023). The late and insufficient rains destroyed the harvest of many farmers in the Zambezi Region and in the whole of Namibia, which has caused severe food insecurity on the household level (Nakale 2023; Tjatindi 2023). Between January and March 2023, around 390 000 people were estimated to be affected by acute food insecurity in Namibia (Ndjavera 2023). In October 2023, a vulnerability assessment identified 695 000 people as in need of drought relief and the government launched a drought relief programme (Kaapanda 2023).

In the 2023/2024 cropping season, however, the situation did not improve. Instead, the lack of rainfall worsened and in northern areas of the country, including the Zambezi Region, the white maize harvest halved, while the national *mahangu*[1] and sorghum harvests were reduced by 22% and 32% respectively (Hembapu 2024). Namibia declared a National State of Emergency due to drought on May 22, 2024 (Matthys 2024). The drought, which affected not only Namibia but large parts of Southern Africa, was driven by the global weather phenomenon *El Niño*, which is projected to occur more frequently in the future due to climate change (Maverick 2024). Climate change not only negatively impacts rainfall patterns but is also projected to significantly raise the temperatures and evaporation rates in Namibia, which could, all together, cause losses of up to 80% for subsistence agriculture in the country (Kiesel et al. 2022:141f.).

This raises urgent questions for cereal cultivation and seed systems. Which cereal varieties and seed types are best suited to cope with current and future extreme weather events? Can drought-tolerant maize varieties or African cereals like *mahangu* and sorghum better provide food security? Are so-called ‘formal’ seeds, bred through ‘modern’ plant-breeding techniques by seed companies and (governmental) research stations, the key to provide cereal varieties for the future? Or are local, ‘traditional’ seeds cultivated by small-scale farmers best adapted to the recurring droughts, so that their revival would hold the greatest promise?

Cereals and seed systems have undergone profound changes in the last centuries and their future in the Zambezi Region remains open and contested. In this ethnographic thesis I bring together perspectives from small-scale farmers, seed suppliers, a miller and personnel from national and governmental agencies as well as non-governmental organizations (NGOs)

[1] Pearl millet is called *mahangu* in Namibia. In this thesis I use the term when writing about Namibia.

to highlight prevalent cereal seed practices and different views on the transformation, significance and prospect of cereal species and seeds in Northeast Namibia. This will be guided by the following research question: *How do my interlocutors perceive and evaluate the rootedness, current situation and future potential of different cereal species and seeds in the Zambezi Region?*

Local seed and food systems are deeply embedded in dynamic sociocultural contexts, including local values and knowledge (Dohr et al. 2015; Walshe 2019:72; Wynberg 2024). However, the sociocultural dimension of local seed systems remains largely understudied (Dohr et al. 2015:7f.). Key social practices such as seed exchanges and the ways in which the spread of 'modern' varieties transforms these practices are highlighted as some of the many research gaps around local seed systems in Southern Africa (van Niekerk & Wynberg 2017:1101, 1120). Nevertheless, several studies have included sociocultural, political and economic aspects in their analysis on seed practices and systems on the African continent and have generally stressed the relevance of local seed systems (e.g. Dohr et al. 2015; Kerr & Wynberg 2024; Wynberg 2024). In this thesis, I build on these studies, including their colonial- and power-critical theoretical grounding, and confirm and compare their empirical findings with my own data.

The idea for the ethnographic research, which forms the basis for this thesis, was born out of the request of a local NGO worker. Louise[2], who at that time worked in the regional agricultural team of the NGO Namibia Nature Foundation (NNF), problematized that little was known about the seed situation in the Zambezi Region despite the importance of seeds for food security and livelihoods. During my research, various interlocutors like other NGO workers and farmers made their interest in the topic of seeds and particularly the state of local seeds explicit. To my knowledge, no extensive study on seed systems in Northeast Namibia has yet been carried out. In the few texts that mention seeds in the region (e.g. Mendelsohn 2006), sociocultural considerations are mainly absent. Due to the lack of region-specific literature, my research aimed to do a small exploratory and descriptive study on cereal seeds in the Zambezi Region, which takes their sociocultural embeddedness into account and focuses on the three main staple cereals of the region: maize, *mahangu*, and sorghum. As I started to research the seeds of these cereals, the cereal species themselves caught my attention. Why, I wondered, has maize so successfully replaced the more drought-tolerant *mahangu* and sorghum varieties in the region and become the dominant cereal crop for both cultivation and consumption? In my thesis I both look at the history and relation of the three cereal species and at the changing practices and evaluations around their seeds. Although agrobiodiversity and seed systems are deeply connected, they are often addressed separately in the literature. Studies on crop species diversity for example often exclude intra-species diversity and the question which seeds

[2] The names of my research partners have been changed to protect their privacy.

are used (e.g. Rampersad et al. 2023:994), whereas studies on cereal seeds often focus on only the most dominant crop species in a location (e.g. Dohr et al. 2015; Kerr & Wynberg 2024). My thesis tries to contribute to the existing literature by combining the interests of crop and seed transformations to paint a more holistic picture of the cereal (seed) situation in the Zambezi Region.

In the following section I briefly explain and reflect on the ethnographic methods I applied and describe the data analysis. Section 3 brings perspectives from the literature together with initial data from my research to introduce the Zambezi Region, to illustrate the role small-scale agriculture plays there and to point to current challenges small-scale farmers face. These challenges have contributed to the spread of maize, which is discussed in section 4. Informed by a basic introduction to the concept of agrobiodiversity and a literature-based overview of the rise of maize in (Southern) Africa, the section analyses why maize has increasingly replaced sorghum and *mahangu* in the Zambezi Region and how this is connected to colonialism and socioeconomic transformations. The section ends with a description on how the future potential of the cereal varieties was evaluated by my interlocutors.

Section 5 starts with a brief general overview of local and formal seed systems and their increasing intertwinement and role on the African continent. Afterwards, the locally relevant seed sources and connected seed practices in the Zambezi Region are described and discussed. In section 6, I outline how my research participants have evaluated local and formal seeds, their current state, and future potential. This is framed by analytical considerations on the continuing asymmetries in cereal and seed systems and certain possibilities for counteracting them.

The discussion in section 7 summarizes that all three cereal species and both local and formal seeds have valuable characteristics to offer for future farming, but that the current neglect of sorghum, *mahangu* and farm-saved seeds hinders them to unfold their potential. Therefore, some of my interlocutors have passionately demanded a revival of local seeds and African cereal varieties. However, given the history of migration and adaptation of cereal species as well as the increasing interlinkages and continuous change of local and formal seeds, I question if such a revival has to be based on the 'localness' of certain cereal species and seeds. In the conclusion in section 8, I sum up the main points of each section and underline my argument that a revival of 'local' seeds and species could instead be grounded in the call to empower currently marginalized farmers and to institutionally support widely overlooked seeds and species to allow for their continuous cultivation and transformation in more equitable ways.

## 2. Methods and reflection

Ethnographic research is a social process shaped by the background, perspective and personality of the conducting ethnographers and their relationships to research partners and participants (cf. Madden 2010:22f.). Therefore, as this section aims to do, it is crucial to describe and reflect on the specific subjective encounters which have generated ethnographic data (ibid.:22f.). This can enhance transparency and allows readers to understand the particularity of the data, its possible expressiveness and its limits.

My research stay in Namibia lasted from February 26 until May 05, 2023, and concentrated mainly on the Zambezi Region, where I stayed in the regional capital Katima Mulilo, in the close-by village of the farmer Justine and in a suburb called Mission for two farmers' trainings. In addition, I joined a seed training in Mashare and began and ended my stay in Windhoek. My research was enabled and deeply shaped by the support, networks, interests and activities of my key research partners: the NNF staff member Louise and the farmer Justine. In the context of ethnographic research, individuals who enable ethnographers to access a certain social setting are often referred to as gatekeepers (O'Reilly 2012:91). As a gatekeeper, Louise brought me in contact with many of my interlocutors, allowed me to participate in several farmers' trainings and introduced me to the farmer Justine, with whom she has worked together in several NNF projects. While Justine kindly hosted me in her village for about a month, she in turn made me acquainted with her family, friends and other farmers in her neighbourhood, and introduced me to the religious community of the Seventh-day Adventist (SDA) church, a vital pillar of social life in her neighbourhood.

It was not only professionally but also personally enriching to get to know Louise and Justine, and, at least in my perception, our relationships were based on mutual sympathy. While I stayed with Justine in her village, she for example expressed that she enjoyed staying together with me and we spent pleasant evenings in her courtyard. In contrast to such moments of closeness, the differences between Justine, Louise and myself stood out several times throughout the research. In addition to age and cultural differences, communication challenges and our different personalities, the hierarchy between Louise and Justine as well as my own privileges influenced our relationships. Justine was one of the recipient farmers of the NNF programmes implemented by Louise and in certain ways depended on her decisions and support. During the farmers' trainings to which Louise enabled Justine and me to participate, different accommodation and seating arrangements (Justine for example shared a room, while Louise and I were allocated a private one), differences in the share of speech, allocated tasks and the different access to resources like the printer further intensified the distance between Justine and me. The fact that I was growing closer to both Louise and Justine during the research sometimes resulted in a conflict of interests. At the same time, my 'double' access – through Louise and her networks, mainly in Katima Mulilo, and Justine and her networks,

mainly in and around her village – allowed me to interact with diverse interlocutors and to gain different insights into local and formal seed systems. Varying on the different research locations and groups of people I interacted with, I applied various ethnographic methods which are outlined in the following section.

### 2.1. Semi-structured interviews

In Katima Mulilo, where I stayed from March 05 to 19, 2023, I mainly conducted semi-structured guideline interviews to gain insights into formal and local seed systems. The interview type of semi-structured guideline interviews offers several advantages. While the guideline, mostly developed based on literature, the research questions and initial data, allows to focus on specific topics relevant to the research, the flexible adaptation of such guideline to the interviewee and the interview situation can facilitate a more natural conversation, the inclusion of new, unexpected topics and the omission of less relevant questions as the interview unfolds (Schlehe 2008:127). As I interviewed different stakeholders, I created a new interview guideline for each interview. An example of such a guideline can be found in Appendix A.1. In the beginning of each interview, I explained my research intentions and asked for the consent of my interlocutor to participate in the research. Then I asked if I was allowed to record the conversation with my phone, which was fine for most interviewees. A few times my interlocutors preferred me to only take handwritten notes, or I assumed this would be more appropriate. Even when an interview was recorded, I took notes during the conversation. After an interview I digitalized the jottings in more detail and transcribed the audio recording, if there was any. During remote interviews I took notes on my laptop.

Louise introduced me to most interviewees and supported the conduction of several interviews, for example by driving me to a respective office. As Louise was particularly interested in the topic of my research, she also joined some interviews which irritated me in the beginning but proved to be insightful and helpful, as she added her own questions and comments. The office of the NNF regional agricultural team, consisting of Louise and a colleague, was located in Katima Mulilo in the same building as a part of the Ministry of Agriculture, Water and Land Reform (MAWLR), the Namibian Agronomic Board (NAB), the German Corporation for International Cooperation (GIZ) and other organizations. As I was allowed to use the office, too, this facilitated the contact with many interlocutors and allowed some interviews and conversations to occur rather spontaneously. In Katima Mulilo, I interviewed staff members from MAWLR, NAB, the biggest regional maize miller as well as two seed suppliers, a representative of the Farmers' Union Likwama, the leader of the national agricultural team in NNF, a Namibian person working for GIZ and two farmers. In Windhoek, I interviewed a person who works for the National Botanical Research Institute (NBRI) and a person who is active at the

NGO Women Solidarity Namibia (WSN). In addition, I conducted telephone and zoom interviews from various locations with two members of the NGO Namibian Rural Women Assembly (NRWA), a German person who works for GIZ and a white farmer who lobbies against genetically modified maize.[3] I conducted all interviews in English or German without a translator. My interlocutors generally replied kindly and openly to my questions. Appendix A.2 provides a list of the interviews and basic information on the interviews and interviewees. Data from interviews is cited by stating the code for an interlocutor (e.g. NAB employee) and the number of the interview (i1-i18). Quotes from recorded interviews are marked by double quotation marks. To enhance the readability, they were grammatically slightly corrected without changes to their content. Quotes from non-recorded formal and informal conversations are marked by single quotation marks to highlight that I might not have caught the exact wording in my notes.

### 2.2. Participant observation and field visits

In Katima Mulilo, first opportunities for participant observation and research encounters beyond formal interviews arose. Louise and her NNF colleague in the regional agricultural team involved me in their activities from early on, including visits to farmers, compost making activities, and the preparation of farmers' trainings. Louise also invited me to the Sustainable Agriculture Forum in Katima Mulilo, where NGO and ministry workers meet every three months to exchange and coordinate their activities. During the Forum's meeting on March 14, I was allowed to present my research plan and receive feedback and first insights. Furthermore, together with a farmer who closely collaborates with Louise and who offered to translate for me, I visited the open market in Katima Mulilo to learn more about the seeds sold there. Unfortunately, the visit was not very insightful, partly due to the midday heat, rather suspicious reactions by the vendors and my difficulties in understanding the translating farmer. As I do not speak any of the local languages, the need for translation became more central once I moved to Justine's village. Justine kindly hosted me in her courtyard from March 19 to April 17, 2023. As she speaks good English, she translated for me most of the time.

At the time of my research, Justine was 53 years old and planted maize, *mahangu*, sorghum, beans, pumpkins and other vegetables and fruits in her village and a field five kilometers away. In the village, Justine lives together with four of her seven sisters and brothers on collectively owned land close to Katima Mulilo. Justine is not married and does not have children herself but helps to take care of the grandchildren of her sisters.

Living together with Justine allowed for a certain general involvement in her daily activities, including her commitment to the close-by SDA church. The church was an opportunity for me to meet more people, to become involved in some voluntary activities and to participate in a youth church camp. My attempt to follow Justine's routine and to assist her where I could,

[3] As genetically modified seeds are not (yet) legal in Namibia, they are not dealt with in this thesis.

also included tasks such as hand-copying religious instructions. Regarding cereals, Justine allowed me to join the harvesting, drying, carrying and sorting of maize cobs and the sorting of the grains which remained after pounding as well as to try the threshing and pounding of maize. When she was too tired or stressed to involve an unskilled person like me in her activities, Justine asked me to sit somewhere and wait for her. In such situations and during other activities such as winnowing I became a pure observer.

The transition between and combination of the practices of participating, that is the immersion in an activity, and observing, which involves a distant stance towards an activity and allows for its analytical description, are at the heart of the ethnographic method of participant observation (O'Reilly 2012:105f.). The method productively resolves the tension between the two at first sight contrary practices and produces new insights, which cannot (easily) be accessed by only observing or participating (ibid.:102, 105f.). While I tried to be more of a support than a burden, the more participatory or more observational participant observation in Justine's village helped me to better understand and appreciate the hard work of cereal cultivation, harvesting and processing. It filled technical terms I did not know before with life and gave me insights to local knowledge and perspectives, which also proved helpful in other research contexts.

Like other methods participant observation depends on (written) documentation, particularly on fieldnotes (O'Reilly 2012:101ff.). Fieldnotes, often based on jottings scribbled in an activity, and then later formulated in more detail, are a subjective and selective documentation of a social situation, especially of the aspects of it deemed most relevant for specific ethnographic research questions (Hammersley & Atkinson 2007:142f., 156). I usually took handwritten jottings in situations of participant observation and digitalized the notes in more detail when I was able to charge my laptop. In this thesis, I quote data from my fieldnotes by stating the code for a situation or interlocutor and the date of the quoted encounter with the suffix po to indicate the method of participant observation (for example: open market, po:09.03.). A list of the cited encounters from participant observation and their codes can be found in Appendix F. During my time in Justine's village, the second key research method consisted in field visits and semi-structured guideline conversations with farmers in neighbouring villages. Justine selected the farmers to visit and was careful not to upset anyone in her choice of where to go. Justine and I mostly visited fields and villages within walking distance. The walks of Justine and me to other farmers were a valuable opportunity for me to learn more about Justine's perspective on seeds and to ask her more questions about previous conversations with other farmers as well as to discuss these conversations with her. Two times Louise drove me to farther villages and another time Prof. Bollig drove Justine and me to her more distant field which allowed us to talk to more farmers.

We encountered the farmers on their fields, on the road or in their villages. Every conversation started with informing the farmers about the research and asking them for consent to participate in it. Following Justine's initiative, farmers were asked to collect a sample of their current harvest. This was helpful as it reduced misunderstandings that could come up due to the heterogeneous naming of cereals and gave a hint to the quality and diversity of the grown crops. I was allowed to take pictures of the samples which I also used for other methods. Justine often commented on the samples and pointed to aspects I am not trained to perceive like the grain size. Justine also translated for me in the conversations with the farmers. Especially in the beginning I sometimes had the feeling that she did not translate everything or put her own opinion inside the answers but with time we became, according to my perception, a good team. Justine put effort and ambition into the project and, for example, requested the list of questions I asked the farmers so she could continue to ask them when I was gone. In the end of a conversation, I gave the farmers a package of carrot seeds, kindly donated by NNF.
Despite their busy schedule, the farmers took some time to sit with us and answer my questions. Nevertheless, the conversations during field visits were generally shorter than the interviews described above and involved more informal and participatory observational elements. A dynamic set of guideline questions, listed in Appendix B.1, structured the conversations. Appendix B.2 provides a list of the conversations (c1-c26) and basic information on my interlocutors such as gender, estimated age and their relation to Justine (or in one case Louise). I did not record the conversations but took handwritten notes which I digitalized later. In Justine's village I already felt uncomfortable with my technological devices and other privileged items and intuitively decided not to record the conversations with my phone. However, through recording I probably would have been able to capture more details, and it is questionable if the already existing vast distance between the farmers and me would have been much affected by me using the phone to record.

## 2.3. Farmers' trainings and further methods

In addition to my comparatively longer stays in Katima Mulilo and Justine's village, I was able to participate in several training courses for farmers. A German working for GIZ in Namibia, who has specialized on seeds in his career and gave Louise and me two interviews, invited us to a seed training he organized in Mashare. The training was offered as part of the GIZ project "Farming for Resilience" and was mainly attended by farmers from the Kavango East and Kavango West Regions. Louise, Justine, two other farmers appointed by another NNF staff member and I were also able to participate. On the first day, April 04, I informed about my research in the trainings' plenary and asked for consent to include insights from the training. On that day, the German seed specialist gave a presentation on on-farm seed saving of cereals and vegetables and facilitated a group discussion on farmers' experiences with seed saving. The

second day, April 05, consisted in a field visit to a neighbouring government farm and a presentation on Conservation Agriculture by a Namibian GIZ employee. During the training I mainly listened and made notes which proved to be very informative.

The other two farmers' trainings I participated in were part of the Multiplier Support Programme (MSP) conducted by NNF in the Zambezi Region. The MSP was a series of training sessions for a selected group of 25 farmers and five mentors and included topics like production planning, agroforestry and teaching approaches. The idea of the programme was to further qualify farmers and to empower them to spread their knowledge in their communities. The mentors supported the farmers and raised funds for them. The training sessions were held by two consultants, one of the mentors and NNF employees. The two consultants and one NNF employee are German speaking Namibians. They were interested in my research and supported me, for example by recommending literature to me. I participated in the mid-course evaluation of the MSP, from March 27 to 29, and one training session, from April 17 to 21. In the introductory round of the evaluation session, I informed about my research and asked for consent. In both sessions I helped to facilitate certain slots, for example by moderating group work and instructing a fishbowl discussion. I particularly enjoyed the second session as I felt more familiar with the people and setting. During the two MSP sessions it was enriching to listen to the group discussions, and to learn more about the farmers, their situation and the programme. In addition to participating in the sessions, listening and taking notes, I conducted a small qualitative survey, a pile sorting exercise and seed sharing mental maps during the MSP sessions.

Due to the heterogeneity of the group of farmers who participated in the MSP, Louise asked me to conduct a small qualitative survey to better understand the situations of the individual farmers. In addition to gathering data on the age, gender, education level, household size, income sources and agricultural activities, I included questions on seeds (see Appendix C). In conducting the survey during both MSP sessions, time was the constraining parameter. I squeezed the small interviews for the survey into the too little breaks and free time during the programme sessions. Several times a conversation was interrupted by the continuing programme.

In addition, in the evenings, I asked four individual farmers to draw a mental map that shows with whom they have shared or exchanged seeds. The mental maps concretized examples of seed sharing networks and were accompanied by interesting conversations. When I asked one farmer in the survey where she gets her seeds from, she replied that she saves seeds, and I had assumed that she would save local seeds. However, through the mental map I understood that she was saving and sharing seeds that she had bought from a seed company before. The method hence enriched and questioned the data gathered in other methods.

Furthermore, during the training session I was allowed one slot in the programme to conduct a method of my choice with all MSP participants. After I had previously experimented with methods like free listing (which was difficult to implement as it is based on writing) and discussed with Louise and her team the limitations of a big seed sharing map, I decided to conduct a pile sorting exercise in that slot. For this exercise, I selected eleven photos from the photos I took during the conversations with farmers which picture the diversity of the cultivated cereals. In the pile sorting exercise, farmers were asked to name the cereal varieties on the picture and to sort them according to specific criteria such as drought-tolerance or marketability (see Appendix D). For this exercise, we split the MSP group into four smaller groups which were facilitated by Louise, her regional colleague, the trainer for the training session and me. This made it possible for the discussions to be more pleasant and inclusive. Furthermore, it made differences between the groups visible and pointed to a certain diversity in how the cereals were evaluated and named. After the exercise, several farmers expressed that they enjoyed the method. It also prompted discussions about traditional seeds, foods and practices in the following days. In the Appendix, selected results from the qualitative survey with MSP participants (s1-s24), the seed sharing mental maps (Appendix E) and the pile sorting exercise (Appendix D) are presented.

### 2.4. Data analysis

In the end of my stay in Namibia, I began the process of data analysis by starting to read through the data corpus. Based on this reading, selected rereading and preliminary coding, I presented first findings in a workshop shortly after I came back to Germany. On May 11, 2023, I gave a presentation about my research at the conference “The value of biodiversity knowledge from colonial origins to global heritage” organized by the Leibniz Institute for the Analysis of Biodiversity Change in Bonn. The presentation also formed the basis for the preliminary summary of my findings which I sent Louise in form of a power point presentation. She shared the presentation with Justine and further research participants, and presented it at the next Sustainable Agriculture Forum on June 13, 2023 (as the zoom connection did not work on that day, I was not able to present it myself). On June 22, I then held a presentation focused on the (historic) relation of maize, *mahangu* and sorghum in the Zambezi Region during the Summer Symposium 2023 organized by the Frobenius-Institute in Frankfurt. Under the pressure of these presentations, I rather quickly generated summaries of my data and a first literature analysis. Thereby, I already identified many themes and observations which are central to this thesis. At the same time, I felt the need for a more systematic data analysis.

For this, I read closely through the data again, completed the open coding and restructured the data according to 16 themes or code classes which had emerged through the open coding (cf. Emerson et al. 1995:141ff., 159). Ethnographic codes refer to “a word or short

phrase that captures and signals what is going on in a piece of data in a way that links it to some more general analytic issue" (ibid.:146). Thereby, patterns and connections within the data are established and put in relation to emerging analytical and theoretical concerns (ibid.:149f.). This approach is built upon the Grounded Theory which seeks to inductively develop theoretical contributions out of empirical data sets (ibid.:143). However, the whole ethnographic process, including the generation and analysis of data, is informed by theoretical views, commitments and interpretations (ibid.:144, 159, 167). Although data and theory are therefore inextricably linked, the process of coding is inductive in the sense that the creation of theoretically relevant meanings starts with and is anchored in the (undoubtably theoretically shaped) data (ibid.:154, 166f.). This process is dynamic and codes and analytical themes are likely to evolve throughout the analysis (ibid.:153f.). To develop a broader narrative, I grouped the 16 classes of codes I identified in different clusters, while the focus of these clusters and the attribution of the individual code classes to them changed over time. Overall, the clusters were related either to cereal agrobiodiversity or to seed systems. As mentioned in the introduction, these two topics are linked to different bodies of literature. Therefore, when I identified specific aspects of scientific debates around agrobiodiversity or seed systems that productively connect with an empirical cluster, the different connections to the literature did not necessarily relate to each other. Because of that, I decided against a usual theoretical section and instead describe the respective key concepts and (theoretical) stances from the literature in front of the empirical section to which they closely link. In the discussion, the different perspectives are compared and brought together.

## 3. Cereal farming in the Zambezi Region

The following section outlines the socioeconomic and environmental conditions in which cereal cultivation and thus also cereal agrobiodiversity and seed systems are embedded in the Zambezi Region. It starts with a brief background on the region, its history and economic situation.

### 3.1. Regional background

The Zambezi Region in Northeast Namibia lies on the edge of Namibia, but in the heart of Southern Africa, bordering Angola, Botswana, Zambia and Zimbabwe (Kangumu 2011:8ff.). The borders of the Zambezi Region do not follow environmental or cultural boundaries (Mendelsohn & Roberts 1997:4). The area became part of the German colony South West Africa after the strip of land was granted to Germany in a bilateral settlement with Great Britain in 1890 (Kangumu 2011:3). It was then firstly named Caprivi Strip after the German chancellor Leo Graf von Caprivi (ibid.:3). Germany had been interested in the region due to geostrategic reasons, in particular its access to the Zambezi River (Hangula 2010:XII; Kangumu 2011:161). However, as the rapids of the Zambezi River hindered the realization of colonial ambitions such as the establishment of a connection to East Africa, the Germans appeared to have lost interest in the region and it was neglected throughout most of the 20$^{th}$ century (Hangula 2010:XII; Kangumu 2011:265). Before 1992, the Zambezi Region had not only been subject to three colonial governments, Germany, Britain and South Africa, but also administered through three separate countries, South West Africa, Botswana and South Africa (Mendelsohn & Roberts 1997:8). Spheres such as education and health were transferred to missionaries and adjacent territories, including the territory of what today is Zambia (Kangumu 2011:266f.). Kangumu (2011:9) argues that the history of political neglect coupled with the fact that the Zambezi Region shares more similarities with its neighbouring countries than the rest of Namibia have contributed to a separate and troubled regional identity characterized by a feeling of non-belonging.

The Masubiya and Mafwe are the biggest ethnic groups, and groups like the Mayeyi, Mbukushu, Barakwengo (San) and Matotela smaller ethnic groups living in the Zambezi Region (Kangumu 2011:4ff., 269). An assessment in 2001 found that Sisubiya was the most common spoken language, followed by Sifwe and Lozi as well as smaller numbers of Siyeyi and Totela speakers, while several San languages were not recorded (ibid.:8). Due to the precolonial Lozi domination, people living in the Zambezi Region were often misclassified as Lozis (ibid.:7, 187). However, Kangumu stresses that the inhabitants of the region rejected and resisted the Lozi domination and did not self-identify with them (ibid.:187f.). Nevertheless, during European colonialism, Lozi was established as the lingua franca, used in school education and as a political means to overcome tensions between the Masubiya and Mafwe (ibid.:7). Both groups compete for the status of being Indigenous to the land and hence of being rightful

owners of resources and land, but the colonial powers denied their ancestral claims (ibid.:187ff., 269).

Land distribution and agriculture have been significantly shaped by settler colonialism in Namibia. From about 1890 onwards, land was unequally distributed to the benefits of white farmers, whereas African farmers were largely disconnected from suitable farming land and agricultural markets (Frøystad et al. 2009:3; Hulke 2022:26). Up to today, the agricultural system in Namibia is characterized by the contrast of large private commercial farms and smallholder subsistence farmers who mostly farm on communal land in the north of the country (Siyambango et al. 2022:254). Despite the postcolonial attempts to reallocate land and to re-establish communal land rights, colonial legacies and structural disadvantages of the northern regions continue also after the independence of Namibia, for instance in the form of limited infrastructure in the north (Hulke 2022:26f.). Moreover, high inequalities in terms of income and wealth persist in Namibia (Frøystad et al. 2009:1). The Zambezi Region is characterised by high poverty and unemployment, including a high youth unemployment rate (Aring et al. 2021:934, 941f.). Half of the people aged between 15 and 34 were unemployed in 2018 (Hulke 2022:27f.). In 2011, around 39% of the population in the Zambezi Region lived below the upper poverty rate and around 23% below the lower poverty rate (ibid.:27f.). Many households rely on state subsidies such as pension and drought relief for survival (Aring et al. 2021:941f.).

Most people secure their livelihood through a combination of farming and non-farming activities, with piecework, pension and small businesses being common non-agricultural income sources (Kamwi et al. 2018:13081f.). Further income sources include the selling of poles, reeds and thatching grass, construction, yokes making and the weaving of baskets or sewing (Kiesel et al. 2022:142). Young people increasingly see their future in non-agricultural projects (Aring et al. 2021:945f.). However, limited access to education and funding makes it currently difficult to start livelihood activities like shops or bakeries as an alternative to agriculture (Kiesel et al. 2022:146). In a study carried out by Kamwi et al. (2018:13081) about 20% of the respondents in the Zambezi Region never attended school, 25% attended grade 1-7 and 55% attended grade 8-12. In a focus group discussion, farmers in the Oshana Region in Northern Namibia criticized the poor quality of the public schooling which for example does not prepare children well enough for the national exams (Dohr et al. 2015:143). In addition, there are little opportunities for formal employment in rural areas in Namibia and young people increasingly migrate to cities (Davies et al. 2020:276). In the Zambezi Region, Katima Mulilo is the biggest city. It has been the economic, political, social and religious centre of the region for a long time and has been the capital and administrative centre of the Zambezi Region (priorly of Eastern Caprivi) since 1935 (Kangumu 2011:176f.). Despite the increasing urbanization, most people in the Zambezi Region continue to live in rural areas. In 2016, this applied to 70% of the around 100 000 inhabitants of the Region (NSA 2017:29).

The importance of non-agricultural income sources notwithstanding, agriculture remains the main source of livelihood for the majority of the population in the Zambezi Region (Aring et al. 2021:934). In addition to its contribution to subsistence and livelihoods, crop cultivation is also seen as a vital part of the local culture (Hulke et al. 2021:114; Kiesel et al. 2022:142). Most farmers in the region are small-scale farmers who cultivate less than three hectares (Kiesel et al. 2022:142). Many farmers combine subsistence agriculture with the selling of an agricultural surplus, but intensive commercial farming is not widespread in the Zambezi Region (Hulke et al. 2021:105, 117f.; Kiesel et al. 2022:142). Market access continues to be difficult for the farmers as the transport to markets amounts to a costly and logistical challenge (miller, i4; NNF team leader, i6; farmer, i12; Hulke et al. 2021:114). Which further challenges do small-scale farmers face and how is their crop cultivation characterized in the Zambezi Region?

### 3.2. Farming characteristics and challenges

Farming in the Zambezi Region is often classified as “low input – low output” cultivation (Mendelsohn & Roberts 1997:28). Farmers primarily cultivate cereals without the application of chemical fertilization and the most common organic fertilizer, if any is used, is kraal manure (Mendelsohn 2006:36; Wanga et al. 2022:7). The soil in most areas of the Zambezi Region has a high sand content and is of poor fertility, while practices such as slash-and-burn-cultivation further lead to soil degradation (Kiesel et al. 2022:141, 143). NNF promotes farming practices such as mulching and compost making to improve soils, but these practices are very labour intensive (NNF employee, po:08.03.). The lack of nutrients in the soil is one of the factors that contribute to low maize yields (Kiesel et al. 2022:141). Although the Zambezi Region is the Namibian region with the second largest area on which registered white maize is cultivated, in the 2020/2021 season it for example only provided around 9% of the marketed produce in the country (NAB 2021:5f.). Rainfed maize production in the Zambezi Region yields on average 1 ton per hectare, which is significantly lower than the 12 tons per hectare which can be potentially harvested in irrigated systems in the country (ibid.:7).

In the Zambezi Region, as mentioned in the introduction, farming is predominantly rainfed (Mendelsohn 2006:36). The maize cropping season lasts from November until April and the annual rainfall averages 600 mm (Kiesel et al. 2022:142). Small rains can already start in October, with heavy rains following in November and the rainfall peaking in January and February (Mendelsohn & Roberts 1997:6). In national comparison, the Zambezi Region has above average rainfall, less evaporation and a warmer winter than the rest of Namibia, which is Southern Africa’s driest country (Mendelsohn & Roberts 1997:6; Siyambango et al. 2022:251). However, the rainfall is highly variable, both temporally and spatially, and serious droughts can occur (Mendelsohn & Roberts 1997:6f.). Kiesel et al. (2022:141) estimate that in one third of the years the rainfall does not reach the minimum of 500 mm needed for maize production.

During my research farmers often highlighted the lack of consistent rain as the main challenge for cereal cultivation (e.g. farmers, c2; c4; c5). An agricultural scientific officer (i1) and several farmers (s7; i17) referred to climate change as the cause for the increasingly insufficient and sporadic rainfall. One farmer (i17) for example explained that 'the problem is rain, it's not like the previous years, but now it's climate change'. When the amount of rain received is too little, the cereal yield is significantly reduced, which can result in a complete failure of harvest (e.g. farmer, c2; agricultural researcher, po:08.03.). When something can still be harvested, water stress decreases the grain size and, when milled, the quality of the meal (miller, i4; farmer, c7). Moreover, droughts make cereal plants more susceptible to pests and diseases (farmer, c7).
Small-scale farmers are particularly vulnerable to droughts due to their high dependence on rain and low adaptive capacity (Kiesel et al. 2022:141). In Northeast Namibia, the current lack of financial resources is identified as the biggest challenge for climate change adaptation (Lazaroff et al. 2021:60f.). Most farmers have no access to capital or loans and the subsidies by the government are described as unreliable (Aring et al. 2021:940f.). Because of the lack of financial resources, irrigation systems are not available for most farmers (Kiesel et al. 2022:142; farmer, i10). During my research, in some cases farmers had a certain irrigation infrastructure at their disposal, but this infrastructure lacked essential components, for example due to a missing or broken pump (NNF team leader, i6; Justine, po:19.03.). NNF plans a cluster-farming project in which groups of ten to fifteen farmers share an improved access to water. In such a system, mechanisms are planned which ensure that the costs for repairing and maintaining the water infrastructure can be borne (NNF team leader, i6). One farmer (c15) stressed that the government should support farmers in creating or improving their water access and problematized the lack of such support. The national Green Scheme programme conducted by the government tried to expand irrigated agriculture in the country but did not meet its initial goals and irrigation remains unaffordable for many Namibians (Siyambango et al. 2022:261; seed supplier 1, i7). In addition, accessing water from rivers and canals is politicised as there are divergent opinions in which way the re-channelling of the accessible water to agricultural irrigation could impact biodiversity and connected tourism in the Zambezi Region (NNF team leader, i6; agricultural researcher, po:08.03.). In addition to the lack of rain, a young NFF employee (po:08.03.) highlighted the occurrence of wildlife as another central challenge to small-scale farming, once expressing his frustration that the NGO only teaches farmers 'to grow food for the wild animals' or to grow food which does not grow after all due to the unpredictability of the rain.

Hulke et al. (2021) illustrate the tension between the ambition of nature conservation and agricultural intensification in the Zambezi Region. As fertile land and land close to rivers is reserved for conservation and tourism aims, farmers in conservation areas are for example disadvantaged (Hulke et al. 2021:111, 113). Furthermore, while conservation areas expand

and wildlife and human populations increase, human-wildlife conflicts intensify, which result in the damage and loss of crops as well as perceived and actual threats to property and safety (Fabiano et al. 2023:306f.). Crop farming is the livelihood activity most significantly threatened by human-wildlife conflicts, with elephants causing most crop damage (ibid.:315, 322). However, the compensation paid in cases of crop raiding is too low and unreliable (Kiesel et al. 2022:145). During my research, in particular elephants (e.g. farmer, i12), buffalos (miller, i4), baboons (pile sorting, po:18.04.), hippos (agricultural technician, i5), and ground squirrels (WSN worker, i19) were singled out as problematic wildlife species. Protecting crops from elephants includes practices such as the making of noises, fire and the presence of people which results in a lot of labour and costs (seed training, po:05.04.; agricultural technician, i5).

My interlocutors also emphasized the damaging effects of birds, especially for *mahangu* and sorghum (e.g. seed training, po:05.04.). One farmer (i12) narrated that small birds which arrive in big swarms of up to thousand birds can eat the whole small grain[4] harvest in a few days. My interlocutors mentioned diverse bird species, including (black) doves (e.g. Justine, po:14.04.), red-billed quelea (commercial farmer, i11), hornbills and green wood hoopoe (e.g. farmer, c26) and Meyer's parrot (pile sorting, po:18.04.). Farmers apply several strategies to protect their plants from birds. Some put plastic bags around the seed heads (e.g. farmer, c26). Others try to scare the birds away, using ropes, tins and drums to produce loud noise (e.g. farmer, c4). During an interview (i12) one farmer showed Louise and me a wind-powered mechanical construction that produces noise to scare the birds away, but which was momentarily broken due to rainfall. During the seed training in Mashare (po:05.04.), farmers mentioned that bird-scaring is a very time-consuming activity when done by people and sometimes achieves only short-term results as the deterring impact can be reduced with the birds getting used to seeing human beings. Further challenges to cereal farming include population growth and land conflicts (seed supplier 1, i7), gender inequality (NRWA worker, i14), theft (Justine, po:14.04.), and livestock such as cattle and goats (pile sorting, po:18.04.).

Labour intensive activities such as the protecting of crops from wildlife used to be carried out with more support from family members. However, my interlocutors emphasized that the cohesion of families and communities is eroding, and that people increasingly become independent of each other, so that it becomes more difficult for farmers to protect the crops and to implement labour intensive farming methods such as mulching (NNF team leader, i6; GIZ employee, i9). Urbanization has increased the shortage of labour in the villages and thus contributes to higher workloads for the, often elderly, farmers who remain in rural areas (Davies et al. 2020:276). This particularly affects women as they have the primary responsibility for food crops and food security and undertake most of the agricultural work (Mendelsohn

[4] 'Small grains' is an umbrella term for certain cereal species like millets. In this thesis I use it to refer to sorghum and *mahangu* in the case of Namibia.

2006:34; Dohr et al. 2015:82). In Northern Namibia, labour is distributed between the genders in a way that men are responsible for livestock, ploughing, sowing, harvesting and further tasks such as construction (Dohr et al. 2015:78). Women are responsible for seeds, in particular the activities of selecting, drying, threshing, cleaning, storing and controlling seeds, in addition to tasks such as weeding and pounding and further responsibilities such as the fetching of firewood and water (ibid.:77f., 53ff.). My interlocutors described women as the guardians or custodians of seeds (farmer, i12; Louise, po:12.04.). When I asked one farmer more detailed questions about the seeds he used, he for example referred me to his wife, stating that seeds are within her area of responsibility as woman (farmer, i12). Although both men and women cultivate cereals and handle seeds in the region (e.g. Justine, po:21.03.; NRWA worker, i14), cereal cultivation and the propagation of seeds are hence traditionally seen as female activities (NBRI employee, i18).

## 4. Agrobiodiversity in transition

In Northeast Namibia, the three dominant staple crops grown by smallholder farmers are maize (*zea mays*), *mahangu* (*pennisetum glaucum*) and sorghum (*sorghum bicolor*) (Lazaroff et al. 2021:36; Siyambango et al. 2022:254). However, the local significance and interrelation of the three cereal species has changed profoundly over the last centuries. This is connected to the farming challenges outlined in the previous section.

### 4.1. Conceptual and historical background

Which and how many species and varieties are grown is a central component of agrobiodiversity. To embed the story of maize, *mahangu* and sorghum in the Zambezi Region in wider concerns of agrobiodiversity (loss), the following section starts by asking more general questions. What is agrobiodiversity and how is it connected to sociocultural contexts? Why is agrobiodiversity important? What drives its loss?

#### 4.1.1. Agrobiodiversity and its loss

Agrobiodiversity refers to "the variety and variability of animals, plants and micro-organisms that are important to food and agriculture, which result from the interaction between the environment, genetic resources and the management systems and practices used by people" (FAO 1999). Agrobiodiversity has many advantages and constitutes the foundation for food and nutritional security as well as the sustainability, resilience and profitability of agriculture (Rampersad et al. 2023:986; Ray 2023:80). In addition, agrobiodiversity helps to secure against environmental shocks, pests and diseases and fulfils diverse societal needs (Pottier 1999:123). To enhance agrobiodiversity can also increase the adaptability and resilience of agricultural systems to climate change (Maseno & Chitando 2024:13).

Agrobiodiversity is often measured through a biological analysis of the molecular diversity of plants (Ray 2023:81). However, to understand the rise and decline of agrobiodiversity, socio-cultural, economic, political and historical dynamics must be considered (ibid.:81). Over millennia farmers have created, maintained and modified an enormous variety of crops and further food sources (Pottier 1999:123). As crop agrobiodiversity is produced and continuously developed in human-plant-relationships, Curry (2022:12) speaks of the "sociality of crop species". Furthermore, agrobiodiversity is inextricably linked with cultural diversity (Orlove & Brush 1996:342; Swiderska et al. 2022). Swiderska et al. (2022:2) use the term "food-related biocultural diversity" to stress that cultural practices, values and views essentially contribute to the creation and ongoing cultivation of diverse varieties.

For example, one factor which has driven the high diversity of potato and maize varieties in the Andes has been their fit with culinary requests and taste preferences (Howard 2003:9). Furthermore, the importance of local values for crop diversity can for instance be

illustrated by Miyawaki's (1996) case study on sorghum varieties in Southwestern Ethiopia. He argues that the utility of varieties impacts the spread and decline of indigenous varieties, but that farmers do not consciously disregard indigenous varieties as they are keen to keep the varieties, which they have received from their kin upon marriage or through seed sharing interactions in their neighbourhood (Miyawaki 1996:109). Only when external factors such as droughts make farmers lose a variety, they will ask other farmers for a variety best suited for cultivation (ibid.:109). Environmental shocks and the replacement of local varieties with globally dominant crops and 'modern' cultivars are main causes of agrobiodiversity loss (Khoury et al. 2022:92). This is also the case in the Oshana Region in Northern Namibia, where increasingly erratic rainfall and droughts result in an increased loss of local seeds which are often replaced by formal seeds promoted by the government and other institutions (Dohr et al. 2015:38ff.). In general, the spread of formal seed systems and 'modern' agricultural practices are further causes of agrobiodiversity loss as well as the increasing globalization of markets and processes like urbanization (Moreta et al. 2015:4; Khoury et al. 2022:92). Pottier (1999:126) argues that the wide-spread loss of agrobiodiversity started with the commodification of crops connected to the spread of colonial markets and intensified with the Green Revolution. The Green Revolution in the 1960s has disseminated few high-yielding but input-dependent rice and wheat varieties on a large scale in Asia and Latin America and thereby caused a decline in other cereal species and varieties, resulted in a dependence on external inputs, increased inequalities and led to socioecological degradation (Kloppenburg 1988:6; Ray 2023:80f.). Since then, food systems have globally become more and more homogenized and especially three cereals, maize, wheat and rice, have spread at the expense of other cereal, oil and starchy species (Khoury et al. 2014). Although human beings have cultivated and collected 7 000 plant species throughout history, nowadays only 20 species supply 90% of the world's food needs, and maize, wheat, and rice, make up 60% of the human diet (Chivenge et al. 2015:5689).

The loss of agrobiodiversity goes hand in hand with the endangerment of associated cultural diversity, including local knowledge and Indigenous languages (Khoury et al. 2022:87). Gronemeyer et al. (2015:3) speak of "cultural deforestation" to refer to the parallel degradation of natural resources with the weakening of social bonds, village structure and food and nutritional security in Malawi. The spread of 'modern' food and seeds and industrial agriculture has, in combination with developments such as urbanization and youth outmigration, contributed to a decline of community cohesion, cultural practices and beliefs (Swiderska et al. 2022:8f.). Colonialism has also importantly driven agrobiodiversity loss. Mamati and Omare (2024:210ff.) for example highlight in the case of Kenya that the enforcement of European settler interests had caused a disruption of Indigenous agricultural practices, a loss of land and cultural identity and the discontinuation of local, nutritious crops. They generally stress the mental impact of

colonialism which has pushed Africans to devalue and abandon their Indigenous agricultural practices, knowledge and food in favour of changes according to imperial taste (ibid.:212f.).

Indigenous crops like sorghum, millets and cowpeas are often very nutritious (Swiderska et al. 2022:12). Sorghum for example contains many antioxidants and macro- and micronutrients (Wanga et al. 2022:1). Maize grains only obtain little amounts of high-quality proteins and minerals, so that maize-based diets can lead to malnutrition and diseases like Pellagra (Rouanet 1987:4; McCann 2005:7). Nevertheless, maize has largely replaced sorghum and millets in Africa. To this day, maize is the most important cereal crop on the continent, used both for subsistence and agroindustry, with 90% of the maize grown in Africa being white maize intended for human consumption (McCann 2005:11f.). How did maize spread on the African continent?

#### 4.1.2. Rise of maize in (Southern) Africa

Maize originates from Central America, where humans presumably developed it from the related grass plant *teosinte* (Rouanet 1987:1). After thousands of years of cultivation and crop improvement, domesticated maize occurred in more than two hundred different subpopulations before Colombus set foot on the Americas (Curry 2022:9). From the 16$^{th}$ and 17$^{th}$ century onwards maize varieties spread worldwide, including to and on the African continent (Rouanet 1987:1f.). The exact ways in which maize arrived to and spread in Africa are controversial but scholars assume that the crop had multiply entry points and routes, being dispersed via Arab traders from the north of Africa through the Sahara, and by colonial powers, particularly the Portuguese, to the West and East African coast (Miracle 1965; McCann 2005:23ff.). Mircale (1965:42-44) argues that the Portuguese had significant incentives to initiate and/or expand maize production as maize was perceived as the most economic crop to feed enslaved people. The spread of maize on the African continent benefited and escalated slavery (Cherniwchan & Moreno-Cruz 2019). In addition to colonial undertakings, maize spread rapidly on the continent as the crop was also adapted by African farmers as a tradeable, relatively easily cultivatable, and processable high-yielding food crop (Miracle 1965:45). In Central Africa, maize and cassava widely replaced locally rooted millet and sorghum varieties (ibid.:47). For West Africa, too, European references indicate that maize had substituted millets and sorghums in coastal regions within the seventeenth century and was seen as a primary regional crop by the eighteenth century (McCann 2005:24). Nevertheless, maize had different trajectories in different African regions as it spread across diverse socioecological settings (ibid.:53).

Maize reached Southern Africa presumably in the 17$^{th}$ century via Portuguese traders and African farmers at first integrated it into existing agricultural systems as a vegetable crop, while sorghum and millets remained the dominant cereal crops (ibid.:26, 35). McCann (2005:94ff.) argues that maize's trajectory in Southern Africa became then intertwined with the

specific regional history of European settler colonialism, mining, industrialization, connected labour migration of African men and the resulting feminization of agriculture. According to McCann, maize transformed from a surplus vegetable into the dominant cereal crop mainly through two interconnected processes. On the one hand, the labour migration of men pushed African female farmers to grow maize due to its low labour requirements and its good marketability in mining centers (ibid.:108ff.). Around 1930 maize had replaced sorghum as a market and subsistence crop (ibid.:110f.). On the other hand, the import of white dent maize varieties from North America allowed white settler farmers to cultivate maize on a large-scale for commercial purposes, including for export (ibid.:105f.). The international market and millers rewarded it when plants were uniform in both quality as well as look (ibid.:115). As a result, certain white maize varieties which were internationally most competitive were standardized and pushed through by white commercial farmers, colonial politics and the design of the milling and market infrastructure around them (ibid.:114ff.). In effect, also the maize grown by African farmers turned mostly white within the 20th century, even though African farmers historically cultivated and preferred a colourful range of maize varieties (ibid.:113ff., 202).

Studies on small grains in Zimbabwe further illustrate how deeply the large-scale abandonment of crops previously cultivated by African farmers is linked to colonialism. Kauma (2021 b) emphasizes that the history of small grains was not linear in Zimbabwe, with both African and colonial settler farmers handling (small) grains heterogeneously, and with African farmers enacting agency in multiple ways. Nevertheless, the systematic underdevelopment of African agriculture and the advancement of a small number of crops like white maize by colonial powers largely resulted in the decline of small grain cultivation and consumption in the country (Kauma 2021 b). In Southern Rhodesia (contemporary Zimbabwe), the colonial government aggressively suppressed cereal varieties grown by African farmers to promote maize grown by white settlers and to ensure its profitability (Kauma 2021 a). For example, the so-called Maize Control Act from 1930 discriminated against small grains and African farmers by institutionalizing lower prices for grains from the regions where they farmed (Kauma 2021 a). At the same time, elders explain that farmers abandoned traditional millet and sorghum varieties in favour of environmentally less suited maize, because both the ceremonial importance of the crops and their prestige had declined due to colonialism and Christianization (Pottier 1999:126f.). As a result of colonialism, the myth of sorghum and pearl millet as being less nutritious and second-rated spread widely, while Indigenous African foods prepared from these grains were framed as inferior and as ‘unworthy’ for Europeans (National Research Council 1996:12f.; Mamati & Omare 2024:211).[5] Due to such stigmatization of small grains the emerging urban African bourgeoisie in Zimbabwe for example changed from small grain to maize

[5] Kauma (2021 b:64) points out that also Indigenous African myths exist which present small grains as less nutritious and lower yielding than grains like maize.

consumption to express their financial and social status (Kauma & Swart 2021). Even after independence, some governments in Zimbabwe (Kauma & Swart 2022) and Zambia (Pottier 1999:170ff.) continued to focus on (hybrid) maize and to neglect other crops as they followed a colonial idea that equated maize with farming progress, and thereby induced or aggravated food insecurity.

What trajectory did maize have in (Northeast) Namibia? Maize was presumably introduced to Namibia both from the south and north of the country and when colonial sources started to document its cultivation from the 19th century onwards, maize had already been established in the country (Irish 2012 a). Nevertheless, maize at first played a rather minor role. Based on travel in 1905 and 1906, the Austrian Seiner (1909:32-34) reported that sorghum was the most dominant cereal crop in Northeast Namibia, followed by *mahangu*. He mentioned that maize was cultivated but argued normatively that it did not have the dominant position it should have (ibid.:34). At the end of the 20th century, this ratio had changed in the region. In 1997, Mendelsohn and Roberts (1997:28) stated that *mahangu* was now the most central crop, grown on 47% of cultivated cereal land in the Zambezi Region (previously called Caprivi-Strip), followed by sorghum (27%) and maize (26%). Nowadays, sorghum and *mahangu* continue to be staple cereal crops in Namibia and are used for multiple food and non-food-related purposes, but especially sorghum has been largely replaced by maize (van Wyk & Gericke 2017:12, 14). Currently, maize is the most important commercial cereal crop in Namibia (Siyambango et al. 2022:254) and the most dominant crop in Katima Mulilo Rural (Wanga et al. 2022:8).

### 4.2. Maize, *mahangu* and sorghum in the Zambezi Region

One farmer (i17) told me that most farmers in the Zambezi Region increasingly move away from cultivating sorghum and *mahangu* and now mainly plant maize as the only cereal crop. She herself farms in the southeast of the Zambezi Region and said that she is aware of only one farmer in her surroundings who still grows sorghum (farmer, i17). From 44 farmers I talked to, 15 farmers indeed indicated that they only planted maize and no *mahangu* or sorghum in the 2022/2023 season. However, about as many (n=16) planted all three cereal crops. The remaining farmers planted either maize and *mahangu* (n=7), maize and sorghum (n=3) or *mahangu* and sorghum (n=3). Yet, even if several cereals are planted, maize dominates both the fields and diets, currently followed by *mahangu* and then sorghum (agricultural technician, i5). Why has maize come to dominate cereal consumption and cultivation in the Zambezi Region?

### 4.2.1. Changes in cereal consumption

A group of 'youth senior leaders' who gathered during a youth church camp in Justine's church highlighted profound changes in diet in a discussion about their cultural heritage and its depletion (church camp, po:01.04.). In the discussion, the youth leaders covered various topics, ranging from clothes suitable for women to wear and rules during their menstrual period to correct funeral practices. Regarding food, one elderly man problematized the transition from healthy foods of the past, such as water lilies, to processed food which came to them 'with the white man'. Particularly, he problematized that 'modern' food has less nutrients and is less healthy, for instance due to chemicals and added sugars, which lead to health problems such as diabetes.

In a discussion about past and present foods during the MSP training, many participating farmers shared this evaluation and provided more nuanced insights into transforming food ways (MSP discussion, po:20.04.). The farmers recounted rich stories about past common ways of preparing and eating special fruits, nuts, roots, tree barks, milk, livestock and wild animals. They also mentioned traditional tools and utensils and touched upon practices of making fire and producing oil, soap and medicine. Many cultural rules and beliefs were mentioned, too. For example, previously it was believed that women should not eat eggs as it would hinder them from giving birth and one woman commented that this prior prohibition is the reason why they like to eat egg so much now.[6] Regarding cereal consumption, it was elaborated that cereal porridge, which is locally called 'pap', used to be eaten in various ways, for example with sour milk, with honey or with salt. Meat and pap were eaten separately and not mixed. Grains which were too small to be pounded could be soaked and cooked like rice. Sometimes the water in which grains were soaked or the ash of burnt maize stems were used for traditional dishes.

When recalling traditional dishes, some farmers stated that they have not eaten them for some time and that only a handful of people still eat them. Nonetheless, the old food ways are not completely abandoned. One farmer voiced that her mother is 'good in preparing food from the past' and talked about a traditional dish she ate at home the week before. In general, however, farmers stressed that they now eat a lot of processed and new food. In the discussion they described food like bread, pasta, cakes and soft drinks as tasty. While I stayed in her village, Justine mainly ate her own food but once she was having white bread and a soft drink for breakfast and expressed how much she enjoyed that (Justine, po:13.04). When I asked two children at church what they ate for breakfast they replied rice and bread (church, po:13.04.).

[6] In Zimbabwe, Kauma (2021 b:71) recalls a similar taboo according to which pregnant women were not permitted to eat eggs.

In the case of cereals, the change in diet has especially affected the consumption of small grains. A farmer described that sorghum together with maize 'was our food, even long time ago' (Likwama representative, i15). However, the consumption of sorghum has largely changed as another farmer (i2) expressed: "if you eat sorghum today and then you have these kids who are growing up to 15, 20 years without seeing sorghum. Even if you bring them the sorghum, they won't accept it". An NNF staff member stated that he used to eat a lot more sorghum as a child, also mentioning a traditional sorghum dish his grandmother used to make, but that he nowadays eats only little sorghum (car ride, po:22.04.). In the case of *mahangu*, too, Justine (po:13.04.) told me that she used to eat more *mahangu* in the past and that her parents for example used to prepare a special sweet bread out of *mahangu*. In contrast to the decline of small grain consumption, maize and maize pap were described as a continuous staple (car ride, po:22.04.). A person working for NAB (i13) stated: "we always have maize". In contrast to *mahangu*, he describes maize as "something that we have been eating from childhood. We are eating pap every day, so we are used to it. *Mahangu* you can go many days without but white maize – it's a staple food" (NAB employee, i13). One seed supplier highlighted the importance of maize as it is deeply rooted in the region and "is this traditional thing that you are traditionally used to maize" (seed supplier 2, i16).

During the pile sorting exercise (po:18.04.) the farmers of all groups classified most *mahangu*, sorghum, and maize varieties as traditional varieties from their ancestors. However, the rootedness and state of small grains is slightly contested and varies geographically. Sorghum and *mahangu* were domesticated in Northern Africa around 5000 and 4000 years ago, respectively, and have been grown in the north of Namibia since before the time of written historical records (Irish 2012 b & c). During the pile sorting exercise (po:18.04.) my group controversially discussed whether sorghum varieties are originally from the Zambezi Region or from Botswana. In Botswana sorghum is much wider cultivated and consumed (farmer, i10; commercial farmer, i11). When it comes to *mahangu*, one farmer shared the observation that in the past more sorghum was grown than *mahangu* (farmer, s3). Another farmer remarked that in the past *mahangu* 'was not our food here in this region', while it is being consumed now (Likwama representative, i15). Traditional *mahangu* varieties are often seen as originating in Northcentral Namibia (e.g. farmers, c13; c16). In specific areas of the Zambezi Region, for example on the clay soils in the flood plains, *mahangu* is more prominent than in others (farmer, i10; i12). When I mentioned to a farmer who farms close to Kongola that I only observe people eating maize pap around Katima Mulilo, he told me that he himself often eats *mahangu* and not only maize pap, planting three hectares of white maize and two hectares of *mahangu* (seed training, po:04.04.). Changes in small grain consumption are hence neither linear nor uniform.

The farmers participating in the MSP training evaluated the changes in diet differently. On the one hand, the farmers associated them with an increase in both population and Western knowledge (MSP discussion, po:20.04.). One farmer evaluated the changes as positive and stated during the discussion that people 'cannot live in the past'. In an interview, a regional miller (i4) framed the changes in consumption as an expression of "society evolving to a certain point". On the other hand, during the MSP discussion (po:20.04.), the farmers stressed several advantages of the past food ways. One farmer summarized: 'we were not really suffering. Nature provided what we needed'. Another farmer stated that no one was staying with hunger as daily practices ensured that food was distributed among everyone. People were said to be strong and healthy. In an MSP group discussion the day before (po:19.04.), a farmer acknowledged that there had been good and less good aspects in their traditions. She and the other participating farmers emphasized that regardless of this, colonialization and missionizing have destroyed traditional practices and knowledge completely (MSP discussion, po:19.04.). Several farmers stated that therefore their (food) culture 'is gone', including the knowledge and practice of preparing and eating traditional foods. They lamented that younger people will not try water lilies or do not like the taste of sorghum pap anymore.

### 4.2.2. Cereal cultivation and marketing

While general societal changes shaped by colonialism and globalization impacted the decrease of small grain consumption in the Zambezi Region, my interlocutors highlighted two specific factors as decisive for the increase in maize cultivation: the marketability and the low labour intensity of maize. The former is especially crucial, and one farmer explained the dominance of maize on the fields by stating: "Yes, *mahangu* can grow better than the maize but since we are used to maize also for marketing – it has got also a market for the local consumption and even outside the region (…). That's why we are mainly focused on maize production" (farmer, i2). Another farmer elaborated: 'In the past, they were planting plenty, plenty of sorghum and *mauza* (…). But nowadays they left *mauza* and sorghum. Now they are planting maize because of money'[7] (farmer, i17). The increased importance of money is a critical change for small-scale farmers in the Zambezi Region. For many areas of life, such as schooling, clothing and food, money is nowadays required (Aring et al. 2021:941). Justine (po:20.03.) once stated: 'Today one needs money, and we don't have money'. A Namibian GIZ employee (i9) explained that in the GIZ programme "Farmer Business School" they try to 'change the mindset of people from subsistence to entrepreneurship (…) because it is the stage where we are living in now, everything is becoming buy and sell'. An agricultural scientific officer (i1) at MAWLR explained, too, that due to the changing circumstances and the fact that farmers now

[7] *Mauza* is another local term for *mahangu*, pearl millet.

also invest money in their fields, they should be earning money from it and a “move from subsistence farming into, you know, farming for business” should be encouraged.

Most farmers I talked to cultivate cereals both for consumption and, depending on the harvest, for the selling of a surplus. However, eleven farmers stated that they only planted for subsistence in that season. Justine (po:17.04.) for example elaborated that she is ‘too old’ for selling her produce and instead cultivates enough for home consumption. Due to climate change and further challenges, the harvest is sometimes not enough for consumption, let alone selling (farmers, c3; c14). If farmers do obtain a surplus, they sell it formally and informally and also give seeds and grains to people in need (e.g. farmer, c4). A person active at the Farmers’ Union Likwama (i15) explained that his motivation of joining the union was the condition that farmers did not have a market for their produce. This situation has partially changed now and with a big regional miller in Katima Mulilo maize can be more easily sold within the Zambezi Region (Likwama representative, i15). However, the possibility to earn money from cereal cultivation differs greatly between the cereal varieties. In the pile sorting exercise, all groups agreed that white maize is very well marketable (Appendix D.1). On the other side of the continuum, yellow and even less so red maize were seen as not well marketable. The different *mahangu* varieties were said to be fairly well and sorghum to be not well marketable.

In Namibia, maize and *mahangu* are crops controlled by the government, which includes that their prices are fixed, and that the sales of registered produce is ensured via import restrictions (agricultural technician, i5). The price for the crops is fixed at a relatively high level. One seed supplier saw this as an incentive for farmers to cultivate maize for selling (seed supplier 2, i16). A regional miller (i4), however, problematized that the high price for grains is translated into a high price for the milled produce which burdens the consumers of the maize meal. Rather often farmers both sell their maize to the miller and buy maize meal from him (e.g. NAB employee, i13). As farmers sometimes do not have adequate maize storages in the villages, they can secure their maize consumption thereby (Louise, po:13.04.). Justine (po:17.04.) explained that selling to the regional mill is only profitable when having storage problems. The biggest regional mill buys 80% of all formally marketed maize from the region (miller, i4). It only takes maize as it is not profitable to mill *mahangu* due to the low quantity of *mahangu* cultivation in the region (miller, i4). Most *mahangu* cultivated in the Zambezi Region is either used for subsistence or marketed informally (NNF team leader, i6). Further regional mills and the Agro-Marketing and Trade Agency (AMTA) buy the remaining 20% of maize as well as the registered *mahangu* (agricultural technician, i5). However, farmers describe the formal *mahangu* market as difficult (as the grading regulations are strict) and as less lucrative (pile sorting, po:18.04.). On the informal market it is possible to get much higher prices for *mahangu*, but the informal market is also described as not reliable (pile sorting, po:18.04.). For sorghum there exists an informal market especially for brewery and for sweet cane sorghum

(NNF team leader, i6; pile sorting, po:18.04.). A surplus of sorghum is for example sold at the open market or to neighbours, but the lack of formal markets results in the lack of incentives to expand sorghum production (Wanga et al. 2022:9f., 13). Several of my interlocutors problematized the lack of a formal market for sorghum (e.g. agricultural officer, i1; farmer, i12). Due to the given market conditions, planting sorghum or even *mahangu* does not give farmers the possibility to earn the cash they need in the current society (NNF team leader, i6). This influences the seed availability. In the pile sorting exercise, the participating farmers indicated that white maize seeds are well available, whereas yellow and red maize and certain sorghum and *mahangu* varieties can be difficult to obtain (Appendix D.2). One elderly farmer remarked that white and red sorghum seeds used to be readily available before but were dropped due to the increasing commercialization and the connected focus on white maize (pile sorting, po:18.04.). In addition to being the most viable cash crop, maize has further advantages. Maize is a productive and adaptable plant which needs less land and labour for a high yield compared to other crops (Curry 2022:9). In the pile sorting exercise, all groups agreed that growing maize is the least labour intensive crop (Appendix D.4). This low labour requirement is crucial as societal changes like urbanization and the weakening of social bonds decrease labour availability, as it was outlined in section 3. Labour shortages can be compensated for by hiring workers, but this in turn increases the pressure to make money. Justine (po:13.04.) mentioned that resource-poor farmers plant maize instead of *mahangu* and sorghum because they cannot pay workers to assist in the field and protect the crops from cattle, monkeys and other wildlife. Bird damage is a particularly decisive challenge. While different bird species and further wildlife affect various maize, *mahangu* and sorghum varieties to a different extent, maize is generally more resistant to bird damage than *mahangu* and sorghum. Several farmers indicated that they discontinued planting *mahangu* and sorghum because of the birds and now plant only maize instead (farmers, c19; c20; c23). A number of farmers pointed out that they could not plant sorghum and *mahangu* in the year 2022/2023 because they had to take care of their grandchildren and did not have enough capacities to grow and protect the crops (farmers, c9; c24).

#### 4.2.3. Reviving small grains?

Maize also has disadvantages. In contrast to *mahangu* and sorghum, my interlocutors described maize as a ‘thirsty’ plant in need of much water and nutrients (e.g. MSP-trainer, po:18.04.). Maize requires sufficient water particularly in the weeks before and after flowering, which makes it vulnerable to drought (Rouanet 1987:27). Whereas white maize needs at least 500 mm, sorghum needs 400 mm and the formal *mahangu* variety *Okashana 2* around 350 mm of water per growing season (Saisai 2023). Due to the high water requirement of maize and its intolerance to temperature variations, higher temperatures and lower rainfall due to

climate change will reduce maize yields significantly, with potentially disastrous consequences for the small-scale farmers nowadays depending on it (Lazaroff et al. 2021:38). *Mahangu* and sorghum, though there can be variations between different varieties, generally perform better in a dry climate than maize (Appendix D.3). My interlocutors identified *mahangu* to be the best drought resistant species (e.g. farmers, c10; c11; c15). Even if the weather is changing and dry, with short *mahangu* often something can still be harvested (farmers, c12; c13). One farmer (c12) said that she did not plant sorghum in the 2022/2023 cropping season as it needs more water than *mahangu*. Another farmer, however, pointed to a short and white sorghum variety which does not need much water and can be harvested early, so that she wants to keep its seed and not the other sorghum seeds (farmer, c4). In addition to being generally more drought-tolerant than maize, *mahangu* and sorghum can tolerate high temperatures and grow well on marginal lands (National Research Council 1996:79, 128).

Therefore, some of my interlocutors demanded a reconsideration of small grains against the background of climate change. One farmer for example advocated for *mahangu* and sorghum by stating: “The changes of the climate make us to look at whatever can grow suiting the environment or the period to which we – So this is why we are diversifying on other crops because *mahangu* can grow better in the drought, and is strong, and also sorghum” (farmer, i2). Hence, he argues that an increase in small grain cultivation could enhance food security: “I think it can grow, it can come back. And these are the stronger seeds for the strong crops for drought, these are really strong. If this is promoted there, I think we could reduce the food shortage in Namibia. Sorghum can grow” (farmer, i2). Due to climate change and the increase in droughts, another farmer (s7) argued that *mahangu* and sorghum have better prospects than maize. One farmer (i10) explained that he shifted from maize to *mahangu*, as the production of maize was low due to insufficient rain and as from *mahangu* something can still be harvested in bad years.

Currently, the Namibian government supports cereal cultivation through measures like seed subsidies, which focus on crops like maize and *mahangu*, but exclude sorghum (agricultural officer, i1). However, the establishment of small grain agriculture would require institutional support, including regulations and policies to establish a market for sorghum (Wanga et al. 2022:12). At the moment, there are only small initiatives to link small grains to markets. Two NGO workers enthusiastically told me about the plan for a business initiative to export small grains from the Zambezi Region to Germany for malt beer production (NNF employee, po:14.04.; WWF employee, po:16.04.). They hope that such an establishment of a market for *mahangu* and sorghum incentivizes farmers to cultivate more small grains instead of maize (NNF employee, po:14.04.; WWF employee, po:16.04.). One NGO worker stressed that *mahangu* and sorghum are better for the soil and due to their high nutrition also for the people (WWF employee, po:16.04.). The other NGO worker emphasized that small grains can survive

better without a lot of rain, and highlighted them as locally rooted (NNF employee, po:14.04.). As he stated that maize is not from the Zambezi Region and that *mahangu* and other local varieties are better adapted to its climate, he argued: ‘we need to thrive on things which are from here’ (NNF employee, po:14.04.). In the same line of thinking, the other NGO worker demanded that farmers should go ‘back to the roots’ (WWF employee, po:16.04.), meaning back to small grains. Sorghum and *mahangu* are preferred over maize ‘because they are the African, the nutritious African grains’ (Louise, po:13.04.) and are seen as the traditional cereal species (WWF employee, po:16.04.).

## 5. Seed systems in transition

The question which cereals have a future in times of climate change is not only a question of one cereal species against another. Instead, the different varieties of maize, *mahangu* and sorghum matter – and with them the available and accessible seeds. The next section therefore portrays the seed situation in the Zambezi Region.

### 5.1. Conceptual and regional background

The following section starts with introducing the terminology of 'local' and 'formal' seeds and then briefly outlines the political and economic context of formal seeds. Afterwards, a general overview of local and formal seed systems in (Southern) Africa is provided, before the cereal seed situation, including the key cereal seed practices, in the Zambezi Region is described.

#### 5.1.1. Local and formal seeds

My interlocutors used diverse seed types which were often classified in a local-formal-dichotomy. At the Mashare seed training, the trainer framed them as "farm-saved" or "informal" seeds on the one hand and as "commercial" or "formal" seeds on the other hand (seed specialist, po:04.04.). These categories and the tension between them were a crucial theme in many research situations. However, my interlocutors mostly named the seed classes differently.

Farm-saved seeds, on the one hand, were called "local" seeds (agricultural officer, i1; farmer, i2; agricultural technician, i5) or 'traditional' seeds (e.g. farmers, c4; c5; c14; NAB employee, i13) and were described as 'old seed' (farmer, c25), "indigenous seeds" (NRWA worker, i14), "cultural seeds" (farmer, s2), "grandparents seeds" (MSP discussion, po:18.04.) or "landraces" (NBRI employee, i18). In this thesis I use the term 'local' as an umbrella term for farm-saved seeds. These seeds can both be derived from varieties long rooted in a place and can also be considerably changed into new varieties in rather short time periods through the repetitive replanting of seeds (cf. Curry 2022:10, 241). I choose the term of 'local' seeds instead of 'traditional' seeds to keep the genealogy and provenance of varieties open and to instead stress their embeddedness in local practices. Local seeds are crucially characterised by the practices of selecting, saving, storing, exchanging and replanting as well as the informal selling and buying of the seeds. Biologically, a seed which can be continuously replanted is called open-pollinated.

Commercial seeds, on the other hand, are formally bred and marketed, for example by companies or governments. My interlocutors called these seeds "improved" (agricultural officer, i1; seed supplier 1, i7; NBRI employee, i18) or "improved certified" (agricultural technician, i5) seeds. With critical undertones they were also named "treated seeds" (e.g. miller, i4), 'engineer seeds' (farmer, i17) and 'artificial' in contrast to 'natural' seeds (WSN worker, i19). The usage of the term 'improved' seeds confused people as farm-saved seeds can also be

improved from year to year by seed selection (seed specialist, i3; miller, i4). In the literature, it is stressed that the dichotomy of 'traditional' versus 'modern' and 'local' versus 'improved' seeds is problematic as it devalues local knowledge and seed systems in comparison to Western agricultural practices and their productivity measured by Western values (Dohr et al. 2015:34). To avoid value-laden terms as 'improved' seeds, I use the term 'formal' seeds to highlight their embeddedness in formalized breeding, market structures and politics. Formal seeds can both be open-pollinated or hybrid.

Hybrid seeds were first developed for maize and have allowed plant breeders to take advantage of a phenomenon called 'hybrid vigour' (Marshak 2021:14f.). For this, firstly, self-pollinated lines are developed which have uniform and desired characteristics but low vigour due to the self-pollination (ibid.:30). Secondly, two of these lines or a self- and an open-pollinated variety are crossed to reinstall the vigour ('hybrid vigour') while the desired characteristics of the priorly self-pollinated lines are kept – at least in the first planting (Marshak 2021:14f., 30). The favourable traits of hybrid seeds are not guaranteed when the seeds are recycled (ibid.:30). Therefore, farmers who apply hybrid seeds must rebuy them for each planting if they want to ensure a steady performance of the seeds. This genetically imposed assurance of a steady seed demand laid the ground for the profitable commercialization of seeds (Kloppenburg 1988:xiii, 11; Marshak 2021:30f.). Seeds used to resist commodification for a long time but such technical innovations in plant breeding and the application of intellectual property rights to bred seeds transformed them into goods which can be profitably privatised (Kloppenburg 1988:xiii, 11). The expansion of intellectual property rights to commercially bred varieties allowed companies to claim ownership about them and to protect the related business potential (Kloppenburg 1988:xiii, 11; Marshak 2021:15). Commercial varieties are patented based on their allegedly isolatable, uniform and repeatable traits (van Dooren 2010:44). However, the concept of 'frozen' patentable seeds not only ignores the history of formal seeds – for example, when germplasm of landraces has been used as a breeding ground – but also the almost inevitable cross-pollination and change of varieties when released into cultivation (van Dooren 2010). As patented varieties are legally protected, their spread and mix with other varieties can be criminalized (cf. Garzón & Escobar 2020:674f.). International regulations such as those by the International Union for the Protection of New Varieties of Plants prioritize the rights of commercial breeders and restrict farmers to regrow and exchange formal seeds (Dohr et al. 2015:122). Thereby, such regulations undermine and endanger informal seed systems and the accessibility of local and formal seeds (ibid.:122, 135). In general, formal seeds have profoundly changed the seed situation in Africa, although local seeds still tend to dominate.

### 5.1.2. Trends of local and formal seed systems in Africa

It is estimated that between 60-100% of seeds planted by African small-scale farmers are derived from local sources (Kusena et al. 2017:2). The main local seed sources are farm-saved seeds, social networks and local markets (Ncube et al. 2023:2). McGuire and Sperling (2016) found in a study in Malawi, Kenya, DR Congo, Haiti, South Sudan and Zimbabwe that on average 90.2% of the used seeds were accessed from local sources, with about half of them from local markets and one third from on-farm seed saving. As local seeds tend to be more affordable, of good quality and available in time and spatial proximity, they contribute more to the seed security of households than formal seed systems (Ncube et al. 2023:1, 5). Formal seeds provided by agro-dealers are often delayed and seed aid mostly comes too late, in addition to often being not well accessible, insufficient and not transparent (ibid.:5, 9). Regarding seed quality, Ncube et al. (2023:8) argue that the quality of local seeds is comparable to formal seeds. Kusena et al. (2017) confirm this in their case study in Zimbabwe, for which they tested 60 samples of locally acquired and stored sorghum seeds according to seed certification standards, in particular their storage moisture, germination rate and fungal incidence. Kusena et al. (2017) conclude that the revised local seeds are of high quality while only few samples supplied from relatives and the government did not meet the certification standards. The seed expertise and experience of farmers which allow them to ensure the seeds' quality is highlighted (Kusena et al. 2017:9; Ncube et al. 2023:8).

Farmers usually use diverse seed sources (Kusena et al. 2017), including sources from both the local and formal seed system (McGuire & Sperling 2016). What seed source is used varies between crops. Whereas own stocks, social networks and NGO seed aid are of great relevance for sorghum and millets, formal seed sources like agro-dealers and governmental aid are more important for maize (McGuire & Sperling 2016:183f.; Ncube et al. 2023:4f.). Moreover, the characteristics and socioeconomic conditions of farmers impact their choice for a seed source. McGuire and Sperling (2016:184ff.) for example show that resource-poor farmers and female-headed households rely more heavily on local markets for seed supply than other groups.

At the same time, local and formal seed systems increasingly become interlinked and seeds originating from formal sources can for example enter local seed systems (Ncube et al. 2023:2). Hebinck and Kiaka (2024:70-76) illustrate that maize varieties in West Kenya have become plural beyond an alleged formal-local dichotomy as farmers dynamically combine formal and local maize varieties which become spatially, and with time often genetically, intertwined. In the Oshana Region in Namibia, most farmers combine their own local *mahangu* varieties with formal *mahangu* varieties like *Okashana 1* and *2* (Dohr et al. 2015:41). Although farmers are careful in handling the different kinds of *mahangu* seeds, and formal and local seeds are usually planted and stored separately, formal seeds are often resown, enter local

seed systems and cross-pollinate with local varieties (ibid.:41, 63, 71). How is the cereal seed situation, including the interlinkages between local and formal seed (systems), characterized in the Zambezi Region?

## 5.2. Cereal seed practices in the Zambezi Region

My interlocutors sourced their seeds for the 2022/2023 season from different sources, usually from two or three different sources at the same time. Seeds were either farm-saved, obtained through seed sharing interactions,[8] given from NGOs and/or bought from other farmers, the open market, seed suppliers or formal shops. The following section describes the main seed sources of my interlocutors as well as the connected seed practices and local knowledge.

### 5.2.1. Selecting and storing seeds

Most farmers I talked to had at least partially replanted their own cereal seeds for the 2022/2023 season or stated that they usually keep and/or will keep seeds in that season. Some of them explicitly voiced their plan to save seeds from the seeds they had bought or received from other farmers in the 2022/2023 season to have their own seeds in the following season (e.g. farmers, c19; c20). Usually, farm-saved seeds are kept from year to year and often derive from seeds given to farmers by their parents and grandparents, with the wedding being an important occasion for the bride to receive seeds from her mother (e.g. farmers, c12; c14; i10). Dohr et al. (2015:86) show in the Oshana Region that seeds as a wedding gift symbolize fertility, a new start and the female responsibility for food security. It is not an option to give formal seeds in that context (ibid.:87).

To save seeds for the next season, desired kernels are selected as seeds and must be stored safely. The cobs of which seeds are taken can be chosen before or after harvest. On-site selection before the harvest allows farmers to consider more criteria, such as the number of cobs a plant has produced and its position in the field, but is also problematised as time-consuming (seed training, po:05.04.). When selected after the harvest, the size and quality of the cobs are decisive and the best, meaning the biggest, nicest and strongest kernels with an intact germination spot, are selected as seeds (e.g. farmer, c7; Justine, po:20.03.). In addition, diverse characteristics of a cereal variety are considered for seed saving. Justine (po:17.04) explained that the yield the plant has obtained is most important, then followed by assessing the duration of its maturity period, its drought resilience and as a fourth aspects its taste. The intended use of a variety shapes the selection criteria. In the case of sorghum, the use of a variety for different purposes like baby food or beer brewing for example determines what role

[8] 'Seed sharing' was the umbrella term used in the data collection for seed exchanges, gifts and loans.

the softness of the shell and grain plays (seed specialist, i3). Although yield is always an important factor, when plants are grown for selling, it becomes the single most important criterion, while other dimensions like taste are not considered (NNF team leader, i6).

The cobs chosen for seeds are either preserved as a whole or threshed by hand or machine. When still covered in their husk, cobs can for example be hung under the ceiling of a kitchen hut to preserve them and to protect them from weevils by the smoke of the fire (e.g. farmer, c9, c14). Usually, cobs chosen for seeds are kept separately from other cobs and must be dried well before they can be stored otherwise. Cobs can for example be dried in the sun or underneath a cover on a tarpaulin on the ground or on elevated platforms. When a cob can be easily broken it is a sign that it is already dry (Justine, po:20.03.). When the dried cobs are threshed, seeds are usually taken from the middle part of the cob while the top and bottom ends of the cobs are removed (e.g. farmer, c4). Even though the kernels on the bottom of the cobs can be big, too, only the ones from the middle are picked as they are said to contain different traits or even different genetics (MSP discussion, po:20.04.).

When threshed, seeds can be stored in different containers which are kept in or close to the house. Several farmers recalled traditional seed storages, for example small huts made from wood and clay with a grass and/or mud roof, in which both grains and seeds mixed with ash are stored separately (farmers, s2; s9). Nowadays, seeds are most often kept in plastic bottles and/or bags, metal drums or big tins (seed training, po:04.04.). Thereby, the quality and cleanliness of a container are important (e.g. farmers, s7; s11). Farmers often mentioned that the container should be closed airtight, and only one farmer, who struggles with fungus on the seeds, favoured an open, ventilated bucket (farmer, s5). Furthermore, the containers are sometimes hung up to prevent rats from entering, and they are kept in a relatively cold place (e.g. farmers, s1; c11).

Several farmers (e.g. c9; c21) explicitly mentioned that seeds can be kept without any challenge, whereas other farmers (e.g. i10; i15) described seed storage as challenging. Weevils are often mentioned as a challenge (e.g. farmers, c8; c10), and mice and rats (e.g. farmers, c14; s11), fungus (farmers, s6; s16) and termites (farmer, c11) can be challenges, too. Furthermore, children can cause damage on the stored seeds (farmers, s8; i10) and one farmer (s16) mentioned that seeds are sometimes stolen. Farmers check seeds regularly, and if needed, the seeds are treated again and then reselected (farmers, c13; s7; s17). A traditional method to disinfect seeds is to expose them to sunshine (e.g. farmers, c13; s13). To keep seeds safe in storage, they are often mixed with ash (e.g. farmers, c5; c14), or ash and chili (e.g. farmers, c2; c7), ash and moringa (farmer, c13), ash, moringa and neem (farmer, c12; NRWA worker, i14), or ash, garlic and chili (farmer, s20). In traditional storages the ash can also be alternated or mixed with dried cow dung (farmer, s2) or sand (seed training, po:05.04.). Often the cold ash is taken from burnt wood at the fireplace (e.g. farmers, c21; s8). One farmer

(c15) explained that he specifically takes the ash to mix with seeds from burnt maize cob residues. The ash works in the way that weevils, that are already inside some seeds and come out to mate, suffocate when everything is covered in ash and then cannot infect other seeds (seed specialist, i8). Most farmers who use ash emphasize that it is effective in protecting the seeds from weevils (e.g. farmers, c15; c19; c20). Half of the six farmers who mentioned to me that they do not mix their seeds with any substance, recalled problems with weevils during seed storage (farmers, c8; c16; c17). Another farmer (c12) who usually mixes her seeds with different substances including ash recalled that if in one season she cannot mix the seeds with the 'traditional medicine' small insects become a problem. Several farmers, however, stated that despite putting ash the insects can be 'stubborn' (farmer, s7) and damage the seeds (farmers, s7; c23; seed training, po:04.04.).

Hardly any of my interlocutors mentioned to put chemical pesticides to protect their seeds. However, one farmer supposed that chemical pesticides are applied on seeds sold at the open market (open market, po:09.03.). In addition, one farmer (i12) stated to use non-organic pesticides to kill insects on seeds, but he also explained that he sometimes applies ash and has learned about the protective potential of neem leaves and green chillies in a workshop. Another farmer (NRWA worker, i14) recalled that when she was young her mother used a poison on seeds which was distributed by the government to kill mosquitos, and that they were later eating that poison through the seeds. Therefore, she said that farmers currently go back to the methods of their grand-grandmothers and apply ash instead (NRWA worker, i14). To apply these traditional methods, local seed saving knowledge is needed. What is the state of such knowledge?

### 5.2.2. Local seed knowledge

Farmers often explained that they learned how to save and propagate seeds from their mother and grandmother, other family members and elderly people (e.g. farmers, c2; c20). Several farmers stressed the importance of accompanying their (grand)parents to their farms as children (e.g. farmer, c26). In addition to learning from senior women and men, a number of farmers mentioned that they learned certain seed practices in farmers' meetings, trainings and through organizations like GIZ (e.g. farmers, c1; s7).

During the MSP training, the seed training in Mashare and during certain field visits with Justine several farmers expressed their wish to learn more about seeds, for example about how to preserve them (e.g. farmer, c24). In the beginning of the seed training (po:04.04.) both a younger and a more senior farmer voiced that they have lost the traditional way of seed saving and the knowledge of how to do the seed selection et cetera. Despite using traditional seed storing methods, the younger and another elderly farmer emphasized that their seeds are affected by pests and that they are hence required to learn more about how to save seeds

safely (seed training, po:04.04.). During the MSP training, in an interview with me, one elderly farmer (s22) pointed out that he, although he still has seeds and knowledge from his grandmother and follows traditional protocols when saving seeds, does not know how to keep his own seeds and hopes to gain more input from the training. Trainings like the MSP training importantly build on traditional knowledge and often mainly encourage farmers to continue the seed saving practices they know well, while merely proposing additional elements and strategies to complement these practices (NNF team leader, i6; NBRI employee, i18). Although local knowledge serves as a foundation for these trainings and continues to be practiced, the previous statements show that many perceive it as gradually lost or as insufficient for current challenges. According to Justine, more knowledge about seed saving is indeed needed. When I asked her for example, why she thinks that one farmer we visited in her neighbourhood did not use her own seeds, Justine (po:20.03.) ascribed this to a 'lack of knowledge' and argued that education is key and necessary. Presumably, she understood our research visits to farmers as an opportunity to raise awareness on seeds and seed saving practices. One time she explained that she only took me to farmers who she thought to be 'willing to be educated' (Justine, po:21.03.). In a few conversations, farmers stated that they do not know how to store seeds and requested Justine and me to tell them how to do so (farmers, c8; c24).

A loss of traditional practices became especially apparent in the case of traditional seed storages. Clay pots were for example traditionally used as a seed storage, but farmers nowadays often lack the skills to make them (GIZ employee, i9; NRWA worker, i14). During the seed training in Mashare (po:04.04.), farmers from the Kavango Region highlighted another traditional method in which a calabash was sealed tightly with a combination of ash, clay and mud and only opened for the next planting. Justine (po:04.04.) confirmed that in the past calabashes covered with clay were used to conserve seeds but that it was now challenging to obtain calabash seeds. A farmer from the Zambezi Region mentioned during the seed training (po:04.04.) also a special type of grass which can be mixed with mud and then used to cover the seeds. He argued that not many farmers practice this nowadays, although some farmers continue to do so in his village.

The decrease of local seed knowledge and practices can have many reasons. Dohr et al. (2015:82ff.) highlight for the Oshana Region in Namibia and the Ruvuma Region in Tanzania that traditional educational practices connected to seeds were interrupted by the obligatory schooling, the HIV/AIDS-epidemic, rural-urban migration and the erosion of traditional family structures (ibid.:83f.). My interlocutors, too, described the introduction of compulsory school attendance as a significant change in their lives (agricultural researcher, po:08.03.). Through the schooling (in town) skills and traditional knowledge fade out and local practices, including the making of clay pots to store seeds, deteriorate (GIZ employee, i9). Dohr et al. (2015:84) problematize that, as many leave the school without graduation, young people have neither

the qualifications to take on a formal job nor the knowledge and skills to farm successfully. Young farmers increasingly become seed insecure presumably because they lack sufficient knowledge; and challenges in seed storing are interpreted to be a result of turning away from traditional knowledge and rituals (ibid.:84, 103). One farmer in their study remarked that due to their different lifestyle and mobility, children are now absent from the fireplace to learn from their grandparents (ibid.:169f.).

In the Zambezi Region, the trend of urbanization is partially reversing and some young people come back to the villages, especially if they have difficulties in finding a job in the cities (miller, i4). However, people who come back to the village have already lost some local knowledge (GIZ employee, i9). Herself young and seated in the capital Windhoek, an NBRI employee (i18) explained to me that most young people who live in urban areas gradually lose seed knowledge, although they are often still connected to their home village and agriculture:

> "We still travel to the village to do the cultivation, and we are very much involved but from the distance. When it comes to, to how things are being done, how we conserve seed, how we select seed, a lot of our parents know that better than us. They know better than us because we are now tied with the modern things." (NBRI employee, i18)

Seed saving practices are also impacted by the fact that farm-saved seeds are not only saved from local varieties but increasingly also from formal open-pollinated and hybrid varieties (e.g. farmers, s2; s22). Following the above-mentioned notion that the location of a kernel on the cob influences its characteristics, one farmer (s10) explained that she consciously alternates the part of the cob she takes seeds from when recycling hybrid seeds with the idea to 'manipulate' the seeds and to make them replantable. However, hybrid seeds of the first generation are genetically uniform and the size and prior location of a kernel on a cob does not have much influence (seed supplier 2, i16). Even formal open-pollinated varieties cannot be easily improved by seed selection and during the seed training in Mashare the trainer discouraged farmers to attempt to do so (seed specialist, po:05.04.). This illustrates that seed practices and knowledge derived from local varieties cannot always be meaningfully transferred to formal seeds and further questions the degree of applicability of the currently deteriorating local seed knowledge.

### 5.2.3. Sharing seeds

Almost all farmers I talked to mentioned that they occasionally give out and/or receive seeds through seed sharing. Social practices of seed sharing are an integral part of local seed systems (van Niekerk & Wynberg 2017:1099). They contribute to agrobiodiversity, particularly the spread and continuation of local varieties, social cohesion, food security as well as the food sovereignty of small-scale farmers (Dohr et al. 2015:89; van Niekerk & Wynberg 2017:1099). Most farmers share seeds with their immediate surroundings, especially family members, neighbours and friends (e.g. farmers, c7; c8). In one seed sharing map, a farmer for example mentioned two seed exchanges with her sisters, one with her brother and another one with her

neighbour (Appendix E.2). The social network of farmers, often determined by their family and residence, impacts their seed access (Dohr et al. 2015:95, 97). In turn, seeds can also build and reinforce social networks (van Niekerk & Wynberg 2017:1118f.). NGOs can for example enable new seed sharing avenues both through events such as seed ceremonies and by expanding farmers' networks (ibid.:1119). During the MSP trainings farmers frequently shared seeds with each other (e.g. farmer, s3; Justine; po:21.03.). Moreover, Justine (po:21.03.) mentioned that also after the training of becoming a lead-farmer she continues to share seeds with other farmers from the training as they trust each other. For any type of seed sharing, trust and a decent harvest for the person who gives away seeds are named as preconditions (Justine, po:14.04.; farmers, c5; c7; c15). Dohr et al. (2015:90, 92), who analyse that seeds are either shared to ensure food security or to integrate new varieties with desired characteristics, stress that trust is most important in the former case.

When farmers lose their seeds, for example due to insect infestation, decreased seed quality, failed harvest or hunger, they can ask other farmers for seeds (e.g. farmers, c24; c25). My interlocutors frequently stated that they share seeds with any farmer who asks for it (e.g. farmers, c16; c17) as it is a social obligation to share seeds with farmers in need (e.g. farmers, s9; i10; Justine, po:21.03.). Dohr et al. (2015:100ff.), too, found in the Oshana Region in Northern Namibia that as long as survival is at stake, farmers have a moral obligation to give seeds to farmers in need. They observe that farmers only seldomly lose their seeds and that certain groups, such as households headed by widowed or divorced women, are at higher risk to become seed insecure (ibid.:102f.). As factors like droughts which cause seed loss are interpreted as a misfortune and not as the fault of the individual farmer, it is not perceived as shameful to ask for seeds (ibid.:103f.). It is believed that misfortunes can affect anyone, so that the non-affected farmers who are asked for seeds are at risk to lose their seeds, too, and to become the ones asking for seeds in another year (Dohr et al. 2015:104; Justine, po:31.03.). When seeds are required for survival, they are often given as a gift (Dohr 2015:100ff.). My interlocutors stressed that when they give away seeds, they do not necessarily expect anything in return (e.g. Justine, po:14.04.). At the same time, the receipt of seeds enacts the responsibility to grow the seeds well (instead of, for example, eating them), and to multiply them, up to the point of being able to share them back (Dohr et al. 2015:104ff.; farmer, s11). Farmers who received seeds in one year are usually not able to ask for seeds again in the following year (Justine, po:14.04.). To return seeds or fresh produce to the person who gave out seeds is seen as a traditional way of thanking that person (farmer, s7). Through seed sharing, a relationship is built in which seeds can be shared in both directions and farmers in shortage do not have to suffer (farmers, s5; s6; s13). Thereby, seed gifts can become seed loans and reproduce solidarity and a communal safety-net (Dohr et al. 2015:106; van Niekerk & Wynberg

2017:1116). This allows farmers to rely on each other and strengthens trust, family and community bonds (farmers, s16; s17; GIZ employee, i9). It also reduces criminality as people do not have to steal seeds to survive (farmer, s11). One farmer (i10) embedded seed sharing in the general view that it is not possible to survive as an individual, but that people depend on each other to thrive.

Seed sharing also contributes to the diversification of grown varieties. Several farmers stressed the importance of seed sharing as it allows them to obtain seed varieties they were not having before (e.g. farmers, c16; c23). Farmers can try out new varieties, compare them to their prior ones and improve their cultivation (farmer, s19). This can enhance the overall regional performance of crops and the development of varieties for the future (WSN worker, i19). Dohr et al. (2015:91) describe that farmers are generally on the look-out for new varieties. Reviewing other farmers' plants particularly before harvest, farmers can ask for seeds from varieties they are interested in (ibid.:94). Requests for seeds are often voiced when favourable plants are seen on another person's field (farmer, c13) or even when someone sees good grains being cooked (Justine, po:21.03.). A successful farmer stated that several people had already asked for some of her seeds while the plants were still growing, so that at the time of the harvest, a portion would be kept for them (farmer, c26).

Seeds for diversification can either be given away without any immediate material return or they can be exchanged with other seeds or goods (e.g. GIZ employee, i9; farmer, c21). Dohr et al. (2015:98ff.) found that seeds asked for to improve one's cultivation are usually exchanged with other goods, labour or money, and rarely given for free, or if so, only in small quantities and/or in close social relations. They found that seeds are only seldomly exchanged with seeds, as it is not common that both exchange partners have seeds the other party is interested in (ibid.:99). My interlocutors, however, frequently mentioned seed exchanges (e.g. farmers, c8; s21), which were also depicted on the seed sharing maps (Appendix E.1; E.2). On the maps it becomes apparent that often different varieties of the same species are exchanged, for example different maize, cowpeas and *mahangu* varieties (Appendix E.1; E.2).
Formal seeds can also enter seed sharing interactions. Seeds which are bought for money are usually not shared as a gift (farmer, s3). However, formal seeds can be exchanged, and one farmer gave the example of exchanging a hybrid maize variety with a hybrid variety from another brand (Appendix E.1). In addition, seeds saved from formal (open-pollinated and hybrid) varieties as well as formal seeds which are freely distributed, for example through NGOs, can enter seed sharing afterwards (farmer, s13; Appendix E.1). NGOs mainly distribute formal open-pollinated varieties (seed supplier 1, i7).

When encountering a seed shortage, some farmers preferred to ask other farmers for help. They emphasized that through seed sharing no money has to be 'wasted' (e.g. farmer, c25) and that they would like to use and preserve traditional varieties which are important and

should not be lost (farmer, c14). Other farmers, however, preferred to buy seeds in such a situation. One farmer (c3) for example stated that by buying seeds from the open market she can behave responsibly and start her own seed. Although a local GIZ employee (i9) criticized the individual purchase of seeds and the resulting avoidance of seed sharing interactions as selfishness, yet another farmer (i10) welcomed such behaviour as it gives (young) people more independence. He deduced that people should not rely on requesting seeds and that they can, through buying seeds, help themselves (farmer, i10). In addition, seed sharing might not always be an option, and one farmer (c5) explained that she had to buy her maize seeds from the open market for the 2022/2023 season because no one around her had a surplus of maize seeds to share due to drought. Another farmer (s16) also indicated that he does not trust shared seeds and prefers to buy the seeds he knows. It is key for farmers to know and trust a seed – either through their own experience with it or the people or institutions they receive the seeds from. Farmers described it as a severe problem when they do not know the seeds' characteristics. One farmer for example mentioned that due to the lack of information on freely distributed seeds, he once planted a donated seed variety too early which resulted in a complete failure (Likwama representative, i15). However, also bought seeds cannot always be trusted.

### 5.2.4. Buying and selling seeds

In Namibia, no large-scale commercial seed production exists, and most formal seeds are imported from the neighbouring countries, in particular Zambia, South Africa, Zimbabwe and Botswana (NNF team leader, i6; NAB employee, i13). The government promotes and subsidizes drought tolerant and early maturing varieties such as the *mahangu* varieties *Okashana 1*, *Okashana 2* and *Kangara*, which were bred by the International Crops Research Institute for the Semi-Arid Tropics (Dohr et al. 2015:41). Currently, seeds provided by the government are only available in a limited quantity and cannot compete well with imported seeds, which offer more varieties and often a higher yield (agricultural officer, i1). Since 2007, formal seeds together with fertilizer, ploughing and weeding services are subsidized by the government under the Dryland Crop Production Programme (Frøystad et al. 2009:8; Kiesel et al. 2022:140). For most farmers such inputs would otherwise not be affordable but still only a small number of farmers supply seeds through the programme (Kiesel et al. 2022:142).

Most of the farmers I talked to in the Zambezi Region at least occasionally bought seeds, with many only buying seeds when encountering a seed shortage (e.g. farmers, c7; c15). Some of my interlocutors stated that they lack the financial means to buy seeds (e.g. farmers, c11; c12). Others, however, indicated that they mainly buy seeds (e.g. farmers, s10, i17). For farmers with some but limited financial resources the open market is the preferred place for purchasing seeds as seeds there are considerably cheaper than the formal seeds

available in shops (farmers, c3; c6). At the open market farm-saved but also formal seeds such as the open-pollinated variety *Okashana 2* are sold (seed supplier 1, i7; seed training, po:05.04.).

Although some farmers (c22; s2) are satisfied with the quality of the seeds sold at the open market, these seeds are often described as unreliable and not good to trust (e.g. farmer, s20; GIZ employee, i9). The characteristics and quality of the seeds sold at the open market are often unknown (agricultural technician, i5; seed supplier 1, i7), and the germination rate, yield potential, disease susceptibility and purity of the seeds can be disappointingly low (e.g. farmers, c10; s3; seed supplier 1, i7). The people who sell seeds at the open market might not know the origin and specificities of the seeds themselves as they work as intermediaries (farmer, c5; GIZ employee, i9). Justine (po:10.04.) supposed that the seeds sold at the open market mainly derive from the Zambezi Region, but most farmers expected that they come from other countries like Zambia, Angola or Botswana (MSP training, po:20.04.; open market, po:09.03.). Moreover, several farmers told me the story of people purposefully cooking, drying and then selling *mahangu* seeds at the open market so that farmers pay for it, but nothing grows out of the seeds (Justine, po:20.03.; farmers, c7; s20). Some interlocutors attributed the low quality of the seeds sold at the open market to the intention to make profit from the seeds (farmer, c6; GIZ employee, i9).

In addition to the open market, formal seeds can be bought in different stores in the Zambezi Region, including retailers and hardware shops. Before two seed suppliers opened their shops in Katima Mulilo in 2016 and 2017, seeds were described as a “gap” (seed supplier 1, i7). One seed supplier voiced: “But seriously, when we came, it was, there was no seed in the picture, there was no maize” (seed supplier 2, i16). Although formal seeds used to be available before, they had been more expensive due to long import distances, they had been less suitable to the ecological conditions of the region and they had been, especially in the case of the open market, of potentially low quality (seed supplier 1 & 2, i7; i16). By opening a seed depot in Katima Mulilo and importing seeds from a Zambian company, the first seed supplier started to provide farmers with a closer and less expensive access to seeds (seed supplier 1, i7). In the following year, a second seed supplier opened his shop in Katima Mulilo as a certified distributor of a South African seed brand that also multiplies seeds in Zambia where the seed supplier imports the seeds from (seed supplier 2, i16). Sometimes their seeds are supplied late, which weakens their competitive ability with the first seed supplier, who continues to have a high share of the market (seed supplier 1 & 2, i7; i16). In addition to their shops in Katima Mulilo, both enterprises work with satellite shops and seed agents to make their seeds more accessible in rural settings (seed supplier 1 & 2, i7; i16; farmer, s12). The first seed supplier further combines the selling of seeds with the dissemination of information and training on the cultivars to raise awareness about their features and performance (seed

depot, po:17.03.; seed supplier 1, i7). The first seed supplier (i7) sells both open-pollinated and hybrid seeds, whereas the second seed supplier (i16) only sells hybrid seeds, but plans to include open-pollinated varieties in the future, too. Both suppliers hope that in the coming years varieties can be specifically developed for the Zambezi Region and be locally multiplied (seed supplier 1 & 2, i7; i16).

Current attempts by the government to upscale local seed multiplication face several challenges. To multiply formal seeds, farmers must register with a cooperative or government agency, obtain foundational seed from a research station and have their field inspected during cultivation (seed specialist, po:04.04.). Seed production then requires consistent rain or irrigation (agricultural officer, i1). After cultivation, seeds are sent to research stations for cleaning and packaging before they are sold by a cooperative or the government (seed specialist, po:04.04). The bigger governmental research stations are located rather far from the Zambezi Region and when seeds are sent there and back again, they can easily be infested by weevils (agricultural officer, i1). The Namibian Seed Improvement Project, which aims to multiply seeds more widely, has so far not yielded the targeted results and even if thoroughly implemented would not yet resolve this transportation issue (agricultural officer, i1; seed specialist, i3; NAB employee, i13).

## 6. State and prospects of local and formal seeds

The previous section has illustrated key seed practices in the Zambezi Region and has hinted that these practices undergo critical changes. Which seeds have the greatest potential for future cereal farming in this context? The formal and especially hybrid seeds, which are increasingly bought, or local seeds, which continue to be farm-saved and shared?

### 6.1. Conceptual and theoretical background

Before the potential prospects of formal and local seeds in the Zambezi Region are discussed, section 6.1. emphasizes that local and formal seeds are embedded differently in global power structures and explores ways to react and resist to these asymmetries. In addition, approaches to conserve endangered varieties are discussed.

#### 6.1.1. Countering asymmetries in food and seed systems

Political and economic interests and institutions have significantly impacted agricultural practices and agrobiodiversity (Ray 2023:81). Section 4 has pointed out that changes in cereal cultivation and consumption in the Zambezi Region and more broadly in Africa have been significantly shaped by colonialism and structural asymmetries between the different cereal crops. Science has contributed to the unequal pathways of the cereals. Local food systems and traditional subsistence crops have received much less scientific attention than commercial ones (National Research Council 1996; Swiderska et al. 2022:2). Agricultural research continues to be export-oriented and motored by external forces, whereby nutritional needs and local preferences are largely ignored (Kerr & Wynberg 2024:12). Currently, maize is the crop best researched in Sub-Saharan Africa (Kondwakwenda et al. 2022:6ff.). International research has made it more productive and easier to process than millets, so that maize even advanced to areas where it is poorly suited (National Research Council 1996:79). Sorghum and *mahangu* meanwhile qualify as neglected and underutilized species (NUS) and were therefore singled out as two of the “Lost Crops of Africa” (National Research Council 1996). In general, NUS refer to species “to which little attention is paid or which are entirely ignored by agricultural researchers, plant breeders and policymakers” (Padulosi et al. 2013:1).

Seed systems and local and formal seeds are embedded in structural asymmetries, too. Kerr and Wynberg (2024:3) illustrate this by demonstrating how hybrid and genetically modified maize seeds are promoted by seed policies and agribusinesses in South Africa and Malawi. In general, formal seeds have been heavily promoted by governments and companies in Africa (Ncube et al. 2023:10). In addition, influential donor-driven initiatives like AGRA, previously known as the Alliance for Green Revolution in Africa, one-sidedly promote formal seeds as part of a technology-centered effort to ‘modernize’ and industrialize African agriculture (Dohr et al. 2015:124f.; Kerr & Wynberg 2024).

However, the high concentration of the commercial seed sector, which is dominated by few transnational players like Bayer, endangers a fair and democratic governance of formal seeds and increases economic dependencies (Dohr et al. 2015:124f.; Kerr & Wynberg 2024). Furthermore, the promotion of formal seeds is often linked to the devaluation of local seeds. Hybrid and genetically modified seeds are often promoted based on the narrative that formal seeds are the (only) solution to cope with current challenges such as climate change and increasing food demand (Kerr & Wynberg 2024). At the same time, local seed systems and their current contribution, quality and future potential are neglected and underappreciated (Ncube et al. 2023:10). Kerr and Wynberg (2024) argue that the systematic devaluation of the expertise of smallholder farmers is one way in which the promotion of hybrid and genetically modified varieties in South Africa and Malawi reinforces existing power imbalances, which are shaped by colonial history. Therefore, they frame the promotion of these seeds as a recolonization of agrifood systems in the two countries (Kerr & Wynberg 2024:2).

Based on an understanding of coloniality that stresses the ongoing political-economic, epistemological and mental consequences of colonial domination, Kerr and Wynberg (2024) follow Ndlovu-Gatsheni's conceptualization of the colonialities of power, knowledge, being and nature to argue that the persisting control exerted by foreign capital and the ongoing prioritization of Eurocentric knowledge continue to repress small-scale farmers and their ways of knowing and being, "leading to a loss of dignity and self-worth, and a disintegration of the relationship between people and nature" (Kerr & Wynberg 2024:12). As formal varieties are for example bred and produced far from the farmers' fields and create the impression that they can be applied without close attention and reaction to the farming environment, they break with and erode local practices and knowledge which are rooted in a specific place and human-environment relationship (Marshak 2021:138ff.).

To decolonize agrifood systems and to oppose rooted and ongoing asymmetries, it is demanded to revive local crops, seeds and Indigenous knowledge as well as to strengthen communal land rights and food and seed sovereignty (Kusena et al. 2017:10; Swiderska et al. 2022). The concepts of food and seed sovereignty expand the concerns of food and seed security and were popularized by the farmers' movement *La Via Campesina*, which fights for land and seed rights against neoliberalism (Mamati & Omare 2024:203). Food and seed security refer to the access and availability of sufficient, safe and adequate food and seeds to fulfil dietary, social and economic needs (McGuire & Sperling 2011:496f.). Food and seed sovereignty integrate these concerns with political questions of unequal access and control over assets and land, risks and benefits in food production (Walshe 2019:69; Maseno & Chitando 2024:8f.). Seed sovereignty encompasses "the rights of farmers to have control over their own seeds and the ability to save, breed, exchange, replant, and sell them as they fit" (Kerr & Wynberg 2024:3). While seed sovereignty emphasizes the self-determination and control of

farmers over the production, dissemination and use of seeds, it opposes intellectual property laws on seeds and highlights the value of community seed saving, sharing and participatory plant breeding (ibid.:3). Garzón and Escobar (2020) argue that seed saving itself can be a form of resistance against neoliberal seed hegemony and show based on ethnographic research in Colombia that both Indigenous and industrial farmers use seed saving to reclaim their seeds and their control over them. In the Global North, too, seed saving can substantiate alternative ways to capitalistic plant production as Phillips (2016:5) shows in her engagement with seed saving in Canada. Furthermore, seed sharing practices for example have the potential to make innovations both from local and formal seeds more accessible (Dohr et al. 2015:133).

The revitalization of Indigenous food systems requires policy protection for Indigenous cultures and their food and crop heritage and could involve linking local crops to markets and ecotourism (Swiderska et al. 2022:13). Thereby, the revival of cultural practices and crops can go hand in hand. In Peru, a project for example combines the reintroduction of potato varieties from the International Potato Center to Peruan Quechua farmers with the restoration of local culinary traditions and customary laws (Nazarea 2006:320). Moreover, the promotion of concepts like agroecology can stimulate the revival of relational farming knowledge (Marshak 2021:147f.). To revalue and reembody local knowledge and cultural memory can counteract hegemonial knowledge structures and enable alternative ways to keep and promote agrobiodiversity (Nazarea 2006). In that context, Nazarea (2006) describes seeds as “repositories of cultural memory” (ibid.:327).

### 6.1.2. Conservation or continuation of cereals

The revival of Indigenous practices and crops requires that they are conserved in some way. Already since the 1970s, social and cultural anthropologists have not only highlighted that practices and knowledge of local communities importantly contribute to agrobiodiversity but also demanded that farmers’ rights and interests should be at the centre of such agrobiodiversity conservation (Orlove & Brush 1996:329, 346). Anthropologists have emphasized that the perspectives on agrobiodiversity held by local communities and globally active conservationists can differ vastly (ibid.:329, 346). Whereas non-indigenous researchers tend to have global conservation aims on their agenda and could even increase the risk of ‘biopiracy’[9] through their study of priorly neglected agrobiodiversity, Indigenous People put the protection of community rights and the community use of conserved agrobiodiversity in their focus (Swiderska et al. 2022:10). International seed activists have stressed that seeds are not the common heritage

[9] ’Biopiracy’ refers to instances in which the agrobiodiversity produced and cared for by farmers is misappropriated and used by companies and researchers for (commercial) purposes without consent and the sharing of benefits back to the farmers (Wynberg 2023:85, 88). Access and benefit sharing agreements try to counter this injustice but run the risk to increase power asymmetries and local conflicts if not implemented carefully (ibid.:93f., 99).

of humanity or can be framed in national terms but belong to the often peasant and/or Indigenous communities that cultivate them (Peschard & Randeria 2020:619). However, crop conservation approaches have (historically) not always taken this into account.

In her book “Endangered Maize”, Curry (2022) analyses the history of various narratives around maize conservation in the Americas. The first crop conservation efforts by white settlers were shaped and stimulated by the belief that traditional crop varieties would disappear with ‘modern’ varieties in the same way as local cultures were expected to disappear through colonization and modernisation (ibid.:6, 29f.). The conservation efforts conducted by white settlers had an economic motive as early conservationists assumed that native varieties, despite common prejudices about them, had the potential to increase productivity and were of general interest for settler agriculture (ibid.:22f.). Although the conservationists appreciated the native maize varieties, they disregarded Native communities and supposed that white settlers (and not Native Americans themselves) had to save the varieties (ibid.:27). The assumed inevitable extinction or assimilation of communities and the plants and knowledge connected to them justified the narrative and supposed necessity of salvage (ibid.:33).

In the 1960s, the worry that farmers’ varieties of many crops were about to be replaced, paved the way for global mass collections (Curry 2022:97). Ex-situ conservation, for example in global and national gene banks, saved farmers’ varieties as genetic resources and made them more accessible to breeders and scientists but has not conserved them as crop varieties (ibid.:229). Crop species and varieties are continually evolving and adapting in cultivation (Pottier 1999:123; Swiderska et al. 2022:19f.; Curry 2022:230). However, by keeping crop samples in gene banks, this process of adaptation is interrupted, and the crops would erode easier when replanted after some decades (Pottier 1999:129). This understanding has introduced a “paradigm shift” (Nazarea 2006:320) in conservation towards decentralized in-situ conservation, which involves growing crops in their ‘natural’ habitat, for example on small-scale farms. Curry (2022:2) stresses the advantages of in-situ crop conservation as it involves farmers and allows for the continuous adaptation of varieties.

At the same time, the situation of agrobiodiversity loss remains complex and ‘modern’ varieties have for example not always replaced traditional ones but have in some instances even enhanced agrobiodiversity (FAO 2019:115). Based on a survey with Ethiopian subsistence farmers, Rampersad et al. (2023) for example argue that newly introduced crops have added onto the existing agrobiodiversity in the study region instead of diminishing it. Indeed, Pottier (1999:5f., 131ff.) points out that the expansion of global capitalism and industrial agriculture have not necessarily replaced socioecological heterogeneity and genetic diversity with homogenous and depleted conditions, or at least not necessarily so permanently. He demands to pay attention to the particular manifestations of global developments in different localities (Pottier 1999:70). Without downplaying the alarming decline of agrobiodiversity, Curry (2022:3,

228f.), too, demands more attention for sites such as small-scale farms where diversity still prospers and is newly generated and where presumably endangered crop varieties are not about to disappear. Instead of freezing varieties from a specific place and time in gene banks, Curry demands to renew and strengthen the creation of diversity, for example through participatory breeding (ibid.:231ff.). She argues that the fundamental problem nowadays is not the loss of agrobiodiversity but the break in creating it (ibid.:233). In industrial agriculture, imperatives such as the upscaling of production give little incentives to foster and create diversity and to react to diverse farm needs (ibid.:232). To oppose this, Curry calls for conditions that allow both diverse human communities and diverse crop varieties to thrive, including the empowerment of structurally disadvantaged farmers (ibid.:224f., 233).

A famous and participatory way in which local seeds and connected practices and knowledge are revived are community seed banks. A community seed bank can be defined "as a locally governed and managed, mostly informal, institution whose core function is to maintain seeds for local use" (Vernooy et al. 2017:318). In addition to the conservation, facilitated continued adaptation and revalorisation of diverse varieties, community seed banks contribute to the access and availability of seeds (ibid.:318). Community seed banks contribute to climate smart agriculture as they also secure and promote varieties with adaptive advantages to transforming climatic conditions (Vernooy et al. 2017). In addition, local practices, knowledge (sharing) and social networks are strengthened (ibid.:318). As community seed banks help farmers to regain control over seeds, especially local varieties, they strengthen farmers' rights (Vernooy et al. 2020). Community seed banks also face challenges, with the most common being a lack of financial resources, a dependence on external support and a lack of legal recognition (Vernooy et al. 2017:318). For community seed banks to be successful it needs time and effort (Vernooy et al. 2020:572). Nevertheless, approaches like community seed banks can facilitate the conservation and continuation of crops in more inclusive ways.

## 6.2. Formal versus local seeds in the Zambezi Region

The following section describes key advantages and disadvantages of formal and local seeds and discusses the endangerment of local seeds in the Zambezi Region. Community seed banks are then mentioned as one possible intervention to revive local seeds and to reverse the structural asymmetries between local and formal seeds in Namibia and the Zambezi Region.

### 6.2.1. Hybrid hope?

The first seed supplier (i7) stressed that the formal varieties he sells, in particular so the hybrid ones, are well suited to the region and the changing climate. In general, my interlocutors praised the hybrid varieties most common in the Zambezi Region as drought tolerant, early

maturing, high-yielding, as resilient to pests and diseases and as well germinating (e.g. agricultural officer, i1; farmer, i2; agricultural technician, i5). Their tolerance to drought makes hybrid seeds especially promising for climate change adaptation (e.g. agricultural technician, i5). Several interlocutors stressed that, indeed, farmers have started to use (and depend on) formal seeds in general or hybrid seeds in particular due to climate change (agricultural officer, i1; NRWA worker, i14; farmer, i17). One farmer (s8) for example remarked that he started to buy seeds from the two biggest local seed brands as the traditional maize seeds were not growing well due to their higher demand for rain. Another farmer (c4) announced that, primarily due to the drought tolerance of hybrid seeds, from the next season onwards she 'will never concentrate on the traditional seed' again. Instead, she wants to reuse bought seeds and buy commercial seeds for additional varieties. Due to the changing weather conditions one farmer and seed supplier (i16) shared his opinion that drought resistant varieties are required and that hybrid seeds are "the future for the Zambezi Region". Furthermore, many hybrid varieties are early maturing which not only has advantages for climate change adaptation but also minimizes the risks of wildlife affecting the fields (farmer, i17). One farmer explained that he grows the formal *mahangu* variety *Okashana* because it takes shorter time to mature and enables the crop to ripen in a time in which elephants are less active (seed training, po:05.04.). During the pile sorting exercise (po:18.04.) farmers summarized that traditional varieties are discontinued because they need longer time to mature and are hence more susceptible to drought, pests, diseases and wildlife, as well as not being well marketable.

In contrast to that, hybrid seeds have the potential to increase the yield and income of farmers (e.g. agricultural technician, i5). One farmer (s1) advised for the high-yielding hybrid varieties due to 'this world of market'. Other farmers (i17; i2) explicitly connected the increase in the planting of hybrid seeds with the increased need to have cash and the resulting change from subsistence farming to the generation of a marketable surplus. One farmer explained:

> "Up to 1999 we were still having this local seeds. But from the 2000s onwards now people started farming for business. Previously, it was just farming for consumption (…). So, this farming for business now, everyone wants to get a better yield, so that you can sell more. So, from this period it has totally come to change." (farmer, i2)

The transition to formal seeds was evaluated as an inherent part of a wider 'evolution' by some (e.g. GIZ employee, i9), but criticized as 'not really good' by others (e.g. NRWA worker, i14). Several farmers were generally skeptical and worried about formal seeds. Justine (po:20.03.) for example described formal seeds as a problem and not good. Other farmers feared that formal seeds would damage the soil, other plants in their surroundings and the environment (seed training, po:04.04.; MSP discussion, po:19.04.). When seeds are imported, they must be treated with a fungicide which some farmers (c4; c12) assumed to have a harmful effect on their soils.

The main disadvantage of hybrid seeds is their high price (e.g. miller, i4; farmers, s2; s10). For smallholder farmers it is not easy to afford hybrid seeds, let alone to rebuy them

every year (farmer, i2; GIZ employee, i9). Especially when farmers have been affected severely by drought, they do not have the means to (re)buy the expensive hybrid seeds (NAB employee, i13). For hybrid seeds a calculus is needed according to which a good harvest can be expected that will allow farmers to earn enough to cover for their previous expenses and to rebuy seeds for the following season (Dohr et al. 2015:108). This calculus contrasts with the common view of the future as unknowable, which also underlines seed sharing relations (ibid.:107f.). Seed sharing practices are based on the belief that any person could run out of seeds one day due to conditions which are only partly influenceable (ibid.:107f.). As the cereal cultivation in the Zambezi Region depends on the unpredictable rainfall, such view of the future is well understandable and questions the applicability of hybrid seeds under the current rainfed conditions.

To allow for a constant high performance, hybrid seeds have to be rebought every year. Louise (po:17.03.) and the seed suppliers (i7; i16) told stories about farmers who were unaware about the differences in replanting between hybrid and open-pollinated seeds, but most farmers I talked to were aware about certain differences. Some farmers (s3; s8) for example indicated that they rebuy hybrid seeds every year, and another farmer (i10) stated that the need to rebuy the seeds scares him. Other farmers, however, shared their confusion about the (im)possibility to replant hybrid seeds (seed training, po:04.04.). When hybrid seeds are replanted their yield and uniformity decreases, but this decrease is not always as dramatic as the textbook suggests (seed specialist, i8). One farmer (s2) stated that his replanted hybrid seeds performed alright in a second planting and only significantly decreased in their performance when planted a third time. Other farmers complained about an immediate substantial decrease in quality when hybrid seeds are replanted (e.g. GIZ employee, i9), for example resulting in the plants becoming taller and thinner (seed training, po:04.04.). In addition, the maturity period can increase when hybrid seeds are replanted, and the resistance of the crops can decrease (agricultural technician, i5). Such experiences reinforce the need to rebuy these seeds, which makes farmers dependent on seed companies and often also on the seed substitution programme of the government (agricultural technician, i5). Connected to this, my interlocutors problematized the profit-interest of seed companies (seed training, po:04.04.). Justine (po:14.04.) for example elaborated that, although she liked hybrid seeds in the beginning, she discontinued using them and now preserves her own seeds as she realized that ‘those businessmen, they are just businessing’.

The good performance of the first generation of hybrid seeds also depends on ‘good practices’ including the usage of inputs such as fertilizers (agricultural officer, i1). One seed supplier (i16) argued that no pesticides have to be applied on certain hybrid varieties due to their resistance to pests and diseases. However, others stressed that some hybrid varieties

are more susceptible to diseases, so that it can become necessary to apply pesticides (farmers, s17; i17). Moreover, many stressed that formal seeds cannot be stored easily and hence must be treated in new ways like pesticides, too (agricultural officer, i1; farmer, i2; Dohr et al. 2015:44f.). Further inputs required for the storage and cultivation of formal seeds are also expensive and therefore not easily accessible to farmers but threatening to put them into debt (Dohr et al. 2015:135f.).

### 6.2.2. Values of local seeds

In contrast to that, farmers often highlighted the economic motive behind saving seeds as it avoids the buying of seeds (e.g. farmers, c4; c8), no money has to be wasted (e.g. farmers, c12; s7) or rather no extra money has to be spent (farmers, s12; s20), and the costs of living are reduced (farmer, s11). One farmer (i17) emphasized that indigenous seeds should not be abandoned as they can be replanted, and no money has to be wasted. When farmers do not have enough money available to buy seeds, saving seeds and going back to traditional seeds is stated as an easy and accessible way to still plant (farmers, s9; s13). Farmers say that their farm-saved seeds cannot stress them and help them to stop struggling (to buy seeds) (farmers, c21; s2). Not only seed access but also the cultivation of traditional seeds is cheaper as they do not require special inputs like fertilizer and can be fertilized with manure only (agricultural officer, i1; seed supplier 1, i7).

Another important factor in saving seeds is their availability in time. One farmer explained that it is ‘good to stay with your own seed’ as it can be planted anytime (farmer, c6). If a person depends on buying seeds, several delays could occur. For example, the farmer might have to borrow money first (farmers, c19; c20). Or it might happen that the seeds are out of stock (farmer, c6). With farm-saved seeds there is no rush to try to get seeds quickly (farmer, c22), no need to wait and worry (farmer, s1), and farmers can directly start the planting any time they want (farmer, c26), usually when the first rain comes (farmers, c25; s1). Seed-saving also allows farmers to be self-reliant and independent both from social networks and the government (e.g. farmers, c11; c15; c24). In addition to these decisive factors, which allow even resource-poor farmers to farm well and in time, farmers highlighted the quality and value of local seeds.

To begin with, through seed saving, which includes the selection of the best and preferred seeds, and the continuous testing and reviewing of varieties, farmers shape the quality of local seeds themselves (farmer, s7). By optimizing and knowing their seeds, including their water requirements, resilience and yield potential, farmers can rely on the seeds and trust them, even in conditions of drought (farmers, c5; s16; s20). Local seeds are described as ‘beautiful’ (farmer, c11), ‘strong’ (farmer, c14) and ‘good’ (farmers, c17; s2; s20). The local varieties can be kept longer without weevils (farmers, c17; s19; i2) and it is possible to store

them without chemicals with traditional methods such as by mixing them with ash (agricultural officer, i1; NRWA worker, i17). Moreover, the local varieties are said to taste better (farmers, s2; s19; NRWA worker, i17). Some traditional varieties are early-maturing (farmer, c17), some can produce big and heavy cobs if there is good rain (Likwama representative, i15) and can obtain a high yield (farmers, c13; c14; s2). Although landraces are often criticized for their low yield (Wanga et al. 2022:13), my interlocutors questioned such general assumptions and problematized the lack of an assessment of real yield differences between local and formal seeds (forum, po:14.03.). Indeed, one farmer (i10) stressed that the yield of *Okashana 2* is much lower than the yield of his traditional *mahangu* varieties which seed heads are twice as long. The traditional varieties take longer time than *Okashana 2* (about two more months) but are described as drought resistant and importantly 'give more food' (farmer, i10). They are said to be more resistant to pests and diseases, although they are still susceptible to birds (farmer, i10). The claim that hybrid maize yields more than local varieties is contested, too, and trials in West Kenya show that under local planting conditions local maize either outyields hybrid varieties or that no substantial yield difference between the two can be identified (Hebinck & Kiaka 2024:82).

In general, my interlocutors stressed that traditional varieties are better adapted to the climatic and ecological conditions, more resistant to pests and diseases and capable to give a certain yield even in drought (agricultural officer, i1; GIZ employee, i9; farmer, s10). One farmer (s17) explained that these seeds were planted for ages and ages so that even the pests know it and the seeds are protected from them. Due to the adaptiveness of local varieties, their conservation value was stressed: "conserving our natural crops (…), we never can overemphasize, it's crucial, it's vital because I think that's your originality and there is no any other plant that can really do well in your environment than your own natural ones" (NBRI employee, i18).

More broadly, the importance of local seeds in terms of heritage and seed preservation was stressed. Justine (po:20.03.) explained that she takes red and purple maize seeds from her sisters as she does not 'want to avoid it' and so that young people can learn about it. One farmer (c14) stressed that she keeps seeds to 'remember the past' and that she will give seeds to her (grand)children and others in the time for sowing. Another farmer (i10) stated that he wants even his grand-, grand-, grandchildren to use farm-saved seeds and that generally farmers should continue with it and not leave it aside. An NBRI employee (i18) said: "I also call the natural plants or landraces as their ancestors. You can't live without your ancestors. Somehow you must have your grand-, grand-, grand-, grandfathers and -mothers gene in you." Another farmer stressed that the traditional seeds are the 'seed for the future' which should be kept and not wasted so that they can be used constantly (farmer, s7). One farmer emphasized that the local seeds and with them their good characteristics and the tradition from their forefathers

cannot be afforded to be lost (Likwama representative, i15). In seed programmes by NRWA, the local NGO highlighted the value of traditional seeds to farmers in the following way:

> "We used to tell our people the importance of our traditional seeds, why we have to use our own seed. Because we see that our own seed is healthier, it's not a poisoned seed, just a normal seed. That seed, it is God the creator who gave it to us, from the beginning. If we eat our own seed, we will be a healthy nation. We need to have what belongs to us. Our traditional seeds are very important, more than those hybrids." (NRWA worker, i14)

Farmers I talked to stressed that they would advise and encourage other farmers to save their own seeds (e.g. farmer, c9). One farmer (s9) suggested that even if farmers have the money to buy formal seeds they should go back to traditional seeds because the 'modern' seeds damage the soils and the local varieties. What is the state of these local, traditional varieties?

### 6.2.3. State of local seeds and varieties

In 2006, Mendelsohn (2006:37) estimated that 42% of the farmers in Northeast Namibia mixed traditional and formal seeds, while 41% only relied on traditional seeds and 17% only on formal seeds. Currently, Wanga et al. (2022:9) found that 80% of the sorghum varieties in Katima Mulilo Rural are landraces based on local seeds. Even in the case of maize, Kiesel et al. (2022:142) suppose that most farmers in the Zambezi Region continue to use farm-saved seeds.

One of my interlocutors indeed remarked that most farmers in her area use their own seeds (farmer, c13). For crops like sorghum and *mahangu* it was often assumed that farmers use local seeds, and that 'traditional' varieties are still around (e.g. agricultural officer, i1; farmer, i2). In the case of maize, however, one farmer (i2) supposed that seeds are usually bought, stating that local maize seeds can be difficult to obtain. Three of my interlocutors stated that they used local sorghum and *mahangu* seeds from their own seeds or other farmers but bought hybrid and/or open-pollinated maize seeds (farmers, s2; s3; c6). One of them elaborated that, unlike sorghum and *mahangu*, her maize seeds were lost in the previous year due to drought, so that she had to buy new ones from the open market (farmer, c5). Sorghum and *mahangu* seeds are sometimes bought, too (e.g. farmer, c7). One farmer (c4) who made good experiences with formal maize seeds for example announced her plan to buy formal *mahangu* seeds for the upcoming season.

While local seeds seem to dominate in some areas and for some cereal species, formal bought seeds become increasingly prevalent. One farmer (i17) even stated that everyone around her buys seeds and that she does not believe anyone to still have the indigenous seeds. The absence of local seeds was sometimes highlighted as the reason to buy seeds. One farmer (s3) explained that she and farmers surrounding her use hybrid seeds because they do not have their own seeds anymore, which are nowhere to be found. During the seed training (po:05.04.) one farmer said that farmers now use *Okashana* because they have lost their own varieties.

Especially due to the increasing interconnectedness between local and formal seed systems, the origin and characteristics of farm-saved seeds increasingly become uncertain and several of my interlocutors questioned if 'local, traditional' farm-saved seeds still exist (forum, po:14.03.). When asked about traditional maize varieties, one farmer replied that one cannot know which seed is what anymore and that even presumably open-pollinated seeds cannot be repeated anymore (Likwama representative, i15). Various people emphasized that local seeds are (critically) endangered or already lost. An agricultural officer (i1) elaborated: "Most people they have lost their indigenous seeds and are now depending on companies." She further warned: "the local seeds, (…) it's disappearing, very soon, we will not have it again, if we are not careful" (agricultural officer, i1). As elderly but especially younger farmers are changing to formal seeds, one farmer (i2) deduced that "the local seeds, they will totally like face out."

One aspect which might illustrate these developments was the way varieties were (not) named. One of the standard questions I asked the small-scale farmers Justine and I interviewed when they presented us cereal varieties from their fields was how these varieties were called. What I had initially imagined to be a rather technical question turned out to be far less straightforward. This became apparent for the first time during a field visit in a village where two farmers, a middle-aged man, and an elderly woman, presented Justine and me two *mahangu*, two sorghum and two maize varieties that differed in colour, length, and size (farmers, c5; c6). When asked to name the varieties, Justine translated to me that the farmers do not know their names. Despite the seniority of the woman, Justine added as an explanation that both are 'new' farmers and only 'old people' know the names of their seeds. Ten days later, two female farmers, a mother and adult daughter, gave us a similar reply (farmers, c16). They showed us four different millet varieties and named two of them *Pemba* and *Kakumaba*. Concerning the other two, a short and a long millet variety, they said that they do not have the name. The women mentioned that older people know the 'proper name' but they themselves verbally distinguish the varieties only by colour or length. This was mirrored by the replies of other farmers who were often able to name some varieties but stated not to know the names of other varieties which were then differentiated by colour or further characteristics like 'hair' (e.g. farmer, c17). In the visits Justine and I continued to conduct over a few weeks, Justine (e.g. po:05.04.) kept mentioning that we will hopefully succeed in finding one old person that could finally tell us the 'real' names of the varieties. Although different people helped us to identify some of the cereal samples, we did not encounter such a person.

An NGO worker at NRWA (i14) and a representative of the Farmers' Union Likwama (i15) both bemoaned the loss of variety names. The NRWA spokesperson associated the absence of names with an increased disconnection from the seeds' origins: "We call them our seeds, but we do not know their names, or (…) where they originate from" (NRWA worker,

i14). There can be a positive correlation between knowing the origin and the name of seeds. Three independent farmers for example called a millet variety *Pemba* which was by one farmer also explicitly termed 'traditional' (farmers, c15; c16; c17). However, not all varieties described as 'traditional' can be named. In other conversations, a farmer mentioned that especially the short millet, which she was not able to name, was from her grandmother (farmer, c16), and another farmer stated that one of her two millet varieties, the one she called 'white millet', was from her ancestors but that she did not know its name (farmer, c21). While the loss of names might indicate a loss of local knowledge, it therefore does not have to be an indicator for the loss of the traditional varieties themselves.

Nevertheless, during the seed training and the pile sorting exercise farmers listed several cereal varieties which are regarded as lost or disappearing. In some cases, the farmers named the varieties in local languages, in other cases they only described them. During the seed training in Mashare, a young woman named, with the help of several elderly women, three *mahangu* varieties and one maize variety which are very hard or impossible to find nowadays. The farmers stated the colour and further characteristics of the varieties such as the length of the stem and head and certain features when pounded (seed training, po:05.04.). During the pile sorting exercise (po:18.04.) names and descriptions of further lost varieties were gathered and one group for example recalled a maize variety which needs a lot of rain, but which can grow big and tall and can produce up to five or six cobs. The group also mentioned certain yellow, red and white maize varieties as well as a white sorghum variety, which are not yet lost but are getting considerably less. Another group named one lost local *mahangu* variety and described two almost lost local maize varieties which were black/white or yellow/white and regarded as extremely tasty. In a third group the taste of one lost variety was highlighted by a younger farmer, too. Although he had only eaten the variety once, he seemed to recall its taste and consistency well and enthusiastically described how it tasted powdery and of maize meal even when roasted. These descriptions of (almost) lost varieties underline the general feeling of loss connected to local varieties. Given this situation and the advantages and disadvantages of both local and formal seeds, which seed futures are possible and desirable?

### 6.2.4. Ways forward

A seed specialist (i3) argued that ultimately there are no 'good or bad varieties', but that the suitability of different varieties highly depends on the farming context and parameters such as the farm size, the available cash-income and labour. One seed supplier (i7) explained that he would advise subsistence farmers to continue to plant and replant open-pollinated varieties. Several of my interlocutors recommended farmers to use local varieties if resources are scarce and food security is at stake because these varieties are more resilient and can produce some

yield even in difficult years and on marginal lands (agricultural officer, i1; NNF team leader, i6; GIZ employee, i9).

In other settings, for example when farmers have fields with good soil fertility which can keep soil moisture and when farmers have enough resources to take risks, it can make sense to use hybrid seeds to obtain a higher yield (NNF team leader, i6). Especially for farmers who have extra-cash available and start "moving up the ladder", hybrid seeds can be most suitable (seed supplier 1, i7). One seed supplier emphasized that hybrid seeds are promising when the focus is on marketing the produce: "there is a community in Namibia which has realized that they need to make money. And to make money, they have to get the hybrids which will give them higher yield" (seed supplier 1, i7). Many of my interlocutors (e.g. Justine, po:04.04.) stressed that especially due to the high costs of hybrid seeds and the risks involved, hybrid seeds are "just for business" (farmer, i2) and only a "solution for commercial purposes" (GIZ employee, i9). Due to the dominance of subsistence farming in the Zambezi Region, this questions the degree to which hybrid seeds can currently provide farming solutions on a large scale. At the same time, the importance of the individual farming context makes it necessary to review in each case what seeds and varieties are best suited for what planting purposes and conditions (seed specialist, i3). Therefore, it is vital that farmers know the advantages and disadvantages of the different seed classes and varieties and take an informed decision on what they want to plant (seed specialist, po:04.04.; NNF team leader, i6). However, the information delivery around the different seed classes and their promotion is not balanced.

Formal and especially hybrid seeds have a lobby and business interests behind them and are heavily advertised for (NBRI employee, i18). For example, programmes of organizations like GIZ often recommend farmers to use formal seeds (GIZ employee, i9). In addition, most money and breeding effort goes into formal, especially hybrid varieties (commercial farmer, i11). Farmers and institutions like NBRI that advocate for traditional seeds are far from advocating for them in a similarly strong way (NBRI employee, i18). This imbalance and the resulting one-sidedness of information leads to a skewed evaluation: as farmers hear more good things about formal seeds, they tend to believe these seeds are the best (NBRI employee, i18). Therefore, an NBRI employee (i18) highlighted the need to not only stress the qualities of formal seeds but also to appreciate those of local seeds and to contribute to a more balanced information delivery. She further elaborated the connection between too little attention and research on traditional seeds and their disregard and underrating in contrast to formal seeds. With a nuanced stance she demanded that the perspectives of small-scale farmers and their traditional seeds should be better understood before their future potential is anticipated:

> "Of course, scientifically and us knowing that the climate is changing, we need something that will bring yield faster, something with shorter, not long (…) time to grow. That's what we have said scientifically but have we engaged with the farmers enough? To understand their point of view? Their perceptions, their understanding? I feel like, of course yes, as for now, I would say, yes, the improved varieties are important and indeed, they are important in terms of fast-growth, withstand the climate changing – but have we done also the same

> justice to understand the other part? Or perhaps we need also to dig deeper and really understand: are the traditional varieties really not withstanding this climate, are they really surely not high yield? Perhaps we do not really understand them. Perhaps we need to invest more into understanding them before we conclude and just try to throw them out like 'no, you are not good, I'm coming up with a better one'." (NBRI employee, i18)

This statement highlights the importance to research and invest into local seeds while it also acknowledges good characteristics of formal seeds. Several of my interlocutors proposed ways to integrate and nurture both local and formal seeds. Some farmers (i10; i15) for example recommended other farmers to use around half of their available cultivation area for traditional varieties and the other half for bought, possibly hybrid varieties, and to observe and compare the outcome. This suggestion, however, is complicated by the threat of cross-pollination.

Another farmer stated: "If we have got ways how to restart to get like, these are the local seeds, these are the hybrid seeds, so that maybe we can keep these, also that the people who want to go on that line, can go on that line" (farmer, i2). At the same time, however, he described that the hybrid seeds have already "spoiled" the local ones and that they do not know how to "reverse back, to get our local seeds" (farmer, i2). He expressed: "Even if you plant your local seeds there, even the hybrids. (…) Ya, they crossbreed, so it changes everything, it changes everything. So currently, it's difficult for us to know the local. They might be there, they are there, but it's really difficult to get them" (farmer, i2).

Some farmers (e.g. c10) I talked to explicitly indicated that they plant different varieties separately, such as white and yellow maize on separate fields. Others stated to just plant them randomly on one field, which then makes it likely that different varieties cross-pollinate (e.g. farmer, c8). In the seed training in Mashare, the pollination behaviour and deduced isolation rules to prevent the mixture of different varieties were specified for each species (seed training, po:04.04.). Sorghum is a partial cross-pollinator, so that different varieties that farmers do not want to mix should have a distance of about 100 meters. In the case of *mahangu* and maize, which are both cross-pollinators, an isolation distance of 300-500 meters is advised to keep the varieties 'clean'. As spatial constraints do not allow all small-scale farmers to follow such isolation protocols, the planting of both local and formal seeds can accelerate the already occurring mix of varieties and the loss of local ones.

Whereas local varieties are generally regarded as endangered, some farmers, nevertheless, emphasized that only certain varieties are lost and that other farmers still have local seeds and continue to keep traditional seeds, although less so than in the past (NRWA worker, i14). NBRI conducted a study on local cereal varieties and indeed found that crop varieties are not yet extinct but only disappear from specific locations: "A certain community would say, a certain plant is lost, is gone but when you go to another community or another region, you are likely to find it" (NBRI employee, i18). Therefore, NBRI now tries to facilitate seed exchanges through regional seed banks, aiming to implement at least one or two community seed banks in all 14 Namibian regions (NBRI employee, i18). The seed banks are built and managed with

the support of NBRI but are locally facilitated by community members who collect seeds, store them according to traditional techniques and personal preferences and give them to farmers who ask for it (NBRI employee, i18). At the time of my research, the project was still in its initial stages but an NBRI employee shared the enthusiasm of farmers in whose communities the first seed banks were to be established: “they are still excited that something like that is going on cause they know they are losing a lot of their seeds and they would want to really make sure their seeds are safe and protected” (NBRI employee, i18). Justine (po:30.03.) confirmed that a regional seed bank would be a useful tool to keep local seeds but highlighted that it would require education to raise awareness on the importance of local seeds which can help to avoid buying seeds. If implemented accordingly, community seed banks themselves could help to spread awareness and knowledge and facilitate the revival of currently deteriorating seed and food practices.

## 7. Discussion: Reviving local seeds?

The previous sections have outlined key transformations of cereal agrobiodiversity and seed systems in the Zambezi Region, including the historic and recent spread of maize as well as the recent increase in formal and hybrid seeds. In this section, similarities and differences between these processes are discussed, and the question is approached what a revival of local seeds could mean in their context.

As section 4.2.2. illustrated, my interlocutors explained the current regional dominance of white maize cultivation mainly through the good marketability of maize, its low labour intensity and resistance to birds. These characteristics make the crop especially attractive in the context of societal changes such as rural-urban migration and monetarization which reduce the availability of labour and increase the need for cash. Section 6 highlighted that the spread of hybrid seeds has also been connected to its suitability to commercial farming. When planted successfully, hybrid seeds can allow farmers to significantly increase their profits. In addition, the enhanced resilience of hybrid seeds to environmental and climatic challenges was emphasized.

White maize and hybrid seeds also have in common that they are institutionally promoted and, for example, better researched than other cereal crops or seed types. The current market situation and politics prioritize white maize, and hybrid seeds are heavily promoted by seed companies and programmes. At the same time, sorghum and *mahangu* as well as local seeds have received less attention and support and have been marginalized by (colonial) powers and profit-driven economic structures, as highlighted in the sections 4.1.1. and 6.1.1. Section 4 illustrated the impact of colonialism on cereal systems as colonial powers promoted certain white maize varieties and simultaneously devalued small grains like *mahangu* and sorghum as well as traditional food practices, both in the Zambezi Region as well as in many other African contexts. As a result, both the consumption and cultivation of sorghum and *mahangu* have decreased drastically in the Zambezi Region.

Under the current climatic conditions this is particularly problematic as maize is more vulnerable to drought than *mahangu* and sorghum. Plant breeding can allow for a certain adaptability and hybrid maize seeds are often specifically bred to cope with drought. However, as section 6 underlined, hybrid seeds are usually not suitable for subsistence agriculture as they are expensive, make farmers dependent on rebuying the seeds and inputs and are connected to fears of having negative effects on the environment. In addition, farmers mentioned that hybrid varieties do not taste as well as local ones.

Several of my interlocutors therefore demanded a revival of sorghum and *mahangu* as well as local seeds. The advantages and valued qualities of local seeds were summarized in section 6.2.2. Local seeds also allow resource-constrained farmers to grow cereals in time and without extra inputs, and the seeds are valued for their high adaptiveness, good storability and

superior taste. Many farmers are not willing to replace their farm-saved varieties with the presumably more viable formal varieties and are instead keen to preserve and continue traditional varieties for the generations to come. Furthermore, section 4 stressed that sorghum and *mahangu* are more drought-resistant, environmentally adapted and nutritious than maize. This makes them promising cereal crops to ensure cereal cultivation and healthy diets in times of climate change. Due to the current neglect of sorghum, *mahangu* and local seeds the call for their revival is coupled with the demand to institutionally support these crops and seeds. Several of my interlocutors stressed that the promotion of sorghum and *mahangu* would for example require the establishment of favourable market structures for these crops in the Zambezi Region. Some NGO workers facilitate such a market access for small grains on a small scale as illustrated in section 4.2.3. In addition, more research on local seeds and varieties is needed as an NBRI employee argued in section 6.2.4. Such research could be an important foundation to determine and advocate the future potential of local seeds and varieties, for instance in terms of their drought resilience. NBRI also showed in a study that, despite their endangerment and the general feeling of their loss, local cereal varieties are still held by (some) farmers in Namibia. NBRI facilitates the spread of these varieties through community seed banks.

Neglected and underutilized species (NUS) like small grains are also increasingly promoted on a regional and global scale (cf. Padulosi et al. 2013:9). The African Orphan Crops Consortium (AOCC) for example genetically analyses and improves 101 neglected African food crops to enhance their integration into food systems and to improve nutrition (AOCC 2024). Moreover, the Food and Agriculture Organization of the United Nations (FAO) declared 2023 to be the International Year of Millets and promoted millet varieties, including pearl millet and sorghum, as underrated nutritious and resilient crops (FAO 2024). Chivenge et al. (2015) emphasize the particular potential of NUS as “Future Crops under Water Scarce Conditions in Sub-Saharan Africa”. In this context, they highlight not only the potential of millets, but also the potential of currently understudied African maize landraces which might prove to be drought-tolerant (Chivenge et al. 2015:5693). This outlines the importance not only of inter- but also of intra-species agrobiodiversity.

The promotion of NUS would be further facilitated by a change of mindset, capacity development, upgraded value chains and the development of an enabling policy environment (Padulosi et al. 2013:38-47). Such a promotion could enhance (climate) resilience, nutrition, income generation, agricultural and cultural diversity, as well as the empowerment of local communities and women (Padulosi et al. 2013:9, 12). My interlocutors emphasized that a more diversified cultivation can improve food security as it often allows for a harvest, even if some crops are affected by weather conditions, pests and diseases or wildlife (e.g. farmer, c5; NBRI employee, i18). While this thesis focuses on cereals, the call for diversification is not limited to cereal crops. In addition to small grains, a farmer (i2) and an NNF team leader (i6) argued that

further agricultural products such as mangos, vegetables, chilis or legumes should have a better market to diversify farming systems and income sources. Especially the wider cultivation of legumes would benefit the soil and diet (commercial farmer, i11; NBRI employee, i18). To revive or promote NUS therefore has many potentials. In the case of cereal varieties and seeds this potential, however, is not necessarily tied to their presumed 'localness'.

Some of my interlocutors argued for the superiority of sorghum and *mahangu* based on their 'Africanness' and described maize as a foreign, colonial crop (section 4.2.3). However, maize was historically not only pushed top-down, but also adapted and spread bottom-up by African farmers (section 4.1.2.). The diverse maize varieties which were imported to the African continent in various ways were experimentally grown, further diversified and adapted in heterogenous processes of an 'Africanization' of maize varieties (McCann 2005:4, 202; cf. Chivenge et al. 2015:5693). As highlighted in section 4.2.1., many of my interlocutors in the Zambezi Region now perceive maize as a traditional and socioculturally important crop as well as the preferred regional staple in the Zambezi Region. At the same time, the local rootedness of sorghum and especially *mahangu* in the local diet was slightly contested. These insights question the exclusive application of the label of 'localness' to small grains.

What makes a variety 'local' or 'traditional'? In an interview, an NBRI employee (i18) proposed the occurrence of crop wild relatives as an indicator to identify if a crop that was introduced to the country at some point has also developed a distinct "native" or "indigenous" variety. In addition to such biological hints, if a variety is 'naturalised' and framed as 'local' or 'traditional' is often related to political considerations and collective, yet not necessarily homogenous, constructions (cf. Kauma 2012 b:7; Bollig & Krause 2023:134). As all cereal species have their own history of migration and transformation, a German seed specialist (i3) argued that it is up to (individual) interpretation which varieties are long enough in a country or region to be classified as 'heirloom'. Section 6.1.2. further highlighted that varieties constantly adapt to new conditions in cultivation, which not only suggests an understanding of their histories as dynamic but also draws attention to their future transformations. Unlike the reintroduction and repetition of 'fixed' varieties from the past, increasing the cultivation of crops like sorghum and *mahangu* could allow for the continued local adaptation and development of the cereals and can therefore deepen or newly create their 'localness'.

In the case of 'local' seeds, their 'localness' is also increasingly questioned, but for different reasons. As section 5 pointed out, the saving, exchanging and informal selling/buying of seeds continue to be crucial seed practices in Southern Africa in general and in the Zambezi Region in particular. Despite the prevailing significance of these rather local seed practices, formal seeds are increasingly used and intermingle spatially, genetically, socially and economically with local seeds. Formal seeds are saved on farms, enter seed sharing networks and

cross-pollinate with local varieties during planting. This can endanger local seeds and as section 6.2.3 showed, my interlocutors increasingly questioned if 'local' seeds are still around. Local seeds are in part voluntarily discontinued due to the benefits of formal seeds, but their loss is also an unintended effect of the increasing interconnectedness of local and formal seed systems. Moreover, the loss of local seeds is connected to the loss of local seed knowledge, which is accelerated by societal transformations like urbanization and formal schooling.

Literature confirms that formal seeds can impact local seeds negatively and can for example accelerate the loss of agrobiodiversity, compromise food security and weaken the capability of farmers to adapt to climate change (Ncube et al. 2023:10). The contamination of local seeds through cross-pollination furthermore affects farmers' confidence in their plants and local knowledge and ultimately impacts farmers' well-being and morale (Kerr & Wynberg 2024:8). As the cross-pollination of local and formal varieties can impact the seed quality of local seeds it also affects seed exchanges which are based on mutual trust (van Niekerk & Wynberg 2017:1119f.).

At the same time, however, the cross-pollination of formal and local varieties in cultivation could to a certain extent also be fruitfully used by farmers to adapt and create new varieties (seed training, po:05.04.). Furthermore, it would be beneficial to integrate NUS and local seeds into formal research, seed and breeding systems as conducted by the AOCC. Such formal improvement of local varieties strengthens and enhances their cultivation but transcends the prior definition of 'local' seeds. Therefore, not only the availability of uncontaminated 'local' seeds is contested, but it is also questionable if their promotion would require a narrow understanding of 'local' seeds.

Section 6 emphasized that both local and formal seeds have beneficial characteristics but that the suitability of a seed depends on the individual context of a farmer, particularly if sufficient financial means are at hand and if at least some of the harvest is sold. Such individual farming circumstances are shaped by the historically grown socioeconomic conditions in the Zambezi Region. Section 3 stressed the historical neglect of the region which has ongoingly contributed to an insufficient market access and infrastructure, low quality school education and the lack of formal employment opportunities. These aspects are, among others, structural factors which hinder farmers from accessing the potentials of formal seeds. As not one seed system alone can provide for all farmers' needs and formal seeds could and should play a complementary role to local seed systems, it is crucial to enhance the accessibility and suitability of formal seeds for small-scale farmers (Ncube et al. 2023:2, 10). In addition to an economic empowerment of small-scale farmers, this should include their participation in and the integration of their preferences and needs in processes like plant breeding (Wanga et al. 2022:11, 13; Ncube et al. 2023:2, 10). While it is important to promote the possibility for small-scale farmers to profit from formal seeds, it would be devastating to do so without appreciating

the value of local seeds and to further research and promote their potential. This could occur both through the institutional acknowledgment and protection of local seed practices, and also through the purposeful and participatory integration of ‘local’ seeds into formal breeding and formal seed systems.

## 8. Conclusion

This thesis began by pointing to the enormous challenges climate change and especially increasing droughts and higher temperatures pose to cereal cultivation in the Zambezi Region, Northeast Namibia. Section 3 stressed the importance of small-scale rainfed cereal cultivation for subsistence and livelihoods in the region. The section also highlighted that in addition to the unreliable rain, wildlife, pests and diseases, the lack of resources, and a shortage of agricultural labour are major challenges to cereal cultivation. These challenges are connected to the colonial history, neglect and 'underdevelopment' of the region as well as more recent phenomena like urbanization and an increased emphasis on nature conservation. Against this background, the thesis followed the question *which cereal species and seeds have a future potential in the Zambezi Region and how their rootedness and current situation are perceived and evaluated.* Thereby, the thesis focused on the three locally relevant cereal species, maize, *mahangu* and sorghum, and two classes of seeds, called local and formal seeds. The research question was approached based on findings from ethnographic research in and around the Zambezi Region, which I conducted in the beginning of 2023. Section 2 described the applied methods and circumstances of the research as well as analysis. The research process was significantly shaped by the access and insights that my two main research partners, the NNF staff member Louise and the small-scale farmer Justine, gave me into local and formal cereal seed systems in the region.

As sections 4 to 6 frequently highlighted, seed systems and crop choices are embedded in dynamic economic, political and sociocultural contexts. Food systems on the African continent have been particularly shaped by colonialism, which has enforced ongoing structures, incentives and ideas that favor certain crops and seed types over others. Section 4 outlined how this has contributed to the loss of small grains and certain maize varieties. The section further illustrated that my interlocutors perceived the rootedness of maize, *mahangu* and sorghum differently. While small grains, especially sorghum, were mostly regarded as long rooted in the region, maize was seen as a 'traditional' staple by some and politicized as a foreign, 'colonial' crop by others. This is connected to the history of maize on the African continent which is both shaped by a centralized colonial promotion of certain maize varieties, as well as diverse, local processes of appropriation and adaptation of the cereal crop. Maize cultivation has also dramatically increased in the last decades. My interlocutors ascribed this to socioeconomic processes such as increased monetarization and urbanization. Thereby, the spread of maize went hand in hand with the decline in sorghum and *mahangu* cultivation. These small grains are more resistant to drought, pests and diseases and more nutritious, but they are also more susceptible to birds and more labour intensive than maize which is a high-yielding and well marketable crop. Due to the current market structure, biological characteristics and the sociocultural importance of maize, my interlocutors stressed the indispensable role

of maize for future cereal cultivation. At the same time, several interlocutors demanded to revive and strengthen the cultivation of sorghum and *mahangu* to adapt to climate change and to improve food security. This would require institutional support, including market structures, for the small grains.

Section 5 described the seed situation and the dynamic cereal seed practices in (Southern) Africa and the Zambezi Region. When it comes to seed saving and storing, both traditional and new methods are practiced in the Zambezi Region. Local practices are increasingly abandoned, which is connected to a decline in local seed knowledge, but they are also partly revived. Seeds continue to be shared informally between farmers. At the same time, seeds are increasingly bought. Buying seeds was either seen as a potential for farmers to become more independent and to access favorable seed resources – or it was regarded as a waste of money and a break with social responsibilities and solidarity which are for example manifested through seed sharing practices. The spread of formal seeds in the Zambezi Region is a rather recent phenomenon and the extent to which farmers depend on formal seeds varies. However, the spread of formal seeds and the increasing interconnection of local and formal seeds has already impacted the current seed situation, which was further emphasized in section 6. As local and formal seeds cross-pollinate and formal seeds are locally saved, shared and propagated, local cereal varieties are increasingly endangered. Nevertheless, they are not yet extinct and could be reintroduced and strengthened through initiatives like community seed banks.

Both local and formal seeds have beneficial traits to offer for future cereal cultivation and were presented as the 'seed for the future' by some of my interlocutors. Formal and especially hybrid seeds, on the one hand, are specifically bred to cope with current challenges like droughts and can enable farmers to increase the farming profit. At the same time, these seeds are expensive and can lead the farmers into indebtedness. Local seeds, on the other hand, allow even resource-poor farmers to farm well. In addition, they are locally adapted, resilient and of high sociocultural relevance. However, they are also largely understudied.

The current structures in place continue to favor white maize and formal seeds at the expense of other valuable cereal species and varieties, and thereby foreclose different promising cereal (seed) futures. To balance the current asymmetries and to enhance the diversity and resilience of cereal farming, it is therefore critical to promote currently marginalized varieties and seeds. As section 7 outlined, such a promotion or 'revival' of small grains, neglected maize varieties and local seeds does not have to be based on their perceived 'localness'. Cereal varieties are characterized by histories of migration and localization and the mix of formal and local seed systems, both a challenge and potential, can dissolve clear distinctions between formal and local seeds. Based on the cited literature and the statements of my interlocutors, I argue in this thesis that the revival of currently neglected varieties and seeds as well as the effort to make dominant varieties and seeds more accessible to small-scale farmers

should focus on the empowerment of these farmers and a balanced information delivery and institutional support of different cereal varieties and seeds. This could encourage and allow small-scale farmers to continuously cultivate, pass on and further diversify both local and formal sorghum, *mahangu* and maize varieties to their needs, preferences and aspirations.

## Bibliography


Aring, Mascha, Ole Reichardt, Ewaldine M. Katjizeu, Brendan Luyanda and Carolin Hulke. 2021. Collective capacity to aspire? Aspirations and livelihood strategies in the Zambezi Region, Namibia. *The European Journal of Development Research* 33:933-950.

Bollig, Michael and Franz Krause. 2023. *Environmental Anthropology: Current issues and fields of engagement.* Stuttgart: utb.

Cherniwchan, Jevan and Juan Moreno-Cruz. 2019. Maize and precolonial Africa. *Journal of Development Economics* 136:137-150.

Chivenge, Pauline, Tafadzwanashe Mabhaudhi and Albert T. Modi. 2015. The potential role of neglected and underutilised crop species as future crops under water scarce conditions in sub-Saharan Africa. *International Journal of Environmental Research and Public Health* 12:5685–5711.

Curry, Helen A. 2022. *Endangered Maize: Industrial agriculture and the crisis of extinction.* Oakland, California: University of California Press.

Davies, Julia E., Dian Spear, Gina Ziervogel, Salma Hegga, Margaret N. Angula, Irene Kunamwene and Cecil Togarepi. 2020. Avenues of understanding: mapping the intersecting barriers to adaptation in Namibia. *Climate and Development* 12(3):268-280.

Dohr, Daniela, Philipp Kumria und Jonas Metzger. 2015. *Saatgut und Sozialsystem. Gender, Monetarisierung und bäuerliche Praktiken der Ernährungssicherung in Namibia und Tansania.* Berlin: LIT.

Emerson, Robert, Rachel Fretz and Linda Shaw. 1995. *Writing Ethnographic Fieldnotes*. Chicago & London: The University of Chicago Press.

Fabiano, Ezequiel, Selma Lendelvo, Alfons Mosimane and Selma Kosmas. 2023. Human-wildlife interaction, rural conflict, and wildlife conservation. In: Bollig, Michael, Selma Lendelvo, Alfons Mosimane and Romie Nghitevelekwa, eds. 2023. *Conservation, Markets and the Environment in Southern and Eastern Africa: Commodifying the 'wild'.* Woodbridge, Suffolk, UK: James Currey, 305-328.

FAO. 1999. *Agricultural Biodiversity.* Multifunctional Character of Agriculture and Land Conference. Background Paper 1. Maastricht, Netherlands. September 1999.

FAO. 2019. *The State of the World's Biodiversity for Food and Agriculture*. Bélanger, J. and D. Philling, eds. 2019. Rome: FAO Commission on Genetic Resources for Food and Agriculture.

Frøystad, Mona, Jürgen Hoffman and Klaus Schade. 2009. *Agriculture: Future scenarios for Southern Africa. Country briefing – Namibia*. Winnipeg, Canada: International Institute for Sustainable Development.

Garzón, Diego Silva and Laura Gutiérrez Escobar. 2020. Revolturas: resisting multinational seed corporations and legal seed regimes through seed-saving practices and activism in Colombia. *The Journal of Peasant Studies* 47(4):674-699.

Gronemeyer, Reimer, Michaela Fink and Jonas Metzger. 2015. *Maize and malnutrition in Malawi. A study of the socio-economic causes of unbalanced food cropping in Dedza and Salima Districts.* Giessen. Commissioned by the German Corporation for International Cooperation (GIZ).

Hammersley, Martyn and Paul Atkinson. 2007. *Ethnography. Principles in practice*. 3rd edition. London & New York: Routledge.

Hangula, Lazarus. 2010. Isolation, invasions and a 'Caprivian' identity. An Introduction. In: Kangumu, Bennett. 2011. *Contesting Caprivi: A history of colonial isolation and regional nationalism in Namibia.* Basel: Basler Afrika Bibliographien, XI-XIII.

Hebinck, Paul and Richard D. Kiaka. 2024. Enacting indigenous and green revolutions in maize in West Kenya. In: Wynberg, Rachel, ed. 2024. *African Perspectives on Agroecology. Why farmer-led seed and knowledge systems matter*. Rugby, UK: Practical Action Publishing, 69-86.

Howard, Patricia L. 2003. Women and the plant world: an exploration. In: Howard, Patricia L., ed. 2003. *Women and Plants. Gender relations in biodiversity management and conservation.* London & New York: Zed Books, 1-48.

Hulke, Carolin, Jim K. Kairu and Javier Revilla Diez. 2021. Development visions, livelihood realities – how conservation shapes agricultural value chains in the Zambezi region, Namibia. *Development Southern Africa* 38(1):104-121.

Hulke, Carolin. 2022*. Development beyond global integration: livelihood strategies, small-scale agriculture, and regional value chains in Namibian conservation areas*. Dissertation. University of Cologne.

Kamwi, Jonathan M., P. W. C. Chirwa, F. P. Graz, S. O. M. Manda, A. W. Mosimane and C. Kätsch. 2018. Livelihood activities and skills in rural areas of the Zambezi Region, Namibia: implications for policy and poverty reduction. *African Journal of Food, Agriculture, Nutrition and Development* 18(1):13074-13094.

Kangumu, Bennett. 2011. *Contesting Caprivi: A history of colonial isolation and regional nationalism in Namibia.* Basel: Basler Afrika Bibliographien.

Kauma, Bryan U. 2021 a. 'Small Grains, Small Gains': African peasant small grains production and marketing in Zimbabwe during the colonial period, c.1890–1970s. *South African Historical Journal* 73(2):257-287.

Kauma, Bryan U. 2021 b. *A social, economic and environmental history of African small grains in Zimbabwe, from the pre-colonial past to the present*. Dissertation. Stellenbosch University.

Kauma, Bryan and Sandra Swart. 2021. 'Many of the dishes are no longer eaten by sophisticated urban Africans'. A social history of eating small grains in Bulawayo, Southern Rhodesia (Zimbabwe), c.1920s to the 1950s. *Revue d'Histoire Contemporaine de l'Afrique* 2:86-111.

Kauma, Bryan and Sandra Swart. 2022. Hunger and power: Politics, food (in)security and the development of grains in Zimbabwe, 2000-2010. *Historia* 67(1):144-176.

Kerr, Rachel B. and Rachel Wynberg. 2024. Fields of contestation and contamination: maize seeds, agroecology and the (de)coloniality of agriculture in Malawi and South Africa. *Elementa. Science of the Anthropocene* 12(1):1-21.

Khoury, Colin K., Anne D. Bjorkman, Hannes Dempewolf, Julian Ramirez-Villegas, Luigi Guarino, Andy Jarvis, Loren H. Rieseberg et al. 2014. Increasing homogeneity in global food supplies and the implications for food security. *Proceedings of the National Academy of Sciences* 111(11):4001-4006.

Khoury, Colin K., Stephen Brush, Denise E. Costich, Helen A. Curry, Stef de Haan, Johannes M. M. Engles et al. 2022. Crop genetic erosion: understanding and responding to loss of crop diversity. *New Phytologist* 233:84-118.

Kiesel, Carolina, Peter Dannenberg, Carolin Hulke, Jim Kairu, Javier Revilla Diez and Alexandra Sandhage-Hofmann. 2022. An argument for place-based policies: the importance of local agro-economic, political and environmental conditions for agricultural policies exemplified by the Zambezi region, Namibia. *Environmental Science and Policy* 129:137-149.

Kloppenburg, Jack R. 1988. *First the Seed. The political economy of plant biotechnology, 1492-2000*. New York: Cambridge University Press.

Kondwakwenda, Aleck, Bruce Mutari, Kennedy Simango, Eileen B. Nchanji, Rowland Chirwa, Jean C. Rubyogo and Julia Sibiya. 2022. Decades of cultivar development: a reconciliation of maize and bean breeding projects and their impacts on food, nutrition security, and income of smallholder farmers in sub-Saharan Africa. In: Mupambwa, Hupenyu A., Adornis D. Nciizah, Patrick Nyambo, Binganidzo Muchara and Ndakalimwe N. Gabriel, eds. 2022. *Food Security for African Smallholder Farmers*. Singapore: Springer, 3-26.

Kusena, Kudzai, Rachel Wynberg and Claid Mujaju. 2017. Do smallholder farmer-led seed systems have the capacity to supply good-quality, fungal-free sorghum seed? *Agriculture and Food Security* 6(52):1-12.

Lazaroff, Marissa, Kiana Lindsay, Lynn Socha and Avik Basu. 2021. *Assessing barriers to climate smart subsistence agriculture in Northeastern Namibia.* University of Namibia (UNAM), United Nations Framework Convention on Climate Change (UNFCCC), Climate Resilient Agriculture in Three Vulnerable Extreme Northern Crop Growing Regions (Crave), Global Water Partnership Southern Africa.

Madden, Raymond. 2010. *Being Ethnographic. A guide to the theory and practice of ethnography.* London: Sage.

Mamati, King'asia and Simon G. Omare. 2024. Indigenous knowledge systems, climate change and food security: perspectives from Bungoma County, Kenya. In: Maseno, Loreen, David A. Omona, Ezra Chitando and Sophia Chirongoma, eds. 2024. *Religion, Climate Change, and Food Security in Africa.* Cham, Switzerland: palgrave macmillan, 201-218.

Marshak, Maya. 2021. *On farms and in laboratories: maize seed technologies and the unravelling of relational agroecological knowledge in South Africa*. Dissertation. University of Cape Town.

Maseno, Loreen and Ezra Chitando. 2024. Religion, climate change, and food security in Africa. In: Maseno, Loreen, David A. Omona, Ezra Chitando and Sophia Chirongoma, eds. 2024. *Religion, Climate Change, and Food Security in Africa.* Cham, Switzerland: palgrave macmillan, 3-26.

McCann, James. 2005. *Maize and Grace: Africa's encounter with a New World crop, 1500-2000.* Cambridge, MA: Harvard University Press.

McGuire, Shawn and Louise Sperling. 2011. The links between food security and seed security: facts and fiction that guide response. *Development in Practice* 21(4-5):493-508.

McGuire, Shawn and Louise Sperling. 2016. Seed systems smallholder farmers use. *Food Security* 8:179-195.

Mendelsohn, John and Carole Roberts. 1997. *An environmental profile and atlas of Caprivi*. Windhoek, Namibia: Directorate of Environmental Affairs.

Mendelsohn, John M. 2006. *Farming systems in Namibia*. Windhoek, Namibia: Research and Information Services of Namibia.

Miracle, Marvin P. 1965. The introduction and spread of maize in Africa. *Journal of African History* vi(I):39-55.

Miyawaki, Yukio. 1996. Cultivation strategy and historical change of sorghum varieties in the Hoor of Southwestern Ethiopia. *Essays in Northeast African Studies. Senri Ethnological Studies* 43:77-120.

Moreta, Danilo E., Prem N. Mathur, Maarten van Zonneveld, Karen Amaya, Jacobo Arango, Michael G. Selvaraj and Beata Dedicova. 2015. Current issues in cereal crop biodiversity. In: Mukherjee, Joydeep, ed. 2015. *Biotechnological Applications of Biodiversity*. Berlin: Springer, 1-35.

NAB. 2021. *White maize grain market report. Marketing season 2020-2021*. Namibian Agronomic Board. Agronomy and horticulture market development division. Agronomy market development subdivision.

National Research Council. 1996. *Lost Crops of Africa. Volume I: grains*. Washington, D.C.: National Academy Press.

Nazarea, Virginia D. 2006. Local knowledge and memory in biodiversity conservation. *Annual Review of Anthropology* 35:317-335.

Ncube, Bulisani L., Rachel Wynberg and Shawn McGuire. 2023. Comparing the contribution of formal and local seed systems to household seed security in eastern Zimbabwe. *Frontiers in Sustainable Food Systems* 7(1243722):1-12.

NSA. 2017. *Namibia Intercensal Demographic Survey: 2016 report*. Windhoek, Namibia: Namibia Statistics Agency.

O'Reilly, Karen. 2012. *Ethnographic Methods*. 2nd edition. New York: Routledge.

Orlove, Benjamin S. and Stephen B. Brush. 1996. Anthropology and the conservation of biodiversity. *Annual Review of Anthropology* 25:329-52.

Padulosi, Stefano, Judith Thompson and Per Rudebjer. 2013. *Fighting poverty, hunger and malnutrition with neglected and underutilized species. Needs, challenges and the way forward.* Rome: Bioversity International.

Peschard, Karine and Shalini Randeria. 2020. 'Keeping seeds in our hands': the rise of seed activism. *The Journal of Peasant Studies* 47(4):613-647.

Phillips, Catherine. 2016. *Saving More Than Seeds. Practices and politics of seed saving*. London: Routledge.

Pottier, Johan. 1999. *Anthropology of Food. The social dynamics of food security*. Cambridge: Polity Press.

Rampersad, Chris, Tesfu Geto, Tarekegn Samuel, Meseret Abebe, Marybel S. Gomez, Samuel Pironon, Lucie Büchi et al. 2023. Indigenous crop diversity maintained despite the introduction of major global crops in an African centre of agrobiodiversity. *Plants People Planet* 5:985-996.

Ray, Avik. 2023. The decline of agrobiodiversity: process of crop improvement, consequent homogenization, and impacts. In: Ghosh, Sampat, Amrita K. Panda, Chuleui Jung and Satpal S. Bisht, eds. 2023. *Emerging Solutions in Sustainable Food and Nutrition Security.* Cham, Switzerland: Springer, 79-121.

Rouanet, Guy. 1987. *Maize*. Translated by Paul Skinner. Oxford: Macmillan Education.

Schlehe, Judith. 2008. Formen qualitativer ethnographischer Interviews. In: Bettina, Beer, Hg. 2008. *Methoden ethnologischer Feldforschung*. Zweite Auflage. Berlin: Reimer.

Seiner, Franz. 1909. Ergebnisse einer Bereisung des Gebiets zwischen Okawango und Sambesi (Caprivi-Zipfel) in den Jahren 1905 und 1906. In: Danckelman, Freiherr von, Hg. 1909. *Mitteilungen aus den Deutschen Schutzgebieten*. Berlin: Ernst Siegfried Mittler und Sohn, königliche Hofbuchhandlung.

Siyambango, N., C. Togarepi, B. Mudamburi, H. A. Mupambwa and S. Awala. 2022. Climate-Smart Agriculture: Perspectives for subsistence crop farming in Namibia. In: Mupambwa, Hupenyu A., Adornis D. Nciizah, Patrick Nyambo, Binganidzo Muchara and Ndakalimwe N. Gabriel, eds. 2022. *Food Security for African Smallholder Farmers.* Singapore: Springer, 251-266.

Swiderska, Krystyna, Alejandro Argumedo, Chemuku Wekesa, Leila Ndalilo, Yiching Song, Ajay Rastogi and Philippa Ryan. 2022. Indigenous Peoples' food systems and biocultural heritage: addressing Indigenous priorities using decolonial and interdisciplinary research approaches. *Sustainability* 14(11311):1-23.

van Dooren, Thom. 2010. Biopatents and the problem/promise of genetic leaks: farming canola in Canada. *Capitalism Nature Socialism* 21(2):43-63.

van Niekerk, Jaci and Rachel Wynberg. 2017. Traditional seed and exchange systems cement social relations and provide a safety net: A case study from KwaZulu-Natal, South Africa. *Agroecology and Sustainable Food Systems* 41(9-10):1099-1123.

van Wyk, Ben-Erik and Nigel Gericke. 2017. *People's Plants. A guide to useful plants of southern Africa.* 2nd edition. Pretoria: Briza Publications.

Vernooy, Ronnie, Bhuwon Sthapit, Gloria Otieno, Pitambar Shrestha and Arnab Gupta. 2017. The roles of community seed banks in climate change adaption. *Development in Practice* 27(3):316-327.

Vernooy, Ronnie, Teshome H. Mulesa, Arnab Gupta, Jahangir A. Jony, Koublan E. Koffi, Hilton Mbozi, P. B. Singh et al. 2020. The role of community seed banks in achieving farmers' rights. *Development in Practice* 30(5):561-574.

Walshe, Clare O. 2019. *Globalisation and Seed Sovereignty in Sub-Saharan Africa*. Cham, Switzerland: palgrave macmillan.

Wanga, Maliata A., Hussein Shimelis and Girma Mengistu. 2022. Sorghum production in Northern Namibia: farmers' perceived constraints and trait preferences. *Sustainability* 14(10266):1-14.

Wynberg, Rachel. 2023. Benefit sharing and biodiversity commodification in Southern Africa: a failed approach for social justice, equity, and conservation? In: Bollig, Michael, Selma Lendelvo, Alfons Mosimane and Romie V. Nghitevelekwa, eds. 2023. *Conservation, Markets, and the Environment in Southern and Eastern Africa: Commodifying the 'wild'*, Woodbridge, Suffolk, UK: James Currey, 79-106.

Wynberg, Rachel, ed. 2024. *African Perspectives on Agroecology. Why farmer-led seed and knowledge systems matter*. Rugby, UK: Practical Action Publishing.

**Internet sources:**

AOCC. 2024. African Orphan Crops Consortium. Healthy Africa through nutritious, diverse and local food crops. Home. Available at: https://africanorphancrops.org/ [Accessed November 04, 2024].

FAO. 2024. International Year of Millets. Available at: https://www.fao.org/millets-2023/about/en [Accessed November 04, 2024].

Irish, J. 2012 a. Zea mays (L. 1753) in Namibia. Interpretive collation based on the combined published sources for all included taxa, as listed. *Namibia Biodiversity Database*. Available at: https://biodiversity.org.na/taxondisplay.php?nr=6477 [Accessed September 28, 2024].

Irish, J. 2012 b. Cenchrus americanus (L. 1753) Morrone in Namibia. Interpretive collation based on the combined published sources for all included taxa, as listed. *Namibia Biodiversity Database*. Available at: https://biodiversity.org.na/taxondisplay.php?nr=23541 [Accessed September 28, 2024].

Irish, J. 2012 c. Sorghum bicolor (L. 1794) Moench in Namibia. Interpretive collation based on the combined published sources for all included taxa, as listed. *Namibia Biodiversity Database*. Available at: https://biodiversity.org.na/taxondisplay.php?nr=6418 [Accessed September 28, 2024].

**Newspaper Articles:**

Hembapu, Otniel. 2024. National silos drying up … as drought maintains grip on nation. *New Era*, 24.04.2024. Available at: https://neweralive.na/posts/national-silos-drying-up [Accessed May 05, 2024].

Matthys, Donald. 2024. Namibia declares state of emergency over drought. *The Namibian*, 27.05.2024. Available at: https://www.namibian.com.na/namibia-declares-state-of-emergency-over-drought/ [Accessed September 28, 2024].

Maverick, Daily. Dying crops, food and water shortages – drought affects millions in southern Africa. *The Namibian*, 24.04.2024. Available at: https://www.namibian.com.na/dying-crops-food-and-water-shortages-drought-affects-millions-in-southern-africa/ [Accessed September 27, 2024].

Nakale, Albertina. 2023. Drought-stricken farmers called to prepare crop fields … as rainy season looms. *New Era*, 20.10.2023. Available at: https://neweralive.na/drought-stricken-farmers-called-to-prepare-crop-fields-as-rainy-season-looms-2/ [Accessed September 27, 2024].

Saisai, Hanks. 2023. Dryland crop production preparation. *New Era*, 29.08.2023. Available at: https://neweralive.na/dryland-crop-production-preparation-2/ [Accessed September 28, 2024].

Tjatindi, Charles. 2023. Poor rainfall threatens household food security. *New Era*, 25.04.2023. Available at: https://neweralive.na/posts/poor-rainfall-threatens-household-food-security [Accessed September 27, 2024].

Ndjavera, Maihapa. 2023. 400 000 Namibians face food insecurity … FAO recommends external food assistance to feed the needy. *New Era*, 12.07.2023. Available at: https://neweralive.na/400-000-namibians-face-food-insecurityfao-recommends-external-food-assistance-to-feed-the-needy/ [Accessed September 27, 2024].

Kaapanda, Victoria. 2023. Over 690 000 in need of drought relief. *New Era*, 16.10.2023. Available at: https://neweralive.na/over-690-000-in-need-of-drought-relief/ [Accessed September 27, 2024].

## Appendix

The appendix provides background information connected to the data cited in this thesis and presents selected results which are quoted in the text.

### Appendix A: Interviews

As written in section 2.1., I created a new interview guideline for each interview. Appendix A.1 provides an example of such a guideline. It shows the guideline created for the first interview (i1) which was conducted with an agricultural officer of MAWLR. As with all other interviews, I started the interview by explaining about my research, asking for the consent of my interlocutor to participate in it, and the permission to record the interview. Appendix A.2 presents a list of all cited interviews as well as basic information on the interviews and interviewees.

#### Appendix A.1 – Interview guideline (example)

Getting started:

- Could you please **introduce** yourself?
- Please elaborate the work you are doing connected to seeds…
    - What is the motivation to/background of that work?

General picture:

- How does the **government** in general **support** the three cereals/seeds?
- What are currently the **main challenges** connected to cereal farming?
- How would you describe the **seed situation** in Namibia/the Zambezi Region?

Local and formal seed systems:

- What is the state of **local seeds/seed saving** for maize, *mahangu* and sorghum?
- What are, in your opinion, the advantages and disadvantages of using local seeds?
- You stressed the importance of differentiating between **seeds and grains** before. Could you please paraphrase in your own words what this difference is all about?
- **Formal seed breeding** against the background of climate change:
    - Why is seed breeding important?
    - What are the main characteristics to be promoted through seed breeding?
    - Who conducts seed breeding? (private vs. governmental seed breeding)
        - (Advantages/disadvantages? Who benefits from seed breeding?)
- How do you evaluate the current **dependence** on seed imports?
- In which ways could the informal and formal seed sector work better together?

Closing:

- Louise mentioned that you are interested in **research**. What kind of research and questions interest you mostly? What do you think should be researched about seeds?
- Is there anything else you would like to share?

**Appendix A.2 – List of interviews**

| | Designation of inter-viewee | Date of the interview | Additional information about the interviewee | Gender | Age |
|---|---|---|---|---|---|
| i1 | agricultural officer | 09.03.23 | Agricultural Scientific Officer, MAWLR | f | ca. 35 |
| i2 | farmer | 10.03.23 | Farmer and MSP-mentor | m | ca. 40 |
| i3 | seed specialist | 13.03.23 | German seed specialist working for GIZ | m | ca. 50 |
| i4 | miller | 15.03.23 | Co-manager of the big regional mill in Katima Mulilo | m | ca. 35 |
| i5 | agricultural technician | 15.03.23 | Chief Agricultural Technician, MAWLR | m | ca. 50 |
| i6 | NNF team leader | 17.03.23 | German team leader of the national NNF agricultural team | f | ca. 30 |
| i7 | seed supplier 1 | 17.03.23 | Seed supplier who opened his depot in Katima Mulilo in 2016 | m | ca. 40 |
| i8 | seed specialist | 20.03.23 | German seed specialist working for GIZ, second talk | m | ca. 50 |
| i9 | GIZ employee | 29.03.23 | Local GIZ employee | m | ca. 55 |
| i10 | farmer | 29.03.23 | Award-winning *mahangu* farmer | m | ca. 50 |
| i11 | commercial farmer | 12.04.23 | White commercial farmer who farms close to Otavi | m | ca. 45 |
| i12 | farmer | 12.04.23 | Award-winning *mahangu* farmer, second talk | m | ca. 50 |
| i13 | NAB employee | 13.04.23 | Employee at NAB | m | ca. 45 |
| i14 | NRWA worker | 14.04.23 | Person active at the NGO NRWA | f | ca. 45 |
| i15 | Likwama representative | 20.04.23 | Member of the Farmers' Union Likwama | m | ca. 50 |
| i16 | seed supplier 2 | 21.04.23 | Seed supplier who opened his depot in Katima Mulilo in 2017 | m | ca. 30 |
| i17 | farmer | 23.04.23 | Farmer who is active at the NGO NRWA | f | ca. 45 |
| i18 | NBRI employee | 28.04.23 | Employee at NBRI, Windhoek | f | ca. 25 |
| i19 | WSN worker | 05.05.23 | Person active at the NGO WSN | m | ca. 25 |

## Appendix B: Field visits and conversations with farmers

The conversations with farmers conducted by Justine and me during field visits were guided by the questions listed in Appendix B.1. The questions developed with the research and not all questions were asked in every field visit, while sometimes additional questions were added. Like the interviews each conversation started with obtaining informed consent. The list of conversations in Appendix B.2 provides basic information on the field visits and our interlocutors.

### Appendix B.1 – Guiding questions

- What do you plant? (species, varieties)
    - Why do you (not) plant species/varieties xy this year?
    - How are the varieties called?
- Where are your seeds from?
- If seeds are saved:
    - Why do you keep your own seeds?
    - How do you select seeds?
    - How do you store seeds? (do you use ash, chili, neem etc.?)
    - Are there challenges when storing seeds?
- If seeds are bought: (don't you have seeds from your grandmother?)
    - Where do you buy seeds? (why?)
    - Are there differences between the seed you buy and your own seed?
    - (Advantage/disadvantage of hybrid/open-pollinated varieties)
- Do you share your seeds? (with whom?)
    - Why do you think it is important to share your seeds?
- What makes a seed a good seed?
- Use of grains: do you sell your produce? Is it mainly for consumption?
- What are challenges in farming?
- …

*The questions on seeds were inspired by van Niekerk and Wynberg (2017).*

**Appendix B.2 – List of conversations**

| | Date of the conversa-tion | Relationship to Justine (or Louise) | Cultivated cereals | Gender | Age |
|---|---|---|---|---|---|
| c1 | 20.03.23 | Neighbour and cousin | Maize, *mahangu*, sorghum | f | 59 |
| c2 | 20.03.23 | Neighbour | *Mahangu*, sorghum | f | ca. 55 |
| c3 | 20.03.23 | Neighbour | *Mahangu*, sorghum | f | ca. 35 |
| c4 | 21.03.23 | Neighbour | Maize, *mahangu*, sorghum | f | ca. 45 |
| c5 | 21.03.23 | Neighbour | Maize, *mahangu*, sorghum | f | ca. 65 |
| c6 | 21.03.23 | Neighbour | Maize, *mahangu*, sorghum | m | ca. 45 |
| c7 | 21.03.23 | Neighbour | Maize, *mahangu*, sorghum | m | ca. 45 |
| c8 | 21.03.23 | Neighbour | Maize, *mahangu* | f | ca. 55 |
| c9 | 21.03.23 | Neighbour and friend | Maize, *mahangu* | f | ca. 60 |
| c10 | 21.03.23 | Neighbour | Maize, *mahangu*, sorghum | f | ca. 35 |
| c11 | 21.03.23 | Neighbour and friend | Maize, *mahangu*, sorghum | f | ca. 60 |
| c12 | 22.03.23 | MSP-participant | Maize, *mahangu* | f | 49 |
| c13 | 22.03.23 | MSP-participant | Maize, *mahangu*, sorghum | f | 44 |
| c14 | 22.03.23 | Neighbour | Maize, *mahangu*, sorghum | f | ca. 65 |
| c15 | 31.03.23 | Brother | Maize, *mahangu*, sorghum | m | ca. 50 |
| c16 | 31.03.23 | Brother's wife and daughter | Maize, *mahangu*, sorghum | f | ca. 45<br>ca. 20 |
| c17 | 31.03.23 | Neighbour | Maize, *mahangu*<br>*[no data on sorghum]* | f | ca. 65 |
| c18 | 31.03.23 | Sister | sorghum<br>*[no data on other cereals]* | f | ca. 50 |
| c19 | 31.03.23 | Neighbour | Maize | f | ca. 60 |
| c20 | 31.03.23 | Neighbour | Maize | m | ca. 40 |
| c21 | 10.04.23 | Neighbour | Maize, *mahangu*, sorghum | f | ca. 40 |
| c22 | 10.04.23 | Neighbour | Maize | f | ca. 45 |
| c23 | 10.04.23 | Neighbour | Maize | f | ca. 40 |
| c24 | 14.04.23 | Sister | Maize | f | ca. 55 |
| c25 | 14.04.23 | Neighbour and friend | Maize, *mahangu* | f | ca. 50 |
| c26 | 14.04.23 | Friend to Louise | Maize, sorghum | f | ca. 45 |

When I cited from a field visit conversation in the thesis, I used the code 'farmer' for all interlocutors.

## Appendix C: MSP-Survey

The small interviews for the survey were held during the mid-course evaluation of the MSP, March 27-29, 2023, and one MSP training session, April 17-21, 2023. The farmers who participated in the MSP to become multipliers were the primary interviewees and in two cases mentors were interviewed, too. The survey included both the questions Louise asked me to focus on, and those added by me to understand the (seed) situation of the farmers better. In some instances, the conversations for the survey were interrupted, so that not all questions could be asked. In Appendix C.1 the questions of the complete questionnaire are given. Appendix C.2 summarizes the replies to some questions which are most relevant to this thesis.

### Appendix C.1 – Questionnaire

Data requested by NNF:

- Name
- Gender
- Age
- Education level
- Location
- Position
- Anything else interesting: e.g. seed agent
- What is grown
- Livestock
- Where agricultural produce is sold

Added by me (general information):

- Household size
- Sources of income

Added by me (section on seeds with a focus on cereals):

- Where do you get your seeds from?
- Why do you think it is important to keep seeds?
- How do you store your seeds? Do you encounter challenges when storing your seeds?
- Do you share seeds? With whom? Are there any rules about seed sharing?
  Why do you think it is important to share your seeds?

*The questions on seeds were inspired by van Niekerk and Wynberg (2017).*

### Appendix C.2 – Selected survey results

| | **Cultivated cereals** | **Agricultural products sold to (not limited to cereals):** | **Sources of income** | **Gender** | **Age** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| s1 | Maize, *mahangu* | Regional mill, AMTA | Pension, selling maize | m | 62 |
| s2 | Maize, *mahangu*, sorghum | Local community, street vendors, parties, funerals | *[no data]* | m | 35 |
| s3 | Fresh maize | Regional mill, local people, street vendors, supermarkets | Farming, pension | f | 62 |
| s4 | Maize | *Plan to sell to community* | Parttime income, relatives | m | 23 |
| s5 | Maize | *Production for consumption* | None (haircuts) | m | 28 |
| s6 | / | Local community | Gardening, livestock | f | 47 |
| s7 | / | Local community | Salaries, business, snacks, rent, firewood, agriculture, fish | f | 49 |
| s8 | Maize, sorghum | Meatco | Livestock | m | 46 |
| s9 | Maize, *mahangu* | Local community, regional mill, AMTA | Farming, pension, grandchildren | m | 62 |
| s10 | Green maize | Open market, local community | NNF, Farming | f | 46 |
| s11 | Maize, sorghum, *mahangu* | Street vendor and markets, AMTA and local farmers | In good years sells vegetables & *mahangu* | f | 53 |
| s12 | Maize | Local community | Labour for few days | m | 38 |
| s13 | Maize | Local community | Selling maize | f | 40 |
| s14 | Maize, sorghum | Marketer, street vendors, sister-in-law in Rundu | Garden, rainfed crops (maize and sorghum) | f | 45 |
| s15 | / | Local community | Tenders, eggs | f | 32 |
| s16 | Maize | Regional mill, AMTA, NNF, company, local community | Honey, gardening | f | 30 |
| s17 | Maize, *mahangu* | Local community | Gardening, firewood, indigenous plants | m | 40 |
| s18 | Maize | Street vendors, public | Salary, firewood | m | 32 |
| s19 | Maize, *mahangu*, sorghum | At the road | Selling firewood, tree planting, chickens | f | 59 |
| s20 | / | Local community | job | m | 25 |
| s21 | Maize | Local community, street vendors (via social media) | gardening, selling | f | 27 |
| s22 | Maize, *mahangu*, sorghum | Butcheries, local people, regional mill, AMTA | Agriculture, small business, pension | m | 62 |
| s23 | Maize, *mahangu*, sorghum | *Production is only for consumption* | *[no data]* | f | 44 |
| s24 | Maize, *mahangu* | Local community, at the road, consumption, tourists | Rainfed farming, garden, baskets | f | 49 |

**Appendix D: Pile sorting exercise**

For the pile sorting exercise on April 18, 2023, the farmers and mentors who took part in the MSP training were divided into four groups. In each group photos of eleven cereal varieties

were piled according to seven criteria. The pictures in Appendix D.1 – D.4 reconstruct the results of each group to allow for their comparison. Only the criteria cited in this thesis are included. The pile sorting exercise was facilitated by Louise, her local NNF colleague, the trainer of the MSP session and me. I asked the other facilitators to follow these instructions:

Instructions for facilitators:

- Ask your group to name the plants on the pictures & preferably ask one person confident in writing to write them on the back of the pictures in English & a local language (alternatively, you write)
- Ask for names of other varieties of maize, *mahangu* & sorghum ( ☾ write on the backside of the poster)
- Explain the pile sorting & ask one person to take a picture of every pile
- **Criteria**: **marketability, availability of seeds, drought tolerance, resilience to pests and diseases, labour intensity, taste, nutritional quality**
- Write down interesting points that come up and the replies to these questions:
    - Pests & diseases: ask what specifically affects the different cereals
    - Markets: ask about formal & informal markets
    - Seeds: what are traditional varieties? Ask for lost varieties

**Appendix D.1 – Marketability**


**Appendix D.2 – Seed availability**

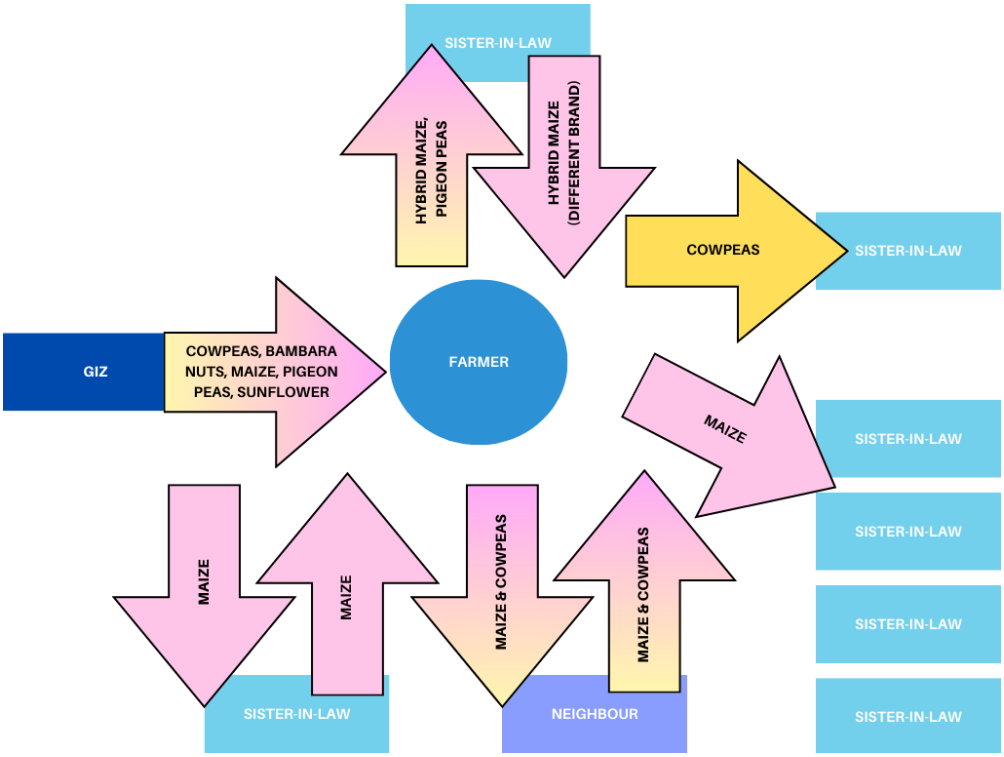
**Appendix D.3 – Drought tolerance**


**Appendix D.4 – Labour intensity**

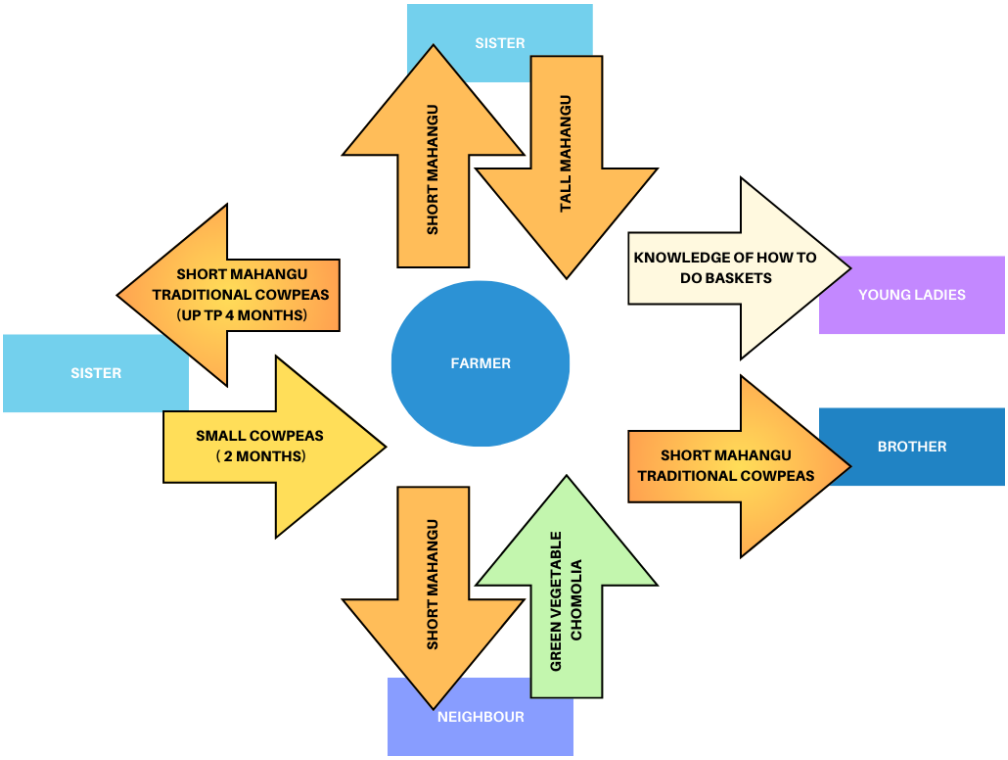
## Appendix E: Seed sharing mental maps

Two of the four seed sharing mental maps are presented in a reconstructed form below. They were originally drawn on paper by hand by two farmers on April 19, 2023.

### Appendix E.1 – Map 1




### Appendix E.2 – Map 2



**Appendix F: Participant observation – List of cited encounters**

| Code / designation of interlocutor | Context | Date(s) | Interlocutor | Gender | Age |
|---|---|---|---|---|---|
| agricultural researcher | Joint visit to a small governmental crop research station for fertilizer testing | 08.03.23 | Agricultural technician at MAWLR | m | ca. 40 |
| car ride | Conversation with an NNF employee who works in a different team in the Zambezi Region during a long car ride | 22.04.23 | NNF staff member (different team) | m | ca. 25 |
| church | At the SDA church I helped children to turn a compost heap | 13.04.23 | Children at the church | f | ca. 12 |
| church camp | At an SDA church camp, youth senior leaders gathered. Justine translated for me | 01.04.23 | Youth senior leaders | f, m | ca. 25-65 |
| seed depot | While waiting for the person managing the seed depot (i7), I chatted with one employee | 17.03.23 | Seed depot employee | f | ca. 25 |
| forum | Sustainable Agricultural Forum organized by NNF | 14.03.23 | NGO and ministry workers | m | ca. 35-60 |
| Justine | Informal conversations during my stay in her village and during field visits | 20.03.-14.04.23 | Justine | f | 53 |
| Louise | Informal conversations, mainly during car rides and in the NNF office in Katima Mulilo | 07.03.-13.04.23 | Louise | f | ca. 60 |
| MSP discussion | Discussions in plenary sessions during the MSP training | 18., 19., 20.04.23 | MSP participants | f, m | 23-62 |
| MSP training | Informal conversation during the MSP training | 20.04.23 | MSP participant | m | ca. 25 |
| MSP trainer | Training content given by an MSP-trainer who is a German Namibian | 18.04.23 | MSP trainer | m | ca. 45 |
| NNF employee | Informal conversations, mainly during car rides and in the NNF-office in Katima Mulilo | 08.03.23 14.04.23 | NNF worker (agricultural team) | m | ca. 25 |
| open market | Conversations with the farmer who translated for me during our visit to the open market | 09.03.23 | Farmer | m | 38 |
| pile sorting | Replies recorded by the facilitators as part of the pile sorting | 18. & 20.04.23 | Farmers | f, m | 23-62 |
| seed specialist | Training content given by the German GIZ seed specialist during the seed training in Mashare | 04.04.23 | Seed specialist | m | ca. 60 |
| seed training | Farmers' discussions during the seed training in Mashare | 04. & 05.04.23 | Farmers | f, m | ca. 20-55 |
| WWF employee | Conversation during an informal gathering | 16.04.23 | WWF employee | m | ca. 50 |

# Culture and Environment in Africa Series
## Edited by the Cologne African Studies Centre

**Issue 1** **Goodman Gwasira 2011**
A Rare Combination of Engravings and Paintings in the Dome Gorge, Daureb/Brandberg: A potential core element for World Heritage Status.

**Issue 2** **Eric Mutisya Kioko 2012**
Poverty and Livelihood Strategies at Lake Naivasha, Kenya: A case study of Kasarani Village.

**Issue 3** **Willis Okumu 2013**
Trans-local Peace Building among Pastoralist Communities in Kenya: The Case of Laikipi Peace Caravan

**Issue 4** **Innocent Mwaka 2014**
Bee-keeping and honey production as alternative livelihood strategies among the Pokot of Baringo County, Kenya

**Issue 5** **Florian Chisawani Silangwa 2014**
Migration and demographic changes. Its implications on land transformation and changing socio-economic development in the Lake Eyasi Basin in Karatu District, Tanzania

**Issue 6** **Leonardo Lembcke 2015**
Socio-Ecological Change and Migration in South-East Lake Naivasha, Kenya

**Issue 7** **Elsemi Olwage 2015**
"Growing together": The politics of knowing and creating an urban commons in Cape Town, South Africa

**Issue 8** **Jonathan H.M. Kempen 2016**
"Sharing is over!": A Case Study on Sharing Norms in the Namibian Resettlement Projects of Skoonheid and Drimiopsis

**Issue 9** **Joel Kigenyi 2016**
Coping with resource extinction: The case of medicinal plants in Kawete village, Iganga district, Uganda

**Issue 10** **Katrin Sowa 2017**
Street-Level Bureaucrats and Passport Networking: Practices of Immigration Law Enforcement in Northern Uganda

**Issue 11** **Tanyaradzwa Edith Whande 2018**
Energy Sources, Access and Women's Livelihood Strategies: A Case Study of Micro-Hydroelectricity Access in Chipendeke Village, Zimbabwe

**Issue 12** **Adelina Matinca 2018**
Human-Wildlife Conflict in Northeastern Namibia: CITES, Elephant Conservation and Local Livelihoods

# Culture and Environment in Africa Series
## Edited by the Cologne African Studies Centre

**Issue 13** **Emily Mika Thuening 2018**
Causes of Expansion of Urban and Peri-Urban Crop Cultivation in Northwest Namibia

**Issue 14** **Wilfrida Omusheni Kuta 2018**
Wildlife conservation on communal pastoral land: A case study of Il Ngwesi Conservancy in Laikipia County, Kenya

**Issue 15** **David Greven 2018**
Conservancies and their Impact on Livelihood and Environment: The Example of Impalila Conservancy

**Issue 16** **Katharina Deichsel 2019**
“Our Lake Is Our Farm”: Local Knowledge of Tugen Fishermen on Environmental Changes of Lake Baringo, Kenya

**Issue 17** **Jennifer Hagemann 2022**
The value of an elephant: Conservation politics and its impact on human-elephant relations in the Kunene Region/Namibia

**Issue 18** **Sandra Tamara Tikale 2025**
Reviving local seeds? Practices and narratives around maize, *mahangu* and sorghum seeds in Northeast Namibia