One livelihood risk factor too many? How unintended impacts of conservation contribute to food insecurity in KAZA.

Abstract

Kavango Zambezi (KAZA) is the world's largest terrestrial Transfrontier Conservation Area (TFCA) covering vast regions of Angola, Botswana, Namibia, Zambia and Zimbabwe. Elephants and other species traverse KAZA across national borders through both protected and inhabited landscapes along Wildlife Migration Corridors. Zimbabwe's Simangani Ward is located within such a corridor. As in most rural areas of KAZA, subsistence farming constitutes the predominant livelihood strategy in Simangani. Research across KAZA has mostly focussed either on climate or wildlife-induced impacts on farming communities. This paper combines findings from in-depth qualitative field work with quantitative livelihood survey data and provides a detailed assessment from a farming-household perspective of on-farm and off-farm income sources, which are mobilised in order to mitigate against grain harvest shortfalls resulting from climatic fluctuations and wildlife depredation.

This study concludes that drought and other stressors have a considerably higher impact on food insecurity than unintended conservation impacts. However, it also confirms that the impacts of crop raiding and livestock depredation caused by wildlife do indeed trigger additional food security risk factors for farming households, whose livelihoods are already under pressure.

Keywords:

Human-Wildlife Conflict, Coexistence, Depredation, Crop Raiding, Climate Change, Food Security, Transfrontier Conservation Area

Introduction

Climate change adaptation has been factored in as a growing challenge to economic development and poverty alleviation and has significantly influenced the debate on livelihood vulnerability for at least two decades.[1] The impacts of conservation on livelihoods and food security have been identified as potentially both positive and negative.[2] More recently, the co-existence of humans with wildlife populations, including 'Human-Wildlife Conflict' (HWC) impacts on human food security, are increasingly featuring within this debate.[3]

In southern Africa, Transfrontier Conservation Areas (TFCAs) were introduced as a key policy instrument to not only integrate ecosystem conservation and socio-economic development across the region's many Protected Areas (PA), but also to do so across national borders.[4] A TFCA is defined as a 'large ecological region that straddles the boundaries of two or more countries encompassing one or more PA as well as multiple resource use areas'.[5]

TFCAs are intended to accomplish much more than conservation goals, including but not limited to development objectives such as policy harmonisation, supporting local livelihoods, addressing vulnerability to climate change and tourism promotion.[6] While compared to other conservation initiatives, there is significant funding available for TFCAs through both public and private international donor organisations, considering the scale of implementation that TFCAs are by design intended to accomplish, it is in most cases still insufficient. Again, often caused by design due to their multi-lateral governance structures and transnational funding mechanisms, implementation of projects within the TFCA's frameworks is often found wanting or severely delayed.[7]

Current debates on TFCAs increasingly feature HWC as a major livelihood concern for communities living within or adjacent to its PA.[8] A large part of this debate centres on Kavango Zambezi (KAZA), the largest of all TFCAs,[9] including Wildlife Migration Corridors in Zimbabwe's Wildlife Management Areas.[10] However, so far,

---

[1] S. Huq, H. Reid, M. Konate, A. Rahman, A., Y. Sokona, F. Crick, 'Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCs)', *Climate Policy*, 4, 1 (2004), pp. 25-43.

[2] Büscher, B. and R. Fletcher, *The Conservation Revolution – Radical Ideas for Saving Nature Beyond the Anthropocene* (London, Verso, 2020)

[3] A.R. Braczkowski, C.J. O'Bryan, C. Lessmann, C. Rondinini, A.P. Crysell, S. Gilbert, M. Stringer, L. Gibson, D. Biggs, 'The Unequal Burden of Human-Wildlife Conflict', *Communications Biology*, 6, 1 (2023), 182.

[4] S.M. Munthali, 'Transfrontier Conservation Areas: Integrating Biodiversity and Poverty Alleviation in Southern Africa', *Natural Resources Forum*, 31, 1 (2007), pp. 51-60.

[5] Southern African Development Community (SADC), 'Protocol on Wildlife Conservation and Law Enforcement', Maputo 18 August 1999, available at https://www.sadc.int/sites/default/files/2021-08/Wildlife_Conservation.pdf, retrieved 21 October 2023

[6] B. Büscher. 'Seeking 'telos' in the 'transfrontier'? Neoliberalism and the transcending of community conservation in Southern Africa.' *Environment and Planning* 42, 3 (2010) pp. 644-660.

[7] F.P. Retief, R.C. Alberts, W.D. Lubbe et al., 'A Critical Evaluation of International Agreements Towards a Revised Categorization for Transfrontier Conservation Areas (TFCAs). *Environmental Management* 72 (2023) pp. 1099-1110

[8] E. Mpofu, V. Radinger-Peer, W. Musakwa, M. Penker, K. Gugerell, 'Discourses on Landscape Governance and Transfrontier Conservation Areas: Converging, Diverging and Evolving Discourses with Geographic Contextual Nuances', *Biodiversity and Conservation* (2023), pp. 1-30.

[9] M. Stoldt, T. Göttert, C. Mann, U. Zeller, 'Transfrontier Conservation Areas and Human-Wildlife Conflict: The Case of the Namibian Component of the Kavango-Zambezi (KAZA) TFCA', *Nature, Scientific reports*, 10, 1 (2020), 7964.

[10] R. Bourgeois, C. Guerbois, N. Giva, P. Mugabe, B. Mukamuri, R. Fynn, W.S. Daré, M. Motsholapheko, L. Nare, E. Delay, R. Ducrot, J. Bucuane, S. Mercandalli, C. Le Page, A. Caron, 'Using anticipation to unveil drivers of local

few scholars working on KAZA have detailed the compounding[11] impact threat of HWC for food security in its combination with climate change and underlying livelihood challenges, a nexus previously described as 'hidden dimensions'[12] and 'hidden costs'[13] of HWC.

Against this backdrop, the aim of this paper is to identify drivers of increased vulnerability for rural households living within one of KAZA's Wildlife Migration Areas in Zimbabwe's Hwange District. Household vulnerability is assessed based on the conceptual framework structured on setting, assets and activities by Hoddinott & Quisumbing.[14]

KAZA combines large territories of the southern African nations of Angola, Botswana, Namibia, Zambia and Zimbabwe into the world's largest TFCA across a total area of almost 520,000km² – a land mass slightly larger than Spain. These territories include different land rights and land use regimes, including PA under various category classifications,[15] totalling an area of 371,394km² under conservation. But it also includes inhabited state, communal, and freehold land, which besides villages and small towns contains both cropland and rangeland totalling 148,520km².[16] I conducted research in the Zimbabwean section of KAZA, specifically the Hwange Communal Areas (HCA). The HCA mostly comprise an area wedged between the main road and railway line from Bulawayo via Hwange to Victoria Falls in the south and the Zambezi River in the north. The HCA are situated in one of the country's lowest suitability categories for agriculture both with and without considering climate change impacts.[17]

Nonetheless, as this article will demonstrate, its households still depend to a large extent on natural resources for growing their crops, raising livestock and fishing. They are exposed to multiple risks emanating from a collapsed economy, a harsh natural environment impacted by climate change, pollution from coal mines and mostly free-roaming wildlife. Taken together, these external and internal factors including health and multi-dimensional poverty indicators[18] make smallholder livelihoods highly vulnerable. Adger's review on vulnerability research traditions has highlighted the complementary value of different approaches to the subject matter, highlighting in particular the value that strictly economic research methods have contributed

livelihoods in Transfrontier Conservation Areas: A call for more environmental justice' *People and Nature* 24, 1 (2023), pp. 1-16.

[11] J. Salerno, F.R. Stevens, A.E. Gaughan, T. Hilton, K. Bailey, T. Bowles, L. Cassidy, P. Mupeta-Muyamwa, D. Biggs, N. Pricope, A. W. Mosimane, L.M. Henry, M. Drake, A. Weaver, S. Kosmas, K. Woodward, N. Kolarik, J. Hartter, 'Wildlife Impacts and Changing Climate Pose Compounding Threats to Human Food Security', *Current Biology* 31 (2021), pp. 5077-5085

[12] M. Barua, S.A. Bhagwat, S. Jadhav, 'The Hidden Dimensions of Human-Wildlife Conflict: Health Impacts, Opportunity and Transaction Costs. *Biological Conservation,* 157 (2013), pp. 309-316.

[13] J. Bond and K. Mkutu, 'Exploring the Hidden Costs of Human-Wildlife Conflict in Northern Kenya. *African Studies Review*, 61, 1 (2018), pp. 33-54.

[14] J. Hoddinott and A. Quisumbing, *Methods for Micro Econometric Risk and Vulnerability Assessment. Risk, Shocks, and Human Development: On the Brink* (London, Palgrave Macmillan UK, 2010)

[15] S. Stolton, P. Shadie, N. Dudley, *Guidelines for Applying Protected Area Management Categories* (Gland, Switzerland, IUCN 2008)

[16] Government of the Republic of Angola, Government of the Republic of Botswana, Government of the Republic of Namibia, Government of the Republic of Zambia, Government of the Republic of Zimbabwe, 'Treaty on the Establishment of the Kavango Zambezi Transfrontier Conservation Area', Luanda, 18 August 2011, available at https://tfcaportal.org/system/files/resources/KAZA%20TFCA%20Treaty_SIGNED.pdf, retrieved 16 May 2023

[17] R. Mugandani, M. Wuta, A. Makarau, and B. Chipindu, 'Re-Classification of Agro-Ecological Regions of Zimbabwe in Conformity with Climate Variability and Change' *African Crop Science Journal*, 20 (2012), pp. 361-369.

[18] World Bank, *Poverty and Shared Prosperity 2020: Reversals of Fortune* (Washington, DC, World Bank, 2020)

to understanding vulnerability.[19] When considering vulnerability from a purely socio-economic perspective, the Zimbabwean livelihood context has been unusual in the southern African region due to the compounding effects of the so-called 'Fast Track Land Reform' (FTLR), hyper-inflation, international sanction regime and corruption-marred 'command agriculture' import substitution programmes over the past two decades.[20] Though causally connected, each of these recent historical contexts had distinct consequences for the country's economy down to vulnerability at the household level and could be directly linked to people's ongoing livelihood experiences.[21]

Figure 1: Map of Research Area

Livelihood Vulnerability and Conservation

The recent history of the multi-ethnic HCA, inhabited mostly but not exclusively by Nambya, Tonga, Dombe, Chewa and Ndebele residents has been marked by violence and forced mobility. This began with the Ndebele invasions in the mid-19th century followed by colonial rule under a mineral concession extracted from the Ndebele King Lobengula through Cecil Rhodes's British South Africa Company in 1890.[22] Under the British colony of Southern Rhodesia (1923-1965) marginal land within the former concession became the 'Wankie Native Reserve', administered by customary law through traditional authorities but forming part of the colony.[23] The Land Apportionment Act of 1930 divided the national territory into three categories: Land

[19] W.N. Adger, 'Vulnerability', *Global Environmental Change,* 16 (2006), pp. 268–281.

[20] F. Mazwi, A. Chemura, G.T. Mudimu, W. Chambati, 'Political Economy of Command Agriculture in Zimbabwe: A State-led Contract Farming Model. *Agrarian South: Journal of Political Economy*, 8, 1-2 (2019), pp. 232-257

[21] I. Kabonga, 'Reflections on the 'Zimbabwean Crisis 2000–2008'and the Survival Strategies: The Sustainable Livelihoods Framework (SLF) Analysis.' *Africa Review* 12, 2 (2020), pp. 192-212.

[22] J. Alexander, J. McGregor and T.O. Ranger, *Violence & Memory: One Hundred Years in the 'Dark Forests' of Matabeleland* (Oxford, James Currey, 2000)

[23] O. Chiweshe, 'Land, Displacement, and Livelihoods Strategies Among the Nambya in North-Western Zimbabwe', in K. Helliker, P. Chadambuka, J. Matanzima, (eds), *Livelihoods of Ethnic Minorities in Rural Zimbabwe* (Cham, Springer International Publishing, 2022), pp. 141-154

reserved for whites, State Land and 'Tribal Land'.[24] Useful land sections within Native Reserves were categorised as 'State Land', set aside for conservation, forestry or other purposes and 'Native Purchase Areas' (NPA), marginal freehold land targeting as prospective land owners 'Natives', who the authorities hoped would eagerly embrace European development models.[25] In the case of Simangani's Zambezi riverfront, the NPA around the Deka Mouth and Msuna became popular recreational fishing grounds for whites.

The Native Land Husbandry Act of 1951 further removed the most valuable land from black farmers and imposed new supposedly 'efficient' farming methods on those who remained on their land, but effectively exposed many of them to a higher risk of vulnerability: It worked against locally adapted strategies of cultivating multiple fields at different elevation levels, with 'different soils, planted with different crops and managed differently [in order to] mitigate risks of drought, pest attacks and crop raiding.'[26] Subsequently, many households were forced to send men to work on now white-owned farms or to migrate to the cities.[27]

The unilaterally declared independent government administration of Rhodesia (1965-1979) relabelled Wankie and other Native Reserves as 'Tribal Trust Land', with the new state assuming formal ownership from the colony.[28] After Zimbabwe's independence under black majority rule the Communal Lands Act of 1982 placed communal land rights firmly under the authority of the central government through the establishment of Rural District Councils (RDC). Although de facto rights were generally delegated to traditional authorities, de jure the RDC were merely required to consult and co-operate with the appointed chief in question.

Finally, land situated along the A8 road between the HCA and PA around Hwange National Park (NP) was owned under freehold title by white farmers, who used it mostly to breed game and/or as private and commercial hunting grounds. Following the government's announcement of the FTLR in July 2000, these farms became targets of nationwide farm seizures[29] and were incorporated into the HCA under the authority of the RDC and traditional authorities. While the FTLR and its domestic and international economic repercussions are still widely felt today, from a legal perspective, the FTLR did not directly affect the communal land rights situation in Zimbabwe.[30] According to Dorward et al.:

[24] Z. Dervieux, and M. Belgherbi, 'We Used to go Asking for the Rains: Local Interpretations of Environmental Changes and Implications for Natural Resource Management in Hwange District, Zimbabwe', in: M. Welch-Devine, A. Sourdril, B.J. Burke (eds), *Changing Climate, Changing Worlds: Local Knowledge and the Challenges of Social and Ecological Change* (Cham, Springer, 2020) pp. 35-54.

[25] I. Scoones, *Land Reform in Zimbabwe: Challenges for Policy* (Brighton, Create Space, 2018)

[26] F. Baudron, J.A. Andersson, M. Corbeels, K.E. Giller, 'Failing to yield? Ploughs, Conservation Agriculture and the Problem of Agricultural Intensification: An Example from the Zambezi Valley, Zimbabwe' *Journal of Development Studies* 48, 3 (2012), p. 404.

[27] R.K. Hitchcock, M.C. Kelly, 'Borders, Boundaries, and Livelihoods in Western and North-Western Zimbabwe, 1890–2021', in N. Pophiwa, J. Matanzima, K. Helliker (eds), *Lived Experiences of Borderland Communities in Zimbabwe: Livelihoods, Conservation, War and Covid-19* (Cham, Springer International Publishing, 2023), pp. 85-99.

[28] A. Cheater, 'The Ideology of 'Communal' Land Tenure in Zimbabwe: Mythogenesis Enacted?', *Africa*, 60, 2 (1990), pp. 188-206.

[29] Commercial Farmers' Union of Zimbabwe, 'List of Farms Gazetted for Acquisition: Extraction of Farm Name, Owner and District from the Extraordinary Government Gazette Notice 233A of 2000', available at https://www.zimbabwesituation.com/old/Farms601_700.html, retrieved 18 September 2023

[30] Scoones, *Land Reform in Zimbabwe*

> Livelihoods involve the use of assets in activities to produce outputs, both to meet people's consumption requirements and aspirations and to invest assets and activities for the future. All this takes place in the context of an uncertain environment.[31]

Up until today, the Zimbabwean section of KAZA, if not the country as a whole, is a highly uncertain environment to live in. The country's Gross Domestic Product per capita in contemporary prices is equal to what it was in 1970 and almost a third lower than what it was at its highest level in 1998.[32] The upper poverty line has been well above 80 per cent among the country's rural population for the past decade. Zimbabwe has been in an almost constant state of inflationary crisis and recurring economic collapse since the early 2000s. First, a costly involvement in the war in the Democratic Republic of Congo drained the government's budget between 1998 and 2002. Then the country was cut off from most Official Development Aid after President Robert Mugabe's government fell out with the United Kingdom and other donor countries as a result of disputes over the administration's handling and the de facto state sanctioning of the invasion of white-owned farms in 2000.[33]

The share of Zimbabwe's population affected by household food insecurity shifted starkly from 30 per cent in 2011 to 60 per cent in 2020 and 55.5 per cent in 2021 under the combined impacts of the government's continued economic mismanagement, COVID-19[34] and record drought between 2018 and 2020.[35] Food production was unstable well before the onset of the crises of the early 2000s, but has since then been further compounded by climate change.[36] Rises in average temperatures and decreasing and irregular rainfall are affecting several regions of the country and especially Matabeleland North, where the case study for this paper is situated.[37] Across Zimbabwe, severe drought episodes have been observed in 1991–1992, 1994–1995, 2002–2003, 2015–2016, and 2018–2019, with particularly high levels of drought vulnerability and exposure in Matabeleland North.[38] According to the Famine Early Warning Systems Network (FEWS), 2023-

[31] A. Dorward, S. Anderson, Y.N. Bernal, E.S. Vera, J. Rushton, J. Pattison, R. Paz, 'Hanging in, Stepping up and Stepping out: Livelihood Aspirations and Strategies of the Poor', *Development in Practice* 19, 2 (2009), p 241.

[32] World Bank 'GDP per capita (constant 2015 US$) – Zimbabwe, World Bank National Accounts Data and OECD National Accounts Data Files', available at https://data.worldbank.org, retrieved 25 April 2023

[33] S.Y. Chivanga and P. Monyai, 'From the Darling of the Superpowers to a Pariah State: Zimbabwe's Official Development Assistance Journey', *African Journal of Democracy and Governance*, 6, 4 (2019), pp. 51-76.

[34] D. Sharma, J.R. Alwang, T. Chingozha, C. Hoy, F. Kurasha, A. Paez Rodas, A., *Reversing the Tide: Reducing Poverty and Boosting Resilience in Zimbabwe* (World Bank Group 2022), available at https://vtechworks.lib.vt.edu/bitstream/handle/10919/113060/P1767360cd8f1f00c0b0c803c995a669a6c.pdf?sequence=2&isAllowed=y, retrieved 25 April 2023

[35] World Meteorological Organisation, 'State of the Climate in Africa 2021', WMO Report No 1300 (2022), available at https://library.wmo.int/index.php?lvl=notice_display&id=22125, retrieved 05 July 2023

[36] Scoones, *Land Reform in Zimbabwe*

[37] R. Hunter., O. Crespo, K. Coldrey, K. Cronin, M. New, 'Research Highlights – Climate Change and Future Crop Suitability in Zimbabwe', University of Cape Town, South Africa, undertaken in support of Adaptation for Smallholder Agriculture Programme' (ASAP) Phase 2. (International Fund for Agricultural Development, Rome, 2020), available at https://www.ifad.org/documents/38714170/42164624/climate_analysis_zimbabwe.pdf/31fb5ab0-7a57-5978-4b82-51ddfd99ba71?t=1606831141000, retrieved 18 September 2023

[38] J. Frischen, I. Meza, D. Rupp, K. Wietler, M. Hagenlocher, 'Drought Risk to Agricultural Systems in Zimbabwe: A Spatial Analysis of Hazard, Exposure, and Vulnerability', Sustainability, 12, 3 (2020), 752.

24 could prove to be another drought season based on climate forecasts of a El Niño event, which 'typically leads to delayed and cumulatively below-average rainfall in Zimbabwe'.[39]

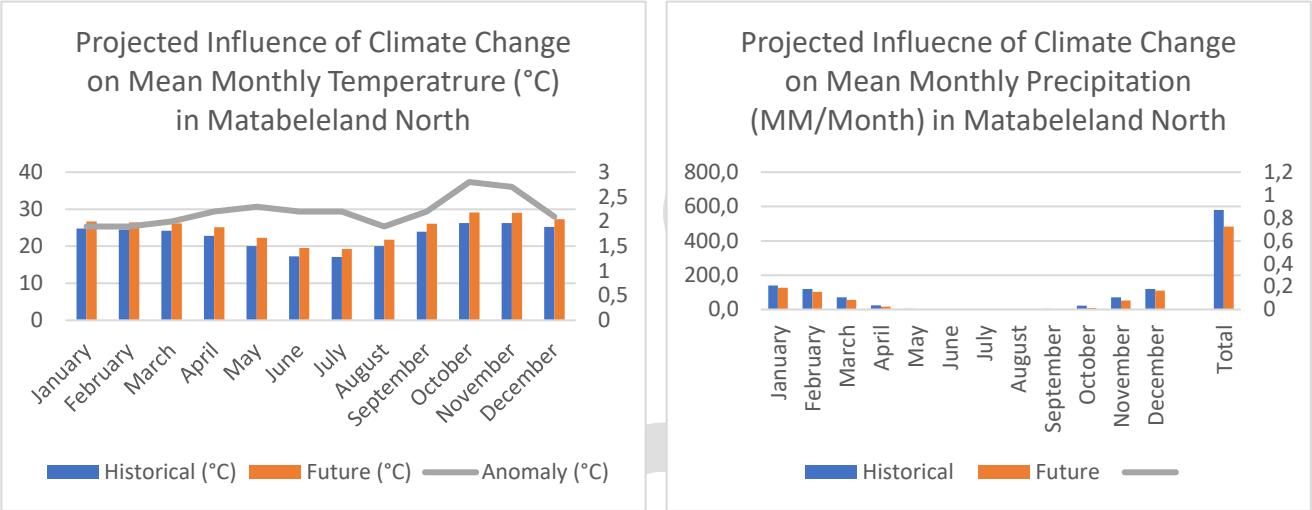

Figure 2: Climate Change Indicators for Matabeleland North, Zimbabwe[40]

In 2016 Zimbabwe embarked on the Targeted Command Agriculture Programme (TCAP). The programme is the latest, heavily subsidised three-year farming input campaign across the country, which for the first time financed food production through contract farming geared to also serve the home market, instead of focussing only on cash crops for export such as tobacco.[41] This led to a bumper harvest in the following season,[42] which conveniently coincided with the arrival of a new government in November 2017.[43] But the TCAP campaign was not sustained over the two following agricultural seasons and could not counter the country's upward trend in household food insecurity before the onset of COVID-19 in 2020.[44] TCAP is also estimated to have cost the cash-strapped country US$1.28 bn of which $280m is alleged to have been misappropriated.[45]

Three main layers of livelihood uncertainties or risks are common among the mostly subsistence-based farming communities of the HCA: Economic development determinants, climate change impacts and HWC. Especially for subsistence farming communities in Zimbabwe the first two have been clearly linked to grain shortages and food poverty.[46] In addition, coal mining tailings have led to the pollution of the Deka river with manganese, nickel and arsenic, impacting negatively on fisheries as well as drinking water for people and livestock.[47] The Deka is a tributary of the Zambezi and a main source of fresh water within Simangani Ward.

---

[39] FEWS Net, 'Zimbabwe Food Security Outlook September 2023: El Niño Expected to Impact the Upcoming 2023/24 Agricultural Season Negatively', available at https://fews.net/southern-africa/zimbabwe/key-message-update/september-2023, retrieved 27 October 2023

[40] Hunter et al.

[41] Mazwi, Political Economy of Command Agriculture in Zimbabwe

[42] Scoones, *Land Reform in Zimbabwe*

[43] N. Beardsworth, N. Cheeseman, S. Tinhu, 'Zimbabwe: The Coup that never was, and the Election that could have been' *African Affairs*, 118, 472 (2019), pp. 580-596.

[44] Sharma, *Reversing the Tide*

[45] The Sentry, 'Legal Tender? - The Role of Sakunda and the Reserve Bank of Zimbabwe', March 2022, available at https://thesentry.org/wp-content/uploads/2022/03/LegalTender-TheSentry.pdf, retrieved 04 July 2023

[46] Scoones, *Land Reform in Zimbabwe*

[47] D. Ruppen, O.A. Chituri, M.L. Meck, N. Pfenninger, B. Wehrli, 'Community-based Monitoring Detects Sources and Risks of Mining-related Water Pollution in Zimbabwe. *Frontiers in Environmental Science*, 9 (2021), 599

This paper investigates how food-poor households that are already living under long-term economic and climate change related pressures cope with additional stressors of HWC, namely crop raiding and livestock depredation. Long before addressing the impacts of climate change became an integral part of the debate, food insecurity was recognised as a central determinant of livelihood vulnerability. Economic livelihood risks and hazards at household level are composed of multiple factors, which in themselves can be difficult to untangle. How to mitigate against hunger and starvation, access to land, water and other resources to basic health care and education are all related questions, which date back to extensive debates in the social sciences surrounding modernisation theory, dependency theory, peasant studies[48] and 'deagrarianisation'[49] to name a few.

According to the Committee on World Food Security, the 'four pillars of food security are availability, access, utilization and stability.'[50] Adaptation to climate change comes with its own sets of challenges and has for quite some time been dominating the scientific debate on livelihood vulnerability in Africa.[51] Following its definition by Adger 'vulnerability is the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt'. In other words, vulnerability is '[…] influenced by the build-up or erosion of the elements of social-ecological resilience. These [elements] are the ability to absorb the shocks, the autonomy of self-organisation and the ability to adapt both in advance and in reaction to shocks.'[52] This article explores multiple sources of vulnerability and livelihood risks, including the extent to which conservation measures intended to protect wildlife unintentionally aggravate livelihood vulnerability through HWC.

KAZA hosts the largest concentration of elephants (*Loxodonta africana*) in the world.[53] According to the 2023 KAZA Elephant Survey, a total of 65,028 elephants are based within or migrating between the broader region of Zimbabwean PA located south (Hwange NP and adjacent PA: 61,531 individuals) and north-east (Sebungwe: 3,498 individuals) of Simangani Ward.[54] This represents a 13.3 per cent increase, up from 57,398 elephants counted in the same two regions in 2014. However, these figures obscure the fact that there had been both a 76 per cent decrease of elephants in the Sebungwe region between 2001 and 2014 (largely attributed to poaching), and a 15 per cent increase in and around Hwange NP over the same period.[55] Whilst

[48] H. Bernstein and T.J. Byres, 'From Peasant Studies to Agrarian Change', Journal of Agrarian Change, 1 (2001), pp. 1-56.

[49] D.F. Bryceson, 'Deagrarianization and Rural Employment in Sub-Saharan Africa: A Sectoral Perspective, *World Development*, pp. 97–111.

[50] Food and Agricultural Organisation (FAO), 'Committee on World Food Security, Reform of the Committee on World Food Security', Final Version, 35th Session, Agenda Item III (Rome 14, 15 and 17 October 2009), available at https://www.fao.org/fileadmin/templates/cfs/Docs0910/ReformDoc/CFS_2009_2_Rev_2_E_K7197.pdf, retrieved 22 May 2023

[51] S.B. Bedeke, 'Climate Change Vulnerability and Adaptation of Crop Producers in Sub-Saharan Africa: A Review on Concepts, Approaches and Methods. Environment, Development and Sustainability', 25, 2 (2023), pp. 1017-1051.

[52] Adger, Vulnerability, pp.268-269

[53] M. Karidozo, M. La Grange, F.V. Osborn, 'Assessment of the Human-Wildlife Conflict Mitigation Measures Being Implemented by the KAZA Partner Countries. Report to the KAZA Secretariat (Kasane, September 2016)

[54] E.M.S. Bussière and D. Potgieter 'KAZA Elephant Survey 2022. Volume II: Stratum Reports' (31 August 2023), available at https://www.kavangozambezi.org/kaza-elephant-survey, retrieved 06 September 2023

[55] K.M. Dunham, 'National Summary of Aerial Survey Results for Elephant in Zimbabwe 2014.' *Great Elephant Census* (Seattle, October 2015), available at https://static1.squarespace.com/static/6450cf25e943031b610c4022/t/64afb7eb13efb231836c1b9e/1689237489055/Oct+2015+Great%2BElephant%2BCensus%2BZimbabwe%2BNational%2BSummary%2B2015.pdf, retrieved 20 May 2023

elephants are enjoying an elevated conservation status in KAZA, there is increasing debate about the impact of wildlife on human wellbeing within inhabited areas adjacent to PA and near existing or designated migration corridors.[56]

This paper argues that HWC precipitates additional hazards and shocks in a social-ecological environment that is already fraught with economic and climatic stressors. In other words, the lack of economic and climatic certainty in the HCA makes livelihoods of rural subsistence farmers more vulnerable and less likely to adapt to HWC. That said, when faced with multiple personal risk factors, people tend to struggle to differentiate between the relative gravity of each risk factor. 'In such circumstances, it may often be the case that individuals are required to make intuitive risk assessments within a restricted time frame, using little or no data, and having a limited cognitive capacity (or even motivation) to fully tackle the task complexity.'[57] Hence, people in Simangani may struggle to objectively assess the orders of magnitude of the many risks they face, be they defined as an economy in collapse, unemployment, climate change, drought, crop raiding elephants or depredation. The empirical literature on multi-risk settings with complex causes and dynamics of vulnerability across multiple hazards is still limited to a few case studies.[58] Whilst much research into multi-risk analysis has been undertaken over recent years, the theories and methods it has produced thus far have lacked accuracy and maturity.[59] While this paper will not be able to fill this gap in the multi-risk literature, it illustrates the complexity of such scenarios in the context of food insecurity, climate change and HWC and highlights the considerable uncertainty regarding multiple risk variables and their interrelationships in any given year.

Setting and methods

Within Zimbabwe, KAZA covers most of Matabeleland North Province. Hwange District is the westernmost administrative area of Matabeleland North and includes the tourist town of Victoria Falls, the coal mining town of Hwange, Hwange National Park (NP) and several safari and hunting concessions. Simangani Ward, the case study for this paper, is located in the north-eastern section of the HCA on the banks of the Zambezi, approximately 120km downstream from Victoria Falls and 40km from Hwange town.

This ward was chosen as a case study because of its location between the two main PA networks of Zimbabwe's section of KAZA and its categorisation as an inhabited Wildlife Management Area

The first of these networks comprises Hwange NP and a cluster of PAs south-west of the A8 road. The second is a string of PAs, starting with private concessions used for rewilding in Kavira State Forest and the Devil's Gorge Conservancy beyond the Gwayi River which forms the ward's eastern boundary, and continued by several PAs all along Lake Kariba, including hunting concessions and KAZA's easternmost NPs of Chizarira and Matusadona.

[56] Salerno et al., 'Wildlife Impacts and Changing Climate.'

[57] I.G. Dawson, J.E. Johnson, M.A. Luke, 'One too Many? Understanding the Influence of Risk Factor Quantity on Perceptions of Risk'. Risk analysis, 37, 6 (2017), p.12.

[58] P.J. Ward et al. 'Natural Hazard Risk Assessments at the Global Scale', *Natural Hazards and Earth System Sciences* 20, 4 (2020) pp. 1069-1096.

[59] J. Wang, Z. He and W. Weng, 'A Review of the Research into the Relations between Hazards in Multi-Hazard Risk Analysis." *Natural* Hazards 104 (2020): pp. 2003-2026.

The Zambezi forms the natural northern boundary of Simangani (and between Zimbabwe and Zambia). The landscape south-east of Simangani is fissured by several coal mines dotted along tributaries of the Gwayi River.

In order to analyse vulnerability to food insecurity, we adapted a simple conceptual framework developed by Hoddinott & Quisumbing[60], which relates the utilisation of different categories of activities and assets in response to shocks in the context of income, prices and consumption. In terms of activities, we focused on subsistence crop farming as the main household food production activity but also considered off-farm income generating activity data. Since goats constitute the principal kind of livestock asset and wealth store in the research area, livestock data and particularly goats were used as the most reliable proxy for total assets.

We employed three main sources of primary data: Two datasets from household surveys conducted across KAZA in 2013 on behalf of the Peace Parks Foundation (PPF)[61] and in 2013 by the World Wildlife Fund (WWF)[62] respectively, partially covering the same informants within Simangani. Using a more comprehensive local sampling approach, semi-structured in-depth interviews were conducted with 181 household heads within all villages of Simangani in 2023. A third of these households had either been already surveyed in the 2013 survey, the one in 2021 or in both. The 2013 and 2021 datasets paint a largely homogenous picture of mostly subsistence-based livelihoods in Simangani and very few HWC related challenges. The geographically more spread out sampling of the in-depth interview approach applied in the research for this paper, on the other hand, allowed for a more nuanced picture to emerge. In addition to this, we conducted 14 expert interviews with local officials in the public, private and NGO sectors.

Glatz-Jorde et al. surveyed 103 households in Simangani Ward as part of their larger KAZA household survey component in Zimbabwe (N=400).[63] WWF managed to resurvey just 14 of these households and 22 additional ones bringing the WWF sample within Simangani Ward to a total of 36.[64] Households included in the 2014 survey covered mostly the Ward's three population centres of Mwemba, Makwa and Msuna, while the 2021 survey only covered Makwa. In both cases the majority of households were found to be concentrated along the main road. This created a bias: It was found during the in-depth research that households clustered along the main road were largely newcomers or 'latecomers'[65] often without crop land. Hence, they were also much less likely to encounter crop raiding.

As part of the research for this article, 181 household members representing 946 individuals were surveyed in semi-structured guided interviews, all personally conducted by the author. Included were questions regarding their expected grain harvest for the season of 2023 and their crop harvest in a satisfactory season

[60] Hoddinott & Quisumbing, *Methods for Micro econometric Risk and Vulnerability Assessment*, p. 64
[61] S. Glatz-Jorde, M. Huber, H. Kirchmeir, R. Topp, A. Mosimane, S. Lendelvo, G. Mukvavi, O. Mulenga, M. Jungmeier, 'Consulting Services for the Socio-Economic Baseline Survey for the Kavango Zambezi Transfroniter Conservation Area (KAZA TFCA) and the Development of a Framework for Monitoring and Evaluating the Impacts of the KAZA TFCA Programmes on Rural Livelihoods' (Klagenfurt, ECO Institute of Ecology Jungmeier GmbH, 27 June 2014), available at https://maps.ppf.org.za/kaza_me/docs/Folder/KAZA_Socio_Economic_Survey_2015.pdf, retrieved 28 October 2023
[62] World Wildlife Fund, 'Kavango Zambezi Transfrontier Conservation Area - Pilot Socio-Economic Survey Report. Development of a Methodology for an Integrated Community-based Socio-Economic Monitoring Approach and Pilot in Zimbabwe and Zambia' (November 2021), available at https://maps.ppf.org.za/kaza_me/docs/Folder/Livelihoods%20Monitoring%202021, retrieved 28 October 2023
[63] Glatz-Jorde et al., 'Consulting Services.'
[64] WWF, Kavango Zambezi.'
[65] J. Mujere, 'Land and the Politics of Belonging in Africa', *Africa*, 80, 3 (2010), pp. 497-502.

('a good year's harvest'). In addition, they were asked whether their fields were raided or entered by elephants over the course of the year and whether they experienced any crop damage caused by other species. To begin with, there are quite a number of individually rational decisions that would lead a farmer to plough and plant in a given season, to not do so or to plant too late because of, e.g., opportunity costs like off-farm work, shocks like the death or accident of a family member, personal health reasons and so on. Such factors have to be considered in context of the research results presented here.

Results

1. Setting

With 69,357 inhabitants, the HCA comprised just under half of Hwange District's entire population in 2022,[66] which is an increase of over 10 per cent compared to the 62,670 counted in the previous census of 2012.[67] Based on the 2022 census taken by the National Statistics Agency (ZIMSTAT), the number of people registered in Simangani Ward in 2022 was 4,489, while the most recent data collected for the distribution of Long-Lasting Anti-Insecticidal Nets (LLIN, mainly for Malaria prevention) on behalf of the Provincial Ministry of Health and Child Care (MOHCC) puts the number of people actually based in the ward at 6,550.[68] The year 2016, for which the last nationwide 'Food Poverty Atlas' with data down to ward level was published,[69] shows a 39.20 per cent median (39.07 per cent average) household food insecurity prevalence within the HCA as whole (excluding two semi-urban 'outlier wards' near the small town of Dete and the Hwange NP Main Camp entrance area, ward numbers 19 and 20, which recorded around 15 per cent prevalence.). This household food insecurity prevalence ratio of 39.20 per cent was equal to the ratio reported for this study's case study area of Simangani, which in terms of population size is the HCA's third largest ward (Ward 10), representing approximately 9 per cent of the HCA's total population, according to the MOHCC figures.

Access to electricity in the HCA, including Simangani Ward, is constrained to a few public facilities and buildings registered with a business licence. Drinking-water access is limited to sparsely distributed water pumps and irrigation schemes funded by non-governmental organisations (NGO). The provincial MOHCC is monitoring the quality of these drinking water sources for organic but not chemical pollutants, excluding tailings from coal mines entering the Deka river, the main tributary to the Zambezi traversing the Ward. This negatively affects livelihoods dependent on resource use of both fisheries along the Deka and livestock watering closer to the contamination source.[70]

2. Crop farming activities

[66] ZIMSTAT, '2022 Population and Housing Census – Preliminary Report on Population Figures' (Harare, July 2022), available at https://zimbabwe.unfpa.org/en/publications/2022-population-and-housing-census-preliminary-results, retrieved 17 May 2023

[67] ZIMSTAT, 'Zimbabwe Population Census 2012' (Harare, October 2013), available at https://www.zimstat.co.zw/wp-content/uploads/publications/Population/population/census-2012-national-report.pdf, retrieved 19 September 2023

[68] MOHCC, 'Ward LLINS Mass Distribution Summary Form: LLIN 13', Province: Matabeleland North. District: Hwange (unpublished, 2022)

[69] ZIMSTAT, 'Food Poverty Atlas' (Harare, November 2018), available at https://zimbabwe.opendataforafrica.org/bmplqqd/food-poverty-atlas-2016?district=1010920-hwange-ward-10, retrieved 29 October 2023

[70] Information provided in semi-structured interview survey (SSIS) by Richard Santungwana, retired MOHCC Educator (Kasase Village, 04 March 2023)

Almost all respondents reported less than optimal harvest results due to irregular rainfall patterns during the planting season of 2022 and harvesting season of April/May 2023 in particular. Too little rainfall at the beginning of 2023 caused unsatisfactory results particularly in the harvest of sorghum and pearl millet, which are the main grain crops grown in Simangani Ward with the exception of the more fertile floodplain soils of Msuna village, where maize is predominant. These climate impacts have found their way into local expressions of the 'millet is closing its eyes', referring to the unsatisfactory size of pearl millet kernels.[71] While the local grain harvest normally takes place between end of April and early May, some farmers already started harvesting their sorghum at the end of February to save their crop from wildlife damage, often sun drying the panicles on the roofs of their houses.[72] In either case, the millet and sorghum kernels are much smaller before being ground into flour and in the case of early harvested sorghum also tend to have more brittle pericarps, causing the grain to yield less than half the amount of output compared to fully matured crops when processed.

On average Simangani crop farmers in the sample taken in 2023 harvested or were expecting to harvest 55 per cent of the amount of grain (sorghum, millet, maize) they would expect to in 'a good year'. Farmers who also reported crop damage by elephants harvested 44.5 per cent, while farmers who reported no elephant crop damage reported 62 per cent of what they would expect in a good year. As stated above, this result may have its shortcomings due to intervening variables that cannot be adequately controlled for. However, while clearly the main threat for a successful harvest is climatic, the impact of elephants is substantial.

As research in nearby Chobe District of Botswana has demonstrated, these results also cannot take account of harvest losses by farmers, who because of elephant crop raids have shifted their fields to smaller or less productive areas within the village, have shifted to other farming or off-farming activities, or have given up cropping altogether.[73] At least since the 2019 planting season, rainfed fertile soil ridges on the outskirts of Simangani villages like of Makwa or Msuna Hills have been abandoned and are no longer ploughed and planted due to frequent crop raiding by baboons (*Papio ursinus*).[74] Further, of those farmers who reported to have scaled down or shifted their cropping strategy because of elephants, most also provided additional reasons, e.g. walking distance to fields coupled with old age or susceptibility to crop damage not just by elephants but also by other species.

N = 181 HH 946 members	**Good Year**		**2023**		**Good Year per capita**		**2023 per capita**		**HH Harvest difference**	**No elephant Crop Raid**	**Elephant Crop Raid**
	KG	USD	KG	USD	KG	USD	KG	USD			
Total	131,944	9,166	55,475	33,285							
Mean	840	504	317	190	208	125	49	29.4	-45%	-38%	-53.3%
Median	630	378	210	126	120	72	23	14	-56%	-50%	-60%

Figure 3: Comparison of harvests with and without elephant crop raids

In a "good harvest season", the sampled farmers in Simangani were able to harvest a median of three drums (3 x 210kg) per household. After processing, a drum yields around 160kg of grain flour. According to official

[71] SSIS, Shupani Sibelo, Village Head (Nkandebwe Village, 22 April 2023).

[72] SSIS, Richard Ngwenya, Household Head (Kasase Village, 24 February 2023)

[73] A.C. Gupta, 'Elephants, Safety Nets and Agrarian Culture: Understanding Human-Wildlife Conflict and Rural Livelihoods around Chobe National Park, Botswana'. *Journal of Political Ecology*, 20, 1 (2013), pp. 238-254

[74] Individual SSIS, Rushebo Rendo, Mavis Nyoni, Sibongile Munsaka and Nkatazo Nchelwani, Household Heads (Makwa Village, 11 February 2023)

government food security planning figures, one adult requires an average minimum of a 120kg cereal "consumption rate" per year.[75] To put this in perspective, the average sample household size was 5.25, while the cost of a 10kg bag of store-bought maize flour was around $6 during the time of research.

A 10 per cent increase of marginal crop loss based on a median decrease in yield between 420kg per household would mean that households whose crop was raided by elephants in the 2022-23 season had to substitute on average 42kg of grains per year, or around 30kg in processed grain flour. Hence, in this construed scenario, an elephant crop raid destroyed a quarter of the required annual amount in mealie meal per capita (according to the government) of an adult living in a household with an average of 5.25 members. At a market (store-bought) price of mealie meal of around $6 for a 10kg bag this is easily calculated to translate into an additional cost of $18 per household per year. In comparison, the school fees for a child going to secondary school in Simangani are about $40 per term ($120 per year). At first sight, stretching these additional harvest loss costs out over a whole year and a whole household does not seem to be that much when compared to losses mostly attributable to erratic and insufficient rainfall or drought decreasing yields to up to two-thirds on average. Thus, it is not surprising that most respondents mentioned bigger worries in their everyday lives than elephants threatening their crops, including the threat emanating from elephant homestead entry or encountering elephants during daily routines (school commutes, fetching firewood and water etc.).

More importantly, only a negligible number of farmers responded positively to the direct probing question: 'will you have less food this year, because of elephants?' Instead, most respondents blamed the 'bad rains' (erratic rainfall) or personal reasons (e.g. health, off-farm work commitments), but not elephants for their unsatisfactory harvest. But when asked 'how much do you think the elephant(s) that entered your field destroyed?' responses between two buckets (40kg) to a drum (210kg) were given (although most answered 'I don't know').

Besides the climatic conditions, of which as stated above drought is the single most relevant one, a lot can go wrong during growing season that has nothing to do with elephants. This pertains particularly to crop raids by other species, including but by far not limited to baboons (*Papio ursinus*), hippos (*Hippopotamus amphibius*) and red-billed quelea birds (*Quelea quelea*). Of course, these kinds of impacts can easily interplay and affect each other: For instance, a farmer, who normally spends all day in his field until his crops are harvested in order to chase away baboons and birds, may suddenly not feel well enough to do so or has important events to attend and no one to take over his guarding spot. Location and social cohesion also play a role. Farmers in the village of Makwa were for instance gradually giving up on fields, lowering the number of farmers that can have each other's back and make a noise when a herd of elephant arrives. In the floodplains of Msuna, fields were very busy during the beginning of harvests and a cow would be chased out of a maize field of a neighbour even in her absence. Farmers in the Msuna floodplains have also long adapted to hippo incursions during the farming season by means of watchtowers that allow them to overlook maize fields and spend their nights on them to be both safe from hippos and enable them to chase these nocturnally grazing animals away with noise and flashlights. Field huts, but no such watchtowers, were observed in other

[75] Ministry of Lands, Agriculture, Fisheries, Water and Rural Resettlement, 'Second Round Crop and Livestock Assessment Report, 2018/2019 season' (Harare, 21 April 2022), available at https://fscluster.org/sites/default/files/documents/2022_second_round_crop_and_livestock_assessment_report_5_may_revised_1.pdf, retrieved 17 July 2023.

parts of Simangani, where farmers will spend their days chasing away baboons, vervet monkeys (*Chlorocebus pygerythrus*) and birds, but not nights, when dangerous elephant raids may occur.

While there are many interrelated factors that may result in a farmer having substantially lower harvest results than expected, factors that cause an elephant to raid a given field (or not) are also numerous. Originating either from conservation landscapes around Victoria Falls and Matetsi to the south-west or from the concessions in Kavira State Forest[76] and Devil's Gorge[77] to the north-east, elephant herds are penetrating and specifically targeting cropland in the HCA during harvest season. Such elephant migration dynamics are widely studied by zoologists, but particularly in this emerging Wildlife Migration Corridor section of the HCA in Simangani not yet fully understood.[78] However, what is clear is that elephant movement behaviour is based on a combination of the seasonal interplay from finding mating partners to rearing their young, forage and water access,[79] both long- and short range migration patterns,[80] infrastructure-related disturbance and displacement,[81] hunting[82] and finding refuge. For example, Guerbois et al. propose that pearl millet fields in the HCA are used by elephants more for refuge but less for raiding than sorghum or maize fields, presumably because millet grows taller than the other crops and thus provides better cover.[83] Directly or indirectly, climate change impacts including changing rainfall patterns and drought can affect all of the above behavioural patterns of elephants as well as other species, [84] in turn potentially leading to HWC peaking particularly at a time when farmers, too, are already suffering from drought. Thus drought simultaneously increases both the vulnerability of household harvests and the risk of further damage caused by HWC.[85]

While baboons, which are present throughout the year, were mentioned as the most frequent nuisance but could be deterred by one's dogs if the latter are sufficiently aggressive and in number, elephants were mentioned as the biggest threat, mainly for the combination of three reasons: Their potentially devastating impact on crops in quantitative terms, the near impossibility of chasing them out of fields, and the related threat to human life they impose. Contrary to elephants, for instance, hippos are the only other potential live-threatening crop-damaging species, but are easily deterred by flashlights and normally only flatten but do not uproot crops when grazing at night.

[76] Expert Interview (EI), Jos Danckwerts, Conservation Director, Wild is Life (Harare/Victoria Falls, 04 October 2023)
[77] EI, Dean Todd, Manager, Devil's Gorge Concession (Msuna, 17 October 2023)
[78] EI, Malvern Karidozo, Principal Researcher, Connected Conservation (Victoria Falls, 17 October 2023)
[79] L. Mlambo, L., M.D. Shekede, E. Adam, J. Odindi, A. Murwira, 'Home Range and Space use by African Elephants (*Loxodonta africana*) in Hwange National Park, Zimbabwe. *African Journal of Ecology*, 59, 4 (2021), pp. 842-853.
[80] A. Purdon, M.A. Mole, M.J. Chase, R.J Van Aarde, 'Partial Migration in Savanna Elephant Populations Distributed Across Southern Africa. *Scientific Reports*, 8, 1 (2018), 11331.
[81] T.S. Adams, M.J. Chase, T.L. Rogers, K.E. Leggett, 'Taking the Elephant out of the Room and into the Corridor: Can Urban Corridors Work? *Oryx*, 51, 2 (2017), pp. 347-353.
[82] I. Mahakata and I. Mapaure, 'An Analysis of the Factors Contributing to Elephant Population Fluctuations in SWRA Using Ranger-Based Knowledge and Perceptions', *Ecology & Conservation Science,* 1, 5 (2021), 555571.
[83] C. Guerbois, E. Chapanda, H. Fritz, 'Combining Multi-Scale Socio-Ecological Approaches to Understand the Susceptibility of Subsistence Farmers to Elephant Crop Raiding on the Edge of a Protected Area', *Journal of Applied Ecology*, 49, 5 (2012), pp. 1149-58.
[84] M. Hines, G. Glatzer, S. Ghosh & P. Mitra, 'Analysis of Elephant Movement in Sub-Saharan Africa: Ecological, Climatic, and Conservation Perspectives', in *Proceedings of the 6th ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies* (2023), pp. 1-11.
[85] Carpenter, S. (2022). Exploring the Impact of Climate Change on the Future of Community-based Wildlife Conservation. Conservation Science and Practice, 4, 1 (2022) p. e585.

Different species also tend to raid different types of grains in different ways, with armoured bush crickets (*Acanthoplus discoidalis*) for instance targeting mostly maize, and red-billed quelea birds preferring millet and sorghum, because their exposed grains are more easily accessible to them than maize kernels which are protected by tough-fibred husks, at least in earlier maturation stages. The crickets may appear as vermin in large numbers just before harvest begins, depending on rainfall conditions and corresponding egg bank sizes in a given year.[86] While they cannot realistically be picked off the crops in the numbers they occur in, their damage is not necessarily as complete and rapidly occurring as the damage caused by the birds. Finally, the number of quelea birds occurring in a given area in a given season also depends on the effectiveness of spraying campaigns conducted by the government.

3. Off-farm income Activities

Over half of the surveyed households (N=99) reported some form of off-farm income during the previous year by at least one household member, while 10 per cent of them had two household members earning an off-farm income (N=18).

Discounting all the households (no less than half the sample) reporting no cash income, most households that did earn a cash income reported monthly salaries between $150 and $300. At the lower end of the spectrum, people would work, for example, as builders for a local missionary or as cattle herders for around $30-40 per month. About 10 per cent of households had mostly younger household members (18 to 30 years of age), who were involved in fixed-term contracts offered mostly by either Chinese coal- and energy-sector firms or an Indian company tasked with building a new water pipeline from the Zambezi to the coal-fired power plant in Hwange. Such contracts would typically pay $300 per month under working conditions that were consistently described as strenuous and lacking safety measures. Finally, 15 per cent of households had members working in the local tourism industry, which is mostly related to sport fishing between the Matetsi and Gwaai rivers, with concentrations of smaller fishing lodge clusters around Deka and Msuna. Wages in these establishments were reported to be as low as $60 per month for a cleaner and casual worker, with the highest wage being $400 earned by a chef working for a high-end lodge quite a distance away in Matusadona NP. But most wages in the sector oscillated around$200 per month. Finally there were also a few household members who were employed by government agencies such as the Zambezi River Authority or the Zimbabwe Power Corporation.

Under these circumstances, with half the households receiving low levels of cash income and others (almost) none except limited remittances (see below), a quantitative analysis of the use of these cash incomes within household livelihoods would be possible but would lead to a widely scattered plot both in terms of goods and services purchased and across timescales. A more interesting trend that has surfaced during the interviews was the description of such cash income by (mostly older and retired) household heads as being used for “sugar and soap’, describing a range of basic household and low-level luxury goods that can only be sourced in the cash economy. Indeed, the ‘centre of gravity’ for most livelihoods appeared to be based on

[86] S.V. Green, ‘Biology and control of armoured bush crickets in Southern Africa’, Final Technical Report for DFID NRRD Project (Greenwich, UK, 30 September 2002), available at https://assets.publishing.service.gov.uk/media/57a08d3240f0b649740016e6/R7428_FTR.pdf, retrieved 28 October 2023

subsistence and local exchange networks, with participation in the cash economy merely being an 'add-on' providing such 'luxuries' as toiletries or sugar.

Close to 50 household respondents (27.6 per cent) had a retired household member, often the head, with a majority of them having previously been employed in the regional mining sector, especially the Hwange Colliery Company (HCC). However, most of these pensioners did not receive a pension or received a very low standard pension of RTGS[87] 40,000 (at the time of research approximately $25). Some also referred to being involved in a group lawsuit against HCC over the neglected payment of their pensions. However, despite a lot of bitterness expressed by the retirees over the way they have been treated, particularly by HCC, since their retirement, they described their general working conditions, job security and pay with the old HCC as much better than the situation that the younger generation of workers find themselves in nowadays working mostly for 'the Chinese and Indians'. While most of the pensioners were men, both them and other elderly household heads, both male and female, did significant labour in the fields. This included pensioners' wives and women who were household heads, some of them the widows of deceased former mine workers. The tasks done by elderly people included not only guarding the fields leading up to harvest season (when the survey was taken) but in many cases also the arduous work of ploughing the fields and planting.

Clearly, basic food (mealie meal and vegetables) was purchased with cash only after harvested stocks were finished and they were mostly bought by or sent in packaged form as remittances from family members. In several cases the elderly household members also mentioned that their grain harvest was actually contributing to the food consumption of their children living in town (Hwange in most cases). Most households had at least one family member (mostly children and grandchildren) working in nearby Hwange (50km) or Victoria Falls (150km). Many also had children living in Harare, South Africa or Botswana, but only one had a son living overseas. But when it came to discussing remittances sent mostly by these sons or daughters, it was only rarely mentioned that they would receive regular income contributions from them. Rather the most common answer was that the sons and daughters had their own families to take care of, followed by them sending money or mealies only when asked in exceptional emergency cases. A typical answer by a household head would be that in a time of urgent need, she (more often than he) would send a message out to their children, who would then discuss whose turn it was or who would be able to assist at a given time. Of those receiving more regular remittances, these amounted to no more than $100-200 once a year for Christmas or $50 every three months. Crucially, when asked what their household would do when it ran out of the harvested food stocks, most would answer that they could not rely on (emergency) remittances as much as they would count on self-employment and casual labour ('piece jobs'), which when asked for detail usually meant helping their slightly better-off neighbours with rethatching the their neighbours' roofs or renovating the walls of mud houses, collecting firewood, cleaning their homes or weeding their plots.

Like agriculture, fishing as a livelihood activity covers anything from seasonal fishing on the Zambezi to supplement the main diet, an important all-year subsistence food sourcing activity, a profit-generating activity both for barter and sale and a wholesale fishing operation to supply buyers coming from Victoria Falls or Hwange town. While there is no room to detail this whole spectrum here, it is important to note the constraints that exist both at the point of the fishing process itself and the method and point of sale: Fishing is constrained by requirements to join a fishing co-operative attracting government fees of $200 covering three months per co-operative and either drying or refrigerating fish. While the former lowers the value that

[87] ZimDollar based on Real Time Gross Settlement, official Zimbabwean currency (but not recognised internationally).

can be generated, the latter means paying a refrigeration fee to the owners of fridges who have access to electricity.[88]

Ultimately, the expectation of food aid distribution, both from the government and from non-government organisations was frequently mentioned as a fall-back option by the poorer households. This is corroborated by official information provided by FEWS.[89] Statistics based on the 2014 PPF Survey[90] and published on the KAZA website emphasise, among other positive outcomes of their support to the programme, that positive attitudes of local populations to conservation in Zimbabwe stood at 59 per cent and were projected to improve toward a 'goal' of 75 per cent in 2019. This statistic has not been updated recently, although data collected by WWF and previously published on the same website did provide survey data on collaboration with and attitudes toward 'conservation NGO' that can be deduced from it.[91] However, when inspecting the data collected by WWF in Zimbabwe,[92] it becomes clear that many of the references made to 'conservation NGO' in fact refer to World Vision or ORAP, which are NGOs that are not involved in conservation but have been directly responsible for food aid distribution and employment in nutrition gardening projects over recent years. Very few informants were aware of the conservation programmes spearheaded by KAZA or had even heard of WWF.

For many households, an important food source is a widely applied programme to introduce irrigated community horticulture schemes first funded through the EU, SNV, Caritas and other development aid donors between the late 2000s and 2010s and then in more recent years an even more widely applied but more concentrated approach by the Christian NGO World Vision to set up so called nutrition gardens. These are fenced-off areas that are given some initial support from the donor agency, which besides fencing most importantly includes technical assistance in setting up co-operative structures and water infrastructure including pumps, basins, tanks and pipes. World Vision in particular has been promoting its horticulture scheme as a means to improve not only food security but also the quality of nutrition and, crucially, as an income earning opportunity. Most of these gardens were certainly in intensive use judging both by observation of the gardens themselves and the high proportion of participants in these horticulture co-operatives within the sample, where households were based close to such a project. Although it is the stated goal of World Vision to turn these co-operatives into profit generating ventures,[93] almost all respondents stated that they were only harvesting for personal use while exchanging some surpluses among their family and neighbours. For these respondents, lack of access to markets and competition were the main reason for not attempting to market their garden produce.

Exchange and barter, not only among family members, but also within the farming village economy and the HCA was observed. Within the village trade for goods and services such as 'piece jobs' remunerated with grains or trading fish or livestock for grains is much more the norm than these kind of exchanges taking place through dollar or RTGS denominated money exchanges. This is hardly surprising in rural Zimbabwe, given the

[88] SSIS, Chipegwa Muzemba (Msuna-Kanjeza Village, 14 April 2023).

[89] FEWS NET, 'Zimbabwe Food Security Outlook February to September 2022: Poor and Erratic Rainfall Likely to Result in Below-Average Harvests for the 2021/22 Agricultural Season', available at https://fews.net/sites/default/files/documents/reports/ZW_FSO_Feb2022_Final.pdf, retrieved 28 October 2023

[90] Glatz-Jorde et al., 'Consulting Services.'

[91] Kavango Zambezi Dashbords, 'Socio Economic Indicators' https://maps.ppf.org.za/arcgis/apps/sites/#/kazadashboards/pages/kavango-zambezi-socio-economic-indicators, retrieved 28 October 2023.

[92] WWF, 'Kavango-Zambezi.'

[93] EI, Lovemore Nyoni, Programme Manager, World Vision (Victoria Falls, 23 February 2023).

instability of RTGS and the lack of dollar accessibility. It is also common to pay school fees with grain harvests, and goats are traded wholesale across district lines to Binga through an established trading system in return for bags of mealie meal. In this way livestock, and in particular goats if they survive HWC, are thus still quite a reliable insurance against crop failure.[94]

4. Livestock and other Assets

This section will focus on livestock and livestock-related asset ownership like scotch-carts and oxen-drawn ploughs, because these were the most commonly observed forms of physical capital asset ownership in Simangani. Accordingly, livestock also included oxen and donkeys as draught animals, with several households owning only either the animal or the mentioned equipment, whilst borrowing or lending the other when needed, usually at a (barter) fee. A handful of households within the sample (less then 5 per cent) owned assets such as a car or a solar-panel-powered TV.

Apart from use of cattle as draught animals, just over half (N=99) the surveyed households owned cattle in the common form of longer-term storage of wealth, but also for customary or 'traditional' reasons. In most cases, the few owners of small herds of over 10 heads (15 per cent) have been-able to build these over many years of long-term permanent employment, often in the mining sector, and effectively keep their stock of cattle as a form of retirement insurance. These stocks are mostly reserved for special expenses or events such as weddings, funerals or costly shocks, e.g. emergency surgeries, but hardly ever slaughtered for celebratory functions. Goats are owned by most households and where this is not the case, the household has either tragically lost its entire goat stock due to depredation or has given up rebuilding the herd because of it (see below). In only a few cases households are currently not keeping goats because they have lost them to disease or have alternative ways to cover larger running costs. It is a consistent pattern across all surveyed respondents that goats and sometimes also sheep or pigs fulfil exactly this function of covering planned or foreseeable expenses throughout the year.

Goat stocks are mostly self-sustaining and less costly to maintain. While cattle are more susceptible to stock theft (often attributed to cross-border raids by Zambians) and drought, goats are much more hardy animals and are mostly left to graze by themselves. Cattle require labour either via a household member or hired herders and must be taken for longer distances to graze along the banks of the Zambezi and its tributaries, where they get frequently attacked by crocodiles. Cattle also attract higher veterinary costs and a government tax (approximately $1 per month per head)

During the interviews villagers attributed livestock depredation mostly to crocodiles (*Crocodylus niloticus*, 356 head per annum), black backed jackals (*Lupulella mesomelas*, 231 heads p.a.) and spotted hyenas (*Crocuta crocuta*, 112 head p.a.). Baboons (63 head p.a.) were also mentioned as a substantial threat particularly to goat kids and chickens, making them the only species to cause HWC in both crop raiding and predation. In total, the 181 surveyed households lost a staggering 628 goats to predation over a one-year period, with baboons mostly attacking kids in and around the homestead, hyenas and jackals preying on them in pastures around forest edges, and crocodiles along the riverbanks. But hyenas were also held responsible for attacks on cattle, often towards the evening while cattle were being driven home to the village kraals.

[94] I. Scoones, I. 'The Economic Value of Livestock in the Communal Areas of Southern Zimbabwe', *Agricultural Systems*, 39 (1992) pp. 339-359.

Out of a total cattle population of 867 within the surveyed sample, 116 head of cattle were lost either this way or taken, mostly as calves, by crocodiles. By comparison cattle stock theft (58 head p.a.) and death from drought or disease (61 head p.a.) added up to an almost identical number of losses, but these were incurred in the course of a few isolated incidents.

Jacobsen recorded annual lion predation costs around Mabale of $3.29 per household based on a population of 7,500.[95] This figure is low compared to goat predation in Simangani Ward, with its slightly smaller population .

Based on the figures collected for the present research 630 goats were killed by crocodiles, jackals, hyena and baboons across the sample population of 946 at a sales value per goat of $25-35. The total cost of predation on goats to the Simangani community of 6,550 would hence be $109,051.27 – 152,671.78. This equals a total of $87.50 - $122.50 per household per annum ($16.65 – 23.31 per capita). This is not at all insignificant, especially because goats are used more as capital 'flow' income and expenditure than cattle 'stocks' , which are rather used as long-term savings. Hence, goat predation affects households in the short to medium term, while cattle predation tends to have longer-term financial impacts.

To put this in perspective of a standard expense for the average household: Depending on the current market value of the goat and level of schooling (primary or secondary), the sale price of four to seven goats will cover for one year of school per child. Termly costs for school fees alone (excluding uniforms and stationary) were $40 for primary school and $60 for secondary school. Based on official government data, approximately 2,200 children in Simangani ward were of school-going age. So the total 'annual schooling bill' for all households in Simangani combined, would have been between $264,000 and $396,000. Extrapolating from this total, the 317 school-age children within the sample would have had a combined annual school bill of $38,040 - 57,060. In comparison, the value of goats lost to predation in the past year was $15,750 - 22,050 or between a third and half of this annual 'total household school bill' within the sample.

Discussion

The combination of economic and environmental instability in Zimbabwe over the past two decades has persistently threatened livelihoods and has caused food poverty levels to rise, particularly among rural populations.[96] Most farmers in the HCA are subsistence farmers and do not market their grains, while their livelihoods are heavily dependent on rainfed subsistence agriculture.[97] The surveyed farmers in Simangani, confirm that they exchange surpluses when possible, but do so mostly locally through direct barter exchange. Thus, they were not part of TCAP. They also do not sell to the government's Grain Marketing Board. That said, some may have benefited indirectly from the programme through informal side-marketing among family networks and through the exchange of surplus inputs.[98] Because subsistence farmers in Simangani regularly have to supplement their own harvest with store-bought maize for several months of the year, they also benefitted from lower nation-wide food prices resulting from TCAP. In any case, as intended, TCAP enabled the government to distribute food aid to areas such as the HCA, where food-poor households had just been identified in a nationwide survey.[99] Then, after COVID-19 had plunged the world into crisis, the

[95] K.S. Jacobsen, 'Human dimensions of coexistence with lions: attitudes, wellbeing and economic valuation' (PhD Thesis, University of Oxford, 2020).
[96] Sharma, *Reversing the Tide,* p. 17.
[97] Glatz-Jorde et al., 'Consulting Services.'
[98] Mazwi et al., 'Political Ecology of Command Agriculture'.
[99] ZIMSTAT, 'Food Poverty Survey'.

season of 2020-2021 turned out to be a comparatively good one, at least at a national scale. But the 2021 survey taken across Hwange during this time paints a bleaker picture of an average unprocessed grain harvest of only 399kg (median 200kg) per household.[100] Given a per capita grain requirement of 120kg in processed grains per year and an average household size of four, this was clearly not enough to subsist on for most families.

For both 2021 and 2022, the FEWS projected most of the HCA to be 'stressed' (Phase 2) and Simangani to be 'in crisis' (Phase 3), with at least 25 per cent of households needing to receive 25 to 50 per cent of their caloric needs through humanitarian food assistance.[101] The slightly better medium-term forecast for Simangani Ward for October 2023 to January 2024 is Phase 2, but with the rest of the HCA this time projected to be in Phase 3.[102] The World Food Programme (WFP) put out a statement in July 2023, warning that again, at least 4.1 million Zimbabweans or just over a quarter of the population are going to need food aid by the end of the year.[103] Nevertheless, in the same month the soon to be re-elected President Emerson Dambudzo Mnangagwa announced that the country is food secure at a highly publicised event in St Petersburg, Russia.[104]

The exposure of rural households to multiple livelihood risks In Zimbabwe, as in many other parts of KAZA, is a common thread not only in academic literature, but also in news reporting and public knowledge about poverty in sub-Saharan Africa more generally. At first sight, the HCAs seem to show relatively farming activity except for subsistence agriculture marked by a dependency on foreign charities. While the droughts of recent years and lack of labour and inputs are usually mentioned as being the root causes for a lack of agricultural development in a region with a food poverty ratio of 40 per cent of the population, human-wildlife conflict is also on the increase. Over the past decade, both the human population of Hwange's rural areas and elephant herds inhabiting the wider region around them have grown substantially by over 10 per cent and 13 per cent respectively. Both crop raiding and fear of the same taking place in the future is contributing to a decrease in local grain fields under cultivation.

Instead, greater effort and consequently greater reliance can be observed in communal irrigation fields that have been set up and fenced off on behalf of international donor agencies and NGOs such as World Vision. However, these irrigation fields are either not large enough to produce sufficient grains for the whole year in one season or are classified (by World Vision) as 'nutrition gardens', thus producing mostly vegetables which, though invaluable for local diets, are not intended to substitute for the abandoned grain fields. Hence, most villagers indicate that they will have to rely more on store-bought staples and that increased food insecurity is looming over the coming months. What the research results also show is that goat predation, in particular, also has a much more immediate indirect impact on household budgets, due to the practice of using goats to cover short to medium household running costs like school fees.

Meanwhile, wildlife populations are thriving on the consumption of their goat herds at the expense of much needed income needed to pay for food, school fees and other livelihood essentials. During the dry months this applies in particular to crocodiles, which find easy prey in livestock grazing on the Zambezi River banks

[100] WWF, 'Kavango-Zambezi'.
[101] FEWS, 'Zimbabwe Food Security Outlook February to September 2022'.
[102] FEWS, 'Zimbabwe Food Security Outlook September 2023'.
[103] WFP, 'World Hunger Map', available at https://hungermap.wfp.org, retrieved 04 August 2023.
[104] M. Trevelyan, 'Zimbabwean President Says Country has Food but Grateful for Putin Grain Offer' (Reuters, 27 July 2023), available at https://www.reuters.com/world/africa/zimbabwean-president-says-country-has-food-grateful-putin-grain-offer-2023-07-27, retrieved 04 August 2023.

as pasture becomes scarce elsewhere. But it cannot be determined conclusively whether wildlife predation within KAZA negatively impacts the immediate livelihood needs of households, for instance to pay for the education of their children. Within the household school fee expenditure variable alone, there are too many intervening factors to consider before one could arrive at an authoritative calculation on how predation of goats 'eats into' household budgets when it comes to schooling. Many children get their fees paid by parents, who are living and working elsewhere. Then again, in these and other cases, cash received for school fees by a grandparent, aunt, uncle or elder sibling of the school child in the household might be used to buy essentials in the market economy, while the goat is still due to be used for payment of the actual fees, or it is exchanged into grains at a value of 100-140kg of (unprocessed) grains and then the grains are used to pay for the fees, and so on.

Notably, by several verbal accounts, the last occurrence in which a person was killed by an elephant in Simangani took place in 1986 (a drunk tourist, 'wanting to offer the elephant a cigarette'). Yet several informants stressed that they were more worried about elephants attacking their children on their way to school than them raiding their crops. Psychological dimensions of rational or irrational behaviour towards the weighing of risks and response to them are beyond the scope of the present paper. However, it should be stressed that the fear of big and potentially dangerous animals, although difficult to account for, may have a bigger impact on people's wellbeing than the economic effects of grain harvests and livestock lost to wildlife damage.[105]

But to conclude, it is not hard to imagine the livelihood pressure coming down on a household whose goat herd is diminishing below a critical threshold needed to pay for upcoming school fees at the beginning of a term, whilst a number of other costs also have to be met, not least of all for grains and other food and other basic needs.

Conclusion

Household livelihoods in Zimbabwe's section of KAZA are primarily threatened by a failed national economy and frequent droughts exacerbated by climate change. Eroding socio-ecological resilience marked by high levels of poverty and household food insecurity increases the susceptibility to shocks among subsistence farmers.[106] Due to this high susceptibility to shocks, HWC compounds these vulnerabilities.[107] This article serves as a contribution to the ongoing debate on HWC both in KAZA and globally.[108] By looking at both farm and off-farm income activities and assets owned, it has described the challenges faced by local households in a largely subsistence agriculture-based community, which is situated in between two large clusters of PA within KAZA.

Research based on the triangulation of quantitative surveys with in-depth field research shows that the impact of HWC may not be the main stressor causing food insecurity, but is critically impacting on a socio-ecological system which is already heavily strained due to longer-term economic and climate change pressures. Crop raiding by elephants and livestock depredation add an additional layer of vulnerability risks to a rural economy that is already exposed to increased climate change impacts and lacks sufficient access to

[105] I.R. Blackie, 'Posttraumatic Stress and Psychological Impacts of Human Wildlife Conflict on Victims, Their Families and Caretakers in Botswana.' *Human Dimensions of Wildlife*, 28, 3 (2023), pp. 248-264.
[106] Adger, 'Vulnerability'.
[107] Salerno et al., 'Wildlife Impacts and Changing Climate'.
[108] Braczkowski et al., 'The Unequal Burden of Human-Wildlife Conflict'

currency-based trade. As a consequence, subsistence farming households are driven to their existential limits, as crop harvests fail to meet people's consumption requirements and depredation keeps livestock investment activities at insufficient levels.[109]

As the redefinition of communal lands as a Wildlife Migration Corridor is taking shape in Zimbabwe's sections of KAZA, its direct and indirect consequences for the livelihoods of local households and their freedom of movement deserve more attention from conservationists advocating for growing wildlife numbers and the donor organisations that fund them. Both the introduction of more traditional approaches to mitigate HWC such as direct compensation schemes and novel conservation funding mechanisms such as Biocredits[110] are mentioned by public and private sector leaders at a local level. However, economic and financial instability in Zimbabwe coupled with high levels of corruption make compensation or market based mitigation of HWC at a household livelihood level an unlikely solution.

Instead of offsetting or compensating costs incurred due to HWC, another way to mitigate vulnerability of household livelihoods would be to lower their expenses via conditional cash transfers. For instance, mothers registered in wards such as Simangani, which has been recognised as a Wildlife Migration Corridor, could receive cash transfers, which would (at least partially) cover school fees based on consistent school attendance as a condition.[111] Funding for such a programme could come from a tax on financially well-endowed organisations such as WWF and PPF, which have been highly successful in raising funds from international donors for biodiversity conservation across TFCA within southern Africa.

MANUEL BOLLMANN
University of Cologne
m.bollmann@uni-koeln.de

Acknowledgments

My biggest thanks for their support and knowledge sharing goes out to my field assistant and interpreter Roger Ncube. Secondly, I am more than grateful to the community representatives of Simangani ward Headman Rafael Nyoni and the Makwa Village Heads Martin Shoko, Benedict Shoko, Bernhard Shoko, Felestina Sibanda and Vangeli Tshuma as well as all other Village Heads of Chezya, Chingonya, Chunga, Gwaayi, Kalowa, Kasase, Msuna, Msuna Hills, Mwemba and Nkandebwe, who have so greatly facilitated my research. Last but not least I am grateful for the very open, kind and wise guidance by Chief Hwange, Amos Sibaya.

[109] Dorward, 'Hanging in, Stepping up and Stepping out'

[110] A. Ducros, and P. Steele. *Biocredits to finance* (London, International Institute for Environment and Development, November 2022)

[111] N. Benhassine, F. Devoto, E. Duflo, P. Dupas, V. Pouliquen, 'Turning a Shove into a Nudge? A "Labeled Cash Transfer" for Education', *American Economic Journal*: *Economic Policy*, 7, 3 (2015), pp. 86-125.