



UN
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STRENGTHENING FOOD SECURITY IN MYANMAR:

A ROADMAP FOR LOCALIZED ACTION

MYANMAR DEVELOPMENT OBSERVATORY

December 2023

The Myanmar Development Observatory (MDO) specializes in research and analytical work concerning the development trajectory of Myanmar, with particular focus on the socio-economic circumstances, the progress on the Sustainable Development Goals, and the impact of the conflict. Working with a range of stakeholders, including UN agencies, Civil Society, the private sector and think tanks, the MDO acts as an interlocutor between evidence from the ground and the actual programming to benefit the most vulnerable in Myanmar and enhance their resilience.

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List of Abbreviations

AARRDS	Myanmar Alliance for Agricultural Research, Rural development & Advisory Service
ACIAR	Australian Centre for International Agricultural Research
AI	Avian Influenza
ASF	African Swine Fever
BCC	Behavioural Change Communication
CA	Conservation Agriculture
CABI	Centre for Agriculture and Bioscience International
CFSAM	Crop and Food Security Assessment Mission
DHS	Demographic Household Survey
EED	Environmental Enteropathy Dysfunction
FAO	Food and Agriculture Organization
GHGE	Greenhouse Gas Emissions
HNO	Humanitarian Needs Overview
IFPRI	International Food Policy Research Institute
ICM	Integrated Crop Management
IEC	Information, Education, Communication
IPC	Integrated Phase Classification
IPM	Integrated Pest Management
IYCF	Infant and Young Child Feeding
MLCS	Myanmar Living Conditions Survey
NPK	Nitrogen, Phosphate and Potassium
PPE	Personal Protective Equipment
R&D	Research and Development
rCSI	reduced Coping Strategy Index
SDG	Sustainable Development Goals
SIS	Small Indigenous Species
SRI	System of Rice Intensification
TCF	Transnational Cooperation Framework
UNDP	United Nations Development Programme
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme

Executive Summary



“ **This report examines the impact of COVID-19, the military takeover, climatic shocks and recent steep food price increases on Myanmar’s of food and agriculture systems** ”

This report examines the structure of food and agriculture systems in Myanmar and the ways in which this has been impacted by COVID-19, the military takeover, climatic shocks and recent steep food price increases. Using an evidence-based roadmap, a set of specific recommendations have been identified for geographic-specific recovery interventions.

The report used a range of information sources. The essential foundation has been the raw data analysis from the Myanmar Living Conditions Survey (MLCS), FAO/WFP Monitoring Reports and the IFPRI Household Welfare Survey. The full narrative reports of each of these surveys have also been reviewed together with those for other surveys, such as the Myanmar DHS 2015 report. In addition, findings from technical papers and peer reviewed journals relating to food and agriculture, environment, livelihoods, and nutrition within Myanmar have been incorporated.

The pillars of food security have each been reviewed: availability, access, utilization and stability. The analysis is presented by state/region and where applicable by agro-ecological zone. The review further includes a multivariate analysis by state of the relationship between diet, access to safe drinking water and levels of child anaemia.

The underlying factors affecting food availability are the high cost of crop and livestock inputs, resulting in a reduction in aggregate food production, an increase in farm household food retention rates, with less marketable surplus for sale. Household access to food is compromised by an overall reduction in livelihood opportunities, lower purchasing power, and higher prices. Markets are not functioning normally. Physical access to markets is impaired by movement restrictions. The high variation between rice prices throughout the country shows market fragmentation. Rural farm and urban non-farm incomes have fallen. Cash as disposable income in hand is overwhelmingly reported as the most acute need. Existing social safety nets are extremely limited. Communications networks currently limit the distribution of emergency cash assistance.

Food utilization has been characterized by changes in intra household distribution, with reduced food consumption and dietary diversity. This has led to preferential feeding (triaging) of children, at the expense of a poorer diet for women in the household. Female physical work burden and time needed for child-care and feeding become more onerous in times of food shortage. Women need to find ways of procuring food for their family and adequately feeding young children is made more difficult by reduced dietary quality. These problems overlay chronic issues of poor household access to water and sanitation as well as chronic threats to food safety. Those households, dependent on livestock are particularly at risk of food insecurity. Livestock holdings are decreasing, and it is important to prevent complete destitution. Maternal and child undernutrition in Myanmar cannot be improved without regular consumption of animal sourced foods. When markets can operate more normally, there will still be structural problems limiting their efficiency in enabling food access.

Agricultural development in Myanmar has been at the expense of the natural resource base, rather than any improvements in efficiency. This has led to deforestation, increases in soil salinity, pollution of watercourses, and threats to the food chain from the use of unsafe chemicals. Progress in food security is constrained by a significant deterioration in extension services since the military takeover.

Points of intervention are identified for strengthening the food security pillars, together with those states being most in need of support. Access or how households obtain food is considered paramount for ensuring food security. Restorative agriculture models are recommended as the sustainable basis, for ensuring aggregate food availability, but most importantly to improve household food access. Further means to improve access are elaborated, concerned with supporting the ways in which food is obtained via own production, purchase through earned income or sale of assets, and receipt of food transfers. These variously include reinforcing social protection systems, support to household level production of high value foods, livestock, and fisheries, leveraging local agriculture for school feeding, reduction of food waste throughout the food chain, and promoting market participation and improving food safety. Links between agriculture and other sectors, especially WASH, are seen as fundamental to improving food utilization.

“ Myanmar is listed as the second most impacted country by extreme weather events in the last two decades ”

“ Avoid a protracted humanitarian intervention, which by itself will not address root causes of food insecurity and may perpetuate dependence ”

Measures in support of achieving stability in food security, focus on the early warning of disruptive weather events, agricultural pest and disease outbreaks as well as key market and trade information alerts. Especially the early warning is very important seen Myanmar’s listing as the second most impacted country by extreme weather events in the last two decades (Global Climate Risk Index 2021)¹ and climate-resilient interventions and early warning are very important.

The response in Myanmar requires a transition from humanitarian aid only to more medium-term interventions. The intention is to avoid a protracted humanitarian intervention, which by itself will not address root causes of food insecurity and may perpetuate dependence. Humanitarian interventions alone will have diminishing effectiveness if there is no timely roll-out of medium-term programmes to mitigate some structural food security issues. They are further necessary to provide an exit strategy from the humanitarian phase. Given the extent and scale of emergencies globally, donors will not be able to fund humanitarian activities indefinitely.

The current political context must be considered. Recommendations are oriented towards non-State actors. For example, ‘extension services’ is not necessarily related with a government structure and should be understood as ‘technical support’ focusing primarily on the role that Cooperation Partners and the private sector can play in strengthening the competence and intelligence of farmers combined with the support of agricultural inputs such as improved seeds and the right variety of fertilizers. The same is true of social protection. The approach proposed here is similar to the model being implemented by the Australian Centre for International Agricultural Research (ACIAR) with local partners in the conflict affected Mindanao region of the southern Philippines. This is the Livelihood Improvement through Facilitated Extension (LIFE) project adapted from the ACIAR ‘Landcare’ model. It works through locally appointed facilitators or community extension workers.^{2,3}

The suggested interventions should be seen as steps necessary to address a systemic fault in the food and agricultural systems in Myanmar attributable to decades of inadequate attention to the sectors. The flaws have become starkly visible due to the outbreak of both the pandemic and the political crisis. They require long term vision to be fully resolved, but under the current context it should be possible to initiate small scale localized (area-based) projects which can be scaled up when the situation allows. The value-added of this study is to cull out state and region-specific problems from a rich literature and existing datasets on the subject. This is followed by location-specific solutions which can be offered. It is hoped that cooperation partners will be able to use this framework in designing and supporting projects on the ground. The exact logistics of such interventions is beyond the immediate scope of the paper, although we have cited some examples such as UNDP’s Enabling Community Resilience and Recovery (ENCORE) project.

¹ Global Climate Risk Index 2021

² Improving livelihoods in conflict-vulnerable areas – Monograph - Australian Government – Australian Centre for International Agricultural Research – The facts of LIFE: An introduction to a new model of agricultural extension for conflict-vulnerable areas of the Philippines. 28 June 2021.

³ Noel Vock & Evy Carusos, Re-tooling agricultural extension for conflict affected areas of the southern Philippines. – Rural Extension and Innovation Systems Journal, 2018 14 (2).

Introduction



The cumulative effect of shocks from COVID-19, the military takeover, climatic shocks and steep food price increases have severely impacted socio-economic conditions for the mass of the Myanmar population. Pre-existing structural weaknesses within the food and agriculture sector, the collapse of social protection mechanisms as well as the absence of universal public health services have profoundly exacerbated the situation. The progress made since 2011 with improvements in child nutrition and the diversification of livelihoods opportunities, both within the rural and urban sectors is threatened. There are concerns regarding an immediate increase in maternal, child and infant mortality rates, which are already high by regional comparisons.⁴

⁴ In 2017 maternal mortality rate (MMR) was 250/100,000, twice as high as the average for the Asia Pacific 127/100,000. The infant mortality rate in 2019 (IMR) was 44/1000 live births, compared with the regional figure of 14/1000 live births.

“The report aims to provide an evidence-based roadmap for strengthening Myanmar's food security and food system within the prevailing context and through applying the nexus approach, balancing immediate need with medium-term interventions designed to enable early recovery and increase the resilience of food systems to future shocks.”

The pillars of food security are examined, especially how they may have been affected by recent events. Factors which limit food production are assessed, especially patterns of input usage and availability. Markets are considered as the interface between availability and access. Their current levels of interconnectivity and integration are examined, together with their effectiveness in coordinating the interests of producers and consumers. The pillars together with the main dimensions this study covers are reflected in the below figure.

Figure 1

The pillars of Food Security covered in this report



Prospective areas for intervention are outlined, including social protection, restorative agriculture, support to market infrastructure and extension services, diversification of food production, and elimination of food losses. These consider current UNDP community-level food and agriculture interventions. It is recommended that future interventions should be low-cost, micro-level and community based, capable of replication and dissemination over a wide area. Innovations should be supported by a high level of information provision and community awareness.

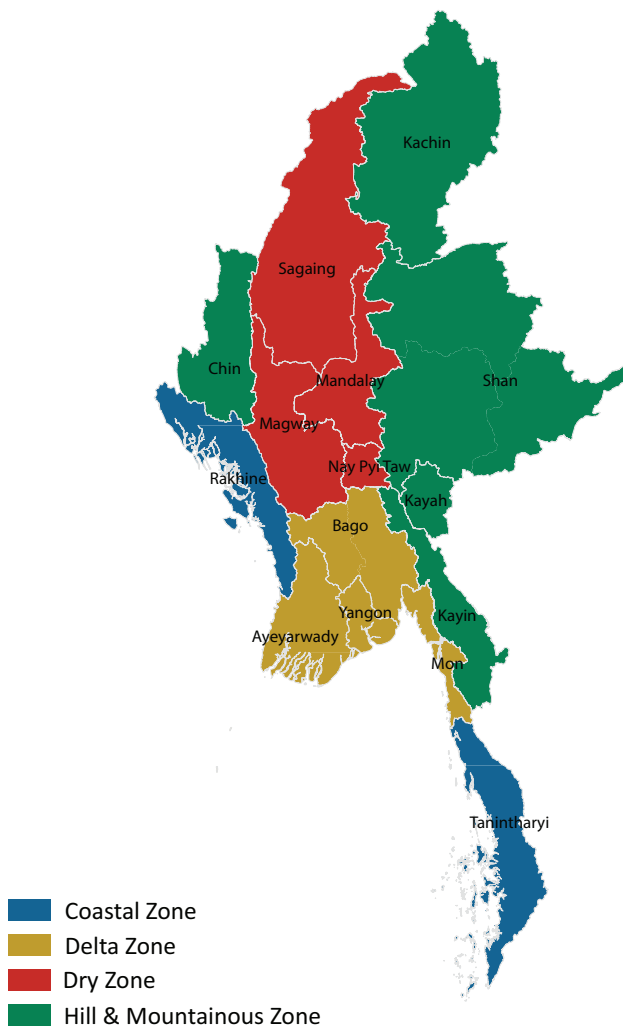
Methodology



The report has been developed, using a range of information sources. These include UN and other international agency narrative reports, technical journal articles and papers, and analysis of raw datasets. A focus is placed on the raw data analysis from the Myanmar Living Conditions Survey (MLCS), FAO/WFP Monitoring Reports and the IFPRI Household Welfare Survey. The full narrative reports of each of these surveys are reviewed together with those for other surveys. In addition, findings from technical papers relating to food and agriculture, environment, livelihoods, and nutrition within Myanmar have been incorporated. From the respective data sources, the pillars of food security have each been reviewed: availability, access, utilization and stability. The analysis is presented by state/region, urban or rural sector and where applicable by agro-ecological zone. The exercise has produced a considerable amount of data, which can be used for future multiple downstream analyses. For present purposes only data considered to be most adjacent to the focus of the study has been reviewed.

Figure 2

The four agro-ecological zones applied in this report



This report uses the usual classification of four agro-ecological zones: Delta (Ayeyarwady, Bago, Mon, Yangon); Coastal (Rakhine, Tanintharyi); Central Dry (Mandalay, Magway, NPT, Sagaing); Hills and Mountains (Chin, Kachin, Kayah, Kayin, Shan). IPC identifies six agro-ecological zones; Central Dry Zone and Transition Zone, Delta Region Sittaong-Thanlwin Plains, Hilly Regions, Coastal Strips and Shan-Kayah Plateau.

Specific Data Characteristics

All files from the survey data were in STATA imported into R Studio for cleaning using code. Thereafter an iterative process of transforming and visualizing data was used for purposes of interpretation. Many transformations and visualizations examine a specific metric e.g., income change aggregated by grouping variables such as urban/rural, state/region, income group, landholding size.


Broadly speaking the Myanmar Living Conditions Survey (MLCS) 2017 provides insights into conditions prior to the onset of COVID-19, the military takeover and price hikes following the Ukraine war. The FAO/WFP Monitoring Reports and the IFPRI Myanmar Household Welfare survey have taken place since these events. It is, however, not easy to make comparisons across time. Data appears to be in multiple surveys at different times with minor differences. For example, the number of household members is common but one survey counts working-age adults from ages "15 to 59" whereas another counts them from ages "18 to 60". Data may

appear in one survey but not another, e.g., gender of household head can be inferred in the MLCS but is rarely specified in other surveys. The underlying data in one survey may be expressed very differently to another survey. For example, FAO/WFP records income over the last 3 months, whereas MLCS records income by hour/day/week/month/year and is not standardised. Hence comparability across services is limited and it is more appropriate to treat the different surveys as cross-sectional snapshots.

MLCS data is limited by problems with recording amounts of food consumed as well as farm inputs, which are often in units that are not standardized for comparison. Within the data there are many extreme values which appear unreliable.

Data from the first three rounds of the IFPRI Household Welfare Survey have been analyzed. For the FAO/WFP 2022 Monitoring Reports, data from the fifth round has been analyzed.

1

Food
Security
Pillars


This chapter will provide an in-depth analysis of the four food security pillars and points out the most urgent needs per State/ Region and for the agro-ecological zones.

1.1

AVAILABILITY

Myanmar is an agricultural country, well endowed with land, with a generally favourable climate and abundant water resources for agricultural production. An estimated 19.2% of the country's total land surface is classified as agricultural land, of which 86% is considered arable, 11% is under permanent crops and 3% is under permanent pasture. Forest cover in 2016 was estimated at approximately 48% of the country, although this figure is known to be sharply declining.⁵

Prior to 2020, primary agriculture accounted for nearly 30% of the country's GDP and merchandise exports, nearly 50% of the overall employment and around 70% of rural employment. However, the importance of primary agriculture production in terms of GDP has declined from 45% GDP in 1995 to 30% in 2014.⁶ By 2022, this had reduced further to 20%.⁷ This reflects a decline in the share of primary crops such as cereals. Within the agriculture sector, the share of livestock and fisheries production in GDP has expanded, together with their related processing and manufacturing sectors.⁸

⁵ FAO/WFP Crop and Food Security Assessment Myanmar 2016

⁶ FAO/WFP Crop and Food Security Assessment Myanmar 2016

⁷ Trading Economics <https://tradingeconomics.com/myanmar/agriculture-value-added-percent-of-gdp-wb-data.html#:~:text=Agriculture%2C%20forestry%2C%20and%20fishing%2C,compiled%20from%20officially%20recognized%20sources.>

⁸ FAO/WFP Crop and Food Security Assessment Myanmar 2016

“Without the adaptation of farming systems to climate change, there will be increasing vulnerability to food insecurity.”

Domestic production is a key determinant of food availability. Productivity of the agriculture sector has traditionally been low. Farm sizes are typically small, averaging 3-4 acres (1.2-1.6 hectares), and a farmer's holdings are not always contiguous. Unlike other countries in the wider south-east Asian region Myanmar's rural areas have not shared in the benefits from the technical innovations and marketing opportunities for food value chains.

Myanmar is highly prone to the risks of climate change. Without the adaptation of farming systems to climate change, there will be increasing vulnerability to food insecurity. Myanmar's population and agriculture are extremely vulnerable, being concentrated in disaster prone areas. An increase in the frequency and severity of extreme weather events has negatively affected agricultural productivity.⁹ In addition, climate change is responsible for affecting the balance between crops, pests, disease and weeds, as well as reducing the numbers of pollinator insects.¹⁰ The net effect is to increase the amount of farming tasks. This is more problematic where agricultural production is heavily dependent on physical agricultural labour, as in the Myanmar smallholder sector. Women in particular who perform many physical tasks bear an especially onerous burden.¹¹

1.1.1 Labour and Mechanisation

In the small farming sector, there is a reliance on physical labour and draught power. Generally, men are engaged in seedbed and land preparation, fertilizer spraying, and pesticide application. They are more likely to perform tasks that require the use of machinery, or where tasks currently being done manually are more amenable to mechanization. Other tasks such as weeding, manual harvesting and post-harvest activities are shared by men and women. Women perform more manual tasks, such as spreading manure or hand weeding. These gender patterns are found throughout most of Myanmar's agro-ecological zones.

Farm mechanization up to the COVID-19 outbreak had been significantly increasing. The level of mechanisation is limited by affordability. Many smaller farmers who have purchased mechanised equipment notably power tillers have done so through collateral loans, which especially in the prevailing context have become difficult to pay and there is a growing indebtedness.

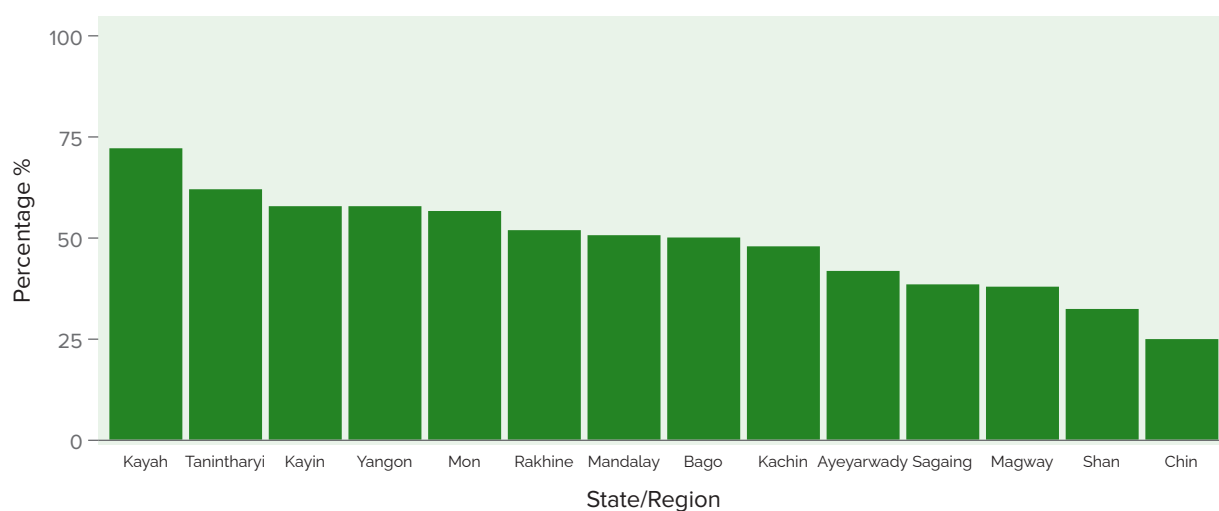
There are large numbers of landless in rural Myanmar. Figure 3 shows approximately half the rural population to be landless nationally. The highest proportion of landless at 70%, is found in Kayah. Chin has the least proportion of landless with 25%. In urban areas, as shown in figure 4, only a small but not significant proportion of the population have crop land. In Chin around 30% of the urban population have some crop land.

Small-holder farmers depend on landless groups to work as daily wage labourers, especially on land preparation, transplanting, and harvesting. Some landless have succeeded in establishing themselves in other farm and non-farm occupations, such as small businesses. Others have migrated to urban centres, or neighbouring countries in search of higher incomes. In most states/regions apart from Shan, there has been a general shortage of farm labour. Farmers need to attract labourers with higher daily wage rates. This in turn has put upward pressure on farm gate prices as farmers must

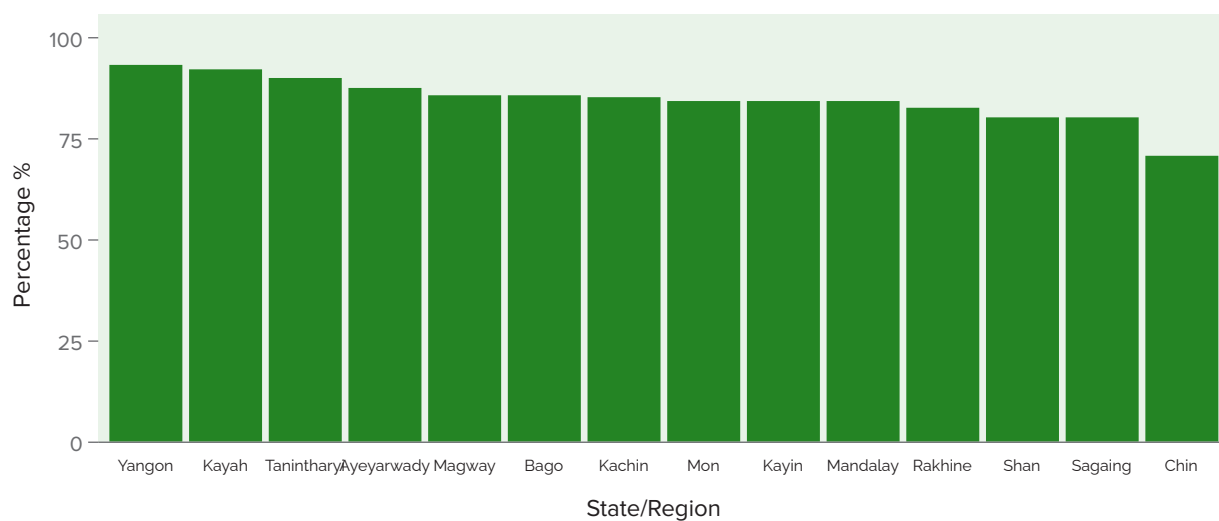
⁹ Republic of Myanmar 2019, Myanmar Climate Change Strategy (2018 – 2030)

¹⁰ Soares, J.C., Santos, C.S., Carvalho, S.M.P. et al. Preserving the nutritional quality of crop plants under a changing climate: importance and strategies. *Plant Soil* 443, 1–26 (2019). <https://doi.org/10.1007/s11104-019-04229-0>

¹¹ Samuel S. Myers, Matthew R. Smith, Sarah Guth, Christopher D. Golden, Babu Vaitla, Nathaniel D. Mueller, Alan D. Dangour, and Peter Huybers, *Climate Change and Global Food Systems: Potential Impacts on Food Security and Undernutrition Annu. Rev. Public Health* 2017. 38:259–77

Figure 3 Proportion of Rural Population Without Cropland

Source: UNDP based on MLCS (2017)

Figure 4 Proportion of Urban Population Without Cropland

Source: UNDP based on MLCS (2017)

recover these additional costs. Reliance on daily labour opportunities for a livelihood nevertheless remains precarious and most landless households are at high risk of food insecurity. More recently, due to the economic downturn, there has been a significant decrease in cultivation, with a corresponding fall in demand for wage labour.

1.1.2 Inputs: Seeds and Fertilizers

There are wide variations in the proportions of seed obtained from different sources, by crop. (Annex 2 gives seed types by source). By far the most important source is that from farmers own saved seed. This is especially the case for rice, maize, tubers and oilseed. Farmers are more likely to trust the seeds they know.¹² The next most important source is that obtained from

¹² FAO/WFP Myanmar Crop and Food Security Assessment Mission (2016). Source: Data compiled by FAO from the Household Survey undertaken by the WFP Myanmar Country Office.

relatives and friends. The formal sector is only of relatively minor importance, probably due to low supply of certified seed, together with its high cost.¹³ Commercial maize varieties in Shan province purchased from traders are a recent exception to the rule. Local markets and formal sector agro traders play a more significant role as sources of seed in the case of beans and vegetables, although farmers own saved seed is still the main source. This low availability and uptake of improved seed limits yields, productivity in the sector, and the level of commercial involvement.¹⁴

Oilseeds crops play an important role in Myanmar and are indeed the second most important crop after rice.¹⁵ Major oilseed crops are groundnut, sesame, and to a lesser extent sunflower, mustard, and nyger.¹⁶ Most production comes from Central Myanmar, mainly Sagaing, Magway and Mandalay divisions. Sesame is mainly grown in the central dry zone of Myanmar, especially in Magway. Both crops are used to make edible oil, with some consumed as a protein source. Given the prevailing conflict situation in Sagaing and Magway, oilseed production is expected to decrease significantly. Groundnuts and sesame are exported to China. Black sesame, a higher value crop is exported to South Korea and Japan. Domestic groundnut and sesame oil mills since 2011 have faced competition from imported palm oil. The latter, being a tree crop, has a higher yield than annual field crops and is therefore lower cost and much cheaper for the consumer. Of more recent concern is that domestic production of palm oil is being encouraged. Palm oil is less desirable nutritionally than are either groundnut or sesame oil. Cultivation in other south-east Asian countries, such as Malaysia and Indonesia, has been extremely destructive, with widespread deforestation and loss of species diversity.

Where consumption of animal sourced foods is low an adequate dietary level of fat in the form of edible oil is essential to metabolize carotenes from plant sources to produce fully formed vitamin A retinol. Hence it is highly desirable that increased quantities of vegetable oil are made available at an affordable price. There is potential for developing sunflower and soybean.¹⁷ However, the cheaper cost of red palm oil for consumers remains a disincentive.

Fertilizers

The inadequate productivity of the farming sector is attributed to the low application rates of chemical fertilizer. Fertilizer use is much lower than in neighbouring countries.¹⁸ Nitrogen deficiencies occur in all major rice growing regions of Myanmar due to low fertilizer use and efficiency, low organic matter content, poor indigenous nitrogen supply, and both alkaline and calcareous soils.¹⁹

Where small farmers can afford to purchase fertilizer, the rates applied vary against technical guidelines according to local considerations.²⁰ Both urea and compound fertilizers are used, with farmers preferring the cheaper urea, some of which is produced domestically, especially during times of high prices. Where there is excessive use of nitrogen fertilizer, standing crops may be susceptible to lodging. Lodging causes yield losses of up to 40% in rice and maize, reduces grain quality, increases time to harvest, increases grain drying costs and increases health damaging mycotoxins on grain.²¹

¹³ M. Win, M. Maredia, D. Boughton (2023). Farmer demand for certified legumes seeds and the viability of farmer seed enterprises: Evidence from Myanmar

¹⁴ T. Oo, T. Shwe (2014) Role of Seed in Transforming of Agriculture in Myanmar.

¹⁵ Favre, R. and K. Myint. 2009. An analysis of the Myanmar edible oil crops sub-sector. Rural Infrastructure and Agro-Industries Division (AGS), Food and Agriculture Organization of the United Nations, Rome.

¹⁶ DOA. 2020. Data Records from Department of Agriculture (DOA), Ministry of Agriculture, Livestock and Irrigation, Nay Pyi Taw, Myanmar

¹⁷ M. Moh, T. Myint, C. Win et al. 2022. Does Myanmar Have Sufficient Edible Oil Production?

¹⁸ Ludemann, C.I., Gruere, A., Heffer, P. et al. Global data on fertilizer use by crop and by country. *Sci Data* 9, 501 (2022). <https://doi.org/10.1038/s41597-022-01592-z>

¹⁹ Other soil nutrient deficiencies include phosphate, zinc, sulphur.

²⁰ S. Thar, R. Farquharson, T. Rasilan et al. (2021) Recommended vs. Practice: smallholder fertilizer decision in central Myanmar.

²¹ UK Research and Innovation - Understanding and reducing lodging in maize and rice. 2023.

Most inorganic fertilizers are imported from abroad.²² (The rising trend in fertiliser imports is shown in Annex 1). In 2021, international inorganic fertilizer prices and shipping costs were substantially higher. Recently the cost of fertilizers like all other inputs has been affected by the sharp decline in the value of the local currency. Demand for fertilizer has further been affected by significantly reduced farmer incomes, lower credit availability, and more uncertain agricultural profitability (IFPRI 2021)²³.

Local organic fertilizer production (animal and green manure) comprise only a relatively small share of total fertilizer use in Myanmar. Farmyard manure can be used as an organic fertilizer, when available but it is often in short supply, due to limited numbers of household livestock. Typically, a rural farm household would keep only one pair of draught animals which produce limited amounts of urea. Where power tillers are used there may not be any. Knowledge of proper handling and storage of farmyard or green manure is lacking, either singly or in combination with inorganic fertiliser.²⁴

Figure 18 (later in the paper) shows that the need for fertilizer as a top reported need, is virtually non-existent in the 14 states surveyed. It is barely mentioned except minimally only in Rakhine and Shan states. This may reflect the reduction in cultivation by farms. Types of fertilizer are not differentiated by the data. But it is likely that there may be some element of substituting the more expensive compound (NPK) with the cheaper urea.

²² IFDC (2018) estimated that in 2016/17 about 7 percent of the fertilizers consumed in Myanmar was locally produced. This local production mostly consists of urea, using the abundant natural gas resources in the country. While annual domestic production of urea – primarily by parastatal firms – was as high as 200,000 tons in the mid-2010s, it had declined to approximately 50,000 tons in 2017, a small share of the over 1.3 million mt of inorganic fertilizer used in the country (<https://knoema.com/atlas/Myanmar/topics/Agriculture/Fertilizers-Production-Quantity-in-Nutrients/Urea-production>).
USDA (United States Department of Agriculture) (2021a). Burmese Government Temporarily Waives Import and Export Licenses for Select Agricultural Products. Report number BM2021-0010. Washington, DC: USDA.

²³ IFPRI (2021) The outlook for Myanmar's inorganic fertilizer uses and 2021 crop harvest.

²⁴ KK Mu, K Ngwe, T Da Min, AN Oo, SS Ma (2018) Assessment of farmers attitude on the use of farmyard manure and chemical fertilizers for cotton production in Dry Zone

²⁵ IFPRI Strategy Support Programme – Working Paper 41 – July 2023 - Myanmar's Livestock Sector – An overview of production and consumption in 2022.

²⁶ Ben Belton, Ame Cho, Ellen Payongayong, Kristi Mahrt, Eric Abaidoo - Commercial Poultry and Pig Farming in Yangon's Peri-Urban Zone. Food Security Policy Project (FSPP) - Feed the Future Innovation Lab for Food Policy - Research Paper 174 - June 2020.

1.1.3 Availability of Credit

For most small farmers, formal credit and micro-finance, is not available. Where the Myanmar Agriculture Bank does make provision, this is usually insufficient to finance access of all required inputs. Agriculture input suppliers and buyers of agricultural products are generally reluctant or unable to provide credit to farmers. Consequently, there is reliance on informal credit for the purchase of inputs. These loans are mostly unregulated, and some, especially traditional money lenders, may charge usurious interest rates.

1.1.4 Livestock and Fisheries

Livestock is an integral component of the agricultural sector and livelihood system in many parts of Myanmar. Animals are particularly important in the dry zone. Most farms throughout Myanmar have some livestock. They are both a source of food, and income through the sale of animal products.

Livestock production over the longer term has increased²⁵, but mainly outside of the smallholder sector, in medium sized farms and in the peri-urban areas. Most chickens and fish are sold direct to Yangon, as farmers selling fish, poultry and eggs to traders are based around the capital. Market participation of small livestock holders away from the capital and especially in the rural areas is marginalized. This is due to the additional transport distances to be covered and therefore more costs incurred by small traders with little capital, located away from the main market centres.

Myanmar follows the secular global trend in the livestock sector with the biggest increase in production and consumption being in the poultry sector. Consumption normally benefits more the better off, those with disposable income.²⁶

Agribusiness dominates animal feed supply, which together with most veterinary drugs or medicines are purchased from local markets. Most pig rearing farms handle ‘improved’ not traditional breeds. They use formulated and not the traditional feed. Small farmers with a few animals continue to use non-formulated food, which may often be only food waste.

Access to government veterinary services has always been limited, especially for small farmers. Extension services are not widely available and there is no routine surveillance of epizootic diseases. As noted earlier, these are systemic flaws which considerably worsened in the past two years. African Swine Fever is a particular threat to pig owners in Myanmar, and across the wider south-east Asia region. As in the case of agriculture, technical information which is received is usually through private traders and agents. Few farmers have received proper training in pig production. Animal diseases may represent a public health threat, where animals are housed near to humans, as may be the case in urban and rural Myanmar. Young children at household level are especially at risk of contracting illness.

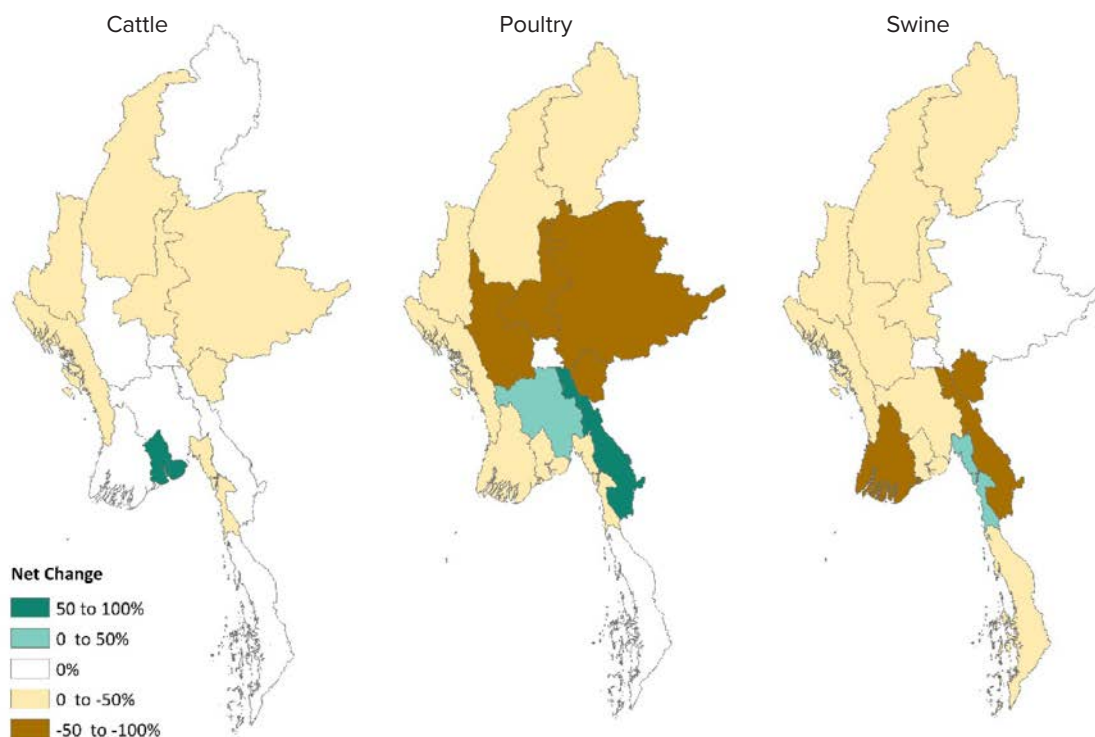
Price changes in livestock are a key indicator of food security. Figure 5 shows data for cattle, poultry, and swine by state/region.

The first three maps illustrate the relative changes in herds by state/region and by livestock animal, between 2021 and 2022. Net change represents the proportion of change by state/region for each livestock animal. Dark greens represent large proportionate decreases in herds (from -50% to -100%), whereas dark browns indicate large increases in herds (over 100% increases). The neutral off-white colour represents “no change” as well as modest increases. The fourth map shows the intensity of conflict in the states

- ²⁷ Laura K. Borkenhagen, Poe Poe Aung, Thura Htay, Zaw Win Thein, Ommar Swe Tin, Thet Su Mon, Win Myint, Emily S. Bailey, Timothy G. Wanninger, Ahmed M. Kandeil, Richard J. Webby, Gregory C. Gray. A cross-sectional study of avian influenza A virus in Myanmar live bird markets: Detection of a newly introduced H9N2? *Influenza Other Respi Viruses*. 2023;17:e13111.
- ²⁸ Matthew Scott Luskin, Erik Meijaard, Selly Surya, Sheherazade, Chris Walzer, Matthew Linkie African Swine Fever threatens Southeast Asia's 11 endemic wild pig species. *Conservation Letters - Volume14, Issue3 May/June 2021e12784*
- ²⁹ Ayako Ebata, Hayley MacGregor, Michael Loevinsohn, Khine Su Win. Why behaviours do not change: structural constraints that influence household decisions to control pig diseases in Myanmar. *Preventive Veterinary Medicine* 183 (2020) 105138.
- ³⁰ Robel Alemu, Steven A. Block, Derek Headey, Yan Bai and William A. Masters. Where are nutritious diets most expensive? Evidence from 195 foods in 164 countries. Tufts University 2018.

Figure 5

Net Change in Livestock Herds 2021-2022. UNDP based on FAO-WFP (2022)



and regions. Sagaing, one of the most conflict prone state stands out showing the highest depletion of all forms of livestock.

Not surprisingly cattle being the most valuable, there is least change in holding size. The main change is a significant increase in Yangon. This might indicate livestock sold in nearby states are being trekked to the largest market. Given that offtake of animals is greater in urban than rural areas, this may also show high selling in urban areas with a greater concentration of cattle in favour of the better off livestock owners. Swine herds decreased in all states except Shan, Kayin and Kayah (there is no data on Nay Pyi Taw). Poultry numbers show the greatest movement in both directions. This is perhaps to be expected, as poorer households will either eat or sell their own poultry in hard times. Declines are most evident in Shan, Kayah, Mandalay, and Magway. By contrast Kayin state shows an actual high increase in poultry numbers. For pigs there has been a general decline across the country, reflecting offtake due to either sale or consumption. The highest falls are seen in Kayin and Ayeyarwady.

Prior to the COVID-19 pandemic a recent study of rural households found that rearing animals to be sold as adults for slaughter (meat production) was more common for small ruminants (98.1%) and chickens (99.8%) compared to cattle (69.8%).³¹ Small ruminants as well as poultry are important sources of protein and micronutrients. Normally these are sold through local markets.

Bovines are mostly kept in small numbers at household level primarily for draught or for milk. Analysis of the MLCS 2017 survey data, shows that buffaloes and cattle are sold via traders for the export market. The official livestock export market resumed in October 2017, after which livestock sales and exports rose significantly. There is a large illegal cattle trade with China, which detrimentally affects what farmers get for sale of their animals,³² at the same time as decreasing availability for consumers.

As shown in Annex 3, 'Expected buffalo sales by state/region, 2017', buffalo prices are significantly higher than for cattle. For cattle, prices of males are shown to be significantly higher than for females. (Annexes 4 & 5).

Following the COVID-19 pandemic, military takeover and recent price rises, prospects for livestock holders have significantly deteriorated and those households most dependant on livestock production are at high risk of food insecurity. The Humanitarian Needs Overview (HNO) reports that nearly half (47%) of livestock owners reported a decrease in herd size or flock size compared to 42% in 2021. Among livestock producers 10% reported that they had sold their last draught animal. This seems to be primarily due to the increased price of feed as well as animal diseases, the high cost of veterinary medicines and problems in accessing veterinary services. There are, however, no actual reports that livestock offtake is due to 'distress selling', caused by acute food shortages.

About 5% of all agricultural households in Myanmar are engaged in fishing. Nearly half of the population resides in coastal areas, where fish is a key dietary component.³³ Fish is the cheapest form of animal protein, important for low-income households.

³¹ Tu Tu Zaw Win & Angus Campbell & Ricardo J. Soares Magalhães & Kyaw Naing Oo & Joerg Henning. Characteristics of Livestock Husbandry and Management Practice in the Central Dry Zone of Myanmar. *Tropical Animal Health and Production* (2019) 51:643–654 <https://doi.org/10.1007/s11250-018-1738-9>.

³² The activities of middlemen further reduce the prices which livestock producers receive.

³³ Yee Mon Aung, Ling Yee Khor, Nhuong Tran, Michael Akester, Manfred Zeller, A Disaggregated Analysis of Fish Demand in Myanmar, *Marine Resource Economics*, volume 37, number 4, October 2022.

The fisheries sector is composed of both capture and aquaculture activities.³⁴ Aquaculture may often be integrated with livestock production, which is a rational model, both economically and environmentally. Livestock waste is mostly consumed by pond fish and does not affect nearby waterways. Fishponds typically use a carp polyculture model. Wild fish stocks of key economic species such as hilsa are declining due to over-fishing, habitat loss, water contamination and failure to control illegal fishing. Agricultural pollution in Myanmar is a major source of contamination of waterways through residue from fertilizers, pesticides, and animal waste.³⁵ This threatens the interests particularly of artisanal fishing communities and consumers.³⁶

1.1.5 Irrigation access and efficiency

Access to irrigation and water management are problems for small farmers. For those that do have access, there are problems with efficiency, rated at only 25%.³⁷ Mismanagement of irrigation is leading increasingly to soil salinity, especially in dry areas, with long-term threats to production and food availability.³⁸ Zinc deficiency is associated with saline soils and affects public health and nutrition.³⁹ The problem is exacerbated again by the weak capacity of the extension services in providing technical support to farmers.⁴⁰

Construction and maintenance of primary and secondary irrigation canals is handled by the Irrigation Department. Water management of local tertiary canals is managed by informal Water Users' Groups, incorporating Village Water Committees. Given the fragmented nature of farmers' irrigated fields and the absence of any effective system for collection, most farmers do not pay water taxes. This limits revenue available for re-investing in essential maintenance and system improvements.⁴¹

1.1.6 Food Losses in the value chain

Food waste is an important determinant of food availability in Myanmar. Food losses/waste occurs at various stages in the value chain. Those responsible include farmers, processors, village traders, wholesalers, and retailers respectively. For farmers and those in the middle of the food supply chain, the absence of cold storage facilities renders food, especially perishable food, liable to spoilage.

According to a study conducted by UNDP, post-harvest losses in the dry zone of Myanmar are as high as 20% and these occur mainly during post-harvest handling and storage.⁴² This confirms the reliability of the earlier FAO/WHO estimate of 19%.⁴³ Post-harvest losses due to rodents are reportedly very high.⁴⁴ Post-harvest losses are higher in the traditional manual chain than in the mechanized chain.⁴⁵ Agricultural extension services have neglected post-harvest technologies.

Post-harvest losses at farm level typically occur where grains are poorly dried and stored, usually at too high a level of moisture (>14%). Faulty storage conditions for harvested crops, with high temperatures, high humidity and water activity are key factors.⁴⁶ These conditions allow mycotoxins to proliferate, which affect food at each level of the value chain, posing a

³⁴ So-Jung Youn, Jessica Scott, Joanna van Asselt, Ben Belton, William W. Taylor, Alexa Lupi, Determining the role of wild-caught and aquaculture-based inland fisheries in meeting Burma's Human Nutritional Needs, Human Nutrition and Human Health Impacts of Aquaculture/ Study/16HHIO5MS

³⁵ Open University (UK) Water resource management in Myanmar. Chapter 3 Causes and effects of water pollution. <https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=156325>

³⁶ Lauren Burcham, Klaus Glenk, Michael Akester, Annabelle Bladon and Essam Yassin Mohommed, Myanmar's artisanal fisheries: how much are they really worth? IIED Working Paper, London. 2020

³⁷ FAO/WFP Myanmar Crop and Food Security Assessment Mission 2016

³⁸ Aung Naing Oo ...[et al]. Food security and socio-economic impacts of soil salinization in the central dry zone of Myanmar: a case study. *Journal of Agroforestry and Environment* 2017, 11(1-2): 149-154

³⁹ Alloway, B.J. Soil factors associated with zinc deficiency in crops and humans. *Environ Geochem Health* 31, 537-548 (2009). <https://doi.org/10.1007/s10653-009-9255-4>

⁴⁰ SeinnSeinn MU, Ahmad MM, Thapa GB, Shrestha RP (2015) Farmers' Adaptation to Rainfall Variability and Salinity through Agronomic Practices in Lower Ayeyarwady Delta, Myanmar. *J Earth Sci Clim Change* 6: 258. doi:10.4172/2157-7617.1000258

⁴¹ FAO/WFP Myanmar Crop and Food Security Assessment Mission 2016

⁴² UNDP - Enhancing Food Security through Improved Post-Harvest Practice in the Dry Zone of Myanmar JUNE 6, 2018.

⁴³ FAO/WFP Myanmar 2016 Crop and Food Security Assessment Mission

⁴⁴ Nyo Me Htwe, Grant R Singleton and Pyai Phyo Maw, Post-harvest impacts of rodents in Myanmar; how much rice do they eat and damage? *Pest Management Science* - April 2016 DOI: 10.1002/ps.4292

⁴⁵ Martin Gummert, Nguyen-Van-Hung, Christopher Cabardo, Reianne Quilloy, Yan Lin Aung, Aung Myo Thant, Myo Aung Kyaw, Romeo Labios, Nyo Me Htwe & Grant R. Singleton Assessment of post-harvest losses and carbon footprint in intensive lowland rice production in Myanmar.

⁴⁶ Storage temperature of 22 to 29°C, humidity >14% and water activity of 0.90 to 0.99.

serious public health threat. The most important mycotoxin, aflatoxin is most frequently cited as affecting groundnuts and maize but does contaminate a wide range of crops. Due to climate change, unseasonal rainfall can occur at any time to affect Myanmar's farming systems. Where this is late in the season, grain may be harvested at too high a moisture level, providing conditions rife for mycotoxin growth.⁴⁷

1.1.7 Technical support

Historically, extension services (technical support) and training programmes provided by the government have been insufficient, in terms of both quality and coverage.⁴⁸ There were very few qualified staff at a higher level within the agriculture ministry to provide technical support at scale. The numbers of competent field staff were too few to reach most smallholders. Extension staff were without adequate transport or proper incentives to fully carry out their work.⁴⁹ Since 2021, these services have diminished further and are non-existent in many areas.

Crucial knowledge gaps were never adequately addressed in key technical areas. Most importantly these include soil husbandry, fertilizer use (both organic and inorganic) safe means of pest and weed control and threats to the food chain posed by mycotoxins, especially aflatoxin. These in turn restrict participation in new opportunities such as commercial melon production, or hybrid maize production. Extension services play a lesser role in information dissemination than do private traders, where commercial production is being promoted.

1.1.8 Agricultural policy

Official government agricultural policy is a key determinant of food availability in-country, as well as food diversity. Policy lays a heavy emphasis on rice, effectively reducing crop diversification. Increases in rice yields through intensive production are unsustainable.

The Military Administration have sought to make rice, considered to be a strategic crop, available at affordable prices. To pursue this policy, rice exports were controlled through the issuance of export licences, and farmers were required to sell their rice at low prices to the domestic milling industry. The low prices benefited consumers, but penalized farmers. To ensure that the lower incentives did not adversely affect rice production, farmers were allocated production quotas and benefitted from lower land taxes compared with those who grew other crops, such as pulses or beans. An increase in the use of high-yielding varieties and fertilizers, also supported rice production growth.

Both official and illegal exportation of Myanmar rice to China has been significantly increasing. This has been the case particularly since COVID-19, with the devaluation of the Myanmar currency. The high demand from China and the movement of rice across the porous border affect the price of rice for domestic consumers in Myanmar. If high volumes of rice flow to China, domestic rice availability falls, and prices in Myanmar rise.⁵⁰ When rice intended for export to China accumulates in Muse, Northern Shan state, this

⁴⁷ David F Herridge, MarMar Win, KhinMarMar Nwe, Khin Lay Kyu, Su Su Win, Tun Shwe, YuYu Min, Matthew D Denton, Peter S Cornish. The cropping systems of the Central Dry Zone of Myanmar: Productivity constraints and possible solutions. *Agricultural Systems* Volume 169, February 2019, Pages 31-40

⁴⁸ A Noomhorm, S Chen 2011. Rice harvesting and post-harvest technologies in Myanmar: a training manual.

⁴⁹ NyiNyi, 2004, general role and technical proficiency of agricultural extension agents under human resources development (HRD) in Myanmar, MSc Thesis, Yezin Agricultural University, Myanmar

⁵⁰ Paul Dorosh, Myat Thida Win, Joanna van Asselt. Production Shocks, Exports and Market Prices – An Analysis of the Rice Sector in Myanmar. IFPRI Discussion Paper 01830 – April 2019.

has the effect of reducing domestic farm gate prices and the prices paid by consumers.

Management of food availability at the country level is problematic. The agriculture sector has always had limited institutional capacity to evaluate up to date information on rice consumption or actual food stocks available in country. There are in turn few in-country experts who can effectively use information for any response or to design a coherent longer-term strategy.

1.2

ACCESS

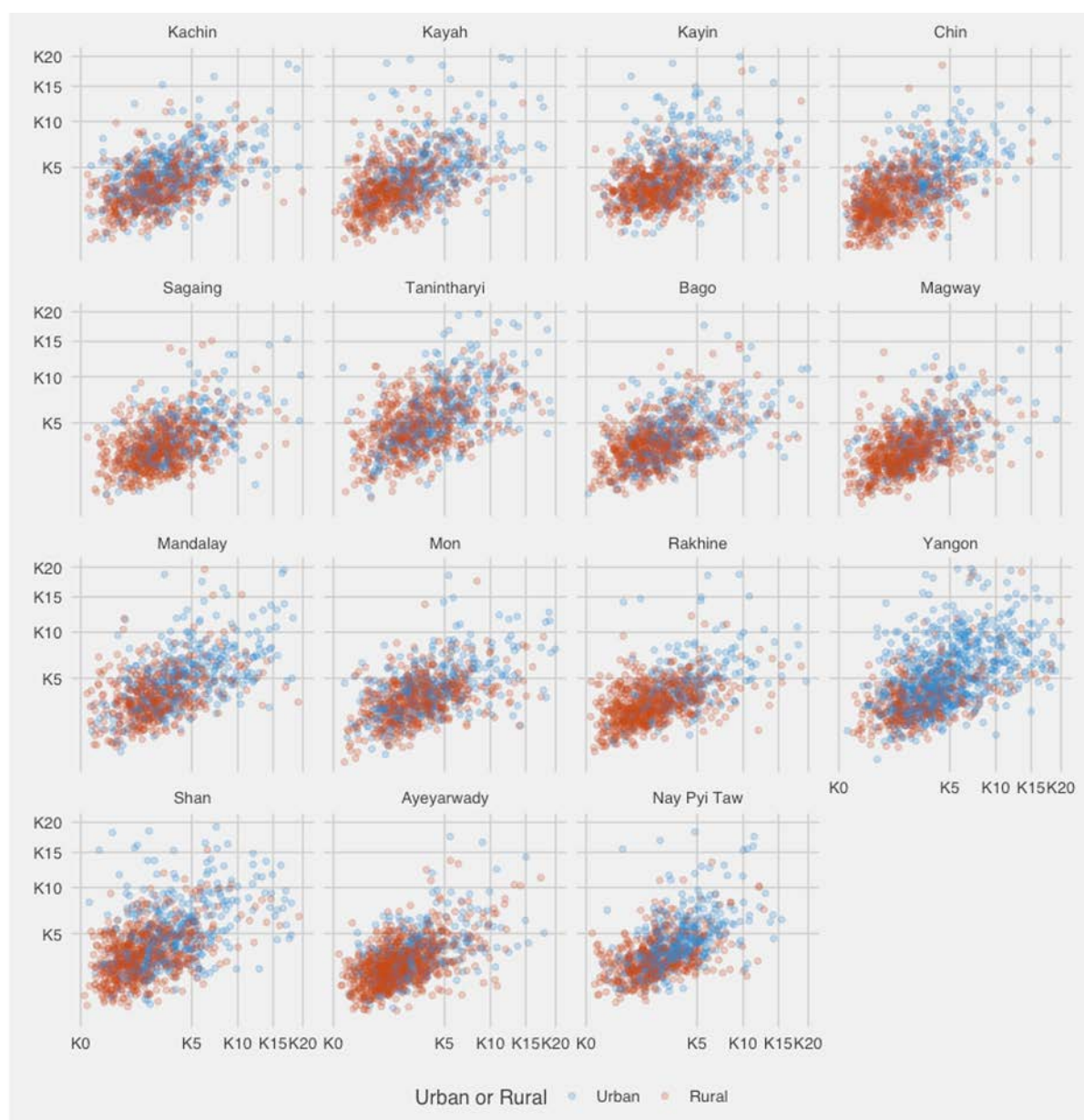
The relationship between food availability and affordability in Myanmar is currently affected by both loss of livelihoods and market dysfunction. Farmers receive low farm gate prices in relation to the higher costs they have had to pay for their inputs. Many consumers in both rural and urban areas cannot afford to buy food in the market due to their low purchasing power. A recent study found that "women frequently reported either reducing their food consumption or adapting their consumption (i.e., purchasing cheaper products or brands, or eating lesser quantities of expensive foods such as meat)."⁵¹ Farmers cannot pass on to the consumer their increased input costs in the form of higher prices. Small scale rice millers and food processing businesses cannot make any profit when their raw food commodity costs are so high.

Markets are the interface between availability and access. Even in rural areas, most food consumed has hitherto been obtained through purchase, not directly from homestead production. Figure 6 provides some perspective on the degree of market participation by individual State/ Region.

These charts show a per-household breakdown of total annual household income on the x-axis, with total annual household consumption on the y-axis. Both axes are shown on a square-root scale in order to facilitate clearer visualization of the data for lower-income households. Each dot represents one household, with urban households shown in blue and rural households in red. The small number of Households earning or consuming over 20 million K per year are not shown.

Rural households exhibit lower income and lower consumption than urban households overall, with this effect being particularly pronounced in states which contain the largest and most prosperous cities such as Yangon. This is consistent with the greater degree of market participation by urban than rural households.

⁵¹ Sara E. Davies, Belinda Eslick, Darlene Joy D. Calsado, Claire Samantha Juanico, Zin Mar Oo, Robin E. Roberts, Yadanar & Naomi Woyengu (13 Jul 2023): Centering social reproduction during crisis: women's experiences of food insecurity in Myanmar, Papua New Guinea, and the Philippines during the COVID-19 pandemic, *Review of International Political Economy*, DOI: 10.1080/09692290.2023.2231472

Figure 6 Household Income to Consumption by S/R and Urban/Rural Households.

Source: UNDP based on HVS (2020) and MLCS (2017)

1.2.1 Markets

The role of traders in agricultural produce is pivotal to the functioning of value chains, linking farms, rural and urban markets, food processors, and ultimately consumers. But these intermediaries need to function in the right way to ensure equity. Markets lack overall regulation to enforce the good business practices which should go with a properly functioning market system.

The key determinant of household purchases is price. But there is often no assurance that consumers are paying a fair price. Middlemen frequently withhold price information from potential buyers and sellers to maintain their dominance along the value chains.

1.2.2 Rice Prices

Domestic rice prices in Myanmar have not over time connected with those on the wider international markets.⁵² There has been no co-integration between Myanmar and Thai rice prices. Markets in Myanmar are not well integrated long-distance across the country, as suggested by the degree of price variation between state/region. This is apparent from figures 7, 8 and 9, which show patterns for 2017 and 2022 respectively. Rice is sold as whole grain or broken. As the staple cereal it is the most standardized food commodity for purposes of comparison.

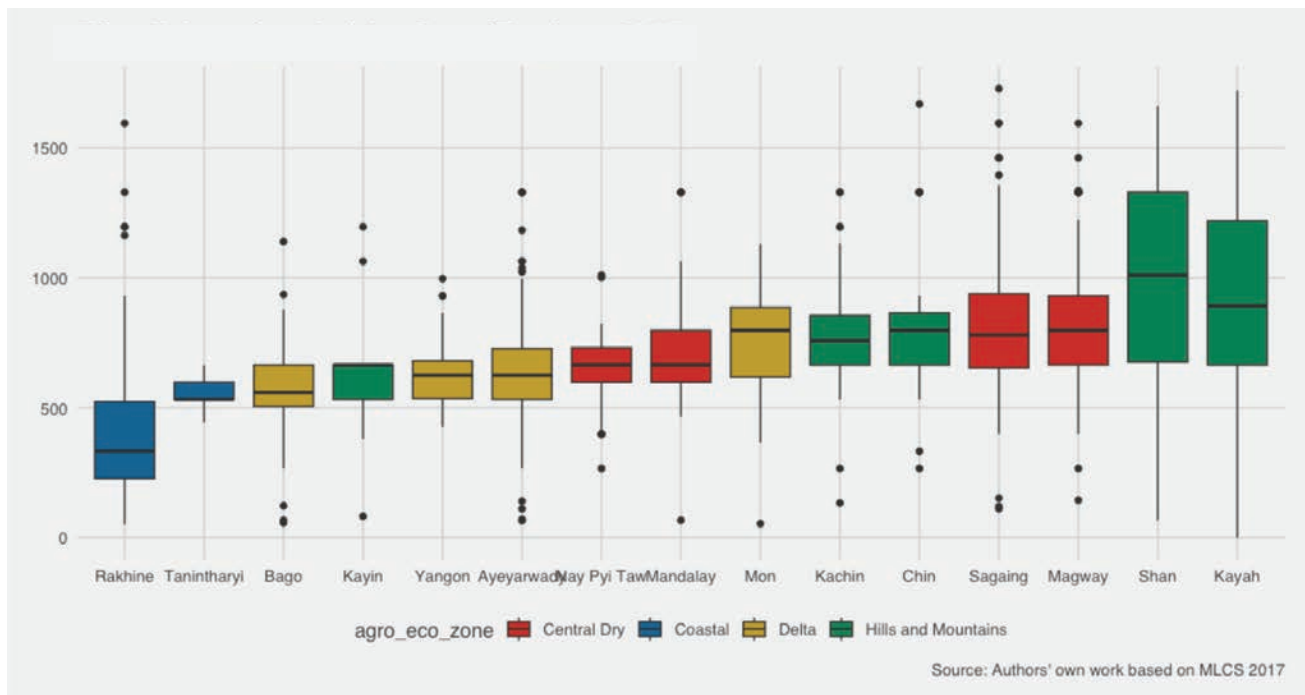
⁵² Surprisingly this shows even less integration with international markets than the informal markets of North Korea, where rice prices closely follow price trends in Chinese markets.

⁵³ IFPRI – Strategy Support Programme Working Paper 23 Farm commercialization in Myanmar: A transformation on hold or in reverse? August 2022.

The three figures below show the higher median rice prices in the more rural states of Kayah and Shan. These data also exhibit a wider range in prices, suggesting lower internal market integration. Kayah state is particularly affected by conflict, which limits the ability of households to access and buy and sell in markets. Recently conflict has been a further aggravating factor limiting market access, in both Sagaing and Chin. Long travel times make access to markets particularly difficult in Kachin, Sagaing, Chin and Rakhine.⁵³

Figure 7

Rice Prices (per kg) by State/Region in 2017.



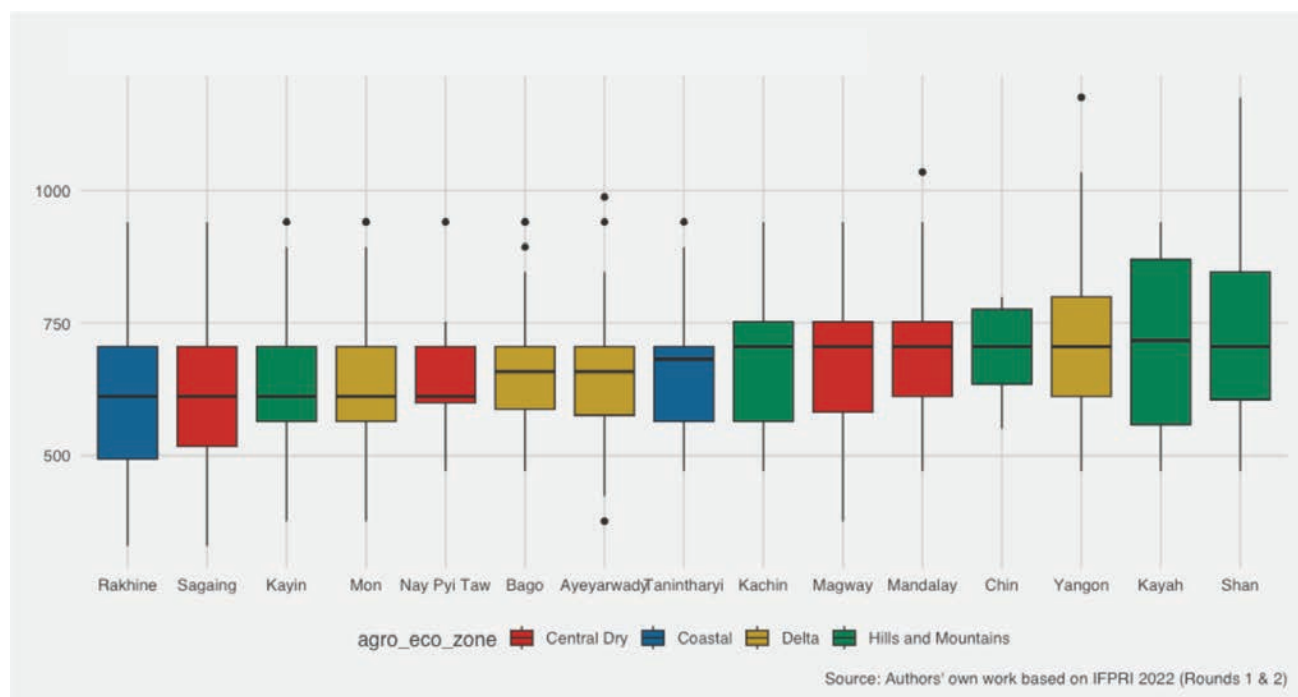
Source: UNDP based on MLCS (2017)

This chart illustrates rice prices (per kilogram) by state/region in 2017, with distributions for those prices per state being represented by boxplots. The box part of each “box-and-whisker” plot shows the range of the middle 50% of prices reported for the state/region. The boxes are filled with colour to represent the agro-ecological zone to which each state belongs. Each solid horizontal line located within each box represents the median for the distribution of

expected prices within that state/region. The “whiskers” of each plot are the solid vertical lines emanating from each box. They represent “minimum” and “maximum” values, excluding outliers. Outliers are represented as solid black dots.

Kayah and Shan have the highest median prices. They further exhibit the greatest degree of internal price variation, suggesting market fragmentation.

Figure 8 Prices of Long-Grain Rice (per kg) by State/Region in 2022.



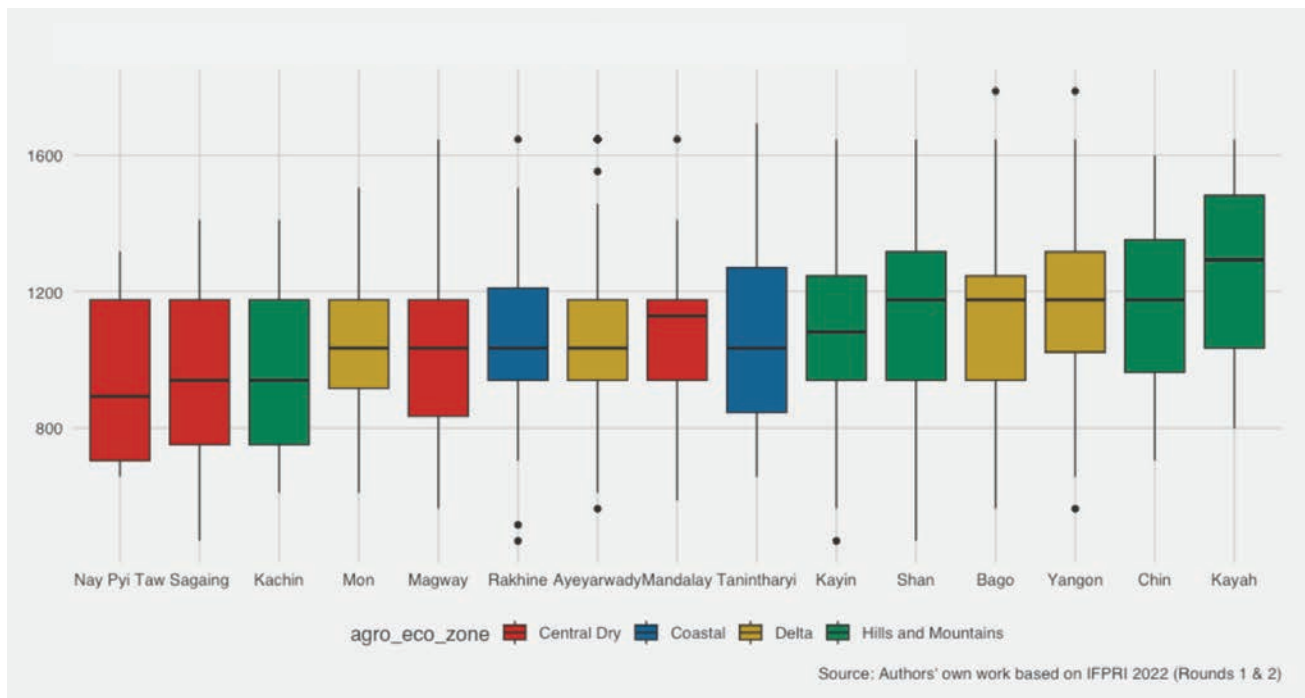
Source: UNDP based on IFPRI (2022) Rounds 1 & 2

This chart can be used to compare long-grain rice prices (per kilogram) by state/region in 2022, with distributions for those prices per state being represented by boxplots.

With the exception of Kayin, rice prices in the ‘Hills and Mountains’ appear to be generally higher than for states in other agro-ecological zones. As in 2017, Kayah and Shan show the highest median prices, together with the greatest degree of internal price variation.

Figure 9

Prices of Short-Grain Rice (per kg) by State/Region in 2022.



Source: UNDP based on IFPRI (2022) Rounds 1 & 2

This chart illustrates short-grain rice prices (per kilogram) by state/region in 2022, with distributions for those prices per state being represented by boxplots and its relation to the intensity of conflict.

Median prices for short grain rice appear highest in the 'Hills and Mountains' agro-ecological zone states of Kayah, Chin and Shan (relatively high conflict intense zones) and in the 'Delta' states of Bago (also relatively high conflict) and Yangon. Prices vary widely in a number of states, irrespective of agro-ecological zone. The overall picture in 2022 is one of apparently greater price variation for short grain rice than for long grain rice.

Local markets within a limited area of an individual state or region have normally been quite well integrated.⁵⁴ However, transport and distribution make engagement with the wider market difficult. Recent restrictions on access to travel and the movement of food suggest that the functioning of local markets is now seriously constrained, Kayah being a particular example. In addition, market capacity is limited by problems of inadequate storage, for both dry and perishable produce. Consumption is mostly determined by what food is produced locally.

Road density in Myanmar is the lowest in Asia. Myanmar's road network does not extend to all townships. Improved and better-connected roads are essential for the supply and distribution of food for the villages. The informal market outlets serve as the primary food source or sale points for households. Even where rural communities are served by roads, their condition deteriorates during the rainy season. The rail network, too, is poorly developed. Trucks therefore tend to carry small loads over long distances, increasing the average

⁵⁴ Whether this remains the case would require a further quantitative analysis of markets at the intra state level. Data is available but is currently beyond the scope of the present study to review.

- ⁵⁵ FAO/WFP Myanmar Crop and Food Security Assessment 2016.
- ⁵⁶ A more recent update of the level of malnutrition in Myanmar is given in the 2022 Joint Child Malnutrition modelling estimate (UNICEF/WHO/World Bank). This gives only a single national level estimate of 24.1% for stunting in Myanmar. There are no estimates for individual states. <https://iris.who.int/bitstream/handle/10665/368038/9789240073791-eng.pdf?sequence=1>.
- ⁵⁷ A more recent update of the level of anaemia in Myanmar is given in Global Health Observatory of the WHO, <https://data.who.int/indicators/i/8D58801>. This is showing anaemia levels at national level of 42.1% of women 15-49 years, rising to 47.8% during pregnancy. There are no figures for individual states.
- ⁵⁸ Households with a low food consumption score increased from 9.4% in December 2021/February 2022 to 15.7% in October/December 2022. The shares in October/December were highest in Chin (48.3%), Kayin (23.1%), and Magway (22.7%). Inadequate diet diversity among adults rose from 20.6% to 25.1% over the same period with rates higher for women, especially in rural areas. More than a third of all children aged 6-23 months and 15.9% of all children aged 24-59 months have inadequate diet quality.

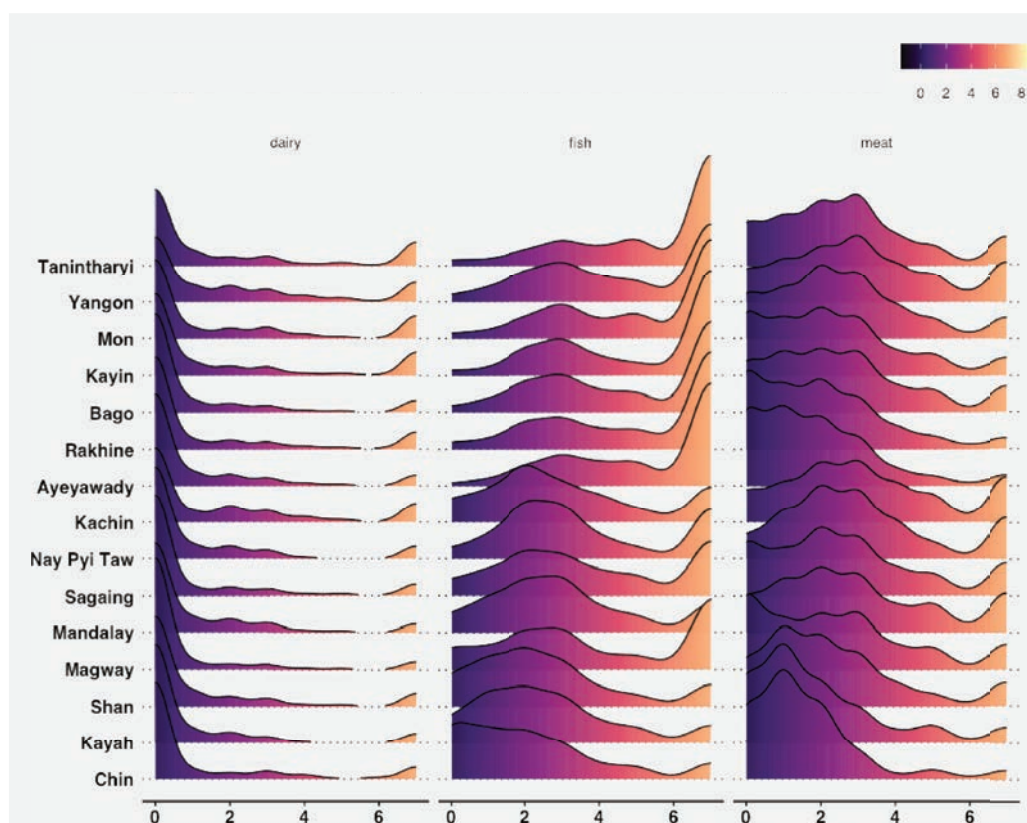
transportation cost per unit of food commodities. Limited competition between transport companies further contributes to high unit food costs.

Capacity of on-farm storage for smallholders is often inadequate for retaining the newly harvested crop for any period. This restricts the ability of farmers to time the market. At harvest time there is usually a glut of new produce and prices are low. Selling it later in the marketing season when prices are higher is often difficult.⁵⁵ This puts smallholders at a disadvantage compared with larger agricultural concerns with greater storage capacity.

1.2.3 Food Consumption

Prior to the COVID-19 pandemic most of the population had chronically low-quality diets. Consumption of pulses, fruits, vegetables, and animal sourced foods (ASF) were inadequate, with deficiencies of protein and key micronutrients. The Myanmar Demographic and Health Survey 2015 recorded nationally 29% of children <5 as stunted. Levels of stunting were far higher in the worst affected states, especially in Ayeyarwady, Chin, Kachin, Kayah and Rakhine.⁵⁶ There were high anaemia levels of 47% of women 15-49 years, rising to 57% during pregnancy.⁵⁷ Dietary diversity has further deteriorated since COVID-19 and subsequent events. This is reflected in successive rounds of the IFPRI Myanmar Household Welfare Survey.⁵⁸ Households are increasingly less able to afford meat, fish, eggs, dairy, and fruit.

Figure 10 Distributions of Meat, Fish and Dairy Consumption (last 7 days).



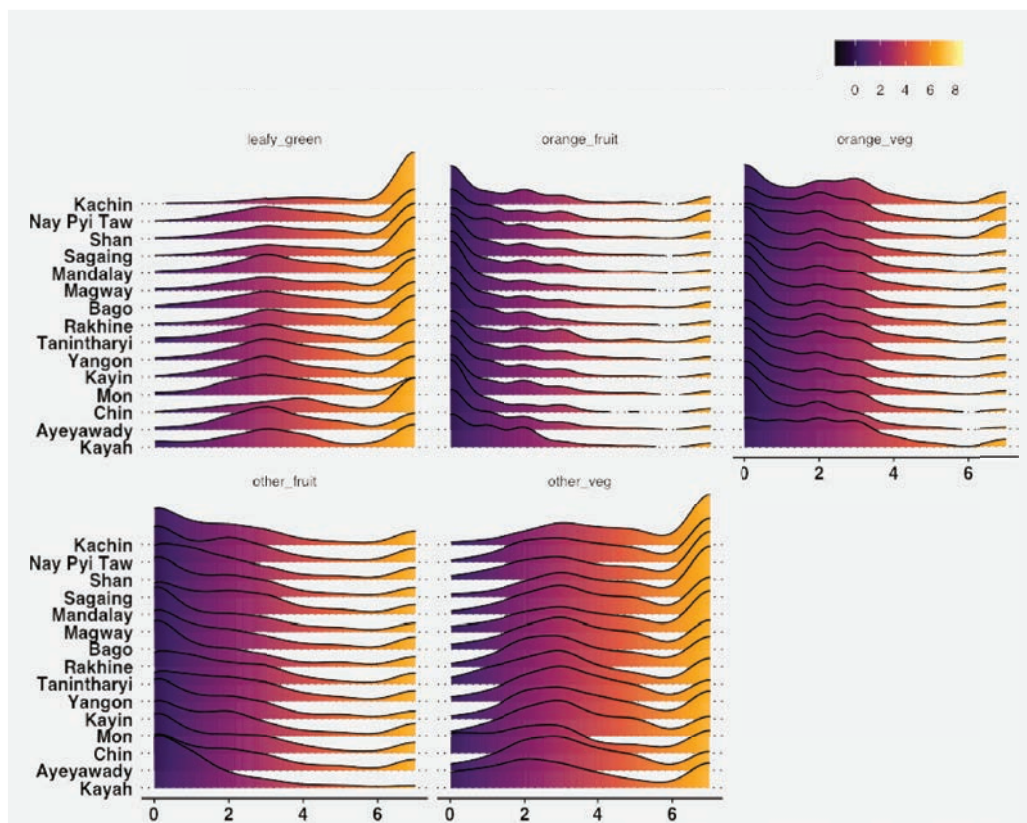
Source: IFPRI Round 1 (2022)

This chart can be used to compare the state/region level breakdown of animal sourced foods consumption by density (y-axis) which is the proportion of households reporting consuming animal sourced foods for x days out of the past seven (x-axis).

Frequency of meat consumption based on analysis of the IFPRI 2022 is low amongst the general population. Consumption of dairy is particularly low and may reflect the lower availability of milking animals or yield, as well as an overall lack of purchasing power. This is clear from the consumption patterns based on analysis of the IFPRI 2022 data, compared with other types of animal sourced foods (ASF). Most states show high fish consumption, with the lowest levels in Shan, Kayah, and Chin, where there are the least fisheries. ASF consumption overall is lowest among these states, which exhibit the worst child stunting levels.

Figure 11

Distributions of 7-day Fruit and Vegetable Consumption.



Source: IFPRI Round 1 (2022)

This chart can be used to compare the state/region level breakdown of distributions of fruit and vegetable consumption by density (y-axis) which is the proportion of households reporting consuming fruit and vegetables for x days out of the past seven (x-axis).

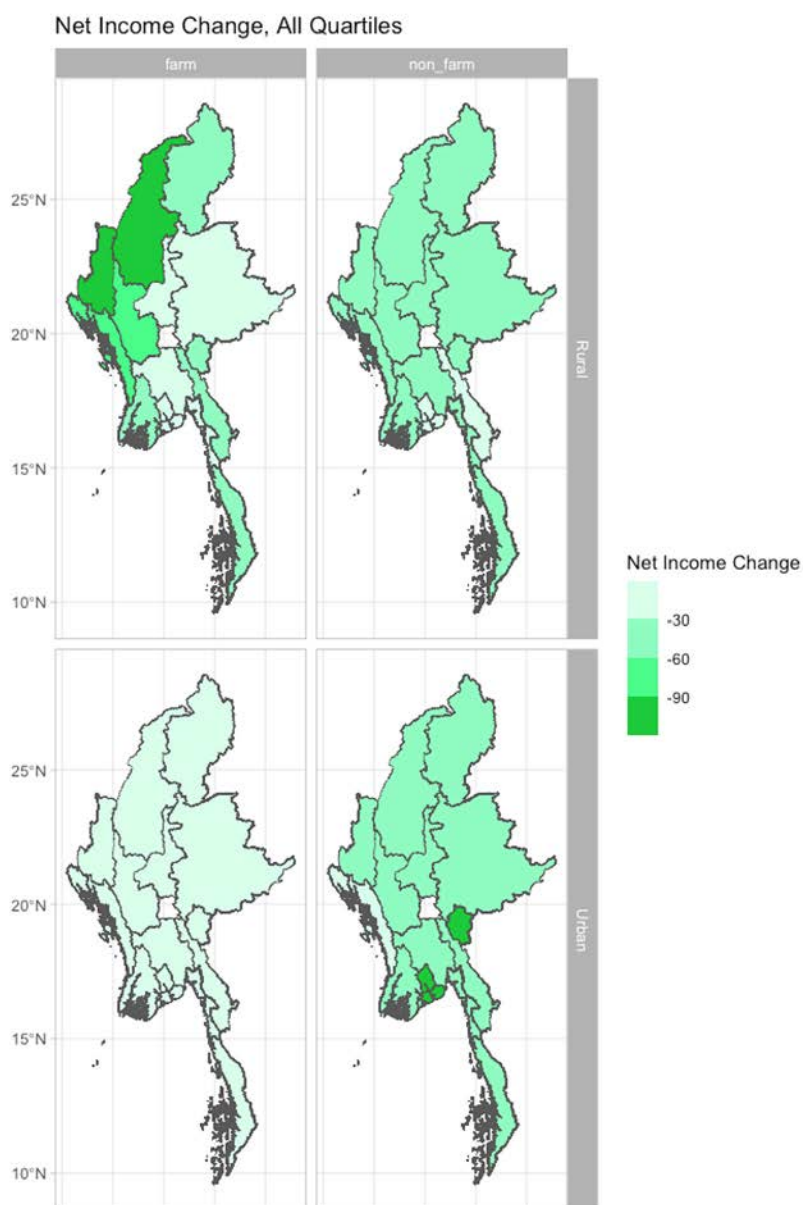
Consumption of this food group seems for many people to be mainly dominated by cheaper more commonly available vegetables, especially green leafy vegetable. Poorer households can no longer afford to regularly consume orange pigmented carotene rich fruits, or vegetables.

Food affordability has been affected by the general contraction of the economy, with loss of livelihoods in both the rural and urban sectors. Incomes of farm households have sharply declined with the high-cost inputs and the fall in demand for their produce. There is widespread unemployment and depressed wages affecting agricultural labourers. Small rural businesses and traders have suffered heavy falls in revenue.

Food insecurity amongst urban communities is growing sharply, given the high numbers of job layoffs of factory workers. In urban centres, more recent migrants from the countryside are most at risk. They are frequently unskilled, and their communities tend to be more fragmented, with weak social networks, compared to their rural places of origin. They routinely face higher rents and costs of living and have fewer available coping options to withstand acute shocks.

Figure 12

Net Income Changes, Farm/Non-Farm Income Source and Urban/Rural Households.



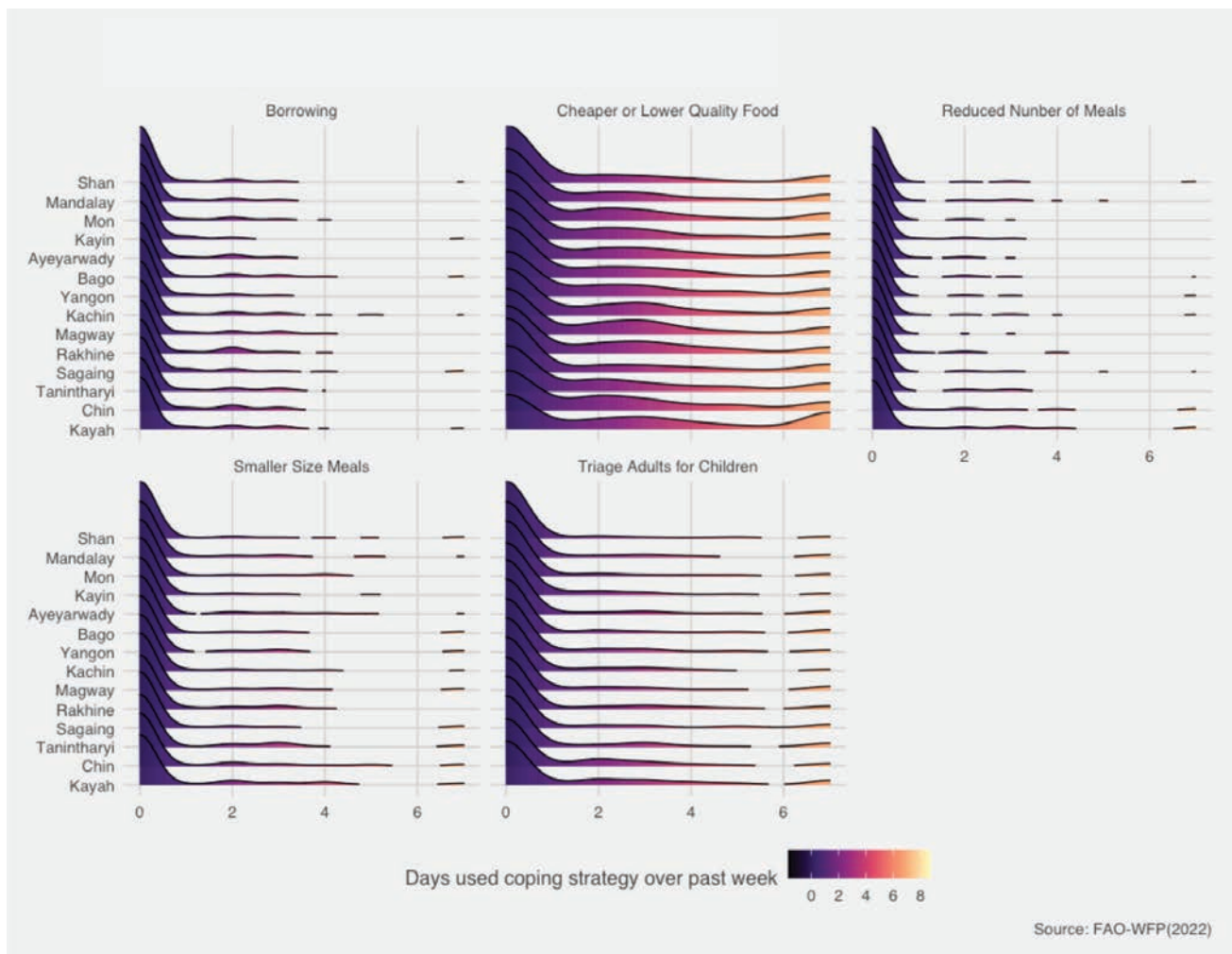
These maps can be used to compare “net changes” in income per household between 2021 and 2022 by state and region, with the highest proportions (-90% and above) represented in dark red. “Net change” is represented by the sum of the total number of households reporting each of the five possible answers allowed by the survey with “much less income than last year” represented as -2, “less” as -1, “no change” as 0, “more as 1 and “much more” as 2. The rows show a breakdown by effects on Urban/Rural households and the columns show a breakdown by income-source (divided into “farm” incomes and “non-farm” incomes).

Rural farm incomes (top left map) have been hardest hit in the North-West of the country, with the conflict affected states of Chin and Sagaing (high-conflict intensity) exhibiting the highest proportions of households reporting “much less” income than a year previously. However, urban non-farm incomes (bottom-right map) have also been hard hit across most states, with the worst net effects in Yangon and Kayah.

⁵⁹ Sara E. Davies, Belinda Eslick, Darlene Joy D. Calsado, Claire Samantha Juanico, Zin Mar Oo, Robin E. Roberts, Yadanar & Naomi Woyengu (13 Jul 2023): Centering social reproduction during crisis: women’s experiences of food insecurity in Myanmar, Papua New Guinea, and the Philippines during the COVID-19 pandemic, *Review of International Political Economy*, DOI: 10.1080/09692290.2023.2231472

Figure 12 shows the variation in coping strategies across states. These are reduced number of meals, reduced size of meal, less quality food, adults skipping meals, increased borrowing. Women especially have experienced a pattern of reduced food intake during this period.⁵⁹

Figure 13 Distributions of rCSI Coping Strategies By State/Region



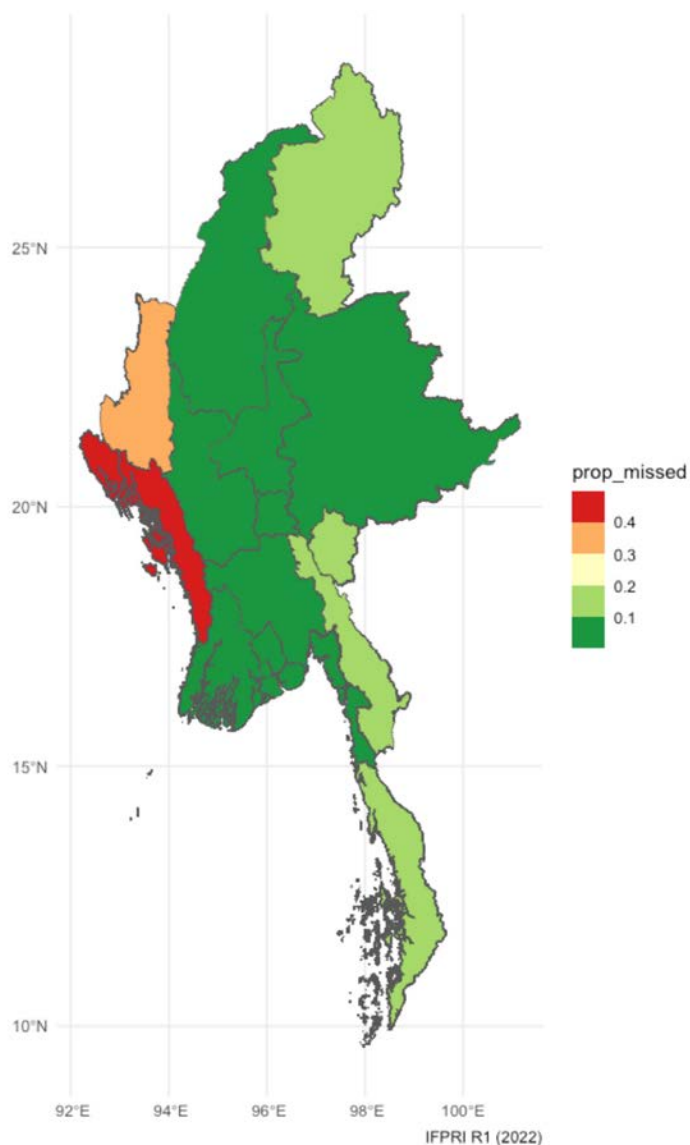
Source: FAO-WFP(2022)

This chart can be used to compare the relative reliance on different RCSI coping strategies by density of distributions per state/region. The height of each distribution represents the relative proportion of households who reported using that strategy for x days over the past seven.

By far the most common coping strategy across all states was eating cheaper or lower quality food. Kayah state exhibits the highest proportion of households using this strategy every day, represented by the “fattest” tail on the right of the distribution. The second most common strategy was adults eating less in order to feed children (i.e., “Triage Adults for Children”) which again appears to be slightly more common in Kayah and Chin states.

With fewer income-earning options, households are faced with rising prices for food and other necessities. Inevitably coping strategies need to be adopted by households to prevent the worst effects of these challenges. The longer the crisis persists the more households exhaust their coping mechanisms, lose their assets, and face destitution.

Figure 14 Proportion of Households Not Consuming Oils and Fats daily.



This chart illustrates the prevalence of households which do not eat oils and fats every day as a proportion of all households surveyed within each state during the IFPRI Round 1 survey in 2022. Such proportions are represented by a diverging colour scale, such that states with the highest proportion of such households are shown in red, whereas states with the lowest are shown in dark green.

A majority of households across Myanmar consume oils and fats every day, except in Rakhine and Chin where respectively 40% and 30% of the households do not consume oils and fats on a daily basis. The relatively high frequency of oil and fat consumption is probably due to the availability of cheaper red palm oil. Fat is a dense source of energy. Regular fat consumption is essential where populations derive their vitamin A mainly from plant sources, in the form of beta carotene. Dietary fat is required for the intestinal absorption of beta carotene.⁶⁰

⁶⁰ Sara E. Davies, Belinda Eslick, Darlene Joy D. Calsado, Claire Samantha Juanico, Zin Mar Oo, Robin E. Roberts, Yadanar & Naomi Woyengu (13 Jul 2023): Centering social reproduction during crisis: women's experiences of food insecurity in Myanmar, Papua New Guinea, and the Philippines during the COVID-19 pandemic, *Review of International Political Economy*, DOI: 10.1080/09692290.2023.2231472

1.3

UTILIZATION

Utilization and bio-utilization give some perspective on qualitative aspects of access. These processes in turn may be affected by how food is produced and made available.

1.3.1 Nutritional value of food

Low-income households are unable to afford high quality more digestible foods. This is emphasized in a recent article underlining that the rampant inflation, low wages and a decrease in the production of staple foods are depriving millions of people of a nutritious diet, creating irreversible health problems and deepening cycles of poverty.⁶¹ Much of the food available for child feeding is of high bulk, with low energy density. This needs to be fed to young children in small amounts throughout the day. This is problematic given that safe potable water, and cooking fuels are limited. Mothers cannot devote enough time for feeding due to high physical work burden on farming and other household tasks. Environmental health threats may affect food utilization at the general household or community level, as outlined below.

1.3.2 Food safety

Supporting product information, perceived food quality and safety are important to the wider food environment. People are often unaware of the nutritional content of foods, or how they relate to health. There is widespread concern regarding food safety, but it is unclear to consumers whether food purchased in the market is safe or not. Bad practice is common. For example, unsafe animal food is knowingly sold, without animal diseases being detectable.⁶² Food quality may be subject to such practices like groundnut or sesame oil being adulterated with the much cheaper less healthy palm oil.⁶³

The use of unsafe pesticides imported from China affects consumer food safety. Different types of food in local markets can be affected by mycotoxins.⁶⁴

⁶⁵ Food which is visibly mouldy is never sold in markets. However, mycotoxins

⁶¹ Frontier (2023) <https://www.frontiermyanmar.net/en/we-cant-choose-what-we-eat-malnutrition-wracks-myanmar/>

⁶² Ayako Ebata. Social embeddedness of pig value chains in Myanmar and its implications for food and nutrition security *Food Security* (2022) 14:965–976.

⁶³ M. Moh, T. Myint, C. Win et al. 2022. Does Myanmar Have Sufficient Edible Oil Production?

⁶⁴ Mahato DK, Lee KE, Kamle M, Devi S, Dewangan KN, Kumar P, Kang SG. Aflatoxins in Food and Feed: An Overview on Prevalence, Detection and Control Strategies. *Front Microbiol.* 2019 Oct 4;10:2266. doi: 10.3389/fmicb.2019.02266. PMID: 31636616; PMCID: PMC6787635.

⁶⁵ Visser ME, Schoonees A, Ezekiel CN, Randall NP, Naude CE. Agricultural and nutritional education interventions for reducing aflatoxin exposure to improve infant and child growth in low- and middle-income countries. *Cochrane Database Syst Rev.* 2020 Apr 9;4(4):CD013376. doi: 10.1002/14651858.CD013376.pub2. PMID: 32270495; PMCID: PMC7141997.

(especially aflatoxins) may still occur at dangerously high levels, without being visible to the naked eye.

1.3.3 Prevalence of Illness

Table 1 below demonstrates a relationship between food intake, agriculture and WASH factors in contributing to the level of anaemia. Soil borne helminth infestation (ascaris, whipworm, hookworm) is a concern in Myanmar, given the widespread poor sanitation infrastructure, as well as farming compost and irrigation practises.^{66 67 68} This affects female health, especially of those women performing manual agricultural tasks.⁶⁹ Hookworm infection may precipitate anaemia in pregnant women or more generally women of childbearing age, especially where dietary intake of iron, is at best marginal.⁷⁰

The DHS 2015 figures show anaemia prevalence for women and children respectively and the states/regions with the greatest severity of anaemia are those where soil borne helminth transmission is most prominent. Those areas most prone to periodic flooding are especially at risk.⁷¹ The prevalence of anaemia as indicated in the DHS 2015 survey is correlated across states/regions with access to safe water and sanitation, and intake of iron rich foods, notably meat and fish.⁷²

It is possible to aggregate household-level data (from MLCS, IFPRI, FAO-WFP) and then produce metrics for consumption of fish and meat as well as for access to drinkable water. However, there are various possible ways of producing these aggregate metrics based on the underlying household-level data. For example, Table 1 shows four regression models explaining anaemia rates using the following two metrics (each model is shown with and without additional data on access to drinkable water):

1. Means of 7-day meat and fish consumption, by urban/rural
2. Gini coefficients of 7-day meat and fish consumption, by urban/rural

- ⁶⁶ Aung, E., Han, K.T., Gordon, C.A. et al. High prevalence of soil-transmitted helminth infections in Myanmar schoolchildren. *Infect Dis Poverty* 11, 28 (2022). <https://doi.org/10.1186/s40249-022-00952-6>
- ⁶⁷ Ziegelbauer K, Speich B, Mäusezahl D, Bos R, Keiser J, et al. (2012) Effect of Sanitation on Soil-Transmitted Helminth Infection: Systematic Review and Meta-Analysis. *PLoS Med* 9(1): e1001162. [doi:10.1371/journal.pmed.1001162](https://doi.org/10.1371/journal.pmed.1001162)
- ⁶⁸ Where compost is used without faecal content being properly decomposed, this competes with the growing plant for nitrogen, and is therefore agronomically counter-productive.
- ⁶⁹ Dunn et al. *Parasites & Vectors* (2017) 10:374
- ⁷⁰ Brummaier T, Tun NW, Min AM, Gilder ME, Archasuksan L, Proux S, et al. (2021) Burden of soil-transmitted helminth infection in pregnant refugees and migrants on the Thailand-Myanmar border: Results from a retrospective cohort. *PLoS Negl Trop Dis* 15(3): e0009219. <https://doi.org/10.1371/journal.pntd.0009219>
- ⁷¹ Han et al. *Tropical Medicine and Health* (2019) 47:1 <https://doi.org/10.1186/s41182-018-0133-6>
- ⁷² WASH and food intake data from MLCS 2017 survey

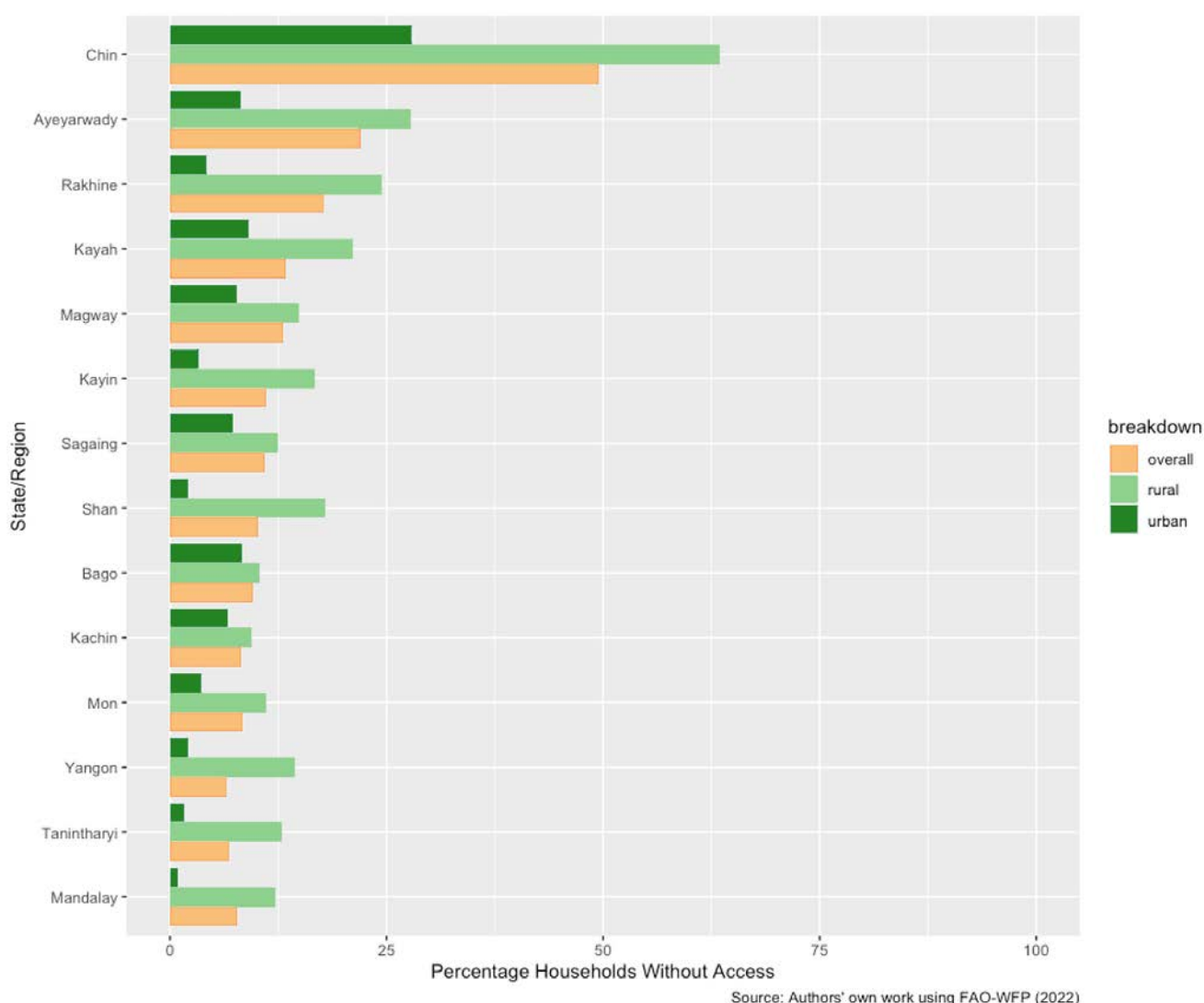


Table 1 Regression Table (Anaemia Rates)

	<i>Dependent variable:</i>			
	anemia_u5			
	(1)	(2)	(3)	(4)
MeanDaysRuralFishConsumption	0.051 (0.072)	0.090 (0.077)		
MeanDaysUrbanFishConsumption	-0.014 (0.089)	-0.068 (0.098)		
MeanDaysRuralMeatConsumption	-0.101 (0.076)	-0.080 (0.080)		
MeanDaysUrbanMeatConsumption	0.142** (0.057)	0.120* (0.060)		
NoDrinkableWaterUrbanDrySeason		-0.130 (0.426)		-0.482** (0.200)
NoDrinkableWaterRuralDrySeason		0.184 (0.147)		0.315*** (0.068)
GiniCoefficientRuralFishConsumption			-0.909 (0.561)	-1.625*** (0.360)
GiniCoefficientUrbanFishConsumption			0.495 (0.757)	1.600** (0.499)
GiniCoefficientRuralMeatConsumption			1.270** (0.473)	1.092*** (0.277)
GiniCoefficientUrbanMeatConsumption			-2.038*** (0.486)	-2.190*** (0.300)
Constant	0.179 (0.160)	0.202 (0.161)	0.866*** (0.194)	0.813*** (0.123)
Observations	15	15	15	15
R ²	0.610	0.687	0.753	0.933
Adjusted R ²	0.454	0.453	0.654	0.883
Residual Std. Error	0.066 (df = 10)	0.066 (df = 8)	0.053 (df = 10)	0.031 (df = 8)
F Statistic	3.915** (df = 4; 10)	2.931* (df = 6; 8)	7.603*** (df = 4; 10)	18.689*** (df = 6; 8)

* p<0.1; ** p<0.05; *** p<0.01

This table can be used to compare regression models explaining anaemia rates (for under 5s) using different aggregate measures of the 7-day distributions of fish/meat consumption and access to drinkable water (broken down by urban and rural households). Adjusted R² is a conservative measure of variance (in anaemia rates) explained by each model. Means of 7-day consumption do not explain much variance in anaemia rates (Model 1: Adjusted R²=45% of variance explained). Adding in access to drinkable water does not add value (Model 2: Adjusted R²=45%). However, Gini coefficients of 7-day consumption of fish and meat are much more useful (Model 3: Adjusted R²=65.4% of variance explained). Adding in access to drinkable water further improves on the Gini coefficients (Model 4: Adjusted R²= 88.3% of variance explained).

Figure 15 Percentage of population by state without access to potable water

In addition to soil transmitted helminths, other WASH related problems which affect bio-utilization include diarrhoea and environmental enteropathy dysfunction (EED). Figure 15 shows access to safe water supply. Chin, Ayeyarwady, and Rakhine have least access, also recorded some of the highest rates of diarrhoea amongst children.⁷³ Diarrhoea results usually from the ingestion of pathogens from faecal contamination of food or water. Appetite in children with diarrhoea is sharply depressed and there is reduced nutrient absorption from the limited food they can ingest. Environmental enteropathy dysfunction is a subclinical condition (without signs or symptoms) affecting the gut, associated with compromised growth and stunting. The effect of EED is to flatten the intestinal villi which reduces the surface area of the small intestine, decreasing nutrient absorption.⁷⁴ EED has been associated with zinc deficiency.⁷⁵

⁷³ Myanmar Demographic and Health Survey 2015-2016

⁷⁴ Koji Watanabe and William A. Petri, Jr EBioMedicine. 2016 Aug; 10: 25–32. Environmental Enteropathy: Elusive but Significant Subclinical Abnormalities in Developing Countries.

⁷⁵ Graeme P Young, Elissa K Mortimer, Geetha L Gopalsamy, David H Alpers, Henry J Binder, Mark J Manary, Balakrishnan S Ramakrishna, Ian L Brown, and Thomas G Brewer. Zinc deficiency in children with environmental enteropathy—development of new strategies: report from an expert workshop. *Am J Clin Nutr* 2014;100:1198–207.

Aflatoxins pose a major threat to maternal and child health. In a poor country such as Myanmar, exposure to aflatoxin is widespread during pregnancy and early life and demonstrates a significant relationship with reduced linear growth. Aflatoxin B1 is one of the most potent naturally occurring carcinogens.

Its aetiological role in liver cancer is well established. It is now associated with stunting and depressed child immune systems, with evidence of a modulating effect with a range of other diseases; reduction in the efficacy of some vaccinations; and interference with the metabolism of protein and key micronutrients. Ingestion of persistently high aflatoxins poses significant health risks.⁷⁶ They affect a wide range of food crops in Myanmar.⁷⁷ Animal feed may be similarly affected.⁷⁸ Where grains contaminated by aflatoxin are fed to livestock this will in turn contaminate meat and milk.⁷⁹ This is concerning as milk is an important food for children.

Researchers are examining the possible synergic effect of mycotoxins on EED and the impact on stunting. The intestinal pathology that arises in mothers and young children from exposure to aflatoxin and other mycotoxins is very similar to that of EED.⁸⁰

Precipitation extremes due to climate change, whether excessive rainfall or drought, increase exposure to pathogens, bacteria, parasites, mycotoxins, and a host of viruses. This is especially the case, where, as in Myanmar, many people are without safe water and sanitation.⁸¹ WHO in Myanmar have projected that climate change is expected to cause additional mortality due to malnutrition, malaria, diarrhoea and heat stress.⁸²

There is compelling evidence that elevated CO₂ levels are responsible for reducing protein, iron and zinc levels in food plants. This affects the nutrient content of legumes, cereals and tubers, on which many in Myanmar are heavily dependent.⁸³ However the mechanism through which this happens is not fully understood.⁸⁴ Reduced micronutrient content in growing food plants in turn, increases their susceptibility to biotic and abiotic stress, ultimately affecting production.⁸⁵

- ⁷⁶ (Am J Clin Nutr 2004;80:1106 –22; European Journal of Clinical and Biomedical Sciences 2016; 2(5): 51-58).
- ⁷⁷ Ei Ei Chaw. Analysis of aflatoxin contamination in Myanmar agricultural commodities. JSM Mycotoxins 67(2), 89 - 99(2017) <http://doi.org/10.2520/myco.67-2-4>
- ⁷⁸ Siri-anusornsak, W.; Kolawole, O.; Mahakarnchanakul, W.; Greer, B.; Petchkongkaew, A.; Meneely, J.; Elliott, C.; Vangnai, K. The Occurrence and Co-Occurrence of Regulated, Emerging, and Masked Mycotoxins in Rice Bran and Maize from Southeast Asia. Toxins 2022, 14, 567. <https://doi.org/10.3390/toxins14080567>
- ⁷⁹ Aflatoxins when present in excessive amounts in animal feed, can seriously reduce livestock productivity. They have been shown to cause liver damage or cancer, decreased milk and egg production, immune system suppression and interference with reproductive efficiency.
- ⁸⁰ Johanna Andrews-Trevino, Patrick Webb, Robin Shrestha, Ashish Pokharel, Sudikshya Acharya, Ram Chandyo, Dale Davis, Kedar Baral, Jia-Sheng Wang, Kathy Xue, Shibani Ghosh. Exposure to multiple mycotoxins, environmental enteric dysfunction and child growth: Results from the AflaCohort Study in Banke, Nepal.
- ⁸¹ Samuel S. Myers, Matthew R. Smith, Sarah Guth, Christopher D. Golden, Babu Vaitla, Nathaniel D. Mueller, Alan D. Dangour, and Peter Huybers, Climate Change and Global Food Systems: Potential Impacts on Food Security and Undernutrition Annu. Rev. Public Health 2017. 38:259–77
- ⁸² WHO Myanmar Newsletter Special 10 September 2020 – Climate Change & Health.
- ⁸³ ibid
- ⁸⁴ Attention is being directed to how the effect of elevated CO₂ interacts with elevated temperature, salinity, waterlogging, drought stress and soil microorganisms to reduce plant nutrients.
- ⁸⁵ Soares, J.C., Santos, C.S., Carvalho, S.M.P. et al. Preserving the nutritional quality of crop plants under a changing climate: importance and strategies. Plant Soil 443, 1–26 (2019). <https://doi.org/10.1007/s11104-019-04229-0>



1.4

STABILITY

Stability of production is affected by both immediate shocks responsible for acute food insecurity and longer-term effects, which can lead to chronic food insecurity. In addition to widespread and increasing conflict, Myanmar is with increasing frequency affected by natural disasters, notably drought, cyclones, heavy episodic rainfall, and seasonally high temperatures, as well as episodic crop pests and disease. Much of Myanmar, and especially its rice-producing area, is prone to extensive flooding.

Although rice production usually exceeds domestic requirements at national level, the country being a net exporter of rice, in some areas where there is sustained damage due to serious storms and floods, especially in the most disaster-prone states, production may fall significantly and there will be pockets where people may face severe food shortages and could require relief assistance. Flood-related crop losses can cause rice prices for consumers to increase sharply. With major floods, some farmers experience a total loss, with no stocks for subsistence, or revenue from sales to buy further agricultural inputs for replanting. Such catastrophes exacerbate vulnerability to food insecurity and malnutrition in areas of Myanmar where children are already malnourished (especially in Rakhine and Chin). The impact combined with an increase in morbidity, often through waterborne diseases can lead to permanent stunting. Recently, Rakhine, Chin, Magway and Sagaing, as well as Kachin have been affected by cyclone Mocha. This severely impacted the agriculture and fishery sectors, causing heavy loss of assets crucial for livelihoods, further undermining food security prospects and maternal and child nutrition.

Deterioration of the underlying natural resource base contributes to longer term instability with threats to livelihoods and chronic food insecurity. Myanmar's economic development has been at the expense of land degradation, deforestation, and bio-diversity loss. Myanmar's rice growing areas are highly prone to soil salinity due to deficient management of irrigation practises.^{86 87} In coastal and riverine areas there is decline of fish stocks as in the case of key economic species such as hilsa.^{89 90}

1.4.1 Pests and diseases

In Myanmar, many of the more intensive agricultural practices now employed rely heavily on the input of broad-spectrum hazardous pesticides and herbicides. These are usually imported from China, being the cheaper option. These have been found to contribute to soil degradation, as is observed in Mandalay region.⁹¹ The use of hazardous pesticides has caused serious public health effects: dermatological, gastrointestinal, neurological, carcinogenic, respiratory, reproductive, and endocrine effects.⁹² In 2006, 47 people died out of 532 pesticide poisoning incidents, and in 2007, 59 people died out of 608 cases in Pyin OoLwin Township, Myanmar⁹³.

Farmers demonstrate a low level of awareness regarding the impact of pesticides on soil, environment, food, and health, as well as knowledge

⁸⁶ Aung Naing Oo, Kazuo Ando, Theingi Khaung and Moe Tin Khaing Food security and socio-economic impacts of soil salinization in the central dry zone of Myanmar: a case study *J. Agrofor. Environ.* 11 (1 & 2): 149-154, 2017

⁸⁷ SeinnSeinn MU, Ahmad MM, Thapa GB, Shrestha RP (2015) Farmers' Adaptation to Rainfall Variability and Salinity through Agronomic Practices in Lower Ayeyarwady Delta, Myanmar. *J Earth Sci Clim Change* 6: 258. doi:10.4172/2157-7617.1000258

⁸⁸ Toru Sakai Keisuke Omori Aung Naing Oo Yan Naung Zaw Monitoring saline intrusion in the Ayeyarwady Delta, Myanmar, using data from the Sentinel-2 satellite mission *Paddy and Water Environment* (2021) 19:283–294 <https://doi.org/10.1007/s10333-020-00837-0>

⁸⁹ Lauren Burcham, Klaus Glenk, Michael Akester, Annabelle Bladon and Essam Yassin Mohommed, Myanmar's artisanal fisheries: how much are they really worth? IIED Working Paper, London, 2020

⁹⁰ Yeap Soon-Eong and Tan Sen-Min Issues facing the traditional fish products industry in Southeast Asia 9th JIRCAS International Symposium 2002 - 'Value-Addition to Agricultural Products', I15-12/

⁹¹ Win TT, Thu M, Swe TM, Ko TK, Aung TT, Ei HH, Win NN, Swe KK, Hlaing AA, Winnandar, Khaing AA 2020. Degradation of Soil Quality in Mandalay Region of Myanmar Due to Overuse of Pesticides in Agriculture. *Asia-Pacific Journal of Rural Development*. 2020 Dec;30(1-2):113-38.

⁹² B Alewu, C Nosiri. Pesticides and human health. In: Stoytcheva M, editor. *Pesticides in the Modern World – Effects of Pesticides Exposure*. InTech (2011). p. 231–50. Available from: <http://www.intechopen.com/books/pesticides-in-the-modern-world-effects-of-pesticides-exposure/pesticide-and-human-health>

⁹³ S. Silapanuntakul, T. Srihabut, M. Khine (2016). Pesticides use practice and its related factors among farmers in PyinOoLwin Township, Myanmar. *International Journal of Health Sciences*. 2016 Mar;4(1):48-58

regarding their storage, handling, application levels and safety precaution measures. Capacity of the agricultural extension to provide essential information at local level is very limited.⁹⁴ Inevitably the use of broad-spectrum pesticides leads to increased pest resistance and more frequent outbreaks of secondary pests.⁹⁵

Legal imports of pesticides have increased from 11,000 tons to nearly 50,000 tons in the ten years between 2011 and 2021 (Annex 1). This figure is likely to increase further once supply chains become fully functional. There are in addition further imports through the illegal cross-border trade of pesticides. This can only add to problems of misuse, low level of knowledge, exacerbating the already serious public health threats and the destructive environmental impact.

1.4.2 Climate shocks

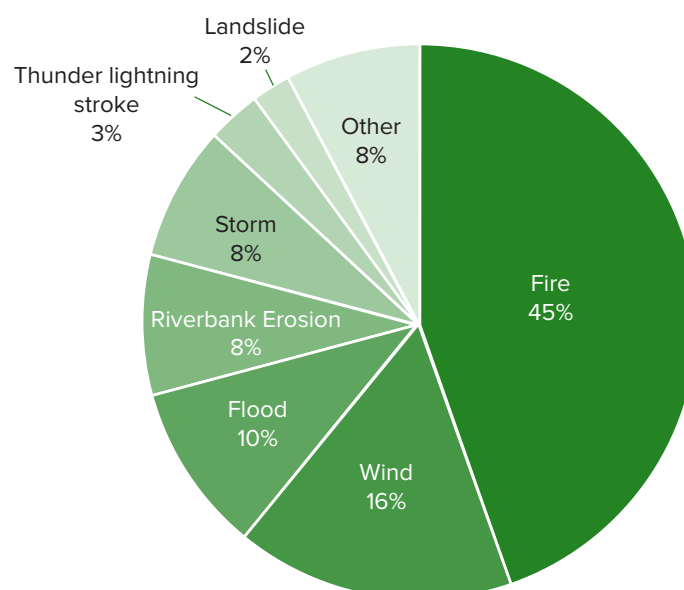
Myanmar is exposed to multiple hazards and disasters that are being compounded by climate change. The country is considered the second most vulnerable country in the world to extreme weather events related to climate change, and is exposed to cyclones, floods, droughts, and extreme temperatures (Andrade Correa and Jansen 2022). According to the Sendai Framework for Disaster Risk Reduction (UNDRR 2020) disaster database, there have been over 43,000 records of disaster events in Myanmar over the period 1952-2020. Environmental disasters, such as fire, are the most common (Figure 2). These disasters, hazards and other slow onset impacts of climate change present both immediate shocks and longer-term risks to the country. From 1952-2020, cyclones have caused over 170,000 deaths, and floods have resulted in over 130,000 people being relocated (UNDRR 2020). Climate change impacts will continue to be particularly pronounced in conflict-affected and poor countries like Myanmar (IPCC 2023).

⁹⁴ Banning hazardous pesticides: Recommendations for Myanmar September 2021 International Labour Organization Liaison Office in Myanmar.

Awotide, B. A., Karimov, A., Diagne, A., & Nakelse, T. (2013). The impact of seed vouchers on poverty reduction among smallholder rice farmers in Nigeria. *Agricultural Economics*, 44(6), 647–658.

⁹⁵ Babbendreyer et al. Impact of integrated pest management in the rice and maize in the Greater Mekong Subregion. CABI Study Brief 32: Impact.

Figure 16 Number of disaster records across different categories (1952-2020)



Myanmar's exposure to hazards and disasters is a significant challenge because the country's economy and society are highly dependent on its climatic conditions, natural resources, and ecosystems. In particular, the nearly 70% of the country's population who are in rural areas and are reliant on agricultural activities are vulnerable to disasters and hazards that threaten food security and agricultural productivity (Andrade Correa and Jansen 2022, World Bank 2022a).

The importance of responding to the risk of climate change was recognised by Myanmar's previous government, which introduced the Climate Change Strategy for 2018 to 2030. The Strategy set out top-down implementation and capacity development activities aimed at addressing the negative impacts of climate change on Myanmar's people, economy, and infrastructure (MONREC 2019). However, the implementation of this policy has been disrupted by the COVID-19 pandemic and the political, economic, and social instability engendered by the military takeover in early 2021.

1.4.3 Conflict

The military takeover has amplified the poverty, food insecurity, and economic impacts of the pandemic. Domestic and international supply chains were disrupted as foreign governments, organizations, and businesses reacted to the military takeover, resulting in banking operations coming to a virtual standstill and trade volumes declining significantly. The financial system nearly collapsed, there was a mass resignation of public sector employees led by the health and education sector, and restrictions on movement. Based on data available immediately following the military takeover, the UNDP predicted that Myanmar would lose the human development and poverty reduction gains made over the preceding decade, with poverty likely to return to levels not seen since 2005 (UNDP 2021).

Whilst the conflict dynamics in each area are vastly different it is still useful to create a broad picture of the conflict. UNDP attempted to capture the increasing civilian conflict vulnerability dimension by creating an index called 'Vulnerability to Conflict Index' (VCI), based on data of violent acts against civilians post 1 February 2021. VCI is constructed using data from the Armed Conflict Location and Event Data Project (ACLED) and Data4Myanmar. Furthermore, with the VCI updated regularly, civilian vulnerability to conflict can be tracked over time. Identifying vulnerability on the township level can be used to inform development programming in the current scenario.

For this report the aggregate State/ Region level VCI ranking is used, with Sagaing, Kayin and Tanintharyi ranking highest and Ayeyarwady, Nay Pyi Taw and Yangon ranking lowest.

Sagaing shows strongest correlations with a consistent decrease in main livestock herds in 2021-2022 (fig.2). It is also clear rice prices, especially short grain rice, are highest in the most conflict prone zones. Furthermore, rural incomes were hardest hit Chin and Sagaing. Overall, the impact of the conflict on food security is undeniable, but the impact at the household level depends on the individual resilience and coping mechanisms.



2

Humanitarian- Development Transition



Humanitarian assistance is currently being provided based on assessed needs, and to where targeted beneficiaries may be accessible. These activities and beneficiaries are outlined in annexes 6 and 7, by all agencies and UN agencies respectively. These are mostly focused on the provision of cash or vouchers for food and daily necessities, as well as some early recovery support, through provision of basic farming inputs.

The intention is to avoid a protracted humanitarian intervention, which by itself will not address root causes of food insecurity explained in detail in the previous sections and may ultimately build an undesirable dependence. Humanitarian interventions will have diminishing effectiveness if there is no timely roll-out of resilience building programmes. Given the immense demands for humanitarian aid elsewhere globally, donor funding at present levels cannot be guaranteed for much longer. The humanitarian phase in Myanmar therefore requires an exit strategy or a complementary and connected strategy to be in place.

The response design can be strengthened where synergies are developed at the outset between the humanitarian and medium-term components. For example, public works will address immediate priorities, an important cash injection through daily wage labour to boost food access. As in the WFP Myanmar Country Strategic Plan (2018–2022) food relief was provided to those engaged in the renovation or improvement of key physical infrastructure (watersheds, irrigation canals) and nutrition sensitive assets such as drinking water facilities, and home or school gardening. The net effect is to improve resilience of the food system to future shocks.

The two main components of the WFP Myanmar Community Resilience Project (MRCP) are to provide food transfers and/or cash-based transfers to populations affected by crisis and provide specialized nutritious foods for prevention of acute malnutrition among pregnant and lactating women and adolescent girls and children under 5. However, the MRCP further aims to support sustainable livelihoods, a pre-requisite for improved access and to ensure access to basic services.

UNDP's Enabling Community Resilience and Recovery (ENCORE) project is designed to deliver interlinked short-, intermediate-, and long-term interventions along the crisis-to recovery-to-resilience continuum. It is also initiating the Start-up Livelihood Assistance for Women (SLAW) to restore livelihoods of women. The gradually phased interventions, calibrated according to community-prioritized needs and capacities, includes (i) household-level basic needs responses (Phase 1), (ii) intermediate-term community-level crisis response interventions (Phase 2), and (iii) long-term community-led recovery and resilience-building initiatives (Phase 3). Emphasis on building community resilience and increasing sustainability is central to the project's overall strategy, safeguarding community and household assets from climate, disaster, and economic crises to continue to deliver basic services and sustain basic household incomes. The gradual progression of community support enables the project to adapt carefully to the complex and widely varying operational conditions across project sites while gradually building trust and social cohesion, thus promoting community ownership and social cohesion.

School feeding was a key component of the WFP Myanmar Country Strategic Plan (2018–2022) and is likely to be re-introduced once the operational context permits. School feeding using entirely locally produced food would stimulate local agriculture and ensure sustainability, once external donor support ceases.

There had been significant developmental progress in the food and agriculture sectors prior to the COVID-19 pandemic and subsequent events. In the prevailing context it is difficult to re-start these programmes on any scale. Initially more modest small-scale initiatives are proposed in the following sections, which offer an additionality to the humanitarian phase.

2.1

LESSONS FROM INTERNATIONAL RESPONSES

The current USAID strategy in Afghanistan is to maintain support to humanitarian food aid and nutrition programmes whilst ensuring the roll-out of livelihood development.⁹⁶ The latter focuses on support to agriculture, orchards, and livestock. Non-farm occupations receive support, notably jewellery and carpet making as well as cashmere processing. These traditionally employ large numbers of women.

The widespread flooding in Pakistan's Sindh and Balochistan provinces in 2022, initially required a humanitarian response in the form of cash transfers, for people to afford buying food. Strategy has since changed to improving food access through the restoration of jobs and livelihoods, whilst maintaining in place cash transfers for the most vulnerable. This includes provision of agricultural fisheries and livestock inputs, improving critical irrigation infrastructure, and introducing climate smart agriculture models.⁹⁷ The strategy attaches special importance to the inclusion of women, the landless, and other disadvantaged groups.

It is instructive that during the earlier international response to typhoon Yolanda in the Philippines in 2014, the affected communities moved very quickly to restore their livelihoods. International aid agencies were however slow to adapt, as livelihood recovery solutions required longer timeframes.⁹⁸ Hence the need to factor this as early as possible.

⁹⁶ USAID Afghanistan Agriculture and Economic Growth Fact Sheet 2023.

⁹⁷ October 2022. The Government of Pakistan, Asian Development Bank, European Union, United Nations Development Programme, World Bank - Pakistan 2022 Floods Post Disaster Needs Assessment.

⁹⁸ Final Report UK Department for International Development. Evaluation of DFID's Humanitarian Response to Typhoon Haiyan (Yolanda) May 2015.

2.2

CONSIDERATIONS FOR FUTURE PROGRAMMING

While suggesting the localized interventions below, UNDP is not advocating for a specific policy approach, nor commenting on the feasibility of the various policy options at a national level at the current time. Clearly, in a context in which governance is contested and conflict is raging in parts of the country, the ordinary practice of designing and implementing economic and social reforms is challenging, and in some areas, impossible. Also, the ecological diversity of Myanmar calls for local solutions and not necessarily a blanket agriculture and food security policy applicable to the whole country. Nevertheless, this report serves as a roadmap for stakeholders in Myanmar, and as a starting point for a discussion about how localized interventions can be used to address the long-standing problem of food insecurity and malnutrition in the country – currently exacerbated by the political crisis – with localized interventions.

Food security cannot be considered in isolation without reference to sectors outside of food and agriculture. Food security interventions should be included within a broader thematic programme. Ideas for interventions need to be identified participatively, reflecting the most prescient concerns of communities. This better enables the possibility for synergies between sectors, rather than a narrow technical focus. Operational linkages should be developed between food and agriculture, water and sanitation, health, and education services.

Myanmar is one of the main countries, most vulnerable to the effects of climate change. Extreme climate events impact each pillar of the food system: availability, access, utilization and stability. Climate smart agricultural systems should be established. These are resilient to the effects of excessive rainfall and drought, and greatly reduce greenhouse gas emissions from the farming sector. Efforts also need to counter the more frequent crop pest and disease outbreaks, public health threats to the food chain, especially the deterioration in food safety, threats to bio-utilization, as well as the reduced nutrient value of food.

Women engaged in food and agricultural production experience high work burden, a poor level of occupational safety, and threats to their health. This has serious implications for both maternal and child nutrition. In addition, they experience special vulnerability to the effects of extreme weather events, economic disruption and poorer dietary diversity in times of food insecurity. All food and agricultural interventions should involve women in assessing priorities, the design of interventions, identification of monitoring indicators and project management. Interventions should be supported with Nutrition Education, Behavioural Change Communication (BCC) and Community Awareness, including the development of IEC materials.

Rural farm and urban non-farm incomes have fallen. Food insecure populations have reduced both consumption levels and dietary quality, with prioritizing of child feeding. Disposable income is overwhelmingly reported as the most acute need. Existing social safety nets are extremely limited. Communications networks currently limit emergency cash assistance distribution. Response efforts should be aimed initially at implementing essential life saving measures. Cash and voucher or in-kind distribution in support of early recovery should be expanded at the earliest opportunity and then quickly transitioned where possible to livelihood and income generating interventions. Advocacy is essential for longer term programmes in support of the most vulnerable groups, notably maternal and child cash or in-kind benefits, and micronutrient food fortification.

Agricultural development in Myanmar has been at the expense of the natural resource base, rather than any improvements in efficiency. Important concerns are deforestation, irrigation and soil salinity and the use of chemical fertilizer and unsafe herbicides and pesticides. Restorative models of food production should be initiated through micro-level projects at community level. These should be designed for widespread replication, and extension. Formats include the System of Rice Intensification, Conservation Agriculture, Integrated Crop Management, and Integrated Pest Management.

Food security and the resilience building of communities has been constrained by low institutional development, especially the under-resourced extension services. A credible extension service, backed up by an active research and development network is essential. Without this change any innovations will have little impact. Extension cadres must wherever possible, be practically involved in international projects. Evidence from micro level projects should be systematically gathered as a basis for promoting good practice and influencing strategy. Information messaging should be developed on technical aspects of food and agriculture for future use by the extension service at community level. In the current context these can be delivered by CSOs and other non-State actors.

Households, dependent on livestock are particularly at risk of food insecurity. Livestock holdings are decreasing, and it is important to prevent ultimate destitution. Maternal and child undernutrition in Myanmar cannot be improved without regular consumption of animal sourced foods. Cash and voucher support should be given to alleviate immediate problems of high animal feed and veterinary medicine costs. Veterinary services, where provided by non-State actors, will require capacity building to boost farmers awareness of livestock husbandry, especially on animal nutrition and disease management.

Markets are currently not fully functional, with problems of physical access, reduced food availability and low consumer purchasing power. When markets do operate more normally, there will still be intrinsic problems limiting their efficiency. Initially efforts should focus on raising the level of market access and participation. Information on food quality, value and safety should be made available to buyers and sellers engaged in markets, through collaboration between international agencies working with local actors.

Disaggregation of information to identify more precisely the most vulnerable locations and groups, is beyond the scope of the present study. Development of the Integrated Phase Classification (IPC), based on a more detailed analysis of the existing agro-ecological zones should be taken forward. Localized characteristics are identified, relating to agriculture, environment, natural resources, economy, trade and demography.

3

Proposed
Intervention
Areas

Based on the evidence presented in the previous sections, the states and regions may be ranked (subjectively) according to their vulnerability across multiple pillars and the dimensions within the pillars. Table 2 shows the ranking, followed by a localized set of interventions in table 3.

Table 2 Food security vulnerability ranking (1 lowest – 5 highest)

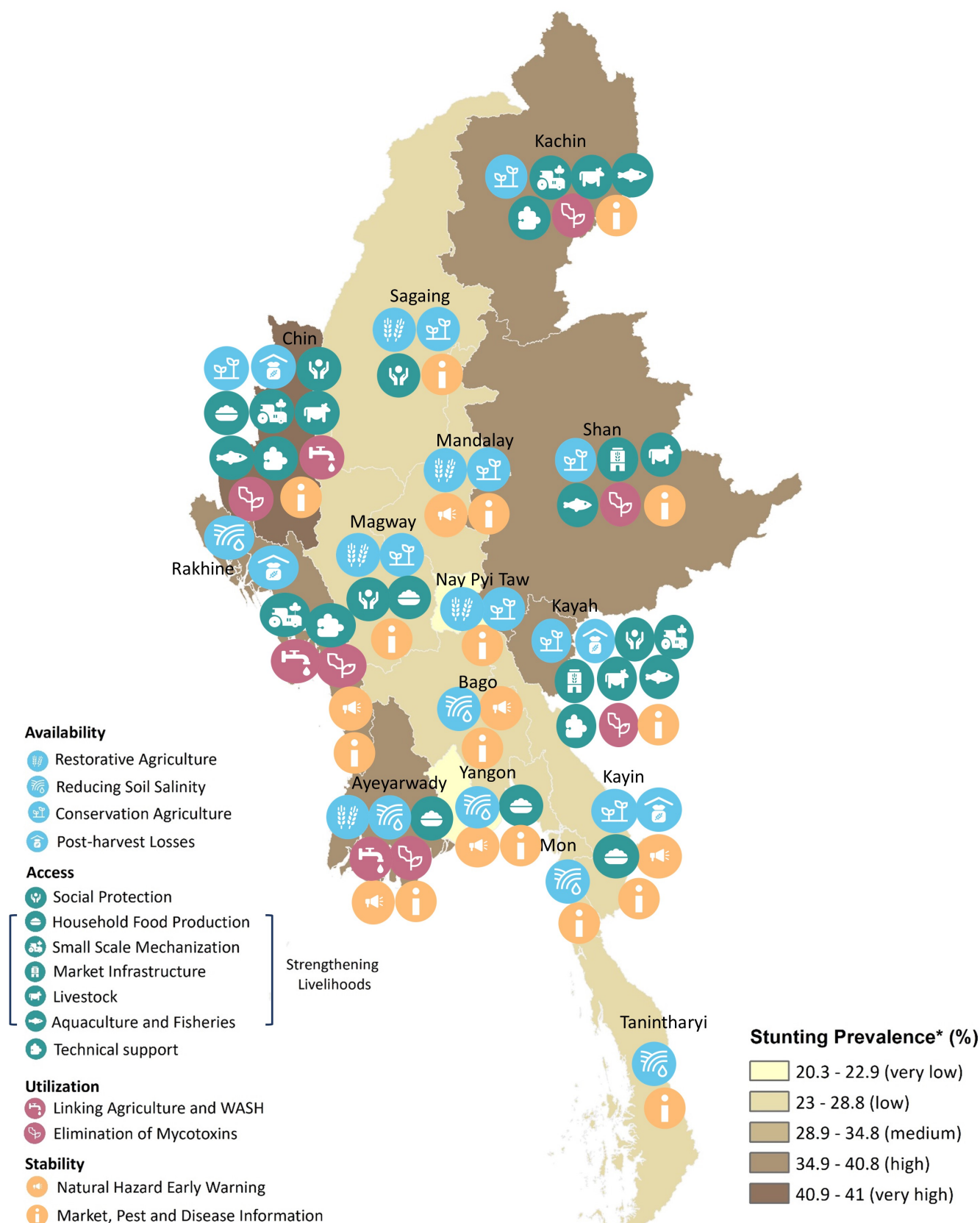
Chin, Rakhine	5
Kayah, Ayeyarwady	4
Kachin, Kayin, Shan	3
Sagaing, Tanintharyi, Yangon	2
Bago, Magway, Mandalay, Mon, Nay Pyi Taw	1

Table 3 Interventions by State/ Region

3.	PROPOSED INTERVENTION AREAS	STATES/ REGIONS
3.1	Availability	
3.1.1	Restorative Agriculture	Ayeyarwady, Mandalay, Magway, Nay Pyi Taw and Sagaing
3.1.2	Reducing Soil Salinity	Rakhine and Tanintharyi, Ayeyarwady, Bago, Mon and Yangon
3.1.3	Conservation Agriculture	Chin, Kachin, Kayah, Kayin, Shan, Mandalay, Magway, Nay Pyi Taw and Sagaing
3.1.4	Post-harvest losses	Chin, Kayah, Kayin and Rakhine
3.2	Access	
3.2.1	Social Protection	Chin, Kayah, Magway, Sagaing
3.2.2	Strengthening Livelihoods:	
	- Household Food Production	Magway, Ayeyarwady, Chin, Kayin, and Yangon
	- Small Scale Mechanization	Chin, Kachin, Kayah and Rakhine
	- Market Infrastructure	Kayah, Shan
	- Livestock	Chin, Shan, Kachin and Kayah
	- Aquaculture and Fisheries	Chin, Shan, Kachin and Kayah
3.2.3	Technical support	Chin, Kachin, Kayah, Rakhine
3.3	Utilization	
3.3.1	Linking Agriculture and WASH	Chin, Ayeyarwady and Rakhine, Sagaing, Tanintharyi
3.3.2	Elimination of Mycotoxins	Ayeyarwady, Chin, Kachin, Kayah, Rakhine, Sagaing, Tanintharyi and Shan
3.4	Stability	
3.4.1	Natural Hazard Early Warning	Ayeyarwady, Bago, Kayin, Mandalay, Yangon and Rakhine
3.4.2	Market, Pest and Disease Information	All States and Regions

An emphasis on access or entitlement to food is considered here as the main imperative in responding to food insecurity. There are four types of food entitlement, or ways in which to ensure access to food. These are through: a) production by growing food, b) trade based through purchase, c) labouring to earn income with which to buy food, and d) receipt of food transfers e.g. from civil society or international agencies. We provide specific solutions under each pillar summarized above. Figure 17 below shows a quick visualization of the number and type of intervention required by state/region. The darker shades represent states/regions where malnutrition (measured by stunting rates) are the highest. Not surprisingly, the most malnourished states/regions such as Kachin, Chin, Rakhine, Shan, Kayah and Ayeyarwady require the highest number of interventions.

Figure 17 Specific Areas of Intervention mapped



* Percentage of children under 5 who is below minus two standard deviations from the reference median for height-for-age, a condition reflecting the cumulative effect of chronic malnutrition.

3.1

AVAILABILITY

The System of Rice Intensification and Conservation Agriculture are sustainable production models. Both are neutral to scale, and their introduction has brought benefits to large and small farmers. Where introduced to large scale farms in the main production areas, they can increase food availability on a regional or national scale. Hence, they are considered here in the first instance under availability. However, they may improve access to food at the household level, through more stable and low input production. This is relevant for small farmers in those states where agriculture is most neglected and under-resourced, notably Rakhine, Chin, Kachin and Kayah.



3.1.1 Restorative Agriculture

System of Rice Intensification (SRI) is a departure from the traditional practice of growing the crop in flooded soils to growing it in an aerated soil with an entirely different system of crop and water management. Water requirements are considerably less when SRI is used. The soils are kept moisty but not flooded throughout the growing period. Emissions of methane, the most potent greenhouse gas, are therefore much reduced, and there is no anaerobic build-up of methane producing bacteria. Seeding requirements are greatly reduced, although a specific type of seed is necessary, which would need to be available either through the agriculture department or from private traders.

There is less breakage of grains during milling, and higher milling out turns, which significantly reduce post-harvest losses. Similarly harvested grains exhibit less chalkiness. It is likely that SRI grains are higher in protein since such characteristics are associated with higher protein content. This is important given that rice has the lowest protein content, among the major cereals, promotion of high yielding varieties with reduced protein, and the effects of elevated CO₂ similarly reducing protein content.

SRI roots have a larger reach than those within conventional rice production systems. Hence, they penetrate more deeply into the soil, acquiring micronutrients from lower soil horizons. The stronger deeper rooting system furthermore makes the rice plant hardier and confers greater resistance against pests and disease. Due to their greater density, rice grains produced under SRI have higher concentrations of key dietary micronutrients, iron, copper, zinc, magnesium and manganese. Arsenic uptake by SRI rice plants is up to 90% less than that of rice produced in flooded paddy fields.

The use of organic compost, replacing the need for expensive chemical fertilizer would significantly reduce nitrous oxide emissions, another potent greenhouse gas. Chemical pollution caused by water run-off from paddy fields would also be reduced.

There is a significant reduction of female physical work burden during peak labour periods. Less labour is required for tillage and land preparation. Rice transplanting becomes less onerous due to the much lower seeding rate.

The system enables ready use of mechanical weeding, seed planters and transplanters further reducing female work burden. SRI water management is shown to break the cycle of mosquito reproduction, reducing the incidence of mosquito-borne diseases, notably malaria, dengue fever and Japanese encephalitis.

At the household level, SRI productivity gains may permit reduction in land devoted to rice and allow more diversified farming systems; improved dietary diversity through producing more micronutrient rich vegetable and animal foods. The principles of SRI can be readily applied to a range of other cereals and legumes, as well as to horticultural production.

Both the tillering and flowering stages are longer with SRI than with high density planting and this lengthens the time for rice to reach the harvesting stage. The standing rice crop might therefore in theory be exposed to any inclement weather risks to do with a slightly more lengthened season. SRI nevertheless ensures a stronger root system, which makes the plant hardier in countering weather events, as well as conferring more resistance to pests and disease.

Neighbouring Vietnam, a leading rice exporter globally, is a major success story where 40% of rice is currently produced by SRI. However, it has taken 20 years from inception to achieve this level. The dissemination of SRI across Vietnam required a lengthy period of very thorough trial and experimentation, on all soil types throughout the rice growing areas. Pilot farmers then became trainers of trainers for other farmers. Extension staff were thoroughly trained in applying the basic SRI principles.^{99 100}

SRI has previously been introduced into Myanmar, without any significant take-up. Future attempts to promote SRI will require the same intense process as has been implemented in Vietnam. The model is particularly relevant to major rice producing states/regions, such as Ayeyarwady. It is also an appropriate model for introduction into those rice producing parts of the Dry Zone (Mandalay, Magway, Nay Pyi Taw and Sagaing), where the limited water resources are inefficiently managed.



3.1.2 Reducing Soil Salinity

The water management system used by the SRI format prevents further build-up of soil salinity. However, saline soils may need to be reclaimed through re-configuring agricultural production. Biological solutions have been shown to work in Pakistan through using salt-tolerant plants, grasses, and shrubs such as *jantar* or *kallar* grass.¹⁰¹ Annual cereals production on land with high alkalinity, may need to be replaced by other options such as salt-tolerant fruit trees. These are potentially more lucrative but require a longer time investment before they become productive. Jackfruit has been successfully introduced on a small-scale commercial basis in Vietnam, within saline areas of the Mekong delta. Guava or durian trees are further options. These interventions are immediately essential in those states/regions most affected by soil salinity, notably in the Coastal Zone states/regions (Rakhine and Tanintharyi) and Delta Zone states/regions (Ayeyarwady, Bago, Mon and Yangon).

⁹⁹ Norman Uphoff - The System of Rice Intensification (SRI) as a System of Agricultural Innovation - Journal Ilmu Tanah dan Lingkungan · January 2011.

¹⁰⁰ Cornell University College of Agriculture and Life Sciences - SRI International Network and Resources Center – Vietnam - <http://sri.ciifad.cornell.edu/countries/vietnam/index.html>.

¹⁰¹ Asad S Quereshi, Asaf Sarwar, Managing salinity in the Indus Basin of Pakistan, Intl. J. River Basin Management Vol. 7, No. 2 (2009), pp. 111–117.



3.1.3 Conservation Agriculture

Conservation Agriculture (CA) is an approach, which can be applied to cereal, legume, and vegetable cultivation. This model is equally applicable for both large and small plots in rural areas as well as for urban areas (backyard gardening or peri-urban cultivation). The essential principles are zero or minimum tillage and soil disturbance; permanent soil cover through mulching; crop rotation, including pasture crops for livestock; the use of intercropping and organic fertilizer. The system uses a method of direct seeding, rather than broadcasting. For smallholder agriculture this may be carried out using small-scale equipment, either an oxen or hand drawn seeder, or simply a wooden stick.

Once the system is properly embedded, there are improvements to soil structure, rooting zone; soil-moisture holding capacity and ultimately in soil fertility. Because of the zero or minimum tillage principle, as well as deeper rooting system, there is improved carbon sequestration and correspondingly reduced soil carbon emissions. Due to the protective soil covering through mulching, there are lower rates of evapotranspiration and higher soil and sub-soil moisture levels. Soil erosion rates are similarly minimized. Crop rotation promotes weed control and improved resistance to pests and diseases. With the elimination of herbicide, pesticide, and fungicide residues, there is no chemical run-off, removing a serious threat to water quality and safety. The techniques of IPM and bio-pest control formats are readily integrated within CA.

As in the case of SRI, improvements in soil structure, soil pH and fertility, will lead to improved uptake of plant nutrients and hence contribute to the higher nutritional quality. The biodiversity increases through cultivating a wider range of food crops, will further improve dietary diversity. Any gains however, in the nutritional value of crops achieved through CA, as with SRI, need to be maintained through good post-harvest practices, threshing and drying and nutrient-retaining methods during storage, processing and cooking.

There is a reduction in labour requirements, as tillage and weeding tasks are greatly reduced. As in the case of SRI this reduces female work burden enabling mothers to focus more on care and young child feeding. CA requires chemical herbicides usually for the three years it normally takes for the system to become embedded. Given the widespread use the problem of toxic chemicals being used, as referred to elsewhere in the report, alternatives need to be promoted.

CA has been promoted successfully globally. Brazil and Argentina both now have more than 50% of arable land under CA. Concern Worldwide have successfully developed CA within Zambian agriculture.

The use of minimum tillage and the cropping patterns employed ensure that CA is better able to withstand soil degradation. Dissemination of this model would therefore benefit the more hilly and mountainous states, notably Chin, Kachin, Kayah, Kayin, and Shan, where the level of soil conservation practices among farmers is low. The ability of CA to retain adequate soil moisture levels would benefit farming in the Dry Zone (Mandalay, Magway, Nay Pyi Taw and Sagaing), which is highly vulnerable to drought.

Integrated Crop and Pest Management

Integrated Crop Management (ICM) and Integrated Pest Management (IPM) are linked complementary approaches. They represent a 'whole farm approach' which is site specific and includes the use of crop rotations, appropriate cultivation techniques, careful choice of seed varieties, minimum reliance on artificial inputs such as fertilisers, pesticides and fossil fuels, maintenance of the landscape and the enhancement of wildlife habitats. Food, kitchen and garden waste can be used for organic fertilizer. IPM combines early warning of pest outbreak, with prevention and control via organic measures. Where resources permit, facilities should be established in country to produce organic pesticides and bio-control agents.

There are possibilities within these systems for re-establishing hardy indigenous varieties of sorghum, millets, and legumes. These offer tolerance of a wide range of climatic conditions, as well as enriching diets and the local food economy.

IPM and ICM are readily integrated with Conservation Agriculture. Dissemination of these models would therefore benefit those states especially prone to soil erosion notably Chin, Kachin, Kayah, Kayin, and Shan. They would further improve the resilience of those states/regions most susceptible to drought, especially Mandalay, Magway, Nay Pyi Taw and Sagaing. As with Conservation Agriculture, these models are equally applicable for both large and small plots in rural areas as well as for urban areas (backyard gardening or peri-urban cultivation).

Integration of both trees and livestock is possible within annual cropping systems and can ensure an addition level of resilience. Agroforestry is an appropriate model for restoring sloping land cultivation in hilly areas. This is especially relevant in those states which are most affected by deforestation.



3.1.4 Post-harvest losses

The immediate imperative is to conserve food at on farm level through improving the traditional postharvest chain to reduce losses and protect food safety. Ultimately food waste needs to be addressed at all levels of the value chain in Myanmar, to maximize food availability. Given the reality of what can be accomplished in the present context, the most immediate stages are considered here.

The FAO 2016 Crop and Food Security Assessment Mission (CFSAM) recommends the development of on-farm and community grain storage facilities to reduce post-harvest losses due to fungal spores and insects. This is related to the section below on the need to eliminate the threat of mycotoxins. UNDP has previously implemented projects aimed at improving food storage for small farmers.

Reduction of post-harvest losses is essential in the main food producing states/regions to maximize food availability at the national or regional level. However, investment in food loss reduction would promote greater food access in those states/regions, where local agriculture has been neglected and it is essential to maximise the limited production. This applies in particular to Chin, Kayah, Kayin and Rakhine states.

3.2

ACCESS

This section deals firstly with more immediate routes for ensuring food access. Then with interventions for maximising food provision at household level.



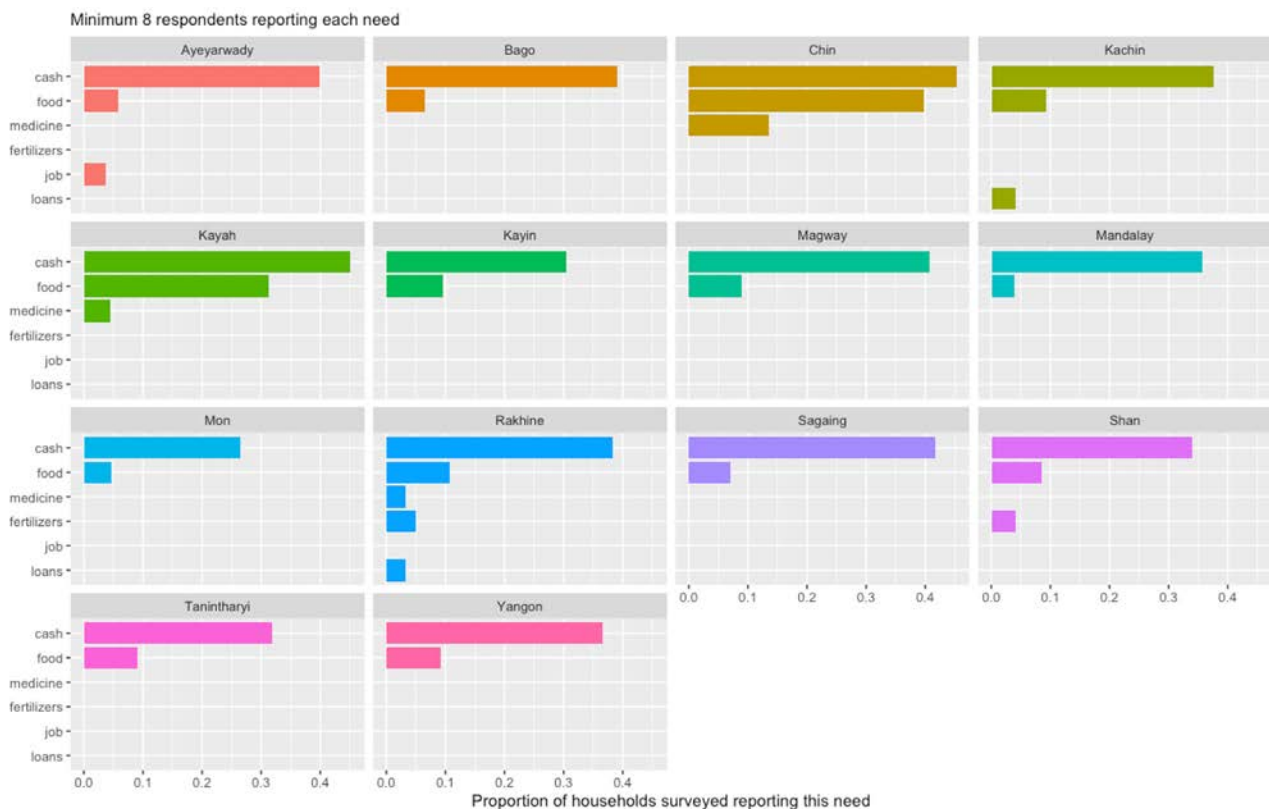
3.2.1 Social Protection

In Figure 18 below, cash as disposable income is indicated as the overwhelming need in each of the 14 states, particularly in Chin, Kayah, Magway and Sagaing. The next most important need is food. Pre-existing social safety nets and social protection, such as maternal and child cash transfers, are the first line of defence for vulnerable groups against food insecurity.¹⁰² These can be implemented through digital cash transfer as well as BCC through phone or online sessions, where phone connections still exist. The impact of cash is likely to be increased where there is support through nutrition education/ BCC.¹⁰³ In turn knowledge of the value of foods will enable more informed market choices.

¹⁰² Strategy Support Programme working Paper 07. January 2021. Opportunities and Constraints for production and income growth in rural Myanmar. Inter-regional variations in the composition of agriculture, livelihoods and the rural economy. Ben Belton, Ame Cho, Mateusz Filipski, Joseph Goeb, Isabel Lambrecht, David Mather, and Myat Thida Win.

¹⁰³ IFPRI - Strategy Support Programme Research Programme 29. Dietary Quality and Nutrition in Myanmar: Past progress, current and future challenges Kristi Mahrt, Derek Headey, Olivier Ecker, Andrew Comstock, Salauddin Tauseef

Figure 18 Top 5 Reported Needs by State/Region.



Such schemes have been successfully implemented in Yemen and other crisis countries. Whether this is a feasible option in Myanmar depends on the prevailing operational context and donor willingness to fund such a large-scale intervention. When benefits are spent on food and hygiene items, this provides some degree of stimulus to local markets. Social protection systems can be further used in support to farmers and rural markets, where basic agricultural inputs are provided through targeted cash/vouchers. Figure 18 indicates a need for cash across all states/regions.

A more permanent stabilizing effect on mother and child nutrition is through micronutrient fortification.¹⁰⁴ This is a more cost-effective option than cash transfers, which can be more easily sustained. However, it is limited by the extent to which rice markets are integrated. Given the fragmented nature of the market system, fortification of the rice staple might be more effectively carried out at local smaller scale rice milling plants with upgraded processing equipment.

Given the logistical and technical issues often associated with micronutrient fortification, biofortification may be preferred. A prerequisite to biofortification is the screening of local rice and other cereal varieties to first identify those demonstrating better use of nutrients, especially through absorption, under prevailing conditions of climatic change.

School feeding programmes may be seen initially as income transfers providing a social safety net.¹⁰⁵ As and when schools are widely functioning, there may be scope to develop synergies between local food production and education, through leveraging local food production to provide for school feeding. School feeding programmes globally are designed to achieve a range of objectives. These may be variously concerned with improving school attendance, educational achievement, and promoting physiological growth.

Programmes to supply schools with locally produced food have been implemented in several countries, including Brazil, Ghana, Guyana, Kenya, Mali and Sri Lanka. In Vietnam, there has been a successful programme for incorporating nutrition education in schools. This is a promising foundation for improving nutritional knowledge at scale.¹⁰⁶ The net effect can be to improve infant and young child feeding (IYCF) practices and better inform household food choices.

3.2.2 Strengthening livelihoods

For those who are dependent on the agriculture sector for their livelihoods, the following measures can improve access by raising productivity which would increase direct access to food and indirect access by generating more income from engaging in the sector. Regenerating livelihoods is equally important for those who are outside the agriculture sector as disposable income has been cited as the most critical requirement in multiple surveys this study reviewed.



Household Food Production

A study of Magway, Ayeyarwady and Chin found that home gardens are positively associated with improved food security and dietary diversity. This was particularly the case with landless households, who own home gardens,

¹⁰⁴ IFPRI – Strategy Support Programme. Working Paper 29. February 2023. Dietary Quality and Nutrition in Myanmar: Past progress, current and future challenges. Kristi Mahrt, Derek Headey, Olivier Ecker, Andrew Comstock, Salauddin Tauseef.

¹⁰⁵ Alderman H, Bundy D School Feeding Programs and Development: Are We Framing the Question Correctly?

¹⁰⁶ Trang Nguyen, Alan de Brauw, Marrit van den Berg, Ha Thi Phuong Do Testing methods to increase consumption of healthy foods evidence from a school-based field experiment in Viet Nam. Food Policy Volume 101, May 2021, 102047

producing fruits and vines.¹⁰⁷ This observation is supported by international surveys.^{108 109} The above interventions in conjunction with livestock and fisheries initiatives are essential to building resilience in Chin and Kayin, which are consistently the states with the worst food consumption and dietary diversity indices.

Extending household food production would improve dietary quality for rural and peri-urban communities. This should be part of a strategy for diversifying rural livelihoods, with skills training for women. This should encompass processing and trading, increasing marketing channels for higher value food products. Processing of locally produced groundnut and sesame could stimulate local production and discourage consumption of environmentally destructive palm oil.

There is considerable potential for encouraging peri-urban horticultural production around major cities, such as Yangon. Development in this sector is significantly less than in neighbouring countries. The urban market is more accessible for producers and there is usually a higher degree of pre-existing physical market infrastructure than there is in the rural areas.



Small Scale Mechanization

Given the current problems of farmers level of indebtedness when purchasing larger equipment such as ploughing tractors, the focus should be on smaller equipment.

A useful strategy would be to mechanize female tasks, such as weeding, transplanting, threshing, and drying. This would assist with reducing female physical labour burden and increase returns to their labour. It is possible for such equipment to be used by small farmers on a group basis. This type of project has been implemented by UNDP in the past. Mechanized post-harvest systems significantly reduce losses compared with traditional manual operations. Efforts should be initiated in the most agriculturally deprived states, Chin, Kachin, Kayah and Rakhine, as previously mentioned above.



Market Infrastructure

Small scale interventions should be considered which may act as building blocks for future market development. Initial efforts would be well directed to market infrastructure in Chin and Kayah. These states are the least integrated with markets nationally and where consumers must pay the highest rice prices. In addressing markets and the wider food environment, much can be done through providing information to make markets transparent, improve knowledge of food quality and safety. Nutritional education in support of either social protection or agricultural interventions would provide an important perspective on the value of food.

Food safety is a concern of buyers in markets. Awareness of the most common food safety threats, and how to prevent them is crucial. It is essential to collaborate with the private sector, as retailers currently provide most advice on the use of chemicals inputs and on such areas as animal epizootics. Lessons learned on marketing and food safety could assist with developing a consumer protection strategy.

¹⁰⁷ Rammohan, A., Pritchard, B. & Dibley, M. Home gardens as a predictor of enhanced dietary diversity and food security in rural Myanmar. *BMC Public Health* 19, 1145 (2019). <https://doi.org/10.1186/s12889-019-7440-7>.

¹⁰⁸ Haider BA, Bhutta ZA. Web appendix 16 – dietary diversification strategies including home gardening, livestock farming and dietary modifications. *Lancet*. 2008;371:417–40.

¹⁰⁹ Hawkes C, Ruel MT, Arimond M, et al. From agriculture to nutrition: pathways, synergies, and outcomes. Washington, DC: IBRD and the World Bank; 2010.

Innovations in agriculture and aquaculture sectors should focus on women. Nutrition education/BCC should be provided in support. Often the public are unaware of the nutritional content of foods or how they contribute to health. Linkages on nutrition awareness from the food and agricultural sector can be combined with public health messaging.

Support to physical marketing facilities for food preservation, hygiene and safety needs some capital outlay for larger scale preservation and storage equipment. Refrigeration is recommended powered by electricity, especially in urban areas where connection to a grid more possible; in more remote rural areas solar powered refrigeration may be appropriate. Whilst desirable, this is beyond the scope of any immediate intervention. More modest localized interventions could, for small sellers, provide flasks or cool boxes if ice is available through purchase, where wider refrigeration facilities are not accessible.

Smallholder farmers should be organized through training to improve their ability to comply with buyer requirements and to collectively negotiate with middlemen and wholesalers.

Building market infrastructure is essential throughout Myanmar. However, there is a particular need for support in Shan and Kayah. These states experience the highest staple food prices, greatest price range and the lowest degree of market integration. Urban areas are more dependent on markets than rural, so market-based interventions are highly appropriate in the urban setting, especially to protect the urban poor.



Livestock

There is a need for animal re-stocking amongst small livestock keepers in rural and especially in peri-urban areas, where livestock offtake has been particularly heavy. Re-stocking needs to be supported with some initial feed and veterinary support as well as technical guidance and awareness raising. Beneficiaries should be able to generate sufficient income to purchase feed and veterinary medicines. Similar projects which have not factored in this consideration have failed.¹¹⁰ Women are traditionally responsible for livestock rearing. So, this will be an opportunity to restore and promote female livelihoods through engaging with women's groups. Encouragement should be given to small-scale livestock value chains, to increase availability of animal sourced foods.¹¹¹ To reduce child stunting there needs to be promotion of small amounts of animal sourced foods being regularly consumed by young children.¹¹² Awareness raising is therefore necessary to encourage households to achieve an optimum balance between market sales and home consumption of animal foods.

Livestock holders need information about improving biosecurity, especially in more formal small and medium enterprises animal production as these are potentially the main clusters of African Swine Fever (ASF) and Avian Influenza (AI) transmission. ASF threatens the domestic pig breeds of SE Asia, including those farmed in Myanmar.¹¹³ Knowledge of the signs, symptoms and causes of ASF is low amongst farmers in Myanmar. Outbreaks of AI are most likely to occur in the larger or medium scale poultry production units, given the denser numbers in which poultry are kept. These tend to be in or near peri-

¹¹⁰ EU Programme for Improved Nutrition (PINS) Sindh province, Pakistan.

¹¹¹ Evidence from Vietnam indicates that smallholder livestock value chains can be efficient and should not be marginalized through large scale industrialized production.

¹¹² Headey, Derek D.; Hirvonen, Kalle; and Hoddinott, John F. 2017. Animal sourced foods and child stunting. IFPRI Discussion Paper 1695. Washington, D.C.: International Food Policy Research Institute (IFPRI). <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/132232>

¹¹³ UK Department for Environment, Food and Rural Affairs, Animal and Plant Health Agency - Animal Health and Welfare Advice - International Disease Monitoring - Updated Outbreak Assessment #24 - African swine fever (ASF) in Asia and Oceania 13 February 2023

urban areas, However, smaller poultry keepers are also at considerable risk. They are far less likely to be given compensation where their birds die from infection or are culled.¹¹⁴

There needs to be community awareness of the risk from livestock to human disease transmission, where animals are kept close to households.

Livestock interventions, providing animal foods are required to improve maternal and child nutrition generally. They are, however, most immediately required in states exhibiting both the highest prevalence of child stunting and of women of short stature. These include Chin, Shan, and Kachin. In addition, Chin, as well as Kayah are the states with the lowest levels of ASF consumption.



Aquaculture and Fisheries

Support may be given to artisanal fishing communities in coastal or riverine areas, where essential fishing gear needs replacing.

The important dietary contribution of fish could be upscaled still further through greater use of small indigenous species (SIS) in homestead ponds. This in practice is conservation of local species through sustainable exploitation. SIS are eaten whole and not gutted like larger fish varieties, so bones and viscera are consumed complete with all macro and micronutrients.

There are success stories from Bangladesh, where SIS have been incorporated into homestead fishponds with Polycarp culture. It is preferable to introduce SIS into standalone fishponds, rather than an integrated livestock fisheries system, as SIS need clearer water to thrive.

Women eat a greater quantity of SIS in Myanmar than men, who tend to eat larger fish. However, the level of overall fish consumption by women is low by comparison with FAO/WHO dietary recommendations. Moreover, there are negative perceptions of consuming certain types of fish during pregnancy and lactation. This is an opportunity missed for preventing protein and micronutrient deficiencies. Therefore, behaviour change communication activities in support of fisheries projects are essential, to promote fish consumption by mothers and children.¹¹⁵



3.2.3 Technical Support

Capacity of non-state extension cadres needs to be built on the full range of essential technical areas, so that they can in turn provide the necessary level of support. Information, education, and communication (IEC) materials produced in support of micro-level projects may be shared with the agriculture extension department. Materials should be developed through community participation with farmer knowledge collected and formalized. These materials can contribute to the technical foundation for any future rolling out of a comprehensive extension service. Such approaches should be initiated in states where smallholders have hitherto received least support. These are most notably in Rakhine, Chin, Kachin and Kayah.

Extension services are crucial in making the link between agriculture and nutrition. This is best achieved through focusing on women in their

¹¹⁴ Alex de Waal, *New Politics, Old Politics*, 2022

¹¹⁵ Quennie Vi Rizaldo, Wae Win Khaing, Ben Belton, *Small fish consumption in rural Myanmar*, *Maritime Studies* (2023) 22:16.

respective roles in food production and childcare and feeding. Efforts in this domain should be supported with nutrition education, BCC, and community awareness. International projects which seek to improve food security and nutrition should involve women in the identification of priorities and in project management.

Extension services ideally need to be supported by a robust research and development (R&D) function. As with the extension service, R&D in Myanmar is seriously under resourced. Nevertheless, scope exists for further developing the Myanmar Alliance for Agricultural Research, Rural development & Advisory Service (AARRDS), through involving international agencies engaged in the food and agriculture sector, the Department of Agricultural Research, local and international academic research centres.

The Centre for Agriculture and Bioscience International (CABI) sustainable agriculture project readily lends itself to collaboration with extension services and local researchers. The project works with scientists in Myanmar to understand farmers' reliance on hazardous pesticides to fight a range of crop and pests and diseases.¹¹⁶

¹¹⁶ <https://www.cabi.org/news-article/project-to-help-achieve-sustainable-agriculture-in-myanmar-already-bearing-fruitful-results/>



3.3

UTILIZATION



3.3.1 Linking Agriculture with WASH

The technologies to treat, manage and recycle human waste (composting, drying and biogas) have already been well developed as local and rural practices. There is a need for scaling up. Large scale dry composting for nutrients to be recycled back to the land is feasible. Dry latrines can compost human waste directly, but these must be carefully managed to prevent attracting flies. The biggest need for waste evacuation is often in urban slums.

Activities in agriculture need to be closely coordinated with those in the WASH sector to reduce and eliminate soil helminth transmission which particularly affects women engaged in agriculture labour. Where sanitation facilities and practices can be improved this will be a significant step in achieving this objective. Agricultural extension services dealing with livestock, with efforts to improve use of animal waste for farmyard manure, need to consider prevention of public health hazards.

Upgrading or construction of new WASH infrastructure at community and school level will go a long way to reducing gastrointestinal illnesses and boosting nutrition through improved bio-utilization. Schools are ideal for disseminating BCC materials, for combined hygiene and nutrition education.

Efforts to improve WASH should target those states with the greatest need. Chin, Ayeyarwady and Rakhine have least access to safe potable water. They also record some of the highest prevalence of child diarrhoea.¹¹⁷



3.3.2 Elimination of Mycotoxins

Mycotoxins, especially aflatoxin affect a wide range of food commodities, especially grains and nuts, rendering food unsafe, or lowering its commercial value.¹¹⁸ Mycotoxins need to be eliminated from the food chain via better field practices including prevention of insect damage and improved storage, threshing, and drying. These measures need to be supported by awareness raising.

Detection of mycotoxins has in the past involved the use of expensive diagnostic laboratory and field equipment, although costs are reducing with new technological development. However, early warning of mycotoxins can be indicated using low-cost diagnostic equipment like water and humidity measures. These can readily be provided to small farmers either individually or in small groups. Efforts to eliminate mycotoxins from the food chain should focus initially on those states with the worst levels of child stunting and those where local agriculture is least well developed. These encompass Ayeyarwady, Chin, Kachin, Kayah, Rakhine and Shan.

¹¹⁷ Rakhine state has the highest rates of anaemia amongst women and children, which is WASH related, as well as being connected with dietary quality.

¹¹⁸ Aflatoxin in particular affects groundnuts, an important protein and oil crop in Myanmar and hybrid maize which has recently been the subject of widespread dissemination by government and agri-business. Both are ingredients in ready to use therapeutic foods (RUTF) for treatment of acute malnutrition (undernutrition). Aflatoxin is a barrier to local manufacture in Myanmar of RUTF being approved by UNICEF and the SUN Initiative.

3.4

STABILITY



3.4.1 Natural Hazard Early Warning

Early warning is important for disaster preparedness and planning and for risk mitigation. This is especially important in Ayeryarwady, Bago, Kayin, Mandalay, Yangon and Rakhine. These states are at highest risk of cyclone and flood damage. Anticipatory, early warning (and response) systems should be established, to safeguard assets at community level, using local knowledge to counter natural hazards.

Early warning interventions need to consider that women may be disproportionately affected by drought and flooding. They are more vulnerable to such shocks, have less access to resources, as well as to information on weather threats. Weather alerts and early warnings delivered through a phone app are efficient tools applied in other countries. For example, in Kenya an app uses weather station data to help pastoralists prepare for droughts and weather forecasts. Dry weather conditions forecast would allow pastoralists to transfer their livestock to other areas with available food and water. The app can point out where these areas are, saving pastoralists time and potentially their animals' lives.



3.4.2 Market, Pest and Disease Information

In the conflict context of Myanmar, access to accurate and on-time information has become more challenging, especially seen the rapid changes and dynamic context. Up to date and localized information on market dynamics, pests and diseases would be very beneficial for ensuring the decision making of farmers and provide more stability. Market and trade information, including information on commodity flows and food prices, imports and exports is crucial throughout the country, but especially in Shan and Kayah, where markets seem to be least efficient. As highlighted throughout the report, pests and diseases, including epizootics are a serious risk in Myanmar, both for the public health and well as for the food security.

Under the current context, certain app-based warning systems can be introduced with minimal dependence on any physical infrastructure. However, reasonable internet connectivity will be essential. In Myanmar there was an app active until the military takeover, Golden Paddy by Impact Terra. It provided besides information on market prices, updates on weather, and pest & water risk alarms.¹¹⁹

¹¹⁹ ImpactTerra - <https://www.impactterra.com/golden-paddy>

Annexes



Annex 1 Fertilizer Imports by quantity and value 2011 - 2019

Figure 19 Fertilizer Imports by quantity and value 2011 - 2019



Source: Comtrade

Annex 2 Seeds Systems in Myanmar and their characteristics

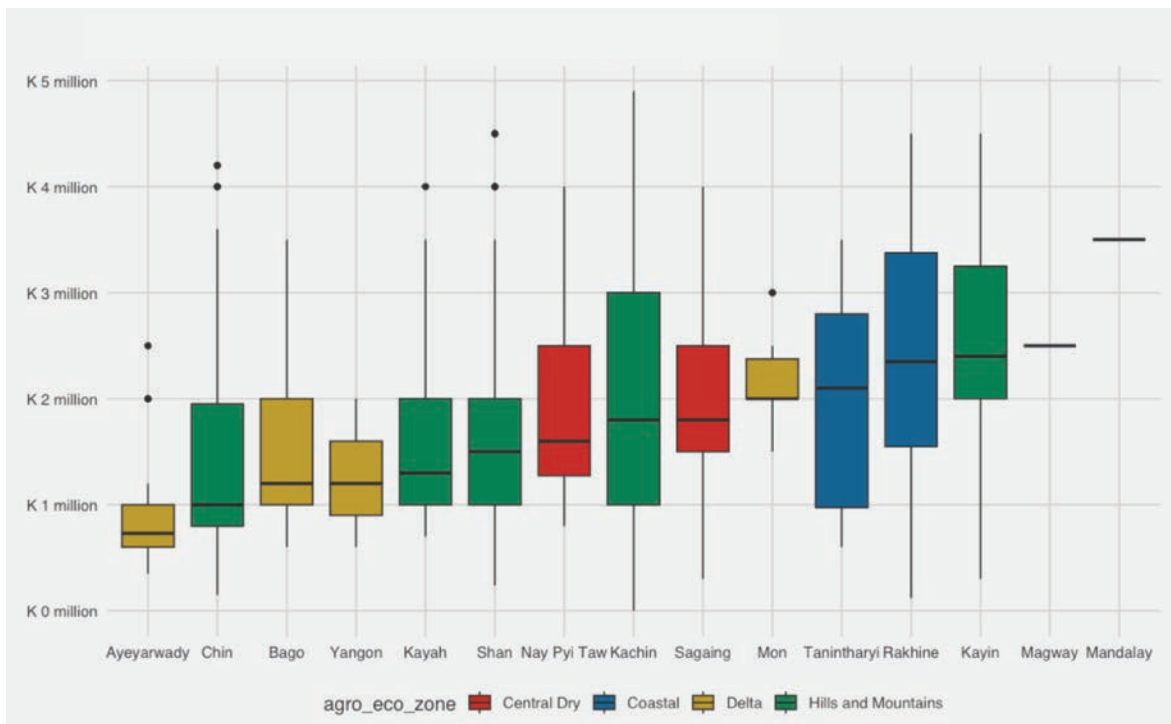
Figure 20 Seeds Systems in Myanmar and their characteristics.

Criteria	Informal Local/Farmer	Intermediary Public-Private	Private Commercial
Type of Crops	Major food & cash crops	Major food crops	Cash crops
Key Crops	Rice, pulses & beans, roots & tubers, oilseeds	Rice, pulses, beans & oilseeds	Hybrid corn/rice, vegetables, potato
Type of varieties	Local varieties	Improved	Improved
Seed Quality	Farmer selected	Certified, C2	Certified (internal QA)
Distribution & Marketing	Farmer saved & exchanged; local sales	Local sales, barter and markets	Imported, Agrodealers

Source: UNDP visual

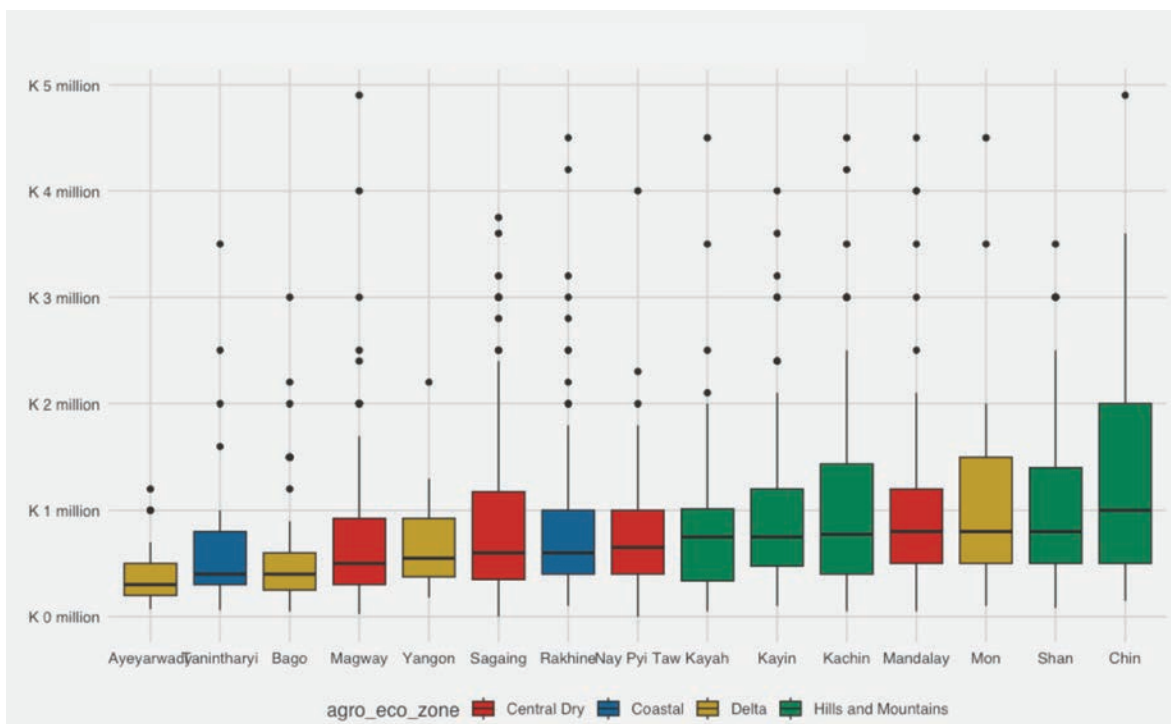
Annex 3 Buffalo and cattle sales

Figure 21 Expected Sale Prices of Buffaloes.



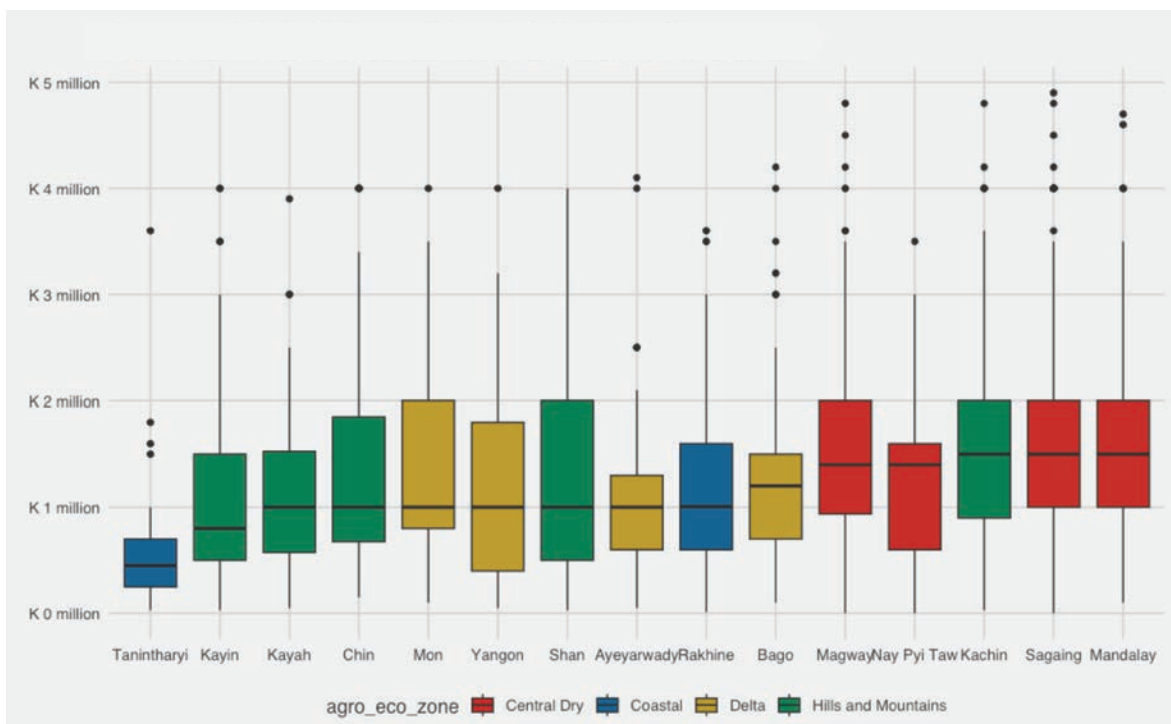
Source: UNDP based on MLCS(2017)

Figure 22 Expected Sale Prices of Cattle (Female).



Source: UNDP based on MLCS(2017)

Figure 23 Expected Sale Prices of Cattle (Male).



Source: UNDP based on MLCS(2017)

These charts compare expected sales prices by state/region in 2017, with distributions for those prices per state being represented by boxplots. The box part of each “box-and-whisker” plot shows the range of the middle 50% of prices reported for the state/region. The boxes are filled with colour to represent the agro-ecological zone to which each state belongs. Each solid horizontal line located within each box represents the median for the distribution of expected prices within that state/region. The “whiskers” of each plot are the solid vertical lines emanating from each box. They represent “minimum” and “maximum” values, excluding outliers. Outliers are represented as solid black dots.

There is a very wide price range for buffaloes across states. Within individual states, such as Kachin, Tanintharyi and Rakhine there is a wide variation, further suggesting market fragmentation. Female cattle has a more narrow price range. With the exception of Chin state, expected prices for male cattle exhibit a wider range of price variation than is the case for prices of female cattle.



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