Building Food System Resilience in Protracted Crisis Situations

Food-Gum Arabic system resilience assessment and facilitation tool (FoSRA-GA-FT)

Version 1.0

Eelke Boerema, Charleen Malkowsky, Gerrit-Jan van Uffelen

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Wageningen Centre for Development Innovation
Wageningen, June 2021

Report WCDI-21-167
(working document)

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Food and Agriculture Organization of the United Nations

Eelke Boerema, Charleen Malkowsky, and Gerrit-Jan van Uffelen, 2021. *Building Food System Resilience in Protracted Crisis Situations; Food-Gum Arabic system resilience assessment and facilitation tool (FoSRA-GA-FT).* Wageningen Centre for Development Innovation, Wageningen University & Research. Report WCDI-21-167. Wageningen.

Building food system resilience in protracted crises is an important goal of Food and Nutrition Security Resilience Programme (REPRO). REPRO adopts a food system – target system interface systems' approach to analyse, understand and build absorptive, adaptive and transformative food system resilience capacities in the face of shocks and stressors, in order to improve food and nutrition outcomes.

Each REPRO country has a specific thematic focus for which a facilitation tool will be developed and published. This working document is a such part of the series of FoSRA publications under FNS-REPRO, with s special focus on the food-Gum Arabic system interface and its assessment.

This working document is a collaborative effort between the Wageningen Centre for Development Innovation (WCDI) of Wageningen University and Research (WUR) and FAO Sudan under the Food and Nutrition Security Resilience Programme (FNS-REPRO). The proposed methodology and tools will be field tested in Sudan and validated by the parties mentioned above, based on which a final document will be produced.

This document presents the working document of the food-Gum Arabic system resilience assessment and facilitation tool (FoSRA-GA-FT). The FoSRA methodology will be employed by Wageningen Centre for Development Innovation (WCDI), in close consultation with FAO, to develop food system resilience pathways in Sudan as part of the REPRO Programme. There are three interrelated parts of the food system resilience assessment: the FoSRA conceptual framework; the FoSRA field assessment (including an extensive training and tool kit); and learning and knowledge management. The FoSRA-GA-FT will contribute to developing good practice and policy recommendations in building food system resilience in protracted crisis situations from the perspective of the underpinning Gum Arabic system.

Keywords: Sudan, Food Systems, Resilience, Protracted crises, Gum Arabic, Food and Nutrition security

This report can be downloaded for free at https://doi.org/10.18174/548787 or at www.wur.eu/cdi (under publications).

Report WCDI-21-167

Photo cover: Eelke Boerema

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BUILDING FOOD-GUM ARABIC SYSTEM RESILIENCE IN PROTRACTED CRISIS SITUATIONS

List of abbreviations and acronyms

FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FNS	Food and Nutrition Security
FoSRA	Food System Resilience Assessment
FSA	Food System Analysis
HLPE	High Level Panel of Experts on Food Security and Nutrition
IDP	Internally Displaced People
IPC	Integrated Food Security Phase Classification
NGO	Non-Governmental Organization
FoSRA	Food System Resilience Assessment
FoSRA-GA-FT	Food- Gum Arabic System Resilience Assessment Facilitation Tool
UNISDR	United Nations Office of Disaster Risk Reduction
UNSCR	United Nations Security Council Resolution
WCDI	Wageningen Centre for Development Innovation, Wageningen University & Research
WUR	Wageningen University & Research

Concepts and definitions

Working definitions for the main concepts used in this document.

Protracted crisis
Macrae and Harmer (2004) define protracted crises as *'those environments in which a significant proportion of the population is acutely vulnerable to death, disease, and disruption of their livelihoods over a prolonged period of time'*.

Resilience
The United Nations Office of Disaster Risk Reduction (UNISDR) definition of resilience: *'The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions'*.

In relation to the Rome Based Agencies' focus on agriculture, food security and nutrition, resilience is essentially about the inherent capacities (abilities) of individuals, groups, communities and institutions to withstand, cope, recover, adapt and transform in the face of shocks.

Food systems
According to van Berkum (2018)[1]: *Food systems comprise all the processes associated with food production and food utilisation: growing, harvesting, packing, processing, transporting, marketing, consuming and disposing of food remains (including fish). All these activities require inputs and result in products and/or services, income and access to food, as well as environmental impacts. A food system operates in and is influenced by social, political, cultural, technological, economic and natural environments* (HLPE, 2014; UNEP, 2016; Global Panel 2016; HLPE, 2017).

Sustainable food systems
A sustainable food system is a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised (FAO, 2018[2]). This means that:
- it is profitable throughout (economic sustainability);
- it has broad-based benefits for society (social sustainability); and
- it has a positive or neutral impact on the natural environment (environmental sustainability).

Food System Resilience
The concept of food system resilience analyses how system components and their actors (from producer, middleman, traders, consumers etc.), are affected by – and respond to shocks and stressors, accounting for ripple effects across the food system, providing insights into varying existing and required resilience capacities and strategies which enable system actors and components to mitigate, prepare for and recover from negative impacts ensuring desired, (improved) socio-economic, environmental and food and nutrition security outcomes.

1 https://library.wur.nl/WebQuery/wurpubs/fulltext/451505
2 http://www.fao.org/3/ca2079en/CA2079EN.pdf

0 Introduction

0.1 Purpose and background

0.1.1 Purpose of the document

This document presents the zero draft of the food-Gum Arabic system resilience assessment (FoSRA-GA) and facilitation tool (FoSRA-GA-FT). The FoSRA methodology will be employed by Wageningen Centre for Development Innovation (WCDI), in close consultation with FAO, to develop food system resilience pathways in Sudan as part of the Food and Nutrition Security Resilience Programme[3] (FNS-REPRO, hereafter: REPRO)(WUR n.d.). The FoSRA-GA-FT is being developed as part of REPRO's output 4: REPRO's learning agenda and knowledge management(FAO, 2020) [4].

Building food system resilience in protracted crises is an important goal of REPRO Sudan, taking a food system approach and exploring food and nutrition security (FNS) outcomes. In doing so REPRO Sudan (FAO, 2020)[5] focuses on the food-Gum Arabic system interface. These approaches are used to analyse, understand, and promote absorptive, adaptive, and transformative food system resilience capacities in the face of shocks and stressors in order to improve FNS outcomes.

The FoSRA-GA-FT will contribute to developing good practice and policy recommendations in the domain of building food system resilience in protracted crises areas. This document is a working version. The zero draft of the food Gum Arabic system resilience assessment and facilitation tool (FoSRA-GA-FT) is frequently being updated with new insights and experiences of the FNS-REPRO project – thus, whilst the majority of concepts and tools were tested in practice already, some elements are an improved version of the previously implemented approach and methodology, and still await validation. The goal by the end of the project is to produce a final document containing the learnings on food system resilience in protracted crises (in particular the learnings on the food-Gum Arabic system interface of the entire 4-year programme), resulting in the compilation of a final framework.

0.1.2 The REPRO programme: building resilient food systems in protracted crises

The Netherlands has played a key role in the unanimously adopted Security Council resolution 2417[6] on conflict induced food insecurity(United Nations 2018). UNSCR-2417 was triggered due to the rise of hunger for the third year in a row; a rise driven by protracted conflict and adverse climate events, and threatening to erode or even reverse gains made in ending hunger and malnutrition[7].

Since then, this trend further intensified, confirmed by the most recent report on the State of Food Security and Nutrition in the World 2020[8]: "The magnitude and severity of food crises worsened in 2020 as protracted conflict, the economic fallout of COVID-19 and weather extremes exacerbated pre-existing fragilities." (GRFC, 2021). In 2020 155 million people were in food crises or worse (GRFC, 2021).

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3 https://www.wur.nl/en/Research-Results/Research-Institutes/centre-for-development-innovation/show-cdi/FNS-REPRO-building-food-system-resilience-in-protracted-crises.htm

4 FNS-REPRO 2-pager: http://www.fao.org/3/ca6159en/ca6159en.pdf

5 FNS-REPRO Sudan 2-pager: https://drive.google.com/file/d/1bVYJpeAM-0hHBlaAJLNRqMx042EOMgN9/view?usp=sharing

6 https://www.un.org/press/en/2018/sc13354.doc.htm

7 The State of Food Security and Nutrition in the World. http://www.fao.org/3/I9553EN/i9553en.pdf

8 The State of Food Security and Nutrition in the World. http://www.fao.org/publications/sofi/2020/en/ This fifth annual Global Report on Food Crises (GRFC 2021) results from months of collaboration among numerous members of the international humanitarian and development community. The Food Security Information Network (FSIN) coordinates this process, facilitating multiple partners at global, regional and national levels to share food security and nutrition data, analysis and valuable insights. Without the commitment, contributions and expertise of 16 agencies and many individuals this valuable work would not have been possible.

The REPRO programme is an initiative by the Dutch Government to operationalise the United Nations Security Council Resolution 2417. This resolution seeks to address food crises and famine as an act or result of war and calls upon the international community to explore new ways to strengthen food system resilience in times of crises and situations of conflict.

REPRO is a four-year programme (2019-2023) funded by the Dutch Ministry of Foreign Affairs and implemented by FAO under its strategic programme 5; it seeks to increase the resilience of livelihoods to threats and crises that affect agriculture, food, and nutrition. The Wageningen Centre for Development Innovation (WCDI), a knowledge institute of the Wageningen University (WUR), has been subcontracted to implement REPRO's learning agenda and knowledge management. REPRO target countries are Sudan, South Sudan, and Somaliland. This document focusses on Sudan only, examining the specific topic of how food and nutrition outcomes can be linked to Gum Arabic systems.

0.1.3 REPRO's learning agenda in Sudan: Gum Arabic

In Sudan, the REPRO programme focuses on the role of Gum Arabic in building more resilient food systems. Learning and knowledge management are integrated in REPRO's design in order to both inform adaptive programme management, promote improved policy and practice, and facilitate engagement at different levels from field-based projects to the Global Network Against Food Crisis.

WCDI will develop a learning agenda along the following topics:
- **Diversifying livelihoods and increasing farmer incomes**, through improving technical, organizational and commercial capacity to produce and market Gum Arabic;
- **Supporting landscape restoration and reduce degradation**, piloting building back (elements of) the green belt in Darfur;
- **Reducing conflict between crop and livestock producers**, through rehabilitating livestock corridors and increasing fodder availability, among others, and;
- **Increasing the share in the benefits of the Gum Arabic production for women**, e.g. through the support of existing and creation of new dedicated women's producer groups.

0.2 The food-Gum Arabic system resilience assessment and facilitation tool

As Figure 1 below presents, there are three interrelated parts of the food system resilience assessment and facilitation tool:
- I. The FoSRA conceptual framework (green, left side)
- II. The FoSRA field assessment including the FoSRA toolbox (blue, right side); and
- III. Learning and knowledge management (red, bottom part)

I: The FoSRA conceptual framework is made up of three components:
- understanding food systems and their FNS outcomes (component 1)
- exploring the food-Gum Arabic system interface (Sudan) and its contribution to FNS outcomes; (component 2) and
- applying principles and practices to building food system resilience in protracted crises (component 3)

II. The FoSRA field assessment consists of two components:
- applying interactive tools to understand Sudan's food and Gum Arabic systems and their behaviour (component 4); with support of a toolbox provided in annex 1 (the toolbox consists of two parts: 1) training the FoSRA data collection team, and 2) tool guides to engage the main actors and stakeholders to co-create an understanding of food systems)
- developing food system resilience pathways with a focus on Gum Arabic value chains in support of food systems' resilience and improved FNS outcomes (component 5) and

III. Learning and knowledge management section consists of:

- validating pathways through questioning (component 6)
- documenting good practises developing policy recommendations and strengthening concepts (component 7).

Figure 1 provides an overview of the FoSRA-GA-FT. The structure of the document is in line with the main components of the FoSRA framework, meaning that component 1 is introduced in chapter 1, component 2 in chapter 2, and so forth.

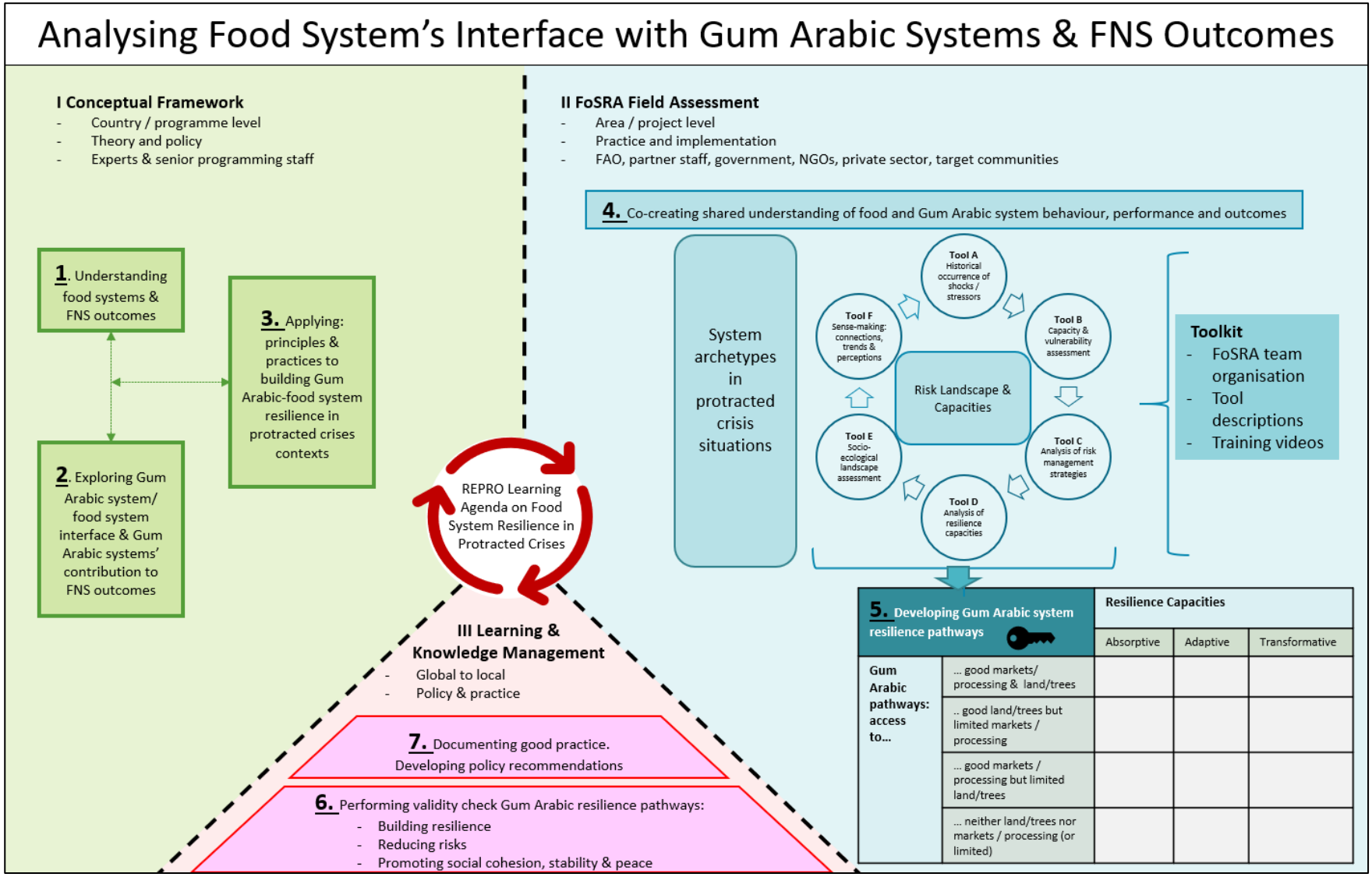


Figure 1 *Food system resilience assessment and facilitation tool.*

0.3 Document Overview

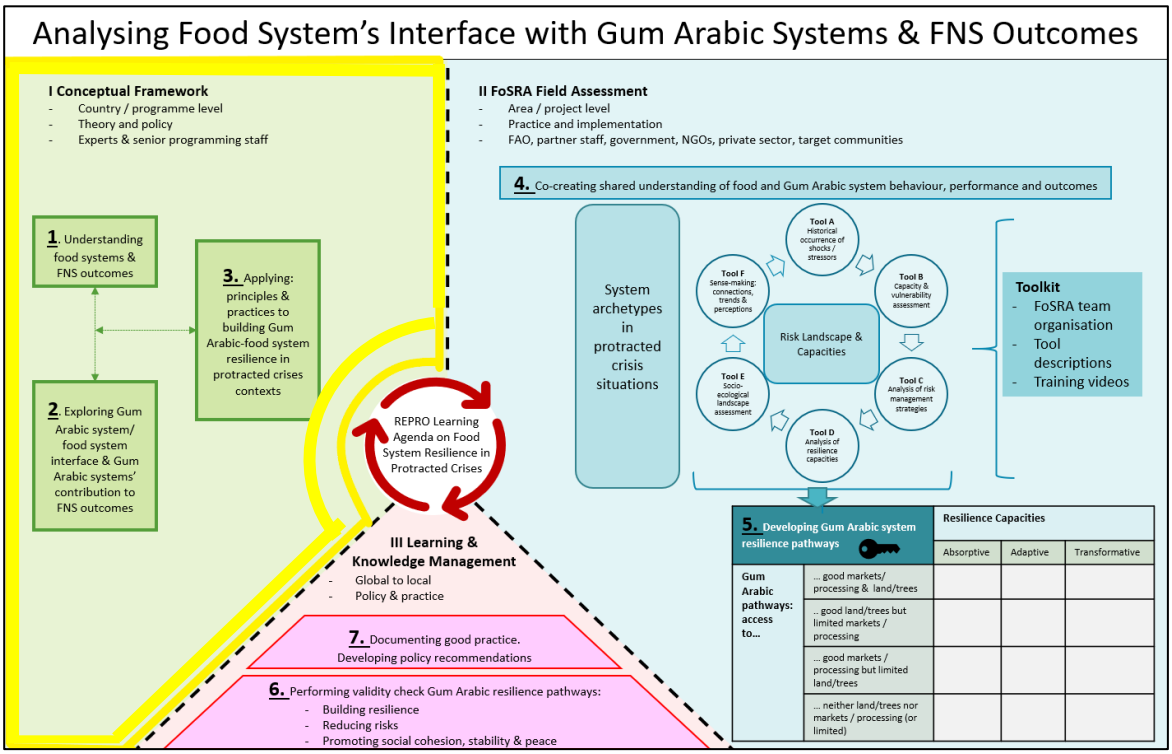
As the framework in Figure 1. presents, this document is organised into three main parts: I. Conceptual Framework, II. The FoSRA Field Assessment, and III. Learning and Knowledge Management.

This first part, the Theoretical Framework, presents the theories, concepts, and principles required in building food system resilience during a protracted crisis. This part is of interest to policy makers, donors, and senior programme staff of implementing agencies involved in food and nutrition security programming. This part of the FoSRA-GA-FT framework aims to: increase understanding of how food systems work and produce/deliver FNS outcomes (component 1); explore the interface between the food system and a specific critical component, Gum Arabic, underpinning the resilience of the food system (component 2), and apply principles to building food system resilience in protracted crisis contexts.

The second area of the framework, the FoSRA Field Assessment, aims to gather information to co-create a joint understanding of food and Gum Arabic system dynamics and behaviours, specifically focussing on shocks, stressors, and resilience capacities (component 4) – this section is also further deepened through the introduction of interactive tools (4.5.1 and appendices). The following section (section 5) explains how, on the basis of these insights, specific pathways can be identified to strengthen resilience capacities of the Gum Arabic system that underpins food system resilience (component 5). This part of the report is of key interest to the agency that engages with local actors and stakeholders to implement the FoSRA.

The third part of the report captures learning and knowledge management aiming to validate the findings of the FoSRA, document good practice and develop policy recommendations on food and Gum Arabic system theory, concepts and principles.

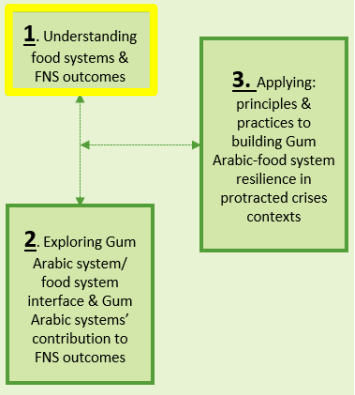
PART I - CONCEPTUAL FRAMEWORK



Part I establishes the conceptual framework for the FoSRA assessment. It explains how a food system is analysed, how to make sense of the food-Gum Arabic system interface, and how guiding principles are applied.

1 Component: Understanding food systems and their food and nutrition security (FNS) outcomes

Output: gaining a general understanding of food systems and their food and nutrition security (FNS) outcomes. This step will generate an overall understanding of food systems and the resulting FNS outcomes as an overall background to exploring the food- system interface (2. Component).



1.1 Food system framework

The food system framework developed by van Berkum (2018) is adopted to:

- provide a structured checklist of topics
- draw attention to the potential vulnerabilities of the food system
- identify the most limiting factor(s) to achieving FNS.

Information is collected on food system activities (food supply system and other food system activities and processes, see orange wheel in Figure 2), their socio-economic (blue wheel in Figure 2) and environmental drivers (green wheel in Figure 2), and their impact the final food system outcomes. A stakeholder analysis of the key actors involved in food systems is also part of the analysis.

Data on major shocks and their impact on food systems (and their outcomes) is included in the analysis (e.g. a drought would be identified as part of assessing the environmental drivers, sections: climate, water or soil).

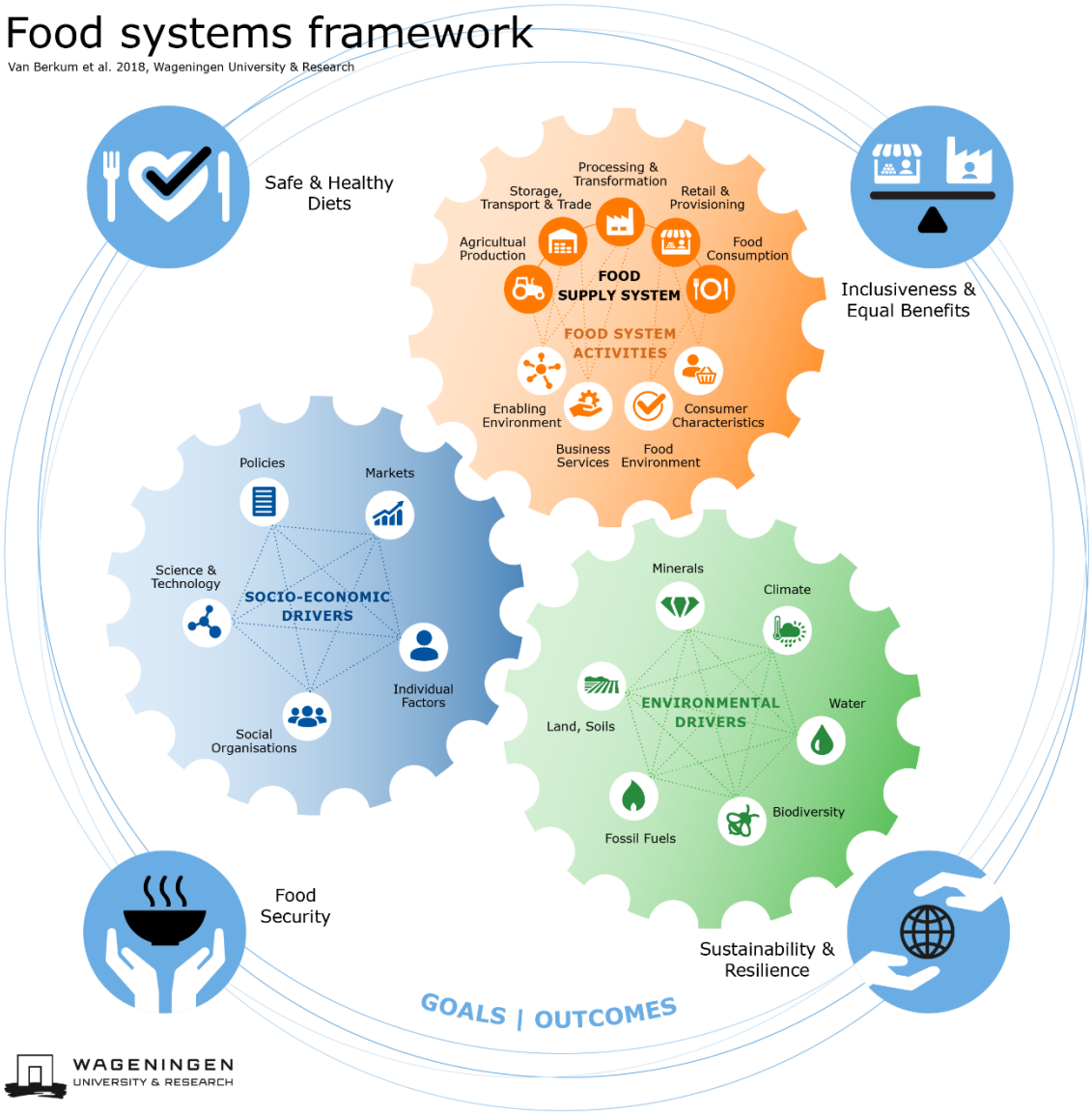


Figure 2 *Mapping the food system and its relationship with drivers (Berkum et al, 2018).*

Outcomes cover: Safe and Healthy Diets, Inclusiveness & Equal Benefit, Sustainability & Resilience and Food Security. The main focus of FNS-REPRO and respective assessments is the Food Security aspect (and healthy diets in the nutrition sense), however, the other dimensions are taken into account where feasible. The FNS outcomes are well documented, and data can be accessed through the Global Report on Food Crises 2020[9], the Integrated Food Insecurity Phase Classification[10] (IPC, 2021), the Global Report on IPC levels/numbers and FNS outcomes/and forecasts(FEWS NET, n.d.)[11], and other assessments (for example, Crop and Food Security Assessment Mission reports).

There are also other frameworks on food systems, most notable of which is The High Level Panel of Experts on Food Security and Nutrition (HLPE, 2017), food system framework[12], which following working versions of the document may build upon.

[9] This fifth annual Global Report on Food Crises (GRFC 2021) results from months of collaboration among numerous members of the international humanitarian and development community. The Food Security Information Network (FSIN) coordinates this process, facilitating multiple partners at global, regional and national levels to share food security and nutrition data, analysis and valuable insights. With he commitment, contributions and expertise of 16 agencies and many individuals.

[10] http://www.ipcinfo.org/

[11] https://fews.net/IPC

[12] http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-12_EN.pdf

1.2 Sudan: quick scan food systems and FNS outcomes

The quick scan is being conducted on the specific country level to gather information on the national, regional, or local food system and its outcomes. In this REPRO case, it is the Sudan food system with a particular focus on North & East Darfur states.

1.2.1 How to collect data: desk review and expert consultation

Information and data can be collected via a **desk review** and **consultations** of available national and local data, using any or a combination of the following ways:

- a literature review
- documentation available through relevant institutions and for a, such as IPC and food security clusters
- use of expert knowledge (thematic/geography)

Data Sources

Some general sources of relevant information are presented below.

- FNS Somaliland and Sudan country profile and descriptions:
  https://www.fsinplatform.org/global-report-food-crises-2020

- IPC country updates
  http://www.ipcinfo.org/ipcinfo-website/where-what/east-and-central-africa/sudan/en/

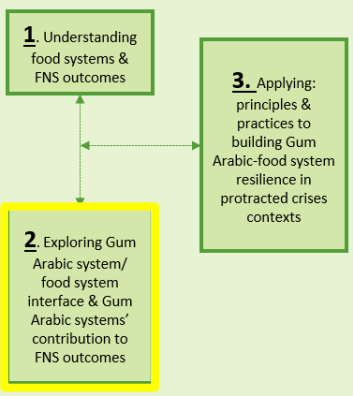
- Agro-ecology, markets, livelihoods:
  https://fews.net/east-africa/sudan

- Food Systems Dashboard for general information on country food systems
  https://foodsystemsdashboard.org/countrydashboard

Figure 3 *Sudan Country Profile.*

2 Component: Exploring System Interfaces and FNS

Output: Understanding the critical role of specific (target) systems such as the Gum Arabic system in underpinning food systems and the contribution of food systems to FNS outcomes.



2.1 Why Gum Arabic

A scoping mission undertaken identified Gum Arabic as a promising system since it shows high potential to increase people's ability to access food. This is based on Gum Arabic systems economic value additionally to its potential to stabilise the region through possible environmental peacebuilding entrance points:

- Gum Arabic in Darfur is an important commodity as a coping strategy in times of hardship, as well as a potential factor for food security and economic growth in more peaceful times;
- Sudan Gum Arabic production accounts for 60% of the world market and Darfur accounts for 30% of Sudan's production;
- Gum Arabic offers not only an income and indemnity to farmers against seasonal fluctuations in the prices of their agricultural products, but is also an important source of foreign exchange to Sudan, injecting annually between USD 100 - 120 million into the economy;
- Humanitarian actors using the Cash-for-Work concept provided food to people who plant Acacia Senegal trees to replace parts of the lost forest cover (charcoaled-up as a coping strategy during the crisis) to protect against the desert encroaching into agricultural production areas;
- Gum Arabic plantations fit well in the rehabilitation/restoration of integrated land-use systems in drought prone areas receiving 200-350 mm of rain annually. Gum Arabic plantations enriched with other native tree species can set an example of greenbelt restoration to increase resilience of agriculture based food systems in protracted crisis setting;
- Gum Arabic is an excellent nitrogen fixer since they absorb it from the atmosphere and efficiently convey it to the soil (Kalilou, 2021);
- The government in North and East Darfur sees women groups involved in establishing and exploiting Gum Arabic forests as a smart partnership, and;
- As highlighted above, the changing relationships between groups over land resources are a serious source of conflict, and relationships between farmers/Gum Arabic producers and livestock herders/pastoralists need to be managed along the principle of a "win-win" relationship, especially along the livestock corridors, rather than a "win-lose" dynamic as is often - and currently - the case;
- Gum Arabic provides meaningful and profitable engagement for former combatants, returnees or youth which can pay for food and shelter, as well as it helps them to re-integrate into society. This disincentivises participation in active conflicts which contributes to stabilising the region long-term (Kalilou, 2021).

2.2 Gum Arabic systems framework

Subedi and Vernooy (2019)[13] developed a framework of resilient seed systems for healthy food systems by adapting Van Berkum's (2018)[14] food system model. This model was further adapted to fit Gum Arabic systems as well, showing how Gum Arabic actors and activities interact with environmental and socio-economic drivers and how this all links to food system outcomes.

The model therefore allows the exploration of Gum Arabic, its outcomes, and interactions with food systems and food system outcomes. By doing so, critical challenges and gaps can be identified to strengthen Gum Arabic systems and their contribution to food system outcomes.

The model does not explicitly mention the impact of shocks and stressors on Gum Arabic systems and their interaction with Gum Arabic system/food system outcomes. It is, however, clear that shocks and stressors shape socio-economic (as well as socio-politico-economic) and environmental drivers that, themselves, impact Gum Arabic actors and activities. Part two of this report investigates the impacts of shocks and stressors on the food system and how it influences local FNS outcomes in a context-specific manner.

The framework below illustrates and conceptualises the interface of Gum Arabic and food systems (Figure 4).

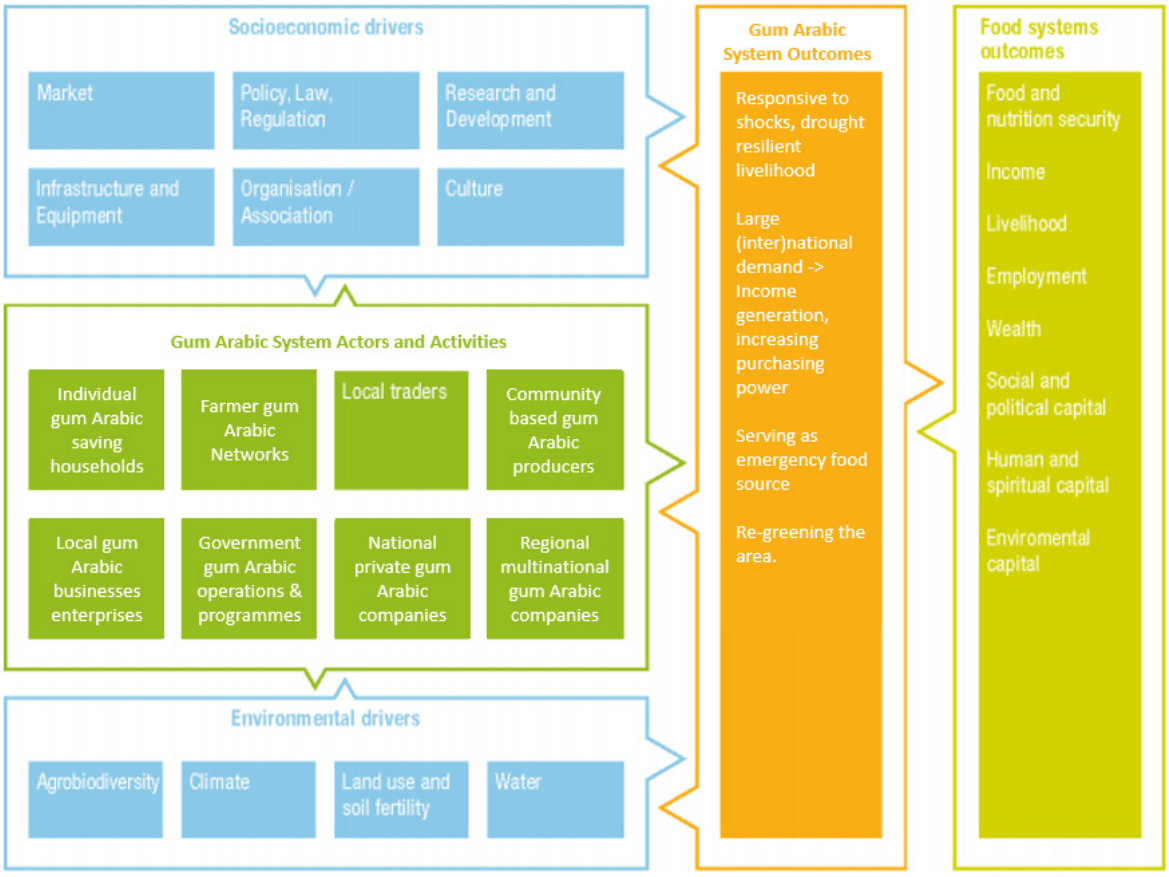


Figure 4 *Framework for resilient Gum Arabic systems for healthy food systems (adapted from Subedi and Vernooy, 2019).*

[13] Based on 'Healthy food systems require resilient seed systems': https://cgspace.cgiar.org/handle/10568/105871

[14] The food systems approach: sustainable solutions for a sufficient supply of healthy food: https://library.wur.nl/WebQuery/wurpubs/538076

How Gum Arabic systems underpin a healthy food system:

- Gum Arabic is a major value chain in many regions such as Sudan. Income generated through activities in the Gum Arabic sector is used to purchase food, thereby impacting dynamics of the food system and respective FNS outcomes.
- Gum Arabic has huge potential in agro-ecology / intercropping since it influences micro-climate, ground water accessibility, and serves as a natural fertiliser which can boost farm outputs which can either be consumed by households or sold at markets, thereby creating additional income and availability (Kalilou, 2021).
- Gum Arabic also supports agropastoral systems by improving growth of pasture grass by fixing atmospheric nitrogen and by being a source of fodder. This underpins the fodder system for livestock directly as well as indirectly (Kalilou, 2021).
- Based on Sudan's important value index (IVI), Gum Arabic ranks first as the most important commercial non-wood food products (NWFPs) and accounts for about 71% of Gum Arabic supply to international markets (Carucci et al.,2020), thus making it a crucial economic driver.
- Gum Arabic is resilient to drought and can be consumed as an emergency food source in times of crisis, as well as having multiple other purposes including feed for animals, medicinal use, crafting of tools, honey production and as fencing (Tarig et al.,2017).
- Gum Arabic can be regarded as a strategic linkage between the Humanitarian and development divide since it can serve as a long-term development initiative (income generation) and as an emergency food source (humanitarian side), thus, in a protracted crisis context like Sudan, the interface of Gum Arabic and FNS outcomes is flexible.
- A resilient Gum Arabic system depends on innovative business models and value chains, empowerment of farmers, shortening of the value chain to increase farmers' incomes, and local implementation of international and national policies.

2.3 Sudan: Gum Arabic systems, food systems and FNS outcomes

2.3.1 Step 1: developing a general understanding of the food -Gum Arabic system interface and FNS outcomes

Information and data can be collected via a **desk review** of available national and local data complemented or enriched by **consultations**. Data can be collected using any or a combination of the following ways:

- literature research
- documentation available through relevant institutions and forums such as FAO, specialised agencies, and professional bodies for example Food Security Clusters
- consultations with knowledge experts (thematic/geography)
- national level consultations with key stakeholders in food and Gum Arabic systems.

A potential tool to be utilised in consultation workshops is the causal diagram, which can be used to depict which factors influence what, and whether a change in one factor causes a similar or opposite change in another factor. Attention is given to feedback loops and whether these result in reinforcing, balancing, or eroding food and Gum Arabic system dynamics and their contribution to FNS outcomes.

2.3.2 Step 2: Quick scan of the risk landscape of Gum Arabic and food systems

This step identifies the main hazards (shocks and stressors), the exposure to hazards and the likelihood of suffering harm (susceptibility).

Exploring the risk landscape includes objective measures on shocks/stressors (i.e., intensity, scope, and frequency) and subjective measures (i.e., the perceived effect of shocks/and stressors on Gum Arabic systems and FNS outcomes).

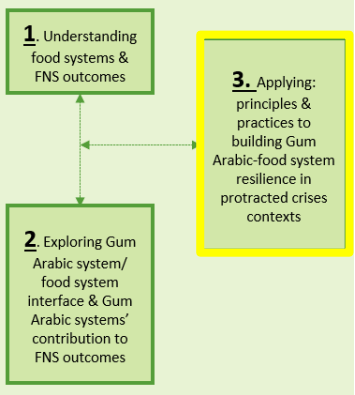
How to collect data: desk review and expert consultation

Information and data can be collected via a **desk review** of available national and local data. Data can be collected using any of the following ways:

- literature research
- documentation available through relevant institutions and fora such as FAO, specialised agencies, and professional bodies for example Food Security Clusters
- use of expert knowledge (thematic/geography)

3 Component: Building food system resilience in protracted crises: applying principles & practices

Output: understanding the challenges and applying principles and practices to building food system resilience through strengthening the underpinning Gum Arabic system for improved FNS outcomes in protracted crises.



Building Gum Arabic system resilience in protracted crises to address food system resilience requires:

- understanding the characteristics, limitations, and constraints of operating in protracted crisis contexts
- adopting approaches to building resilience for food and nutrition security
- applying the principles for promoting integrated Gum Arabic system development.

3.1 Protracted crisis situations: characteristics, limitations and constraints

In identifying resilience goals for a specific target system such as Gum Arabic, it is important to consider the constraints on addressing FNS in protracted crises, and the implications of these.

Protracted crises are heterogeneous but are nevertheless defined by several characteristics (Maxwell, 2011)[15]:

- **Protracted crises are defined by both time duration and magnitude**. Many have lasted for 30 years or more and are characterized by extreme levels of food insecurity.
- **Few protracted crises are traceable to a single, acute shock**. Conflict is often a cause, but climatic, environmental, or economic factors may also be causes. Unsustainable livelihoods are both a consequence and cause of protracted crises.
- **Intervention mechanisms are often weak**. Development donors are often unwilling to make significant investments in protracted crisis contexts, and private-sector engagement in protracted crises is often lacking or dominated by informal or illegal economic activities that extract wealth but do little to reinvest in sustainable improvements. Thus, market-led and technology-driven development is extremely difficult to sustain in protracted crises.
- **Protracted crises remain on the humanitarian agenda** in part because of poor food security or nutritional outcomes, and in part because humanitarian agencies are often the only available vehicle for intervention under the prevailing architecture of international assistance.
- Protracted crises often occur in contexts in which **states are incapable or unwilling to provide basic services or infrastructure** or are downright predatory toward the population. In short, protracted crises, and the populations caught in them, fall between standard categories of intervention and are often forgotten.

There are conceptual limitations and institutional constraints to working in protracted crises, limited growth potential from private sector investment, various constraints to public-sector or international programmatic interventions, and no consensus on operating principles or priorities. In general, three types of limitations exist (Maxwell, 2011).

[15] Maxwell, D., L. Russo and Luca Alinovi, 2011. Constraints to addressing food insecurity in protracted crises. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3411957/

- **Conceptual limitations**: external interventions are organized on the normative assumption that humanitarian assistance is to save lives in disaster/crises context and that with recovery the trajectory returns to improvement and development.
- **Institutional constraints**: a major institutional factor constraining livelihood change in protracted crises is the bifurcation of donor funding (between relief and development).
- **Programming constraints**: several programming constraints limit external interventions. One is the limitation(s) of the dominant programmatic framework; another includes practical elements of programme management; a third is normative (humanitarianism as a principled approach addresses individual needs and development, with a focus on state/government building.

3.2 Principles and practices for strengthening resilience for FNS in protracted crises

The Rome-based Agencies' *Conceptual Framework for Strengthening Resilience for Food Security and Nutrition in Protracted Crises Contexts*[16] (WFP, 2015) presents key principles and practices to support the resilience of individuals, households, and communities. These are:

- **Local and national ownership and leadership**: people, communities and governments must lead resilience-building for improved food security and nutrition.
- **A multi-stakeholder approach**: assisting vulnerable people to build their resilience is beyond the capacity of any single institution.
- **Combining humanitarian relief and development**: planning frameworks should combine immediate relief requirements with long-term development objectives.
- **Focus on the most vulnerable people**: ensuring protection of the most vulnerable people is crucial for sustaining development efforts.
- **Mainstreaming risk-sensitive approaches**: effective risk management requires an explicit focus on the decision making of national governments, as well as enhanced monitoring and analysis.
- **Aiming for sustained impact**: interventions must be evidence-based and focussed on results.

3.3 Draft guiding principles of Gum Arabic value chain development

FNS-REPRO activities are also designed to help communities make best sustainable use of local resources and manage challenges in innovative ways. Overarching principles of the work under the Gum Arabic component are:

- Use Gum Arabic as an entrance point to further restore the landscape area, including local shrubs and grasses. This includes sustainable considerations regarding water and soil conversation techniques
- Enhance the ability of vulnerable rural communities to adapt to climate change, by improving their technical, organisational, and commercial capacity to produce and market Gum Arabic.
- Developing capacities of local smallholder associations[17].

As part of the REPRO programme's learning agenda, these principles are tested, validated and adapted. Hence, they should rather be seen as a draft version at this stage.

[16] https://docs.wfp.org/api/documents/WFP-0000062320/download/

[17] REPRO proposal p. 30-32

3.4 Sudan: building local Gum Arabic System Resilience

3.4.1 Step 1: Define Gum Arabic system resilience as instrumental capacity

Gain/build key actors'/stakeholders' understanding of food / Gum Arabic system resilience as a functional capacity, through the following key questions for designing resilience interventions to build resilience:

- Resilience of what?
- Resilience to what?
- Resilience for whom?
- Resilience 'through what'?

This will provide the basic rationale for guiding the field-based Gum Arabic / food system resilience assessment and should clarify for local actors and stakeholders in the FoSRA the 'hows' and 'whys' of the FoSRA as a foundation for building resilient food systems.

For example in the case of REPRO Sudan, the rational would be: the resilience of Gum Arabic systems and respective connected livelihoods ('of what') towards key shocks & stresses such as droughts, pests, price volatility and conflicts ('to what') for agro-pastoralist households in North- and East-Darfur ('for whom') through strengthening and utilizing the potential of the Gum Arabic value chain for improving income generation ('through what'). This example reflects REPRO's Theory of Change (ToC).

However, the answers to those questions are likely to differ, depending on which of the varying actor groups is being asked - local beneficiaries, policy makers, or international experts. It is important to keep this in mind to mitigate any tensions caused by misunderstandings, and to create a dialogue to facilitate communication with one another in a transparent and productive manner. This also creates an organic starting point for programming decisions.

How to collect data: desk review and expert consultation

Information and data can be collected via a **desk review** of available national and local data and expert **consultations**. Data can be collected using any, or a combination of, the following ways:

- literature research, including policy docs and initiatives on promoting resilience
- documentation available through relevant institutions and fora such as FAO, specialised agencies, and professional bodies for example food security clusters
- use of expert knowledge (thematic/geography).

Data sources

Some general sources of relevant information are presented below.

- FSIN series on promoting FNS resilience[18](FSIN, n.d.).

3.4.2 Step 2: Define Gum Arabic / Food system boundaries: archetypes in protracted crises

In order to make a meaningful contribution to promoting Gum Arabic sector development in protracted crisis situations, REPRO in Sudan works in areas that show different food/ Gum Arabic system archetypes, all of which are typical for protracted crisis contexts.

Archetypes represent different patterns of food/ Gum Arabic system behaviour, offering unique leverage points for enabling changes that build more resilient Gum Arabic systems, thereby also improving FNS outcomes. In the case of Sudan, being the world's largest exporter of Gum Arabic, Gum Arabic producers involved in Gum Arabic activities are estimated to be up to 20 percent of Sudan's population, or around 6 million people, and are among the poorest and most vulnerable to food insecurity (Adam et al.,2016).

[18] https://www.fsinplatform.org/resilience-measurement

According to FAO Multi-Disciplinary Context Analysis Report[19] (2020), which was undertaken during REPRO's inception phase, Gum Arabic production in North- and East-Darfur, Gum Arabic production is challenged by a number of factors common in contexts of protracted crises, including: climate variability, pests and diseases, conflicts and insecurity, poor market access, poor infrastructure and lacking skills and tapping equipment, which result in an unutilized potential for the development of Darfur livelihoods. The percentage of the actual Gum Arabic tapping and collection in North-Darfur, compared to the existing hashab stands, is generally low: equivalent to 20 percent in total. The percentage of the actual Gum Arabic tapping and collection in East-Darfur, compared to the existing hashab stands, is on average even lower (10 percent) (Carucci et al., 2020). This potential can be utilized as a driver for development by developing pathways for increasing the resilience of the Gum Arabic system in Darfur.

How to collect data: desk review and expert consultation
Information and data can be collected via a **desk review** of available national and local data and expert **consultations**. Data can be collected using any of the following ways:

- literature research including policy documents and initiatives on promoting resilience
- documentation available through relevant institutions and fora such as FAO, specialised agencies, and professional bodies, for example food security clusters
- use of expert knowledge (thematic/geographical)

Data sources
Some general sources of relevant information (to be accessed geographically disaggregated) are presented below:

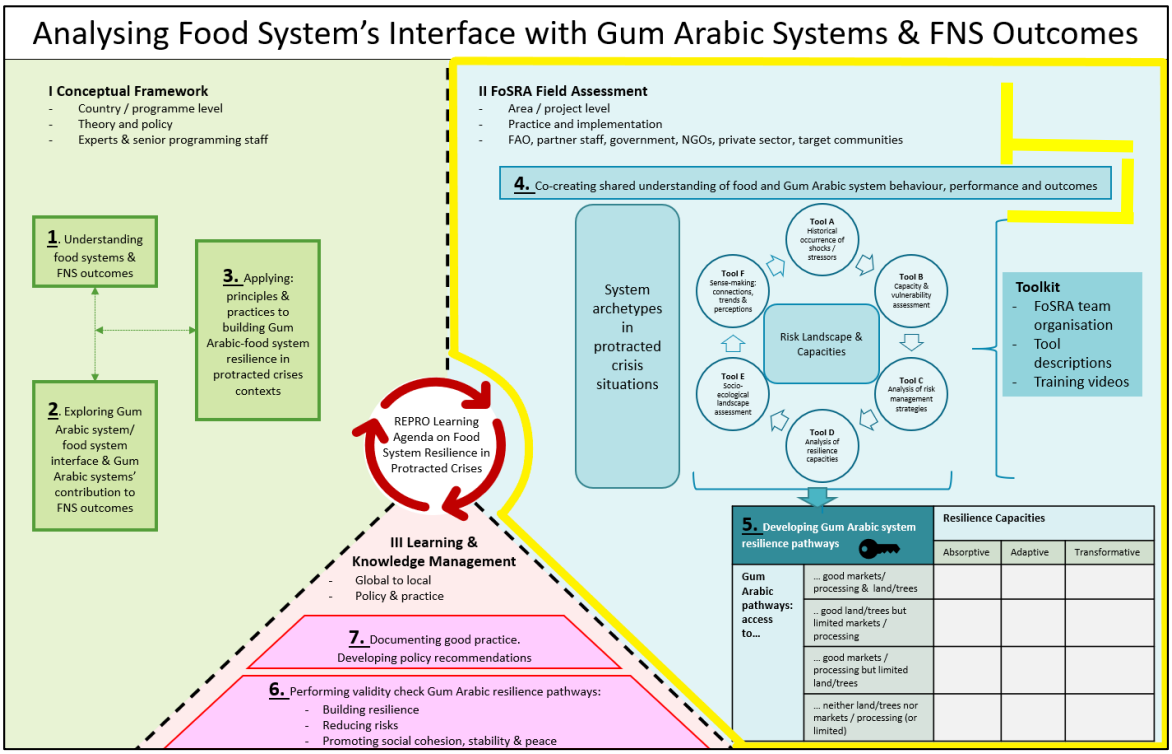
- FNS Sudan country profile and description:
  https://www.fsinplatform.org/global-report-food-crises-2020

- IPC country updates
  http://www.ipcinfo.org/ipcinfo-website/where-what/east-and-central-africa/sudan/en/

- Food Systems Dashboard for general information on country food systems
  https://foodsystemsdashboard.org/countrydashboard

[19] Michela Carucci, Tarig Elsheikh Mahmoud, Abdel Rahman Elmahdi and Mohamed El Mukhtar Ballal. 2020. FOOD AND NUTRITION SECURITY RESILIECE PROGRAMME (FNS-REPRO): Multi-dimensional context analysis in the North and East Darfur States, Sudan. FAO April 2020.

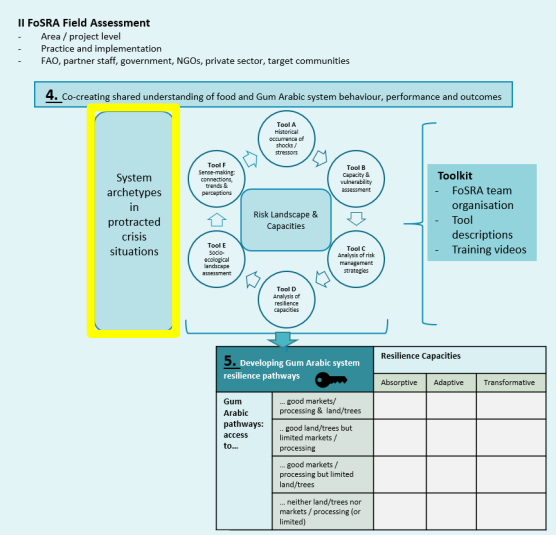
PART II – FoSRA-GA FIELD ASSESSMENT



Part II explains the field-based elements of the FoSRA assessment, looking at the definition of food-Gum Arabic system boundaries and archetypes, and explaining the relevance of comprehending system behaviour and dynamics in the face of shocks and stressors. The concept of resilience is clarified, and interactive tools to gather this data are integrated and can be explored. Finally, the resilience pathway matrix is introduced which supports the sense-making process of all gathered information from the field.

4 Component: Applying interactive tools to understand food-Gum Arabic systems and their behaviour

Output: understanding local Gum Arabic and food systems and their behaviour in the face of shocks and stressors.



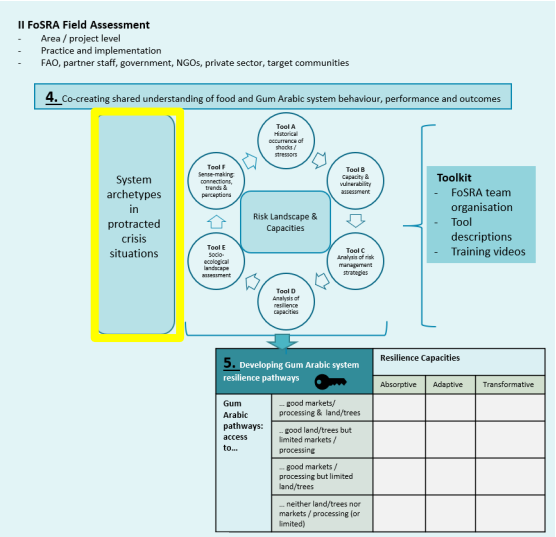
4.1 Define Gum Arabic system resilience as instrumental capacity

Validate the findings and insights from the national level (see component 3).

4.2 Set target system boundaries: archetypes in protracted crises

Develop with local actors and stakeholders the geographical boundaries of the main Gum Arabic system archetypes in the locality.

In the case of Darfur in Sudan, this includes North- and East-Darfur regions, and especially areas in which Gum Arabic is grown / traded and/or partially processed already. This lays the foundation for the identification of Gum Arabic pathways as explained in component 5.



4.3 Document major shocks and stressors impacting specific target systems

It is important to determine what the major shocks and stressors are in a particular area and how they have, in general, impacted the Gum Arabic system developments and their interfaces with overall food security.

Particular attention should be given to typical shocks/drivers impacting Gum Arabic systems, driving poor FNS outcomes in protracted crisis contexts; conflict/insecurity, economic shocks, and climate shocks.

Major shocks and stressors impacting Gum Arabic systems and respective food systems will be identified by local stakeholders and target communities, focusing on their impact on Gum Arabic systems and how these systems have changed as a result.

In focus group discussion (FGD) the most important shocks and stressors over the last 10-15 years should be identified and the impact on Gum Arabic as well as food systems should be discussed (this will be further detailed as part of Tool a) historical timeline in the toolkit).

Typical questions to be asked include:
- What are the most important shocks or stressors that impact Gum Arabic systems?
- What has changed as a result of that shock/stressor (separate for each shock/stressor on Gum Arabic systems), and why?
- What have been the consequences of these changes in dealing with future shocks and stressors?
- What resilience capacities in Gum Arabic systems have been instrumental for recovery of these systems for maintaining or improving FNS outcomes?

With regards to conflict and displacement it is important to mention that these often result in changes in land use. For example, displaced communities opening up new land close to their dwelling places.

So, an important question may be:
- Have shocks and stressors resulted in different land use patterns?
- Have shocks and stressors impacted the viability of livelihoods or production of Gum Arabic in general?

4.4 Identify resilience capacities and dynamics in Gum Arabic systems

From an analytical perspective, resilience in Gum Arabic systems focuses attention on the relationship between them, the impact of shocks and stressors, and the Gum Arabic systems' capacity to preserve and improve on FNS outcomes.

Building food system resilience involves strengthening its absorptive, adaptive, and transformative capacities, to cope with (and recover from) specific shocks and stressors. Understanding how different types of shocks and stressors affect local Gum Arabic system is fundamental to designing interventions that strengthen their system resilience.

The FoSRA adopts the 3-D resilience framework (Béné et al., 2012) to promote food system resilience capacities in the form of context-specific Gum Arabic pathways that strengthen absorptive, adaptive and/or transformational capacities as required for the local context and circumstances.

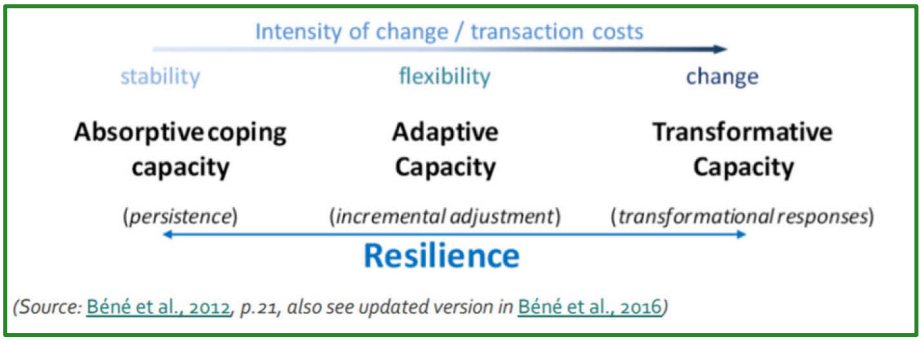
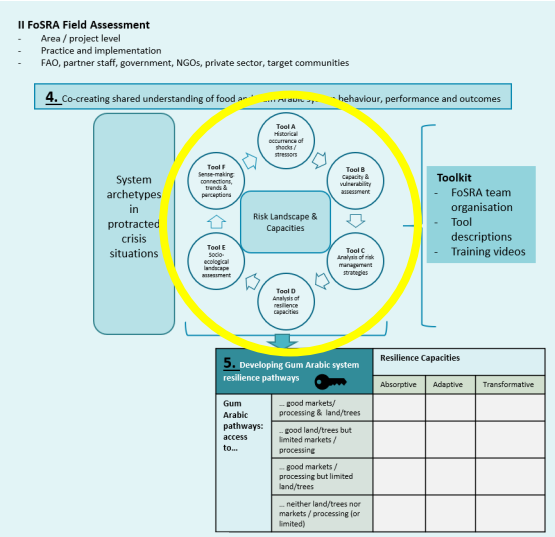


Figure 3 *The 3D resilience framework (FAO, 2015).*

How to collect data

- use of expert knowledge (thematic/geography); and
- interactive/participatory work with local stakeholders and community groups (KII, FGDs).

4.5 Analysing Food Systems via the Gum Arabic system



To analyse food systems in protracted crises contexts five tools have been developed. These analytical tools will identify and analyse data at household and local community level.

The tools map out and facilitate understanding of local food and Gum Arabic systems, how protracted crises affect them, and what actions are being or could be taken to improve resilience. They involve facilitators working with local farmers and/or stakeholders with surveys and workshops to analyse the following:

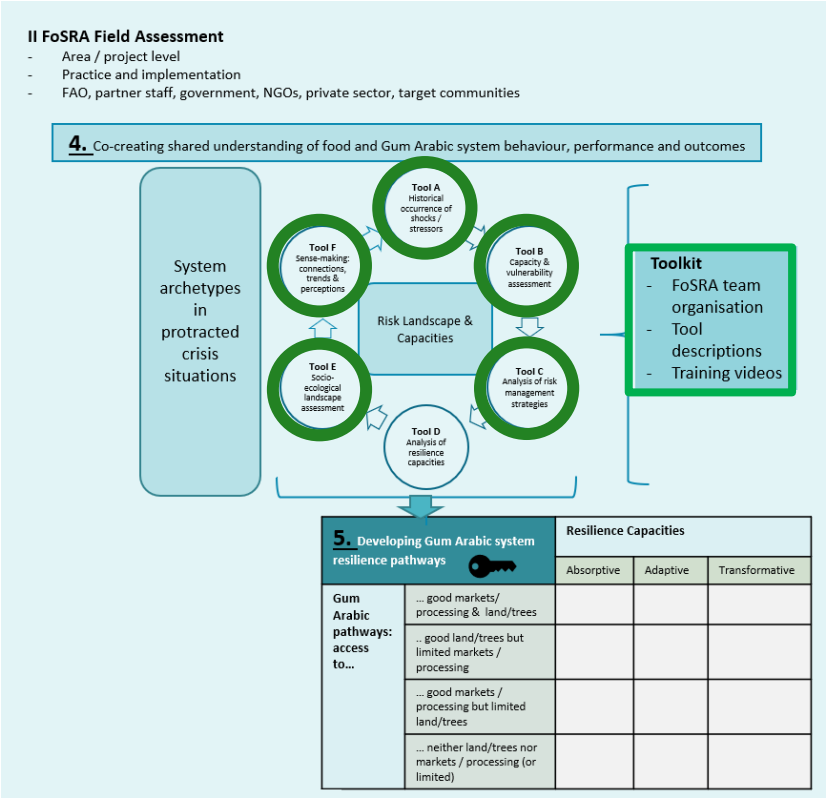
- Which shocks and stressors occurred in the area in the past 10 years (Tool A)
- Which vulnerabilities and capacities are present and required (Tool B)
- Which risk management strategies are prevalent and required (Tool C)
- Which resilience capacities are in place and required (Tool D)
- How communities and the (changing) ecological landscape interact with each other (Tool E); (this tool is still under revision and may be adapted or replaced / supplemented by short courses on landscape governance through a related educational project)
- How all the above logically link together from different perspectives (Tool F)

The tools are organized in six steps that, together, analyse local and regional food systems and give insights for designing appropriate and effective context specific interventions to strengthen food system resilience.

Each tool is connected to the following tools in a sequence, deepening their insights. Results are captured in report summaries, posters, and data sets, produced by the facilitators, that synthesises the information gained from all the workshops and outlines possible actions. This is a strong basis for the next component of the assessment; developing pathways that enable farmers in protracted crises to increase resilience in Gum Arabic systems, thus underpinning food system performance and improved FNS outcomes.

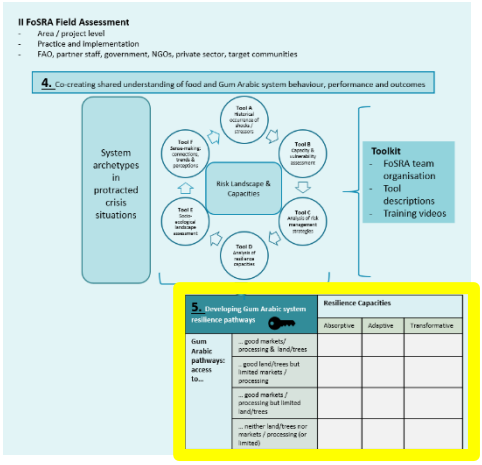
4.5.1 Exploring the FoSRA Tools

The tools can be explored through the framework extract below. Clicking on the respective tool opens the subsequent Appendix sections where the toolkit is placed.



5 Component: Develop resilience pathways

Output: development of local Gum Arabic system pathways, that address critical gaps in food system resilience and engage relevant actors.



This final step is the matchmaking process whereby policy goals, leverage points, spheres of influence, and policy instruments are brought together to inform food-Gum Arabic system resilience pathways that are relevant to local contexts and dynamics.

Accordingly, it is important to have a good overview of different segments of society within this context to determine who participates in the Gum Arabic sector and under what conditions. Key factors to consider are access to land and/or Gum Arabic trees and access to markets and processing facilities. For example, in North and East Darfur, one can distinguish between three main groups/ scenarios:

1. Those who have access to lands and trees consistmostly of the Gum Arabic upstream actors. Those are always the small-scale gum Arabic producers and the Gum Arabic Producer Associations' (GAPAs) members (70%) with full access to small and fragmented landholdings (less than 2 hectares). They have a limited number of trees ranging between 200 -500 trees/hectare. These entities access only rural (or small, mobile village) markets called Umdawarwar as they lack access to urban and central markets, where prices are better and value added activities such as processing are lacking. This results in lower prices or goods much lower in value compared to their gum harvest. Essentially whilst these actors can access land and trees, they have little to no access to markets aside from primitive and inefficient rural markets; this results in an unsatisfied food security status.
2. There are a few (10%) large scale gum Arabic producers represented by some large scale projects (e.g. Acacia project in Kordofan and Blue Nile) who have access to large areas (e.g. 10000 hectares) with densely packed trees and who also have good access to rural, urban, auction and export markets. Some even have good warehouses for processing.
3. Finally there are those that are considered as downstream value chain actors who are mostly city traders, processors and exporters that have full access to urban, auction and export markets as well as processing and value added activities, but mostly lack access to lands, trees or rural markets. A small number of this group do also access land and trees through contract farming with group 1 (upstream value chain actors

Gum Arabic resilience pathways are formulated based on the most promising leverage points that are within, or in reach of, policy goals as well as the spheres of influence of the policy maker, implementor and local communities.

Prioritisation can be done based on a qualitative assessment of costs versus expected systemic change, increased Gum Arabic system resilience capacities, and projected FNS outcomes (based on scenario planning).

5.1 Identify leverage points

Once key challenges in Gum Arabic systems have been defined, leverage points are identified to strengthen the resilience of Gum Arabic and subsequent food system outcomes. A leverage point is a place/characteristic in a system where a small shift in one factor or process can contribute significantly to building Gum Arabic system resilience.

How to collect data

- Deskwork
- Interactive / participatory work with local stakeholders and community groups (KII, FGDs).

5.2 Define spheres of influence

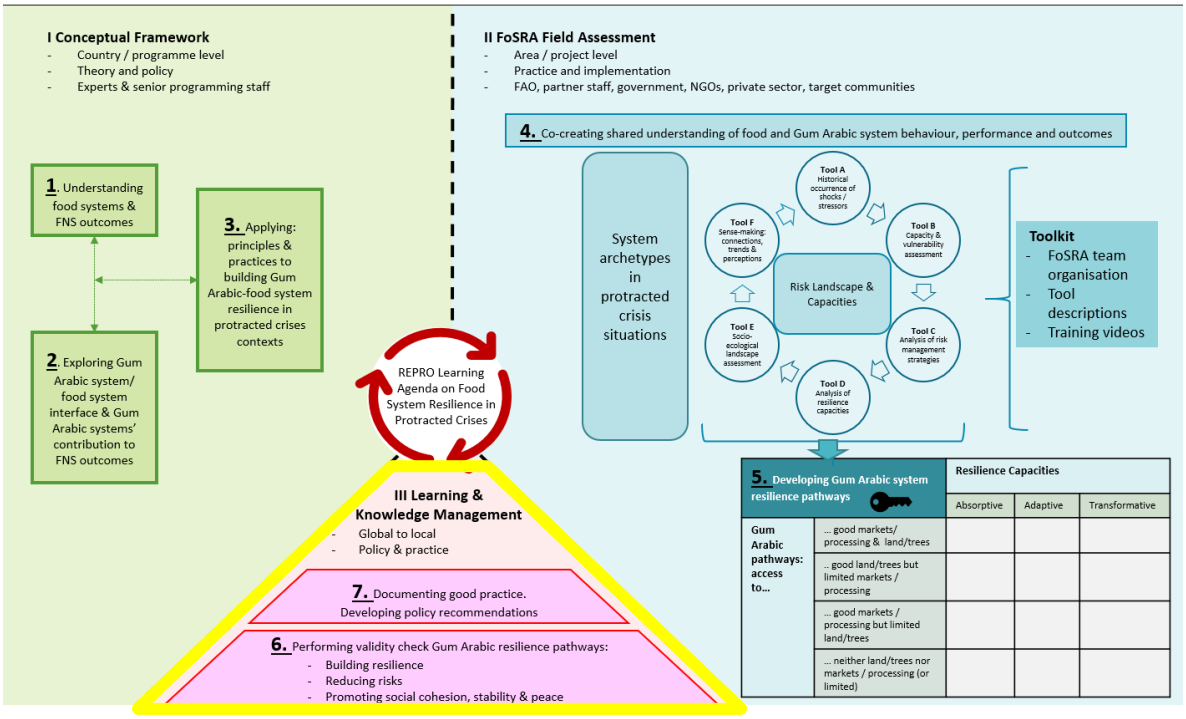
Understanding the Gum Arabic and food systems, their dynamics and resilience capacities is not sufficient to define actions. Understanding the dynamics of power and influence of actors is equally required for developing effective pathways to strengthening Gum Arabic systems and overall food system resilience. Understanding the stakeholders' domain, and identifying those that can activate leverage points, is a key element in the design of effective systems pathways.

How to collect data

- Deskwork
- Interactive / participatory work with local stakeholders and community groups (KII, FGDs).

PART III – LEARNING & KNOWLEDGE MANAGEMENT

Analysing Food System's Interface with Gum Arabic Systems & FNS Outcomes



Part III represents how the first two parts can be combined in a final validation, learning and knowledge management step. Validation against resilience principles and nexus thinking is introduced, followed by a conversation that aims to document good practices and to provide policy recommendations.

It is explained how the result of the assessment has multiple values in that it can support learning at a global level (for example through the Global Network Against Food Crises or its connection to UNSCR-2417) while simultaneously informing the local programming in the target area in an evidence-based, adaptive manner.

6 Component: Validate Specific Resilience Pathways

Output: Validate resilience system pathways to ensure that they contribute to sustainable and resilient FNS outcomes.

6.1 Various potential validation approaches

This report is a working document, and this section is still in the process of improvement and testing. It is still not decided if the validation will be specifically focussed on Gum Arabic systems or take a more holistic view on food systems and their outcomes. The validation process could take one of the following three shapes:

a. **A set of characteristics**. A list of characteristics of resilient food systems and communities will be generated on the basis of Twigg's characteristics of a disaster resilient community (Twigg, 2009) and the extension of his work that further included conflict-sensitivity by including 'safe' and resilient communities into the frame (Da Silva, et al., 2011). The newly created set of characteristics will extensively describe the ideal setting of what a resilient and safe community and food system in protracted crises situations would look like. The key aspects are flexible and can be selected according to their relevance in the local context.

b. **A nexus question list**. This includes key questions to ask from a humanitarian, developmental and peacebuilding perspective to ensure that all silos are considered when looking at the findings of the previous components of the document. Hence, the identified resilience pathways would be questioned to ensure that programming ensures long-term sustainability from all angles.

c. **A modified version of testing seed system approaches**. This option is based on Subedi and Vernooy (2019)'s work on seed systems but was adapted and made relevant to Gum Arabic systems. The following sections - 6.1.1 Criteria for resilience in food systems, and 6.1.2 Food System's contribution to social cohesion, peace, and stability - explain this option in further depth since this one has been developed already. However, this does not mean that this option is more valid than the others, it solely reflects REPRO's current stage of working progress.

6.1.1 Criteria for resilience in food systems

A proposed Gum Arabic system pathway must meet several criteria based on research and experience in order to be resilient. Subedi and Vernooy's (2019)[20] concepts on seed systems were adapted to match Gum Arabic systems as well. According to this, a resilient Gum Arabic system:

- relies on the ability of Gum Arabic system actors to absorb disturbances, regroup, or reorganize, and adapt to shocks and stressors
- results from multiple Gum Arabic knowledge interactions and continuous learning among Gum Arabic system actors and related institutions
- is demand-driven and responsive to differentiated needs and interests, supporting all users and farming systems
- recognizes, respects, and supports the key roles played by women farmers as Gum Arabic custodians, managers, networkers, and entrepreneurs.

[20] Based on 'Healthy food systems require resilient seed systems': https://cgspace.cgiar.org/handle/10568/105871

6.1.2 Food systems' contribution to social cohesion, peace, and stability

Developing local Gum Arabic system pathways in fragile and conflict affected contexts can be instrumental in sustaining peace (FAO, 2018)[21]. In praxis this means a focus on social cohesion as a pathway to positive local collective action, for instance through providing equitable access to entering the value chain.

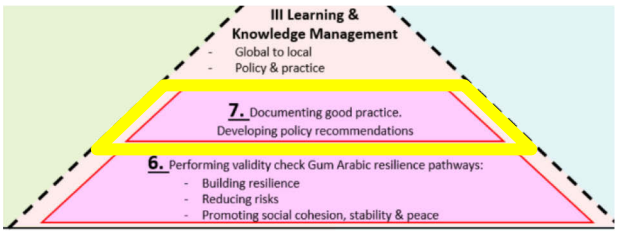
In promoting the contribution of Gum Arabic systems to peace and stability, FAO recommends the following:

- Invest in better understanding of the local context and sequence interventions, such as designing peacebuilding and agricultural development strategies in a complementary manner; that is, beyond conflict sensitivity, into active analysis and collaboration.
- The focus should be on locally owned action rather than external actors. Peacebuilding in this context involves the restoration of a network of relationships or new arrangements for inclusive and participatory governance.
- Set examples that demonstrate a shift in approach; that is, away from focusing on risks, to one highlighting opportunities.

[21] FAO. 2018. Farmer seed systems and sustaining peace: http://www.fao.org/3/ca1793en/CA1793EN.pdf

7 Component: Policy and Practice

Output: Documentation of good practice and formulation of policy recommendations for all suitable levels and insights for adaptive REPRO programming.



This step brings together the insights of the assessment, the local level actions and the global.

Policy recommendations can cover all suitable levels, from regional / national governments to the Global Network Against Food Crises[22] (2020).

The same applies for documenting good practices, contributing to the creation of an evidence-base of approaches that worked in specific protracted crisis contexts for Gum Arabic systems and their interface with the overall local food system.

Good practices can relate to food system resilience in general, or to Gum Arabic systems and their interface with food systems.

Questions that can help in this step are:
- What were the most insightful learnings of the assessment/ action?
- How should these learnings be documented to create a reliable evidence base for future programmes and governance decisions?
- Are policies and practices logically aligned or support each other?
- Are there goals between policy and desirable practice?
- How can policies adapted to reinforce good practices?
- How can these insights be useful in other contexts in the region or even globally?

Insights can further be used to inform the design and strategy of programmes that aim to build resilient food systems by targeting the underpinning Gum Arabic systems.

[22] http://www.fightfoodcrises.net/

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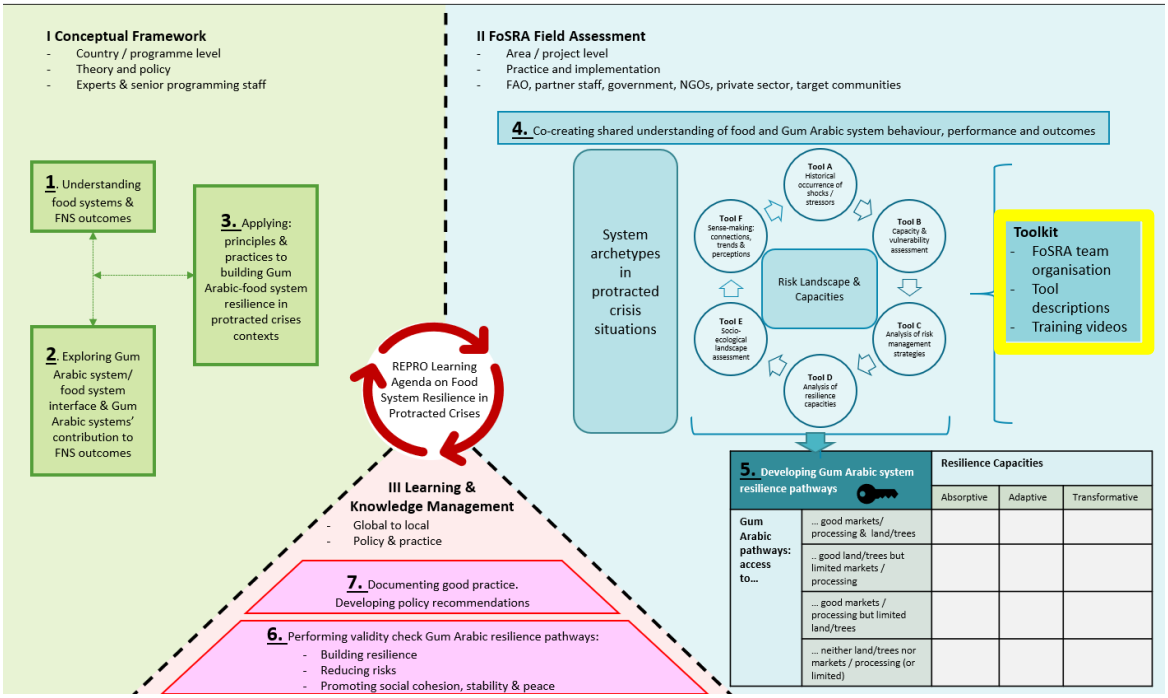
APPENDICES

Appendix 1 Toolbox

Analysing Food System's Interface with Gum Arabic Systems & FNS Outcomes



Appendix 1, the Toolbox, is the practical element of part II since it details tool descriptions and respective facilitation guides. Furthermore, it includes training presentations, training videos and other practical information that inform how the tools can be used best to gather information.

A1 Building local capacity for undertaking the FoSRA

FoSRA training PowerPoints have been developed to support and facilitate capacity building workshops for undertaking FoSRA data collection under FNS-REPRO in Somaliland (February & September 2020) and Sudan (October 2020).

The FoSRA training PowerPoints are developed to match each country's thematic focus, Gum Arabic, and are continuously updated and improved. As such, the materials are to be seen as a work in progress.

The PowerPoints can be accessed on Google Drive through the following link:
https://drive.google.com/drive/folders/1PZtSYZv03bRHM3W1r8jdaCeL_Dyq7AQe?usp=sharing

A2 Employing the FoSRA tools

This component provides an in-depth explanation of the different, recommended tools to undertake the FoSRA.

The tools are organized in six steps that, in combination, analyse how shocks and stressors impact the local food system with a specific focus point on the interface of the selected target system (Gum Arabic system) and the FNS outcomes. The tools generate insights for designing appropriate and effective context specific interventions to strengthen food system resilience:

- Tool a) Identifying shocks and stressors over time and their impacts on livelihoods
- Tool b) Identifying existing capacities and vulnerabilities in face of shocks and stressors
- Tool c) Comprehending existing risk management strategies facing shocks and stressors
- Tool d) Understanding prevailing resilience capacities to deal with shocks and stressors
- Tool e) Understanding dynamics and interactions between the natural environment and human activities
- Tool f) Sense-making: connections, trends, and perceptions

Each step results in a report, produced by the facilitators, that synthesises the information gained from all the workshops and outlines possible actions. This is a strong basis for the following component of the assessment; developing pathways that enable farmers in protracted crises to increase resilience in Gum Arabic systems, thus underpinning food system performance and improved FNS outcomes.

Tool A: Historical Timeline of Shocks & Stressors

Purpose: to identify recurring shock/stressors in geographic target areas which occurred in the last 10 years looking at frequency and impact.

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.

By: facilitating a participatory discussion capturing local knowledge and understanding by drawing a historical timeline of shocks and stressors on a flip chart with markers.

Duration: approximately 45 minutes.

Tool B: Vulnerabilities & Capacities in Face of Shocks & Stressors

Purpose: to identify livelihood capacities and vulnerabilities of target communities / livelihood groups at 'one point in time' in the face of a shock and/or stressor.

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.

By: facilitating a participatory discussion capturing local knowledge and understanding by drawing and filling a vulnerabilities and capacities matrix (CVA matrix) a on a flip chart with markers.

Duration: approximately 45 minutes.

Tool C: Risk Management Strategies facing Shocks & Stressors

Purpose: to identify and understand risk management strategies that are present in target communities / livelihood groups, in the face of recurring and impacting shocks/stressors in geographic target areas.

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.
By: facilitating a participatory discussion capturing local knowledge and understanding by drawing and filling in a risk management strategies table making use of a flip chart and markers.
Duration: approximately 45 minutes.

Tool D: Resilience Capacities & Strategies facing Shocks & Stressors

Purpose: to identify resilience capacities of target communities / livelihood groups for building/strengthening resilience of livelihoods in the face of shocks/stressors.
Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.
By: facilitating a participatory discussion capturing local knowledge and understanding by drawing and filling in a resilience capacities table making use of a flip chart and markers.
Duration: approximately 45 minutes.

Tool E: Socio-Ecological Landscape Assessment

Purpose: understanding the interconnections of the natural environment and socio-economic aspects to local communities (in order to ensure long-term sustainability and governance dynamics that determine land access etc.).
Through: a community and individual scoring process to map perceptions of changes in socio-economic landscape dynamics and trends vis-à-vis development of livestock pathways.
By: facilitating a community workshop and discussion.
Duration: approximately half a day.

Tool F: Key Informant Interview Format

Purpose: mapping perceptions on change and its implications for food system resilience programming, deepening understanding on critical elements for food system resilience programming that are discovered in tool 1 -4.
Through: stories of Change with key informants including: local community leadership, representatives of key ministries, relevant private sector actors, NGO and other international organisation staff.
By: facilitating a qualitative and in-depth discussion with a key-informant.
Duration: approximately 1.5 hours**.**

In summary

Together, the six steps and tools therein described above provide a thorough and effective method of analysing food systems and their specific target points at a local and state level and form a robust basis for developing intervention pathways that will contribute to their system resilience.

Moreover, the analysis itself increases resilience as local farmers and other stakeholders by taking part in a process to co-create understanding of Gum Arabic systems and food system behaviour create a foundation to implementing commonly agreed upon resilience system pathways.

A3 FoSRA Tools' Facilitation Guides

FoSRA Tool a: Historical Timeline of Shocks and Stressors

Why Assessing the History of Shocks and Stressors?

Purpose: Identification and prioritization of shocks & stressors

A resilience approach acknowledges the need to measure shocks and stressors within complex systems and over extended periods of time[23] (Mock et al., 2015) [24]. To identify recurring shock and stressors (hazards) in REPRO target areas which occurred in the last 10 years and considering impacts, is the starting point for gaining an understanding on critical food system behaviour in face of shocks and stressors.

In the field of development, shocks have been defined as "external short-term deviations from long-term trends, deviations that have substantial negative effects on people's current state of well-being, level of assets, livelihoods, or safety, or their ability to withstand future shocks" (Zseleczky and Yosef, 2014) [25].

In contrast, stressors are long-term pressures (e.g. degradation of natural resources, urbanization, political instability or diminishing social capital) that undermine the stability of a system (i.e. political, security, economic, social or environmental) and increase vulnerability within it (Bujones et al., 2013) [26].

Communities often face a wide variety of hazards. Each hazard has its own unique impact and thus, one needs to identify which hazard occurs most frequently and/or has the most severe impact on the livelihoods of people in target areas in order to formulate strategies to address the impact.

The nature of protracted crises is that they are long-term and cannot be understood without looking into the past – its impacts are long-term and develop over time. One can learn lessons by exploring the pasts these crises develop over time scales and spaces.

To address hazard impacts in a protracted setting, it is useful to regard them in their interaction and sequence to each other, gaining a deeper understanding of the risks faced by the community.

Identified hazards have to be prioritized in order to further define which shocks and stressors are to be explored sequential in tools 2, 3 and 4.

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[23] See also FSIN Technical Paper 2. Resilience is to be observed at a given point in time and over extended periods because the effects of resilience capacity are path-dependent and time-sensitive (FSIN Technical paper2; p13).

[24] Systems Analysis in the Context of Resilience: https://www.researchgate.net/publication/282575135_Systems_Analysis_in_the_Context_of_Resilience

[25] Are Shocks becoming More Frequent or Intense?: https://www.ifpri.org/publication/are-shocks-becoming-more-frequent-or-intense

[26] A FRAMEWORK FOR ANALYZING RESILIENCE IN FRAGILE AND CONFLICT-AFFECTED SITUATIONS, USAID: https://www.sipa.columbia.edu/academics/capstone-projects/framework-analyzing-resilience-fragile-and-conflict-affected-situations

How to Assess the History of Shocks and Stressors?

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.

By: facilitating a participatory discussion capturing local knowledge and understanding by making use of a flip chart and markers.

Duration: approximately 45 minutes.

Use: sheet A1 or a flipchart for filling in the timeline.

Steps to Follow

Ask the groups to draw a disaster (shocks and stressors) timeline (see figure….) and answer the questions below:

<u>Step 1: Identifying shocks and stressors having occurred over the last 10 years</u>

- Make a clear difference between **'shock'** and '**stressor**'
- Note down a **top 3** according to **frequency** and make a **top 3** according to **impact** with a historical timeline on sheet A1 or on a flipchart

<u>Step 2: Identifying impact of shocks and stressors</u>

- What are **3 key impacts** of the most impactful **shock** or **stressor** on your **livelihood**?

➢ **Key impact 1 (most important):**

➢ **Key impact 2 (2nd most important):**

➢ **Key impact 3 (3rd most important):**

<u>Step 3: Discussion – most worrying shock or stressor</u>

- Which shock or stressor do you worry about the most and why? **Please explain clearly.**
- Mention and describe **3 most important aspects** from most worrisome to least worrisome.

Most important shock or stressor that you worry about:

➢ **Reason 1 (most important):**

➢ **Reason 2 (2nd most important):**

➢ **Reason 3 (3rd most important):**

Use the most worrying shock or stressor that is identified here in the following exercises 2- 4.

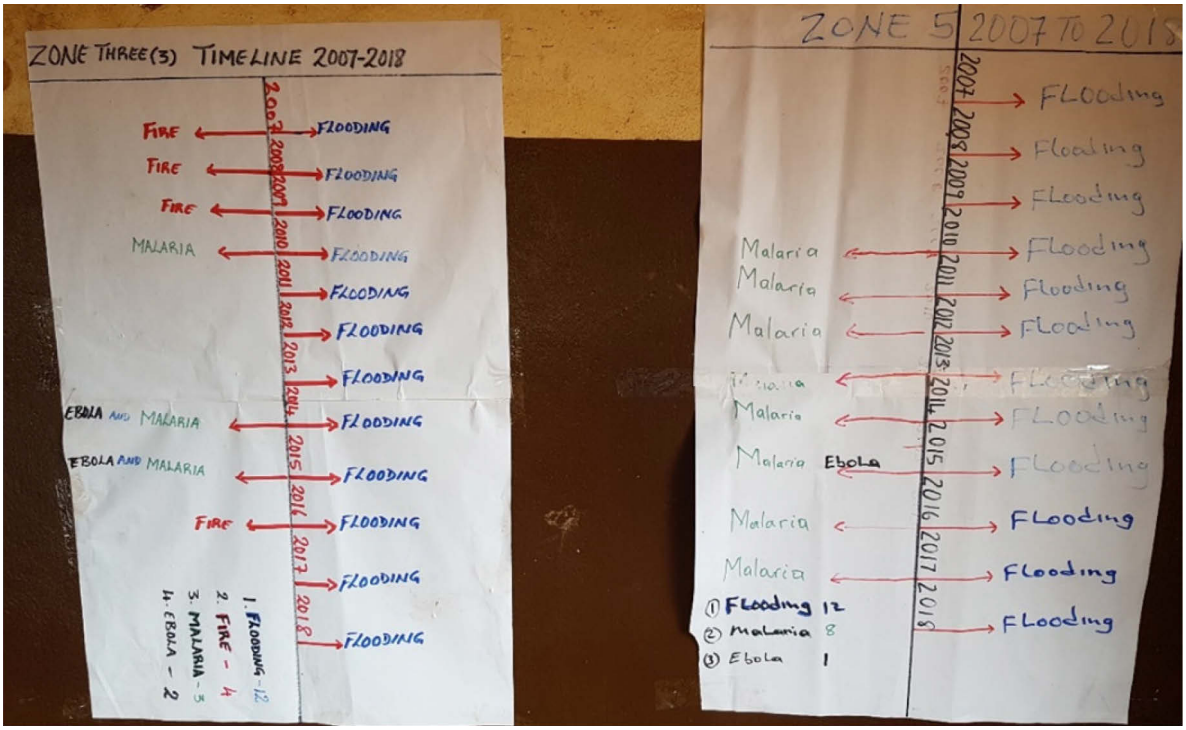

Figure 6 *Example of a disaster timeline (Source: Eelke Boerema).*

Disaster Timeline Sheet

Year	Shock	Stressor
2020	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2019	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2018	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2017	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2016	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2015	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2014	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2013	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2012	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2011	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
2010	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____
Top	Rank 1)_____	Rank 1)_____
	Rank 2)_____	Rank 2)_____
	Rank 3)_____	Rank 3)_____

FoSRA Tool b: Capacity and Vulnerability Assessment

Why Assessing Capacities and Vulnerabilities?

Purpose: to identify livelihood capacities and vulnerabilities at 'one point in time' in the face of a shock and/or stressor.

This exercise identifies **vulnerabilities** and **capacities** of groups, communities, individuals, or livelihoods in face of a **specific shock or stressor**. The basis of the CVA framework, as described in by Anderson and Woodrow[27], is a simple matrix for viewing people's vulnerabilities and capacities in four broad, interrelated areas: physical/material, social/organisational, motivational/attitudinal and political/institutional[28] (see Figure 3). **Vulnerability** is composed of different interrelating factors along these four dimensions. On the other hand, groups, communities, individuals or livelihoods typically have **capacities** that can address these **vulnerabilities** in order to reduce risk for disasters.

How to Assess Capacities and Vulnerabilities?

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths

By: facilitating a participatory discussion capturing local knowledge and understanding by making use of a flip chart and marker

Duration: approximately 45 minutes

Use: sheet A2 or a flipchart for filling in the CVA

Steps to Follow

Step 1: Identification of capacities and vulnerabilities in the face of shocks and stressors

- Use CVA table on sheet A2 identify **vulnerabilities and capacities** of your community or livelihood group in the face of the **most impactful shock/stressor** which was identified in **tool 1**
- Describe in the top left of the table which shock/stressor is examined and describe capacities and vulnerabilities in face of this shock or stressor in the CVA table on sheet A2 or on a flipchart

Shock or Stressor: Drought	Vulnerabilities	Capacities (what is in place)
Physical/material (what productive resources, skills, and hazards exists?)	Lack of proper infrastructure such as bridges, dams, water piping. Lack of financial resources	Simple technology for warning systems, Improved distribution of water gauges
Social/Organisational (what are the relations and organization among people?)	Unwillingness to leave, Bottom up approach to risk, Socio-economic restraints force them to stay	Social cohesion, cooperation between scientists and communities, awareness of present risk
Motivational/Attitudinal (how does the group/community view its ability to change?)	Religious and cultural restraints prevent affected from acting	Recognition of the need of community involvement. Increased awareness and willingness to reduce risk
Political/Institutional (what are political/institutional capacities or vulnerabilities?) (Political is optional, depending on the level of political sensitivities in the context)	Institutional action mainly focussed around relief, Dissonance between responsibilities of local government and their actions, responsible for evacuations but delegating that responsibility to civil society	Civil society organisations and community representatives take on a large role in risk reduction, organizing evacuation, warning and informing communities of risk and onset.

Figure 7 *Example of a CVA table (Eelke Boerema).*

[27] The CVA is described in detail in Anderson' and Woodrow's 'Rising from the Ashes' (1989).

[28] A fourth dimension was added to the CVA exercise, namely political/institutional, by the authors of this report to make the CVA more sensitive for assessments in contexts of protracted crises.

Sheet A2: CVA Table		
Describe Shock / Stress _____	**Vulnerabilities**	**Capacities**
Physical/material (what productive resources, skills, and hazards exists?) e.g. environmental degradation, unsafe/safe infrastructure	1) 2) 3)	1) 2) 3)
Social/Organisational (what are the relations and organization among people?) e.g. level of education, presence of social safety nets, vulnerable livelihoods,	1) 2) 3)	1) 2) 3)
Motivational/Attitudinal (how does the group/community view its ability to change?) e.g. community's view of its ability to create change	1) 2) 3)	1) 2) 3)
Political/Institutional (structures, decision-making processes, power relations affecting responses) (Political is optional, depending on the level of political sensitivities in the context)	1) 2) 3)	1) 2) 3)

FoSRA Tool c: Risk Management Strategies

Why_Analysing Risk Management Strategies?

Purpose: to identify and understand risk management strategies that are existing in communities/localities/livelihood groups. Following the rationale of the Disaster Risk Management Cycle (DRMC), risk management strategies are proposed along four interrelated phases; preparation, mitigation, response and recovery[29], in the face of recurring and impacting shocks/stressors. For REPRO's purpose, the 'response' phase is replaced with 'coping' strategies[30].

This tool is applied in REPRO programme areas, with the purpose to determine to what extent do communities, individuals, households, livelihood groups:

- **prepare** for impacts from shock/stressor
- **mitigate** the negative effects from a shock/stressor (before or during)
- **cope** with negative effects while it is happening
- **recover** from a disaster after it has happened

How_to Analyse Risk Management Strategies?

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.

By: facilitating a participatory discussion capturing local knowledge and understanding by making use of a flip chart and markers.

Duration: approximately 45 minutes.

Use: sheet A3 or a flipchart for filling in Risk Management Strategies.

Steps to Follow

Step 1: Discussion - identification on risk management strategies

- Use the **most impactful shocks and stressors as identified in tool 1 and 2** and ask each group to think of risk management strategies applied when dealing with this shock/stressor
- Ask each of the groups to **answer the following questions related to risk management strategies** in the face of the **most impactful shock/stressor** as identified in tool 1 and 2:

➢ How does your community / livelihood group / region **prepare** for a disaster before it happens?
  - E.g. preparedness plans; emergency exercises/training; early-warning systems.

➢ How does your community / livelihood group / region **minimize (mitigate)** the negative impacts of a disaster?
  - E.g. building codes and zoning; vulnerability analyses; public education.

➢ How does your community / livelihood group / region **cope** while they are being affected by a disaster?
  - E.g. ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters.

[29] The DRMC is described in detail in; Disaster Management Cycle, a Theoretical Approach, Vasilescu et al (2008).
[30] As disaster response is often relatively absent in protracted crises, a more detailed focus is given to coping strategies.

- How does you community / livelihood group / region **recover** from a disaster after it has happened?
  - E.g. humanitarian aid, temporary housing, savings, grants, medical care.

- Which of the identified factors from the above questions are done by the community/locality/livelihood groups **themselves (internal)** and which are done by **outside actors (external)**?

Step 2: Describe risk management strategies in the face of a shock or stress

- Describe in the top left of the table which **shock** or **stressor** is used and fill in the **risk management strategies** on sheet A3 or on a flipchart
- Make a difference between 'internal' strategies, referring to risk management strategies employed by people within the community and 'external' strategies, referring to risk management strategies employed by outsiders from the community.

Sheet A3: Risk Management Strategies				
Describe the specific **Shock/Stressor:**_____				
Prepare for a disaster **(preparedness)**	Minimizing effects of a disaster **(mitigation)**	Cope with a disaster **(coping)**	Recover from a disaster **(recovery)**	
1) 2) 3)	1) 2) 3)	1) 2) 3)	1) 2) 3)	**Internal Perspective** (what communities do themselves)
1) 2) 3)	1) 2) 3)	1) 2) 3)	1) 2) 3)	**External perspective** (support coming from outside, e.g. government or international organisations)

FoSRA Tool d: Resilience Capacities

Why Identifying Resilience Capacities?

Purpose: to identify capacities for building/strengthening resilience of livelihoods in the face of shocks/stressors.

The 3-D Resilience Framework (see Figure 4), Béné et al (2012), proposes that resilience emerges as the result of three capacities: absorptive, adaptive and transformative capacities. Each capacity leads to a different outcome: persistence, incremental adjustment, or transformational responses. Building **resilience** involves making investments that strengthen the **absorptive**, **adaptive** and **transformative capacities** of vulnerable populations to cope with and recover from specific shocks and stressors.

In studying **food system resilience,** it is important to understand how **community resilience capacities** are maintained or change over time and place as a result of impacting shocks/stressors. Gaining this insight will also help to develop scenarios to invest in building community resilience.

REPRO will utilise the 3-D Resilience Framework (Béné et al., 2012) to map resilience capacities and their outcomes across main shocks and stressors.

How to Identify Resilience Capacities?

Through: a focus group discussion with 6-10 (male, female, youth and/or mixed) local representatives of predominant livelihood groups (i.e. farmers, pastoralists), target communities, elders and youths.

By: facilitating a participatory discussion capturing local knowledge and understanding by making use of a flip chart and markers.

Duration: approximately 45 minutes.

Use: sheet A4 or a flipchart for filling in Resilience Capacities.

Steps to Follow

Step 1: Discussion – identification of resilience capacities in the face of a shock or stress

- Discuss on the existence, or absence, of resilience capacities in the community

Step 2: Describe resilience capacities in the face of a shock or stress

- The table makes a difference between **capacities that are already in place (1st row – existing capacities)** and **capacities that are missing but required (2nd row – capacity gaps)**
- Note down the most impactful shock or stressor which was used in tool 1-3 and fill in the Resilience Capacities Table in sheet A4 or on a flipchart

Absorptive capacity	Adaptive capacity	Transformative capacity
The capacity to withstand threats and minimize exposure to shocks and stressors through preventative measures and appropriate coping strategies to avoid permanent, negative impacts.	The capacity to adapt to new options in the face of crisis by making proactive and informed choices about alternative livelihood strategies based on an understanding of changing conditions.	The capacity to transform the set of livelihood choices available through empowerment and growth, including governance mechanisms, policies/regulations, infrastructure, community networks, and formal and informal social protection mechanisms that constitute an enabling environment for systemic change.

Figure 4 *The Three Resilience Capacities (FAO, 2015).*

Sheet A4 Resilience Capacities			
Describe the specific **Shock/Stressor:** _____	**Absorptive capacity:** Ability to preserve/restore essential basic structures and functions	**Adaptive capacity:** System continues to function without major changes or issues	**Transformative capacity:** Shock/stress does not have any effect on the community
Present capacities to withstand shock/stressor: (in place in the community)	1) 2) 3)	1) 2) 3)	1) 2) 3)

Required capacities to withstand shock/stressor (missing in the community)	1) 2) 3)	1) 2) 3)	1) 2) 3)

FoSRA Tool e: Socio-ecological Landscapes

The tool is not standalone. It will be reinforced with a link to other regional projects that align with the FNS-REPRO project -NUFFIC funded training and institutional collaboration projects- which will develop a landscape-oriented short course that will align with these topics.

WHY **analyse the socio-ecological landscape?**

- Important to acknowledge connections to ecological environment & long-term sustainability, human wellbeing linked with ecological balance. Dependence on natural environment needs to be accounted for when planning sustainable food system interventions, for example related to Gum Arabic
- (Stable) access to land and resources as central to food system resilience (and awareness of existing tensions/ clashes about management of / access to the natural environment)
- Governance (formal/ informal) of resources is critical to ensure a management that supports/promotes sustainable livelihoods, for example related to Gum Arabic (also in light of climate change and resulting impacts on the usability of local landscapes over time), and peaceful living
- Diversity of natural landscapes as well as agricultural crops is tightly linked with resilience & climate action -> requires understanding of existing diversity and its tends
- Innovation & knowledge transfer from women or elders determines trends in how the natural environment is used and cared for

HOW **should a socio-ecological landscape analysis be conducted?**

General guidance

- Group size, number of workshops, duration of sessions when implementing it, timing of day (to not interfere with their work) and resources required / available
- Who? Gender, returnees, IDP's, agro-pastoralists etc.
- Box 1 presents thematic categorise including the questions for later community scoring

Box 1: Indicators categories including key questions, adapted from: **Invalid source specified**.

Diversity

1. Is the landscape composed of diverse natural ecosystems and land uses?
2. Are different local crops, varieties and animal breeds conserved and used in the community?
3. Is agricultural biodiversity and associated knowledge documented and exchanged?

Governance of landscapes / natural environment

4. Does the community have customary/formally recognized rights over land, (seasonal) pastures, water & natural resources?
5. Is there connection, coordination and cooperation within and between communities for natural resource management?
6. Are common resources managed sustainably?
7. Are ecological interactions between different landscape components considered while managing natural resources?

Accessibility & mobility

8. Is access to resources and subsequent livelihood opportunities fair and equitable for all community members, including women, at household, community and landscape level?
9. Are households and communities able to move around between different production activities and locations as necessary (specifically access dimensions of grazing areas and markets)?
10. Are their tensions/ clashes/ conflicts related to the management or accessibility of natural resources?

Conservation practices

11. Are any of these landscape areas (formally or informally) protected?
12. Do current community activities (for example livelihoods) impact the natural environment negatively?
13. Do current community activities (for example livelihoods) impact the natural environment positively?

Resilience of natural environment

14. Does the landscape have the ability to recover and regenerate after extreme environmental shocks (e.g. rangelands after severe droughts or floods)?

Nutrition / local production & consumption

15. Does the community consume a diversity of locally produced food?

Innovation & knowledge transfer

16. Does the community develop, improve and adopt new (agricultural or conservation) practises and / or revitalises traditional ones to adapt to changing conditions, including climate change?
17. Does the community develop innovative use of the local biodiversity for its livelihoods?
18. Are local knowledge and cultural traditions related to biodiversity transmitted from elders and parents to their youth?
19. Are women's knowledge, experiences & skills recognised and respected at household, community and landscape levels?

Step 1: Building a Common Understanding of the Landscape and changes over time therein

Introduction, participatory mapping (building of a common ground of landscape boundaries and prevalence of types of landscapes and how they changed over time, e.g. through climate change, population pressure etc.)

Step 2: Clarifying Concepts: Biodiversity, Resilience

a. Discussion of biodiversity: discuss list of examples of agricultural diversity (crops but maybe also wildlife since larger wildlife may destroy crops while others, such as bees, may be beneficial)
b. Resilience: brief discussion (if not done through prior tools & groups may be the same) – explain resilience, explain adaption, refer to timeline of shocks/ stressors from tool a)

Step 3: Explanation of Indicators & process

- Talk through the indicator categories, ensure that an understanding of questions is given and consistent between participants
- Explaining the scoring process itself, (individual, group), which scale (e.g. 0-10)
- Explain how trends are indicated through arrows (increasing over time, stays the same, decreasing over time (variations in the middle can be used, reflecting the strength of a particular trend:

Step 4: Scoring

(via stones in a pile, white / black board, paper, poster etc.) & trends (5 or 10 years?)

a. Individual scoring
b. Group scoring (added up from individuals or doing a new group vote, but then discussed in plenary or small groups, see also step 5)

Indicator Question number	Name		Name		Name		Name		Group Consensus	
	Score	Trend	Score	Trend	Score	Trend	Score	Trend	Score	Trend
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										

Box: Matrix to Capture Results - Communities' scores and trends

Step 5: Group Discussion

- Going through the final score sheet and discuss reasons, weaknesses and strength of their landscape etc.

FoSRA Tool f: Sense-making - Key Informant Interviews

Mapping perceptions on change and its implications for FNS programming through *Stories of Change* (key-informant interview) with the following participants (1.5 hour in total):

- local community leadership (focus interview on community-level perspective of the key-informant)
- community elders or spiritual leaders (focus interview on community-level perspective of the key informant)
- representatives of relevant ministries including agriculture/forestry/livestock/water at locality level (focus interview on the sectoral perspective of the key-informant)
- relevant private sector companies (focus interview on private-sector perspective of the key-informant)
- NGOs/international organisations (focus interview on humanitarian-development-peace perspective of the key-informant)

Shocks & Stressors:

1. What have been **main changes** in the **nature and number** of shocks and stressors over the last 10 years?
2. What have been the **main changes** in terms of **impacts** of shocks and stressors on the lives and livelihoods of people over the last 10 years?
3. What do you think should or can be do about this?

Risk Management Strategies:

1. What have been the **main changes** in **preparing** for the impacts by shocks and stressors over the last 10 years?;
2. What have been the **main changes** in **reducing the impacts** (mitigation) of shocks and stressors over the last 10 years?
3. What have been the **main changes** in **coping** with the impacts of shocks and stressors over the last 10 years?
4. What have been the **main changes** in terms of **recovering** from the impacts of shocks and stressors over the last 10 years?

Resilience Capacities:

1. What have been the **main changes** in the **capacity to withstand** (absorptive) the impact of shocks and stressors over the last 10 years?
2. What have been the **main changes** in the **capacity to adapt** (adaptive) to alternative livelihood options in the face of shocks and stressors over the last 10 years?
3. What have been the **main changes** in the **capacity to transform** (transformative) to new livelihood strategies in the face of shocks and stresses over the last 10 years?

Gum Arabic Programming:

1. What beneficiary/community **needs** should be considered in design & implementation of Gum Arabic Programming?
2. what beneficiary/community **preferences** should be considered in design & implementation of Gum Arabic Programming?
3. what beneficiary/community **existing capacities** should be considered in design & implementation of Gum Arabic Programming?

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Wageningen Centre for Development Innovation supports value creation by strengthening capacities for sustainable development. As the international expertise and capacity building institute of Wageningen University & Research we bring knowledge into action, with the aim to explore the potential of nature to improve the quality of life. With approximately 30 locations, 6,800 members (6,000 fte) of staff and 12,900 students, Wageningen University & Research is a world leader in its domain. An integral way of working, and cooperation between the exact sciences and the technological and social disciplines are key to its approach.