Food Sovereignty in Practice: Developing Climate Resilient Food Systems

Briefing Paper 5

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FOOD SOVEREIGNTY IN PRACTICE DEVELOPING CLIMATE RESILIENT FOOD SYSTEMS

BACKGROUND

Climate change poses the most significant threat to global food and nutrition security by directly impacting yields and indirectly through impacts on water availability, pollination services etc. (Mbow et al., 2019). Climate change related events are distorting cropping patterns across the globe particularly in rainfed smallholder farming systems which contribute 60% of global agricultural output (Bioversity, 2017). A recent modelling study indicates that anthropogenic climate change has reduced average global agricultural productivity by 21% since 1961, the productivity reduction is reported to be substantially more severe (26–34%) in Africa and Latin America and the Caribbean (Ortiz-Bobea et al., 2021).

As food systems are made vulnerable by climate change there is an urgent need to develop strategies and practices that are ecologically efficient and climate change resilient. Over the past few years there has been a renewed focus on small farms, agrobiodiversity, climate smart agriculture and related aspects. There is also a perceptible shift in terms of both national policies and programmes from a technology and capital-intensive productivity driven view of food to understanding food as a public good with its ecological and cultural components. However, it is mostly limited to discrete projects and policy statements and does not reflect a broader institutionalized food governance strategy.

Food sovereignty provides a useful conceptual platform to understand and develop appropriate food system responses to climate change which can be embedded in national and global food governance systems. Whilst there is a significant body of work on food sovereignty, there is limited understanding on how it can enable climate change adaptation of food systems and forms the primary concern of this paper. This briefing paper aims to describe the different pathways and processes through which food sovereignty can promote nutritious and climate change appropriate foods. Whilst the pathways discussed can lead to multiple impacts across a range of issues, the focus of this paper is on food products in keeping with the overall theme of the briefing paper series i.e. ‘protective foods that protect the planet’. In the following sections, I describe and analyse the concept of food sovereignty, develop a conceptual framework, explain key outcomes and present some policy implications.

FOOD SOVEREGNITY

The food sovereignty movement began as a farmer and peasant led repudiation of the capital intensive and productivity centred green revolution and globalized neoliberal agri-food networks (Clark 2016). Its present form is primarily attributed to a politically transformative peasant movement, La Via Campesina (LVC) that began in South America in 1980s and is now a global coalition with national constituent farmer and peasant organizations around the world. Over the last two decades a significant body of work on food sovereignty, both academic and what might be termed as activist, has evolved along several different disciplinary and ideological axes to create a compelling and increasingly influential narrative (Agarwal, 2014; Zimmerer et al., 2020; Godek, 2021).

At its conceptual core, food sovereignty envisions democratic ownership of food resources and policies at different scales and the recognition of food as a public good (Gurcan, 2014). Whilst there are different interpretations and approaches, the primary objective of all food sovereignty movements is to create socially and ecologically equitable and healthy food systems that are also resilient and sustainable (Zimmerer, 2020).

This definition and concept of food sovereignty evolved over time, from the right of self-reliance of nations (1996), to the rights of people to define domestic production and trade (2002) to the current definition which was formalized in the Nyéléni Declaration of 2007 in Mali, *as the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems* (Gliessman et al., 2019). The founding principles of food sovereignty as articulated in Nyéléni Declaration of 2007 are stated in six pillars, summarized below.

1. Right to sufficient, healthy, and culturally appropriate food for all individuals and communities.
2. Rights of smallholder farmers as producers of food.
3. Enabling localised food systems.
4. Localized community governance of natural resources and associated rights.
5. Acknowledging and building traditional knowledge and skills on food production, ecological conservation etc.
6. Applying agroecological methods for food production to improve resilience and sustainability.

The principles mentioned above have found explicit legal and constitutional recognition. Fifteen countries have laws to implement food sovereignty and it is included in the national constitution of 7 countries namely Bolivia, Venezuela, Ecuador, Nicaragua, Mali, Senegal, and Nepal.

It is well recognized that implementing food sovereignty can help realign food policies towards strengthening socially and ecologically equitable and sustainable food and nutrition security (Weiler et al., 2015). It can also play an important role in addressing urgent ecological sustainability issues, more specifically on climate change mitigation and adaptation (Zimmerer et al., 2020).

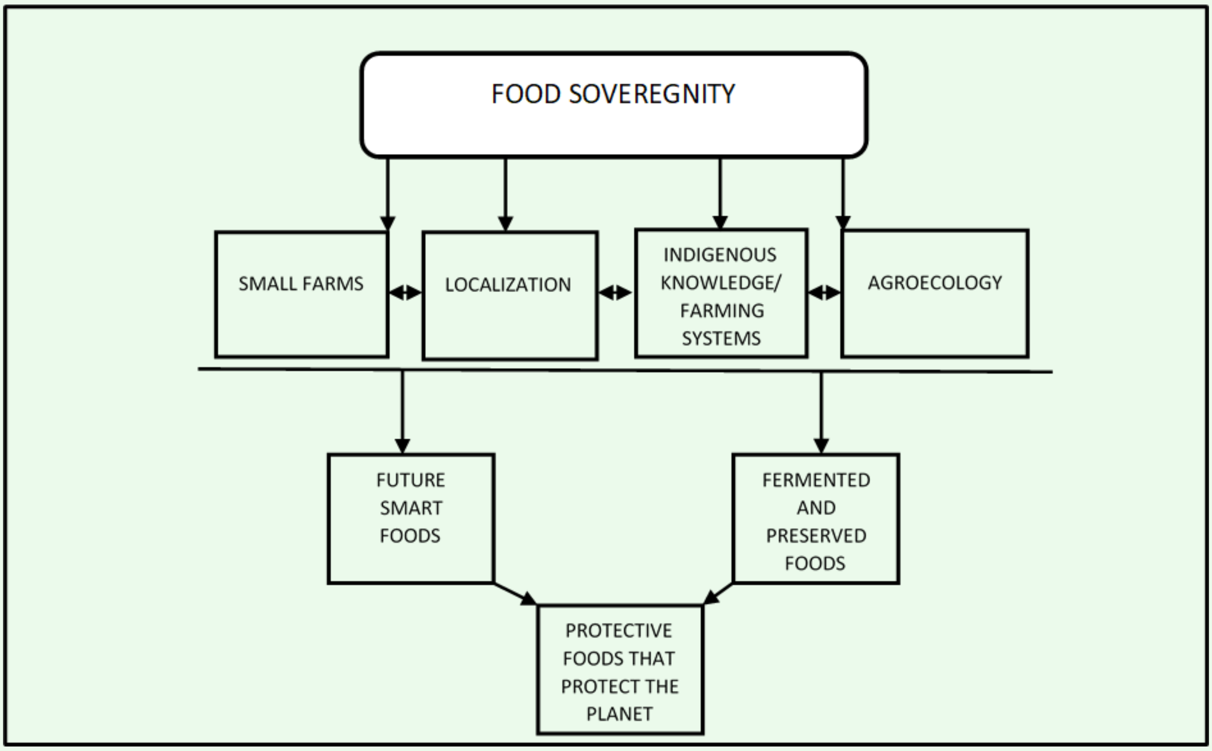
At the very outset it is important to understand that the components or principles of food sovereignty such as localized supply chains or small farmer support have been implemented as discrete interventions in a range of different contexts over the past several years. The unique potential of food sovereignty is that it cohesively brings together multiple components and enables critical linkages and complementarities in both policy and operations. The next section describes how food sovereignty and its constituent elements can help in climate change adaption and mitigation.

FOOD SOVEREGNITY AND CLIMATE CHANGE: KEY PATHWAYS AND COMPONENTS

Food sovereignty interventions can help in both climate change adaptation and mitigation through multiple pathways related to food production, supply chains, dietary habits, farm technologies etc.

As figure-1 illustrates, 5 key components of food sovereignty together and separately facilitate specific production patterns that enable pathways to specific food and food products. These foods and food products fall in 2 categories, (i) Future Smart Foods (FSF) and Preserved or Fermented Foods (PFF) which as we will see in the following sections can enable nutrition and climate change sensitive food systems.

FIG 1- FOOD SOVEREGNITY AND CLIMATE CHANGE SENSITIVE FOODS



PATHWAYS

INDIGENOUS KNOWLEDGE AND FARMING SYSTEMS

Indigenous or traditional farming practices and systems refer to a range of production systems and practices specific to particular geographic regions as well as applying methods developed over generations which are best suited to local ecologies and cultures (Saxena et al., 2016; Kurashima,Fortini & Ticktin., 2019). The definition here includes whole food systems such as high-mountain Andean agricultural systems and specific practices such as intercropping, crop rotation, cover cropping, traditional organic composting, integrated crop-animal farming (Saxena et al., 2016; Hamdani et al., 2021). Such systems are known to be more resilient to disturbances as they are contextualized by local landscapes and ecologies (Kurashima,Fortini & Ticktin., 2019).

A good example of such a system found in different parts of the world is dryland terraced landscapes. Extensive networks of terraces as part of indigenous systems can be found the Loess Plateau, North China, the Colca Valley, Peru and in Yemen (Guo,Garcia-Martin & Plieninger, 2021). FAOs Globally Important Agriculture Heritage Systems (GIAHS) programme provides other instructive examples of how agriculture systems integrate food sovereignty principles such as diversity, local knowledge, culture and food traditions, ecological concepts that have been applied over centuries (FAO, 2018). As of 2018, sixty two GIAHS sites have been identified in 22 countries worldwide. These sites, over time, have demonstrated their resilience by adapting to changes in climate through use of drought-tolerant varieties, production diversity and application of traditional farm practices and technologies.

Indigenous systems also represent an important link with crops that are culturally accepted and well suited to local agroecological conditions and dietary practices. Many indigenous food systems are based on endemic food crops or farmer-saved varieties of major food staples, such as corn, rice, and wheat (Saxena et al., 2016). In the Andean system, farmers cultivate as many as 50 varieties of potatoes in their plots and their communities can have over 100 local varieties (Carrasco-Torrontegui et al., 2021). This high level of diversity and genetic variability makes these foods and production systems highly adaptive. A study on indigenous Andean system identified 36 crops that support food sovereignty and are grown using ancestral technologies (Carrasco-Torrontegui et al., 2021).

AGROECOLOGY

According to the High Level Panel of Experts on Food Security and Nutrition, "*from a scientific and technical perspective, agroecology applies ecological concepts and principles to food and farming systems, focusing on the interactions between microorganisms, plants, animals, humans and the environment, to foster sustainable agriculture development in order to ensure food security and nutrition for all, now and in the future. Today's more transformative visions of agroecology integrate transdisciplinary knowledge, farmers' practices and social movements while recognizing their mutual interdependence*" (HLPE, 2019).

The definition and understanding of agroecology in the context of food sovereignty is seen as set of principles and practices that can be applied at the field, farm and whole food system scale (Kerr et al, 2021). Agroecological practices seek to enhance efficiencies of ecological processes and minimize social-ecological costs from agriculture such as soil degradation, water contamination, greenhouse gas emissions and inequitable social structures (Kerr et al, 2021).

Such agroecological approaches and indigenous knowledge on farming practices, as described above, are highly complementary components. Many agroecological approaches build on traditional farming practices and provide scientific guidance to optimize these traditional methods.

Agroecology is knowledge intensive rather than capital intensive and is compatible with small farm systems with high production diversity (Holt-Giménez & Altieri, 2013). The range of benefits provided by agroecology as an integrated system across ecosystem management, biodiversity promotion, social structures and dietary norms can specifically enable the production and consumption of food and food products, which are ecologically, nutritionally and culturally appropriate.

LOCALIZATION

Enabling local food systems in terms of scale and power distribution is a core element of food sovereignty. Originally the 'local' narrative in food system analysis was constructed as a resistance to the globalized capitalist agriculture system; creating a local-global binary (Tregear 2011). This spatial dimension has evolved into 'local food systems' with its specific relationships and processes to improve local development practices and as an economic and rural development strategy (Valencia, Whitman & Blesh 2019). A fundamental aspect of localizing food is territoriality i.e. the relationship between food and the place of production. It is this relationship which bears out the specific benefits related to culture and ecology. Food production and dietary habits are deeply rooted in local socioecological, cultural and political contexts in terms of both production and consumption. Hence localization strategies play an important role in enabling traditional systems across the food value chain from production, processing, storage and consumption.

At its core, as the terms suggests, food sovereignty is about empowerment, it is about enabling equity in food systems. Localization needs to be understood in that context and how it informs processes of policy and implementation. Food sovereignty implementation needs to be community driven and participatory for the outcomes to be sustainable and effective. The extent and content of localization impacts all other components discussed in this section and it can be a significant determining factor in enabling climate change pathways discussed in thus paper.

SMALL FARM SYSTEMS

In many ways, at the heart of putting food sovereignty in practice is the supporting of small farm systems which are reservoirs of agrobiodiversity and associated indigenous knowledge and as a source of livelihoods for millions of households in the poorest parts of the world. Most countries in Asia and Africa are dominated by small landholdings. As per one estimate, 85% of family farms in SSA are smallholdings, with a farm size of less than 2 hectares (CIRAD 2013) and in most cases less than 1 hectare (Rapsomanikis 2015). According to a study based on analysing multiple data sets, family farms produce at least 53% of the world's food (Graeub 2014). The major part of food supply by volume in many countries is supplied by small farms. For example, Tanzanian small farmers produce 69% of the food in the country and in Nepal, 2.7 million small farms produce 70% of the national food production (Graeub 2014).

Besides food supply in terms of volume, small farms make a particularly important contribution in providing essential micronutrients. A recent study published in the *Lancet* quantifies the relationship between farm size and production diversity based on global data sets (Herrero et al. 2017). It tests the relationship in terms of both different foods and 7 essential nutrients i.e. vitamin A, vitamin B12, folate, iron, zinc, calcium, and protein. In terms of nutrient contribution, the study finds that small farms (≤20 ha) produce most of the essential nutrients (>80%) in SSA, Southeast Asia, South Asia, China, and the rest of East Asia Pacific. Farms smaller than 2 ha, produce more than 25% of the nutrients in South Asia, Southeast Asia, SSA and East Asia Pacific. The analysis from this study also shows that small farms have the highest level of agrobiodiversity.

CLIMATE SENSITIVE PROTECTIVE FOODS THAT PROTECT THE PLANET

FUTURE SMART FOOD

Future Smart Foods (FSF) is a recently defined category which includes foods with properties that can help address some of the key challenges related to the sustainability, adequacy and dietary quality of contemporary food systems. It builds on the concept of Neglected and Underutilized species (NUS) and brings together elements of agrobiodiversity, nutrition and ecology. FSFs are defined as neglected and underutilized species (NUS) that are nutrient dense, climate resilient, economically viable, and locally available or adaptable (FAO, 2018). For a food to be classified as FSF, it needs to be a NUS food which also meets the following 4 criteria (FAO, 2018):

1. Nutrient dense (enhance nutrition)
2. Climate resilient (e.g. require low inputs, promote climate change resiliency and environmentally friendly by reducing soil runoff and erosion),
3. Economically viable
4. Locally available/adaptable.

As is evident from the above criteria, especially the fourth criterion, the identification of FSF foods needs to be highly localized in terms of both geography and production systems. In the majority of cases they form part of small farm systems (FAO 2018). FAO has reported some consultations on mapping of FSF, however there is limited evidence of a systematic regional or country level mapping by governments or other agencies. Generally, FSF have been identified across the different food groups such as cereals (maize, rice, grain, wheat, millet, sorghum barley and teff), legumes (soybean, chickpeas, cowpea, common beans, mung beans and groundnut), vegetables and fruits (tomato, eggplant, pepper, cocoa, mango, clover, garlic, mustard, pea, onion, saffron, green grams and cola nut) and roots, tubers and bananas (banana, plantain, yam, sweet potato, cassava and potato).

FSF are especially suitable to adapt to the ecological challenges associated with climate change (Acevedo et al, 2020). More specifically they can contribute to climate change resilient food systems through 3 pathways. First is through better resilience and adaptation in terms of production. FSF can cope with abiotic stresses such as drought, heat, flooding, salinity and shorter growing season, as well as pests associated with climate changes (Acevedo et al, 2020). Second is through ecological management such as improving moisture retention in soil, improving soil quality, and reducing erosion. Third is through lower carbon footprint on account of high water use efficiency and early maturity (Acevedo et al, 2020).

It is important to apply clearly and quantifiable indicators to assess the efficiency and impact of the different pathways. Whilst there is no uniform comprehensive evaluation system, a number if useful metrics have been developed. For example, metrics that measure the water footprint of crops as developed in a study by Mekonnen and Hoekstra (2014), which found that most fruits and vegetables have a low water footprint and high nutrient density. Other indicators combine both nutrition and environmental considerations and measure nutritional yield and nutritional water productivity (Nyathi et al., 2019). Measuring carbon footprint provides useful insights to compare the ecological efficiency of different crops and help in systematic identification of FSF. The table below shows the carbon footprint of different crops including NUS (Mustafa 2021).

TABLE 1- CARBON FOOTPRINT OF A SAMPLE OF CROPS (*adapted from Mustafa 2021*)

CROP	GLOBAL AVERAGE CARBON FOOTPRINT (kg CO2-eq/kg)
Maize	0.45
Pearl millet	0.47
Sorghum	0.88
Rice	3.50
Wheat	0.52
Cowpea	0.61
Chickpea	0.80
Bambara groundnut	-
Dry beans	1.55
Mung bean/green gram	-

Millets are a good example of the features and potential of FSF. Minor millets include a range of different millets such as finger millet, foxtail millet, proso millet, kodo millet, little millet and barnyard millet. They are nutritious with high levels of macro and micro-nutrients and dietary diversity and offer significant resilience to climate on account of their tolerance to drought and, biotic and abiotic stresses and short maturing period etc. Furthermore, in terms of climate change mitigation, the low input requirements for millets also leads to a lower carbon footprint compared to other major staples that are input intensive in terms of fertilizer, pesticide and water requirements (Mal et al., 2010).

Many FSFs such as millet, sorghum, bambara groundnut, lentils, and groundnuts play an important role as a staple food in marginal agriculture in semi-arid and hilly regions and are strategically placed to subsistence agriculture in low-income contexts. For instance, sorghum, millet, bambara groundnut, lentils, and groundnuts are recommended food choices under nutritional and water limited conditions. In this regard, they can benefit low-income producers and consumers of food who are limited in their capacity to adapt to increasing climatic risks (Mabhaudhi et al.,2019).

TABLE 2- LEGUME AND CEREAL CROP FOOD CHOICES RECOMMENDED TO COMBAT NUTRITIONAL AND WATER DEFICIT (Mabhaudhi et al.,2019)

Nutritional and health challenges	Recommended food		Recommended food choice-limited water conditions	
	Legume	Cereal	Legume	Cereal
Protein	White lentils soybean	Sorghum; wheat	Bambara groundnut; groundnut	Sorghum
Carbohydrates	Bambara groundnut; lentils	Equally suitable	Bambara groundnut	Sorghum; millet
Energy	White lentils	Equally suitable	Groundnut	Sorghum; millet
Fat	Groundnut	Equally suitable	Groundnut	Sorghum; millet
Vitamin-A	Common pea	-		-
Micronutrients	Soybean	Equally suitable	Bambara groundnut	

As traditional knowledge associated with FSFs is often undocumented or hidden because of the isolation of areas and language barriers, there is a need to proactively tap into this knowledge to understand the various traits of local FSF species and varieties. This enables them to be improved and further adapted to local farming systems. Building knowledge about traditional FSF crops can enhance community-based landrace conservation and production (Chivenge et al., 2015; FAO, 2018).

PRESERVED AND FERMENTED FOODS

This category refers to a range of traditionally preserved foods found in different parts of the world. These foods are found across food groups such as dairy, cereals, vegetables, legumes, roots, meat, fish (Tamang et al., 2019). Preserved foods are an important part of many local food cultures and a critical source of nutrients, especially in regions with challenging agroecological conditions. A recent study on the Himalayan region identifies over 200 varieties of community specific fermented foods which are consumed as staples diets or in the form of pickles (Tamang et al., 2021). Similarly, studies have mapped preserved food in other regions of the world, although the current evidence is quite limited in terms of geography and food products. The table below provides a few examples of fermented foods from to illustrate the nature diversity across regions and food groups.

TABLE 3- EXAMPLES OF FERMENTED FOODS BY COUNTRY AND FOOD GROUP (*adapted from* Tamang et al., 2019)

COUNTRY/REGION	**SUBSTRATE**	**FOOD**
DAIRY		
India, Nepal, Bhutan, China (Tibet)	Yak/cow milk	Chhu
North, East Central Africa	Cow milk	Leben/Lben
CEREALS		
Burkina Faso, Ghana	Pearl millet	Ben-saalga
Mexico	Miaze	Pozol
VEGETABLES		
Spain	Cupers	Cupers
India, Nepal, Bhutan	Leafy vegetable	Gundruk

LEGUME		
Ghana, Nigeria	Locust bean	Dawadawa
China, Taiwan	Soyabean	Meitauza
ROOTS AND TUBERS		
Central Africa, Zaire	Cassava	Chikwangue
West and Central Africa	Cassava	Gari

A variety of preservation techniques are used by different communities including some form of fermentation. Here I provide a few examples as exemplars of preservation techniques from different parts of the world. In the Himalayan region dried fermented acidic vegetable products are produced using 'anaerobic fermentation' or 'pit fermentation' and then sun drying the freshly fermented vegetables (Tamang et al., 2021). In the Andean region, specific potato varieties are preserved using ancient sun drying methods to produce Chuno (black freeze-dried potato) and Tunta (white freeze-dried potato) (Pennarireta et al., 2011). In the Vanuatu islands, "Mara Technique" is a method for preserving unripe banana for over 2 years; the technique was documented as part of a government climate change adaptation project (GoV, nd).

The core nutritional properties of fermented foods are highly variable as they are a function of the substrate used and process conditions (Melini et al.,2019). The preservation process leads to additional health benefits and there is good evidence that preserved and fermented foods provide a range of dietary and health benefits (Tamang et al., 2021). Fermented foods are rich in various bioactive molecules which are known for improving immune function, improves digestion and nutrient assimilation (Melini et al.,2019).

The climate resilience and mitigation effect of this food category can operate along 3 different pathways. The first pathway relates to climate adaptation through community and household level buffer stocks created by preserved foods which can help food supplies cope with weather related production disruptions. The second pathway is through improving supply chain efficiencies by reducing post-harvest loss. The third pathway is through low level energy requirements of traditional methods compared to other forms of food processing such as canning and freeze-drying.

POLICY AND PROGRAMME RECCOMENDATIONS

1. Incorporate food sovereignty principles into national laws and policies.
2. Conduct a systematic audit of relevant national policies across sectors including trade, financing, land management, agriculture and health to assess compatibility with climate management and food sovereignty.
3. Building on the GIAHS initiative, create national level registries of unique agricultural systems.
4. Document traditional production methods, microbiology, and biochemistry of locally preserved and fermented foods.
5. Create a scientific protocol for mapping of FSF and PFF and a global repository of all relevant data.
6. Include Future Smart Foods and preserved and fermented foods in national dietary guidelines.

CONCLUSION

The different components of food sovereignty described in this paper, together enable equitable and sustainable food systems. Whilst they are described as distinct components for analytical purposes, in effect they overlap and interact at multiple levels and effect changes in concert. Policies and programmes must reflect this integrated nature of food production systems and food sovereignty. The fundamental idea of food sovereignty is to make food systems responsive to the requirements, conditions and properties of primary food producing communities. The relative importance of different components and the methods through which they should interact must depend on the specific context. This is especially important as the impacts of climate change related events are very varied, from prolonged droughts in certain regions to unseasonal rains in others.

The protective foods described in this paper can contribute to improving the climate adaptability in some of the most vulnerable communities and regions in the world. These foods also provide guidance to encourage and develop similar methods and processes in other suitable contexts. The range of these foods demonstrates how communities have used the providence of nature to create resilience, by nurturing optimal dependence with their ecological surroundings and landscapes in some of the most hostile environments. As we negotiate the perils of anthropogenic climate change, there is perhaps an important lesson here.

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