

# FOOD SYSTEMS AND CLIMATE

FRAMEWORK FOR PUBLIC POLICIES



Brasília, November 2025



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# GLOSSARY

**Agroclimatic Zoning:** a tool for planning land use, taking into account climate conditions and regional vulnerabilities.

**Agroecological Transition:** a gradual process of changing the management practices in production systems, with the goal of moving from a conventional model to agriculture based on ecological principles and technologies.

**Agroecology:** agroecological production seeks to optimize the integration of productive capacity, the use and conservation of biodiversity and other natural resources, ecological balance, economic efficiency, and social justice, whether or not they fall under the control mechanisms established by Law No. 10,831 of 2003 and its regulations. Agroecology has been reaffirmed by numerous social actors, organizations, and research and educational institutions as a science, a practice, and a social movement, as it studies and applies ecological principles to agroecosystems, integrating scientific knowledge with traditional wisdom to build environmentally, economically, and socially sustainable systems.

**Antimicrobial Resistance:** the ability that microorganisms develop to survive and proliferate even in the presence of antimicrobials. This resistance generally arises from excessive or inappropriate use of these medications.

**Biodiversity:** variability of living organisms from all origins, including, among others, terrestrial, marine, and other aquatic ecosystems, as well as the ecological complexes they are part of; also encompassing diversity within species, between species, and across ecosystems.

**Climate Adaptation:** the adjustment of natural and human systems to climate change and its effects, in the present and in the future alike. Adaptation plays an essential role in reducing exposure and vulnerability to the climate crisis.

**Climate Change:** changes in the climate that can be directly or indirectly attributed to human activity, altering the composition of the global atmosphere and adding to natural climate variability. This definition distinguishes human-driven climate change from natural variations that occur without anthropogenic influence.

**Climate Federalism:** multi-level governance that coordinates climate actions among the federal government, states, the Federal District, and municipalities, while respecting territorial particularities.

**Climate Justice:** the connection between development and human rights that promotes a human-centered approach to addressing climate change. Its aim is to guarantee the rights of vulnerable populations, ensuring that the harms and benefits of climate change and its impacts are distributed equitably and fairly.

**Climate Mitigation:** the reduction of greenhouse gas (GHG) emissions. It is the primary pathway identified by science to slow the progression of global warming and the alteration of the planet's climate patterns, thereby preventing even more severe impacts.

**Ecosystem Services:** the benefits relevant to society provided by ecosystems: a) provisioning services: those that provide goods or environmental products used by humans for consumption or

commercialization, such as water, food, timber, fibers, and extracts; b) supporting services: those that sustain life on Earth, such as nutrient cycling, waste decomposition, production, maintenance or renewal of soil fertility, pollination, seed dispersal, control of potential pest populations and potential vectors of human diseases, protection against ultraviolet solar radiation, and maintenance of biodiversity and genetic resources; c) regulating services: those that contribute to maintaining the stability of ecosystem processes, such as carbon sequestration, air purification, moderation of extreme weather events, maintenance of the hydrological cycle balance, mitigation of floods and droughts, and control of critical erosion and landslide processes; d) cultural services: non-material benefits provided by ecosystems, including recreation, tourism, cultural identity, spiritual and aesthetic experiences, and intellectual development, among others.

**Environmental Racism:** the disproportionate burden of environmental and climate impacts on black populations, quilombolas, traditional peoples and communities, Afro-Brazilian religious communities, and indigenous peoples, amplifying their historical, social, economic, and political vulnerability.

**Extreme Climate Events:** phenomena such as droughts, floods, heat waves, and hurricanes, that are intensified by climate change. Examples include the droughts in the Pantanal and the Amazon and the heavy rains that affected the Brazilian state of Rio Grande do Sul in 2024.

**Family Farming:** a form of rural production based on the size of the farm, relying mainly on family labor for economic activities, in which at least a minimum percentage of household income is generated by activities carried out on the family's property. It includes foresters, fish farmers, extractivists, fishers, indigenous peoples, members of rural quilombola communities, and other traditional peoples and communities that meet the legal criteria, as established by Law No. 11,326 of 2006.

**Food Deserts:** geographic areas characterized by the limited availability of and accessibility to adequate and healthy foods.

**Food Insecurity:** a situation in which a person does not have guaranteed access to basic, safe, and quality foods, in sufficient quantity, on a permanent basis, without compromising access to other essential needs. It may occur at a mild level (occasional irregularity in access to food), a moderate level (systematic compromise of quantity and quality), or a severe level (when an individual goes hours or days without food, experiencing hunger).

**Food Security and Nutrition:** the realization of everyone's right to regular and permanent access to quality foods in sufficient quantity, without compromising access to other essential needs, based on dietary practices that promote health, respect cultural diversity, and are environmentally, culturally, economically, and socially sustainable.

**Food Sovereignty:** the right of peoples to define their own sustainable food production, distribution, and consumption policies and strategies, guaranteeing the right to food for all. It is based on small- and medium-scale production, respecting local cultures and the diversity of peasant, fishing, and indigenous production methods, as well as marketing and rural land management practices, in which women play a crucial role.

**Food Swamps:** areas with a high density of establishments selling mainly ultra-processed foods, contrasting with the low availability of healthy and fresh options. The term can also apply to locations where ultra-processed foods are abundantly available, especially in urban peripheries, where their low price makes them almost an inevitable consumption choice, representing a risk factor for malnutrition, obesity, and chronic diseases.

**Food System:** the set of processes and infrastructure involved in feeding a population: cultivation, harvesting, processing, packaging, transporting, marketing, consumption, distribution, and disposal of food and food-related items. It also includes the necessary inputs and outputs generated at each stage. These systems and their integrated processes influence nutrition, diet, health, community development, agriculture, and the environment.

**Global Syndemic:** the synergistic interaction of multiple epidemics that share social drivers and common causes, that mutually exacerbate one another and requiring integrated solutions. An example is the Global Syndemic of Obesity, Undernutrition, and Climate Change, which share determinants such as food systems, transportation, urban design, and land use, among others. It disproportionately affects poorer countries and, within all countries, it disproportionately affects people living in poverty. Poverty amplifies the effects of the Global Syndemic, which in turn, aggravates and perpetuates poverty.

**Greenhouse Gas (GHG):** compounds such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) emitted by human activities, which contribute to global warming by trapping heat in the atmosphere.

**Healthy and Sustainable Food Systems:** the food systems that ensure food security and nutrition for all, without compromising the economic, social, and environmental foundations needed to ensure food security and nutrition for future generations. They must be economically viable, generating benefits for workers, governments, businesses, and consumers; socially just, ensuring equitable distribution of value and contributing to nutrition, health, traditions, working conditions, and animal welfare; and environmentally responsible, ensuring neutral or positive impacts on biodiversity, natural resources, ecosystem health, and reducing losses, waste, and toxicity.

**Hidden Costs or Externalities:** economic, environmental, and social impacts not accounted for in food systems (e.g., degradation of natural resources, public health, etc.).

**Human Right to Adequate Food:** adequate food is a fundamental human right, inherent to human dignity and essential for the realization of the rights enshrined in the Federal Constitution. Public authorities must adopt the necessary policies and actions to promote and ensure food security and nutrition for the population.

**Polycultures:** an agricultural practice that combines multiple species in the same area, promoting biodiversity and climate resilience.

**Sociobiodiversity:** interrelationship between biological diversity and the diversity of sociocultural systems.

**Traditional Peoples and Communities:** culturally distinct groups that recognize themselves as such, possessing their own forms of social organization, occupying and using territories and natural resources as a condition for their cultural, social, religious, ancestral, and economic reproduction, and utilizing knowledge, innovations, and practices generated and transmitted through tradition. Decree No. 6.040/2007 provides the definition of Traditional Peoples and Communities, establishing a specific policy for them, and Decree No. 8.750/2016 designates the following civil society representatives who participate in the National Council of Traditional Peoples and Communities: indigenous peoples; quilombola communities; Afro-Brazilian religious communities; Roma peoples; artisanal fishers; extractivists; coastal and marine extractivists; *caiçaras*; *faxinalenses*; traditional healers (*benzedeiros*); islanders; herbalists (*raizeiros*); *geraizeiros*; *caatingueiros*; *vazanteiros*; *veredeiros*; everlasting flower gatherers; *pantaneiros*; *morroquianos*; Pomeranian people; *mangaba* collectors; babassu coconut

breakers; *Araguaia retireiros*; *fundos and fechos de pasto* communities; riverine peoples; *cipozeiros*; *andirobeiros*; *caboclos*; and youth of traditional peoples and communities. In addition, the 5<sup>th</sup> National Conference on Food Security and Nutrition also recognized the following groups as Traditional Peoples and Communities: agrarian reform settlers, *caboclos*, peasants, recyclables collectors, shellfish gatherers, populations affected by dams, *sertanejos*, and non-indigenous peoples from Roraima.

**Ultra-processed Foods:** industrial formulations composed of many ingredients and subjected to multiple processing steps. They contain little or no unprocessed foods and are generally characterized by high levels of salt, fats, and sugars, as well as the addition of substances rarely used in home cooking. They often include additives intended to alter color, flavor, aroma, or texture, thereby modifying their sensory characteristics.

# INSTITUTIONAL TERMS

**Climate Plan:** a government plan, prepared in an intersectoral manner, that guides the Brazilian climate policy through to 2035, focusing on mitigation and adaptation strategies. It aims to ensure a just transition in social, economic, and environmental terms, incorporating means of implementation, education, science, technology, and innovation, as well as monitoring, evaluation, and transparency.

**Interministerial Chamber for Food Security and Nutrition:** a federal body that coordinates food security and nutrition policies across 24 ministries.

**National Council for Food Security and Nutrition:** a component of the National System for Food Security and Nutrition that serves as a space for social participation to monitor and propose Food Security and Nutrition policies.

**National System for Food Security and Nutrition:** a public system of intersectoral and participatory management established by Law No. 11,346 of September 15, 2006, intended to guarantee the human right to adequate food. It provides for coordination among the three levels of government, as well as with organized civil society, for the implementation and execution of public food security and nutrition policies. Its objectives include formulating and implementing food security and nutrition policies and plans, fostering integration of efforts by government and civil society, and promoting the tracking, monitoring and evaluation of food security and nutrition in the country.

**Nationally Determined Contribution (NDC):** the climate targets that each signatory country to the Paris Agreement submits, detailing how it will reduce its emissions. Each NDC is a national climate action plan to reduce greenhouse gas (GHG) emissions. Since 2015, 195 nations have periodically submitted their NDCs to the United Nations Framework Convention on Climate Change (UNFCCC). They must be updated every five years with progressively more ambitious targets. Together, these plans are intended to contain targets that are ambitious enough to keep global warming below 1.5°C relative to pre-industrial levels (i.e., relative to the average temperature recorded between 1850 and 1900).

**Public Food Security and Nutrition Facilities:** public facilities designed to provide, distribute, or market food and meals to ensure the Human Right to Adequate Food and to promote food security and nutrition. Examples include government-subsidized restaurants, community kitchens, food banks, and family-farming distribution centers.











# FOREWORD

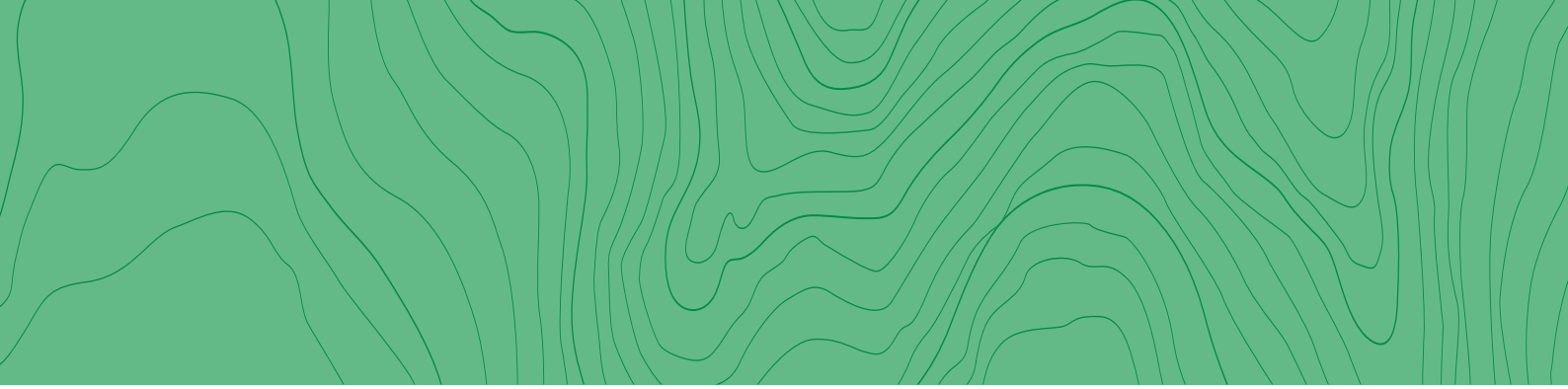
With the goal of improving public policies at all government levels regarding the complex relationship between food systems and climate change, the **National Secretariat for Food Security and Nutrition** of the Ministry of Social Development and Assistance, Family and Fight Against Hunger presents the **Food Systems and Climate Framework for Public Policies**. The initiative results from a partnership with the **Observatory on Food Security and Nutrition Policies** of the University of Brasília and was supported by the Climate and Society Institute.

Fulfilling the **Human Right to Adequate Food** is a central commitment of the Ministry of Social Development and Assistance, Family and Fight Against Hunger. The ministry seeks to expand continuous and dignified access to an adequate and healthy diet for the entire Brazilian population. In recent years, food insecurity in Brazil has shown consistent signs of control, reaching once again a historic achievement: **the removal of Brazil from the United Nations Hunger Map, in July 2025**.

Climate change, and its connection to food systems, poses new challenges to guarantee the Human Right to Adequate Food. These systems' ability to provide healthy foods regularly and equitably is intrinsically tied to climate factors. At the same time, food production, processing, distribution, and consumption have contributed to intensifying the climate crisis. This feedback loop has generated violations of the Human Right to Adequate Food, especially among people experiencing vulnerability, underscoring the **urgency of integrating the organization of food systems with food security and nutrition and climate policies**.

Internationally, Brazil plays a prominent role in global climate governance. It is a signatory to the United Nations Framework Convention on Climate Change, ratified by the National Congress in 1994, and continues to advance its climate agenda through regulatory milestones such as the National Policy on Climate Change. These measures strengthen the country's commitment to global goals and are essential for defining actions to mitigate climate impacts and to promote a just adaptation for populations in vulnerable situations.

As a result of these initiatives, since 2023 the Ministry of the Environment and Climate Change and the Ministry of Science, Technology and Innovation have led the preparation of the Second Climate Plan, based on national mitigation and adaptation strategies, while also coordinating sectoral plans. Of the sixteen sectoral adaptation plans established, the Sectoral Plan for Food Security and Nutrition, coordinated by the National Secretariat for Food Security and Nutrition, brings together short, medium, and long-term targets and actions until 2035, covering the current Multiyear Plan cycle and two future stages.



Regarding food systems, notable efforts also include adaptation plans organized by the Ministry of Agrarian Development and Family Farming and by the Ministry of Agriculture and Livestock, as well as seven mitigation plans, with particular emphasis on agriculture and livestock.

It is also important to highlight the commitments undertaken by the Ministry of Social Development and Assistance, Family and Fight Against Hunger, essential for guaranteeing the Human Right to Adequate Food in the climate context. They are laid out in the ministry's Institutional Strategic Planning and in the Multiyear Plan, both for 2024–2027, including this **Framework**, as well as the Brazil Without Hunger Plan, which sets targets to reduce climate change impacts on food systems. More recently, the Third National Plan on Food Security and Nutrition included specific guidelines to promote food systems that are resilient to climate change. All these initiatives demonstrate the priority conferred to the climate agenda within federal policies and contribute to stronger policy design and responses.

Specifically, **this document analyzes the relationship between food systems and climate, highlighting multiple approaches based on the systematization of knowledge and reflections on possible pathways**. It is an invitation to convergence and coordination among different sectors and arenas of public policy formulation and implementation, strengthening a comprehensive view of the stages of the food system, without overlapping with any other initiatives.

It is expected that the **Food Systems and Climate Framework for Public Policies** will inspire and support the identification of alternatives, helping to expand the movement and action of public policies that consider the entire food system.

We wish you an insightful reading!

Ministry of Social Development and Assistance, Family and Fight Against Hunger



FOOD SYSTEMS AND  
CLIMATE FRAMEWORK  
FOR PUBLIC POLICIES

## FOOD SYSTEMS



PRODUCTION



SUPPLY



ACCESS



CONSUMPTION



LOSSES  
AND WASTE

= Steps necessary so that **FOOD** reaches **PEOPLE**

HUMAN RIGHT TO  
ADEQUATE FOOD

CLIMATE  
CHANGE

CONTEXT

FOOD  
SYSTEMS

## FOOD SYSTEMS AND CLIMATE FRAMEWORK FOR PUBLIC POLICIES

[government and society work together]

Climate  
Change  
visible around  
the world

Climate  
affects  
and is affected  
by food systems

Why create a  
Framework?

Climate crisis  
+  
social  
inequalities

Development  
model  
exacerbates  
problems





# I. OBJECTIVES

## GENERAL

To contribute to the guidance, convergence, and integration of policies and actions across different public levels and sectors to drive the transition toward healthy and sustainable food systems in the face of climate change, promoting Climate Justice, the Human Right to Adequate Food, and Food Security and Nutrition.

## SPECIFIC

1. To contribute to broadening the debate on the relationship between climate change and food systems.
2. To propose principles and pathways, guiding actions that drive the transition toward healthy, sustainable, and equitable food systems.
3. To promote, across different public levels and sectors, the adoption of coordinated adaptation and mitigation actions to address the climate crisis and enable the transition of food systems.







## PREMISE 1:



Human activities that result in **greenhouse gas (GHG) emissions** are the main causes of global warming.



In 2024, for eleven consecutive months, the **highest temperatures in 175 years** were recorded, exceeding 1.5°C.



Despite being essential for the planet, human well-being, and the economy, **25% of the world's biodiversity has already become extinct**, making food production less efficient and more vulnerable, and affecting soil, pollination, and water.



**Toxic substances**, such as pesticides, chemicals, plastics, and heavy metals, contribute to the reduction of biodiversity and compromise the regeneration of ecosystems, exacerbating environmental and social crises, and also having serious effects on human health.

## PREMISE 2:



The **way food is produced** contributes to global warming, while climate change affects production, quality, and access, threatening the human right to adequate food.



Climate change and climate emergencies compromise the population's access to **fresh foods**, such as fruits and vegetables.



The production and consumption of **ultra-processed foods** harm health and cause environmental impacts.



Food systems are central and determining components of the **global syndemic of malnutrition, obesity, and climate change**.

## PREMISE 3:



Climate change worsens the health and food security of **women, children, Black people, Indigenous people, Afro-Brazilian religious communities, and other traditional peoples and communities**, intensifying racial and socioeconomic inequalities.



**Peripheral areas of urban centers** suffer greater consequences from the climate crisis and extreme weather events.



**Rural populations** are facing increasing difficulties in securing their livelihoods.

## PREMISE 4:



The climate crisis seriously threatens Brazil's **socioeconomic development**.



In extreme scenarios, **losses in agricultural production** could reduce Brazil's GDP by up to 1.3% by 2050.



Climate change can directly increase **inflation**, especially food inflation.



## II. PREMISES

The premises were established based on leading scientific evidence that analyzes the relationship between climate change and food systems, including their causes and consequences, and that guides the proposal of principles and pathways for the transition to healthier and more sustainable food systems.

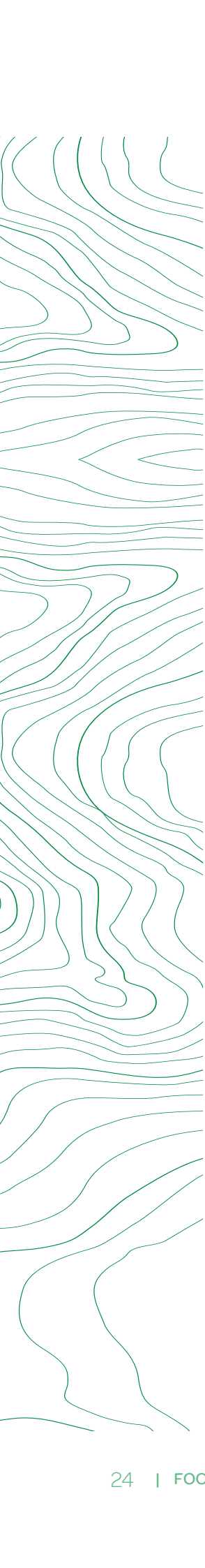
### PREMISE 1

#### CLIMATE CHANGE IS A REALITY, AND ITS EFFECTS ARE ALREADY FELT ACROSS THE PLANET

- 1. Human activities that result in greenhouse gas (GHG) emissions are the main causes of global warming.** Between 1990 and 2019, global GHG emissions rose by about 54%, mainly due to fossil fuels and industrial processes. From the Industrial Revolution to 2022, emissions are estimated to have increased around 182-fold. Unsustainable energy use, land-use change, and patterns of production, consumption, and lifestyle add to the drivers of global warming.
- 2. Temperature records have been broken year after year, and in 2024 they exceeded 1.5°C: the threshold set by the Paris Agreement.** In 2024, for eleven consecutive months, the highest temperatures in 175 years were recorded. Projections indicate increases between 1.2°C and 1.9°C above pre-industrial levels (1850–1900) over the next five years. The accumulation of GHGs and natural phenomena explain this rise and show that current measures are insufficient to avoid more severe impacts.
- 3. Planetary limits for maintaining natural cycles that sustain human life on Earth are being exceeded.** Some of the impact indicators include the compromised integrity of the biosphere and the ozone layer, the emergence of new pollutants, altered biogeochemical cycles, ocean acidification, declining water availability, and land-use change. Climate change, one of such limits, has worsened and fed back into this scenario.
- 4. Correlations between climate change and impacts on natural habitats resulting from socioeconomic dynamics are highly significant.** The climate crisis, one of the main drivers of change in nature over the past 50 years, represents a growing risk due to its pace and interaction with other factors that contribute to environmental degradation.
- 5. Biodiversity, which includes the variety of species and ecosystems, is under threat, and its loss aggravates climate change.** Although biodiversity is essential to the planet, human well-being, and the economy, about 25% of global biodiversity has already been lost. This makes food production less efficient and more vulnerable and affects soils, pollination, and water.

- 6. Rising average temperatures and extreme events seriously affect ecosystem services. These services are essential to food, water, and climate regulation, and protection against natural disasters.** In 2024, Brazil recorded its hottest year since 1961 and is considered a country of medium to high socio-environmental vulnerability due to its extensive coastline, high population density, and role as a major producer of agricultural commodities.<sup>100</sup> Projections indicate that, by 2040, water availability in the country could fall by up to 40%, increasing the risk of scarcity, especially in semiarid regions.
- 7. Oceans and aquatic environments are also affected by climate change.** Since 1970, oceans have absorbed more than 90% of the excess heat in the climate system, which alters marine currents and affects ecosystems. By absorbing large amounts of atmospheric CO<sub>2</sub>, a natural process that helps slow global warming, oceans become more acidic. This acidification harms sensitive marine organisms, such as corals and mollusks, and aggravates the impacts of fishing and climate change on biodiversity.
- 8. Pollution resulting from current production systems has worsened environmental impacts.** Pollution generated by current production systems contaminates the air, water, and soil, harming ecosystems, affecting human health, and contributing to global warming and climate change. Toxic substances, such as pesticides, chemicals, plastics, and heavy metals contribute to biodiversity loss and impair ecosystem regeneration, worsening environmental and social crises, and causing serious effects on human health.
- 9. Heat stress on people, animals, and plants is another consequence of rising temperatures.** It leads to health problems, such as increased hospitalizations due to air pollution from fires, more dengue cases related to excessive heat, and even deaths from high temperatures, especially among people in vulnerable situations.
- 10. Globally, about 79% of GHG emissions come from fossil fuels, while 21% to 37% are caused by agriculture and land use.** The main cause of GHG emissions worldwide is the burning of fossil fuels, such as coal, oil, and natural gas, used in electricity generation, transportation, and industry. This is the largest source of carbon dioxide, the gas that is the largest contributor to global warming.
- 11. In Brazil, the GHG emissions profile differs from the global pattern.** In 2022, land use, land-use change, and forests accounted for 39.5% (805,694 kt CO<sub>2</sub>e) of total emissions, followed by agriculture and livestock-raising with 30.5% (622,014 kt CO<sub>2</sub>e), and then the energy sector with 20.5% (418,451 kt CO<sub>2</sub>e).
- 12. Global warming, intensified by deforestation, has affected Brazilian biomes.** Especially the Amazon and Cerrado, which accounted for around 89% of the area deforested in 2024. The efforts dedicated by the Brazilian government resulted in reduced deforestation, since 2023, by 31% in the Amazon and by 41.2% in the Cerrado. Regarding GHGs, efforts to contain deforestation, especially in the Amazon, resulted in a drop of over 12% in emissions compared to the 2022–2023 period.



- 
- 13. Brazil is highly vulnerable to climate change due to its extensive coastline, its economy linked to the primary sector, and a tropical climate.** Extreme events such as desertification in the Northeast region, droughts in the Amazon, fires in the Pantanal, and floods in the Southeast and South regions result from human action and global warming, causing serious social and environmental impacts. Longer and more intense droughts often strike territories that also experience alternating periods of extreme rainfall, such as the Amazon<sup>46</sup>

## PREMISE 2

### FOOD SYSTEMS BOTH CAUSE AND SUFFER THE CONSEQUENCES OF CLIMATE CHANGE

- 1. The way food is produced contributes to global warming, while climate change affects production, quality, and access, threatening the Human Right to Adequate Food.** In Brazil, systems based on monocultures, intensive use of natural resources and pesticides, and long distribution chains increase CO<sub>2</sub> emissions.
- 2. Bringing new areas, especially forested ones, into agriculture and livestock-raising activities has helped place the country as a leading food producer, but it has had negative climate impacts.** Between 1985 and 2023, the area used for agriculture and livestock in Brazil expanded from 187.3 million hectares to 282.5 million hectares, occupying about one third of the national territory. This expansion occurred mainly in the Amazon (53.8 million ha) and the Cerrado (38.1 million ha), driven by pastures (59%) and soybean (14%). In the Amazon, 78% of soybean expansion took place over forests. In the Cerrado, 41% of the production advanced over savannas. Together, these biomes concentrated 67% of the country's pasture area in 2023.
- 3. Climate change directly affects food availability.** Between 2014 and 2023, losses caused by water scarcity or excess in Brazilian agriculture totaled about R\$ 282 billion. In an earlier period from 2005 to 2015, impacts on agriculture and livestock accounted for 67% of the country's economic losses.
- 4. Climate change is shifting crop areas, with direct impacts on food production.** The relocation of agricultural areas puts pressure on crops that are often essential to Brazilian food culture and aligned with healthy diets. Extreme weather events and the conversion of preserved areas into agricultural frontiers<sup>45</sup> can harm biodiversity and food security and nutrition, especially in developing countries<sup>46,47</sup>.
- 5. Irregular rainfall and increasing water scarcity affect all regions of Brazil.** With longer droughts and greater rainfall variability, irrigation demand is projected to rise by 66% by 2040, especially in the Cerrado and Caatinga biomes<sup>48</sup>. Between 2012 and 2017, intense droughts in the Northeast affected more than 80% of municipalities<sup>49</sup>.

- 6. Pollution of water sources harms agricultural production, fishery resources, and human and environmental health<sup>50</sup>.** Climate change increases water pollution by intensifying pollutant runoff, favoring harmful algal blooms, reducing dissolved oxygen, and releasing contaminants such as heavy metals and salts into aquifers<sup>51,52,53,54</sup>. The lack or reduction of water supply, in volume, quality, and regularity, undermines access to water for drinking, production, and hygiene, affecting family health and food security and nutrition<sup>55</sup>. Impacts include herd mortality, increased desertification, water reservoirs depletion and contamination, outbreaks of diseases such as diarrhea, and higher hospitalization and mortality rates among children and the elderly<sup>56,57,58</sup>.
- 7. Excessive use of pesticides and chemical fertilizers contributes to climate change and harms health.** These inputs emit GHGs, degrade soils, contaminate water and air, reduce biodiversity, and kill essential pollinators<sup>59,60,61</sup>. Their impacts affect rural workers and exposed populations, and are found in foods, including ultra-processed products<sup>62,63</sup>. Exposure to these substances generates social, environmental, economic, and health risks<sup>64,65,66,67</sup>, with pesticide residues detected even in breast milk<sup>68,69,70</sup>.
- 8. Intensive animal production systems accelerate climate change, degrade the environment, and increase health risks.** Heat stress makes animals more susceptible to disease<sup>71,72</sup>. In addition, excessive antibiotic use in confinement systems contributes to increased antimicrobial resistance, a global threat that could cause 10 million deaths per year by 2050. The problem is worsened by the transfer of resistant genes among animals, humans, and the environment<sup>73,74,75,76,77,78</sup>.
- 9. Enteric fermentation from bovine digestion impacts CO<sub>2</sub> emissions.** In 2022, Brazilian agriculture and livestock-raising accounted for 30.5% of national GHG emissions, with enteric fermentation from cattle as the sector's main source: 64.5% (404,062 kt CO<sub>2</sub> eq)<sup>79,80</sup>. Land-use change remained the largest source of emissions in rural areas (39.5%), mainly due to the opening of new pasture areas, confirming the correlation between agriculture and deforestation<sup>81,82</sup>. It is estimated that 90% to 99% of tropical deforestation is associated with agricultural expansion, with cattle herds responsible for 93% of livestock emissions<sup>83</sup>.
- 10. The sustainability of global fisheries is severely threatened, as well as that of rivers, wetlands, and other aquatic sources.** Overfishing already exceeds sustainable limits and, together with pollution, extraction of minerals and fossil fuels, coastal degradation, rising temperatures, and ocean acidification, compromises the production of marine foods, alters food chains, and forces species migration<sup>84</sup>. These impacts also affect rivers and wetlands, harming the diet, health, well-being, and income generation for traditional peoples and communities, indigenous peoples, shellfish gatherers, riverine populations, and even non-coastal populations.
- 11. Climate change has led to the loss of food varieties, compromising genetic diversity, food security, and ancestral knowledge.** Rising temperatures, changes in rainfall and extreme events affect agrobiodiversity conservation, leading to the extinction of local varieties<sup>85</sup>, such as heritage maize and medicinal plants, and reducing the viability of cultivation, especially in indigenous and rural communities<sup>86</sup>. This undermines food sovereignty<sup>87</sup>, ancestral knowledge, and sustainable farming systems developed over generations.

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- 12. Food consumption generates significant environmental impacts, measured by GHG emissions and by water and ecological footprints.** Globally, animal-source foods are the main drivers of such impacts<sup>88</sup>. In Brazil, between 1987 and 2018, GHG emissions and the water and ecological footprints rose by 21%, 22%, and 17%, respectively, with a notable increase in the consumption of ultra-processed meats<sup>89</sup>. Analyses of Brazilian consumption profiles in 2008–2009 indicate that diets high in red meat (158 g/day) can generate up to 6.4 kg of CO<sub>2</sub> equivalent and use 6,293 liters of water, almost double the impacts of a more balanced diet with less meat (50 g/day)<sup>90</sup>.
- 13. Climate change affects the nutritional quality of foods.** The increase in CO<sub>2</sub> reduces the concentration of protein, iron, zinc, and B-complex vitamins in cereals such as wheat and rice. This can worsen undernutrition and nutrient deficiencies, especially among populations whose diets are based on cereals<sup>91,92</sup>.
- 14. Climate change threatens food security and nutrition by disrupting transportation, raising logistics costs, and reducing access to fresh foods.** Extreme events block routes, undermine storage, and reduce agricultural output, affecting the logistics of food production and distribution, with impacts on GHG emissions, food prices, and food security and nutrition<sup>93</sup>. This can intensify food deserts, since reduced local production and damage to supply networks further limit access to fresh, healthy foods, especially in vulnerable regions<sup>94</sup>.
- 15. Climate change and climate emergencies compromise access to fresh foods such as fruits and vegetables.** Changes in climate cycles, with irregular rainfall, extreme events, soil degradation, and pests, increase agricultural vulnerability, reduce access to fresh foods, and favor consumption of ultra-processed products<sup>95,96,97</sup>. In Rio Grande do Sul (Brazilian south region state), during the state's largest climate emergency (2024), 16% of food outlets were in affected areas; in 11 cities, more than 40% of establishments were impacted, undermining access to fresh or minimally processed foods such as fruits, vegetables, and meats, and affecting fishmongers (29%) and restaurants (18%) in special<sup>98</sup>. In addition, water scarcity, intensified by extreme events, undermines cultivation, reduces supply, raises prices, and hinders access to healthy foods, particularly affecting family farming, as well as impairing processing and distribution<sup>99,100,101</sup>.
- 16. Long food supply chains, with greater distance between the places of production and consumption, emit more CO<sub>2</sub> compared with systems that prioritize regional production.** The emissions from medium and long chains for a basket of five foods (tomato, apple, onion, orange, and potato) are 4.21 and 15.41 times higher, respectively, than from short supply chains<sup>102</sup> that are less demanding in logistics and have positive reflections on food prices and on climate change adaptation.

- 17. Food losses and waste are directly linked to GHG emissions in food systems.** Food losses and waste occur throughout the productive supply chain from harvesting and slaughter to retail and consumption, totaling around 30% of foods and contributing with 500 million tons of CO<sub>2</sub>, or 10% of food-system emissions worldwide<sup>103,104</sup>. In 2022, approximately 1.05 billion tons of food were lost or wasted globally, generating 8% to 10% of global GHG emissions<sup>105</sup>. In Brazil, the lack of traceability and detailed data limits the identification of critical points and the monitoring of progress in waste reduction<sup>106</sup>.
- 18. The consumption of ultra-processed foods harms health<sup>107</sup> and generates environmental impacts.** Between 1987 and 2018, GHG emissions and the water and ecological footprints of these products rose by 245%, 233%, and 183%, respectively, with particularly sharp increases linked to ultra-processed meats<sup>108</sup>.
- 19. The plastic in food packaging, including that of ultra-processed products, is a serious environmental pollutant.** Around 430 million tons of plastic are produced per year worldwide, more than 60% of which is for single use, with a significant share associated with the food sector. Plastic production depends on fossil fuels, increasing CO<sub>2</sub> emissions and worsening climate change<sup>109,110,111,112,113,114,115,116,117,118</sup>. Improper disposal generates microplastics, releases pollutants, and contaminates soil, water, and marine life, also harming human health and causing long-term environmental impacts<sup>119</sup>.
- 20. Greenwashing and false solutions can harm food systems and hinder action on climate change<sup>120</sup>.** Deceptive messages hide socio-environmental impacts and mislead consumers concerned about the sustainability of food systems<sup>121</sup>. False solutions, also called greenwashing, confuse consumers and delegitimize socio-environmental certification processes (globally, 64% of people consider it essential to understand environmental impacts, which shows how influential these attributes are in people's choices)<sup>122,123,124,125,126,127</sup>. One example: products marketed as substitutes for animal production, aiming to offer cheaper protein aligned with sustainability principles, but which, in many cases, continue to support traditional production models, inducers of negative socio-environmental impacts, thus reinforcing climate change. Moreover, such products may be highly processed and rely on additives and ingredients with a large environmental footprint<sup>128,129,130,131</sup>. In Brazil, even though the Consumer Defense Code prohibits deceptive and abusive advertising, the practice persists<sup>132,133</sup>. The dissemination and support of greenwashing undermines real initiatives that structurally build healthy and sustainable food systems<sup>134,135,136</sup>.
- 21. Food systems are central components and determinants of the Global Syndemic of undernutrition, obesity, and climate change.** In this phenomenon these problems coexist and reinforce one another. They share common causes, such as unsustainable food systems and socioeconomic inequalities. This cycle affects human health and the sustainability of food systems, especially in vulnerable countries, with additional drivers such as transportation, urban planning, and land use<sup>137</sup>.



## PREMISE 3

### CLIMATE CHANGE EXACERBATES INJUSTICES, DEEPENS POVERTY, WIDENS INEQUALITIES, AND PRIMARILY AFFECTS PEOPLE AND COMMUNITIES IN VULNERABLE SITUATIONS

- 1. The climate crisis disproportionately affects populations in vulnerable situations.** Indigenous peoples, traditional peoples and communities, and residents of peripheral areas, especially women and children, suffer disproportionately from climate impacts, due to their ways of life and the degradation of the territories they inhabit. These groups are more exposed to extreme climate events, and to increased poverty, reduced employment opportunities, and difficulties in accessing adequate food<sup>138,139,140</sup>.
- 2. Women and girls, especially black women and girls, are disproportionately affected by climate change.** Care work, which is essential for life, health, and well-being, falls disproportionately on women and girls and it is worsened by the climate crisis<sup>141</sup>. Extreme events, water scarcity, and food insecurity increase the need for essential care - such as fetching water, securing food, and caring for the sick - and expose women to risks such as pollution, forced displacement, and disease<sup>142,143,144</sup>. Globally, women perform 76.2% of unpaid care work, and spend 3.2 times more time on it than men<sup>145</sup>. This overload limits time for education, paid work, climate-adaptation activities, and constitutes a central challenge for gender justice<sup>146,147,148,149</sup>.
- 3. Gender inequality makes women farmers particularly vulnerable to the climate crisis.** Women farmers represent approximately 20% of the agricultural workforce in Latin America, and face barriers to credit, land, inputs, technologies, and information, which jeopardizes the adoption of resilient and sustainable agricultural practices<sup>150,151,152</sup>.
- 4. The climate crisis is also a crisis in children's rights.** Although they are those least responsible for climate change, children and adolescents are among the most affected, especially in households headed by black, Indigenous, and quilombola women. In Brazil, more than 40 million children and adolescents (nearly 60%) are subject to climate risks<sup>153</sup>; of these, 12.2 million lack adequate sanitation and 2.8 million lack regular access to water, mainly in rural areas (approximately 1.5 million without piped water and 1.2 million relying on sources outside their homes)<sup>154</sup>. During extreme events, children in vulnerable situations lack response mechanisms, or existing ones are insufficient, leading to effects such as reduced school attendance.
- 5. Youth in the Global South suffer the environmental crisis disproportionately.** In developing countries youth face poverty and constraints in accessing basic services and natural resources. They are also excluded from political processes, which harms capacity building<sup>155</sup>, resilience, and responses to future events for which they bear little or no responsibility. This makes intergenerational injustice evident<sup>156</sup>.



- 6. Society's participation in decision-making spaces regarding the climate crisis faces several barriers.** Access to information about decision-making processes is limited<sup>157</sup> and often dominated by groups with greater political and economic power<sup>158,159,160</sup>, excluding local communities and ordinary citizens<sup>161,162</sup>. Low levels of civic education, key to expanding democratic, representative participation, also hinder the involvement of women, youth, black people, and indigenous peoples in climate discussions and decisions<sup>163,164,165,166</sup>.
- 7. Social protection systems are affected by the climate crisis.** Most of the population in vulnerable situations exposed to the crisis remains unprotected. Among the 20 countries at highest climate risk, only 8.7% of the population has social protection, estimated to 25% at the 50 most vulnerable countries<sup>167</sup>. In social assistance, climate events exacerbate poverty and overload the social-assistance network, creating immediate, massive demand for services, benefits, and psychological support<sup>168,169</sup>. In health, they raise disease incidence, affect mental health, increase the vulnerability of people with pre-existing conditions, and overload services that are unable to cope with continuously growing demand<sup>170,171</sup>. In education, events damage infrastructure and close schools, resulting in dropouts, food insecurity, and learning interruptions<sup>172</sup>. More than 370 thousand children in Brazil's state capitals study in schools located in risk areas, vulnerable to floods, flash floods, and landslides<sup>173</sup>, while students in the 10% municipalities with the highest temperatures could lose between 0.66 to 1.5 years of learning by the end of high school due to heat<sup>174</sup>.
- 8. Environmental racism amplifies the impacts of climate change.** Racialized and historically marginalized populations, such as black people, indigenous peoples, quilombolas, Afro-Brazilian religious communities, and traditional peoples and communities - often live in areas more vulnerable to disasters, facing greater exposure to pollutants and limited access to essential services. They suffer a disproportionate share of environmental impacts from climate change. Risks and harms are unevenly distributed, as is the implementation of public policies and development projects, such as hydroelectric plants, mining, wind farms, and agribusiness, that cause forced displacements, resource loss, and environmental degradation, excluding these communities from decision-making<sup>175,176,177,178</sup>. At the same time, the absence of land demarcation, pollution of rivers and seas, and the siting of landfills in peripheral areas reveal neglect that perpetuates historic inequalities and social marginalization<sup>179,180</sup>.
- 9. Climate change exacerbates vulnerabilities related to health and to food security and nutrition among Black and Indigenous peoples, Afro-Brazilian religious communities, and traditional peoples and communities, deepening racial and socioeconomic inequalities.** These communities are more vulnerable due to greater exposure of their territories, limited response capacity, and exclusion from strategic decisions and climate financing<sup>181</sup>. Their health and food security and nutrition are harmed by climate shocks that restrict access to foods and destroy crops, including medicinal herbs of Afro-religions<sup>182,183</sup>.



**10. Extreme weather events and environmental degradation drive internal migration in Brazil, especially from the Northeastern semiarid and the Amazon to urban areas.**

Between 2010 and 2022, 70% of displacements were caused by climate events, with more than 700 thousand people displaced in 2022 and 2023<sup>184,185,186</sup>. In 2022 specifically, this exodus reduced the rural population, overloaded cities, and worsened problems related to infrastructure, housing, poverty, and access to basic services<sup>187,188,189,190</sup>.

**11. Peripheral urban areas bear greater consequences from the climate crisis and extreme weather.**

Urban peripheries, marked by precarious infrastructure and high socio-environmental vulnerability, suffer disproportionate impacts such as floods, landslides, and heat waves, which caused 48,075 deaths between 2000 and 2018 and affected 93% of Brazilian municipalities in the last decade<sup>191,192,193,194,195</sup>. In 2024, natural disasters damaged 2.6 million houses and affected 13.1 million people, worsening the housing deficit<sup>196,197,198</sup>. With 87.4% of the population living in urban areas<sup>199</sup>, accelerated urbanization and unplanned occupations deepen socio-spatial segregation, restricting the right to the city in the face of climate change and gentrification<sup>200,201</sup>.

**12. Climate change intensifies food deserts by undermining the production, distribution, and access to healthy foods, primarily affecting populations in vulnerable situations.**

In Brazil's 91 municipalities with more than 300 thousand inhabitants, around 25 million people live in food deserts – including 5.4 million in favelas and urban communities, who are more exposed to extreme climate events, and 6.7 million living in poverty. Additionally, 15 million people live in food swamps, characterized by an abundance of ultra-processed products, including 1.8 million with low income and 104 thousand residing in peripheral areas and favelas<sup>202</sup>.

**13. Social inequalities are exacerbated by the predominance of hegemonic food systems that are intertwined with climate change.**

Dominant systems, based on extensive areas of agricultural monoculture and livestock production, affect socioeconomic relations and intensify competition for natural resources and for instruments to support production. This limits the competitiveness and climate-adaptation capacity of family farming and smallholdings<sup>203</sup>.

**14. Access to land and land conflicts are exacerbated by climate change, affecting peoples and communities in vulnerable situations.**

Climate change exacerbates land conflicts by reducing agricultural productivity, aggravating water scarcity and fertile land shortages, and increasing competition for resources<sup>204</sup>. This process particularly affects family farmers, indigenous peoples, and traditional communities, undermining their permanence in territories and their sociocultural continuity. Coupled with extreme events, these conflicts result in forced displacements, violent disputes, and greater corporate control over land, further deepening inequalities, threatening sociobiodiversity, and undermining food sovereignty<sup>205</sup>.

**15. Rural populations face growing difficulties in securing their livelihoods.**

Climate change has caused decline and losses in the production of foods that guarantee subsistence for farming families, also impacting income generation that sometimes comes from the sale of surpluses. This affects specially women, raising financial costs, reducing dietary diversity and consequently increasing food insecurity in rural areas<sup>206</sup>.

- 16. Climate change undermines water security, deepening inequalities in access to safe water and intensifying risks.** Climate change affects water flows, leading to water scarcity for drinking, cooking, production, and other basic needs such as personal hygiene – impacting 1.8 billion people worldwide<sup>207</sup> and more than 32 million in Brazil<sup>208</sup>. This impact is particularly severe for populations in vulnerable situations, such as people experiencing homelessness, who are more exposed to problems like dehydration and heatstroke, as well as to the consumption of low-quality and unsafe water<sup>209</sup>. Access to water ceases to be treated as a right and instead becomes framed as an act of assistance or charity, violating the principles of dignity and non-discrimination<sup>210</sup>.

## PREMISE 4

### THE CURRENT DEVELOPMENT MODEL CONTRIBUTES TO THE CLIMATE CRISIS AND IS ALSO AFFECTED BY IT<sup>211,212</sup>

- 1. The climate crisis poses a serious threat to Brazil's socioeconomic development.** Inaction could reduce accumulated GDP growth by 20.6%, generate economic losses of up to R\$ 1.8 trillion<sup>213</sup>, including R\$ 13 billion annually due to extreme events, and prevent the creation of 3.4 million jobs, pushing between 800 thousand and 3 million Brazilians into extreme poverty by 2030<sup>214</sup>.
- 2. Rising temperatures and extreme events threaten Brazil's infrastructure.** These damages have caused annual losses equivalent to 1.3% of GDP<sup>215</sup>, totaling R\$ 55.5 billion between 2017 and 2022<sup>216</sup>, while adaptation over the next 30 years could require R\$ 540 billion<sup>217</sup>, with annual costs reaching up to US\$ 7 billion by 2050<sup>218</sup>.
- 3. Climate change creates financial impacts on public health.** It intensifies heat stress, the occurrence of tropical diseases and zoonoses, water-related problems, and poor nutrition, while also worsening respiratory illnesses and increasing injuries, hospitalizations, and mortality from extreme events, thereby raising public health expenditures<sup>219</sup>. The direct costs of these impacts are estimated between US\$ 2 and 4 billion per year by 2030, including expenses with medical treatments, hospitalizations, and services related to diseases such as malnutrition, malaria, and diarrhea, all aggravated by climate-related events like heatwaves<sup>220</sup>. The environmental and socioeconomic damages related to health exceed by about 167% the economic output of the agriculture, forestry, and fisheries sectors<sup>221</sup>.
- 4. The climate crisis undermines labor and productivity.** Extreme heat reduces productivity by 2% to 3% for each degree above 20°C, increases the risk of occupational diseases<sup>222</sup>, and could reduce global working hours by 2.2% by 2030 – equivalent to 80 million jobs and US\$ 2.4 trillion in annual losses<sup>223</sup>. The agriculture and construction sectors will be most affected, as they rely heavily on physical labor and outdoor activities<sup>224</sup>, particularly in low- and middle-income countries. For businesses, this results in lower productivity, higher costs, and risks to competitiveness, demanding worker protection and adaptive measures<sup>225,226</sup>.

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- 5. In extreme scenarios, agricultural production losses could reduce Brazil's GDP by up to 1.3% by 2050.** With a temperature increase of 3°C by 2050, agricultural output in Brazil could fall by as much as 50%. Globally, over the last 30 years, climate disasters have caused losses equivalent to 5% of world GDP, about US\$ 123 billion per year<sup>227</sup>. Family farming, which is essential for food production, is particularly vulnerable due to its limited adaptive capacity and resilience<sup>228</sup>.
  - 6. Shifting water patterns create economic impacts in agriculture and livestock.** Between 2014 and 2023, financial losses in Brazil totaled R\$ 282 billion, with R\$ 59.2 billion in 2022 alone due to droughts, representing 21% of the total. Excess rainfall severely affected agricultural production in the Center-West and South, while droughts hit mainly the Northeast, Southeast, and South<sup>229</sup>.
  - 7. Climate change can directly increase inflation, particularly food inflation.** A 1°C temperature rise in a given month can raise food inflation by about 0.2% in the following year<sup>230</sup>, while globally, warming may increase food inflation by up to 3.23% annually<sup>231</sup>. This effect worsens access to food, especially among vulnerable populations. In Brazil, several food items experienced price increases in 2024<sup>232</sup> due to multiple factors, including geopolitical conditions, international prices, and exchange rate fluctuations, inflation<sup>233</sup>, as well as extreme weather events that affected crops such as coffee and tomatoes, with impacts extending into 2025<sup>234</sup>.
  - 8. The hidden costs of global food systems generate severe economic impacts, particularly burdening poorer countries and populations.** In 2023, global food systems generated hidden costs of US\$ 11 trillion per year (about 10% of global GDP)<sup>235</sup>, and in 2024 caused US\$ 11.6 trillion in environmental and social damages<sup>236</sup>. In Brazil, hidden costs reached US\$ 500 billion (≈16% of GDP), of which around US\$ 80 billion could be avoided annually<sup>237,238</sup>. These costs include environmental damage, biodiversity loss, and health impacts that fall disproportionately on vulnerable populations.
  - 9. The degradation of Brazilian biomes threatens the economy and agricultural production.** Beyond lowering agricultural productivity and revenues, degradation weakens climate regulation and ecosystem services in which these biomes play an essential role, with losses estimated at up to R\$ 3.6 trillion by 2050<sup>239,240</sup>. In the transition zone between the Amazon and the Cerrado, a key grain-producing region, shifts in climate patterns toward drier, hotter conditions already affect more than one quarter of productive area, driven mainly by deforestation, with an outlook for worsening by 2030 and 2050<sup>241</sup>.
  - 10. Market concentration increases the power of large corporations and makes food systems more vulnerable to climate change.** It undermines the autonomy of farmers and consumers and directly affects the transition to healthy, sustainable food systems due to the growing influence of major corporations in shaping national policies and regulations, as well as in controlling food prices and supply. While corporate participation is legitimate, there are significant asymmetries compared with other social actors, restricting choice and decision-making capacity, and undermining food sovereignty and the Human Right to Adequate Food<sup>242</sup>.

- 11. Food systems are shaped by socioeconomic development models that require public and private investment.** However, dominant food systems have concentrated investment in commodities, reinforcing less sustainable production patterns and monotonous diets, rather than fostering the sustainable diversification needed for food security and nutrition, and for the transition to healthy, sustainable food systems. Moreover, these investments can also strengthen the market power of multinational corporations and broaden their influence over national policies<sup>243,244,245</sup>.



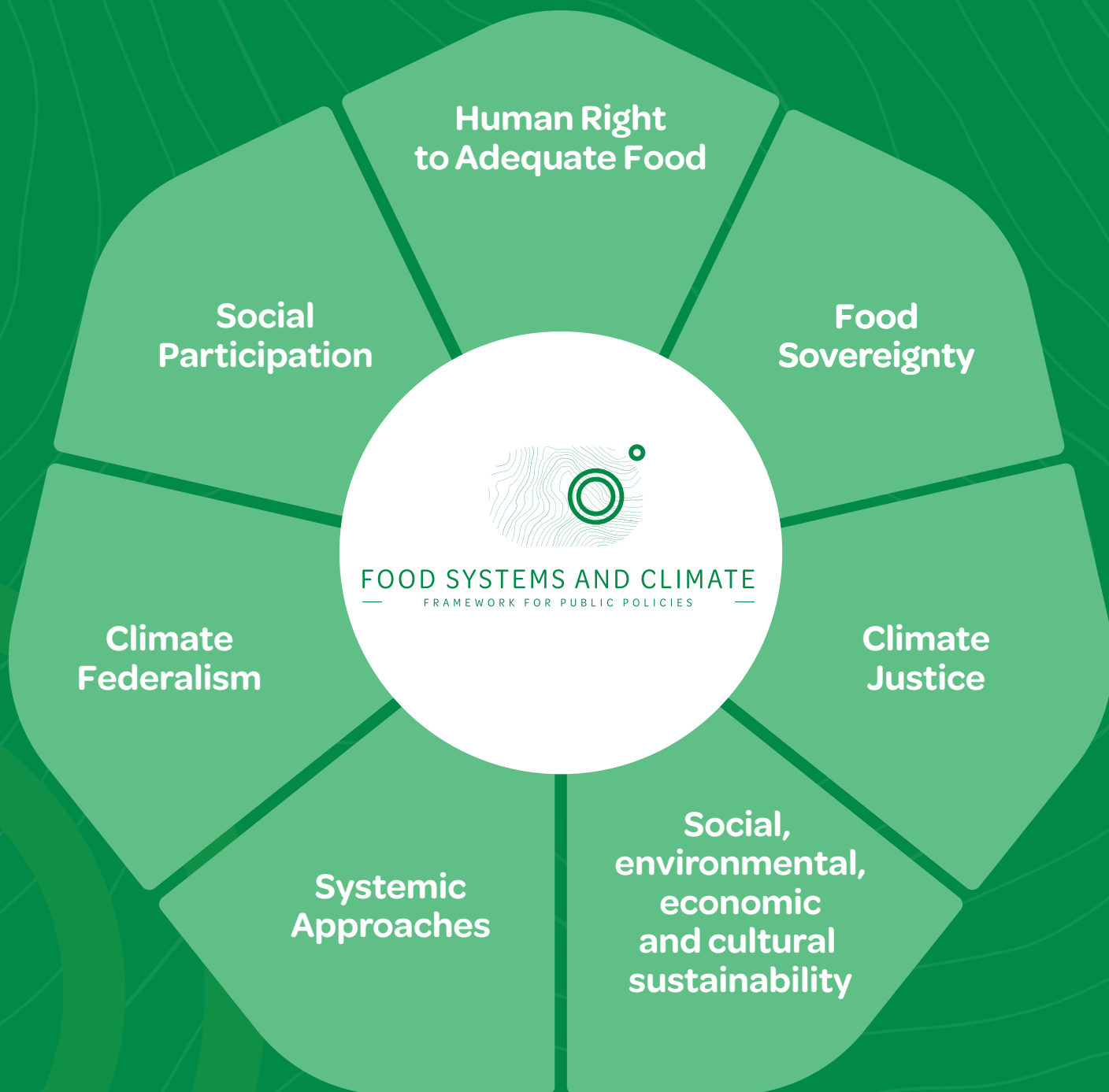








# FOOD SYSTEMS AND CLIMATE FRAMEWORK FOR PUBLIC POLICIES PRINCIPLES



FOOD SYSTEMS AND  
CLIMATE FRAMEWORK  
FOR PUBLIC POLICIES



## III. PRINCIPLES

**W**ithin the scope of the Food Systems and Climate Framework for Public Policies, these principles guide the formulation, implementation, and evaluation of government policies aimed at solving collective challenges and providing conceptual foundations that ensure coherence, equity, efficiency, and sustainability in actions related to food systems and climate change.

Aligned with the objectives and guidelines of this Framework, these principles can drive the transformation of food systems by enhancing their resilience, strengthening sustainability, and promoting socioeconomic inclusion in the face of climate challenges.



### THE HUMAN RIGHT TO ADEQUATE FOOD

The Human Right to Adequate Food, enshrined in Article 6 of the Federal Constitution of Brazil, establishes the obligation of the Brazilian State to respect, protect, promote, and fulfill this right, ensuring that all people are free from hunger and have regular and permanent access to quality food, in sufficient quantity and in a sustainable way, without compromising other essential needs.

Adequate food means ensuring regular and permanent access to food that meets both the biological and social needs of individuals, considering the stage of life and special dietary requirements, while respecting local knowledge and traditions<sup>246</sup>. It must follow the principles of variety, balance, moderation, and pleasure (taste); incorporate gender and ethnic dimensions, and be based on environmentally sustainable production methods, free from physical, chemical, and biological contaminants, as well as genetically modified organisms<sup>247</sup>.

As a principle of this Framework, the Human Right to Adequate and Healthy Food guides scenario analysis, the definition and implementation of actions. It calls for a human-rights approach that prioritizes people in vulnerable situations, upholding the rule of law, and guaranteeing transparency, accountability, as well as free and informed social participation. These are the parameters for advancing toward sustainable, resilient, and equitable food systems that ensure the production, supply, distribution, and consumption of food and safe drinking water.





## FOOD SOVEREIGNTY

Food sovereignty is the right of peoples to define their own sustainable policies and strategies for food production, distribution, and consumption, guaranteeing the right to food for the entire population. This principle emphasizes small and medium-scale production, respects local cultures and the diversity of livelihoods of small farmers, fishers, indigenous and traditional peoples and communities, and recognizes the fundamental role of women in these processes<sup>248</sup>.

Within the scope of this Framework, food sovereignty highlights that the greater a country's external dependence to ensure domestic food supply, the greater its vulnerability to international political and economic instability, which places it at a disadvantage in negotiations of all kinds.

This principle also reinforces the relationship between food systems and climate change, advocating for the autonomy of peoples and countries in local food production and supply, the promotion of biodiversity, and the leadership of women. This is essential because long production and consumption chains, and intensive monocultures have been shown to generate significant negative impacts.



## CLIMATE JUSTICE

Climate justice recognizes that climate change affects different social groups unequally, with those in vulnerable situations, low-income and peripheral populations, women, children, black and indigenous peoples, and traditional peoples and communities bearing the greatest burdens.

The intersection of food systems and climate justice acknowledges the interconnection between ecological, political, economic, and social dimensions, indicating that strategies to strengthen the resilience of food systems must consider the socioeconomic inequalities present in these contexts<sup>249,250</sup>.

As a principle of this Framework, climate justice directs public policies to promote equity, human rights, racial and gender equality, and social justice, ensuring that the transition to sustainable food systems is just and inclusive. The pursuit of climate justice is directly related to combating environmental racism and all forms of inequality.



## SOCIAL, ENVIRONMENTAL, ECONOMIC AND CULTURAL SUSTAINABILITY

Traditionally, sustainable development is defined through three pillars: social, environmental, and economic. However, in the context of this Framework, it is also essential to include the cultural dimension, which values the preservation and strengthening of traditions, practices, values, and sociocultural identities.

This perspective guides the adoption of solutions that aim to reduce socioeconomic inequalities, protect and restore biomes, promote sociobiodiversity, and diminish power asymmetries. It also reinforces the need for a fair distribution of resources, including financial ones, to ensure adequate living conditions for present and future generations.



## SYSTEMIC APPROACHES

The complexity of the climate crisis and transition of food systems, and the interconnection and interdependence between them, demand systemic approaches, since fragmented strategies or those that reproduce current dynamics of food systems within the climate agenda are insufficient for achieving effective solutions. The necessary transformation calls for integrated actions that promote equity and sustainability, recognizing the interdependence of environmental, social, economic, and political factors that structure food systems.

The intersection between climate change and food systems demands solutions that go beyond mitigation and adaptation to environmental impacts. It requires the progressive realization of human rights, especially the Human Right to Adequate Food.

Within this Reference Framework, systemic approaches should align objectives, actions, targets, budgets, and commitments across different sectors and governance levels throughout all stages of food systems, from production to consumption<sup>251,252</sup>.



## CLIMATE FEDERALISM

Climate federalism expresses multilevel governance to address climate change, integrating mitigation and adaptation actions across the Union (federal government), states, municipalities, and the Federal District, aligned with territorial needs and international commitments. In Brazil, this perspective is led by the Council of the Federation, established by Decree No. 11,495/2023<sup>253</sup>, whose plenary resolution sets commitments for climate federalism, considering the dynamics of river basins, ecosystems, and biomes, among other premises<sup>254</sup>.

This initiative is connected to the creation of the Coalition for High Ambition Multi-Level Partnerships, endorsed by 62 countries, including Brazil<sup>255</sup>.

The integration of strategies and responsibilities among governments is rooted in Brazil's federalism, established with the Proclamation of the Republic. Since then, the country has implemented this system through various strategies, such as the division and sharing of responsibilities among the Union, states, municipalities, and the Federal District. Notable examples of this cooperation include the Unified Health System (SUS, in Portuguese), which guarantees the constitutional right to health through shared financing and responsibilities across all three spheres of government. The Unified Social Assistance System follows the same logic. In the climate agenda, a key example is the restructuring of the Interministerial Committee on Climate Change, created in 2007 and reorganized in 2023<sup>256</sup>, to organize, at the federal level, the planning and execution of Brazil's climate policy, in accordance with Law No. 12,187/2009, which established the National Policy on Climate Change<sup>257</sup>.

As regards the objectives set forth in this Framework, Brazil also relies on the National System for Food Security and Nutrition, which provides the conditions for coordinated, integrated, and decentralized processes supported by instruments for planning, management, information, and financing, mechanisms that can support adaptation and mitigation actions within the transformation of food systems.



## SOCIAL PARTICIPATION

Social participation is the process through which individuals, groups, and civil society organizations contribute to the formulation, implementation, monitoring, and evaluation of public policies and government decisions. It is a right guaranteed by the Federal Constitution.

Given the complexity and inequalities related to the climate crisis and the hegemonic food system, it is unlikely that effective solutions can be attained without society's involvement, especially that of the most vulnerable groups.

In this Reference Framework, social participation must ensure that the groups most affected have an active voice in the decisions that impact their lives and the population as a whole. This principle requires that decisions be made democratically, free of conflicts of interest, in a transparent and inclusive manner, encompassing the entire public policy cycle, not only the consultation or diagnosis phases.









**PATHWAYS  
TO  
CHANGE**

**I – DEMOCRATIC MULTILEVEL GOVERNANCE**

1. Drive intersectoral coordination and commitment sacross all levels of government
2. Ensure democratic governance with mechanisms to prevent conflicts of interest
3. Strengthen social participation
4. Secure funding to reorient food systems
5. Implement education, information, and communication strategies.
6. Influence coordination and cooperation of international technical and policy agendas in intergovernmental and multilateral forums.

**HEALTHY AND SUSTAINABLE  
FOOD SYSTEMS**

**II - TRANSITION TO HEALTHY AND  
SUSTAINABLE FOOD SYSTEMS**

1. Reorient production methods and land use to address climate change
2. Promote the agroecological transition and other food production systems guided by conservationist and regenerative practices.
3. Ensure water security for food production and human consumption
4. Strengthen sociobiodiversity as an integral part of food systems
5. Conceive food supply as a State policy, ensuring national sovereignty and climate resilience.
6. Promote resilient and circular city models to expand social and environmental co-benefits
7. Promote environments that support adequate and healthy eating for people and ecosystems
8. Reduce food loss and waste
9. Invest in science, technology, and innovation to advance sustainable food systems



## IV. PATHWAYS

**T**he **Food Systems and Climate Framework for Public Policies** propose a set of pathways to support the design and structuring of strategies and responses to the challenges outlined in its premises, with the goal of achieving the objectives set forth in this document.

The approach adopted is deliberately comprehensive, mobilizing core themes that guide and encourage policies toward food systems capable of recognizing and addressing contemporary challenges linked to climate change, and that must be further developed across different federal levels, taking into account specific contexts.

From this perspective, this section is organized into two major parts, detailed in subsections: (I) democratic multilevel governance, and (II) the transition toward healthy and sustainable food systems.

### I – DEMOCRATIC MULTILEVEL GOVERNANCE

Democratic governance is understood as a management process that creates opportunities for legitimate participation by different sectors of society throughout the public policy cycle. In other words, it refers to how public authorities implement policies and services continuously, considering institutionalized aspects and possibilities for the participation of different social segments in institutional structures, encompassing relationships among actors and organizations, decision-making processes, and the implementation, monitoring, and evaluation of public policies.

It is therefore essential to ensure representation and diversity and to prevent and manage conflicts of interest, so that decisions prioritize the common good and serve the public interest. In the context of this Framework, given the complexity of the agenda that brings together food systems and climate, these aspects are particularly important.

Governance processes are challenging by nature, and this Framework proposes co-creation and co-management practices, structuring networked actions that consider the diverse realities, needs, and experiences of territories. As proposed here, governance has the potential to increase the efficiency and effectiveness of public action.



## 1. DRIVE INTERSECTORAL COORDINATION AND COMMITMENTS ACROSS ALL LEVELS OF GOVERNMENT

Brazil's major national public policy systems, such as health and social assistance, offer solid experience with participatory governance across all administrative levels. Similarly, comparable processes are being strengthened for environmental and climate management. Within the scope of this Reference Framework, Brazil has a distinctive advantage: the National System for Food Security and Nutrition. With its pillars of social participation, represented by councils (from federal to municipal levels), and cross-sectoral management structured in intersectoral chambers (also present at all government levels), this system enables dialogue and decision-making across the sectors and dimensions required to connect food systems and climate.

Within the National Council for Food Security and Nutrition, two-thirds of the seats are held by civil society representatives, ensuring diversity and representation of the different dimensions of the food security and nutrition agenda and contributing perspectives and experiences to transform realities and improve public policies. The 24 ministries represented in the National Council also make up the Interministerial Chamber for Food Security and Nutrition, where priorities and actions are negotiated and coordinated. The Chamber drafted the 3rd National Plan for Food Security and Nutrition based on deliberations of the 6th National Conference on Food Security and Nutrition, held in 2023.

The National System for Food Security and Nutrition present a concrete opportunity to align priorities and commitments across sectors, and to expand dialogue with other public policy systems, which is an essential condition, since the governance of the food system in the climate context requires coordination with macro-policies and their institutions. For such governance to be effective, processes must also include accountability and enforceability instruments that ensure proper handling of and response to human rights violations linked to this agenda.

### Recommendations:

- a. Strengthen debate on the interrelationship between food systems and climate within governance spaces of the National System for Food Security and Nutrition and its components, such as the Interministerial Chamber for Food Security and Nutrition, the National Council for Food Security and Nutrition, and the National Conference on Food Security and Nutrition, as well as their state, district, and municipal counterparts.
- b. Strengthen governance bodies that coordinate and negotiate political commitments among sectors for the adoption of strategies in the scope of sustainable, resilient food systems and climate across all three levels of government.
- c. Strengthen the negotiation, planning, and implementation of joint commitments by different sectors regarding policies, programs, and actions for climate mitigation and adaptation within food systems.
- d. Build information and monitoring systems that enable the coordination of priority strategies in emergencies related to food systems and climate.

- e. Guide the prioritization and coordination of bills and other normative instruments between the Executive and Legislative branches that favor healthy, sustainable, and resilient food systems and climate policies, in line with this Framework's principles and guidelines.

## **2. ENSURE DEMOCRATIC GOVERNANCE WITH MECHANISMS TO PREVENT CONFLICTS OF INTEREST**

The convergence between food systems and climate requires governance capable of addressing the complexity of these agendas, while integrating climate justice and the Human Right to Adequate Food into policies, programs, and strategies. Consequently, solutions and alternatives must focus on combating hunger and ensuring food security and nutrition.

Governance spaces for policymaking that reconcile the diverse interests of sectors and actors, globally, nationally, and locally, must be guided by the principle of preserving the public interest throughout decision-making and implementation processes. To that end, mechanisms are needed to guarantee transparency and establish criteria for participation by different actors throughout the policy cycle, with a focus on preventing and managing conflicts of interest<sup>258</sup>.

Conflicts of interest are situations in which a secondary private interest (of individuals or groups) may improperly influence the primary interest of a strategy, potentially leading to decisions contrary to the public interest<sup>259,260</sup>. The concept of commercial determinants of health helps identify actors and their interests, and clarifies the systems, practices, and pathways through which commercial agents influence human health and health equity, sometimes contributing to, and other times undermining health and the public interest<sup>261,262</sup>.

### **Recommendations:**

- a. Address and reduce power asymmetries in decision-making processes, guaranteeing social participation in governance bodies so that collective and common rights and interests prevail over private and commercial interests.
- b. Make it explicit and acknowledge the specific responsibilities and interests of the various sectors and actors involved in discussions on food systems and climate change, ensuring transparency in decision-making processes.
- c. Ensure that discussions and decisions on food systems and climate change are based on evidence produced free from conflicts of interest, in light of the commercial determinants of health.
- d. Establish, within federal governance, a mechanism capable of proposing guidance and guidelines, as well as structuring processes and procedures to identify, prevent, and manage conflicts of interest.





### 3. STRENGTHEN SOCIAL PARTICIPATION AS A CENTRAL ELEMENT OF POLICIES, STRATEGIES, AND ACTIONS.

Social participation in building policies, programs, and strategies is essential to strengthening democracy and achieving the necessary results. One example is the National Council for Food Security and Nutrition, which serves as a space for convergence between the food systems and climate agendas, highlighting priorities, pathways, and solutions already practiced by peasants, family farmers, indigenous peoples, quilombolas, traditional peoples and communities, peripheral communities, and grassroots organizations<sup>263</sup>. For territorial solutions to reach decision-making spaces, legitimate and informed participation of rights holders in public policies is essential.

The climate crisis also generates other forms of vulnerability. For instance, communities near industrial-zoning areas, communities at risk and/or exposed to environmental disasters, and climate refugees must have opportunities for participation and advocacy. Likewise, urban and peripheral communities, disproportionately affected by climate changes and extreme events, must also have a voice, not only to express their demands but to share their experiences of resistance and resilience.

#### Recommendations:

- a. Ensure the participation and inclusion of the needs and proposals of socially vulnerable groups including agrarian reform settlers, black populations, peripheral communities, indigenous peoples, quilombola communities, traditional peoples and communities, women, youth, and children, throughout the public policy cycle related to food systems and climate.
- b. Recognize the centrality of diverse practices, forms, and expressions of knowledge in transforming food systems in the face of climate change.
- c. Expand civil society and academic participation in decision-making spaces, prioritizing historically underrepresented public-interest organizations.
- d. Incorporate multidimensional indicators into the planning and monitoring of strategies and actions on the food systems and climate agenda that take into account environmental racism and the intersections of race, gender, class, ethnicity, and territory.
- e. Strengthen food security and nutrition councils within the National System for Food Security and Nutrition to broaden the reach and implementation of these agendas.
- f. Ensure adequate budget allocations for institutional spaces dedicated to social participation.
- g. Provide training and capacity-building opportunities for civil society organizations serving the public interest from different social segments to support development processes across the public policy cycle.
- h. Foster coordination among the different public policy councils working on the food systems and climate agenda.

- i. Integrate organizations and collectives working toward the Human Right to Adequate Food into social participation mechanisms in sectors beyond those directly related to food security and nutrition, allowing knowledge on territories and food practices to contribute to the organization of sustainable food systems and the circularity of processes.

#### **4. ENSURE ADEQUATE FINANCING AND INCENTIVES TO REORIENT FOOD SYSTEMS**

The functioning of food systems is leveraged by a set of public policies through the provision of different forms of public financial support, applied across the different stages of food production, processing, distribution, and consumption.

The Ecological Transformation Plan is an example of an initiative that brings together several programs to build public policies and strategic tools so that financing across sectors, and society as a whole, can reach a new level of sustainable and technological development.

Specifically, the Safra Plans for Family and Commercial Agriculture saw increases in their total funding from 2023 onward, underscoring the importance of these instruments in strengthening the primary sector of the economy.

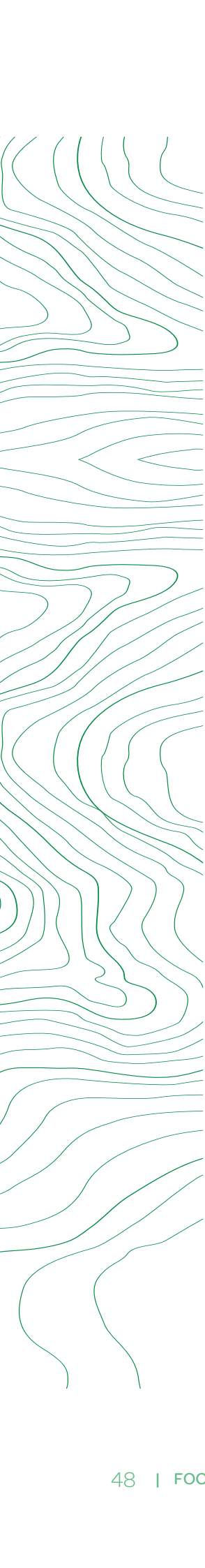
Simultaneously and paradoxically, there are significant amounts of tax exemptions for products and inputs in the agricultural sector, such as pesticides, which contradict the agenda of transforming food systems, considering the parameters of climate change mitigation and adaptation.

Meanwhile, the growing financialization of the sector mobilizes private investors' capital and channels it into agribusinesses (private financial instruments), also influencing land-related issues through funds that acquire land.

The current debate linking food systems, climate, and food sovereignty points to the importance of ensuring that these public and private mechanisms work in sync with one another, amplifying efforts and resources to provide healthy foods to society, while aligning with environmental quality, reducing inequalities, and promoting social and economic justice.

##### **Recommendations:**

- a. Guide public and private financing for food systems, prioritizing techniques, practices, and inputs based on the precautionary principle regarding potential climate change intensification, with special attention to environmentally degrading activities and the carbon footprint of these processes.
- b. Organize and size public financing and tax treatment applied to food systems according to national planning for food production aimed at domestic supply and exports, ensuring food sovereignty, particularly in the face of climate change impacts.

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- c. Reorient financing, subsidies, and other fiscal mechanisms applied to food systems, considering negative externalities and so-called hidden costs generated by less efficient agricultural production models in curbing GHG emissions and promoting sustainable food systems.
  - d. Steer private financial instruments that invest in the agricultural sector toward climate mitigation, climate adaptation, and food-system sustainability, including safeguards against potential land conflicts, such as those arising from land acquisitions by transnational groups via investment funds.
  - e. Ensure adequate and targeted financing mechanisms for different sectors and social groups.
  - f. Strengthen the institutional capacities of public agencies to develop, directly or indirectly, analyses for formulating incentive and financing policies that consider the correlation between food systems and climate change.
  - g. Guarantee adequate financial resources through funds to confront the climate crisis and hunger, ensuring efforts are focused on sustainable, equity-promoting solutions.
  - h. Ensure periodic review and updating of selective taxes on products and practices proven harmful to human health and the environment, based on impact evaluations and scientific evidence, and direct that revenue to fostering sustainable food systems.
  - i. Compensate indigenous peoples, quilombolas, and other traditional peoples and communities, as well as family, peasant, and agroecological farming, for the environmental services they provide, which are vital to climate resilience.

## **5. IMPLEMENT STRATEGIES FOR EDUCATION, INFORMATION, AND COMMUNICATION ON FOOD SYSTEMS AND CLIMATE CHANGE**

Measures necessary to ensure that the link between food systems and climate promotes climate justice and the realization of the Human Right to Adequate Food require an ongoing, high-quality process of education, information, and communication, enabling public managers and society to expand their understanding and analytical and propositional capacities regarding this agenda. A continuous process of training, knowledge exchange, and dissemination contributes to improving available information and knowledge, strengthening public policies.

Within this Framework's pathways, education, information, and communication as collective processes also promote autonomy in food choices, connected to food sovereignty and respectful of local food cultures. This perspective is consistent with the Reference Framework on Food and Nutrition Education for Public Policies and Environmental Education. It encourages formal and informal educational and training actions for schools, academic and grassroots communities, social movements, and public managers. The approach is intersectional, territorialized, and sensitive to specific food and cultural contexts within food systems and climate<sup>264,265,266</sup>.

#### **Recommendations:**

- a. Disseminate information and tools that promote transparency and guidance for different segments of society to implement strategies and actions.
- b. Structure processes for the continuous training of managers, professionals, and interested societal segments.
- c. Coordinate practices related to food, nutrition, and environmental education across the three levels of government through training, instruction, courses, and materials, emphasizing the relationship between food systems and climate.
- d. Expand and improve information sharing through official communication channels of the federal Executive to states, the Federal District, municipalities, and society at large.
- e. Adopt the strategic role of social communication in disseminating accessible, engaging, and reliable information about responses to the climate crisis in food systems and about existing sustainable alternatives.

## **6. INFLUENCE COORDINATION AND COOPERATION OF INTERNATIONAL TECHNICAL AND POLICY AGENDAS IN INTERGOVERNMENTAL AND MULTILATERAL FORUMS.**

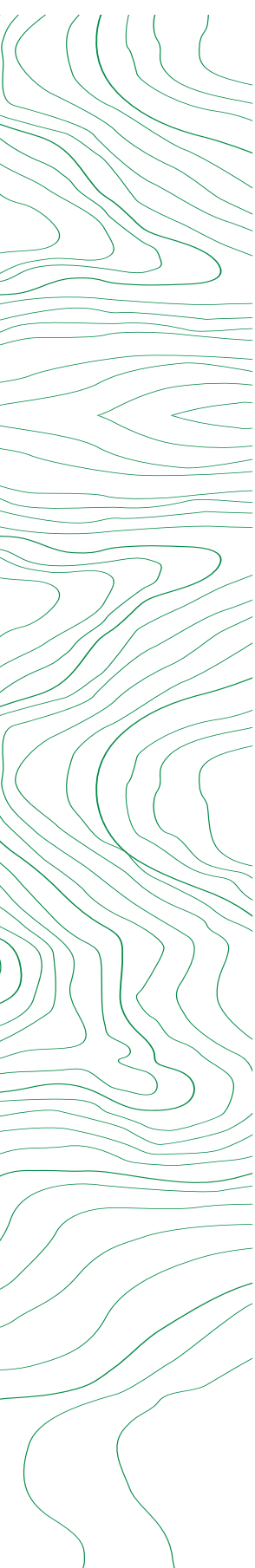
At the international level, there is growing recognition that approaches producing positive outcomes for both food systems and climate are necessary and can be enhanced. One example is the mission of the Global Alliance against Hunger and Poverty to accelerate efforts to eradicate hunger and poverty while reducing inequalities, revitalizing global partnerships for sustainable development, and promoting sustainable, inclusive, and just transitions.

In practical terms, to limit global temperature rise to near 1.5°C relative to emissions from food systems, positions and negotiations in international coordination and cooperation spaces must involve ambitious, convergent, assertive, and measurable proposals at both political and technical levels.

#### **Recommendations:**

- a. Adopt the concepts and principles of Food Sovereignty and the Human Right to Adequate Food to guide negotiations in international coordination and cooperation spaces addressing food systems and climate.
- b. Reference Brazil's achievements in food security and nutrition, considering the concept adopted in the Organic Law on Food Security and Nutrition and the National System for Food Security and Nutrition, its objectives, and bodies to guide cooperation processes, positions, and proposals in intergovernmental negotiations and implementation internationally.





- c. Apply the concept of adequate and healthy eating from the Dietary Guidelines for the Brazilian Population<sup>267</sup> and the concept of healthy eating in Decree No. 11,936/2024<sup>268</sup> as benchmarks to guide cooperation processes, positions, and proposals in intergovernmental negotiation and implementation spaces at the international level.
- d. Direct Brazil's commitments toward transitioning food systems in ways that align with confronting climate change, taking into account the polycrises of climate, biodiversity loss, health, and water.
- e. Recognize and promote sustainable food production practices in national and international negotiations related to food systems and climate, valuing adequate and healthy eating and sociobiodiversity, while discouraging what harms the environment and health, such as ultra-processed foods and excessive consumption of animal-source products.
- f. Integrate this Framework's principles, guidelines, and pathways into the monitoring and formulation of national and global targets for the Nationally Determined Contribution (NDC).
- g. Expand and strengthen institutional capacities and the exchange of knowledge, social technologies, and best practices among countries and international organizations, with emphasis on Global South countries, enhancing locally adapted solutions and fostering innovations in sustainable and climate-resilient food systems.
- h. Promote and implement social participation as an essential requirement for cooperation and technical support actions from international agencies.
- i. Reinforce coherence in coordination and negotiation processes in multilateral and regional spaces in which Brazil participates, such as the Committee on World Food Security, Community of Portuguese-Speaking Countries, Group of Twenty (G20), Cooperation block comprising Brazil, India, Russia and South Africa (BRICS), Southern Common Market (Mercosur), Community of Latin American and Caribbean States (CELAC), Amazon Cooperation Treaty Organization, Union of South American Nations (Unasur), among others, ensuring that national positions and experiences are valued and serve as references, including those related to social participation and academic exchange.
- j. Promote the definition of criteria for non-governmental actor participation in multilateral forums to ensure transparency and effectiveness in processes, and prevent, mitigate, and manage conflicts of interest.
- k. Adopt the polluter-pays principle in multilateral negotiations concerning the establishment and allocation of funds, ensuring that those who pollute most bear greater financial or participatory responsibility, considering asymmetries between Global North and South countries, promoting equity between historical contributors to the climate crisis and those most affected.

- I. Base national humanitarian aid on the principles of food sovereignty, of the Human Right to Adequate Food, and of food security and nutrition, ensuring actions address short- and medium-term needs without compromising local capacities to recover their food systems and autonomy.







## II – TRANSITION TO HEALTHY AND SUSTAINABLE FOOD SYSTEMS

Contemporary food systems demand urgent solutions in the face of the climate crisis, requiring adjustments and transformations across all stages. This section focuses on adapting production, supply, and consumption practices, including losses and waste.

### 1. REORIENT PRODUCTION METHODS AND LAND USE TO ADDRESS CLIMATE CHANGE

Predominant food systems invariably promote land use and production methods that exacerbate climate change due to their particularities, especially the intensity of natural resource exploitation, low crop species diversity, the need to mobilize large land areas for a single purpose, and intensive use of inputs, pesticides, and energy.

At the same time, it is essential to recognize the diversity of production models within food systems, with distinct practices to be strengthened, such as integrated crop-livestock-forest systems, no-till farming, biological nitrogen fixation techniques, among other initiatives implemented under the ABC+ Plan (2020–2023)<sup>269</sup>, which aim at sustainability and conserving agroecosystem productive capacity.

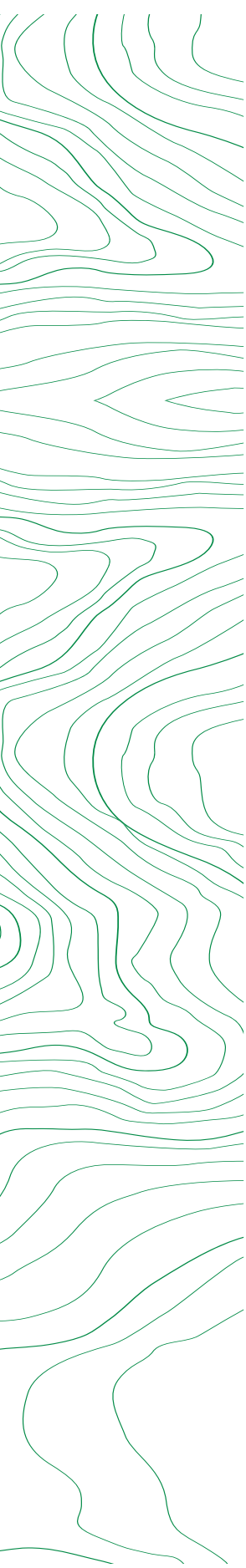
In this context, it is also worth highlighting the National Pesticide Reduction Program<sup>270</sup>, which promotes agricultural practices aligned with the purposes of this Framework, notably fostering healthier and more sustainable food systems, which is a particularly sensitive issue due to intensive pesticide use in Brazil.

Reorienting production methods is among the necessary actions to slow climate change. It is urgent to adapt food production to the climate crisis, increasing the supply of healthy, sustainable, diverse, and affordable foods.

#### Recommendations:

- a. Halt deforestation, particularly that connected to the expansion of the agricultural frontier, by systematically adopting environmental compensation as a mechanism for authorized vegetation removal (net-zero deforestation), while mobilizing investments and efforts to convert degraded areas into sustainable food production spaces.
- b. Strengthen and enable mechanisms that protect and restore Permanent Preservation Areas and Legal Reserves for integrated landscape management and creation of ecological corridors, adopting participatory monitoring and territorial surveillance when relevant to forest conservation and restoration governance.
- c. Strengthen agricultural and agroclimatic zoning mechanisms, such as the Climate Risk Agricultural Zoning, for optimal use of arable areas, investing in dynamic adjustments related to climate change, guidance, and directions aligned with the best available scientific knowledge for diversified territorial occupation.





- d. Strengthen early warning systems for climate emergencies as a central measure to protect agricultural production and vulnerable communities, enabling preventive and adaptive actions and ensuring social participation as an effective capacity-building mechanism.
- e. Strengthen and promote production methods integrating conservationist practices, particularly soil and water conservation, instead of those harmful to maintaining vital ecosystem services for food production.
- f. Invest in production methods that favor crop diversity, encouraging regional initiatives that promote polycultures and other dynamics integrating plant and/or animal species for diversified landscapes, enabling agroforestry systems.
- g. Invest in Technical Assistance and Rural Extension as a strategic instrument to promote production systems grounded in conservation practices.
- h. Ensure land allocation and demarcation for indigenous peoples, quilombolas, and other traditional peoples and communities, while strengthening the national agrarian reform policy to orient land use toward healthy food production, sustainable local development, and social and climate justice.
- i. Consider tidal territories as part of the discussion on land, territory, and water territoriality rights.
- j. Expand policies for family farming and the solidarity economy, particularly subsidized credit and adequate mechanisms to enable access, as well as technical assistance for climate adaptation and agroecology promotion, especially for communities and territories most vulnerable to climate change.
- k. Expand mechanisms, emergency plans, and insurance for family farmers and other vulnerable food production sectors exposed to adverse climatic events.
- l. Provide support to family farmers and traditional communities, considering their traditional strategies for restoring natural resources, especially arable soil, after intense droughts, floods, and other extreme climate events, with appropriate technical and financial support.
- m. Establish stricter regulations and policies for controlling and reducing pesticide use, particularly reviewing tax exemptions based on analyses of socio-environmental impacts resulting from these policies.
- n. Curb the escalation of antibiotic use in intensive animal production, in line with scientific premises and international agreements and protocols; incorporate animal welfare as a core element of husbandry, recognizing that production systems that respect animals contribute directly to human health, environmental sustainability, and climate resilience.

- o. Encourage agricultural models that prioritize diversified food production and discourage cultivation of non-food crops or inputs for products and foods that negatively impact human health or the environment, especially in family farming, such as tobacco and hops, for cigarettes and alcoholic beverages, respectively.
- p. Invest in and promote traceability in the beef supply chain, encouraging production compliance with good practices and strengthening state inspection capacity.

## **2. PROMOTE THE AGROECOLOGICAL TRANSITION AND OTHER FOOD PRODUCTION SYSTEMS GUIDED BY CONSERVATIONIST AND REGENERATIVE PRACTICES.**

Agroecology is both a science and a practice that develops an in-depth understanding of agroecosystems by combining agronomic, ecological, and socioeconomic knowledge<sup>271,272,273</sup> emphasizing the sustainable use, preservation, and conservation of natural resources; more integrated territorial practices; and controlled use of external inputs. It also expresses the collective construction of social movements advocating for political and economic transformations that demand food sovereignty, social justice, and collective rights<sup>274</sup>. Agroecology is furthermore recognized as an effective approach to large-scale food production, an endeavor that is increasingly gaining recognition.

While recognizing various farming practices that conserve natural resources and promote more sustainable production systems - an undeniable achievement of tropical agriculture in Brazil - advancing the agroecological transition through changes in practices and management of traditional or conventional agroecosystems also means revisiting the productive and social foundations of land and natural resource use, as set out in the National Policy on Agroecology and Organic Production<sup>275</sup>.

Given the challenges of organizing sustainable food systems amid the vastness and diversity of Brazil's territory, sectors, production dynamics, and modes of land and resource use, it is essential to strengthen all initiatives guided by the assumptions mentioned above. These efforts should support processes that facilitate the transition from traditional or conventional models toward sustainable food production systems.

Public procurement that prioritizes products from family farming and agroecological production is one of the key means to drive this transition. In Brazil, there is a legal preference for purchasing organic, agroecological, or sustainably produced foods for the National School Feeding Program<sup>276</sup>. In addition, the Food Acquisition Program purchases food directly from family farmers, without the need for standard public procurement procedures, and distributes it to individuals experiencing food insecurity, as well as to the social assistance network, public food security and nutrition facilities, and public and philanthropic educational institutions<sup>277</sup>.



## Recommendations:

- a. Elevate the agroecological transition to the level of State policy, through the National Policy on Agroecology and Organic Production, supported by a law that provides mechanisms and instruments specifically designed for this purpose, addressing the particularities of this system and the farmers who practice it.
- b. Embed the concept of territories in policies that promote agroecology, encouraging the organization of rural spaces to foster the development of production systems integrated both among themselves and with the local context in which they operate.
- c. Identify and promote agroecological transition methods that support climate change adaptation measures, as a priority across different public sector competencies, recognizing and supporting the social sectors that advance such initiatives.
- d. Strengthen and expand processes of conversion or transition from traditional or conventional models toward food production systems based on conservation practices, such as no-till farming, crop rotation, and crop-livestock integration, as well as agroecological transition.
- e. Support the conversion of degraded pastures into integrated food production systems, prioritizing investments in natural resource conservation practices and agroecological transition, with a view to reducing high-GHG-emission agricultural and livestock systems.
- f. Encourage agroforestry projects and other systems that integrate food production with the plant cover provided by forests and with biodiversity.
- g. Revitalize technical assistance and rural extension, guiding farmers, especially rural youth, to develop the capacities needed to produce food through more sustainable, climate-resilient methods, with special attention to agroecology.
- h. Implement public policies to promote the production, distribution, and use of bio-inputs, with adequate technical and financial support for different productive sectors.
- i. Ensure that payment for environmental services is included in public policies that promote agroecology, recognizing its concrete contribution to environmental conservation and climate change adaptation, and to the stability and permanence of farmers in agroecological activities, through fair and transparent mechanisms.
- j. Invest in agroecological production systems in urban, peri-urban, and metropolitan areas, fostering diversified food production, with particular attention to peripheral neighborhoods and food deserts.
- k. Promote marketing and distribution mechanisms for organic and agroecological products, prioritizing farmers markets, institutional markets, responsible consumption networks, and short supply chains.

- I. Expand public food procurement programs, such as school meals, food acquisition programs, and other State mechanisms, focusing on the purchase of fresh and minimally processed foods produced through organic and agroecological systems, especially from traditional peoples and communities, and indigenous peoples that promote sociobiodiversity.

### **3. ENSURE WATER SECURITY FOR FOOD PRODUCTION AND HUMAN CONSUMPTION**

The concept of water security encompasses the availability of water in sufficient quantity and quality to meet human needs, productive activities, and multiple uses. These attributes can only be achieved by conserving aquatic ecosystems. In both rural and urban contexts, guaranteeing the right to water, especially during extreme climate events is a multifaceted challenge that encompasses infrastructure, water-resources management, and public policy. Universalizing basic sanitation services remains a challenge in Brazil, closely tied to environmental quality and climate resilience.

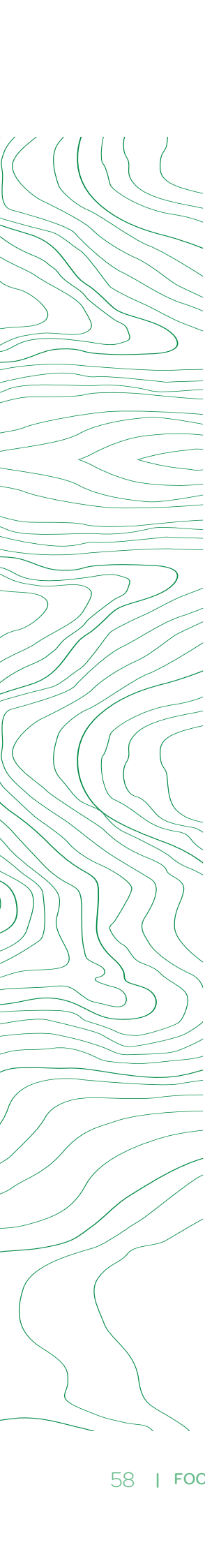
In Brazil, the Cisterns Program<sup>278,279</sup> aims to promote access to water for human consumption and food production by implementing simple, low-cost social technologies. It serves low-income rural families and rural public facilities affected by drought or water scarcity, with priority for traditional peoples and communities. The program is a concrete response to the climate crisis. It expands access to water for drinking and production in regions marked by irregular rainfall, strengthens family resilience to extreme events, and guarantees the human right to water.

Accordingly, taking firm action to democratize the use of water resources, ensuring access for everyone from the perspective of the Human Right to Adequate Food, and recognizing acceptable levels of drought- and flood-related risk, is a fundamental pathway at the intersection of food systems and climate change.

#### **Recommendations:**

- a. Treat access to, availability, and quality of water as vital attributes for food production. Also adopting conservation efforts that protect water sources within agricultural and water-resources policy, covering the entire food supply chain.
- b. Strengthen watershed management and elevate it to a State priority. The State must guarantee the instruments and means required to fully establish water-resources management capacity consistent with climate challenges and multiple uses.
- c. Invest in ecosystem restoration and water-resource protection by implementing intensive initiatives to restore riparian forests and springs, with clear targets, planning, resources, monitoring, and transparency.
- d. Invest in the deployment and management of social technologies for rainwater storage for drinking and food production, to ensure water security. Mobilize budgets and government structures to do this with participatory engagement of local communities, especially in the semiarid region and the Amazon.



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- e. Include the immediate guarantee of access to safe drinking water in climate contingency plans, especially for groups in vulnerable situations.
  - f. Guarantee continuous access to safe drinking water through public fountains and water stations strategically installed in high-traffic and/or high-density areas. Pay particular attention to people experiencing homelessness and outdoor workers, as well as regions sensitive to climate change, and ensure regular maintenance for water quality and uninterrupted operation.
  - g. Strengthen and implement environmental and food and security nutrition education strategies tied to the debate on food systems and climate, to educate children, youth, and adults on the value and relevance of water resources for food systems.
  - h. Conduct broad public communication campaigns so that the water resources agenda is present in the daily lives of all Brazilians.

#### **4. STRENGTHEN SOCIOBIODIVERSITY AS AN INTEGRAL PART OF FOOD SYSTEMS.**

Sociobiodiversity, the interrelationship between biological diversity and sociocultural systems, involves sustainable practices and the management of these resources through the cultural and ancestral knowledge of peoples<sup>280</sup>. Many peoples and communities have taken organized, proactive action and developed capacities rooted in traditional knowledge linked to production, culture, conservation practices, and respect for nature, processes that are vital for conserving biodiversity and livelihoods.

These knowledge systems and practices are decisive for climate adaptation and resilience because they provide a systemic view of the territory and its possibilities, including how to withstand adverse pressures. Sociobiodiversity offers distinct ways and means to react and respond. Much of what is applied to food production draws on this knowledge, while new ways of acting are forged daily through hands-on experimentation and management of biodiversity.

In Brazil, the National Sociobioeconomy Plan<sup>281</sup> promotes forest- and sociobiodiversity-based economies by identifying, innovating, and valorizing their socioeconomic, environmental, and cultural potential. It aims to expand market participation and income for indigenous peoples, traditional communities, and family farmers. The Program to Promote Sociobiodiversity and Extractivism guarantees fixed prices and encourages marketing of extractive and sociobiodiversity products<sup>282</sup>. In addition, the National Policy for the Sustainable Development of Traditional Peoples and Communities<sup>283</sup> and the national biodiversity<sup>284</sup> strategies and action plans already address these topics.

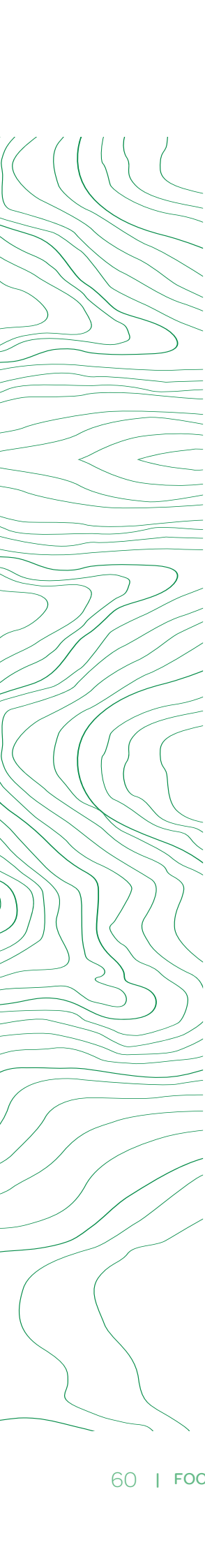
## Recommendations:

- a. Protect and conserve territories and knowledge that make up sociobiodiversity, in all its magnitude and plurality, especially in their ethnic, racial, and gender dimensions.
- b. Promote biocultural community protocols to protect traditional knowledge, ensure participatory management of genetic resources and heritage, and fight biopiracy.
- c. Expand access by family farmers, indigenous peoples, traditional peoples and communities, and quilombolas to germplasm banks.
- d. Strengthen sociobiodiversity value chains and traditional agricultural systems through policies that foster and expand community seed banks *in situ*, *ex situ*, and *on-farm*. Consolidate and expand networks of seeds and hardy breeding stock to prevent genetic erosion and promote agroforestry systems.
- e. Establish specific policies and programs to recover, conserve, and multiply native animal breeds, so as to strengthen and expand family farming and the capacity of other social sectors to organize food production systems that provide animal protein based on sociobiodiversity, while supporting climate adaptation.
- f. Promote self-consumption of sociobiodiversity products, valuing adapted varieties and traditional knowledge, reducing external dependence and CO<sub>2</sub> emissions by encouraging short supply chains, and increasing community resilience to climate change through local experiences.
- g. Foster convergence among public policies aimed at promoting sustainable food systems, especially policies specific to indigenous peoples, quilombolas, family farmers, and traditional peoples and communities.
- h. Encourage a shift from predatory tourism models to models that respect local food systems and promote sociobiodiversity foods as alternative sources of income.
- i. Incorporate refaunation and wildlife-restoration programs as part of climate-action strategies and as a means of strengthening sustainable food systems.

## 5. CONCEIVE FOOD SUPPLY AS A STATE POLICY, ENSURING NATIONAL SOVEREIGNTY AND CLIMATE RESILIENCE.

Food supply encompasses the production, processing, storage, transportation, distribution, marketing, and consumption of food<sup>285</sup>. It is important to highlight the strong link between these supply components and climate change. It is the chain as a whole, including its spillovers, that enables food to reach consumers, and it demands numerous efforts to curb GHG emissions.

The National Food Supply Policy<sup>286</sup> sets guidelines centered on promoting food security and sovereignty. One of its expressly stated pillars is climate action mitigation, advanced by encouraging agroecological practices, sociobiodiversity, the strengthening of sustainable food systems, and support to local and regional production and marketing circuits.



In addition, as Brazil<sup>287,288</sup> has done, prioritizing fresh, culturally and regionally appropriate foods in the basic food basket - those that support adequate diets, health, and the environment - helps stimulate production, distribution, and marketing dynamics that shape food availability and price composition. These aspects are closely linked to supply policies.

**Recommendations:**

- a. Ensure that food supply as a fundamental public action for national sovereignty is prioritized on the government agenda as a central climate adaptation strategy, mobilizing integrated policies that respond to observed and projected risks and impacts.
- b. Redefine food supply as a structuring axis of agricultural policy, aligning incentives for production, distribution, and marketing with low climate impact criteria and models that combine food sovereignty with GHG-mitigation goals.
- c. Ensure that food-supply policies, programs, and strategies prioritize basic-basket foods, with a focus on climate resilience and food security and nutrition.
- d. Invest in logistics infrastructure for family farming (processing, storage, and transportation) and strengthen marketing channels, including support for cooperatives to expand markets, value regionally produced foods, and favor short supply chains with socioeconomic and environmental benefits.
- e. Expand and revitalize public food storage infrastructure, including private sector participation, to create strategic capacity for immediate responses to extreme climate events, guaranteeing emergency stocks and helping regulate the market when necessary.
- f. Analyze how agricultural commodity exports affect domestic supply and food prices in Brazil and implement governance mechanisms that ensure regulatory stocks and food security and nutrition, especially during climate and economic crises.
- g. Establish institutional mechanisms to monitor food price dynamics, such as the Food Price Observatory, with a view to implementing measures that ensure access to food by anticipating government action in response to fluctuations that may affect food security and nutrition, particularly during crises caused by extreme climate events such as droughts and floods.
- h. Guarantees emergency distribution of healthy foods, prioritizing fresh and minimally processed items, as defined in the basic food basket<sup>289,290</sup>, to serve populations affected by climate emergencies in a timely manner, especially in shelters, isolated communities, and vulnerable areas.

- i. Plan and implement specific logistics for emergencies and climate disasters, mapping alternative routes and using regional distribution centers in coordination with Civil Defense and the Armed Forces, when necessary, to ensure fast and safe access to food.
- j. Encourage social innovations that use surplus fruits and vegetables by supporting community and solidarity kitchens, local agro-industries, donation networks, solidarity marketing circuits, and food banks.
- k. Establish and enforce national systems for food recovery and redistribution, with strategic infrastructure for food security and climate mitigation, accompanied by regulatory frameworks that include liability protection, tax incentives, and traceability standards that facilitate food donation.
- l. Classify food banks as strategic actors at the intersection of social and environmental policies, with eligibility criteria that recognize their multiple benefits for food security, climate mitigation, and social justice.

## **6. PROMOTE RESILIENT AND CIRCULAR CITY MODELS TO EXPAND SOCIAL AND ENVIRONMENTAL CO-BENEFITS**

The discussion on circular models involves reviewing processes shaped by linear dynamics, often simplified as production, distribution, consumption, and disposal, and can be analyzed from multiple angles. In contrast, circularity calls for economic processes to connect and feed back into one another. The most visible, direct effects of circular processes are minimizing waste and optimizing stages of the production cycle, thereby reducing costs and environmental impacts<sup>291</sup>.

Cities have powerful leverage in debates at the intersection of food systems and climate. An estimated 80% of food produced globally is consumed in urban areas<sup>292</sup>, as in Brazil, where 85% of the population lives in cities. The transformation potential of these spaces can be examined by assessing how production, supply, consumption, food losses and waste unfold locally<sup>293</sup>.

Initiatives in this field can have wide-ranging effects on school feeding, short food-supply chains, waste management, and public communication, information, and education initiatives, among others. A national example is the National Strategy for Food Security and Nutrition in Cities (*Alimenta Cidades, in Portuguese*), which guides local organization and promotes a comprehensive view of the food system, focusing on the outskirts of major cities, where access to healthy foods is limited and where climate change has the greatest impact<sup>294</sup>. Another important policy for building healthy cities is the National Urban and Peri-Urban Agriculture Program, which seeks to support cities toward greater resilience and better adaptation to climate change<sup>295</sup>. Another example of an initiative that promotes circular and resilient cities is the Solidarity Kitchen Program<sup>296,297</sup>, which provides free, high-quality meals primarily to people in vulnerable situations and at social risk, including those experiencing homelessness and food insecurity.





## Recommendations:

- a. Promote initiatives for cities to incorporate food as a central component of urban planning, such as zoning for urban agriculture and protection of rural areas, guaranteeing the Human Right to Adequate Food, food sovereignty, and the right to the city, and aligning these actions with municipal climate-mitigation and adaptation plans.
- b. Expand urban and peri-urban agriculture so that local, healthy foods reach consumers, increasing urban resilience; improving microclimates, and helping control flooding and other effects linked to extreme climate events.
- c. Invest in maintaining and creating green belts in urban-planning projects to prevent expansion over food-production areas.
- d. Strengthen and integrate municipal departments (agriculture, supply, environment, food security and nutrition, urban planning, and others) to protect natural resources and implement strategies that increase the resilience of food production systems to extreme climate events.
- e. Implement public policies for land regularization, specific zoning, collective titling, and official recognition of traditional territories in urban contexts, guaranteeing the permanence of these communities, combating real-estate speculation, and promoting social and environmental justice.
- f. Include climate risk management in urban plans, ensuring monitoring and preparedness to protect food production, supply, and access during emergencies. This includes mapping urban areas that are vulnerable to extreme climate events and implementing early warning systems.
- g. Develop rapid response protocols to minimize problems in food supply during local emergencies, including investments in resilient infrastructure such as secure warehouses, distribution centers with backup power, and alternative transportation routes.
- h. Recognize solidarity kitchens as essential services in emergencies and include them formally in municipal contingency plans, with clear activation pathways via Civil Defense, the Unified Social Assistance System, and health surveillance.
- i. Recognize and promote solidarity economy initiatives that coordinate diverse capacities and build community and territorial autonomy.
- j. Implement public policies that ensure accessible and wide-reaching communication about public facilities and response protocols for climate-related food security and nutrition emergencies, coordinated with agile social protection actions.

## 7. PROMOTE ENVIRONMENTS THAT SUPPORT ADEQUATE AND HEALTHY EATING FOR PEOPLE AND ECOSYSTEMS

An adequate and healthy diet upholds the Human Right to Adequate Food. It ensures permanent and regular access, under socially fair conditions, to eating practices that are appropriate in quantity and quality, and that consider biological, social, and environmental aspects in line with people's nutritional needs. In Brazil, this concept is guided by the Dietary Guidelines for the Brazilian Population and the Dietary Guidelines for Brazilian Under-2s, which recommend prioritizing fresh or minimally processed foods, limiting processed foods, and avoiding ultra-processed ones<sup>298,299,300</sup>.

These guidelines encourage a predominantly vegetables based, diverse diet, preferably sourced from family farming and organic or agroecological production whenever possible. Beyond promoting sustainable, environmentally respectful practices, they also value sociobiodiversity and Brazilian food culture, reinforcing the importance of fairer, more resilient food systems<sup>301,302</sup>.

Adopting an adequate and healthy diet has a positive effect on environmental pressures, especially those linked to livestock and products based on commodity crops<sup>303</sup>. In Brazil, such a diet has the potential to reduce emissions by 45 million tons of carbon per year<sup>304</sup>. It also helps reduce greenhouse gases, contaminants, and chemical pollutants, supporting biodiversity and the health of people and the planet<sup>305,306,307,308,309,310,311</sup>.

However, putting this into practice depends not only on individual choices but also on the food environments in which people live. Physical, economic, political, and sociocultural factors directly influence both access and decision-making. Public policies and regulations therefore play a key role in creating conditions that enable and encourage access to healthy, sustainable diets that promote health and protect the environment<sup>312,313</sup>.

In this context, structuring policies such as the National School Feeding Program<sup>314</sup>, Decree No. 11,821/2023<sup>315</sup> (which guides actions to promote adequate and healthy eating in schools), Decree No. 11,936/2024<sup>316</sup> (which revised the basic food basket), and the latest tax reform<sup>317</sup>, play strategic roles by guiding a set of public policies. The National School Feeding Program caters for more than 40 million students daily in 150,000 public schools<sup>318</sup> across the country, following the Dietary Guidelines and restricting funds for ultra-processed foods. The new basic food basket strengthens the integration of nutritional guidelines into agricultural, trade, and tax policies, reinforcing the connection between adequate diets, public health, environmental sustainability, and climate goals. In the economic sphere, the tax reform exempted essential foods in the basic food basket, reduced tax rates by 60% in specific foods, and set a surcharge for sugary and alcoholic beverages.



## Recommendations:

- a. Recognize, redistribute, reduce, represent, and reward care activities across the entire food system, from biodiversity preservation to meal preparation. These activities are carried out primarily by women and should be understood as both a right and the foundation upon which all other rights are built.
- b. Promote exclusive breastfeeding for the first six months and continued breastfeeding for 24 months or more, improving child health and reducing the environmental impact of unnecessary substitutes.
- c. Strengthen the capacity and response of the Brazilian Human Milk Bank Network during climate emergencies and disasters by integrating milk banks into climate-emergency plans and ensuring safe milk for premature newborns.
- d. Include socio-environmental criteria and prioritize, in public procurement, the purchase of fresh and minimally processed foods, predominantly vegetables and preferably produced by family farming, using organic, agroecological, and sociobiodiversity methods.
- e. Set maximum allowable percentages for purchasing processed and ultra-processed foods with state and municipal funds for institutional procurement (e.g., Food Acquisition Program and similar programs, hospitals, prisons, Armed Forces).
- f. Require that state, federal district, and municipal funds for purchasing foods under the National School Feeding Program follow the same nationally established limits restricting purchases of processed and ultra-processed foods.
- g. Expand food traceability mechanisms and promote public policies that enable their implementation, with special attention to animal-source foods, allowing choices that exclude products from supply chains that cause environmental degradation, are high in GHG emissions, or rely on unfair labor relations.
- h. Propose regulatory instruments that alert consumers to the environmental impact of foods, considering the entire supply chain.
- i. Implement compensatory tax mechanisms applied to products with scientifically proven high environmental impact, such as animal-source and ultra-processed foods.
- j. Implement regulatory measures to reduce consumption of ultra-processed foods with negative environmental impacts.



- k. Support the creation and maintenance of public facilities dedicated to food security and nutrition in food swamps and food deserts, as well as in areas with populations experiencing social vulnerability.
- l. Invest in access to adequate and healthy food in urban peripheries through urban and peri-urban gardens, productive backyards, and agroecological spaces, encouraging access to fresh, pesticide-free foods.
- m. Ensure that food procurement and distribution during extreme climate events and emergencies prioritize fresh, minimally processed, and processed foods adapted to regional food cultures, in line with Decree No. 11,936/2024, which defines the new basic food basket.
- n. Promote formal and non-formal education strategies on food, nutrition, climate change, and sustainability among children, adolescents, youth, and university students, emphasizing local foods, sociobiodiversity, and regional food culture.
- o. Promote workplaces that support access to, and adoption of, adequate and healthy diets by offering cafeterias and canteens that prioritize fresh or minimally processed foods, predominantly vegetable based, and that restrict ultra-processed products.
- p. Map out food deserts and food swamps and direct public policies to expand community access to fresh and minimally processed foods, promote dietary diversity, and value local food culture and sociobiodiversity.
- q. Ensure that schools incorporate principles of a healthy, sustainable, just, and resilient food transition, serving as strategic spaces for promoting adequate and healthy eating.
- r. Include in school curricula, topics on food and nutrition education related to the food system and create experiential educational models in which gardens are used creatively to teach not only nutrition and the environment but also biology, chemistry, mathematics, and social development.
- s. Develop information and engagement campaigns that guide and raise awareness of consumers toward healthy, sustainable choices, reinforcing the Brazilian dietary guidelines.
- t. Expose, counter, and combat greenwashing and deceptive health or sustainability claims spread through abusive advertising practices, particularly those promoting ultra-processed foods as substitutes for animal protein. Such tactics can mislead consumers about the true nature, composition, origin, and quality of these products.



## 8. REDUCE FOOD LOSS AND WASTE

Food loss and waste are understood as reductions in the quality or quantity of food available for supply and consumption within food systems, resulting from infrastructure conditions, as well as decisions and actions throughout production, supply, and consumption. Post harvest loss refers to losses along the supply chain, while waste occurs mainly at retail and consumption<sup>319</sup>. These stages account for most impacts related to food loss and waste.

Key metrics to understand the impact of loss and waste include GHG emissions (CO<sub>2</sub>-equivalent) and the associated carbon, water, and land use footprints. Reducing food loss and waste is therefore an effective, necessary strategy to cut GHG emissions and to ensure that food is used for its intended function<sup>320</sup>, alongside environmentally sound disposal, in line with the National Solid Waste Policy<sup>321</sup>.

In Brazil and worldwide, major challenges to advance this agenda include consolidating monitoring and evaluation tools for loss and waste, so the scale and stages where waste occurs can be measured and appropriate strategies developed.

To that effect, the Second Strategy to Reduce Food Loss and Waste outline a set of coordinated initiatives to curb food losses and waste nationwide. Based on an intersectoral approach rooted in Food Security and Nutrition and the need to transform the current food system, the strategy offers a diagnosis and a package of measures, including an action plan to address losses, mainly post-harvest, and waste, primarily at the retail level<sup>322</sup>.

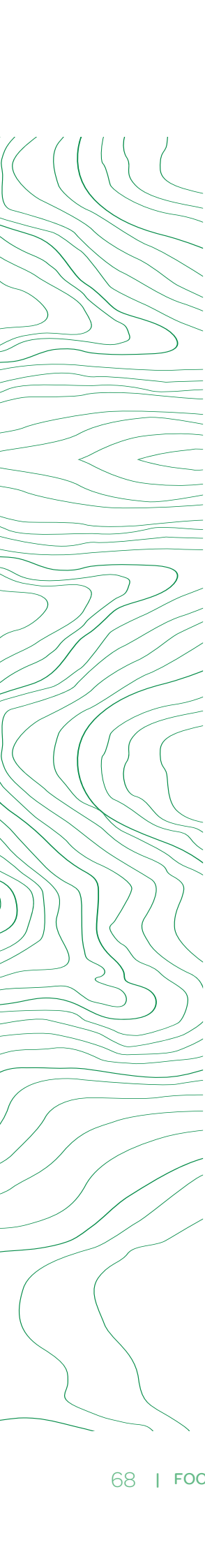
A strong component of this Second Strategy is improving the food-donation system and strengthening food banks in Brazil<sup>323</sup>. These are public or private, nonprofit physical or logistical structures that provide free services to source, receive, and distribute foods donated by public or private sectors, with an emphasis on sustainable management of available foods. They prioritize combating loss and waste and channeling donations to families in food insecurity<sup>324</sup>.

### Recommendations:

- a. Monitor and identify critical control points for food loss and waste in cities and throughout the food chain, starting at production.
- b. Promote technological development, including social technologies, aimed at reducing food loss and waste throughout the supply chain, especially for family farmers and traditional peoples and communities.
- c. Promote technological development and free distribution of State sponsored innovations to reduce food loss and waste, especially for small and medium producers. Examples include creating applications to redistribute surplus food and using artificial intelligence to forecast demand and adjust production accordingly.
- d. Activate local public procurement programs, such as the Food Acquisition Program and the National School Feeding Program, to purchase directly from family farmers and affected producers. These programs should value regional and traditional production, ensure emergency food supply, and strengthen local economies during and after extreme climate events.

- e. Improve post-harvest and storage practices by training farmers in harvesting, refrigeration, and storage techniques to reduce food loss and waste.
- f. Invest in infrastructure and logistics, including better roads, refrigerated transport, and cold chains, to minimize losses during distribution.
- g. Encourage social innovations to use surplus fruits and vegetables that do not meet retail aesthetic standards but are sanitary and nutritionally fit for consumption.
- h. Promote the use of these cosmetically imperfect yet edible products through markets and public procurement or donation programs, benefiting farmers and people in vulnerable situations.
- i. Remove regulatory barriers and create enabling rules that facilitate large-scale donation of surplus food, including civil liability protection for donations, differentiated tax incentives by food type and donation volume, labeling standards that distinguish safety from quality, and simplified procedures.
- j. Encourage donation chains for surplus fresh, minimally processed, and processed foods, with regulations that protect donors and beneficiaries.
- k. Connect public and social facilities to use surplus foods sustainably, maximizing resource use and encouraging circular economy practices in urban contexts.
- l. Engage and hold sectors and actors accountable, especially those associated with food loss and waste, for developing intersectoral and intergovernmental measures to reduce losses.
- m. Identify, recognize, organize, and promote the exchange of innovative and effective strategies and initiatives that address food loss and waste.
- n. Quantify and regularly publish data on food loss and waste throughout supply chains to support evidence-based public management decisions.
- o. Provide guidance on loss and waste reduction strategies for all actors and sectors along the food chain, from production to consumption, and make this information accessible to the general public.
- p. Carry out communication and education initiatives in food, nutrition, and environmental education that address food waste and conscious packaging use, encouraging reuse, waste reduction, and the strengthening of sustainable and circular urban food systems.
- q. Raise public awareness about food waste and responsible resource use and provide information to retailers on proper food storage to avoid premature disposal and reduce excessive packaging.
- r. Implement educational campaigns on planning purchase, storage, and the full use of foods.
- s. Invest in composting and in the use of organic waste to produce fertilizer or energy.



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- t. Include food banks as initiatives for climate change mitigation and adaptation, preventing emissions caused by scarcity and food loss and waste, while expanding access to adequate and healthy foods for vulnerable populations.
  - u. Establish evaluation measures that prioritize solutions with documented multiple benefits, such as food recovery and redistribution that simultaneously support climate, nutrition, and social goals.
  - v. Set national targets for loss reduction.

## **9. INVEST IN SCIENCE, TECHNOLOGY, AND INNOVATION TO ADVANCE SUSTAINABLE FOOD SYSTEMS**

Science, technology, and innovation play a decisive role in forging pathways and responses to the challenge of reorienting food systems amid climate change. Brazil has substantial scientific and technological capacity and has contributed to the debate with research and data on climate scenarios, methods for measuring GHG capture and emissions in tropical agriculture, and the recovery and development of genetic materials and techniques suited to sustainable food-production models.

Increasing investment in science, technology, and innovation, with a focus on developing food systems that are sustainable and adapted to local realities, has proven crucial in the current climate context. Brazil has already shown strong applied capacity in food production, for instance by improving crop productivity and expanding agriculture and livestock into the Cerrado and the Amazon, making the country a global leader in commodity exports.

The effects of climate change, particularly the unequal vulnerability of different groups to its impacts, call for a paradigm shift toward sustainable food systems that ensure food security and nutrition and promote social justice. Advancing participatory research models is also essential, given their transformation potential and the innovations they generate.

The extensive experimentation and knowledge of traditional communities, farmers, and other groups who manage biodiversity and work toward resilience, such as in water resources management, must be increasingly recognized and integrated. Private sector institutions are likewise developing solutions to build food production models that are better adapted to climate change.

These diverse paths for generating knowledge, technology, and innovation are essential and must be further strengthened. They also play a vital role in preventing false solutions and counterproductive practices that undermine efforts to build sustainable food systems.

### **Recommendations:**

- a. Rally institutional efforts to enhance and organize spaces for debate, action, and communication to disseminate scientific evidence that counters misinformation aimed at discrediting climate change debates and the spread of false solutions and greenwashing related to food system organization.



- b. Invest in methods, technologies, and input suited to sustainable food production on small production units, encouraging diversification in farming and reducing dependence on technology packages, particularly when they are not appropriate for local conditions. This will strengthen the adaptive capacity of family farming and its integration into regional food production.
- c. Invest in science, technology, and innovation to advance the agroecological transition.
- d. Fund research and studies aimed at developing efficient systems for capturing, storing, and using groundwater, surface water, and rainfall, in alignment with existing social practices and local knowledge, as well as soil and water management techniques focused on conservation.
- e. Support research focused on food production that recovers and develops genetic materials resilient to water and temperature stresses arising from climate change.
- f. Promote research and grant programs that strengthen seed banks and seed houses *in situ*, *ex situ*, and *on-farm*, and networks of guardians of agrobiodiversity.
- g. Fund research and studies on uses of biodiversity for food and nutrition within public Science, Technology, and Innovation institutions.
- h. Promote research lines and new financing models for initiatives aimed at reducing food loss and waste.
- i. Encourage research and innovation to expand low-GHG models and techniques for food production, distribution, and consumption across all stages of the chain, including measuring carbon emissions and sequestration within food systems.
- j. Encourage a transition away from plastics and other packaging with negative environmental impacts by developing alternatives and substitutes for food containment, along with proper disposal and environmentally sound destination of unusable materials.
- k. Monitor the production of items in the basic food basket and possible reductions due to climate change.
- l. Invest in and build capacities to monitor changes in the nutritional composition of foods resulting from climate change and agricultural practices.
- m. Improve longitudinal data collection and predictive modeling to analyze the causal links between extreme climate events, hunger, undernutrition, and obesity, thereby deepening the understanding of how climate change affects food systems.
- n. Expand the monitoring framework of the Brazilian Food Bank Network to include methodologies for quantifying greenhouse-gas emissions, so food bank data can be integrated into national emissions inventories.
- o. Promote inclusion of family farmers, indigenous peoples, and traditional peoples and communities in higher and postgraduate education, with a focus on sustainable food systems.





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# FINAL CONSIDERATIONS

**T**his **Reference Framework** promotes a systemic, integrated view of food systems in the context of climate change. It aims to guide the definition of objectives, targets, commitments, and actions across sectors to drive the **transition to healthy and sustainable food systems**, grounded in Climate Justice and the Human Right to Adequate Food.

Making this effort part of State policy also requires advancing **climate federalism**, meaning effective cooperation among the federal government, states, the Federal District, and municipalities. This cooperation should be supported by planning and management tools, information systems, financing mechanisms, and, as a fundamental principle, social participation.

This **multilevel governance** must align with territorial needs and strengthen the **adaptive capacity of food systems to climate change**, which is already evident in daily life and scientifically undeniable. It should also expand mitigation efforts **so that food systems become part of the solution**.

This document does not seek to exhaust all possible pathways, nor should it. Food systems are complex and rooted in different realities and levels. We therefore chose a deliberately broad approach to be deepened, expanded, and detailed across the federative levels according to local contexts, specificities, and capacities. In addition, the Framework is intended to contribute reflections to the international arena, **reinforcing Brazil's contribution to the global climate agenda** and to healthier, more sustainable, and more resilient food systems.

This is a starting point for **reflection and priority-setting, mobilizing actors and measuring results**, while honoring the diversity of territories, of economic and social sectors. It reaffirms the centrality of realizing the human right to adequate food and ensuring food security and nutrition as part of the response to the climate crisis.



# ANNEX

## METHODOLOGICAL PATHWAY

Beginning in the second half of 2023, debates around updating the National Climate Change Plan (*Plano Clima*) made it possible to start systematizing the first lessons on what is already known about interactions between food systems and climate. The process of drafting the plan included meetings with experts from different fields, cross-sector discussions, and dialogue in social participation spaces, such as the National Council for Food Security and Nutrition. These processes were essential for consolidating shared understandings, identifying gaps, and guiding the initial development of guidelines that connect food systems and climate within public policy, which were later consolidated and presented in this document.

The first stage in preparing this document was the virtual seminar “Food Systems and Climate Justice: Evidence, Policies, and Actions,” held on October 3 and 10, 2024. It gathered experts from academia, civil society, and government. This was followed by a literature review to identify and compile scientific evidence on the impacts of climate change on food systems in Brazil and worldwide and, conversely, to analyze the role of food systems in the climate crisis.

The literature review initially brought together around 70 articles and reports, plus complementary analyses of national and international governance documents that address the interaction between food systems and climate. These included climate commitments and targets, such as the Paris Agreement, the Conferences of the Parties under the United Nations Framework Convention on Climate Change, and the Nationally Determined Contributions, along with scientific papers and other academic work.

The review helped establish the premises that introduce this document. They represent the main scientific evidence analyzing the relationship between climate change and food systems, including causes and consequences for food security and nutrition and for the health of people and the planet. This evidence served as the basis for defining the guiding principles that cut across the entire document and, finally, for proposing pathways necessary for the transition to healthy and sustainable food systems.

On April 14–15, 2025, a Working Workshop was held with strategically selected participants from civil society organizations, academia, different government sectors, international organizations, and others.

The goal was to create a space for listening and dialogue to support the collective development of the document. The meeting included about 50 experts and representatives from ministries, universities, civil society organizations, international bodies, and social movements.

A Public Consultation was held from May 27 to June 22, 2025, allowing for broader social participation. It received 309 suggestions from 52 participants, including 35 individuals, seven from the public sector, six from civil society organizations, and four from the private sector, all contributing to improvements throughout the document.

Additionally, the Framework, in versions both before and after the public consultation, was presented and discussed in plenary sessions of the National Council for Food Security and Nutrition held in 2024 and 2025. These stages expanded the listening process to include multiple perspectives, helping to consolidate a robust reference framework aligned with current needs and challenges.



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