
MODULE 4:
ASSESS
Food
Justice
Ecosystem
Restoration

ASSESS FOOD SYSTEM RESILIENCE

This module provides tools for investigating how effective your jurisdiction's current food system may be in responding to and recovering from disruptions. We have segmented the assessment into five steps:

1. Evaluate baseline food system functioning

How well a food system responds to a crisis depends in part on how well the system was working *before* the disruption occurred. Start by conducting a current (or "baseline") assessment of the level of food system functioning in your jurisdiction. For this step, you will use the **Baseline Food System Functioning Indicators (page 63)** tool.

2. Identify critical food system assets

Take an inventory of assets that are critical to a well-functioning food system. These assets may be physical, social, or natural. Mapping critical assets helps plan for physical hazards such as storms or floods. For this step, you will use the **Asset Inventory (page 67)** tool.

3. Assess potential hazards to the food system

Identify the specific hazards that are likely to pose the most risk (i.e., the estimated likelihood and impact) to your food system. Hazards can be natural or human-made and manifest in the food system as short-term shocks such as a hurricane or long-term stressors such as political instability or chronic food insecurity. For this step, you will use the **Risk Assessment (page 70)** tool.

4. Consider food system vulnerabilities

Different communities or individuals within communities might experience the food system impacts of hazards in different ways. Therefore, the next step is to understand areas of greater physical and social vulnerability. For this step, you will use the **Vulnerability Assessment (page 80)** tool.

5. Examine food system resilience attributes

It is useful to identify food system characteristics that demonstrate resilience attributes that could counteract or reduce vulnerability. The resilience attributes proposed in this section are specific to food system resilience. For this step, you will use the **Resilience Attributes Investigation (page 86)** tool.

Taken together, these five steps will prepare you to identify and implement targeted food system resilience strategies.

EVALUATE BASELINE FOOD SYSTEM FUNCTIONING

This section will help you to:

- Develop a definition of a well-functioning food system in your jurisdiction that aligns with and supports work already happening
- Identify and collect indicators of the baseline level of food system functioning in your jurisdiction

We recommend that the first step in assessing food system resilience be to gain an understanding of the baseline (current) level of food system functioning in your jurisdiction, so you can document change over time. To do this, start by determining what a well-functioning food system looks like in your community, and then identify what indicators can be used to measure your baseline level of food system functioning. The guidance and tools in this section are based on the idea that, at a minimum, *a* well-functioning food system "*provides safe, nutritious, accessible, and culturally acceptable food for all residents of a community before, during, and after disruptive events*."[1] Included in this definition is the idea that food is accessible, available, and acceptable (the definitions of these terms are provided in the **Understanding Food System Resilience (page 13)** section).

Consider the above definition of a well-functioning food system and add to or alter it according to your local context in the next tool. Your definition of a well-functioning food system might also be informed by:

- Existing plans or documents from your **Policy and Plan Scan (page 53)**
- Community collaborations and engagement processes
- Previous assessments of your jurisdiction's food system
- Global goals, or work done in other jurisdictions

Once you determine your definition of a well-functioning food system, continue to the table in the **Baseline Food System Functioning Indicators** tool to identify what indicators might be appropriate to measure the functioning of your food system. Collecting baseline data on food system functioning will help to:

- Understand the food system, hazards, and the interconnections between systems
- Track progress on food system resilience goals and indicators
- Prioritize resources and decisions
- Create effective policies and programs
- Prioritize equity in your food system resilience work
- Facilitate collaborations around data collection and sharing

We recommend that you use several different indicators to measure the different dimensions of a well-functioning food system. In **Table 5** we provide examples of select baseline indicators of food system functioning (based on the food system resilience definition used in this guide).

USING DATA EQUITABLY

When deciding on indicators of food functioning keep in mind how well the data and indicators capture the experiences of the communities that experience the greatest inequities and how using data may or may not contribute to equitable food system outcomes. While data can be beneficial in helping to visualize inequities and for prioritizing resources, data only tell part of the story. Decisions are often only as good as the data they are based on. Making decisions using inaccurate or incomplete data can be just as bad or worse than making decisions with no data at all. Further, often data does not capture the human experience of inequities and injustices, nor the invisible lines and other factors that shape the way we actually experience our food system. Using proxy data can risk not fully grasping the "truth" or characterizing it incorrectly. Missing data, incomplete data, over-generalization of data, and out-of-date data can lead to the wrongful allocation of resources.

To use data equitably, it is important to:

- Use transparency when collecting and analyzing data
- Include community in the identification, collection, analysis, and presentation of data while respecting and ideally reimbursing for the time commitment and potential burden
- Supplement and confirm quantitative data with stories and experiences from those most impacted

The below resources can help you integrate equity considerations into your baseline data collection.

- Principles for Advancing Equitable Data Practice: Urban Institute
- Toolkit for Centering Racial Equity Through Data Integration: University of Pennsylvania Actionable intelligence for Social Policy
- Powering Health Equity Action with Online Data Tools: 10 Design Principles: Ecotrust
- Measuring Racial Equity in the Food System: Michigan State University Center for Regional Food Systems

Table 5. *Example Baseline Food System Functioning Indicators*

Food System Function	Example Indicator	Data Source
Food Accessibility (Economic)	% change in Supplemental Nutrition Assistance Program enrollment	USDA Food and Nutrition Services[2]
Food Accessibility (Physical)	% of homes without internet access—including computer, mobile, etc.	U.S. Census Bureau: American Community Survey[3]
Food Availability	Pounds of milk production	USDA National Agriculture Statistics Service[4]
Food Acceptability	% of households reporting not being able to acquire the type of food they want out of the total state population	U.S. Census Bureau: Household Pulse Survey[5]

The first draft of your indicators table may be idealistic, representing what you would want to measure to understand the food system in your jurisdiction if you had unlimited time and resources. Likely, your final choice of indicators will also be guided by feasibility. When considering an indicator, ask yourself:

- Does national level publicly available data exist for this indicator?
  - How often is it updated?
- Does more granular local level data exist for this indicator?
  - If not, are there time and resources available to collect sufficient data?

The next step is to collect the baseline data for your indicators, so you'll be able to compare over time. For each indicator, you will want to specify:

- The current level/measure of the indicator (*Indicator Current Value*)
  - For example: Current household food insecurity for your jurisdiction is 12%.
- What level/value of the indicator would be needed for the system to be well-functioning (*Indicator Goal*)
  - For example: Household food insecurity will be below 5%.

TOOL #5: BASELINE FOOD SYSTEM FUNCTIONING INDICATORS

Description:

In this tool, you will apply the information presented in the previous section to fill in the template of baseline food system functioning indicators. You will first determine the indicators and then fill in the table with data. You might want to put the table into a shareable format to collaborate with colleagues.

A Microsoft Excel version of this tool is available for download here.

Instructions:

1. Write your definition of a well-functioning food system in the box below.
2. Based on your definition, use Column A in the table to list the core elements of food system functioning (e.g., food accessibility, procedural equity).
3. For each element, in Column B, list the indicators that would be used to measure the element. You likely will have multiple indicators for each element.
4. Next in Column C, write what level/value of the indicator would be needed for the system to be well-functioning.
5. Remember to check your **Policy and Plan Scan (page 53)** tool to see what goals already exist.
6. In Column D, collect and list the current value of the indicator and the year or date it was collected
7. Finally, in Column E, provide the source of the current indicator value.

Image credit: Clare DiSanto; CLF Food Policy Networks Photo Contest, 2020

Write your definition of a well-functioning food system here:

Example: A well-functioning food system in jurisdiction X provides safe, nutritious, accessible, and culturally acceptable food for all residents before, during, and after disruptive events. It also ensures equitable and just participation in the food system (procedural equity) and distribution of food system resources (distributional equity). It creates new structures that counteract existing inequalities and will prosper for current and future generations (intergenerational equity).
Your definition:

TEMPLATE. BASELINE FOOD SYSTEM FUNCTIONING INDICATORS

A. Food System Functioning Element	B. Indicator	C. Indicator Goal	D. Indicator Current Value	E. Data Source

IDENTIFY CRITICAL FOOD SYSTEMS ASSETS

This section will help you to:

- Understand different types of assets that are critical for food system functioning
- Articulate why select assets are important for food system functioning
- Generate a list of key food system assets that help promote a resilient system

Now that you have an understanding of the current level of food system functioning in your community, it is useful to inventory the different assets that are critical for providing these functions. "Critical" for this planning guide means those assets that are vital to ensuring a well-functioning food system before, during, and after a disruptive event (based on your definition of a well-functioning food system). We recommend grouping the assets into four categories: natural, physical/built, political, and social. **Table 6** provides a definition of each asset category and examples from the food system of this asset. Note that some assets may fall into multiple categories.

Table 6. *Food Systems Asset Categories*

Food Systems Asset	Definition of Asset Category	Critical Food System Function
Natural	"Natural assets are those of the natural environment. These consist of biological assets (produced or wild), land and water areas with their ecosystems, subsoil assets and air."[6]	Land that is protected and used for food production provides a critical asset if global and regional food supply chains are disrupted for long periods of time, and to provide diversification in the food system.
Physical/Built	Physical and/or built assets are those that are human-made. They consist of infrastructure, buildings, community spaces, equipment, etc.[7]	Food pantries are an essential source of food for many households with food insecurity. During disruptive events, they could also play an important role in distributing food to address crisis-related needs.
Political	Political assets refer to the type or amount of power or influence, for making change or engaging in the political process.[7]	Dedicated government staff time and resources, with access to leadership, enable for more efficient and effective food system planning and action.
Social	Social assets include the people, organizations, and connections between them in your community.[7]	An established coalition of community-based organizations, academic institutions and other partners that meet regularly and work together on food system challenges can provide a reliable network of resources in the face of disruptive events.

EQUITY CHECK

Ensure that you are including a diverse range of voices from your community, including representation from a diversity of neighborhoods, to identify critical assets. Different partners in your community may perceive assets differently or have new ideas to consider.

In thinking about assets in your community that are considered critical for food system functioning, consider:

- What are the most important food system assets critical for community well-being?
- Which assets are necessary for ensuring food availability, accessibility, and/or acceptability or other forms of food system functioning?
- Who are the assets critical for? Who benefits from these assets? How might others in the community define assets as critical?
- What would happen if those assets did not exist?
- What effect would there be on other parts of the food system if one type of food system asset failed or did not exist?

Food system infrastructure is also dependent on and interdependent with other infrastructure systems such as waste and wastewater, transportation, energy, and chemical systems. Considering how food system components depend upon and interact with those other sectors is an important part of understanding and protecting food system functioning. We encourage you to consider assets from those sectors as well.

MAPPING FOOD SYSTEMS ASSETS

Mapping food system assets and infrastructure has emerged as one way for planners and community partners to better understand local food systems and how they function.[8,9] Using maps to locate food system assets and vulnerabilities can be useful, especially if you are concerned about physical hazards such as storms or floods that are likely to disrupt your food system and physical infrastructure. If your community already has some food system data mapped, consider using it to enhance your understanding of food system assets, hazards, vulnerabilities, and resilience attributes. If you're at the beginning of your food system planning and have not mapped your food system, you can use the resources in this guidebook to identify and collect current data.

TOOL #6: ASSET INVENTORY

Description:

This resource can help you to identify assets in your community that are considered critical for food system functioning or may be leveraged to support your vision of a resilient food system. Identifying the most critical assets can also help you communicate more clearly how and why the food system is a key part of your jurisdiction's resilience planning and emergency response. It is important that you include diverse voices when considering assets and engage community partners in this work.

A Microsoft Excel version of this tool is available for download here.

Instructions:

1. Review your definition of a well-functioning food system. Then, identify which types of natural, physical, political, and social assets and infrastructure would be needed to ensure that those functions continue even during a disruption. If there are other asset categories—intellectual, financial, cultural, etc.—that are critical to your food systems functioning, add the category to the table below under **Asset Type**.
2. Describe each asset and its critical function in the Critical Food System Assets Table.
3. Review the list by asking yourself and others:
    a. Are there types of assets that have more or less representation in the list?
    b. Are you missing something critical?

While you do not have to limit your critical assets to what fits in this table, to keep your assessment in the next section manageable, it may help to prioritize them.

Image credit: Clare DiSanto; CLF Food Policy Networks Photo Contest, 2020

TEMPLATE. CRITICAL FOOD SYSTEM ASSETS TABLE

Asset Type	**List/Describe Asset**	**Critical Food System Function**
Natural	*1.* *2.* *3.*	*1.* *2.* *3.*
Physical	*1.* *2.* *3.*	*1.* *2.* *3.*
Political	*1.* *2.* *3.*	*1.* *2.* *3.*
Social	*1.* *2.* *3.*	*1.* *2.* *3.*

ASSESS POTENTIAL HAZARDS TO THE FOOD SYSTEM

This section will help you to:

- Identify key hazards that pose a risk to your jurisdiction's food system, and assign risk scores to the hazards
- Consider how hazards with high-risk scores could harm the food system

Once you have a sense of the critical assets that are required for a well-functioning food system, you will want to identify the specific hazards that are likely to pose the most risk to these assets and the overall functioning of your food system. While hazard and vulnerability are of course intertwined, this guide purposely separates the hazard and vulnerability assessment. This allows you to get a clearer picture of each before focusing on how they intersect.

Hazards can be natural or human-made and manifest in the food system as short-term shocks or long-term stressors. Not every community is at risk of experiencing the same hazards. For example, farms located in coastal areas may be more likely to experience sea-level rise or flooding, whereas inland or urban areas may be more exposed to heat-related disruptions.

Hazards also do not occur in isolation. With a warming climate, for example, it is increasingly likely that communities and their food systems will have to cope with multiple crises at the same time, such as when hurricanes hit the Gulf Coast of the US during the COVID-19 pandemic.

Identifying food system hazards also requires thinking beyond natural disasters and considering other social, economic, or political events or structural inequities that could negatively ipact functions, such as ensuring food access, affordability, and acceptability within specified food system boundaries.

The **Risk Assessment** will walk you through a process to estimate the expected risk of natural and human-made hazards to your jurisdiction's food system. This assessment will ask you to:

1. **Identify hazards:** What are the natural and human-made disruptions that might impact the food system?
2. **Estimate likelihood:** Based on historic data and projections, how likely is it that the different hazards will impact your jurisdiction's food system?
3. **Estimate impact:** If the hazard were to happen, how severe would the impact be to the food system?
4. **Assign a risk score:** Risk is calculated by multiplying the likelihood with the impact of a hazard.[9] Hazards with a higher risk score may be a good target for interventions.

TOOL #7: RISK ASSESSMENT

Description:

Use this activity to assess the expected risk of natural and human-made hazards to your jurisdiction's food system.

A Microsoft Excel version of this tool is available for download here.

Instructions:

1. **Identify hazards.** In Column A of the Worksheet, list the relevant hazards. For frequent events such as snow, consider putting in a threshold level of concern, e.g., number of inches.
    a. Review your **Policy and Plan Scan (page 53)** for existing disaster preparedness, hazard mitigation, and/or climate adaptation documents for your jurisdiction to identify natural and human-made threats that impact the food system. Your local government will likely have an All-Hazards Mitigation Plan. This plan should account for natural disasters that are more likely to impact your jurisdiction.
    b. Review maps that indicate areas of geographic concern. FEMA floodplain maps, for example, are available and included in many local hazard assessments. They can show you which food system assets or transportation routes may be more likely to experience closure from flooding.
    c. Consider if there are other hazards that have not been included in the documents you reviewed that specifically impact the food system and should be included in this food system resilience planning effort. Recognize that some food system assets are particularly sensitive; for example, if schools are required to close for a relatively small amount of snow, school meals may not be provided.
    d. You may want to include rows for systemic threats outside your jurisdiction that harm food access, availability, and acceptability. For example, drought, conflict, or taxation outside of your jurisdiction may impact the prices of food in your jurisdiction.
2. **Estimate likelihood.** In Column B, assign a likelihood score to each hazard based on historical data and/or projections for the hazard in your community.
    a. If there are data on likelihood in the existing documents you reviewed, use that data.
    b. If historical data are not available for your community, put in an estimate or guess about the likelihood based on history, nearby areas, or projections for the future.
    c. If community and regional data are not sufficient, you can use a scale from 1 (likely to happen once in the next 100+ years) to 5 (likely to happen several times per year).

Image credit: Clare DiSanto; CLF Food Policy Networks Photo Contest, 2020

Table 7. *Food System Risk Assessment Rubric*

Score	Likelihood of hazard occurring
5	Several times per year
4	Once per year
3	Once in the next 5 years
2	Once in the next 20 years
1	Once in the next 100 years or more

d. As you consider the likelihood scores for each hazard, ask yourself and your planning team:

- How often has the hazard occurred in the past?
- Is the frequency likely to change in the future?
- Based on existing estimates of this type of threat, how often is it likely to occur in your community or region?

3. **Estimate impact.** In Columns C-F, assign an impact score on the elements of a well-functioning food system for each hazard.

a. Assign a column for each the elements of a well-functioning food system that you identified using the **Baseline Food System Functioning Indicators (page 63)** tool.

b. Consider how severe the impact of this hazard would be on each component of a well-functioning food system? The **Scoring level of impact rubric** below provides one example of a scale of 1 (little to no impact) to 5 (severe) that you could use. Note that in this step you are thinking about how severe an impact different hazards may cause to the food system. In step two you thought about the likelihood/frequency of hazards. You will combine the likelihood and impact in the next step.

c. If your definition of a well-functioning food system focuses on food access, availability, and acceptability, consider the following questions:

- How might this hazardous event affect food access (both economic and physical)?
- How might this event affect food availability?This includes things such as disrupting the supply chain, closing distribution facilities, or harming workers.
- How might this event affect food acceptability?
- Could certain types of food become unavailable? Will it affect the safety or nutritional quality of the food available?

The below rubric is intended to be used to stimulate thinking about how to estimate the impact of a hazard to your food system. The examples are provided as a guide, but we encourage you to develop your own criteria for what makes a hazard impactful to your food system, based on local context and the goals of your food system resilience work. Impact is scored on a scale of 1 (little to no impact) to 5 (severe impact).

EXAMPLE. SCORING LEVEL OF IMPACT RUBRIC

Score	Impact – Food Access	Impact – Food Availability	Impact – Food Acceptability
5	Substantial increases in food insecurity & demand for federal and local food assistance programs among general population observed; store closure is widespread & lasts many weeks; movement restricted due to lockdown orders that last for weeks	Major food retailers are out of nearly all or all stock and unable to replenish within a few days.	Food is unsafe to eat and/or cannot meet dietary needs of general population (i.e., some or all food groups unavailable for prolonged period of time, rising risk of malnutrition).
4	Rates of food insecurity continue to be higher than average but coming down; above average demand for food assistance observed among specific populations; major transportation routes into the jurisdiction closed for many weeks due to damage from flooding and mudslides	Food retailers out of stock of staple food items, very little to no variety in staple food options and not all food groups available, for multiple days or weeks.	Specific food items to meet dietary needs and culturally acceptable foods are hard to find in stores.
3	Food retail hours limited and food pantries unable to keep up with short-term increase in demand; major thoroughfare closed due to damaged bridge but will reopen within 1-2 weeks.	Variety of food available but at a high price due to supply disruptions.	Populations with special dietary needs or cultural/ religious preferences have to go to multiple sources to get adequate food.
2	Public transportation to food stores disrupted for no more than one week due to worker strike. Disruption in food bank hours due to volunteer shortage but resolved within one week.	Some food items temporarily unavailable but restocked within one week.	One type of food item is unsafe or limited geographically.
1	Food access disrupted due to technology glitch that lasts no more than one day. All food retails and emergency food providers open regular hours.	Food retail fully stocked but may experience higher demand.	High variety of foods available in stores to meet special dietary needs; all food and water safe to ingest.

4. **Calculate a risk score:** Once you have assigned likelihood and impact scores, calculate a risk score by multiplying the likelihood score by the sum of impact scores for each hazard (risk = likelihood X impact).
    a. First, calculate the Impact Total by adding up the impact scores of each element for a hazard (impact access + impact availability + impact acceptability).
    b. Next, multiply the Likelihood Score by the Impact Total to get the Risk Score.

To use this information to identify which hazards pose the greatest risk to food system outcomes, think of risk as a combination of the likelihood of an event occurring in a particular location and the severity of the potential impact from the event. Hazards with the highest risk score theoretically pose the greatest risk to your food system and could be prioritized when considering how to build specified resilience.

5. **Get feedback and revise your matrix:** Share your matrix with people in other departments or organizations, community partners, academic collaborators, etc. What community members experience on the ground may be different from your estimates, so it is important to consider this tool as a starting point and to revise the scores based on the feedback from reviewers.
6. **Review:** Review the new scores to identify the key hazards that pose the most risk to your food system's ability to continue functioning.

TEMPLATE. FOOD SYSTEM RISK ASSESSMENT MATRIX

A. Hazard	**B. Likelihood Score** *(1-once in 100 years; 5-several times a year)*	**C. Impact – Food Access** *(1-little to no impact; 5-severe)*	**D. Impact – Food Availability** *(1-little to no impact; 5-severe)*	**E. Impact – Food Acceptability** *(1-little to no impact; 5-severe)*	**F. Impact – Total** (Sum C-E)	**G. Risk Score** (B*F)
Hurricane	*4*	*3*	*2*	*1*	*6*	*24*
Pandemic	*3*	*4.5*	*3*	*2*	*9.5*	*28.5*

ANALYZE FOOD SYSTEM DISRUPTIONS

Another way to think about how different hazards may impact food systems and lead to disruption is to use what's known in engineering as a fault tree **(Figure 8)**. This approach illustrates the pathways through which a hazardous event can disrupt food system functioning and lead to a significant food system disruption. Considering these pathways in a structured way can not only point your attention to risks of concern but also suggest areas for intervention in order to interrupt these pathways.

The **Food System Disruption Analysis** approach was originally developed by the Johns Hopkins Center for a Livable Future and colleagues Xilei Zhao and Judith Mitrani-Reiser[10], and has been slightly modified and renamed here.

The food system disruption analysis has one main "tree" **(Figure 8)** and eleven subtrees. The main tree shows all the major ways food system disruptions could occur. For example, the system can be disrupted due to food not being available, accessible or acceptable. Below each of those are factors that can lead to food not being available, and so on. The sub-trees dig deeper into the factors on the main tree, all the way back to an original hazard event, to help structure your thinking about pathways.

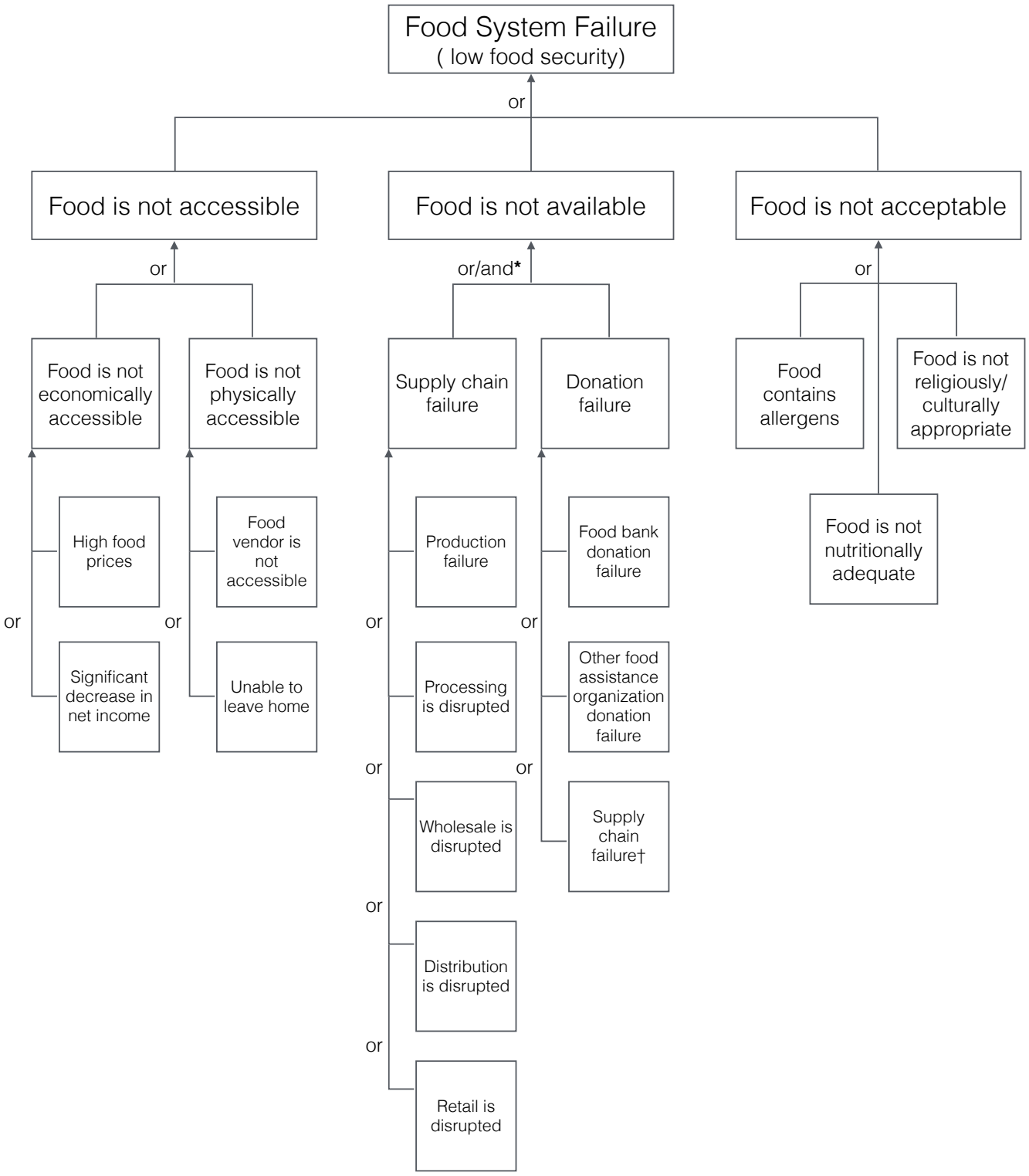
In this section we present the main tree, and how it can be used to think about food system disruptions. We recommend that you review the original publication for more information about the sub-trees.[10]

In the main tree, factors are combined with "or," "and", "or/and."

- The "or" indicates that it is true if any of the items occur (e.g., food is not economically accessible if there are high food prices or a significant decrease in income (main tree)).
- The "and" indicates that both the items must occur (e.g., food purveyors are not accessible because they are not within walking distance and cannot be accessed by car, bike, or public transportation (subtree three)).
- The "or/and" specifies conditions where you should use them.

Of course, hazards interact in complex ways beyond what can be depicted in this tree, and often occur in tandem. We also note that it's impossible to capture every factor and hazard in the tree. Nonetheless, this visualization can be helpful in thinking through the relevant pathways.

Figure 8. *Food System Disruption Analysis: Main Tree.*[3]



* This is "or" for populations under an income cut-off, but changes to "and" for populations above an income cut-off

† See the events that contribute to "supply chain failure"

To use the food system disruption analysis approach to examine food system functioning in your jurisdiction:

- Identify a hazard that has affected or is likely to affect the food system. You can use the hazard with the highest risk score from the **Risk Assessment (page 70)** tool.
- Start on the bottom left side of the main tree **(Figure 8)** and ask whether the hazard could significantly
  - increase food prices OR
  - decrease net income
- If you are not sure, go to the original publication,[10] and review the sub-trees. The subtrees provide additional information about how a hazard might lead to the main tree elements (e.g., how a hazard could cause high food prices).
- If you answer yes to either of the conditions (high food price or decrease in net income), this hazard has the potential to make food economically inaccessible.
- Next move to “food is not physically available”, and ask whether the hazard could cause
  - Food purveyors to not be accessible OR
  - People to not be able to leave home
- Next move to “food is not available” part of the tree. Could the hazard you selected lead to a supply chain disruption or/and a food donation disruption?
- Finally, consider if the hazard could lead to food becoming unacceptable.
- If at the end, you have determined that the hazard has the potential to make food not accessible OR not available OR not acceptable, theoretically this hazard could cause a food system disruption.

DESCRIBE VULNERABILITIES

This section will help you to:

- Understand the different dimensions of vulnerability
- Explore physical and social vulnerability to hazards that may disrupt the food system in your jurisdiction

In the previous section you identified hazards that pose a risk to your food system. Different communities, or individuals within communities, however, might experience the same hazard in very different ways. Therefore, this section focuses on exploring vulnerability. Vulnerability is the degree to which an asset or group is exposed, susceptible to, or unable to cope with a hazard. Vulnerability is made up of the following:[11]

- **Exposure** is the contact, and the degree of contact, between the hazard and the asset or group.
- **Sensitivity** is the degree to which an asset or group is affected by the exposure.
- **Absorptive/Adaptive/Transformative Capacity** is the ability of an asset or group to adjust to potential disruptions in the food system, take advantage of opportunities, or cope with the consequences.[12]
  - "Absorptive capacity is the capacity to take intentional protective action and to cope with known shocks and stress."[13]
  - "Adaptive capacity is the capacity to make intentional incremental adjustments in anticipation of or in response to change, in ways that create more flexibility in the future.[13]
  - "Transformative capacity is the capacity to make intentional change to stop or reduce the causes of risk, vulnerability, poverty, and inequality, and ensure the more equitable sharing of risk so it is not unfairly borne by people living in poverty or suffering from discrimination or marginalisation."[13]

Vulnerability can be a measure of social, physical, or natural elements. For example, different groups of people in your jurisdiction might have more or less vulnerability to food system disruptions, or different infrastructural items (e.g., roads, bridges, food providers, etc.) in your jurisdiction might be more or less vulnerable to a hazard. Something that is more vulnerable to a particular event is at a greater risk of experiencing negative consequences of a disruption because it is either more exposed to the disruptive event, more sensitive or unable to adapt or transform in the face of the event.

PEOPLE-FIRST LANGUAGE AND "VULNERABILITY"

Take care in communicating about vulnerability, to avoid reducing a person or community to their risk factors. We recommend using person-first language indicating that a person or group "has" or "faces" vulnerabilities (or other risks), rather than language such as "vulnerable people," which can be disempowering or hurtful. See the Centers for Disease Control and Prevention Key Communication Principles for more information about this.

PEER PERSPECTIVE

"The challenge is to think beyond just food, but to think of what is the root cause of the situation."

(Food System Resilience Community of Practice participant, statement edited for clarity)

Assessing food system vulnerability requires looking at both the physical environment and infrastructure required to support a functioning food system, as well as the underlying social determinants of food system outcomes, such as poverty, land access, or institutional racism.

The following tool is broken into two parts. The first guides you through a process for assessing physical vulnerability in food system infrastructure based on the assets you identified previously in this module. The second asks you to identify the people or communities whose health and livelihood may be particularly vulnerable to a disruption in the food system, and underlying stressors that may contribute to those vulnerable states. For each part, you will be asked to also identify potential food system characteristics that could counteract or reduce vulnerability.

Photo Credit: Seth Sawyers, Charles Street, mid-blizzard Flikr, CC BY 2.0

TOOL #8: VULNERABILITY ASSESSMENT

Description:

This tool will take you through the steps of identifying physical and social vulnerabilities in your food system and prioritize the areas that are most critical to address in the short term. Through this process you will consider the physical and social vulnerabilities in your food system and community that may make your food system especially at risk to hazards. This activity draws from the **Risk Assessment (page 70)** tool. Use this tool to assess the vulnerability of each of the hazards with the top risk scores identified using the **Risk Assessment (page 70)** tool.

An Microsoft Excel version of this tool is available for download here.

Instructions:

PART 1. PHYSICAL VULNERABILITY

1. Select one of the hazards you identified as having a high-risk score using the **Risk Assessment (page 70)** tool. Write the hazard at the top of the worksheet.
2. Using the list of critical assets you generated in the **Asset Inventory (page 67)** tool, in Column A list the assets that could be impacted by this hazard.Remember that you should consider physical, social and natural assets
3. In Column B describe how each asset would come into contact with the hazard.
    a. For example: if the hazard is a hurricane, and the asset is food pantries, the exposure could be a hurricane making landfall in your jurisdiction.
4. For each asset, describe in Column C the factors that might make it more *sensitive* to the impacts of the hazard.
    a. For example: if the hazard you selected is a hurricane, and the asset is food pantries, are some of your food pantries located near the coast or in a flood plain?
5. In Columns D-F, for each asset, list characteristics that could support its capacity to absorb, adapt, or transform to the hazard.
    a. For example: if the hazard you selected is a hurricane, and the asset is food pantries,
        i. **absorptive capacity** would be the food pantry having a back-up power generator so it can absorb the shock and continue operations uninterrupted.
        ii. **adaptive capacity** would be the food pantry setting up operation sites, in collaboration with community partners, in areas of the jurisdiction that are less prone to flooding and severe hurricane impacts.
        iii. **transformative capacity** would be the food pantry working with community and government partners to reduce food insecurity in the jurisdiction, by addressing underlying root causes.

Image credit: Clare DiSanto; CLF Food Policy Networks Photo Contest, 2020

TEMPLATE. PHYSICAL VULNERABILITIES

Hazard:					
Asset	**Exposure**	**Sensitivity**	**Absorptive Capacity**	**Adaptive Capacity**	**Transformative Capacity**

PART 2: SOCIAL VULNERABILITY

In addition to physical vulnerability, you also need to consider the underlying socio-economic characteristics of your jurisdiction and food system that may make certain population groups experience more susceptibility to your top hazards and/or reduce their capacity to cope with the impact.

- Which people or communities face the greatest vulnerability to a disruption in the food system?
- How could this disruption impact a group's food access, availability, and/or acceptability?

For the hazard you selected in part 1, answer the questions below to help you consider the social vulnerabilities.

TEMPLATE. SOCIAL VULNERABILITIES

Part A. Respond to the following questions about the hazard you selected in part 1
HAZARD:
What groups are most likely to be exposed to this hazard?
What groups may experience greater sensitivity to this hazard?
What groups may have greater absorptive capacity? Less absorptive capacity?
What groups may have greater adaptive capacity? Less adaptive capacity?
What groups may have greater transformative capacity? Less transformative capacity?
What policies, economic or social conditions, or other long-term factors may have led to some groups having higher vulnerability to this hazard?

Part B. For each group identified in part A, consider:
How could the hazard disrupt physical food access for this group?
How could the hazard disrupt financial access to food for this group?
How could the hazard disrupt the availability of food for this group?
How could the hazard disrupt the availability of culturally or nutritionally appropriate foods for this group?
What policies, economic or social conditions, or other long-term factors may have led to this group experiencing greater disruptions in food access and availability?

Note. In this tool you focus on items that put assets and groups at greater risks to hazards. In later modules of this guide, you will consider strategies to address these items.

EXAMINE FOOD SYSTEM RESILIENCE ATTRIBUTES

This section will help you to:

- Understand attributes that have been linked with resilient systems
- Assess the presence of these resilience attributes and how they may or may not be present for crucial food system assets in your jurisdiction

In the previous section, you considered how different assets and groups experience vulnerability to food system hazards, including what characteristics contribute to vulnerability. This section focuses on the reverse: a set of characteristics—resilience attributes—that have been linked with more resilient systems. As described in the **Get Started (page 5)** module, these include diversity, redundancy, connectivity, capital reserves, flexibility, preparedness, and equity.

Table 8. *Resilience Attributes*

Attribute	**Description**
Diversity	A variety of food system elements that can serve a *similar* purpose
Redundancy	Multiple or duplicative food system elements that can serve the *same* purpose
Connectivity	Multiple food system elements that connect and communicate with one another
Capital reserves (social, financial, natural, political)	Available "backup" resources that can be utilized during a disruptive event
Flexibility	The ability to make modifications to food system elements during disruptive events when needed
Preparedness	A plan in place for how to ensure food access, availability, acceptability and agency during a disruptive event
Procedural Equity	Establish "transparent, fair, and inclusive" food system resilience planning, implementation, and evaluation processes[14]
Distributional Equity	Ensure the benefits and burdens of your food system resilience planning are equitably distributed[14]
Structural Equity	Uproot long-term embedded structures that perpetuate inequitable food system and resilience outcomes[14]
Intergenerational Equity	Actions taken today conserve resources for future generations[15]

Many different lists of key resilience attributes exist.[16,17,18] We chose this list because we think they are key for food system resilience planning and work. You are welcome to add to or remove attributes from this list as you see fit. We provide some questions to help with this in the tool.

For the activity in this section, you will estimate how much your critical assets exhibit each resilience attribute. This is subjective and should be seen as an initial investigation into the attributes rather than a comprehensive assessment.

TOOL #9: RESILIENCE ATTRIBUTES INVESTIGATION

Description:

This activity will help you to gain a better understanding of food system resilience attributes and how they may or may not be present for crucial food system assets in your jurisdiction. This tool builds on the work that you did in the previous section using the **Vulnerability Assessment (page 80)** tool. You will repeat the steps below for each priority hazard.

A excel version of this tool is available for download here.

Instructions:

1. At the top of the worksheet, fill in a hazard from the **Vulnerability Assessment (page 80)** tool.
2. In the "Asset" column, fill in the critical assets you used for the hazard in that tool.
3. In the remaining columns, assign a value from 1 (low) to 5 (high) for how well the asset demonstrates each resilience attribute.

The questions below, using the example of food pantries, may be helpful in considering these ratings.

- Diversity:
  - *How many food pantries exist? Where are they located? What non-pantry types of organizations exist for people to get foods before, during, and after a disruption?*
- Redundancy
  - *How many food pantries exist? Where are they located? Would people be able to access multiple pantries or alternatives to pantries during the hazard event?*
- Connectivity
  - *Are the food pantries connected or in communication with each other, either directly or via an organization such as a food bank? Are they connected with other food providers in the jurisdiction or region? Are they connected with other key partners, like the local government or larger social services providers in the jurisdiction? Is there an information source where consumers can choose pantries based on closings, hours, etc.?*

Image credit: Clare DiSanto; CLF Food Policy Networks Photo Contest, 2020

- Capital reserves
  - *Do the food pantries have the social, financial, natural and political resources that they would need to act during a disruptive event? What financial resources and insurance do they have? How many staff do they have or is it all volunteer-run?*
- Flexibility
  - *Can the food pantries adapt and transform their operations during the specific hazard you selected? Do they have personnel, communications, or other tools that enable this flexibility? Are they prevented from acting flexibly by any policy or other constraints?*
- Preparedness
  - *Are the food pantries prepared for the specific hazard you selected? Do they have a plan in place for disruptions? Does it include items specific to the risks from this hazard? Is it up to date and well communicated? Do they have insurance coverage relevant to this hazard?*

TEMPLATE. FOOD SYSTEM RESILIENCE ATTRIBUTES INVESTIGATION

Hazard:						
Asset	Diversity (1-low; 5-high)	Redundancy (1-low; 5-high)	Connectivity (1-low; 5-high)	Capital Reserves (1-low; 5-high)	Flexibility (1-low; 5-high)	Preparedness (1-low; 5-high)

EQUITY CHECK

Revisit the **Equity in Resilience (page 22)** module**,** specifically **Tool #1. Equity Considerations to Guide Food System Resilience Planning (page 31)** to help consider these principles in more depth.

Recognize that the attributes don't always align neatly, and that they can play out in inequitable ways or have other tradeoffs. While we consider procedural, distributional, structural, and intergenerational equity as core resilient attributes, they are not something that can easily be quantified for all assets. Therefore, rather than assigning values, equity should be included in the discussion of every asset and every attribute. We have provided some questions below to help you discuss and consider procedural, distributional, structural, and intergenerational equity issues as they relate to diversity, redundancy, connectivity, capital reserves, flexibility, and preparedness.

- Has building an attribute been done at the expense of procedural equity? Have community members been included in projects that relate to the attributes?
  - For example, was a full equity assessment conducted for a new project on hurricane mitigation measures? Does the project include community partnership and ownership?
- Is the attribute equally distributed?
  - For example, are food pantries accessible to all communities in the jurisdiction in need of their services?
- Does the presence of the resilience attributes promote or result from systematic injustices and racism in the food system?
  - For example, do some grocery stores have more capital reserves than others because of systemic inequities?
- Does the presence of a resilience attribute exist at the expense of future generations? Has the focus been on building the attributes in the short-term, rather than considering long-term impacts?
  - For example, has another shipping terminal been built to improve redundancy but lacks stringent environmental regulations?

You may want to make adjustments to your scores or add notes about any negative effects of the attribute, in terms of how it plays out for the asset in question. For example, while redundancy is beneficial for resilience, "too much" redundancy is inefficient and could lead to challenges in areas such as connectivity.

LEARN MORE ABOUT ASSESSING FOOD SYSTEMS

Resilience & Health Assessments

- Disaster Resilience Scorecard for Cities: Food System Resilience Addendum: UN Office for Disaster Risk Reduction
- U.S. Climate Resilience Toolkit: Tools, information and expertise on climate resilience from the federal government
- The National Risk Index: FEMA
- Assessing Health Vulnerability to Climate Change: A Guide for Health Departments: Climate and Health Program, Centers for Disease Control and Prevention
- The CDC/ATSDR Social Vulnerability Index: Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry
- County Health Rankings: University of Wisconsin Population Health Institute

Food System Assessments

- Baltimore Food System Resilience Advisory Report, Chapter 2: State of the Baltimore Food System, p 21-42.
- State of the Food System Report 2018: City of Austin, TX Office of Sustainability
- Food and Agriculture Sector-Specific Plan: Cybersecurity & Infrastructure Security Agency

National Data Mapping Resources

- Excess Food Opportunities Map: US Environmental Protection Agency
- USDA Food Environment Atlas: USDA Economic Research Service
- Food Access Research Atlas: USDA Economic Research Service
- Map the Meal Gap: Feeding America

State & Local Mapping Examples

- Food Access in Austin: City of Austin
- Ohio Food System Map: Ohio State University Knowledge Exchange
- Colorado Food System Map: Colorado State University

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