

Estimating Community Resilience

*Select Topics in International Population and Health*¹

By Cristina Bradatan, Hannah Rosenblum, Gabriel Amaro, and Bethany DeSalvo

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INTRODUCTION

Community resilience is the capacity of communities to respond and adapt to disturbance and change. Increasingly, national statistical offices (NSOs) and other organizations are using this concept to identify communities that may be less resilient to disruptive events, including climate change. This report will describe four existing community resilience measures in an international context and discuss the ways in which they are used.

In defining “community resilience,” **community** is often seen as a complex system characterized by various attributes and their relation to the surrounding natural environment. Although there is no universally accepted definition of **resilience** (Patel et al., 2017), the Latin root of “resilience” (resilire: to jump back) is a common thread in most of its definitions (Box 1). Resilience is often defined from a static point of view and thus linked to stability. Resilience is also dynamic, however, and can be defined as the ability of a system to remain viable through adaptation and transform when the system is disrupted (Kruse, 2017 and Magis, 2010). **Community capacity** is sometimes used interchangeably with community resilience as it also implies the idea of community resources available to build community well-being. Resilience, however, is the only term used for contexts of change when significant and disruptive events are expected to affect the community (Magis, 2010).

¹ This technical note is part of a series on *Select Topics in International Population and Health (STIPH)* that explores matters of interest to the international statistical community. The U.S. Census Bureau helps countries improve their national statistical systems by engaging in capacity building to enhance statistical competencies in sustainable ways.

Box 1.

Selected Definitions of Resilience by Various Organizations

United Nations Office for Disaster Risk Reduction:

“The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.” (United Nations Office for Disaster Risk Reduction, 2022.)

European Commission: “. . . the ability not only to withstand and cope with challenges but also to transform in a sustainable, fair, and democratic manner.” (European Commission, 2020.)

U.S. Department of Homeland Security: “. . . the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies.” (U.S. Department of Homeland Security, 2021.)

African Development Bank Group: “. . . the ability to cope with, adapt to, and recover from shocks and stresses, and reduce vulnerability in the future.” (African Development Bank Group, 2022.)

Intergovernmental Panel on Climate Change:

“. . . bouncing back and returning to a previous state after a disturbance. More broadly the term describes not just the ability to maintain essential function, identity, and structure, but also the capacity for transformation.” (Intergovernmental Panel on Climate Change, 2022.)

THEORETICAL MODELLING IN COMMUNITY RESILIENCE INDEXES

Community resilience is an increasingly popular concept in discussions across a range of topics, including natural hazards, responses to COVID-19, climate change, and food security. Over the past 5 decades, more than 2.4 million lives and \$3.7 trillion in assets have been lost due to natural disasters with total annual damages increasing 800 percent since the 1980s. Climate change is expected to compound these losses (World Bank, 2021). Confronted with these issues, individual countries and international organizations have started to identify less resilient communities in which to improve capability to face disruptive events. “Measuring resilience allows an organization to focus on raising awareness of deficiencies, prioritize community needs, and allocate limited resources (National Academies of Sciences, Engineering, and Medicine, 2019). Community resilience, however, is not directly observable. Rather, resilience must be linked to a specific threat (e.g., resilience to forest fires or resilience to flooding) to be measured. Specifying the threat is key, as the same community may be both highly vulnerable to rising sea levels and highly resilient to forest fires.

Building a measure of community resilience is complicated, as it requires selecting from an array of applicable indicators and techniques for calculating indexes. In the United States alone, for example, over 70 peer-reviewed community resilience index methodologies have been published, using more than 100 quantitative indicators (Edgemon et al., 2020).

Despite the variety just described, there is widespread agreement regarding the broad dimensions used to assess community resilience (National Academies of Sciences, Engineering, and Medicine, 2019; refer to Figure 1). These dimensions are:

- **Natural (environmental):** Natural resources or environmental conditions such as health of ecosystems, natural land cover, or indicators of environmental quality.
- **Built (infrastructure):** Infrastructure systems such as residential housing, schools, commercial and industrial buildings, power, transportation, bridges, roads, communication, or water and wastewater systems.
- **Financial (economic):** Economic assets and livelihoods of a community measured using variables such as income levels, personal wealth, income equality, or employment rates.
- **Human and cultural:** Demographic characteristics, knowledge and skills, health, and physical abilities of community members. These can be measured using variables such as educational levels, age distributions, health insurance, access to medical and mental health services, food security, percentage of special needs

Figure 1.
Dimensions of Community Resilience



Source: U.S. Census Bureau, based on National Academies of Sciences, Engineering, and Medicine, 2019.

populations, and access to transportation and communication services.

- **Social:** Social networks and connectivity among groups and individuals within a community. This can be measured using variables such as length of residence, level of volunteerism, religious affiliation, or community organizations and services.
- **Political (institutional or governance):** Access to resources and the ability/power to influence their distribution.

As the academic literature around community resilience indexes continues to grow, so does the interest of governments and international development agencies in creating and using indexes to build more resilient communities. For example, it has been only in the last 2 years that the United States and the European Union developed resilience indexes that are updated and used for various policy purposes. In the following four sections, we will discuss community resilience methodologies and indexes in use by the United States, Mexico, the European Union, and the African Development Bank Group.

UNITED STATES: COMMUNITY RESILIENCE INDEX

In March 2020, the U.S. Census Bureau created an experimental data product called the Community Resilience Estimates (CRE). The CRE was created in response to the COVID-19 pandemic and was designed to aid agencies and organizations to prepare for and respond to the COVID-19 health crisis at the local level. After feedback from stakeholders, an updated version of the CRE was

Table 1.

Household and Individual Risk Factors in the Community Resilience Estimates

Characteristic	Risk Factor (RF)	Definition
Household	RF 1	Income-to-Poverty Ratio (IPR) below 130 percent of the poverty line.
	RF 2	Single or zero caregiver household (only one or no individuals living in the household who are ages 18–64).
	RF 3	Unit-level crowding, defined as more than 0.75 people per room.
	RF 4	Communication barrier, defined as either limited English-speaking or the lack of anyone in the household over the age of 16 with a high school diploma.
	RF 5	No one in the household employed full-time, year-round. (This flag is not applied if all residents of the household are 65 years or older).
	RF 6	Households without a vehicle.
	RF 7	Households without broadband internet access.
Individual	RF 8	Disability posing constraint to significant life activity (reporting any one of the six disability types: hearing difficulty, vision difficulty, cognitive difficulty, ambulatory difficulty, self-care difficulty, and independent living difficulty).
	RF 9	No health insurance coverage.
	RF 10	Aged 65 or older.

Source: U.S. Census Bureau, 2021(b).

released in August 2021 as an official Census Bureau data product (U.S. Census Bureau, 2021a).

Using microdata (records for each individual interviewed), the official CRE data product uses risk factors derived from the 2019 American Community Survey (ACS) to flag vulnerable individuals within a given community. The CRE provides estimates of the number of people in a specified community who have low, medium, and high levels of risk. The number of risk factors are determined by examining the demographic, socioeconomic, and housing characteristics shown in Table 1 using ACS microdata. For household level variables, if the household meets the criteria for the risk factor, every individual in the household is assigned that risk factor.

A person is considered to have:

- Low risk, if they have 0 risk factors.
- Medium risk, if they have 1–2 risk factors.
- High risk, if they have 3 or more risk factors.

The use of microdata enabled the Census Bureau to release a data product that addresses masking, a common issue in existing vulnerability and resilience indexes. Masking often occurs in publicly available data when, for disclosure avoidance purposes, detailed information at the individual level is restricted. By using small area modelling and microdata, the Census Bureau was able to release the CRE at small geographies while maintaining respondent confidentiality. Additionally, these techniques reduced error, produced quality estimates, and provided the best level of geographical coverage. The resulting data product, the CRE, is an index that includes aggregate-level (e.g., tract, county, and state) small area estimates and their respective margins of error (Figure 2). Emergency managers and government officials can use the detailed information about an affected population available from the CRE to plan for and respond to disasters impacting

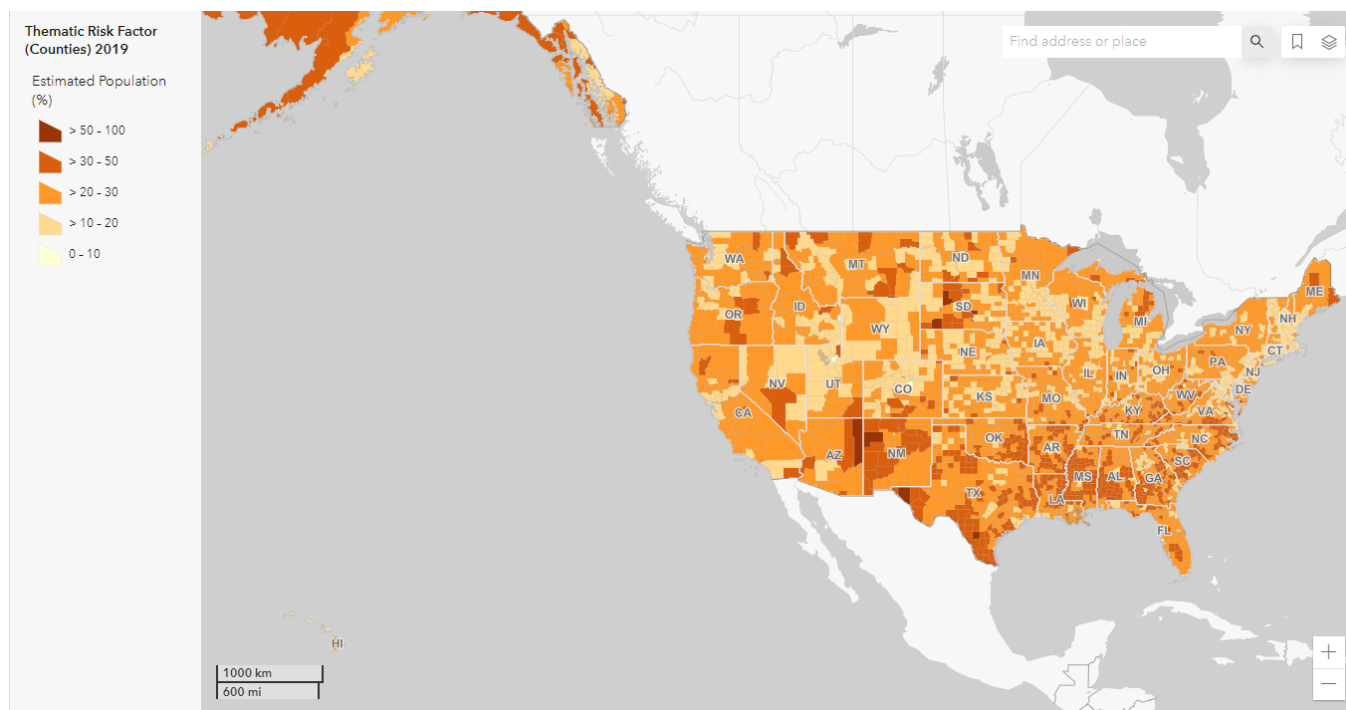
communities across the United States. Although initially created in response to the COVID-19 pandemic, the CRE is a tool that can be applied to other community threats such as flooding, sea level rise, and wildfires.

EUROPEAN UNION: RESILIENCE DASHBOARDS

The European Union (EU) considers resilience an important goal when defining its policy strategies. Since 2020, the EU has used a dashboard tool to track resilience in each member state (as well as the EU as a whole) and to measure the impacts of its policy strategies (European Commission, 2021). The EU considers four interrelated dimensions of resilience relevant for Europe:

1. **Social and economic:** “The ability to tackle economic shocks and achieve long-term structural change in a fair and inclusive way.” It is measured using variables such as health, education, work, economic and financial stability, sustainability, as well as indicators that point to vulnerable groups that may be adversely affected by the green and digital transitions.
2. **Green:** Is “. . . about reaching climate neutrality by 2050, while mitigating and adapting to climate change, reducing pollution, and restoring the capacity of ecological systems to sustain our ability to live well within planetary boundaries.” The green dimension considers the potential increase in the use of energy due to the digital transition as a challenge for the sustainable use of resources.
3. **Digital:** Is “. . . about ensuring that the way we live, work, learn, interact, and think in this digital age preserves and enhances human dignity, freedom, equality, security, democracy, and other European fundamental rights and values.”
4. **Geopolitical:** Relates to “Europe bolstering its ‘open strategic autonomy’ and global leadership role.”

Figure 2.
Share of County Population With Three or More Community Resilience Risk Factors: 2019



Note: The categorization in this map shows the percentage of county populations that have three or more risk factors. For display purposes, Alaska and Hawaii are not shown here, but are contained in the Community Resilience Estimates.
 Source: U.S. Census Bureau, 2021b.

Figure 3 shows the most recent dashboard for each of the EU countries (European Commission, 2021). The categories range from higher levels of vulnerability/low levels of resilience (orange colors) to lower levels of vulnerability/high levels of resilience (blue colors).

The main goal of this tool is to improve EU resilience through assessing member countries' capacities to respond to hazards and changes while accounting for the vulnerability of the groups affected by these issues (European Commission, 2021). To place EU countries in an international context, the dashboard assesses some non-EU countries as well (Figure 3). The EU dashboard focuses on both vulnerabilities (characteristics and obstacles presumed to exacerbate the impact of negative crises) and capacities (features that increase the potential to cope with crises). For each of the four dimensions, around 30 indicators for the EU-level analysis and 12 for non-EU country comparisons were selected.

As previously mentioned, the four dimensions are not independent of each other. For example, the indicators for the social and economic dimension aim to highlight vulnerable groups that may be negatively affected by the green and digital transitions—increasing taxes on coal and subsidizing the use of solar panels encourages more

households to move toward using green energy. However, the poorest households will only see their expenses go up, as they might not have the resources to install solar panels and may need to keep using coal-based energy resources.

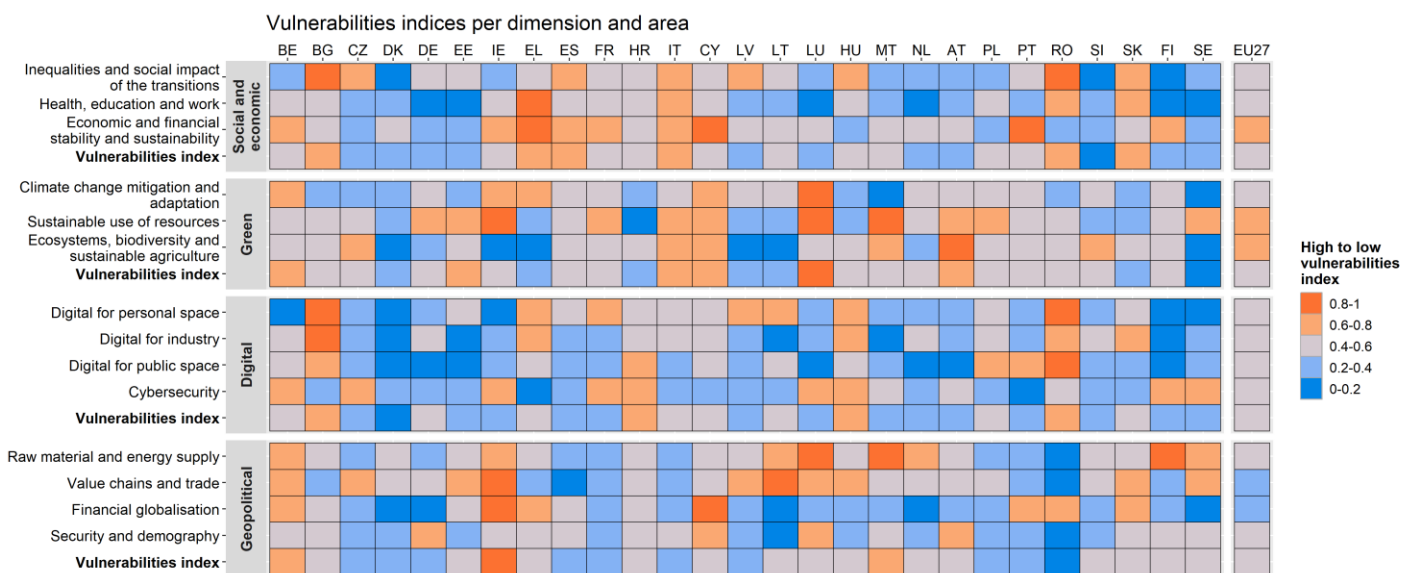
This tool is updated regularly, and it is used by the EU to decide how to allocate development funds for each member country.

Both the Census Bureau CRE and the EU dashboard indexes were built to inform policymakers and the public on community resilience when confronted with significant threats. The EU dashboard works to understand resilience across four dimensions using several macro-level indicators in its assessment at the *country* level. The CRE, on the other hand, focuses on social resilience at the *community* level, and uses microdata to unmask the social risks that might be obscured when aggregate level data are used.

MEXICO: URBAN RESILIENCE PROFILES

In Mexico, resilience measuring tools were created in response to the government's concerns regarding risks (e.g., climate change, lack of sanitary conditions, and population growth) faced by urban residents (Government of Mexico, 2016). In cooperation with international agencies,

Figure 3.
EU Resilience Dashboard for Member Countries and the EU Overall



Source: European Union, 2021.

local stakeholders, nongovernmental organizations, and academic institutions, the Mexican government developed a tool that measures the capacity of cities to recover from disasters. This tool uses the UN-HABITAT City Resilience Profiling Program framework along five dimensions to assess urban resilience:

1. **Organizational:** The intensity of interaction between the different levels of administrative organizations (e.g., federal, state, municipal, local, and individual).
2. **Spatial:** Geographic processes occurring within and across block, district, town, state, or national levels.
3. **Physical:** The strengths and problems of infrastructure networks, facilities, and services.
4. **Functional:** The existence (or lack thereof) and continuity of services such as urban plans and emergency response programs.
5. **Temporal:** The dynamic, time-dependent, and evolving nature of indicators; the evolution of urban conditions at various points in time.

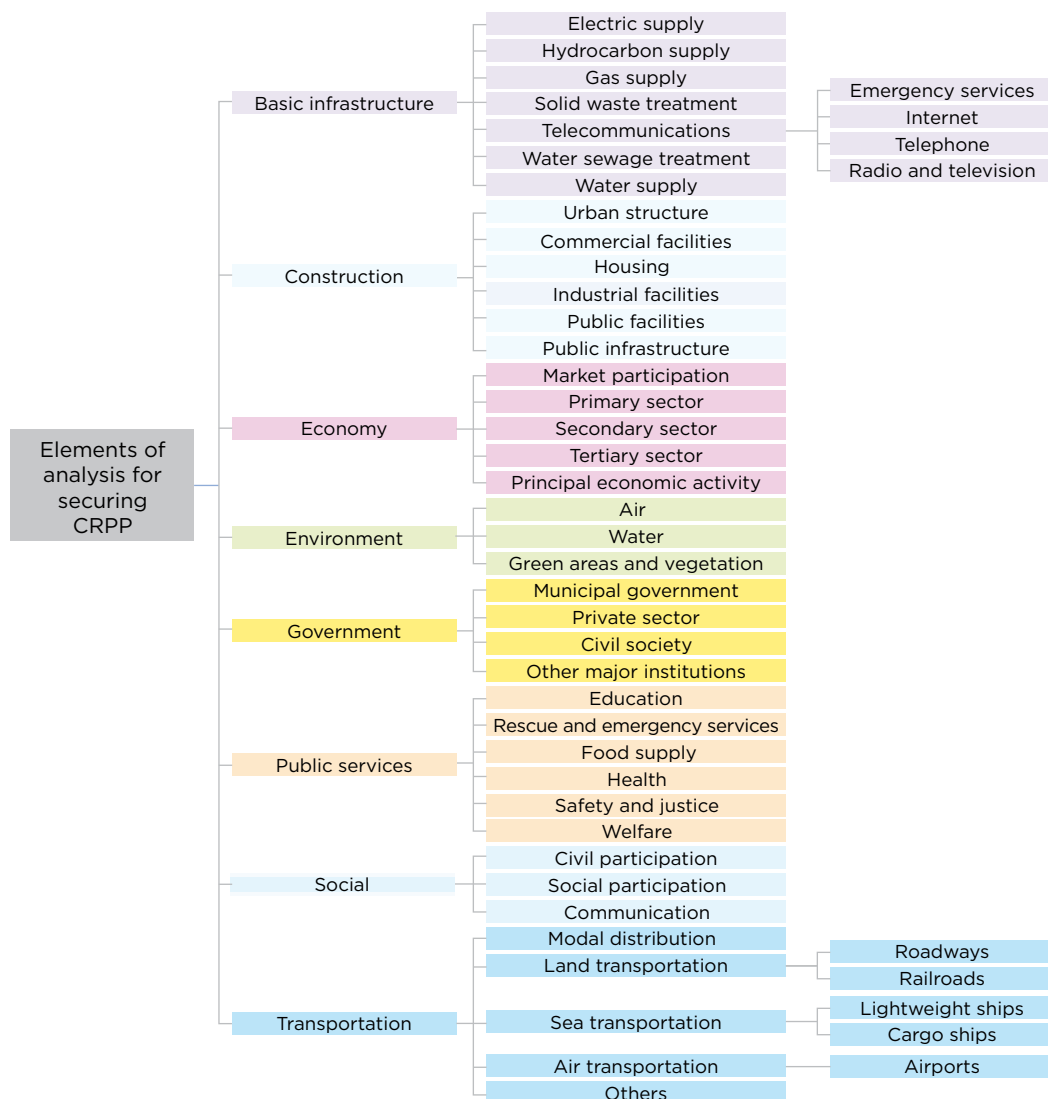
The urban resilience guide is designed for municipal authorities throughout the country to help address urban development challenges. Figure 4 shows the areas and variables used to measure the urban areas resilience.

AFRICAN DEVELOPMENT BANK GROUP: RESILIENCE VERSUS FRAGILITY IN AFRICA

Since 2014, the African Development Bank Group (AFDB) has focused on **fragility** rather than resilience. The AFDB defines fragility as the “condition where countries are subject to pressures that threaten to overwhelm their capacities to manage them, creating risks of instability.” This approach helps AFDB identify contexts within the African countries where institutional capacity can be strengthened, resilient societies can be built, and private investments can be made to reduce vulnerability when faced with shocks and stresses (African Development Bank Group, 2022).

Unlike the previously reviewed national institutions (United States, EU, and Mexico), the AFDB focuses on understanding the specific local conditions that make a region or community fragile instead of developing an index to measure resilience/fragility. Marginalization of certain ethnic groups and persistent economic inequalities are identified as some of the conditions that weaken a state and limit its resilience (Figure 5). Since 2014, the AFDB has organized regular meetings with country stakeholders to discuss how to tackle fragility in their own countries and implemented projects to help communities increase their resilience.

Figure 4.
Elements for Measuring Resilience



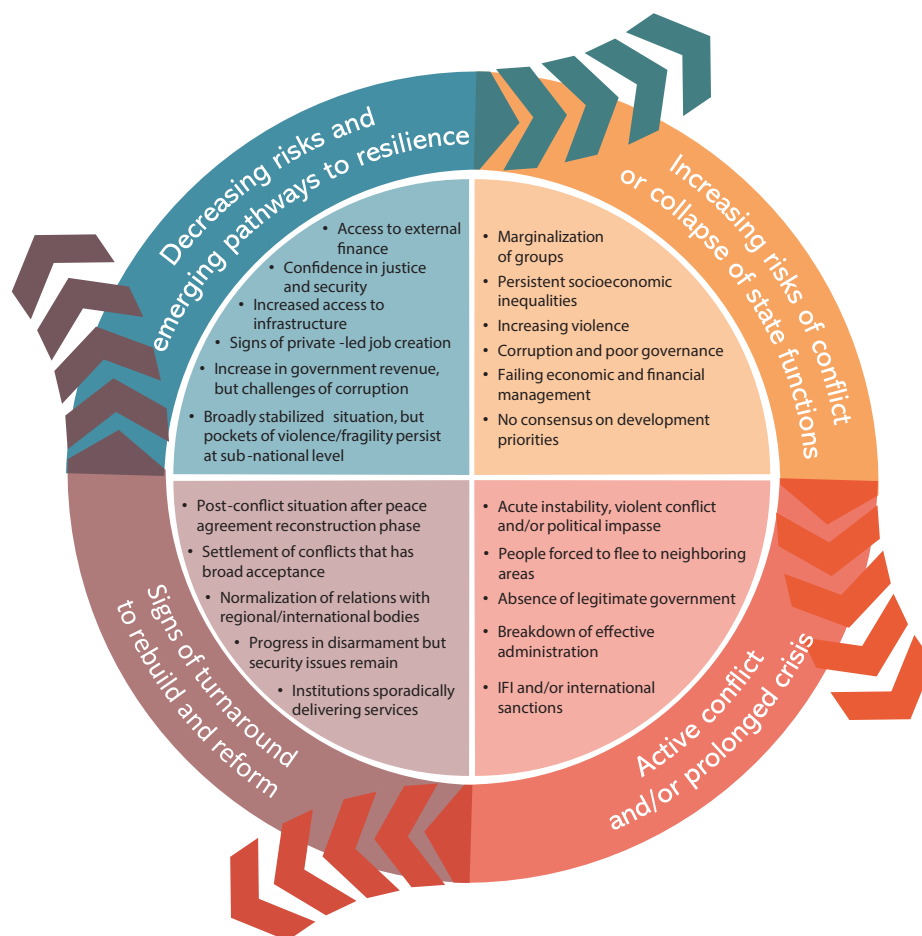
Source: Government of Mexico, Secretariat of the Interior (SEGOB), Secretariat of Agrarian, Land, and Urban Development (SEDATU), National System of Civil Protection (SINAPROC), 2016.

CONCLUSION

Faced with an increasing number of threats due to economic stress, conflict, and natural disasters, nations and regions around the world have developed various tools to measure **community resilience**. In this report, we reviewed the indexes developed by the United States, Mexico, the European Union, and the African Development Bank Group (AFDB). The first three implemented a quantitative approach resulting in the development of an index. The

fourth, the AFDB, used a qualitative approach designed to identify when a specific community is vulnerable to a natural hazard, political conflict, or economic crisis. While a unitary, single index for all communities makes it easy for policy-makers to envision where problems exist and what should be done, a lack of quality and timely data makes this endeavor difficult and expensive for regions with lower statistical capacity.

Figure 5.
Situations of Fragility



Source: African Development Bank Group, 2022.

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