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Rural Futures Lab™

Regional Resilience

Research and Policy Brief

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With

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Rural Futures Lab™

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Executive Summary

This paper has been prepared by the Rural Policy Research Institute's (RUPRI) Rural Futures Lab at the request of the National Association of Development Organizations (NADO) Research Foundation. Its purpose is to provide a translation of the extensive research literature on resilience and to provide a framework for assessing current policy and practice as it relates to regional resilience.

A resilient region (or community) is one that is able to anticipate threats, reduce the impact of these threats by taking pre-emptive action, respond appropriately when these threats materialize, and recover afterwards. Such threats (or shocks) can be natural events, often but not always weather-related; human-made, such as terrorism or industrial accidents; pandemic diseases; or an economic collapse or disruption. A region's resilience is initially determined by the magnitude and severity of such shocks and the region's capacity to contend with them based on its inherent vulnerabilities and available resources. If the shock overwhelms capacity then resilience is measured by the region's ability to recover to a pre-shock level of functioning or to achieve a "new normal" that is at least as favorable. The ultimate outcome represents the region's capacity to cope with the next shock.

Research and experience over the past 20 years suggests that there is broad acceptance of the need for regions and communities to prepare for all hazards. Regions everywhere are increasingly faced with multiple and sometimes cascading hazards. Some communities are more vulnerable than others to natural disasters by virtue of their location or past development decisions; others are vulnerable because of their socio-economic characteristics, while others are at risk because of their undiversified economic structure. Taking a resilience approach requires extending beyond emergency responsiveness to planning and organizing in advance to address these vulnerabilities and to enable rebuilding afterwards in ways that offer healthier, sustainable communities and more robust regional economies.

Federal policy to disasters has been transformed over the past decade and there are strong indications that much has been learned from the research and experience. There is a strong emphasis on the need for seamless coordination of federal, state, and local efforts to prepare for, respond to, and recover from disasters. This policy, reinforced by processes and structures for planning, coordination, training, and exercises and certification, has also generated two very important collaborations across the private, public, academic, and nonprofit sectors. One is primarily focused on the security of critical infrastructure, the other on building the capacity of local communities and regions to drive preparedness, response, and recovery efforts in line with their own vision for the future. Both are recognition that the federal government cannot, and should not, assume full responsibility for achieving national and regional resilience, and indeed in times of severe fiscal restraint, engaging all the resources and talents of regions and communities is the way to proceed.

The regional dimension of resilience is critical. Disasters know no boundaries and throw into sharp relief the need for cooperation and collaboration across county and state boundaries. Moreover, resiliency is not evenly distributed across the landscape, and there has to be integration of responses and resources to support those areas that have inherent vulnerabilities and weak capacity, especially across rural America. The national network of regional development organizations represents an infrastructure that can address these capacity and vulnerability challenges. A national investment in intermediation structures to prepare and protect all communities would be a wise use of resources.

1. Introduction

This paper has been prepared by the Rural Policy Research Institute's (RUPRI) Rural Futures Lab at the request of the National Association of Development Organizations (NADO) Research Foundation. Its purpose is to provide a translation of the extensive research literature on resilience and to provide a framework for assessing current policy and practice as it relates to regional resilience.

Although the United States is no stranger to the impact of major disasters, whether natural or man-made, it was Hurricane Katrina in 2005 that raised the public's anxiety about the ability (or inability) of governments and communities to respond in a timely, adequate, and appropriate manner. In particular, a spotlight was shone on the Federal Emergency Management Agency (FEMA) and its capacity to meet expectations for how a developed nation should prepare for, respond to, and help rebuild after such a disaster. However, the primary focus of the federal agencies, especially the Department of Homeland Security, in which FEMA is housed, at that time was less on natural disasters but on terrorism in the aftermath of the September 11, 2001, attacks on New York and Washington, D.C. But what has been learned since is that the approach to disasters, whatever the cause, requires a common and comprehensive approach at all levels of government as well as in the private and community sectors.

Recent events have put such learning to the test – tornadoes, floods, wildfires, and oil spills – have cost lives, property and ecological damage, and significant economic disruption. And the triple-play in Japan of earthquake, tsunami, and nuclear meltdown raised global awareness to the fragility of even the richest of nations, as well as prompt reminders of the plight of poor countries assailed by massive natural disasters, famine, disease, and war.

Yet in recent weeks, the focus in Congress has shifted to the costs of FEMA's operations, given the intense pressures to reduce deficits and public spending. FEMA became a pawn in Congressional and White House negotiations, and in October 2011, an article in *USA Today* asked whether Presidential Disaster Declarations had been too readily made in response to governors' requests for help, draining available funds for response and recovery.

Economic shocks are also an important part of this discussion. Natural disasters and terrorism cause significant damage to businesses large and small with potentially huge impacts on the economy. But economic collapses can also be disasters in their own right with very similar trajectories to natural ones. These can be induced by events such as the Great Recession, by major shifts in market demand, or by the application of new technologies, and can have widespread or very localized impacts. A closing of a manufacturing plant in a small town can have devastating community ramifications, for which local leadership is expected to come up with a response and a path to recovery, just as if the community had been hit by a tornado.

The box shows some standard definitions of resilience, which encompass ideas of recovering or springing back quickly and easily after a misfortune or difficulty.

> ## Re·sil·ience
>
> **Merriam-Webster**
> (1) The capability of a strained body to recover its size and shape after deformation caused especially by compressive stress; (2) An ability to recover from or adjust easily to misfortune or change.
>
> **The Oxford Dictionaries**
> (1) The ability of a substance or object to spring back into shape; (2) The capacity to recover quickly from difficulties.

The word "resilience" has some very precise meanings in disciplines such as engineering and ecology. However, as it has become more widely used particularly to describe a characteristic of individuals, households, communities, or regions, some of this precision has been lost, with the result that it is in danger of losing its potency. Similar fates have befallen words like "entrepreneurship," "sustainability," and "community." Nevertheless, resilience as a concept is likely to have increasing relevance in the coming years as a way of organizing thinking about, and responses to, major natural and human-made disruptions to the functioning and well-being of society.

The National Science and Technology Council's Subcommittee on Disaster Reduction (2005) described the resilient communities as those that can recognize and understand relevant hazards, know when a hazard is imminent, are able to ensure that individuals at risk are safe from hazards in their homes and places of work, and experience minimum disruption to life and economy after a hazard has passed (Subcommittee [2005], p. 1).

The Community & Regional Resilience Institute (CARRI) expands on these characteristics:

"[A] resilient community is defined as one that anticipates problems, opportunities, and potentials for surprises; reduces vulnerabilities related to development paths, socioeconomic conditions, and sensitivities to possible threats; responds effectively, fairly, and legitimately in the event of an emergency; and recovers rapidly, better, safer, and fairer." (Wilbanks, 2008, p. 10).

In other words, a resilient community – or region – **anticipates** threats, **reduces** the impact of these threats by taking pre-emptive action, **responds** appropriately when these threats materialize, and **recovers** afterwards.

2. A Resilience Framework

The power of the resiliency approach is that it broadens attention from emergency response – how to deal with the immediate impact of a disruptive event – to planning and organizing in advance and rebuilding afterwards within a coherent framework. There are, however, a number of complex considerations that have to be taken into account in determining the nature and strength of a community's resilience. These are presented in the following model derived from a review of current literature.

A starting point is to posit a set of relationships between the status of a community before a disruptive event, the event itself, and the eventual outcome.

The trajectory of a community after an event, and hence the ultimate outcome, is determined by the extent to which the community's capacities match the magnitude and severity of the event, and whether or not there is any significant resulting dysfunction.

The model, drawing from Norris et al (2008), captures this process by incorporating five components – the source of the shock (the disruptive event or stress), the community's capacity to withstand and cope with this shock, the immediate impact, the community's subsequent trajectory, and the eventual outcome.
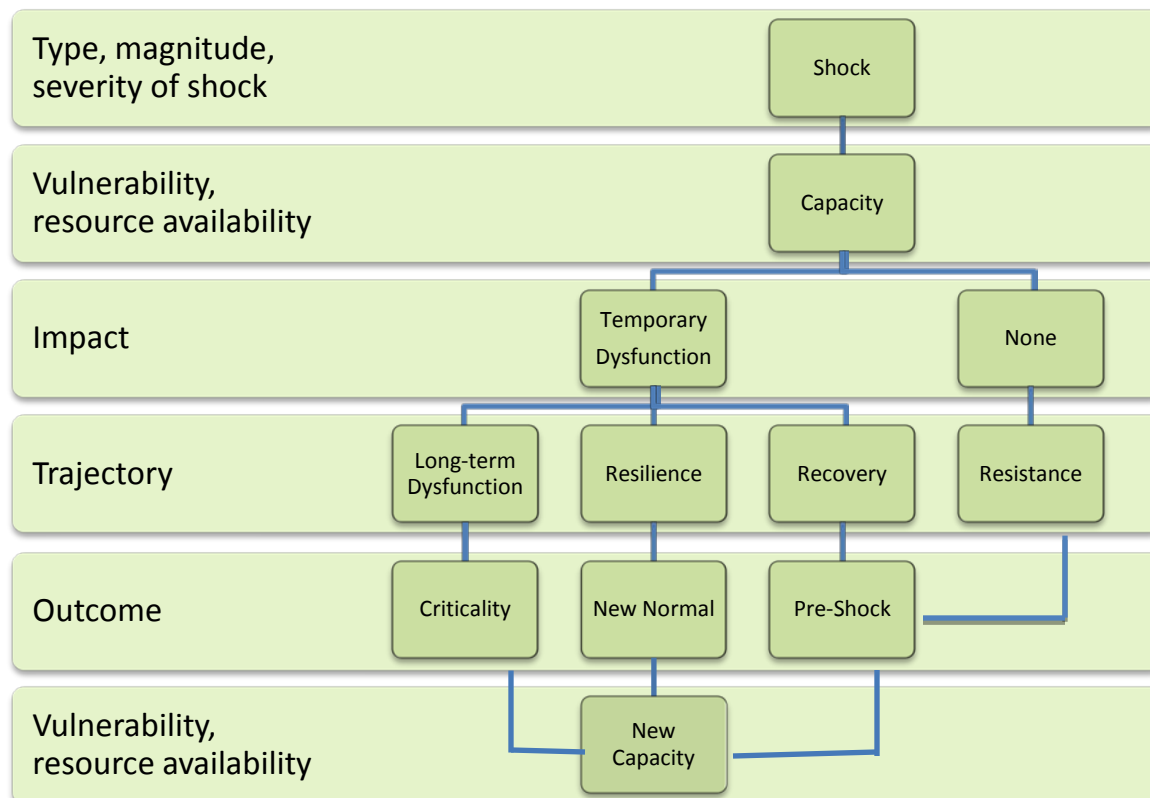

Figure 1: A Resilience Framework

- **Shock** includes two elements: the range of probable events and the magnitude and severity of the actual event(s).
- **Capacity** includes two elements: the inherent vulnerability of the community to shocks and the adaptive resources available to the community.
- **Impact** refers to whether or not capacity matches the magnitude and severity of the shock, and thus whether or not there is any resultant dysfunction of the community.
- **Trajectory** refers to one of four paths the community follows after the shock – resistance, recovery, resilience, or persistent dysfunction.
- **Outcome** is of three types: pre-event functioning, a "new normal," or some level of criticality. The outcome then determines the capacity of the community to withstand the next shock, underscoring the dynamic nature of the process.

Here are some examples of the flow:

- If the community's resources are able to withstand the impact of a shock without a discernible loss of function, then the community has demonstrated **resistance** to the particular type, scale, and intensity of the shock.
- If the impact of the shock overcomes the community's ability to resist, then there will be a state of **temporary dysfunction** as the community responds to the emergency. What happens next depends on the strength and depth of the community's resources.
- The desired trajectory is that of **recovery**, where the community is able to overcome the dysfunction and return to pre-event functioning without the need for substantial, change or adaptation. This is also known as **static resilience** (Felt et al, forthcoming).
- Another trajectory is **resilience**, where the community moves to a "**new normal**," not necessarily better or worse than pre-event functioning, but certainly different. This is the most likely trajectory when the stress is at the level of 'disaster' or 'catastrophe' (see pp. 11-12). Of course, the most desirable outcome is a "new normal" that represents a significant improvement on pre-shock functioning in terms of increased community resources and reduced community vulnerability.
- A worst case trajectory is when the temporary dysfunction becomes **persistent or long-term dysfunction,** also referred to as some level of **criticality** (Moser, 2008; Kasperson et al, 1995), when the community is unable to return to an acceptable level of functioning.
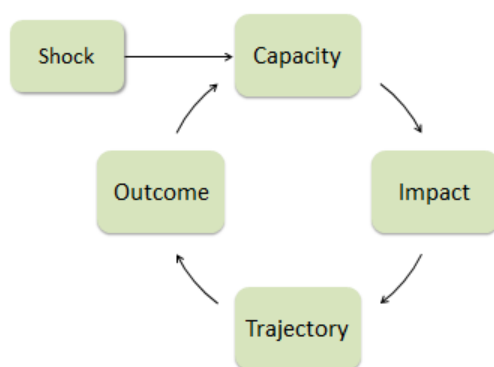
Figure 2: The Iterative Process of Resilience

Figure 2 presents a simplified diagram of the process but emphasizes its iterative nature. The post-event status of a community represents its capacity to contend with the next shock.

From these examples, it can be seen that the aim should be to build up the level of a community's resources so that when they are tested by a major disruptive event or shock the community is able to convert transient dysfunction into either recovery or resilience.

3. Components of Resilience

The following sections summarize the literature relating to shock, capacity, and impact.

SHOCK

Types of Shock

Shocks can include natural events, often but not always weather-related; human-made events, such as terrorism or nuclear or chemical accidents; medical events, such as pandemic diseases; and economic events, such as the collapse of an industrial sector or the cessation of a vital economic activity. These events may, and often do, occur in some combination, thus multiplying the impacts on a community or region.
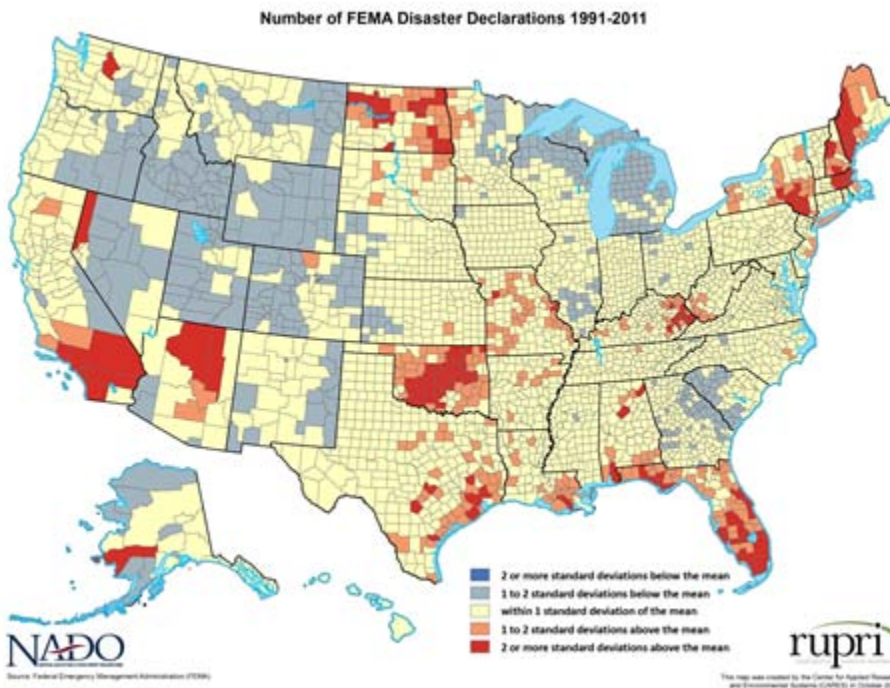
Map 1: FEMA Disaster Declarations 1991-2011

FEMA, being the main coordinating agency for all emergencies and disasters, has an extensive Web site providing both data and information on ways to both prepare for and respond to disruptive events. Map 1 shows the distribution of FEMA disaster declarations in 1991-2011. Particular concentrations are evident in southern California, north and central Arizona, Oklahoma, southern Texas and the Gulf Coast, Florida, New England, eastern Kentucky, and North Dakota. Table 1 provides information on natural events in 2011.

Type of Declaration	Total Number of Declarations 2011	Number of States Affected	Main States Affected (# declarations)	Main Types of Event
Major Disaster	98	41 (+ DC, PR)	Tennessee (5), New Jersey (5), New York (4), Oklahoma (4), Iowa (4)	Hurricane Irene, tornadoes, severe storms, flooding, winter storms, tsunamis
Emergency	26	20 (+ DC, PR)		Hurricane Irene, flooding, severe storms
Fire Management Assistance	109	16	Texas (55), Oklahoma (25), New Mexico (8)	Wildfire

Table 1: Disaster Declarations, 2011

A **major disaster** declaration is made when the event is more severe than state and local governments can handle alone, and for which funding is made available from the President's Disaster Relief Fund for both specific immediate needs and for long-term recovery efforts. An **emergency** declaration is more limited in scope and does not include provision for long-term federal funding. As can be seen from the table, declarations are broadly distributed across the country although, as might be expected, major events such as Hurricane Irene or flooding along the Mississippi and Missouri rivers can generate clusters of declarations. The drought in Texas and Oklahoma accounted for almost 70 percent of fire management assistance declarations in 2011.

These natural disasters are not the only sources of major stress that communities may have to face. **Terrorism** has been a major focus of the emergency management services since 9/11, and as was demonstrated in New York City and Washington, D.C., has the potential to create enormous short- and long-term impacts on the functioning of affected communities. It also had the effect of raising the profile of emergency preparedness nationwide to deal with all manner of disruptive events.

Disease threats have also attracted much attention, particularly those that emanate from animals and transmit to humans (zoonotic diseases) such as HIV and avian influenza. Ease of transport of people and goods across the globe has dramatically increased the potential for the rapid spread of diseases, and has been described as a "...'brewing storm' that...has the potential to inflict horrific consequences on millions of people." (Kaplan, Kahn & Monath, 2009). This has led to increasing scientific and on-the-ground collaboration between human and veterinarian medicine, under the banner of "One Medicine, One Health."

Economic events may be of many different types. They may be a direct consequence of a natural, man-made, or medical event. Economic events may be sudden and unexpected, such as a devastating fire at an industrial plant that leads to its closure, or very long-term as an industrial activity and its associated community slowly declines as a natural resource depletes or competition eats away established markets. Or they can stem from public policy decisions on issues such as international trade

agreements, farm subsidies, natural resource extraction, water rights, environmental protection, transportation, or health care.

Some researchers (Cohen, 1993) refer to another type of shock, **environmental accidents**, which differ from natural disasters, particularly in respect to the persistent uncertainty of toxic exposure, which inhibit both responses and recovery. Environmental accidents tend to be of two types:

- **Technical disasters**, which emerge slowly, engender uncertainty and ambiguity as to their damage potential, and as a consequence motivate an ambivalent official response. Examples include the Love Canal, New York, the coal mine fire in Centralia, Pennsylvania, and asbestos contamination in Globe, Arizona, or Libby, Montana.
- **Technological disasters**, which are spontaneous and universally recognized catastrophic events that occur without immediate warning, inflicting extensive damage on human life and public and private property. Examples include Three Mile Island nuclear power plant near-meltdown in Pennsylvania and the Union Carbide chemical plant explosion in Bhopal, India.

As Cohen noted, some accidents do not fall easily into these categories, such as Exxon Valdez, where the accident occurred spontaneously, inflicting damage in the manner of a technological disaster, but the emergency lasted for months and years as damage was sustained mainly by public natural, economic, and amenity resources. The Gulf oil spill is a more recent example.

An important consideration is that disasters rarely come as discrete events. In March 2011, Japan faced three major events – an earthquake, a tsunami, and a nuclear meltdown – each of which on its own had the potential for huge impacts on the functioning of the country's civic and economic life, but together led to a catastrophe with global ramifications. Katrina in 2005 with its hurricane, extensive flooding, and community collapse also provided a vivid illustration of cascading disasters with long-term consequences.

Magnitude and Severity

A community's resilience has to be measured against the magnitude and severity of the shock. Tierney (2009) provides a very helpful comparison across different degrees of severity. Table 2 makes a distinction between emergencies, disasters, and catastrophes. As can be seen, capacity to respond and recover can be significantly impacted by the severity of the event – Katrina, Haiti, and Japan being obvious recent examples of catastrophes.

At the catastrophic level, there is also the question of **criticality**, where there are limits or thresholds beyond which conditions cannot deteriorate further without system collapse. At that stage, the impacts spread from the impacted community or region to a much wider area. This possibility of system collapse requires a sharp focus on those assets and lifelines that need to be protected in order to assure continued community functioning (Moser, 2008).

	Emergencies	Disasters	Catastrophes
Impacts	Localized	Widespread, severe	Extreme, physical and social
Response	Mainly local	Multiple-jurisdictional, intergovernmental but bottom-up	Federal initiative and proactive mobilization
Procedures	Standard operating procedures	Disaster plans into effect, but likely changes	Massive challenges beyond pre-existing plans
Resources	Within response resources	Extensive damage to emergency services	Emergency response system paralyzed
Recovery	No significant challenges	Major recovery challenges	Cascading long-term effects, massive recovery challenges

Table 2: Typology of Emergencies, Disasters, and Catastrophes (Tierney, 2009)

Kasperson et al (1995) describes three types of criticality used in the ecological sciences:

- *Where the impacts of human activities have so altered the landscape and ecosystems that they have become ecologically degraded.* Examples include large-scale deforestation, strip-mining, and mountain-top removal, which are often associated with long-term economic and community deterioration.
- *Where social, economic, and technological forces undermine the ability of communities to sustain themselves, leaving them extremely vulnerable and their environment degraded.* War is an obvious example.
- *Where the extent and/or rate of environmental degradation precludes the continuation of community functioning at acceptable levels of well-being.* Regions of prolonged drought and famine, such as the Horn of Africa, provide a current and horrific example.

CAPACITY

The capacity of a community to withstand major threats is in large part a function of two factors: its inherent vulnerability to such threats, and the availability of resources for coping with and adapting to the impacts of these threats. How vulnerability and capacity can be measured will be discussed in Section 8.

Vulnerability

Cutter et al (2008) define vulnerability as "the pre-event, inherent characteristics or qualities of systems that create the potential for harm or differential ability to recover following the event" (p. 2). Vulnerability has three components (Moser, 2008; Cutter et al, 2008):

- **Exposure** to a threat – a community located on or close to a geological fault line is clearly more vulnerable to an earthquake than one that is at some distance away.
- **Sensitivity**, or the ability to resist a threat – a community that has not permitted development on its flood plains is less sensitive to a flood threat than one that has not protected its low-lying land.
- **Capacity to adapt** to potential threats – a community with the resources to foresee, prevent, limit, deal with, and recover from an event is less vulnerable than one that has little capacity to plan and respond.

There are different dimensions of vulnerability (Cutter et al, 2008; Colten, Kates & Laska, 2008; Alasia et al, 2008):

- **Physical vulnerability** – communities that are close to hazard-prone areas such as coasts, floodplains, seismic zones, and potential contamination sites are more or less vulnerable depending upon the magnitude, duration, frequency, impact, and rapidity of the onset of an event. Another aspect of physical vulnerability is the condition of the built environment. Where buildings are poorly constructed or maintained, or where critical pieces of infrastructure are susceptible to damage such as bridges, roads, and water and sewer pipes, then the community is vulnerable and faced with the prospects of slow recovery.
- **Economic vulnerability** – communities that are dependent upon a single economic sector for their livelihoods are more vulnerable to a threat than those with diversified economies. Economies that were already struggling before an event are likely to continue on a downward trajectory afterwards, even though in some cases there may be a short-term boost from reconstruction funds.
- **Social vulnerability** – this "occurs when unequal exposure to risk is coupled with unequal access to resources" (Morrow, 2008, p. 4). Morrow identified a number of factors that relate to differential exposure and impact as well as to slow or inadequate recovery. These include poverty, minority status, gender, age and disabilities, low educational and technical skill levels, and weak social capital. Cutter et al (2008) noted "The social vulnerability of communities is borne from inequalities, which affect access to resources and information, the ability to absorb the impacts of hazards and disasters without governmental interventions, housing choice and location, and the political marginalization of impoverished residents" (pp. 3-4). Norris (2010) points out that a community's mental health is an essential precondition of community resilience, which in turn is dependent upon the resilience of the individuals who comprise it. Tierney (2009) observed that Katrina validated approaches that recognize social vulnerability, given the way different groups responded to the disaster and the official responses they received.

Resource Availability

There are two types of responses to hazardous events (Moser, 2008; Gunderson, 2009). The ability to cope or deal with the present or near-term hazards and disturbances by making adjustments rather than structural changes, is known as **coping capacity**; the ability to make changes, sometimes deep and structural to respond to long-term trends, is known as **adaptive capacity**. A decision to rebuild damaged homes or facilities on the same site after a flood may demonstrate a coping capacity, whereas a decision to relocate a community on to higher ground would be an example of an adaptive capacity.

In reality, for a community to be resilient over time, it needs to have both capacities – to be able to cope with present-day known risks, *and* to be able to adapt to changing conditions, including those that are uncertain, unknown, or unpredictable. As Moser (2008) concludes, both are necessary, but neither on its own is sufficient.

Norris et al (2008) describe community resilience as a process that links together adaptive capacities in ways that can yield positive outcomes for populations affected by a hazardous event. They describe adaptive capacities as "dynamic resources that are robust, redundant or rapidly accessible" where resources are the objects, conditions, characteristics, and energies that people value. The three dimensions of these resources are:

- **Robustness** – resource strength with a low probability of deterioration
- **Redundancy** – the extent to which resources are substitutable in the event of disruption or degradation
- **Rapidity** – the speed at which the resources can be accessed and mobilized.

IMPACT

CARRI created a framework based on its extensive research and pilot projects in Charleston, South Carolina, Gulfport, Mississippi, and Memphis, Tennessee. The framework comprises four dimensions of resilience:

1. **Anticipation –** a resilient community is able to anticipate that there may be multiple hazards or threats to people and what they value. These hazards might be non-routine episodic events such as earthquakes, floods, pandemics, or terrorist attacks, or cumulative events such as coastal erosion, drought, or economic disinvestment.

2. **Reduction** – a resilient community understands its physical, economic, and social vulnerabilities to these hazards and takes mitigating action to reduce their impact.

3. **Response –** a resilient community is able to respond to events as they happen, mobilizing resources and coordinating relief efforts.

4. **Recovery** – a resilient community is able to organize itself through the stages of emergency, restoration, reconstruction, and community betterment (Colten, Kates, & Laska, 2008).

The CARRI framework provides both a practical way of organizing a community's approach to preparation, emergency response, and rebuilding, and an effective way to describe the processes that

determine the impact on a community of a major shock. For the purposes of the Resilience Framework, **impact** refers to the net effect of the shock on a community, taking into account the degree of community vulnerability and the robustness, redundancy, and rapidity of the resources available to the community.
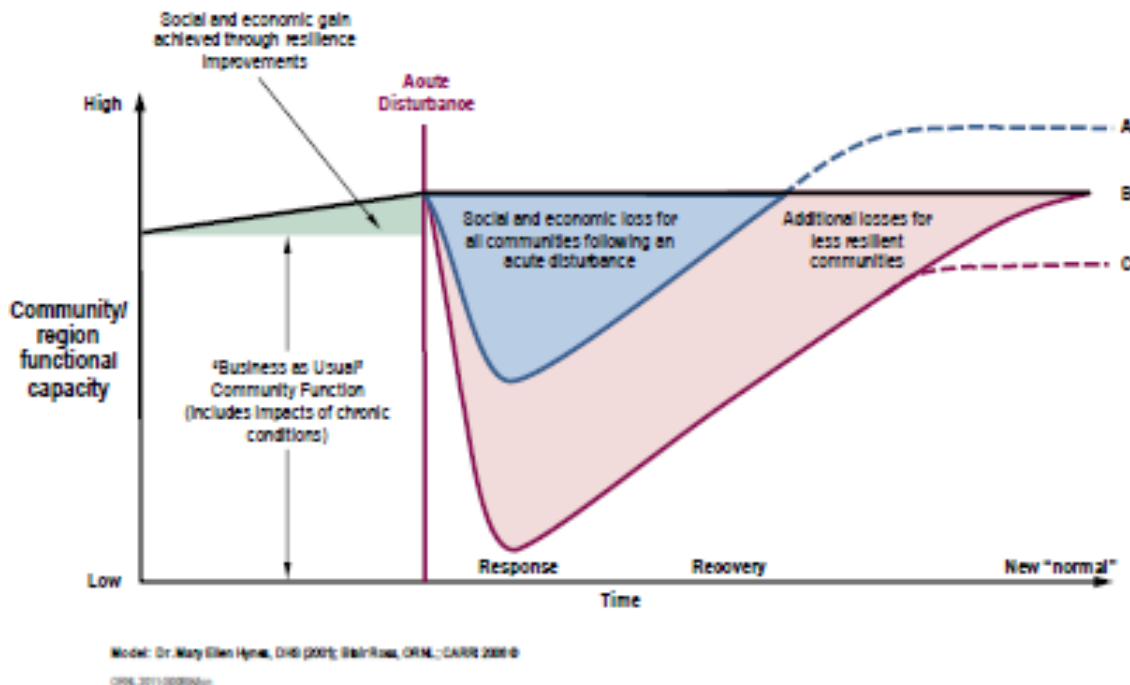

Figure 3: Resilience Loss Recovery Curve (CARRI, 2011)

CARRI uses a "Resilience Loss Recovery Curve" to illustrate the process of community resilience, as shown in Figure 3 (CARRI, 2011, p. 28).

The main points to note are:

- A more resilient community – one that has anticipated threats and mitigated some of them, developed a vision for the future, organized itself around key resiliency priorities, and planned for recovery – can more quickly restart its community services, and chart a path to a "new normal."
- Such a community will incur some losses (blue area) but will not experience the additional losses (pink area) that less resilient communities will occur because it has been able to speed up the recovery and decrease its inherent vulnerability to the shock.
- Some communities will be able to return to pre-shock levels of functionality (Line B); others will fall short (Line C). Those that are able to seize new opportunities to transform themselves may reach a higher level of post-shock functionality (Line A).

4. Economic Resilience

Economic resilience is a special case in any discussion of resilience because the initial shock to the community or regional economy can be sudden -- the closing of a manufacturing plant – or a long, gradual decline, such as that experienced by natural resource-dependent communities. Or because the condition of the economy is a central consideration in preparing for, responding to, and adapting to the consequences of a disruptive natural or human-made event.

There is an increasing focus in business of the importance of resiliency of the supply chain. As supply chains have become more global and complex, the risks from a variety of natural and human-made shocks rise exponentially (Lynch, 2011). A shock impacting any part of a supply chain can cause significant short-term and sometimes long-term damage to economic activity in several geographic locations. The recent earthquake in Japan created major supply problems for assemblers and retailers of Japanese cars in the United States and across the world. Businesses, large and small, have to be prepared for such disruptions and to make their operations as resilient as possible, using much the same planning and mitigation processes as discussed earlier for communities and regions.

> Hurricanes Katrina and Rita severely damaged or destroyed more than 61,000 small businesses with 20 or fewer employees in the Greater New Orleans region and 70,000 on the Mississippi Gulf Coast. But most recovery funds were intended for rebuilding infrastructure and housing – out of $37 billion appropriated by Congress for disaster-impacted regions in FY 2008 and 2009, only four percent was allocated to providing economic assistance to businesses *(Ridgeway, 2010).*

Rose (2009) introduces some important perspectives on what is of particular importance to ensure business and economic resilience:

- **Stock and Flow** – Rose argues that it is important to distinguish between stock and flow as it is flow that is most important to recovery. This refers to production and services – *the maintenance of markets and customers and the generation of income*, without which businesses cannot continue. Stock refers to property and the extent to which it is damaged, and is often the focus of recovery agencies.
- **Temporal dimension –** in the immediate aftermath of an event, Rose suggests that **static resilience**, the ability to maintain function when shocked, can be achieved through *conservation, input substitution, or even relocation*. On the other hand, **dynamic resilience** refers to the speed at which the system recovers from the shock, a function of the availability of resources for *repair and reconstruction*.
- **Capability dimension** -- a related dimension is what Rose calls **inherent resilience,** the ordinary ability to deal with crises, enhanced by planning and preparation in advance. This is distinguished from **adaptive resilience**, which is the ability in a crisis to maintain function through ingenuity and extra effort.
- **Market dimension –** The market plays a crucial role. A focus on the **supply-side** and the taking of action to maintain the function of enterprises and economies is natural in responding to a disruptive event, but ultimately what will determine a successful outcome are the actions that the businesses' customers – the **demand-side** – will take to minimize disruption of their own activities. A slow recovery will encourage customers to look elsewhere and thus further imperil an impacted business.

Alasia et al (2008) focused on economic resilience through the lens of what they termed "community resilience." They examined the likelihood of worsening socio-economic conditions for a community as a result of particular events or actions (shocks). They applied three dimensions to their analysis: **stressors**, such as exposure to global competition; **assets**, such as human capital; and **outcomes**, such as population decline. The researchers' econometric model showed that exposure to global restructuring trends increases community vulnerability to employment decline, and conditions of community distress, such as high unemployment rates, increase community vulnerability to population decline. However, community assets such as human capital, economic diversification, and proximity to metropolitan centers reduce vulnerability to population decline.

Guimaraes et al (1992) looked at the economic impacts of Hurricane Hugo on Charleston, South Carolina, in 1989. They observed that there was an economic surge during the reconstruction period with the infusion of dollars from insurance and public assistance. This proved to be particularly beneficial to certain sectors such as construction, agriculture, retail, transportation, and public utilities. This was a short-term boom, however, which did not compensate for the damage caused by the hurricane, and in due course, the economy returned to its normal growth pattern. Guimaraes et al concluded that income gains were neutral overall and that "the catastrophe was not a positive economic force" (p. 15).

Cohen (1993) also noted the possible economic benefits of disasters in his analysis of the economic impacts of the Exxon Valdez oil spill on the Alaska coastline. After the spill, the emergency response to recover the oil and mitigate the impacts of the spill on shorelines and wildlife led to a boom in local economies amounting by some estimates to $2.5 billion. Some communities, especially those close to the major centers of operations, benefitted directly from this infusion, which helped to offset the negative impacts to the fisheries; others entirely dependent upon the fisheries suffered from a fall in global demand for Alaska products and continued on the pre-disaster trajectory of decreased earnings.

5. Operational Lessons

Colten (2010) drew five main conclusions from CARRI's case studies in Charleston, South Carolina, Gulfport, Mississippi, and Memphis, Tennessee, about some essential requirements for achieving community resilience. These are summarized below together with observations from other researchers and practitioners.

Community engagement – *vulnerable populations have to be part of the deliberation and planning stages, both to ensure they are not neglected but also to tap into their knowledge and networks. Resilience is about relationships.*

- Communities need motivation to engage in community planning..."if we can respond really, really well to things that can and do happen, we will have a strong platform from which to respond to the improbable" (Carlee, 2009, p. 2).
- But lower-income groups always have the weakest voice in recovery decisions unless explicitly integrated into decision processes (Olshansky, 2006). Socio-economic vulnerability can be increased by poor development decisions, and by the effects of demographic shifts (Colten et al, 2008).

Leadership – *effective and trusted leadership is vital before and after the disaster. Leaders must understand their roles, and relationships; be responsive to constituents, cooperate with counterparts; be responsive to changing circumstances, learn from past experiences.*

- Building community is the primary business of local government, not just providing services, but providing leadership for economic and environmental sustainability and social equity (Carlee, 2009).
- Lack of leadership and frequent attrition of recovery support staff at local level presents challenges to consistent and efficient long-term recovery planning (NADO research Foundation, 2011).
- "Collaboration does not just happen; it requires leaders to make personal and institutional commitment" (Carlee, 2009, p. 3).

Communication and coordination – *need effective and redundant communications; informal and formal networks; must be inclusive and reach all segments of population.*

- "Communities that are factionalized, divisive, and suspicious of public and private institutions as a matter of routine are not likely to become models of collaboration during a disaster" (Carlee, 2009, p. 2).
- Trust is essential, and is particularly important in voluntary non-hierarchical networks. It is vital for residents and businesses to have ongoing trust in local and state governments, built on strong personal relationships (Carlee, 2009).

Ongoing preparations and training – *long-term process, update plans, train new leaders, information sharing.*

- Creating community resilience takes a very long time, perhaps decades (Colten et al, 2008).

- Warning systems may be in place but they are ineffective if response and recovery plans are inadequate; similarly, up-to-date data may be available but of no consequence if not used for reducing vulnerability (Colten et al, 2008).
- Increasing physical protections can have the effect of encouraging development in hazard-prone places (Colten et al, 2008).
- Post-Disaster Redevelopment Plans of the sort required or encouraged in Florida are said to have three main benefits:
  o They enable faster and more efficient recovery by allowing the community to do more than react – to act rather than debate.
  o They provide the opportunity to build back better..."a disaster, while tragic, can also create opportunities to fix past mistakes or leap forward with plans for community improvements. Without a guiding vision, short-term decisions may inadvertently restrict long-term sustainable redevelopment and overlook to surpass the status quo" (Florida, 2010, p. 4).
  o They ensure local control over recovery, "before well-intentioned outside agencies and non-governmental organizations rush to aid the community" (Florida, 2010, p. 4).
- Communities that take the lead will have more control over the prioritization and implementation of recovery efforts and their funding…federal disaster assistance agencies tend to follow the local community's lead and are there to support local and state priorities (NADO Research Foundation, 2011).

Flexibility – *plan for the unexpected, be ready for surprises; flexibility at all levels.*

- There will always be surprises: unintended events, anticipated events but failed responses, and expectations proven wrong (Colten et al, 2008).
- Recovery always takes longer than expected at all phases, and can be slowed by conflicts with both processes (top-down vs. bottom-up) and goals (quicker vs. safer/better vs. equity) (Colten et al, 2008).
- "Every post-disaster recovery manifests tension between speed and deliberation. Speed of recovery is important to keep businesses alive, rebuild infrastructure, and provide temporary and permanent housing. If officials do not act quickly, many victims will being rebuilding on their own in ways and at locations they determine (Olshansky, 2006, p. 148).
- Recovery is not a final, identifiable state, but evolves from decisions made over time, and is achieved most readily when local organizations are free to respond to their specific circumstances (Olshansky, 2006).
- Mass evacuations can give rise to unexpected recovery challenges with the composition of returnees substantially changing racial and income characteristics of affected communities (Groen & Povlika, 2010).

Sequencing – *after a shock, focus on restoring highest priority functions first, those without which other functions cannot operate.*

- This is an additional operational lesson that plays an important part of CARRI's current work (see pp. 27-28). As Table 4 shows, community functions can be categorized as infrastructure, economic, or social, and classified as to the order in which they have to be restored to achieve some acceptable level of community functionality.

COMMUNITY FUNCTIONS	First Order *Functions to be restored first if other functions are to reach a new normal*	Second Order *Functions that are heavily dependent upon first-order functions being in place*	Third Order *Functions not normally addressed by disaster responses but that are essential to ultimate full community functioning*
Infrastructure *Primarily physical assets*	Ensure **safety** of citizens Ensure access to adequate **energy** supplies Maintain effective **transportation** systems Ensure access to ample **water** services Safely dispose of **solid waste** Maintain ability to **communicate** with citizens	Protect and promote **health care** of community Safeguard community **records**	Maintain a healthy **natural environment**
Economic *Wealth and job creation*		Maintain a robust **economy** Provide **employment** for all who seek work Ensure adequate **wages** Ensure adequate and affordable **housing**	Work to maximize value of **those with special challenges**
Social *Community fabric, quality of life*			Provide effective **education and training** systems Provide opportunities to develop non-academic **skills** Citizens and citizens' groups take **ownership** of their community Foster a **sense of community and place**

Table 3: Sequencing of Community Function Restoration (CARRI, 2009; Felts et al forthcoming)

6. Policy Context

The overall policy context for preparing and responding to disaster has its legislative foundations in the *Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988* and the *Homeland Security Act of 2002*. The way the nation conducts its response to and recovery from a range of incidents, small and large, is governed by two key documents, the National Response Framework (NRF) and the National Disaster Recovery Framework (NDRF).

The National Response Framework

The NRF published by the U.S. Department of Homeland Security in January 2008, is:

> "…built upon *scalable, flexible, and adaptable coordinating structures* to align key roles and responsibilities *across the* nation. **It describes specific authorities and best practices for managing incidents** that range from the serious but purely local, to large scale terrorist attacks or catastrophic natural disasters" (DHS, 2008a, p. 1).

According to the NRF, effective response requires "… well-trained leaders and responders who have invested in response preparedness, developed engaged partnerships, and are able to achieve shared objectives" (DHS, 2008a, p. 2). A challenge to be addressed everywhere is the high turnover and short tenure among elected officials responsible for response at all levels. "The players' bench is constantly changing, but a concise, common playbook is needed by all" (p. 2). The NRF is intended to supply that playbook. It is a "core document that describes the doctrine to guide our national response, roles and responsibilities, response actions, response organizations, and planning requirement to achieve an effective national response" (p. 3). It includes a number of annexes that provide more detailed guidance on support functions, unique aspects of incident categories, and partnerships.

The objective of response "centers upon saving lives and protecting property and the environment" (DHS, 2008a, p. 8). Five principles define the approach to be adopted, which together constitute the ***national response doctrine***:

- **Engaged Partnership** – among federal, state, tribal, and local levels of government through preparedness activities – planning, resources, training, exercising, and organizing to build, sustain, and improve operational capabilities (DHS, 2008a, p. 9).
- **Tiered Response** – management of incidents should be at the lowest possible jurisdictional level and supported by additional capabilities when needed (p. 10).
- **Scalable, Flexible, and Adaptable Operational Capabilities** – as incidents change in size, scope, and complexity, the response must adapt to meet expanding requirements (p. 10).
- **Unity of Effort Through Unity of Command** – the use of an incident command system to enable agencies with different legal, jurisdictional, and functional responsibilities to coordinate, plan, and interact effectively on the scene.
- **Readiness to Act –** swift and effective action based on risk assessment, proper training and planning, and clear, focused communication.

The National Disaster Recovery Framework

While the NRF focuses on response actions from preparedness through to the short- and medium-term, the NDRF is concerned with promoting effective recovery, particularly for those that are large-scale or catastrophic. The relationship between these is summarized in Figure 4.

NATIONAL DISASTER RECOVERY FRAMEWORK				
NATIONAL RESPONSE FRAMEWORK				
PREPAREDNESS Ongoing	DISASTER	SHORT-TERM Days	INTERMEDIATE Weeks-Months	LONG-TERM Months-years
Planning, resilience & capacity building, preparedness exercises, partnership building, protocols, etc.		Mass care & sheltering, clear transportation routes, business support, emergency medical care, etc.	Interim housing, debris removal, business support, continuity of health care, community engagement for building back stronger, etc.	Permanent housing, rebuild infrastructure, revitalize economy, re-establish healthcare system, mitigation activities, etc.

Figure 4: Recovery Continuum (adapted from FEMA, 2011, p. 8)

The NRDF was published in September 2011 by the Federal Emergency Management Agency, and in a similar manner to the NRF, it sets out core principles, roles and responsibilities, coordinating structures, and planning guidance.

There are nine core principles (FEMA, 2011, pp. 9-11):

- **Individual and family empowerment** – all community members to have equal opportunity to participate in recovery efforts in a meaningful way; ensure that people are not excluded from the process based on race, color, national origin, religion, sex or disability; recognize that a successful recovery is about the ability of individuals and families to rebound from their losses in a manner that sustains their physical, emotional, social, and economic well-being.
- **Leadership and local primacy** – local, state, and tribal governments have primary responsibility for the recovery of their communities and play the lead role in planning for and managing all aspects of community recovery; the federal government is a partner and facilitator in recovery and will vigorously support recovery efforts in large-scale disasters and catastrophic incidents.
- **Partnership and inclusiveness** – are vital for ensuring *all* voices are heard and *all* resources are brought to the table; nongovernmental partners (nonprofit and private) are critical in meeting local needs.
- **Public information** – clear, consistent, culturally appropriate and frequent communications are essential to manage expectations, provide information on available assistance, and make clear the likely pace, requirements, and time needs to achieve recovery.

- **Unity of effort** – common objectives have to come from consensus and a transparent and inclusive planning process with clear metrics for measuring progress.
- **Timeliness and flexibility** – recovery decisions have to be sequenced and coordinated, potential conflicts addressed, and confidence and ownership of the recovery process established; recovery plans, policies, and practices have to be adaptable to meet unforeseen and evolving recovery needs.
- **Resilience and sustainability** – successful recovery promotes practices that minimize the community's risk to all hazards and strengthens its ability to withstand and recover from future disasters – the community's resiliency: includes hazard mitigation and land use planning strategies, critical infrastructure, environmental and cultural resource protection, as well as sustainability practices to reconstruct the built environment and revitalize the economic, social, and natural environments.
- **Psychological and emotional recovery** – addressing the full range of psychological and emotional needs of the community through the process of recovery.

Together, the National Response and the National Disaster Recovery Frameworks comprise the response and recovery aspects of the National Homeland Security Strategy, together with one other component, the **National Infrastructure Protection Plan (NIPP)**, published by the U.S. Department of Homeland Security in 2009. NIPP is focused on protecting and ensuring the resiliency of the nation's critical infrastructure and key resources. The emphasis is on collaboration across the public and private sectors, and identifying authorities, roles, and responsibilities, within a risk management framework, as illustrated in Figure 5.
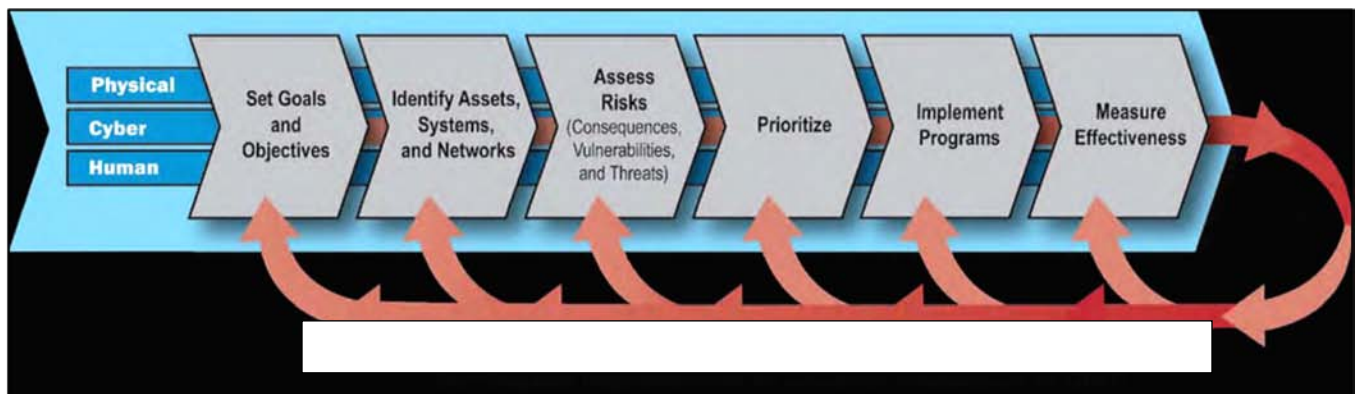

Figure 5: NIPP Risk Management Framework (DHS, 2009, p. 4)

The scope of what constitutes critical infrastructure and key resources extends across eight federal departments and agencies. It includes agriculture and food, the defense industrial base, energy, health care and public health, national monuments and icons, banking and finance, water, as well as transportation, communications, shipping, government facilities, dams, critical manufacturing, nuclear facilities, and many others. The threats anticipated include terrorism, natural disasters, and cyber attacks.

Putting all these elements together into something that has coherence and is capable of effective implementation on the ground is a hugely complex challenge. The premium placed on collaboration, partnership, flexibility, and clear lines of authority and responsibilities demand the engagement of a multitude of agencies, organizations, companies, and individuals. This in turn

requires the development of a wide range of mechanisms and tools to translate the doctrines and principles into practical guidance.

The **National Incident Management System (NIMS)** was published in December 2008 as a companion document to the NRF. It provides the template for the management of incidents regardless of size, scope, or cause so that emergency management and response personnel have a flexible but standardized system in which a variety of agencies can work together in a predictable and coordinated manner (DHS, 2008b, p. 6). The NIMS comprises five components (DHS, 2008b, pp. 7-8):

- **Preparedness** – a combination of assessment, planning, procedures and protocols, training and exercise, personnel qualifications, licensure, and certification, equipment certification, and evaluation and revision.
- **Communications and information management** – common operating procedures based on interoperability, reliability, scalability, and portability, as well as resiliency and redundancy.
- **Resource management** – standardized mechanisms for identifying needs, ordering and acquisition, mobilization, tracking, and recovering resources.
- **Command and management** – based on the incident command system, systems for multi-agency coordination, and public information.
- **Ongoing management and maintenance** – this includes the National Integration Center to oversee and coordinate NIMS, liaise with levels of government, and oversee publications and training courses.

Of particular relevance for this paper is the guidance provided by FEMA on the fundamentals of planning and developing emergency operations plans. **Comprehensive Preparedness Guide (CPG) 101** (Version 2.0), *Developing and Maintaining Emergency Operations Plans*, was published in November 2010. The guide makes very clear the importance of planning in the context of resilience:

> The elected and appointed officials in each jurisdiction are responsible for ensuring that necessary and appropriate actions are taken to protect people and property from any threat or hazard. When threatened by any hazard, citizens expect elected or appointed leaders to take immediate action to help them resolve the problem. Citizens expect the government to marshal its resources, channel the efforts of the whole community – including voluntary organizations and the private sector – and if necessary, solicit assistance from outside the jurisdiction.
>
> Residents and all sectors of the community have a critical role and shared responsibility to take appropriate actions to protect themselves, their families and organizations, and their properties. Planning that includes the whole community builds a resilient community. (FEMA, 2010, p. 1-1)

The guide continues by setting out a set of principles for a planning process for developing an all-hazards plan for protecting lives, property, and the environment. These principles will be familiar to organizations that have been involved in community and regional development planning. They include being community-based, ensuring broad stakeholder participation, using analytical problem-solving to address complexity and uncertainty, considering all hazards and threats, building in flexibility to address different levels of threats, stating clearly mission and goals,

learning lessons from past experience, building on existing plans and policies, identifying priorities and resources, ensuring leadership understanding and buy-in, and setting out roles and responsibilities for implementation.

As well as providing specific planning guidance, CPG 101 gives a sense of how planning at the federal, state, and local levels are supposed to fit together; this is summarized in Figure 6.
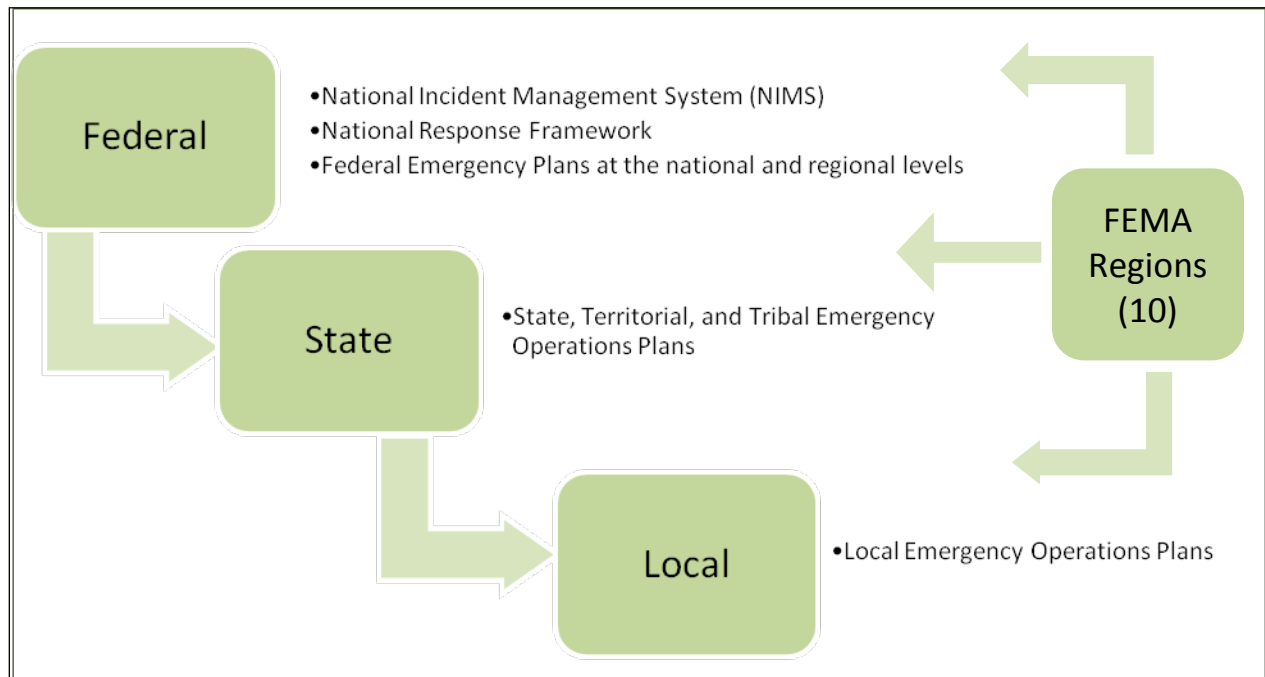

Figure 6: Linking Federal, State, and Local Emergency Plans (adapted from FEMA, 2010, pp. 2-1 to 2-6)

The rationale is that although each level has a specific range of authorities, roles, and responsibilities, local plans should be consistent with state plans, and that state plans should be explicit about how they relate to the National Response Framework, and how they incorporate NIMS. The FEMA regions are required to be the interface between the federal and jurisdictional planning processes, and it is through the FEMA regions that federal operations are integrated and synchronized with planning for operations shaped by the hazards and risks faced by state, territorial, tribal, and local communities (FEMA, 2010, p. 2-6).

7. Taking on the Implementation Challenge

The Infrastructure Security Partnership

The Infrastructure Security Partnership (TISP) was created 10 years ago as a response to September 11 by a group of professional and technical organizations and federal agencies. Its purpose is to facilitate dialogue on infrastructure security and all-hazard resilience issues in the United States. TISP offers technical support and comment on public policy related to the security of the nation's built environment (TISP, 2011, p. 2).

TISP has a diverse membership representing individuals and firms involved in the planning, design, construction, and operation of infrastructure. This membership includes local, regional, state, federal, and foreign agencies; professional associations and industry trade groups; engineering, architecture, and construction firms; codes and standards organizations; educational institutions and universities; planners and economic developers; infrastructure owners and operators; manufacturers and other providers of products and services.

One of TISP's major outputs was the *Regional Disaster Resilience Guide*, published in 2006; an updated version was released in 2011. The guide is designed to provide "a step-by-step process that can be customized to develop a cross-sector, multi-jurisdictional strategy to improve capabilities to deal with any major incident or disaster" (TISP, 2011, p. 2). It was developed through a Regional Infrastructure and Disaster Resilience Task Force, comprising over 80 public and private organizations, corporations, universities and eight federal departments and agencies. The guide incorporates lessons from the latest disasters around the world, and is intended to complement the 2010 National Security Strategy, the National Infrastructure Protection Plan, and the National Response and National Recovery Frameworks.
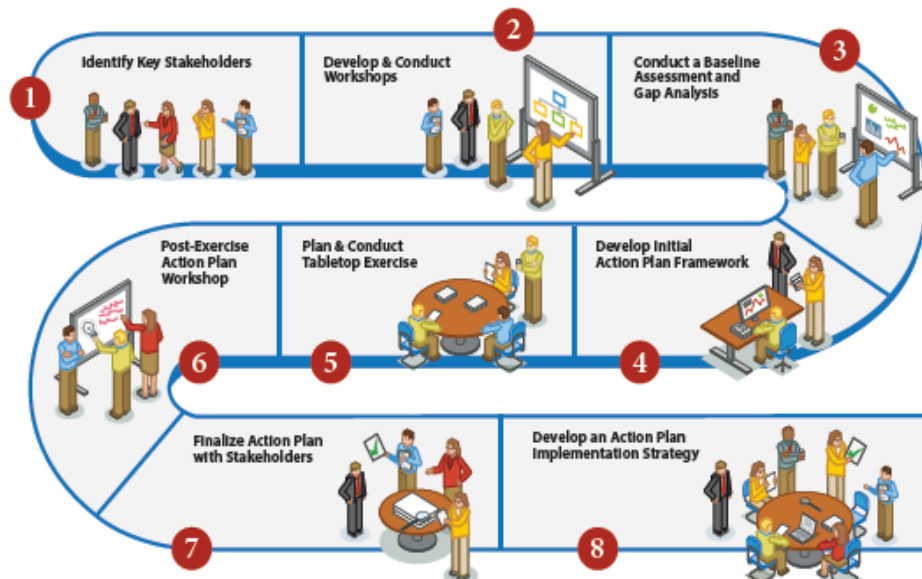

Figure 7: TISP Multi-Step Regional Resilience Guide Action Plan Process (TISP, 2011, p. 12)

The guide is intended for use by local and state officials; energy, transportation management, and environmental protection officials; utility and business owners and operators; schools and other academic institutions, community organizations, faith-based organizations, and non-profits serving people in need or having other community health and safety missions. It describes a process, illustrated in Figure 7, which is supported by a Web-based toolkit of resources that includes examples, templates, and information on plans, procedures, tools, technologies, case studies, and other "best practices," with links to Web sites of government, private sector, and nonprofit organizations for additional information, as well as access to TISP member expertise.

One aspect of regional resilience that TISP emphasizes is the increasingly interconnectedness and interdependence across a broad array of critical infrastructures, notably in energy, telecommunications, transportation, water and water treatment systems, banking and finance, emergency services, government services, hospitals, health care and public health, agriculture and food, commercial facilities, nuclear reactors, materials and waste, dams and levees, manufacturing and chemical facilities, and postal and shipping. In part, this is a result of a growing reliance for managing and operating systems and infrastructures on electronic systems and virtual systems, computer processing, and the Internet.

> This interconnectivity and the resulting interdependencies can create unexpected vulnerabilities and significant consequences. Although security and disaster management practitioners are beginning to focus on interdependencies and the vital connection with resilience, there remains limited understanding of them, the vulnerabilities they create, and how to prevent or lessen their impacts. Disruptions in one infrastructure can cascade, affecting more than one infrastructure and impacting essential government services, businesses, and individuals in a region with far-reaching health and human safety, societal, economic, environmental, and national security consequences. (TISP, 2011, p. 5-6).

The 2011 Regional Disaster Resilience Guide concludes with this strong argument for a holistic strategy for regional resilience:

> Whether a natural disaster, manmade incident, or pandemic, there is clearly a need for a holistic regional strategy to improve the resilience of our infrastructures and other essential services, in addition to the communities and regions that depend upon them. This all-hazard, multi-jurisdiction, cross-sector approach to preparedness and resilience includes detection, prevention, mitigation, response, recovery/restoration, training, exercises, and community outreach. It requires utilities and other service providers to examine external linkages that affect their op-erational and business continuity. It also necessitates bringing together local public, private, and non-profit stakeholders with state and federal partners in collaboration to share information and understand and address regional vulnerabilities and consequences posed by infrastructure interdependencies. (TISP, 2011, p. 53).

The Community & Regional Resilience Institute

CARRI was created in 2007 with a request from the U.S. Department of Homeland Security to the Southeast Region Research Initiative at Oak Ridge National Laboratory to examine the concept of national resilience and suggest research projects that could advance the Department's interests in and understanding of this fast-growing area of study. Over the next five years, the initiative grew into an institute, commissioning research, building collaborations with communities, government, businesses,

and non-governmental groups, and working in three regions – Charleston, South Carolina, Memphis, Tennessee, and Gulfport, Mississippi.

In September 2011, CARRI launched its **Community Resilience System Initiative (CRSI).** This has a sharp focus on supporting communities and regions in taking steps to become more resilient:

> With each crisis, we see more clearly that placing too great of a reliance upon professional "protectors" such as the U.S. Department of Homeland Security (DHS), the Federal Emergency Management Agency (FEMA), and the military is unrealistic. The threats – natural disasters, acts of terrorism, oil spills, and economic downturns – are diverse, compounding, and capable of overwhelming the limited number of professional responders and the finite public resources available at all levels of government. The good news is that there is a tremendous role that civil society can play. Indeed, American communities, neighborhoods, and average citizens are the nation's greatest asset in building resilient communities and a resilient nation. It is time to encourage and support communities in returning to the forefront so that they can do more to ensure their own resilience and regain control over their destiny in the face of disruptive risks. We have a strong history of grassroots resilience; it has been a great American strength, and with a call to action informed by helpful tools and practical knowledge, we can rekindle it (CSRI, 2011, p. vii).

The Community Resilience System (CRS) has been designed to help communities assess their capacity to withstand and recover from significant disturbances. Communities create a vision for their future and establish actions necessary to improve their overall resilience so that they can prepare for, and recover from, any challenge. The implementation of the System in each community or region is overseen and led by a group of committed leaders, whose role is to guide the process and to ensure that others in the community – citizens, business leaders, political leaders – all have chance to be part of and support the resilience-building process. They are brought together in an extended process that helps them work

through all stages of increasing resilience: assessment, visioning, action planning, goal setting, and follow-up, with the CRS providing a range of process tools and suggestions so that communities of all size and type can customize the process for their needs. The CRS is meant to be an easy-to-use technological platform that helps connect people and drive the process. Tools within the system interact with and build upon each other to track and support community progress.

Seven communities and regions are currently piloting the system: Anaheim, California; Anne Arundel County and Annapolis, Maryland; Charleston and the Tri-County Area, South Carolina; Gadsden, Alabama; Greenwich, Connecticut; the Mississippi Gulf Coast; and Mount Juliet, Tennessee.

Figure 8: The Community Resilience System (CSRI, 2011)

Building Economic Resilience

There are several public and private initiatives aimed at business continuity and improving prospects for regional and community economic recovery after a disaster. Business continuity is the focus of the **Voluntary Private Sector Preparedness Accreditation and Certification Program**, known as **PS-Prep™** (www.fema.gov/privatesector/preparedness). This is one of a number of resources made available by FEMA through its www.ready.gov Web site. PS-Prep provides three levels of standards for businesses of all sizes and types to encourage preparedness for continuity and recovery in the event of any emergencies. Among other things, businesses are encouraged to take a holistic approach to preparedness, to focus on survival and organizational resilience, and to understand, develop, and implement a business continuity program.

The **U.S. Small Business Administration** (SBA)**,** through its Office of Disaster Assistance (www.sba.gov), provides low interest financing for homeowners, renters, businesses, and nonprofit organizations for repairing or replacing damaged or destroyed property, equipment, and other assets in declared disaster areas. It also provides resources and assistance for preparedness and planning.   **.org** is the result of a joint effort between SBA and Agility Recovery Solutions to encourage all small businesses to have a recovery plan in place. The Web site presents a range of kits for disaster recovery together with a series of monthly webinars on related topics.

The SBA has also partnered with the U.S. Chamber of Commerce's **Business Civic Leadership Center** and its Disaster Response and Recovery Program (www.bclc. .com) to broaden the Agency's response capacity through information-sharing, research, and volunteer mobilization. The Center's Web site features the **Disaster Resistant Business (DRB) Toolkit**, which is a downloadable software package intended to help businesses better prepare for potential disasters.

www.RestoreYourEconomy.org is a new set of resources created by the International Economic Development Council and U.S. Economic Development Administration. It is intended for economic developers, chamber of commerce professionals, and others working on economic recovery efforts for disaster-impacted communities. The site provides information on the phases of disasters, the potential role of economic developers, both pre- and post-disaster, the components of preparation (business community engagement, business financing, redevelopment strategies, and workforce planning), pre-disaster planning, navigating the federal system, and specific steps for post-disaster response.

8. Regional Dimensions of Resilience

Resiliency has strong regional characteristics that show themselves in a variety of ways.

Disasters Know No Boundaries

The data on disaster declarations during 2011 (see p. 6, Table 1) show that the adverse impacts of major natural weather events can be felt in most states across the nation, so that most communities, urban and rural, can expect to have to deal with at least an emergency and probably a disaster on an increasingly frequent basis. At the same time, a look at the distribution of disaster declarations over the past 20 years (see p. 5, Map 1) shows concentrations in southern California and Arizona, Oklahoma and southern Texas, along the Gulf Coast and Florida, in Missouri and eastern Kentucky, New England, and North Dakota. It is self-evident that such disasters are no respecters of jurisdictional boundaries, and that the dimensions of anticipation, mitigation, response, and recovery demand high levels of cooperation and collaboration across county and state boundaries.

Resiliency Varies Between and Across Geographic Scales

Moreover, resilience, according to Wilbanks (2009), may differ between geographic scales, so it is possible for a highly resilient community to be located within a region of low resilience, and for there to be a community with limited resilience to be part of a highly resilient region. Resilience requires there to be integration of processes, actions, and decisions across scales. When damaging events threaten to overwhelm a community's resources, there need to be appropriate responses from neighboring communities and also from the state and federal agencies. Being able to rely on outside sources of support is an essential part of a community's resiliency.

But, as shown in Figure 9, the respective roles and contributions of different geographic scales vary in their impact on resilience.

Figure 9: Differences Between Scales in Potentials to Support Action (Wilbanks, 2009, p. 6).
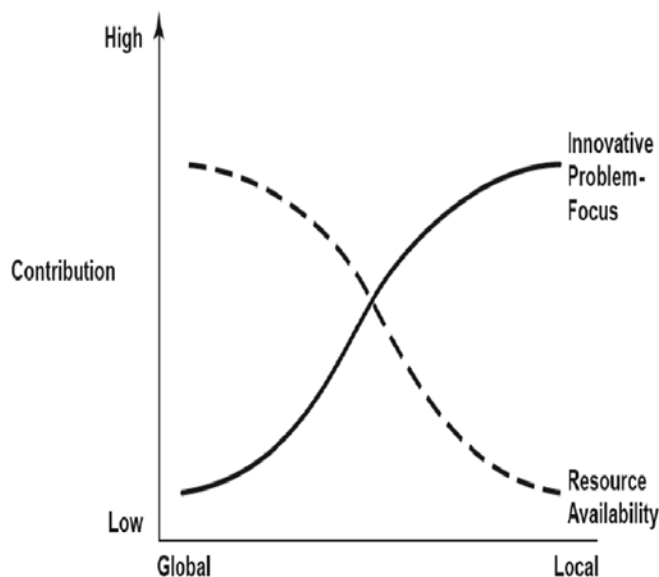
"[R]esource availability is predominantly top down, while innovativeness and problem-focus are predominantly bottom up" (Wilbanks, 2009, p. 6).

There is a clear tension between the need to act quickly and decisively in times of emergency based on clear chains of command and responsibilities, while maximizing opportunities for local citizen control over their destiny and allocation of resources. To assure resilience, there have to be in place co-management structures that can bridge scales, create trust, and strengthen communication. This need is often reinforced by the fact that governmental and other functional boundaries are often a poor fit particularly in situations where resources have to be

mobilized quickly in adverse conditions. Issues over turf and jurisdiction can arise even in the middle of a disaster. This is where intermediary organizations can play an important role in facilitating and managing cross-scale interactions.

Table 4: Cross-Scale Relationships (Wilbanks, 2009)

Resilience Dimension	From Small- to Large-Scale	From Large- to Small-Scale
Anticipation	Information needs as priorities for larger-scale monitoring and data-gathering systems	Information about possible threats and historical experiences with those threats
Reduction/Mitigation	Information about needs for regional-scale stockpiles of emergency supplies	Information about what can be expected from the region in responding to possible emergency needs
Response	Evacuation of displaced population	Provision of emergency supplies
Recovery	Contributions to regional economic growth	Access to financial resources for investment in new infrastructures

Table 4 provides a summary of some of the cross-scale relationships according to the four resilience dimensions.

An additional regional consideration with real, long-term impacts is the spill-over effects of major events, some of which can be felt over very long distances. The mass exodus of population from New Orleans after Katrina was felt in every state in the nation, with some areas, both urban and rural, having to cope with significant shelter and feeding challenges.

Some regions are inherently more vulnerable than others

The potential importance of intermediaries, such as regional development organizations in managing these flows of information and resources, is particularly germane to the discussion of 'capacity' of any given community or region to withstand major threats (see pp. 8-9) given its inherent levels of physical, economic, and social vulnerability. In order to gain some understanding of the geographic distribution of such vulnerability, RUPRI developed a **Vulnerability Index** for all counties in the United States, based on measures of infrastructure, economic, and social vulnerability.

Composite indicators of disaster resilience are gaining recognition as tools for policymaking and public communications. This in large part is because they provide the opportunity to look at environmental, economic, and social measures in ways that help communities and regions understand their vulnerabilities and measure progress to reducing them. One of the leading centers developing such indicators is the Hazards Research Lab at the University of South Carolina. A recent project provided a comparative assessment of community resilience for 736 counties in eight southeastern states (Cutter et al, 2010), making it possible for each county to see how it rated on measures of social, economic,

institutional, and infrastructure resilience and community capital. The RUPRI Vulnerability Index builds
on this approach and on other work on the geography of need (Heflin & Miller, 2011).
Table 5 lists the indicators used to compile this index[1].

Infrastructure	Economic	Social
Miles of primary roads per sq. mile (+) Percentage of population living in group quarters Percentage of households with no vehicle available Number of hotels/motels per capita (+) Percentage of housing units built before 1970 Percentage of housing units that are mobile homes Hospital beds per capita (+) Physicians per capita	Percentage of employment in primary industries Unemployment rate Poverty rate Labor force participation rate (+) Housing affordability index Entrepreneurship employment (nonfarm proprietors, microenterprise employment)	Work age dependency ratio (ratio of population <18 and >64 to population 18-64) Percentage of population that are minorities Percentage of population living in the same house as one year prior (+) Percentage of housing units that are owner-occupied Number of nonprofits per capita (+) Percentage of population with a high school education or less Voter participation in 2008 presidential election Percentage population <65 without health insurance Number of political jurisdictions in county

Table 5: Indicators of Vulnerability

The development of indicators is ongoing, but the main challenge is locating data sets that truly reflect
some aspect of vulnerability, or which are available at the county level nationwide. Examples of possible
additional indicators include:

- Diversity of transportation access – access to rail, transit, air, and water, as well as highway?
- Access to essential supplies – degree of vulnerability to shortages in food and fuel supplies?
- Access to broadband – measures of access, type, and redundancy?

Nevertheless, similar data sources will be available at the state, regional, and local levels for building
into local resiliency-planning processes.

The maps on the following pages are composites of maps prepared for each of the indicators in Table 5,
grouped into the three main categories of infrastructure, economic, and social vulnerability.

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[1] The method used to generate the maps on the following pages was as follows:
- Each of the indicators in Table 5 was standardized and those marked (+) were inverted so that the reference was the same – the higher the level, the more vulnerable the county with respect to these indicators.
- The values of these standardized indicators were summed to create a composite index.
- The maps show those counties that fall more than one or two standard deviations from the mean value.
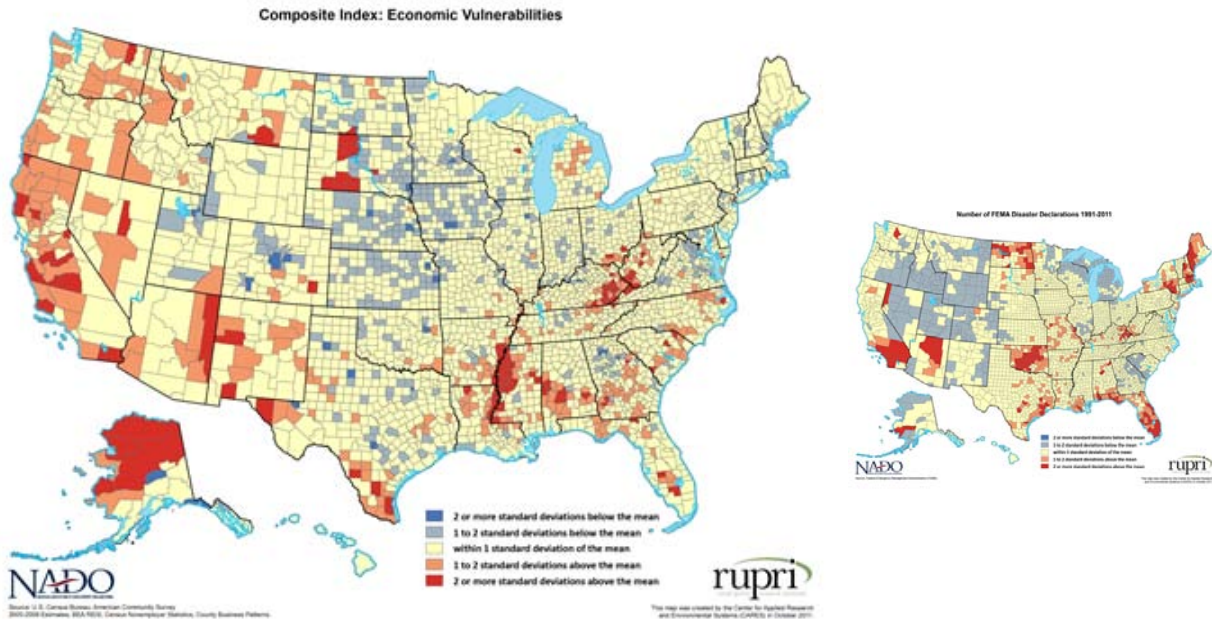
Infrastructure Vulnerability
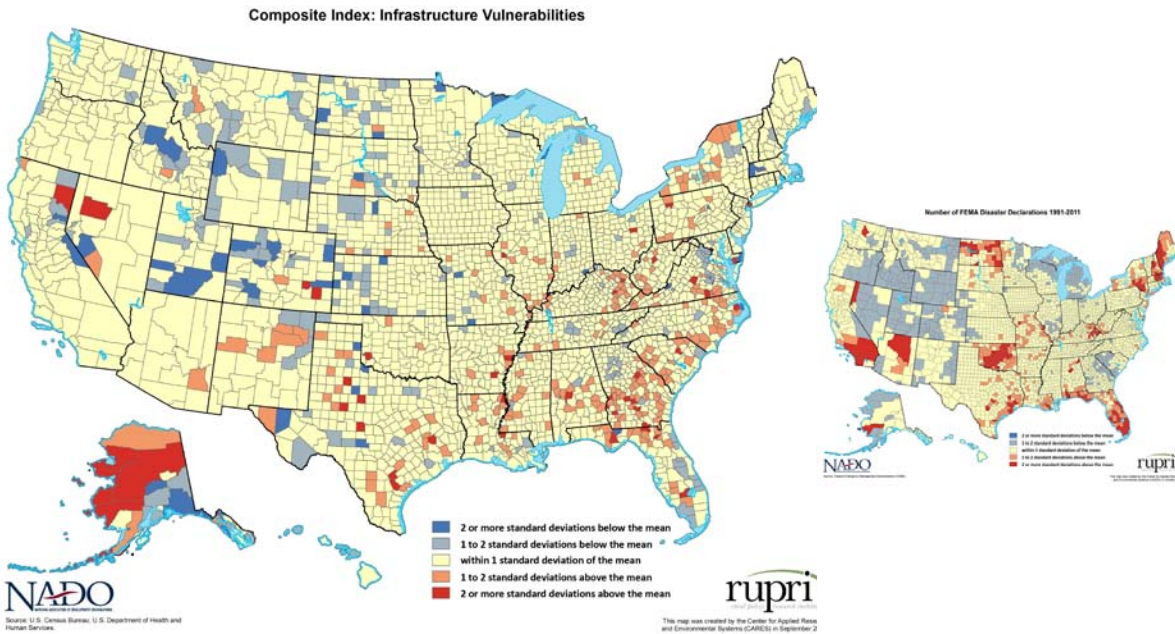
Map 2: U.S. Composite Index for Infrastructure Vulnerability
(Inset: FEMA Disaster Declarations 1991-2011)

The highlights of the analysis of comparative infrastructure vulnerability are:

- The Southeast faces particular challenges especially in respect to the percentage of households without a vehicle, and the percentage of housing units that are mobile homes. This coincides with the high numbers of disaster declarations particularly on the Gulf Coast and Florida.
- The high percentage of housing units that are mobile homes is also a major factor in Appalachia and the Southwest.
- Populations in group quarters are distributed throughout the United States with no strong regional patterns, although there is some clustering in parts of the Southeast, Midwest, upstate New York, and the Upper Peninsula of Michigan.
- Older homes exhibit a strong regional pattern with the Midwest, Great Plains, and Northeast having high percentages on this indicator.
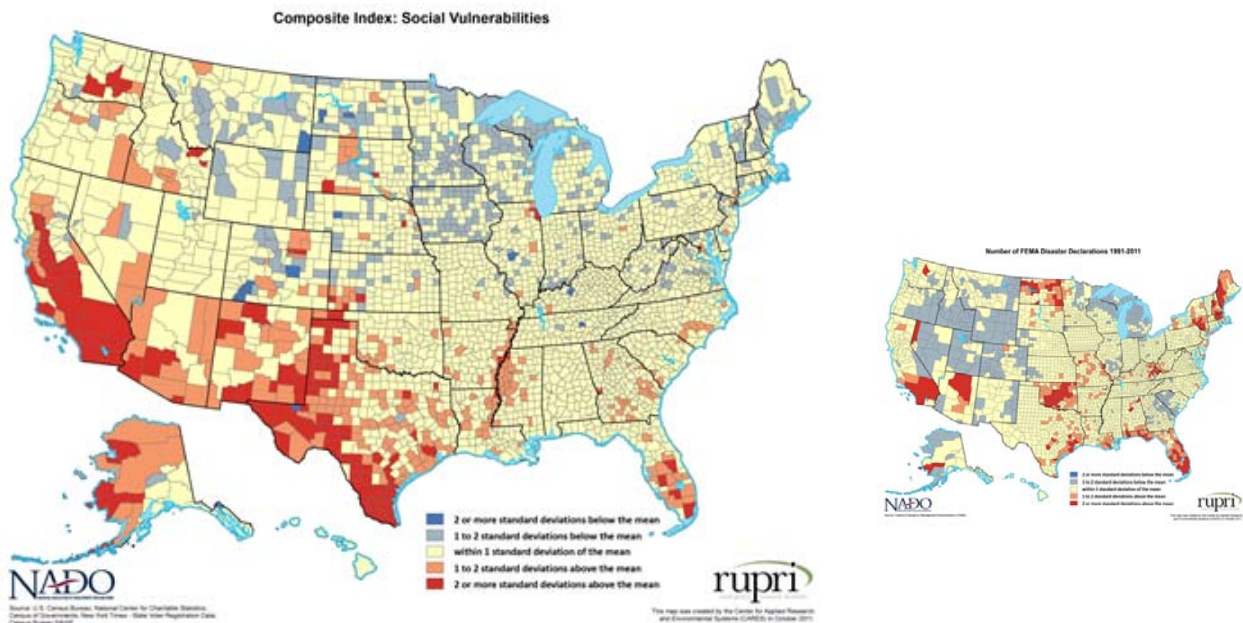
Economic Vulnerability

Composite Index: Economic Vulnerabilities

Map 3: U.S. Composite Index for Economic Vulnerability
(Inset: FEMA Disaster Declarations 1991-2011)

The highlights of the analysis of comparative economic vulnerability are:

- The areas showing most economic vulnerability are Appalachia, Mississippi Delta, southeast border area of Texas, and areas of high Native American populations, and also much of California and parts of Oregon, Washington, Idaho, and Montana. Disaster declarations in areas of high economic vulnerability include southern California, Arizona, and central Appalachia.
- High rates of unemployment (five-year averages) are concentrated in the Delta, Michigan, Southeast, Native American regions of the Southwest and Great Plains, and portions of California and other western states.
- While heavily correlated, significant differences can be seen in the areas facing high unemployment rates and areas with high rates of poverty. Michigan, for instance, has high unemployment rates but less high rates of poverty; whereas the Texas border region has high rates of poverty, but lower unemployment rates.
- The housing affordability index seems to be driving economic vulnerability in California, coupled with unemployment in the north and central parts of the state.

Social Vulnerability

Map 4: U.S. Composite Index for Social Vulnerability
(Inset: FEMA Disaster Declarations 1991-2011)

The highlights of the analysis of comparative social vulnerability are:

- Social vulnerability is particularly evident in the regions stretching from Texas to southern California, a function of high proportions of minority populations and linguistically challenged households. Disaster declarations in areas of high social vulnerability include southern California, south Texas, and Florida.
- High work age dependency ratio is a feature of the Great Plains with high elderly populations, and on the Texas border and other Western states with high percentages of young people.
- Low rates of homeownership can be found in California and the Delta, as well as Native American regions of the Great Plains.
- High percentages of the population under 65 years of age without health insurance are concentrated in Texas, New Mexico, and southern Florida.

9. Commentary

1. Research and experience over the past 20 years, and particularly during the past decade, show a growing understanding of the complexity and dynamics of anticipating, responding to, and recovering from disasters of all types. The idea of community and regional resilience has taken root.

2. It is no longer possible, if it ever was, to focus on a particular type of disaster in isolation, such as terrorism or flooding, for communities increasingly are faced with multiple, and sometimes cascading hazards. This realization demands what is commonly termed an all-hazards approach.

3. Although each hazard presents particular challenges, such as a chemical explosion or a tornado, the processes of preparedness and planning are broadly consistent, and there is general consensus on the main components of these processes.

4. Some communities and regions are clearly more vulnerable than others to disasters, although no community is immune from some sort of threat. Settlements on coastlines, in river floodplains and valleys, in or adjacent to forestlands, on seismic faults, or in the regular paths of major storms can be particularly vulnerable; some of these may well have placed themselves in harm's way as a result of poor or short-sighted development decisions.

5. But vulnerability is more than a function of geography, it can also be economic. The disaster may be the closing of a plant or the collapse of a whole industry as a result of changing market conditions or the introduction of new technologies; or it may be a consequence of a natural disaster that has disrupted or even destroyed local businesses. Sustaining businesses and economies has been shown to be a critical part of regional and community recovery but often not given the priority deserved.

6. Vulnerability can also be social, as the events following Hurricane Katrina very publicly demonstrated. Differential impacts on segments of the population based on race, income, mobility, language capability, and other factors are not only unfair and unjust, but undermine recovery efforts.

7. The focus of agencies responding directly to disasters as they unfold by dealing with the myriad of medical, safety, infrastructure, shelter, and public order challenges remains paramount. But the concept of resilience as an ongoing process has broadened attention to enhanced preparedness in anticipation of an event and to organizing for recovery or a desirable 'new normal' after an event. Seeing disasters as opportunities for achieving healthier, sustainable communities and more robust regional economies represents an important new framing.

8. This broadened focus places a premium on what might be called the "soft infrastructure" of regions and communities, such as community engagement, leadership, communication and coordination, ongoing preparation and training, flexibility, and sequencing.

9. The federal policy response to disasters has been transformed over the past decade. Driven after 9/11 by heightened concerns over terrorism, it has evolved into an all-hazards approach following Hurricane Katrina and a succession of other major disasters both at home and abroad. The development of the National Response and National Disaster Recovery Frameworks have brought to the forefront the need for seamless coordination of federal, state, and local efforts to prepare for,

respond to, and recover from disasters. Elaborate processes and structures have been introduced to pursue planning, coordination, training and exercises, and certification across the country. The documentation show that current federal policy has learned much from recent experience.

10. Interestingly, this concerted federal effort from the Department of Homeland Security and the Federal Emergency Management Agency has generated at least two very important initiatives that have engaged collaborations across the private, public, academic, and nonprofit sectors. One is primarily focused on the security of critical infrastructure, the other on building the capacity of local communities and regions to drive preparedness, response, and recovery efforts in line with their own vision for their future.

11. Out of all these developments emerges an imperative for all regions and communities – the need to plan and prepare in ways that are holistic and fully engaging of all sectors of the community. It is fair to say that there is an ingrained suspicion of, if not outright resistance to, the idea of planning across much of America. But as hurricanes, tornadoes, earthquakes, oil spills, wildfires, floods, and other natural and human-made disasters, continue to assail our communities, there may be a window of opportunity to recast old and worn-out planning efforts and to help communities and regions see a better future for themselves, with or without a disaster. Moreover, in times of fiscal stringency, where the public sector is less able to function as the principal protector and responder, engaging the resources and talents from all parts of communities and regions may be the best way to proceed.

12. Planning is increasingly a requirement of federal and state programs, whether for emergency preparedness, transportation, economic development, environmental and ecological protection, land use, or sustainable communities. The challenge historically has been the categorical nature of these plans which require communities and regions to go through multiple planning processes. Fortunately, there have been recent federal interagency collaboration efforts to integrate and simplify planning requirements within a regional framework.

13. The regional dimension to resilience is critical. Disasters pay no attention to jurisdictional boundaries or to whether a place is designated urban or rural, metro or nonmetro. But in rural areas, many counties and localities do not have the personnel or technical or fiscal capacity to engage in planning and preparation. Many of these may be physically, economically, and/or socially vulnerable, as well as being in harm's way for certain types of disaster. The Economic Development Administration's national network of economic development districts, together with other regional development organizations, represents an extant infrastructure that can address this capacity and vulnerability challenge.

14. Already, many of these regional development organizations are engaged in aspects of creating resilient regions – Florida's regional councils being an example. The tools and processes are available or are in development to enhance community, regional, and economic resilience – the next step is to get them into the hands of local and regional leaders for implementation. A national investment in intermediation structures to prepare and protect all communities would seem to be a wise use of resources. The concentration of disaster occurrences and regional vulnerability suggests that the engagement of the Appalachian Regional Commission and the Delta Regional Authority would also be appropriate to reinforce local efforts. A regional challenge yet to be adequately addressed is southern California and along the Mexico border.

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