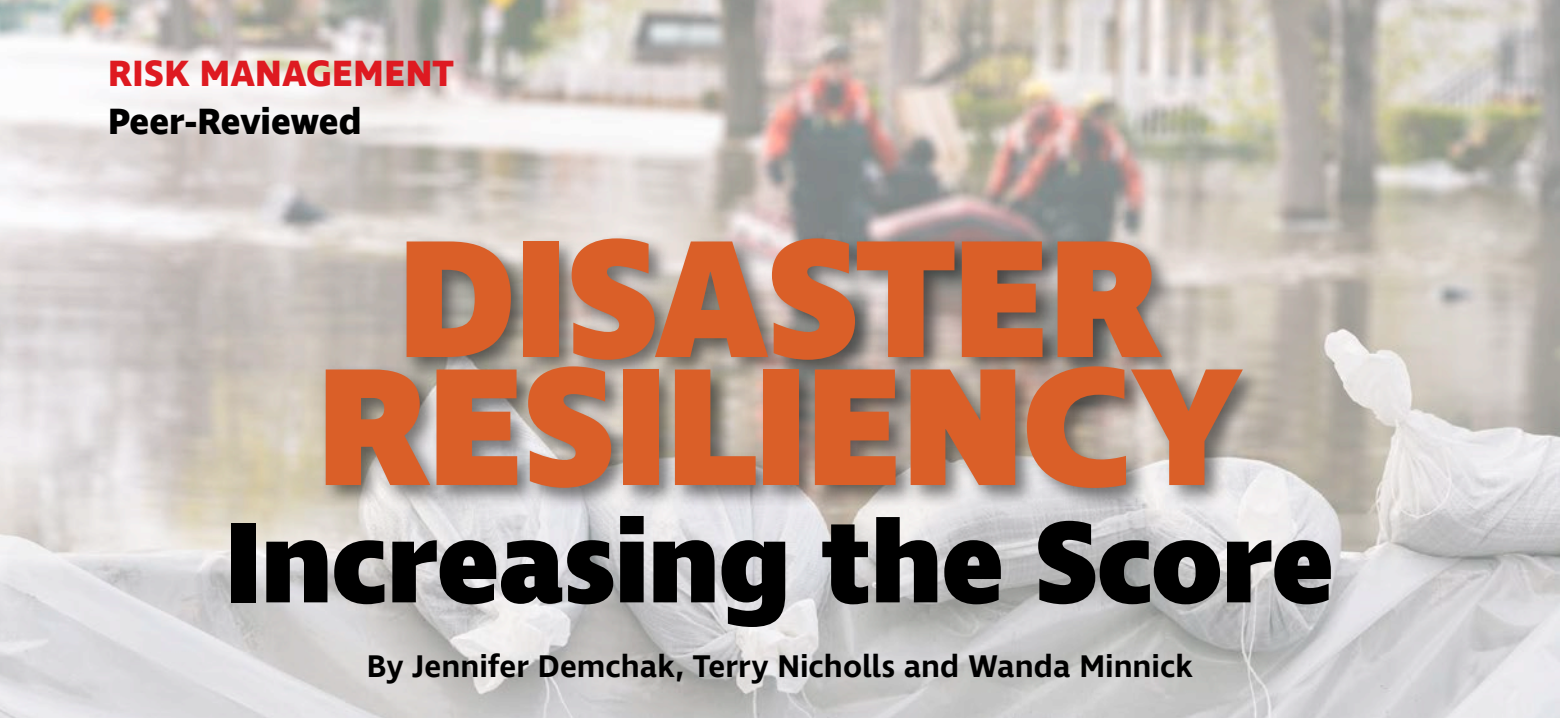

DISASTER RESILIENCY
Increasing the Score

By Jennifer Demchak, Terry Nicholls and Wanda Minnick

THE WORD "RESILIENCE" is generally defined as the capacity or ability to recover or adapt to a misfortune or change. Typically, swift recovery or adaptation dictates the level of resilience. Resilience can be measured at the individual, community, regional and national levels. Regardless of country, culture or society, most people can describe how they perceive a disaster and can explain how it impacts them personally. However, it is unlikely that one could articulate with confidence the disaster resiliency of one's neighborhood, community or region. This article introduces the concept of the disaster resilience score, what contributes to a high resilience score and how best to use it. Through the lens of an OSH professional, a disaster resilience score of the community in which an organization resides could provide a wealth of information on the resources available to that organization during disasters and community-spanning emergencies. OSH professionals can leverage the knowledge of a region's resilience score to help emphasize risk level, identify gaps in resources and develop appropriate emergency action plans. However, it can be argued that most OSH professionals are not aware of whether their community or region has a disaster resilience score, do not have a clear understanding of what contributes to a high resilience score or do not know the importance of the score.

Although natural disasters are a global concern, a universal resilience measurement tool does not exist. However, both the U.S. and Europe have made strides in establishing scores for their communities, using both top-down and bottom-up approaches. Leadership responsible for protecting the public during disasters can benefit from understanding best practice approaches to a resilient community. This article aims to define disaster resilience and examine how disaster resiliency is measured in the U.S. and Europe, consider case studies from communities that have used different approaches, discuss why a disaster resilience metric is important and consider opportunities that could increase the score.

KEY TAKEAWAYS

- **Leadership responsible for protecting the public during disasters can benefit from understanding best practice approaches to a resilient community.**
- **Federal Emergency Management Agency's National Risk Index (NRI) measures natural disaster risk and vulnerability and identifies communities most at risk. The NRI helps to inform which areas are most vulnerable, identifies where funds should be directed and helps community leaders identify the factors that can be changed to improve "low" resilience communities.**
- **Awareness of disaster resilience, the resources available and the steps that can be and have been taken is necessary to mitigate the effects of disasters.**
- **Establishment of the NRI provides the initial framework in which the public can learn the current state of their communities' resilience. This information, in combination with grassroots approaches, is helpful to safety professionals in planning mitigation strategies for natural disasters.**

What Is Disaster Resilience?

A review of the literature provides many definitions of disaster resilience. Natural science defines resilience theory as a socio-ecological system adapting and transforming; disasters are one of the many parts. In contrast, the social sciences say resilience arises from social, economic, behavior and protective factors that enable the ability to cope with disasters (Parsons et al., 2016). Ideally, disaster resilience is decreasing the impacts of disasters and strengthening communities. The key ideas are recovery and adaptation in the face of external disturbance, stress and adversity (Tiernan et al., 2019).

How Do We Measure Resilience?

A universal scorecard does not exist at the global level and there is no consensus on the best approach. The goal of resilient leadership is to plan a community that can withstand an extreme event, experience a tolerable loss and have planned a risk mitigation consistent with achieving a set level of protection (Marzi et al., 2019). The path to achieving this goal includes indices that use top-down or bottom-up approaches, or combinations of approaches. For purposes of this article, top-down strategies represent approaches from the national and state level that are enacted upon regional and local governments. The data collected using top-down strategies typically represent a high-level conglomeration of information that can be collected at the state level and analyzed for comparison purposes at the federal level. Bottom-up strategies represent planning and response approaches that start at the local level, such as town and city emergency services, community shelters and food distribution points that help supplement overall national efforts. For example, the data

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collected in boroughs, towns and cities may or may not be shared directly at the state or federal level, but are rather used locally for planning purposes.

Europe

A global ideal was developed in 2015 with the adoption of the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNDRR, 2015). It has emerged as a prominent bottom-up scorecard approach, has been used in case studies published by the UN Office for Disaster Risk Reduction (UNDRR, 2020), and is framed on 10 essentials for resilient cities. Its focus is on the large and small, sudden onset and creeping, natural and human-made disasters. The framework includes bouncing back instead of adaptive resilience. It uses focus groups, community planning, social media and the social structure of Indigenous populations (Tiernan et al., 2019). The Sendai framework implements integrated and inclusive economic, structural, legal, social, health, educational, technical, political and institutional measures that decrease hazard exposure while increasing resilience (Marzi et al., 2019). The 10 essential resiliency scoring dimensions within the Sendai framework were developed for cities and are listed in Table 1 with one sample question in each.

Each city, using community leaders, focus groups or other means, conducts a self-assessment in each of the 10 categories that results in an overall score. The framework is used to identify vulnerabilities in disaster planning and as a tool to allocate resources. Resilience leaders need to determine at what level measurement will occur; it might be at the county, city or community level. Another example is the comprehensive disaster-resilient index (CDRI), which was developed using a tiered approach at the municipal level across Italy (Marzi et al., 2019). Tier I is a survey and considers the social, ecological, economic and technological features. Tier II is more advanced in the form of a resilience matrix. It is a dynamic model and looks at components over time and space. Tier III reviews the interactions of the components and the impact of the assessment (Marzi et al., 2019). One benefit of the CDRI approach is how the tier components tell a story. Housing is described as part of the infrastructure that informs the vulnerability of the community. The variable of cohesion included economic and social factors and was described as the bond that kept societies integrated. It had detailed information such as family structure, age, gender and commuting. Education helped risk managers understand the communities' preparedness and adaptive capacity, as well as the economic resource component. Finally, the environment helped leaders understand the ecosystem based on climate change and disaster reduction strategies (Marzi et al., 2019).

Other indices in the literature include Parsons et al. (2016), a top-down approach that uses coping and adaptive capacities, such as the Australian Natural Disaster Resilience Index that measures the capacity of a community to prepare, absorb and recover from a disaster. Likewise, another approach titled Communities Advancing Resilience Toolkit is a holistic survey gauging the communities' response to connection and caring, transformative potential, resource availability and disaster management (Parsons et al., 2016).

TABLE 1

SENDAI FRAMEWORK EXAMPLES

The sample questions from the scorecard have been modified to reflect more general language (noted in italics) to expand adaptability to more than cities.

Title	Sample question
1. Organize for resilience	Is resilience properly integrated with other key *regional* functions/portfolios?
2. Identify, understand and use current and future risk scenarios	Does the *region* have knowledge of the key hazards that the area faces and their likelihood of occurrence?
3. Strengthen financial capacity for resilience	What incentives exist for different sectors and segments of business and society to support resilience building?
4. Pursue resilient urban development	Do building codes or standards exist, and do they address specific known hazards and risks for the city? Are these standards regularly updated?
5. Safeguard natural buffers to enhance the protective functions offered by natural ecosystems	Beyond just an awareness of the natural assets, does the *region* understand the functions (or services) that this natural capital provides for the *region*?
6. Strengthen institutional capacity for resilience	Does the *region* have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios?
7. Understand and strengthen societal capacity for resilience	Are grassroots or *other* organizations participating in risk reduction and post-event response for each neighborhood? Are regular training programs provided to the most vulnerable populations in the *area*?
8. Increase infrastructure resilience	Is existing protective infrastructure well designed and well built based on risk information?
9. Ensure effective disaster response	Does the *region* have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system?
10. Expedite recovery and build back better	Do post-event assessment processes incorporate failure analyses and the ability to capture lessons learned that then feed into design and delivery of rebuilding projects?

Note. Adapted from "Disaster Resilience Scorecard Assessment: Case Studies and Lessons Learned from North Macedonia, Romania, and Serbia," by UNDRR, 2020.

U.S.

Community resilience is defined by Federal Emergency Management Agency (FEMA) as the "ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions" (FEMA, 2020, p. 12). On Nov. 23, 2020, FEMA introduced a National Risk Index (NRI) that measures natural disaster risk and vulnerability. This top-down methodology identifies communities most at risk by establishing an NRI at the county and census tract level for 18 natural disasters. Recently, FEMA released an online mapping of NRIs for natural disasters at the county level (FEMA, 2021c). This newly available NRI for counties across the U.S. helps to inform which areas are most vulnerable, identifies where funds should be direct-

FIGURE 1

NRI EQUATION VARIABLES

Annual expected loss	×	Social vulnerability	÷	Community resilience	=	National Risk Index
$						
Expected annual loss is calculated using an equation that includes exposure, annualized frequency and historic loss ration risk factors for 18 natural hazards. The equation quantifies loss for relevant consequence types such as building, people and agriculture.		Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss or disruption of livelihood.		Community resilience is measured using the Baseline Resilience Indicators for Communities published by the University of South Carolina's Hazards and Vulnerability Research Institute. See example indicators in Table 2.		The NRI for each county in the U.S. and components of each item in the formula can be accessed at **https://hazards.fema.gov/nri/map**

Note. Adapted from "National Risk Index: Primer," by FEMA, 2020; "BRIC," by University of South Carolina, n.d-b; "SoVI," by University of South Carolina, n.d-c.

TABLE 2

HAZARDS & VULNERABILITY RESEARCH INSTITUTE BRIC (ABBREVIATED)

Resilience type	Examples of indicators
1. Social resilience	•percentage of population below 65 years •percentage of households with at least one vehicle
2. Economic resilience	•percentage of labor force employed •ratio of large to small businesses
3. Community capital resilience	•percentage of population born in state of current residence •number of Red Cross volunteers per 10,000 persons
4. Institutional resilience	•10 year average per capita spending for mitigation projects •distance from county seat to state capital (inverted; closer is more resilient)
5. Infrastructural resilience	•percentage of housing units not mobile homes •number of hospital beds per 10,000 persons •percentage of housing units built prior to 1970 or after 2000
6. Environmental resilience	•megawatt hours per energy consumer (inverted; less consumption is more efficient and resilient) •Water Supply Stress Index (inverted; less stress is more efficient and resilient)

Note. Adapted from "Hazards Vulnerability & Resilience Institute," by University of South Carolina College of Arts and Sciences, n.d.

ed and helps community leaders identify the factors that can be changed to improve the resilience of communities most vulnerable. FEMA explains who can benefit from the online tool and why it is important:

> Intended users include planners and emergency managers at the local, regional, state and federal levels, as well as other decision makers and interested members of the general public. With an improved understanding of natural hazard risk, communities can take action to reduce it. (FEMA, 2021a, para. 2)

Figure 1 illustrates the variables included in the NRI formula. FEMA's definitions of each variable are provided here. The expected annual loss is defined as the "likelihood and consequence component of risk that measures the expected loss of building value, population and agricultural value each year due to natural hazards" (FEMA, 2020, p. 1) and considers each of the 18 natural hazards specified in the FEMA document. Examples of the 18 natural hazard types include avalanche, coastal flooding, cold wave, drought and hurricane. For example, if an organization is a major employer in a small community along the coastline, the loss of the organization's building value with each successive hurricane strike would increase their community's expected annual loss. If an organization is based in the Midwest and produces food supplies such as soybean, corn or wheat, the loss in agricultural value due to extreme drought would increase this community's expected annual loss. "Social vulnerability is a consequence enhancing component of risk that measures the susceptibility of social groups to the adverse impacts of natural hazards" (FEMA, 2020, p. 6). More specifically, it considers the demographics of the community, the socio-economic levels and housing characteristics that influence the community's ability to prepare, respond and recover from natural hazards.

For example, communities that have a population with two-person earning households with young children could score higher on social vulnerability considering the complex nature of reconnecting children with parents during a disaster. Similar difficulties could apply to communities with a large elderly population. Depending on the age and design of the homes in the community, such as homes that are not designed to stay warm without electricity or homes that do not have a generator, the social vulnerability score could increase. Again, through the lens of a safety professional, knowing the potential impacts to a community during a disaster can help inform how they help their organization prepare. If the building or campus in which your organization resides is built to resist natural hazards and has multiple generators, and food and water supply on hand, then it is possible to lower the vulnerability in the community and reduce dependence on local volunteer services. Lastly, community resilience is the consequence reduction component of risk that measures the ability of a community to "prepare and plan for, absorb, recover from, and more successfully adapt to the impacts of natural hazards" (FEMA, 2020, p. 12).

Since the purpose of this article is to explore how disaster resilience can be assessed, it is important to understand how the community resilience portion of the formula is determined. The source of the community resilience data is the University of South Carolina's Hazards

and Vulnerability Research Institute Baseline Resilience Indicators for Communities (BRIC; FEMA, 2020; University of South Carolina College of Arts and Sciences, n.d.-b). The top-down methodology for BRIC's use and importance is described as follows:

> The BRIC index uses a capitals approach in providing an overall baseline assessment for monitoring existing attributes of resilience to natural hazards. Developed for U.S. counties, BRIC can compare one county to another, help to understand the specific drivers of resilience for individual counties, and monitor improvements in resilience over time. (University of South Carolina College of Arts and Sciences, n.d.-b)

A capitals approach considers natural, social and human capital in the overall assessment process. Table 2 shows the six broad resilience types and examples of indicators within each. Several examples of the 49 indicators are available on the NAPSG Foundation website (2021).

Individual BRIC mappings that represent community resilience at the county level for each state can be found at **http://artsandsciences.sc.edu/geog/hvri/bric**. The web page describes that, thus far, the community resilience scores have been determined at two points in time: 2010 and 2015. This web page provides a clear explanation of how the Hazards and Vulnerability Research Institute BRIC score was incorporated into the community resilience NRI formula. FEMA explains that limitations exist to the community resilience portion of the NRI formula. Community resilience was determined using a top-down approach because at this time "there are no nationally available, bottom-up community resilience indices available" (FEMA, 2020, p. 12). Another limitation to the community resilience portion of the formula is that it is only a snapshot in time and is meant for planning purposes only, as its intent is for broad nationwide comparison and does not replace the need for local risk assessment and analysis, recognizing that local level analysis can be more accurate (FEMA, 2021b).

In total, the expected annual loss, the social vulnerability and the community resilience are entered into the NRI formula and results in an NRI score. This score "represents the potential for negative impacts resulting from natural hazards." The NRI and each of its individual components can be examined using FEMA's online NRI tool (FEMA, 2021c).

Example of How to Use the Data

A safety professional could gain immense value from examining the NRI of the community in which their organization resides by clicking on the interactive U.S. map, finding the county and examining the inputs specific to the county that contribute to their community's NRI. The authors analyzed the NRI data, specifically the community resilience score, to illustrate how the data can be useful. The data showed that 459 counties scored very high, 825 scored relatively high, 937 scored relatively moderate, 719 scored relatively low and 198 scored very low. The community resiliency score of those counties in the very high category scored from 57.7392 to 64.6736 and those in the very low category scored from 50.139 to 41.1894. From a public health perspective, it is important to focus on those in the very low category to help them improve and the very high category to determine what they are doing right.

Of the 198 counties that scored in the very low category, Alaska had the greatest vulnerability, with 26 (89.6%) of its counties in this category. During disasters, they lack the resources to recover quickly. Other information that is important for planning can be obtained from the NRI interactive map. In Alaska, single-parent homes are at 19.44%, the unemployment rate is at 27%, 19.9% lack healthcare and there are only 1.21 doctors per 1,000 people. These are just a few factors that impact the resiliency rate of a community. This can be compared to North Dakota, which had 49% of its counties with a very high resiliency rate. For example, in McIntosh County, the unemployment rate is 0.3%, only 5.9% lack healthcare, single-family homes are still high at 18%, but the county has 30.80 doctors for every 1,000 people.

A safety professional can use this type of information when advocating for investments in disaster prevention and mitigation strategies for their organizations. Research suggests that low resilience could be an indicator of high dependency (Lechner et al, 2016). As dependency grows, resiliency decreases. For example, during the Fukushima disaster, Ford Motor Co. could not obtain the pigment to paint cars because of a nearby manufacturing plant shutting down (Lechner et al., 2016). If an organization receives goods from a third party that resides in a community that has low resiliency to natural disasters, without proper planning, low community resilience could impact an organization's regular operating model. Whether shifting operations to another third party or taking on new and temporary operations while the usual provider of goods recovers, low community resilience can impact your organization's safe operations.

The data can be used to determine disaster recovery strategies. For example, in the case of extreme snowfall or flooding, roads can be shut down and organizations can become a shelter for employees until roads open. The safety professional could be part of planning for these sheltering events; if the community resilience score is low, and local emergency services become overwhelmed, it is likely the organization (not local services) will be the main provider of heat or cooling sources, food sources and an orderly mass evacuation of vehicles once roads open. Low community resilience scores and lack of preparedness at the local level directly impacts the organizations in which safety professionals work. In consideration of Hurricane Katrina, poor construction of the levees and maintenance that surrounded New Orleans, LA, contributed to more than 80% of the city being flooded. In this disaster, many lost their lives and businesses struggled to survive. A social vulnerability and community resilience assessment conducted as a preventative may have helped identify the risk potential and help justify needed improvements and planning.

Each area of the country has different natural disaster vulnerabilities. Therefore, safety professionals must leverage the community resilience scores of those areas in which their organizations interact and where their organization resides to identify potential risks and to develop emergency action plans. The first step is for the safety professional to become aware of the variables that con-

tribute to the NRI and assess how the information can be used for robust emergency planning.

Case Studies

The authors argue that a combination of a bottom-up and top-down approach is needed to increase disaster awareness levels. Sim et al. (2018) presented Hong Kong as a case study for measuring disaster resilience. The authors of that study used Sendai Framework Local Urban Indicator Tools, a model that combines a mixed bottom-up and top-down approach and encourages a cooperation of government and the public to share information. Hong Kong had a population of 7.34 million people in 2016, and faces the highest number of natural disasters in Asia (Sim et al., 2018). The only equivalent city in the U.S. is New York, NY, with 8.62 million people; Los Angeles, CA, has 4.08 million (World Population Review, 2021). The local urban indicator tools have four layers of measurement with indicators. Sim et al. (2018) used level two, which has 31 indicators. The indicators include 10 essentials of making cities resilient. For each essential, a measurement of baseline and resilience occurs, then gaps are identified, solutions are implemented, and data are shared. The 10 essentials are governance, risk scenarios, financial capacity, urban development, buffers on ecosystems, institutional capacity, societal capacity, infrastructure, disaster response and recovery/building back better (Sim et al., 2018). Hong Kong scores high in most categories. It follows risk-sensitive design and has the societal capacity through cultural mutual helping. It invests in resiliency and has an annual budget for prevention and preparedness. In an example where the Sendai Framework was used in the U.S., the resilience of small and mid-size businesses in New Orleans, LA, was analyzed by infrastructure consulting firm AECOM in collaboration with AECOM (2016). This resilience analysis was undertaken in 2016 and was prompted by the acknowledgment that the 300-year-old city had experienced many disasters due to severe weather including Hurricane Katrina in 2005. The Ten Essentials for Making Cities Resilient conceptual framework and the Disaster Resilience Scorecard were used to develop the Disaster Resilience Survey for Small Businesses for New Orleans (AECOM, 2016). Containing aspects of each of the 10 essentials, the survey was divided into five sections: 1. previous disaster history; 2. awareness of potential disasters and impacts; 3. disaster preparedness; 4. during a disaster; and 5. recovery and building back better. Unique to this survey was the addition of a disaster scenario that included questions that respondents for businesses were asked regarding association with a disaster such as an outage of utilities and supply chain disruption (AECOM, 2016). While this bottom-up approach to eliciting disaster preparedness information from the businesses found that vulnerability remained high overall and preparedness of small businesses was low, it also found that there were businesses and business types that were well prepared and could act as role models for the others.

Increasing the Score: Best Practices for Communities

Awareness Campaign

There is merit in understanding what media and educational sources best influence action in different populations. The word "action" can take many forms; for example, it could mean a person feels encouraged to seek additional information having been exposed to informative content. It could also mean that a person could take action to make change, prepare to make change or take no action at all based on the type of media, the content, how it was offered and how it is perceived based on individual differences. Recent studies examine how media type and content influence planned action based on variables such as age, gender, region and education (Abbasi & Nawaz, 2020; Al-Dmour et al., 2020; Armstrong et al., 2021). Media sources such as traditional news, social media (blogs, Facebook, Twitter), infographics, webinars, billboards and radio announcements are some ways people absorb information. A thorough literature review of media types that influence action and a framework that examines how to effectively increase public awareness of personal and community disaster resilience levels is warranted. Once the public is aware of their community's resilience level, only then can they begin to seek greater understanding or prepare to act.

Public Open Space

Resilience leadership uses innovative approaches to develop risk reduction in communities. One best practice to consider is integrating the design of public open space and urban sustainability to increase disaster resilience (Jayakody et al., 2018). In congested urban living areas, public open space can increase the day-to-day quality of life. During a disaster, the public open space can act as a second city. These spaces can be designed for the public to gather, shelter, distribute food and have temporary homes (Jayakody et al., 2018). The public open space is transformed and acts as life support for the community (Zhao et al., 2018). The post-disaster shelter demand is investigated in the preparedness phase and the location is decided upon to minimize travel costs and cover emergency management needs. This information is mapped and shared to develop location-allocation models for shelters and evacuation plans.

In developing the public open space, communities should also build health resistance by decreasing disaster mortality and damage to the health infrastructure. As natural disasters can disrupt services and create food shortages, these disproportionately affect people living in poverty, those with health issues and otherwise disadvantaged individuals (Tiernan et al., 2019).

Geographics

Geographic information and geographic information infrastructure are significant to increase resilience. Real-time geographic information allows the public to share information with each other and the local government. Geographic information infrastructures give the local government timely access to real-time geographic data (Kurwakumire et al., 2019). Geographic information infrastructure is a key tool for disaster relief and is used to map the stage height of a river that regularly flows or a road network that is used for evacuation from a hurricane. Cities that use this approach are adaptive and provide a feedback loop. The socio-ecological system includes five components: the city and its scope, boundary, objective, processes and stakeholders. Next is the stakeholder

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It is important that awareness of disaster resilience, the resources available, and the steps that can be and have been taken are appreciated nationwide to mitigate the effects of disasters. Supporting the efforts of resiliency requires both a bottom-up approach at the grassroots level.

policies made by reviewing the geographic information and geographic information infrastructure. This is followed by the what-if scenarios. This allows for a concrete vision of the management system. Finally, an evaluation of the stakeholders occurs, which feeds back to the first step (Kurwakumire et al., 2019).

Information & Communication Technology

The use of information and communication technology works with geographic information to produce information and make decisions. Citizens can play an active role and increase resilience (Aydin et al., 2016). As access to mobile devices and the internet increases, vulnerability to risk decreases. More people are using mobile technology, which allows for location data to be captured. Applications are being developed to estimate damage after a disaster, people and resource search, and location of post-disaster resources (Aydin et al., 2016). One such application was used in Turkey's Izmir Province with a three-tiered approach. It first contained the location of tent cities, police, hospitals and the security control point (Tarhan et al., 2016). The next portion is a missing person search and insertion. This allows the user to put in their information, date and time that someone was last seen. Finally, a resource insertion content area contains a location name, type, water, food, hot meal, lead time and resource origin (Tarhan et al., 2016). Providing communication between disaster risk managers and the public increases community resilience.

Knowledge gaps decrease resilience efforts and a significant portion of disaster-prone areas are in the least developed countries. Information deficiencies exist on the local level concerning spatial information on risk, resources and capacities (Liu et al., 2018). Humanitarian organizations such as the Red Cross work with communities to collect and digitize local maps, conduct field surveys and focus maps, add land use, recent disasters and risk management to maps, upload mapping information to an open platform and monitor changes (Liu et al., 2018). Huge strides have been made in flood-prone areas throughout the world by conducting door surveys, paper maps being scanned and creating Facebook groups. However, increasing resilience in poverty-stricken areas takes an investment of time and money. More than 132 million people living in poverty live in areas with high flood risk (Rentschler & Salhab, 2020).

Path Forward

In May 2021, $1 billion was earmarked for the pre-disaster mitigation efforts of communities, states and tribal governments (The White House, 2021). The White House (2021) noted that disasters cost the country $100 billion in 2019 and a whole-of-government approach was being undertaken to climate resilience objectives. This includes the increased funding of $1 billion to the Building Resilient Infrastructure and Communities Program, which was double the amount allocated the previous year.

To increase resiliency as defined in the BRIC approach, a first step can be looking at the sources from which information on the variables in the index was collected. An article by Cutter et al. (2014) contains tables with this information, the data provider and descriptions for the calculation of individual indicators. A county can improve its resiliency by focusing on improving the variables in which it is weak. An example could be increasing the number of Red Cross volunteers able to respond to a disaster because this is one of the variables contributing to the index. Standard statistical programming software can be used to calculate the improvements accomplished. Note that updating a current BRIC index is in progress using 2020 census data, so counties will be able to assess their position in reference to the 2015 data. Another approach to assist communities in becoming more resilient is contained in a playbook issued by the National Institute of Standards and Technology (NIST, 2020). The playbook provides a six-step process, from forming a planning team to plan implementation and maintenance, and includes insights from communities that have used the guide.

Conclusion

It is important that awareness of disaster resilience, the resources available, and the steps that can be and have been taken are appreciated nationwide to mitigate the effects of disasters. Supporting the efforts of resiliency requires both a bottom-up approach at the grassroots level, as illustrated by the knowledge gained in the New Orleans, LA, small and mid-size business case study, and the awareness that such a study engenders, as well as the essential information that can be gleaned from the top-down BRIC approach. Understanding community resiliency and appreciating the value of increasing the score are essential. The establishment of the NRI provides the initial framework whereby the public can learn the current

state of their communities' resilience. This information in combination with grassroots approaches will be helpful as we face future natural disasters. With increased awareness campaigns, everyone may know and understand the disaster resilience scores of the communities in which they live and work and use them in mitigation efforts. **PSJ**

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