Matrix Approach to Coastal Community Resilience Assessment

Cate Fox-Lent  
*US Army Corps of Engineers, Engineer Research and Development Center, Concord, MA*

Matthew E. Bates  
*US Army Corps of Engineers, Engineer Research and Development Center, Concord, MA*

Igor Linkov  
*US Army Corps of Engineers, Engineer Research and Development Center, Concord, MA*

Follow this and additional works at: https://scholarworks.uno.edu/resilience


This Event is brought to you for free and open access by ScholarWorks@UNO. It has been accepted for inclusion in Coastal Resilience Workshop by an authorized administrator of ScholarWorks@UNO. For more information, please contact scholarworks@uno.edu.
Introduction
Coastal communities are subject to frequent disruptive events such as hurricanes but traditional risk reduction measures are difficult to achieve when physical improvements are voluntary (elevating homes, waterproofing basements) or culturally unpopular (high seawalls). Yet, coastal communities have no single managing authority in communities to clearly define optimal functionality and determine acceptable trade-offs to achieve resilience (Linkov et al. 2014). Instead “soft” capacities such as collaboration, communication, and decision making can be an equally important factor in achieving resilience (Mendonça and Wallace 2006). Resilience is a property of a system that describes the capacity to continue performing critical functions through disruptive events. Resilience requires integration and performance of both physical infrastructure and soft functions.

Materials and methods

The Resilience Matrix (RM) is a framework for the performance assessment of integrated complex systems. The framework (Figure 1) consists of a 4x4 matrix where the rows describe the four general management domains of any complex system (physical, information, cognitive, social) as described in the US Army’s Network-Centric Warfare doctrine (Alberts and Hayes 2003) and the columns describe the four stages of disaster management (plan/prepare, absorb/witstand, recover, adapt) as defined by the National Academy of Science in their definition of resilience (Committee on Increasing National Resilience to Hazards and Disasters 2012).

Results

Case Study 1: Rockaway Peninsula, NY
The Rockaway Peninsula of Queens, New York City is largely residential. For the demonstration of the RM in this case study, the housing/shelter function is selected as the most critical function and extensive data from community workshops and federal and city task forces collected following Hurricane Sandy to complete the matrix. In this demonstration (Figure 2) we see that housing/shelter in the community has greater capacity to prepare for and absorb coastal storm events than to recover from them and adapt accordingly. Similarly, it has somewhat greater capacity across the social and physical domains compared to the information and cognitive domains. Low scores are largely due to the inadequately long time period to perceive, rather than an outright lack of capacity. This pattern is evident in many coastal environments. In addition to the interpretation of the results, the RM approach provides the opportunity to open communication and establish relationships. Figure 3 displays a non-exhaustive list of the agencies and groups that may have responsibilities or capabilities related to supporting the function of the system components of a community. Establishing strategic partnerships may reduce costs by eliminating redundant efforts and enhance resilience by strengthening collaboration and lines of communication that can prove valuable in real-time disaster response.

Conclusions

Other community resilience assessment tools utilize an established set of demographic and community metrics to develop a relative resilience score. This approach allows comparisons across multiple communities, but does not necessarily help inform communities about how to move forward. The RM uses a stakeholder informed method that ensures metrics and scores are relevant to the immediate community. In addition, the RM is applied for each critical function of a community. This not only breaks down an aggregate score so that decision makers can see where they specific areas of low performance but also allows federal and state agencies with specific missions to evaluate how proposed resilience improvement designs will perform with respect to their area of interest.