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EDITORIAL

Concepts and approaches to resilience in a variety of governance and regulatory domains

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President Obama's Executive Order and Presidential Directive (E.O. 13636 2013; P.P.D. 21 2013) have called for *resilience* of the nation's infrastructure and environmental systems. Resilience has been defined by the US National Academy of Sciences as the ability to plan and prepare for, absorb, recover from, and adapt to adverse events (National Academy of Sciences 2012). There is increasing depth and variety of resilience-related research. There are differing approaches to quantifying resilience and a contrast between resilience and risk, which have implications for regulatory policies. Papers included in this Special Issue of *Environment Systems & Decisions* seek to characterize resilience methodologies and the applications across a variety of domains and topic areas. With many papers and special issues on resilience, the uniqueness of this issue is a tandem focus on quantifying resilience and contrasting of applications of resilience management in the US Federal Government.

The issue starts with a review paper by Larkin et al. (2015) sampling efforts of the US Federal Government to address resilience. It is clear that multiple agencies attempt to formalize resilience and use it in their respective mission space. In many areas, the efforts are fragmented and divergent; more interagency collaboration and focus on developing comprehensive resilience management methodology are required. Part of the challenge in defining resilience is the complexity of agency mission space and diversity of needs. Several papers presented by scientists from the US Army illustrate the diversity of needs and applications including critical infrastructure and military installations. Rosati et al. (2015) introduce a three-tier approach to incorporating resilience into the US Army Corps of Engineers coastal engineering needs and programs. Fox-Lent et al. (2015) describe application of this approach for coastal communities in a case study from Rockaway Peninsula using a stakeholder-driven resilience matrix framework adapted from Linkov et al. (2013). Sikula et al. (2015) focus on integrating resilience in the case of sustaining missions at military installations. The paper argues for the enhancement of traditional engineering and risk approaches with socioeconomic system resilience principles. The proposed Military Installation Resilience Assessment aims to use resilience in the evaluation of both known and unknown hazards.

The literature is exploring the relationship and contrast of risk and resilience. Risk is often calculated as a product of threat, vulnerability, and consequences. Risk analysis often underemphasizes the time domain. Resilience accounts for the time domain when considering the planning, stress absorbing, recovery, and adaptation stage of system evolution. Baum (2015) presents arguments for a close connection between risk and resilience. He describes how risk and resilience require supplementary information. He suggests giving balanced consideration to each of the concepts, which should be deployed in conjunction.

The issue includes case applications of resilience, with emphasis on community and urban perspectives. Davies

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(2015) critiques risk-based approaches for use against natural disasters in urban areas, as the low probability of these events is a challenge for predictive modeling. A resilience framework is proposed. Further exploring resilience from a community or city perspective, McDaniels et al. (2015) provide an approach for characterizing and ranking different infrastructure options when aiming to improve regional resilience. Bukvic (2015) proposes a set of community-related metrics used to determine community adaptation to coastal storms.

Next, Teodorescu (2015) evaluates resilience from a more conceptual context, attempting to quantitatively define resilience using a probabilistic model based on event tree assessment and statistical risk calculations. Cyber resilience for the security of cyber-physical systems is described by DiMase et al. (2015). Baum et al. (2015) describe an evaluation of the global food supply in relation to large-scale disastrous events. Food supply resilience not only has to occur on a global scale, but must be applied locally as well, in the event that food cannot be transported from one community to another in a regional disaster.

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