

Evaluating Risk and Resilience in Engineering with Nature Projects

Rahim Ali (rahima@andrew.cmu.edu), Margaret Kurth, Cate Fox-Lent, and Igor Linkov (US Army Engineer Research and Development Center, Concord, MA, USA)
Todd Bridges and Burton Suedel (US Army Engineer Research and Development Center, Vicksburg, MS, USA)

Background/Objectives. Since its inception in 2010, the US Army Corps of Engineers' Engineering with Nature (EWN) program investigates, demonstrates, and supports the design of projects that meet specific engineering objectives while also providing environmental benefits and enhanced long-term sustainability. In general, EWN projects either take 1) a traditional engineered structure and integrate environmental co-benefits or 2) use novel approaches to leverage natural flow and sediment transport processes to achieve engineering missions. Through these methods, EWN projects have been successful in managing flood risk and supporting long-term waterway navigability. In its most simple description, resilience is defined as the ability to rebound or recover to a previous state after a disruptive event. Although the philosophy of EWN intersects with the concept of resilience, there has been little research in investigating the direct outcomes of resilience through these projects. This study aims to investigate past EWN projects to identify and describe the properties associated with resilience.

Approach/Activities. Using a rubric, over 100 EWN projects will be evaluated to consider how projects prepare/defend, resist/withstand, recover, and/or adapt in the face of disruptions. This effort will evaluate project types, such as "breakwater", "shoreline protection using revetment", or "shoreline protection using eel grass", based on the following indicators: resourcefulness, robustness, rapidity, redundancy, absorption, recovery, and adaptation. Additionally, the rubric will consider other project characteristics such as intended function of the project, timescale of expected effects, need for continued maintenance, extent of natural growth or degradation, and explicit social, economic, and environmental benefits.

Results/Lessons Learned. It is important to note that EWN projects do not ensure resilience and resilience projects do not necessarily utilize EWN approaches. The intended outcome of this study is to better understand the relationship between EWN and resilience goals over short and long-term planning horizons and provide insights into project characteristics that maximize the benefits that can be achieved by engineered projects. Additionally, understanding the relationship between EWN goals and resilience goals provides insight into the characteristics of EWN projects that generate the least conflict between resilience goals.