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Lessons learned: Creating an interdisciplinary team and using a nexus approach to address a resource hotspot

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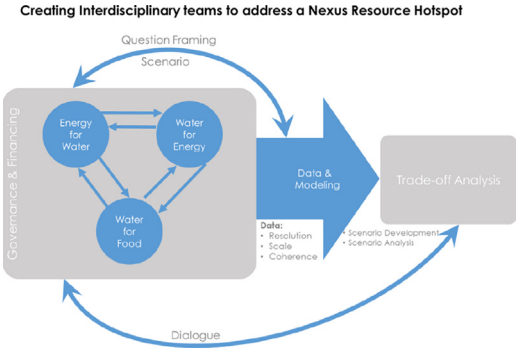
HIGHLIGHTS

- The system-of-systems quantification of water, energy, food, and interconnected systems is similar across hotspots.
- Challenges posed are bound by local knowledge, physical constraints, governance: solutions must be contextualized locally.
- Creating an interdisciplinary team is an iterative process that requires genuine time and energy investment.
- The interdisciplinary approach to developing solutions expands opportunities for economic development and social well-being.

GRAPHICAL ABSTRACT



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ABSTRACT

Moving resource management and allocation away from sectoral silos to a paradigm founded in integration and leveraging cross-sectoral and trans-disciplinary synergies will result in expanded opportunities for economic development and improved social well-being (Mohtar, 2017; Mohtar and Daher, 2017). Interventions to address complex resource challenges must identify opportunities while cognizant of holistic, system level trade-offs (Daher and Mohtar, 2015; Daher et al., 2018a, b, c). These interventions must be contextualized locally: Texas has spatially varied water scarcity, energy resource abundance, and rapid population growth; in the northeastern United States water quality, drainage, and extreme weather events pose far greater challenges. While the overall system-of-systems quantification of water, energy, food and other interconnected systems remains similar across hotspots, the solutions to the challenges posed within each hotspot are bound by local knowledge, physical resource constraints, and governance challenges. This paper introduces the experience of the Texas A&M University Water-Energy-Food Nexus Initiative (WEFNI) in creating a University wide, three-year investigatory experience in which an interdisciplinary group addressed the resource challenges facing the San Antonio region. This Science of the Total Environment (STOTEN) Special Issue documents, in 9 distinct, yet complementary, research articles, the multiple dimensions of this resource hotspot. This paper reflects on the process of creating interdisciplinary teams and presents an overview of the questions and research conducted under thematic foci: data and modeling, trade-off analysis, water for food, water for energy, and governance. Lessons learned from the interdisciplinary experience are presented; potentially transferrable to addressing other resource hotspots within the US, and globally.

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1. Introduction

Growing demands across the interconnected water, energy, and food resource systems express as spatial and thematic "hotspots" that have distinct characteristics which often require unique localized interventions to be addressed. A WEF Nexus "hotspot" is a vulnerable sector or region, with a defined scale and facing stresses in one or more of its resource systems due to resource allocations that are at odds with the interconnected nature of the food, energy, and water resource systems within them (Mohtar and Daher, 2016). The business as usual allocative model for these resources will not be sufficient to address current or anticipated complex and highly interconnected resource challenges. Identifying cross-sectoral synergies (Mohtar and Daher, 2017), adopting a new paradigm for resource management and allocation, moving from silos to nexus integration, are modes of addressing the challenges that will result in expanded opportunities for business growth, economic development, and improved social well-being (Mohtar, 2017). Solutions and interventions must be multi-faceted (Daher et al., 2018a, b, c) and opportunities must be identified, while keeping in mind holistic and system level trade-offs (Daher and Mohtar, 2015; Mohtar and Daher, 2014). Resource Nexus hotspots in Texas, with its spatially varied water scarcity, energy resource abundance, and rapid population growth, differ from hotspots, for example, in the northeastern United States, where water quality, drainage, and extreme weather events pose far greater challenges. The system of systems understanding and quantification of water, energy, food and other interconnected systems is similar across hotspots, however, the solutions and responses to each hotspot is bound by local knowledge, physical resource constraints, and governance challenges.

San Antonio, TX, demonstrates a complex resource hotspot with promising potential: identifying a vision for growth that regards the tight interconnectedness and trade-offs among its WEF resource systems can help realize that potential. Home to both a rapidly growing population in an urbanizing setting and to the Eagle Ford shale play, San Antonio has both increased oil and natural gas production, and major agricultural activity surrounding the city. It comprises a hotspot whose competing demands make it essential that involved stakeholders are properly informed to effectively address future resource challenges. In an effort to ensure the sustainable urbanization of the city, whose growing sectors compete over limited water, land, and financial resources, possible interventions to reduce existing and projected resource stresses must be investigated. In this special issue, the authors build on the existing system of systems understanding and evolution of interconnections within the WEF nexus and propose technological, social, policy, and governance interventions to address the stresses posed. The case studies attempt to identify a vision for multi-faceted interventions that address the complex resource challenges facing the region, while evaluating the trade-offs associated with various pathways forward.

Here, an introduction is shared to the Texas A&M University Water-Energy-Food Nexus Initiative (WEFNI) experience in creating a system wide interdisciplinary group to address the resource challenges facing the San Antonio region. A primary outcome of this three-year investigatory experience is this Science of the Total Environment (STOTEN) Special Issue, which documents in 9 or 10 distinct, yet complementary, research articles that address the multiple dimensions of this resource hotspot. This paper shares the process of creating an interdisciplinary team to address the complex resource challenges facing San Antonio and presents a brief overview of the questions and research conducted under thematic foci that include data and modeling, trade-off analysis, water for food, water for energy, and governance. The conclusion presents lessons learned from the interdisciplinary experience in efforts to better address this hotspot, and replicate elsewhere.

2. Creating the interdisciplinary team to address a WEF Nexus hotspot

The Texas A&M University (TAMU) Water-Energy-Food Nexus Initiative (WEFNI) is a System wide initiative comprising scientists and educators committed to finding solutions to interconnected resource grand challenges (WEFNI, 2018). These scientists and educators make up interdisciplinary teams that share expertise, skill, and scientific abilities to produce the necessary analytics grounded in state-of-the-art science that provide a platform to facilitate inclusive stakeholder dialogue at local, regional and global levels.

2.1. The process of building an interdisciplinary team: sub-groups and their interdependencies

The San Antonio Case Studies (SACS) were launched to support planning for Water-Energy-Food (WEF) Nexus Resources in San Antonio and its surrounding region. Six sub-groups (G) were developed (Fig. 1): G1, Data and Modeling; G2, Energy for Water; G3, Governance and Financing; G4, Trade-off Analysis; G5, Water for Food; and G6, Water for Energy. Each group identified their intended objectives, outcomes, and data collection needs. Following several months of work within the respective sub-groups, a Town Hall style meeting took place with the primary goals of sharing projects, research questions, and data. Potential synergies between sub-groups were discussed, and a nexus interlinkages map (road map) for the overall project was developed. Building on the discussions of the first Town Hall, the framework proposed in Fig. 2 represents the interconnections and interdependencies between the 6 sub-groups. Progress on interlinkages, data and modeling, governance and tradeoffs were made during the first year, however it was concluded that further discussion of stakeholder engagement was needed to develop a stakeholder engagement plan.

Following several full team meetings and regular sub-group and inter-sub-group meetings, a set of highlights and recommendations were identified.

1. Develop a coordinated stakeholder engagement plan.

Fig. 1. The six sub-groups.