MarTREC UTC Project Information Form
USDOT Tier 1 University Transportation Center
Agency ID or Contract Number 69A3551747130

Project Title: Informing post-disaster restoration through modeling interdependent agriculture and transportation networks
Project Abstract: Agriculture (ag) supply chains are of utmost importance for the function of society. Ag supply chains are inherently complex due to their interdependency with critical infrastructure systems including energy, water, and maritime and multimodal transportation. This complexity is increased due to the dependence on time-sensitive and capital-intensive operations, uncertain natural events, and volatile commodity markets as well as their position within rural and low socioeconomic communities. When functioning, the U.S. transportation network provides a backbone that enables the transport of ag inputs (e.g., chemicals, seeds) and outputs (e.g., raw/processed goods).However, disruptions to transportation mode(s) cause severe and cascading operational and economic damage, which are magnified due to the inherent complexity of ag supply chains. For example, Hurricane Harvey's impact on ports and rail was detrimental to ag because it occurred during harvest. Delays on inland waterways impacted the timely delivery of necessary fertilizers. Existing approaches failto capture how these important details – including different transportation modes, sensitivity to time and decentralized geographic space, and the economic impacts for rural communities – impact how transportation should be used when a disruption has occurred and how to coordinate restoration activities across interdependent infrastructure systems. We propose to develop models which determine how to effectively use transportation and coordinate restoration efforts to make ag supply chains more resilient. These models will be run on real data representing components across the agricultural supply chain, multimodal transportation network, and other critical infrastructures, which will lead to contributions and insightful analysis into the resiliency of these systems.
Describe Implementation of Research Outcomes: In this project we built a data-driven model that is a simplified, but tractable, representation of transportation disruptions and their subsequent impact on the agriculture sector. This model provides a baseline for more advanced disruption and ongoing logistics modeling, scenario building, and can guide stakeholder discussions. The results demonstrate the potential impact of coordination between different state and federal transportation entities (e.g., state DOTs, U.S. Army Corps of Engineers). Specifically, we demonstrate that even small amounts of coordinated restoration of damaged transportation waterways and roads causes significant benefits for agricultural yield. The research demonstrates the need for coordination, systems thinking, and understanding of how transportation impacts other interdependent infrastructures.
Impacts/Benefits of Implementation: This model helps establish a methodology for planning in the agricultural sector. For example, it could help build guidelines for the storage size of fertilizer or seed inventory containers to provide sufficient material to withstand likely (or extreme) disruptions to the transportation sector. It could help farmers and their financial backers to plan for economic impacts of these disruptions; this financial impact could also be used to generate support for public investment in redundant or more resilient transportation infrastructure.
Web Links: martrec.uark.edu
Budget (Funding) Amounts & Source(s) (US DOT +Match(s) =Total Costs): $164,301 from MarTREC and$82,836 from academic salary. Total $247,137
Project Start and End Dates: 08/13/18-10/31/21 Completed project
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