



2015 Summer Research Experiences (SRE) for Undergraduates and Teachers

Abstract

GAULI, A., WIKLE, N., YAN, R., GROSS, L., SIMBERLOFF, D., CHUANG, A. and C. LANDERER. Projecting terrestrial species invasion spread using commodity flow pathways. National Institute for Mathematical and Biological Synthesis, Knoxville, TN; Fisk University, Nashville, TN; Truman State University, Kirksville, MO; College of William and Mary, Williamsburg, VA; University of Tennessee, Knoxville, TN.

Models to create projections of invasive species spread are critical in identifying high priority shipping centers and pathways of bioinvasion, essential information in the prevention of environmental and economic harm caused by invasive species. Research into the development of models of biological invasion across broad spatial regions have been targeted towards network models of international shipping pathways. The majority of models for terrestrial invasions have been confined to basic diffusive spread. Nevertheless, many species of harmful pests are known to travel long distances, in part due to transport through commodity shipments. For example, *Solenopsis invicta*, the red imported fire ant, can travel via turf shipments within the United States. The availability of commodity flow data suggests that a model utilizing domestic freight as the dominant vector of dispersal may be a promising, yet unexplored, avenue of research in invasive species ecology. To this end, we utilize data from the Freight Analysis Framework (FAF) to create projections of invasive species spread. The FAF data provides tonnage information on commodities shipped within the United States at state level resolution. Weight values from four sets of data are used in a resampling method to generate the transition matrix at the core of a stochastic matrix model used to create projections of terrestrial invasive species spread. Additionally, we incorporate elements of environmental difference and logistic growth in our projections to achieve greater biological soundness in the results. Furthermore, we introduce ComFlo, an interactive web-based tool designed to aid in the visualization of commodity shipments within the United States.