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Title: Invasive Species: Operations Research for Prevention, Surveillance and Control

Abstract: Invasive species are non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive species can adversely affect agricultural, aquatic, forested, and rangeland ecosystems. Every year, the damage of invasive species costs governments, industries, and private citizens billions of dollars. For example, non-native wood-boring insects, including the emerald ash borer, are estimated to cause $1.7 billion in local government expenditures and $830 million in lost residential property values annually in the United States. Many other effects of invasive species are not easily monetized (e.g., increased water pollution, reduced recreation quality) yet have profound impacts on human well-being. Government programs to address the adverse effects of invasive species depend on the stage of the invasion and include prevention (keep invasive species from entering a new ecosystem), surveillance (find established populations of invaders), and control (minimize their spread and adverse effects). In general, the invasive species management (ISM) problem is to allocate resources among different activities over space and time, with the objective of minimizing the economic and environmental damage as well as the cost of management. In this talk, we first define key concepts of biological invasions, associated economic and environmental costs, and management. Then, we describe mathematical programming models that have been applied to three real-life ISM problems: (1) Allocate an inspection budget among incoming shipments at the Miami, Florida, plant inspection station to minimize the introduction of infested plants into the United States; (2) Allocate a surveillance budget among neighborhoods of Winnipeg, Canada, to maximize the detection of newly established emerald ash borer populations; (3) Determine the surveillance, treatment, and removal of ash trees over space and time in Burnsville, Minnesota, to maximize the benefits of healthy ash trees that are subject to an emerald ash borer infestation; and (4) We discuss limitations of the existing research on ISM planning and provide several directions for further research. Our review highlights the fact that operations research models play a key role in ISM and environmental decision-making.