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A Dynamical Systems Approach to Modelling Competition Between Invasive Weeds and Native Plants

We explore the impact of invasive weeds on native forests by using partial differential equation (PDE) modelling and dynamical systems techniques. We perform this study via competition models where we consider both the weed and native species as functions of position and time. We are primarily interested in the existence of traveling wave solutions to the PDE systems. In particular, we study the existence of a so-called extinction wave which indicates the transition of the forest from a weed-free steady state to a steady state in which the native plant biomass is depleted. We also consider the existence of a traveling wave indicating a transition to a co-existence steady state. We put conditions on the parameters of our model which will be sufficient for the existence of the traveling wave fronts and we further find bounds on the wave speeds. We perform some simulations to support our analytic results. In all cases, we give a discussion on the ecological interpretations of our results, as well as some ideas on how to implement controls on invasive weed growth.