When Two Problems Meet: Analysis and Prediction of the Spread of Invasive Plant Species in Relation to the Changing Environment

Cao, Sarah (School: Palos Verdes Peninsula High School)

Introduced plant species bypass gradual speciation and directly compete with the native species, threatening human health and disrupting the balance of ecosystems. This project aims to systematically understand invasive plant spread when the environment changes and to make future predictions. The Random Forest species distribution model is primarily used to analyze the relationship between all invasive and native plants and 29 environmental factors in Los Angeles. The novel method of grouping individual species and generalizing data is used to explore broader trends. Future predictions of observation likelihood of plants are made using future environment data across 4 time periods and 4 Shared Socioeconomic Pathways (SSPs) based on climate models. The Random Forest model showed high accuracy in predicting the presence and absence of both groups, with a mean AUC value of 0.95 for invasive plants and 0.93 for native ones. Its extrapolation to much larger areas showed less but still high accuracy. The presence of invasive plants is most closely related to climate variables like precipitation seasonality, temperature annual range, and precipitation of the wettest month. It is also predicted to decrease with SSP126 but increase with SSPs higher than 370 over time. The results provide explanations of the invasive plants' ability to overtake ecosystems and thrive in a foreign land under global climate change. The importance of climate variables links the crisis of climate change to the invasion of introduced species. Low-emission policies are thus vital to the containment of invasive plants. By examining these variables and referencing the predicted patterns, more effective management of land and ecosystems can be achieved in both the locality and general.

Awards Won:

Fourth Award of $500

American Statistical Association: Third Award of $500