"Multi-scale modeling of the Spotted Lanternfly Lycorma delicatula (Hemiptera: Fulgoridae) reveals enduring risk to viticulture and regional range expansion by 2055”

Samuel Mandel Owens

TIME AND PLACE
Tuesday, June 25, 2024
10:00 AM
Biology Life Science Building
Room 234

Thesis Committee:
Dr. Matthew Helmus, Advisor, Temple University
Dr. Erik Cordes, Committee Member, Temple University

Please contact the Biology Department with any questions at 215-204-8854
Abstract: Invasive species are a growing issue that will compound under climate change. Rising temperatures, fluctuating precipitation and new transportation pathways will create new opportunities for invasive spread. However, the most direct and impactful consequence of climate change is arguably the removal of climatic barriers to invasive species survival. Predictive risk assessment for invasive species must include an evaluation of this establishment potential so that risk managers can prioritize areas at the highest future risk. Species distribution modeling (SDM) presents an accessible and effective method for predicting areas where these barriers will lift due to climate change. SDM has been applied to this purpose for many invasive taxa, but rarely do modelers take steps to reduce uncertainty for these applications. Ensemble (consensus) modeling is a strategy to reduce uncertainty in applications of SDM for invasive species and climate change. Here we apply an ensemble modeling framework to assess the risk for global establishment of the Spotted Lanternfly (Lycorma delicatula or SLF). SLF has already damaged viticulture within invaded regions and global viticulture is potentially at risk if SLF can colonize other important regions under climate change. We applied the MaxEnt algorithm to produce multi-scale ensemble of models based on regions of interest and the global mean, which we intersect to refine predictions for SLF establishment under climate change. Our models predict that the global suitable area for SLF will increase by 1.1 million km² by 2055. This expansion will primarily occur at present northern range edges in Europe and North America. However, we find that only half of important viticultural regions we sampled retain risk for SLF by 2055, while the other half remain or become unsuitable. Range shifts under climate change have not been examined for SLF, so we present new evidence of this using our modeled framework. Our predicted reduction in risk to more southern viticultural regions aligns with the observed southward contraction of SLF risk. It is likely that SLF will remain a threat to viticulture by 2055 as the suitable area for both shifts northward.