

Title: Using Machine Learning to Study the Effects of Climate on the Amazon Rainforests

Abstract: The Amazonian forests are a critical component of the global carbon cycle, storing about 100 billion tons of carbon in woody biomass, and accounting for about 15% of global net primary production and 66% of its inter-annual variability. There is growing concern that these forests could succumb to precipitation reduction in a progressively warming climate causing extensive carbon release and feedback to the carbon cycle. Contradicting research, on the other hand, claims that these forests are resilient to extreme climatic events. In this work we describe a unifying machine learning and optimization based approach to model the dependence of vegetation in the Amazon on climatic factors such as rainfall and temperature in order to answer questions about the future of the rainforests. We build a hierarchical regression tree in combination with genetic programming based symbolic regression for quantifying the climate-vegetation dynamics in the Amazon. The discovered equations reveal the true drivers of resilience (or lack thereof) of these rainforests, in the context of changing climate and extreme events.