



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

Name(s) Madeline J. Song	Project Number S1110
Project Title El Betweeno: Morisita-Horn Index Correlates Rainfall Variability with Crop Yield	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The 2015-2016 El Niño is predicted to be one of the strongest of its kind since its devastating 1997-1998 occurrence. This project uses Morisita-Horn Index (Morisita's) as a novel approach to conducting spatial analysis of rainfall trends. This project has three goals: 1) create a computer program that conducts spatial analysis of color-coded rainfall maps, 2) apply Morisita-Horn index to processed maps in order to analyze year-to-year rainfall variability, and 3) use crop yield data along with Morisita's-derived rainfall variability to predict crop yield following the 2015-2016 El Niño.</p> <p>Methods/Materials Rainfall maps (United States, 2009, 2010, 2014, 2015) were downloaded from the National Weather Service's precipitation database and yearly crop yields were obtained from the United States Department of Agriculture Crop Summaries (2011, 2015). The Multi-Step Color Detection Computer Program was written for this project in order to process existing data (rainfall maps) into a user-friendly tool capable of utilizing Morisita's in spatial analysis. This multi-step computer program includes gridding, color detection/classification, and calibration.</p> <p>Results 4 gridded maps were generated and used for image analysis and color classification. 16 color algorithms were generated and tested for accuracy in image analysis of rainfall maps. 19 prediction ratios were generated to predict crop yields following the 2015-2016 El Niño storm.</p> <p>Conclusions/Discussion This project provides farmers and consumers with a user-friendly tool which they can use to plan and undertake timely interventions before potentially devastating changes in climate and food security. For many individuals across the world, climate volatility is a direct cause of food insecurity. This project unites mathematics, computer science, agricultural science, and climatology in hopes that collaboration between different fields can accelerate the global fight against world hunger.</p>	
Summary Statement Morisita-Horn Index was applied to rainfall maps with use of computer image analysis software in order to analyze the effects of rainfall variability on crop yields in the years following the 2015-2016 El Niño.	
Help Received	