Research Experiences for Undergraduates (REU) 2013 Abstract

KEUNG, J., NAPOLES, M., VELLA, M., LANZAS, C. and S. CHEN. Agent-based model to investigate seasonality in *Escherichia coli* O157 transmission between pastoral beef cattle. National Institute for Mathematical and Biological Synthesis, Knoxville, TN; University of North Carolina, Chapel Hill, NC; Humboldt State University, Arcata, CA; University of Notre Dame, South Bend, IN; University of Tennessee, Knoxville, TN.

Cattle serve as asymptomatic reservoirs for *Escherichia coli* O157. Transport of contaminated fecal matter beyond the pasture and consumption of contaminated beef are common pathways of *E. coli* O157 to humans. Greater summer incidence of *E. coli* O157 infections in humans and cattle has been observed despite decreased pathogen survival in higher temperatures. The drivers of this seasonal phenomenon are disputed. The objective of this study was to 1) accurately depict behavior of grazing cattle; 2) quantify seasonal differences in pathogen prevalence on the pasture; and 3) form a hypothesis to explain these differences. An agent-based model was developed which incorporates time of day, temperature, cattle behavior, and *E. coli* O157 dynamics in the environment. We simulate a herd of 25 cattle grazing during April and July for the years of 2003 to 2012. We establish a significant difference in mean total infections in April versus July of 1.213 cows (95% CI 1.102-1.323). These values correspond to 8.56% prevalence in April and 13.4% prevalence in July. We hypothesize that the reason for this prevalence trend is temperature-dependent cattle behavior. Results of this study can inform policymakers to minimize *E. coli* O157 transmission at the farm level.