

How does weather influence transmission of *E. coli* O157:H7 from animal operations to produce fields?

Summary

Animal operations adjacent to land used for fresh produce production are a known risk for transmission of *E. coli* O157:H7, and particularly cattle operations have been suspected as the contaminating source during outbreaks. Weather has been suggested, but not proven, to influence the transmission of foodborne pathogens to the wider environment surrounding cattle operations. The goal of this study is to assess how specific weather conditions influence transmission of *E. coli* O157:H7 from animal operations to adjacent lands, and then develop a weather-based risk assessment model of *E. coli* O157:H7 transmission for field proximity to animal operations. This project will result in critical industry guidance about weather factors to account for environmental assessments during the pre-harvest stage of production for farms near cattle operations.

Objectives

We hypothesize that local weather conditions can be used to estimate the distance and direction that *E. coli* O157:H7 will be transmitted from an animal operation to surrounding fields. We also hypothesize that understanding these transmission dynamics due to weather can be used to develop effective risk assessment models and guidance for industry to maximize identification of high-risk fields adjacent to animal operations.

1. Identify normal and extreme weather events associated with an increased risk of *E. coli* O157:H7 transmission from a cattle feedlot to the surrounding environment.
2. Develop risk assessment models based on field proximity to animal operations and *E. coli* O157:H7 transmission via weather.

Methods

At the USDA's Meat Animal Research Center (MARC), a cattle feedlot with 6,000 head of cattle (**Figure 1**), sample collection plots (n=24) will be placed at varying distances (100–1,500 meters) around the feedlot (**Figure 2**). Each plot (**Figure 3**) will consist of two sets of soil, water, air, and surrogate plant surfaces and will be sampled every 2 weeks from May to September for 2 years (n=20). Additional sampling will be conducted before and after extreme weather events. Cattle and wildlife fecal samples will be collected to identify potential strain transmission to sampling plots. Collected weather data will be utilized to develop a generalized linear mixed model to identify weather factors most likely to result in *E. coli* O157:H7 transmission from cattle feedlots to produce fields.

Results to Date

The study site for this project is the USDA MARC feedlot, which has been restricted in activities during the recent federal government reorganization. Therefore, we have not been able to access the site to begin conducting the study. However, we have recruited and hired the postdoctoral researcher who will conduct the research, and all sampling sites have been established across the property of the USDA MARC (**Figure 2**). All the sampling sites have been designed, organized, and material lists generated for immediate construction upon clearance from the USDA. We are currently working on alternative methods to access the facility and sample collection in order to conduct the study at MARC.

Benefits to the Industry

Objective 1 will demonstrate how weather and severe weather events affect transmission dynamics of *E. coli* O157:H7 from a cattle feedlot to adjacent fields. Additionally, it will provide an understanding of how each weather factor on its own, and combined, contributes to transmission distance, direction, and overall pathogen distribution across an area near an animal operation. Objective 2 will provide risk assessment and predictive models for the transmission of *E. coli* O157:H7 from animal operations to adjacent fields. These risk assessment models and industry guidance will be based on general weather conditions impact on pathogen transmission dynamics for application in any growing region. Overall, this study will provide industry guidance about how to assess weather patterns for pathogen monitoring in fields adjacent to animal operations.

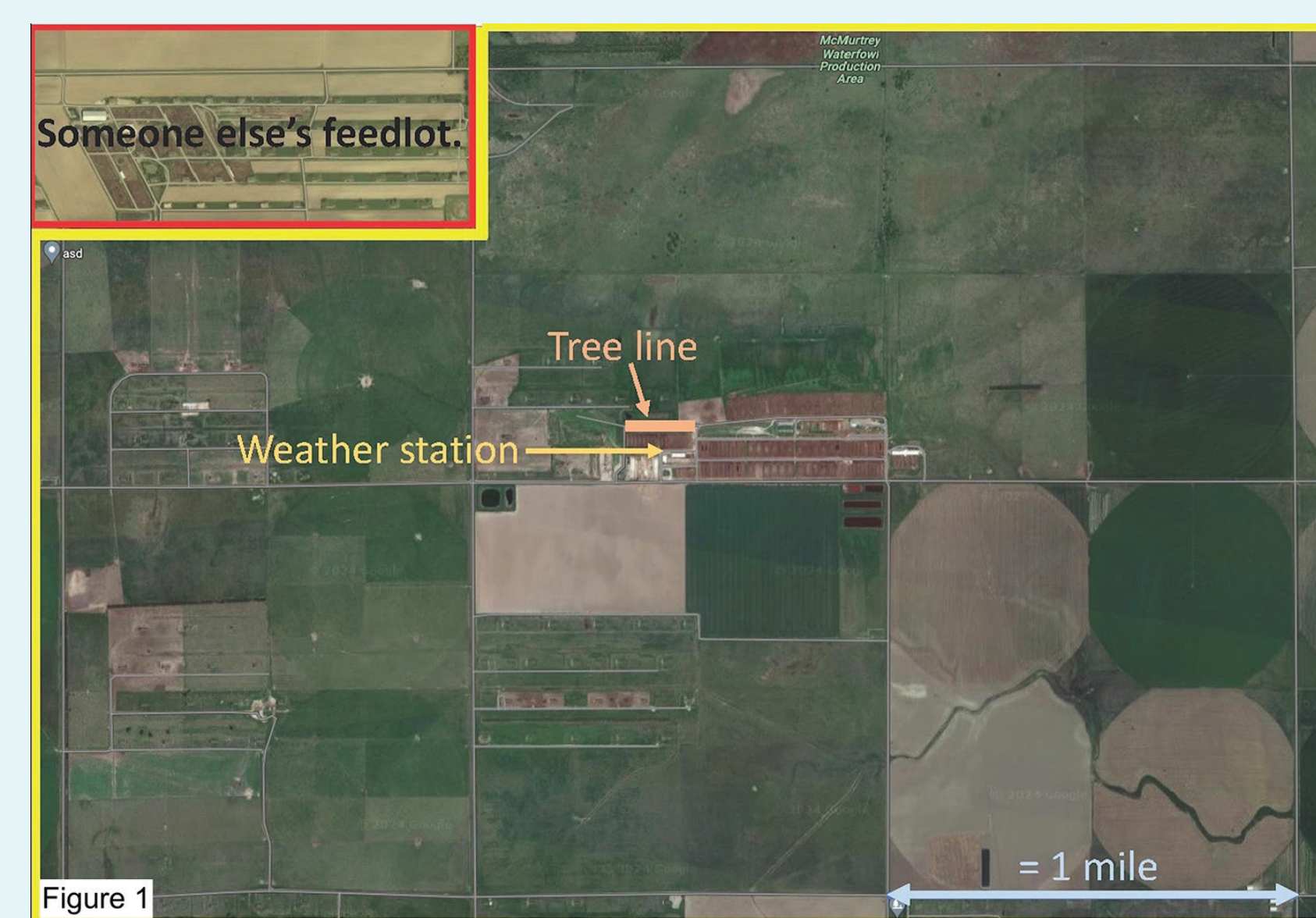


Figure 1: Aerial view of USDA Meat Animal Research Center site



Figure 2: Sample collection plot placement around the MARC feedlot

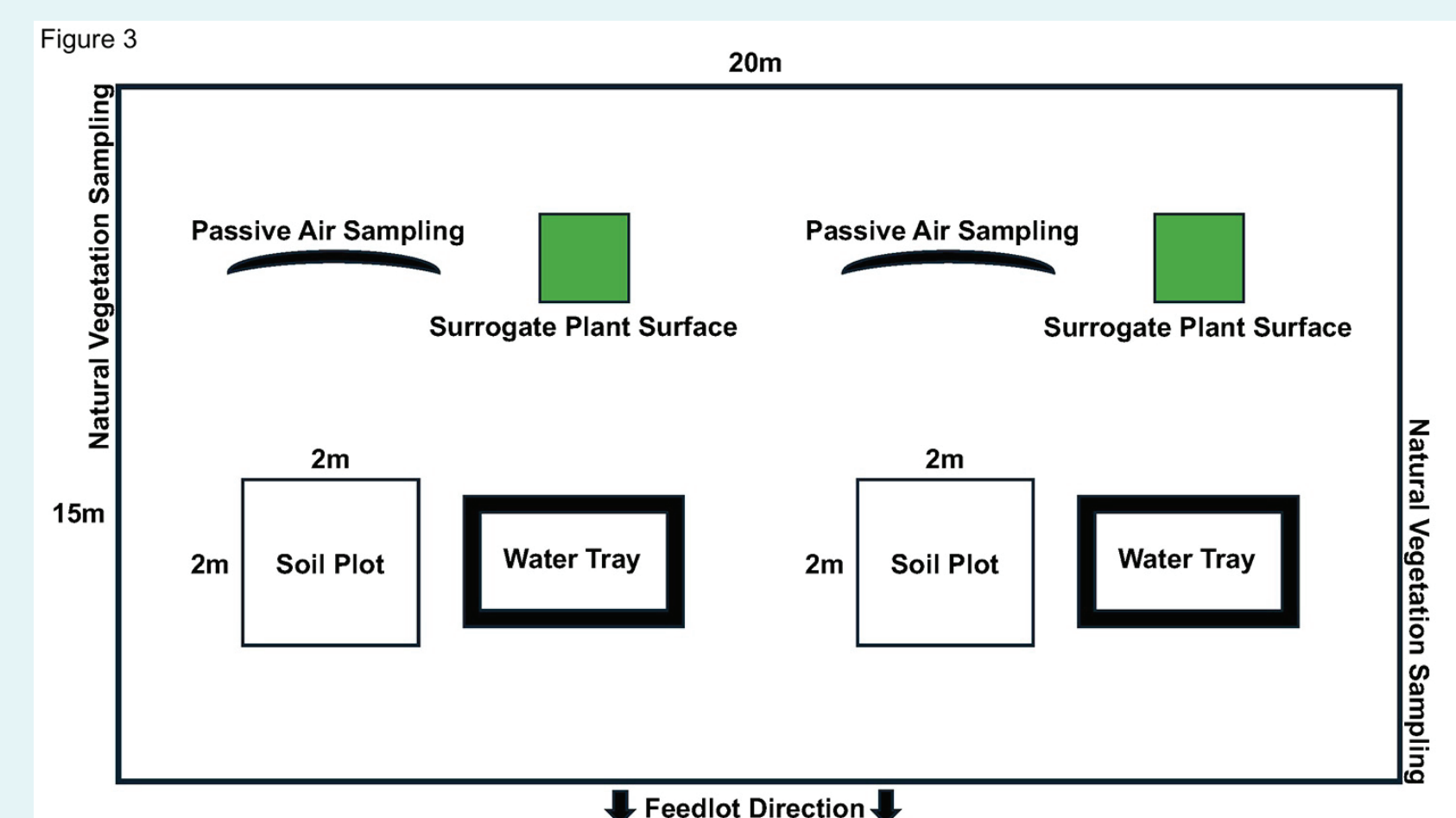


Figure 3: Schematic of sample collection in each plot



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