



# Elevated Tropospheric Ozone Impacts on Soybean Production in the United States from 1985 to 2015

Sharmin Akter<sup>[1]</sup>, Caitlyn Cushman<sup>[2]</sup>, Anne Keary<sup>[2]</sup>, Thomas Pauly<sup>[2]</sup>, Kristina Wagstrom<sup>[2]</sup>

Department of Civil and Environmental Engineering<sup>[1]</sup>, Department of Chemical and Biomolecular Engineering<sup>[2]</sup>

University of Connecticut, Storrs, Connecticut

## INTRODUCTION

### Ground-level Ozone

- One of the hazardous air pollutants
- Damages crop yield quality and quantity, plant growth, and photosynthesis



Credit: Fitzgerald Booker, USDA-ARS Plant Science Research Unit, North Carolina State University

Soybean is the 4<sup>th</sup> most important seed crop globally. Damages due to ozone on soybean plants<sup>[1]</sup>

## OBJECTIVES

Due to the increase in ozone concentration,

1. To determine the soybean yield loss and economic loss from 1985 to 2015 in the United States
2. To estimate the soybean yield loss according to several states from 1985 to 2015

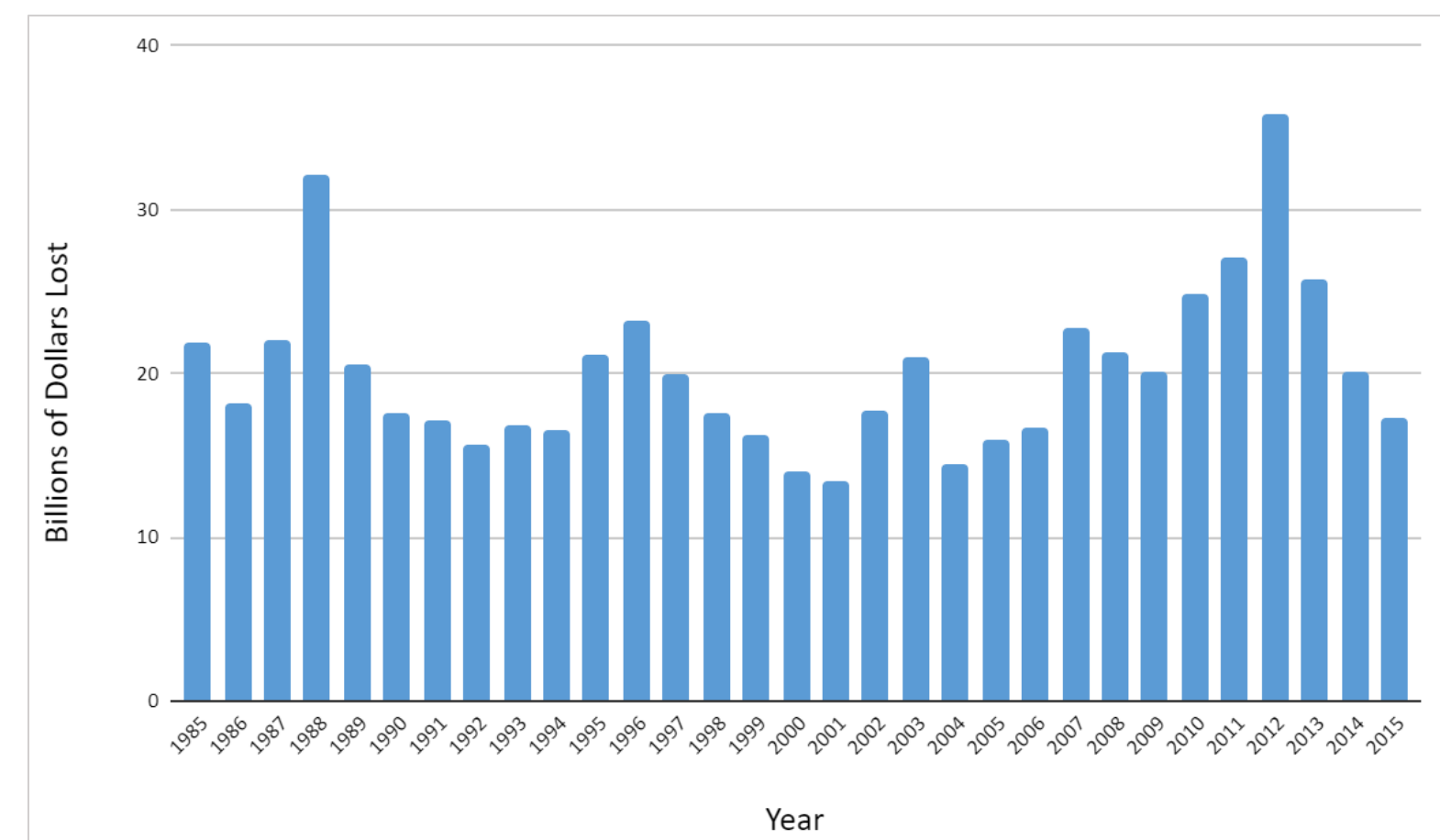
## METHODOLOGY

Annual averaged (daily maximum 8-hr) ground-level ozone at the county level from Land Use Regression (LUR) models

National, county-level soybean production from the United States Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS)

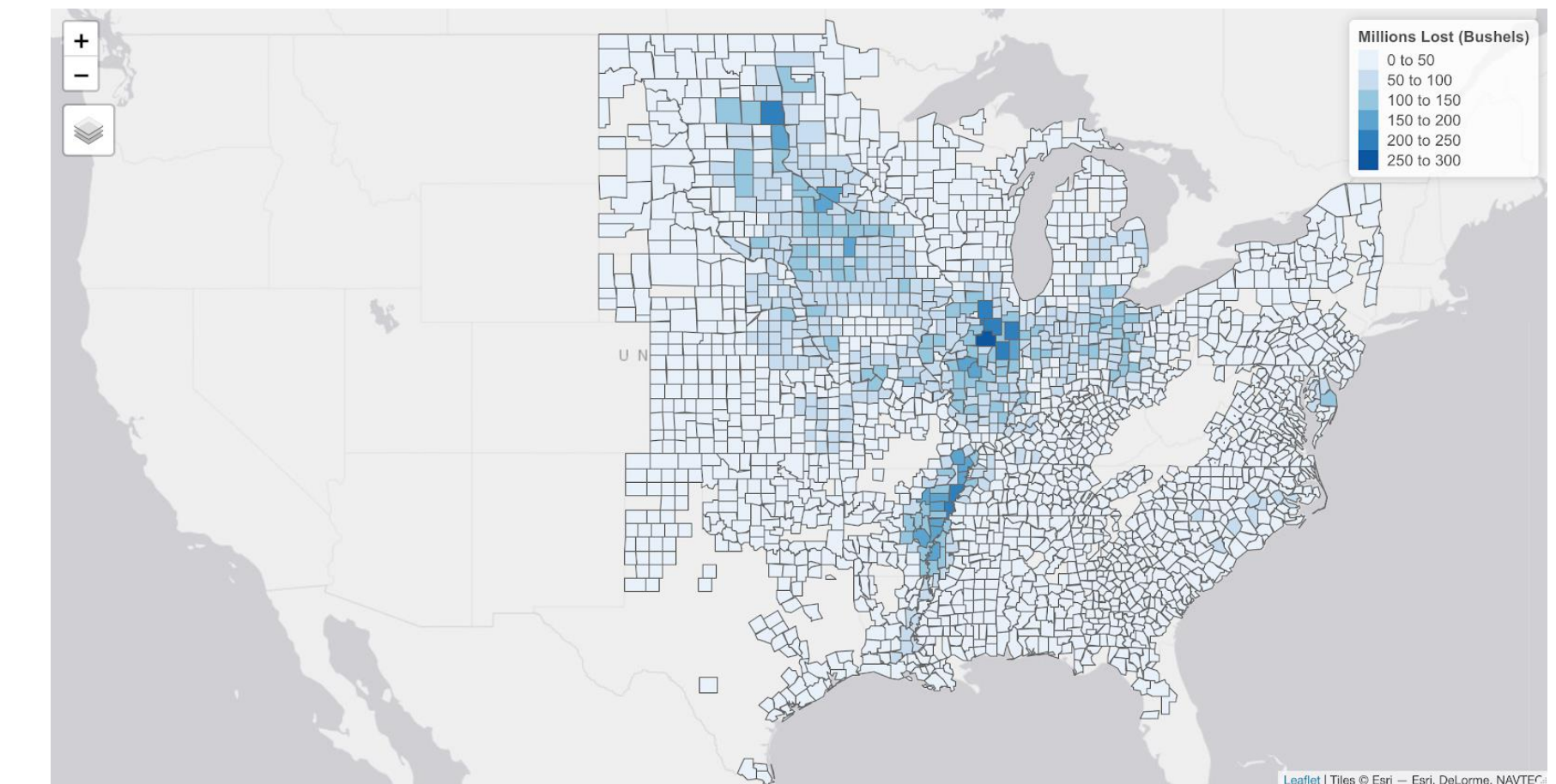
## RESULTS

(a)



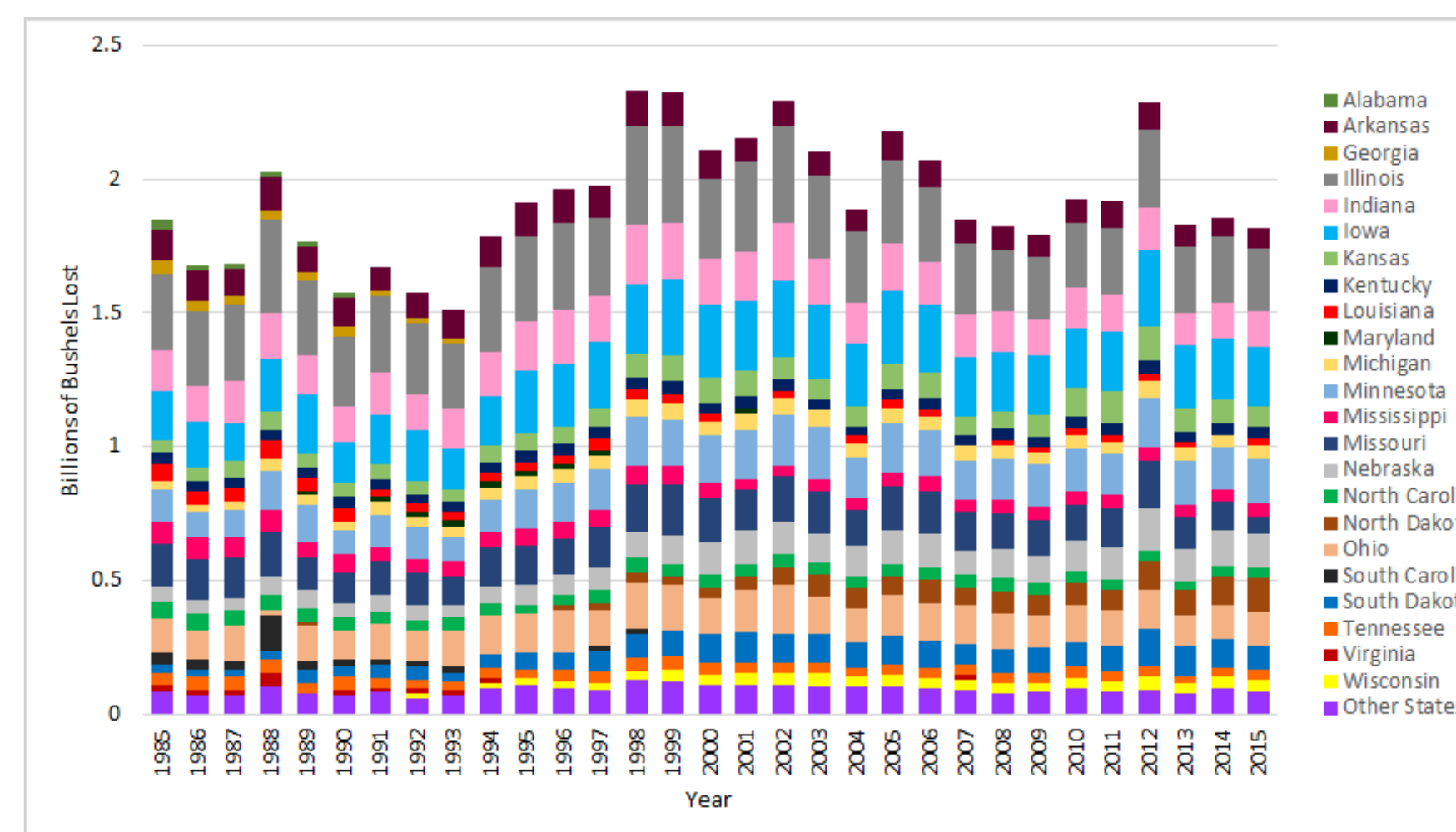
(a) Total billions of dollars lost in the US for the years 1985 through 2015

(b)



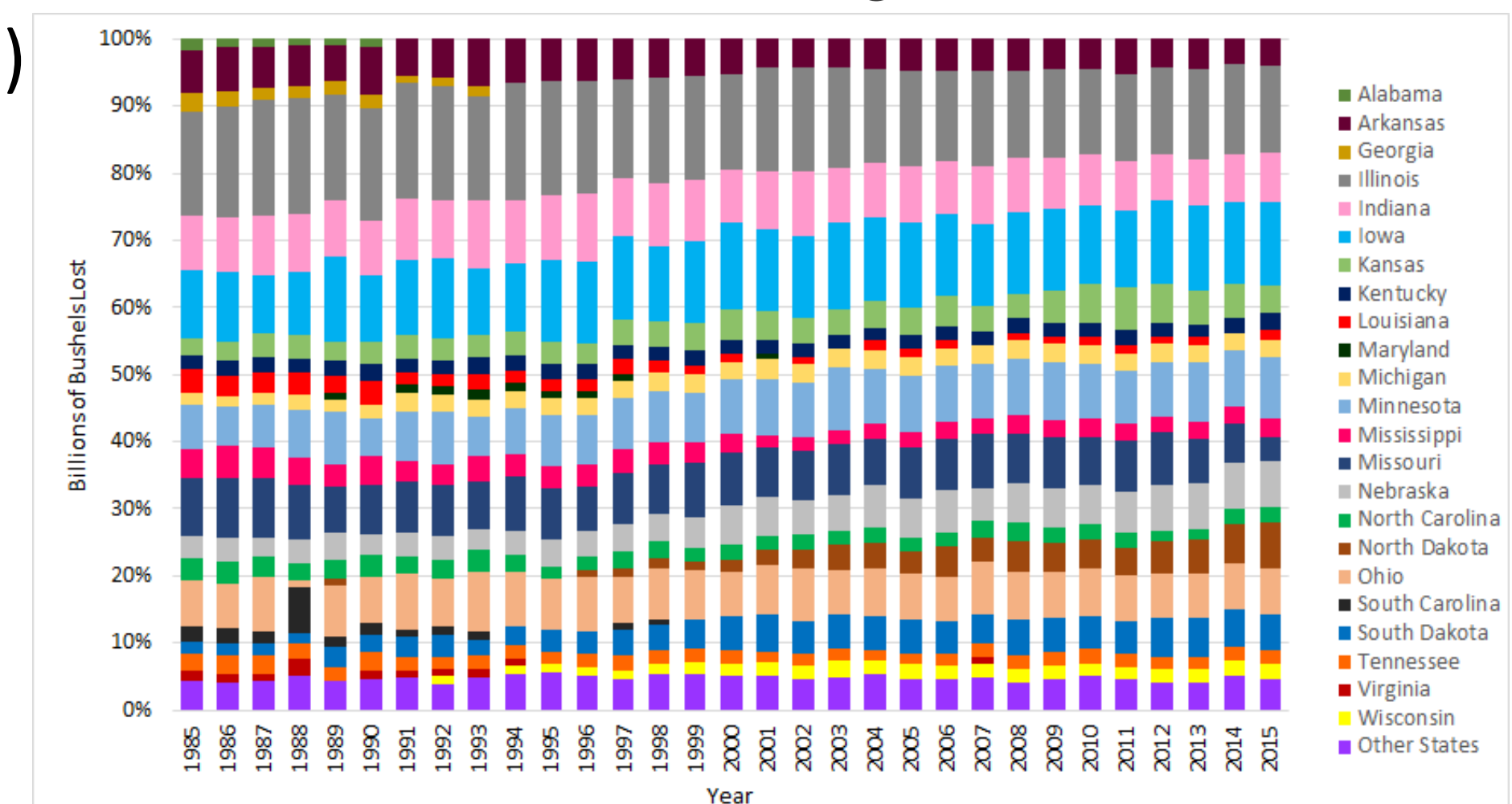
(b) Total millions of bushels of soybeans lost from 1985 through 2015

(c)



(c) Billions of bushels lost in the US from 1985 through 2015 based on several states

(d)



(d) Percentage of total bushel loss in the US from 1985 through 2015 based on several states

## CONCLUSIONS

- More than 35 billion dollars were lost in 2012 alone due to ozone exposure on soybeans
- Mid US states such as Illinois, Iowa, Minnesota, and Missouri experienced higher soybean loss and economic loss due to higher exposures to ozone during 1985-2015

## REFERENCES

- [1]. National Aeronautics and Space Administration, <https://www.nasa.gov/topics/earth/features/soybeans.html>. September 22, 2022