

Jeri D. Barak
University of Wisconsin - Madison
Department of Plant Pathology



Insights into the 2018 Shiga-toxin producing *E. coli* outbreaks with Romaine lettuce



Anatomy of my talk

- Produce consumption in the US
- Diverse commodities associated with STECs
- Deep dive into recent STEC multi-state produce outbreak
 - Spring 2018
 - Fall 2018
- Risk factor: irrigation water

60% of fresh vegetable consumption: potatoes, tomatoes, onion, all lettuce, bell peppers

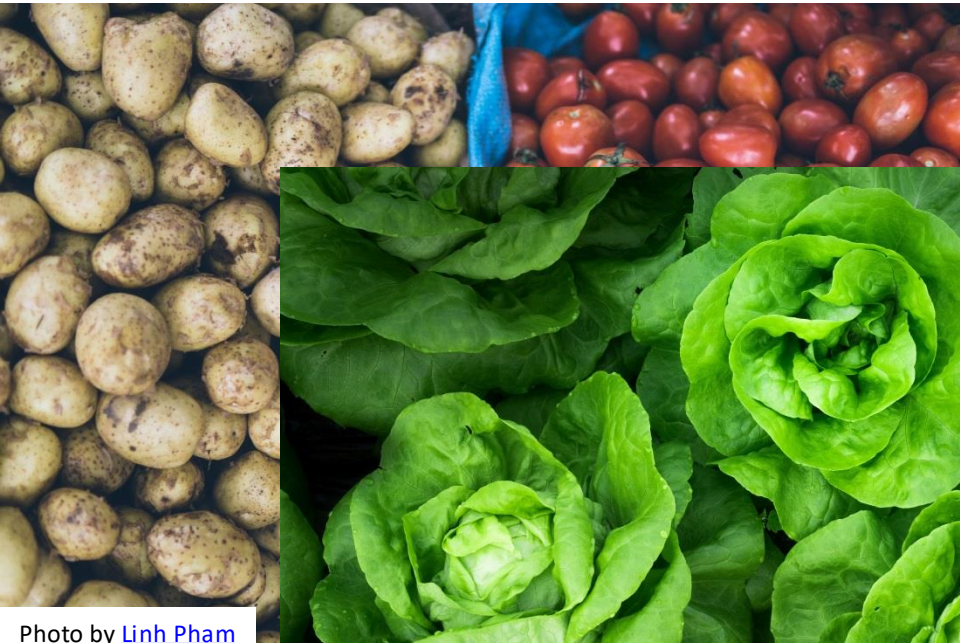


Photo by [Linh Pham](#)



Photo by Damien Kuhn



Photo by [Davor Nisevic](#)

STEC outbreaks associated with produce

2018

Romaine



Photo by [Natalie Walters](#)



2012

Spinach

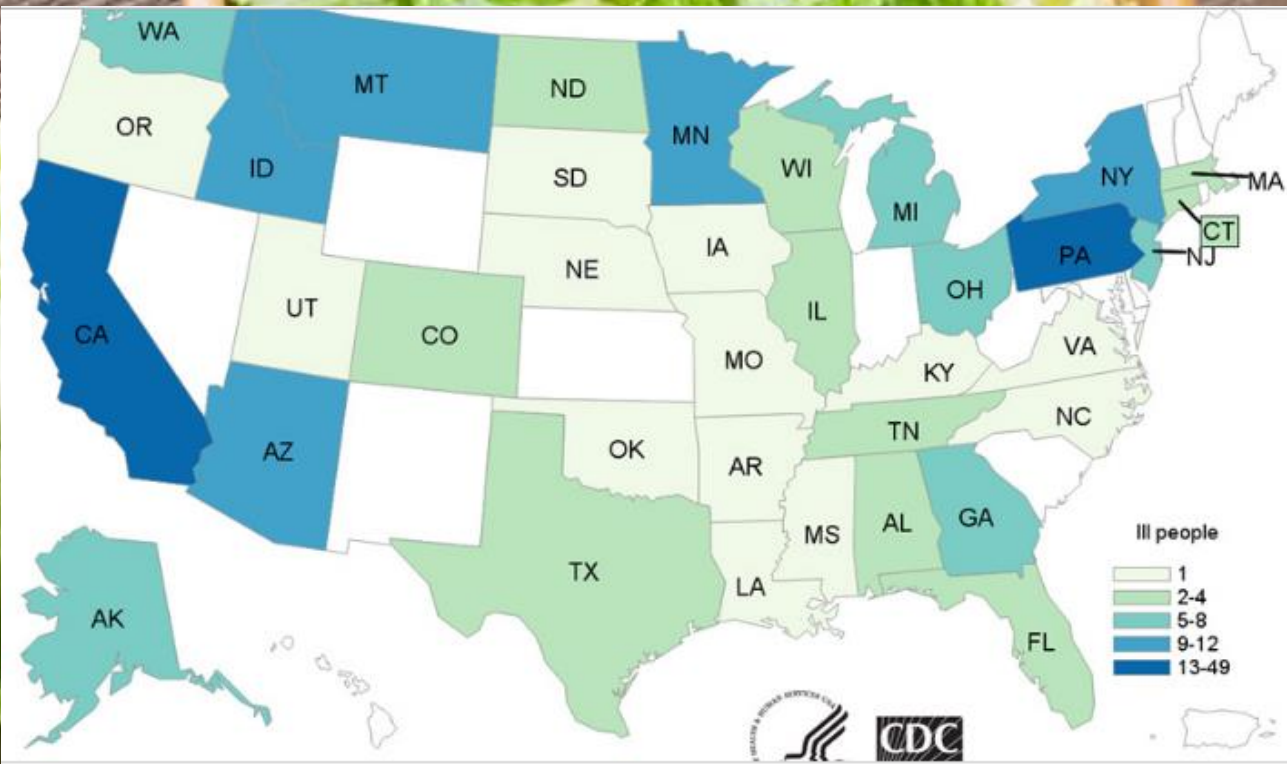
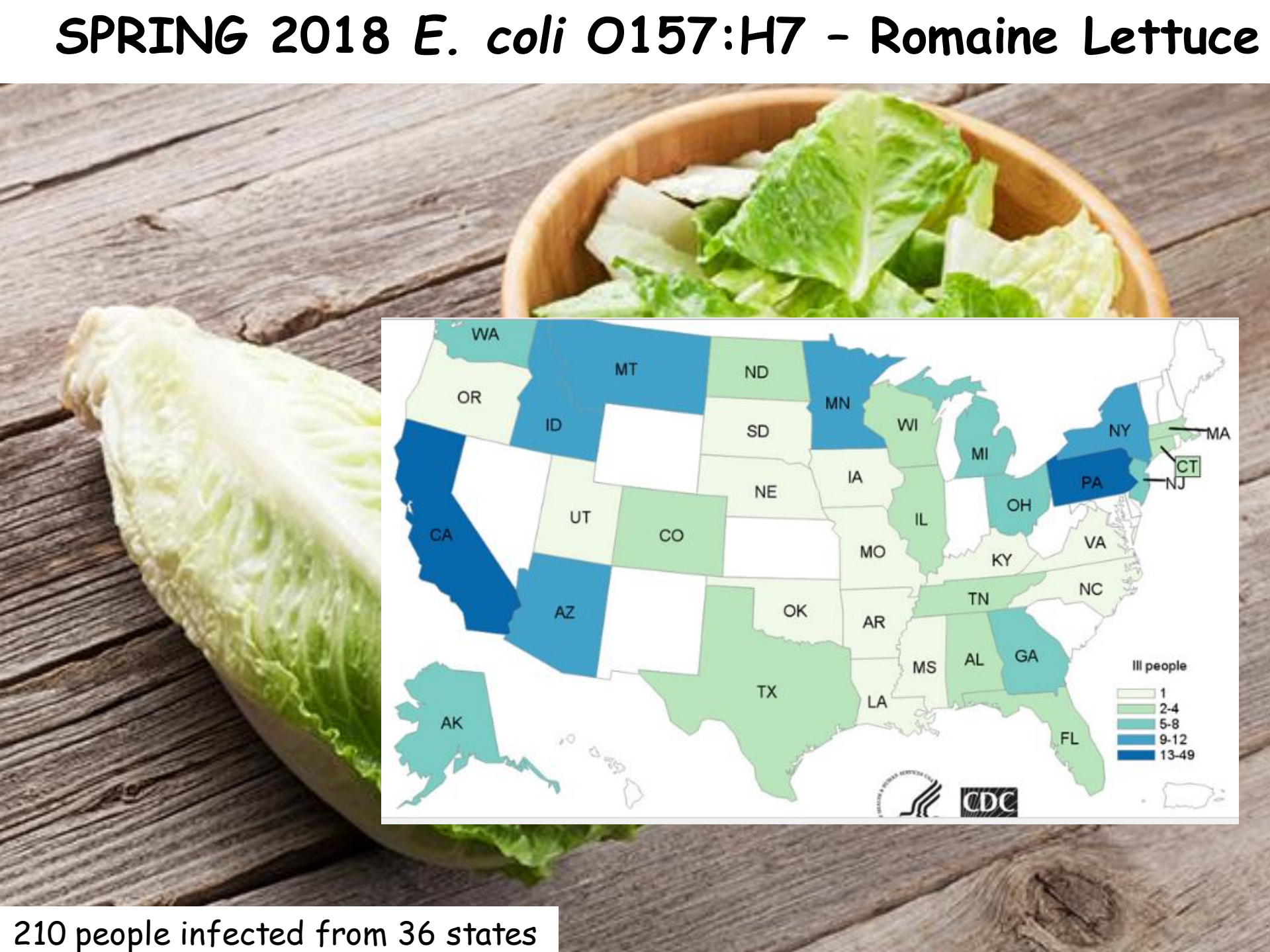


Photo by [Devivahya](#)

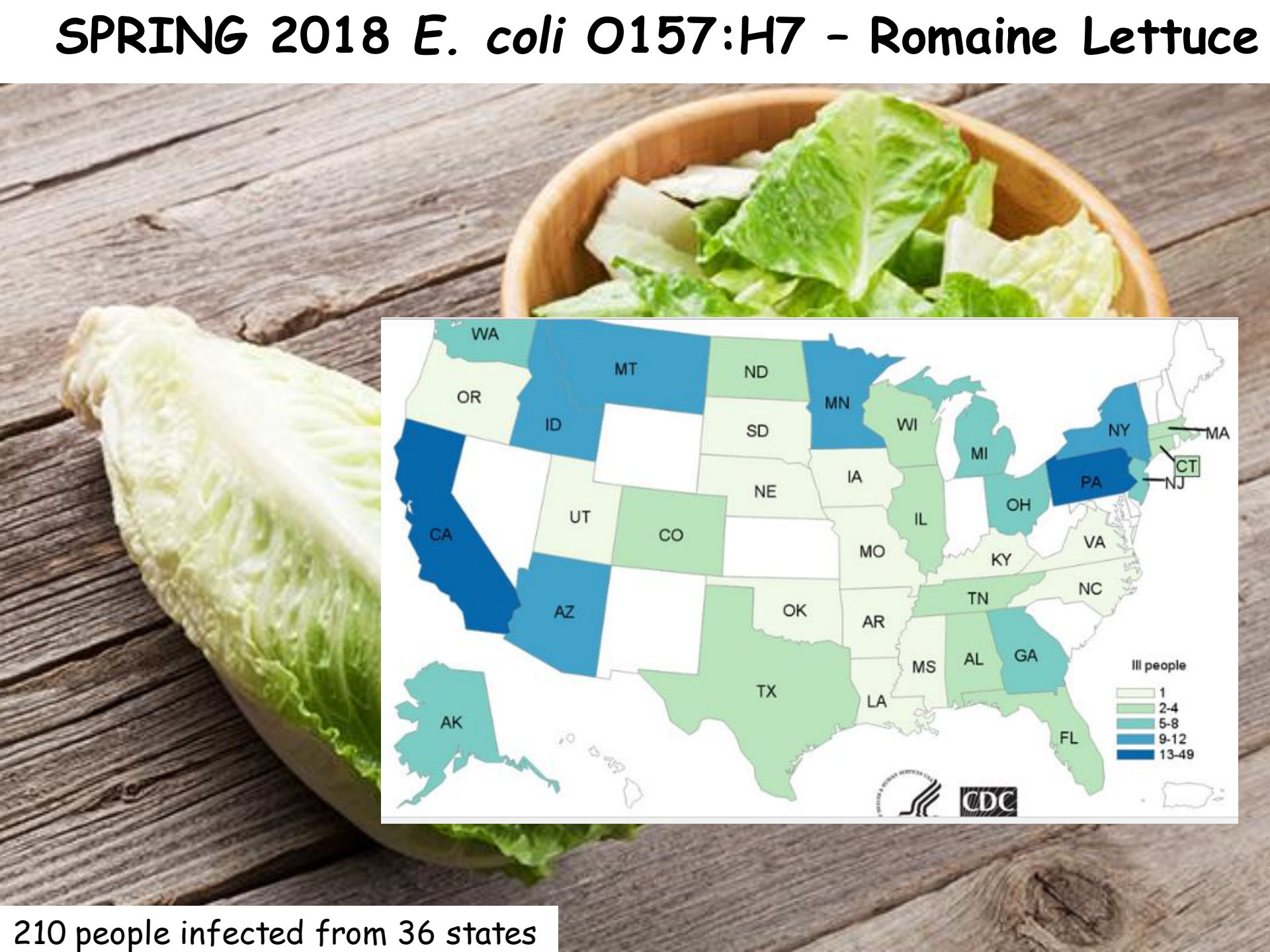


Photo by [chiara conti](#)

SPRING 2018 *E. coli* O157:H7 - Romaine Lettuce



210 people infected from 36 states

[illegible]

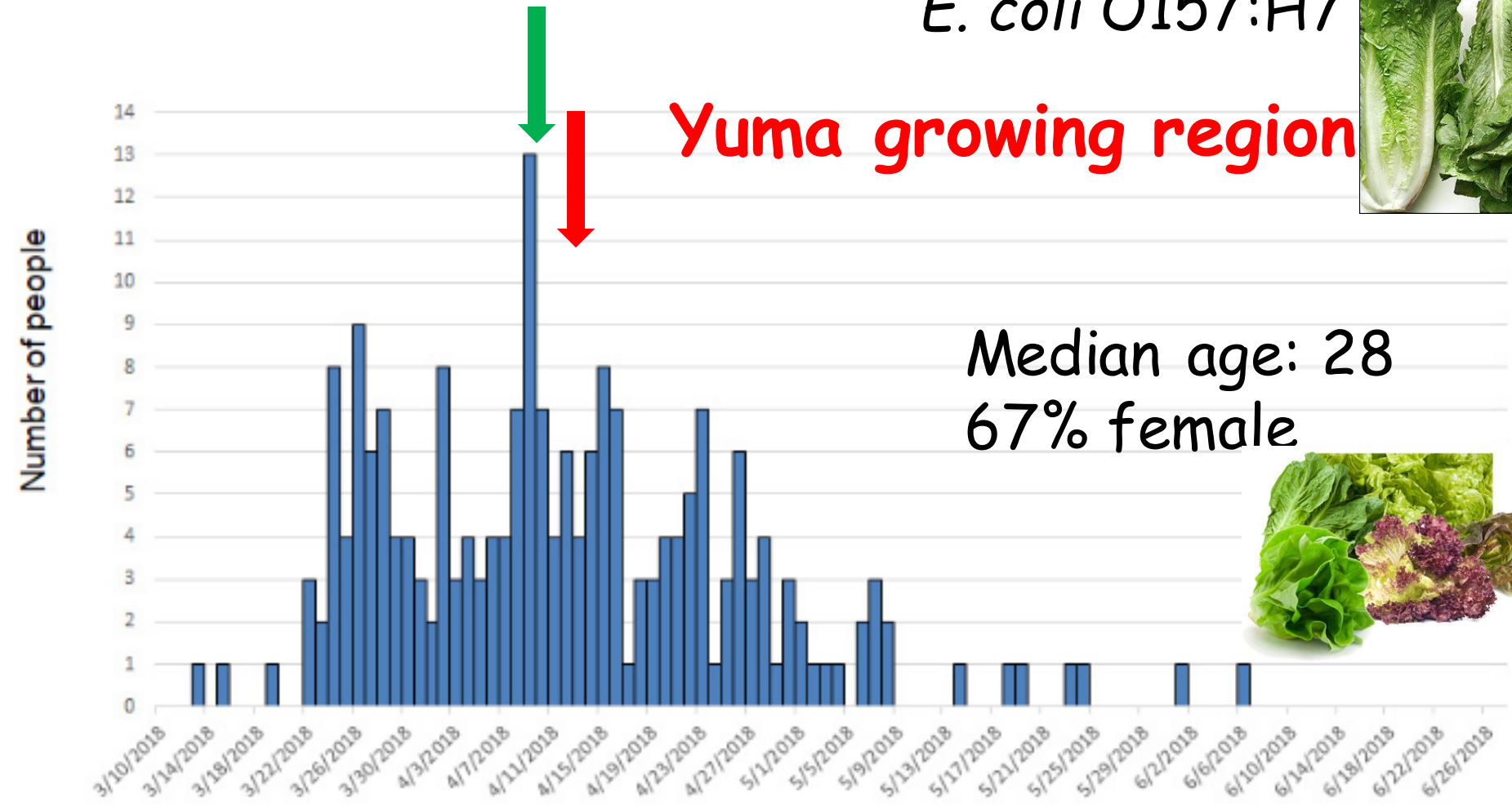
People infected with outbreak strain by date of illness onset

E. coli O157:H7



Yuma growing region

Median age: 28
67% female






Salinas, CA — April - November

Yuma, AZ — November - March

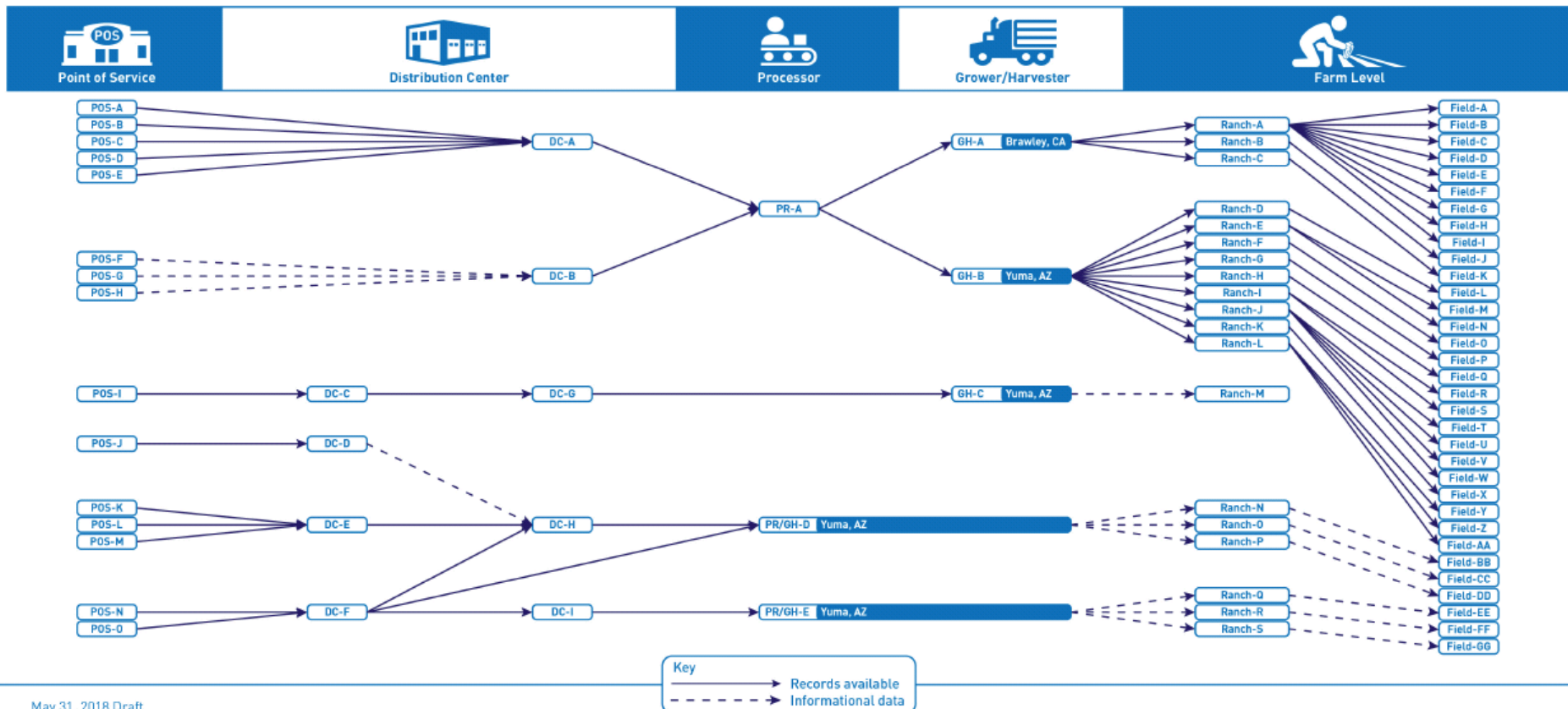
Loreto, Baja



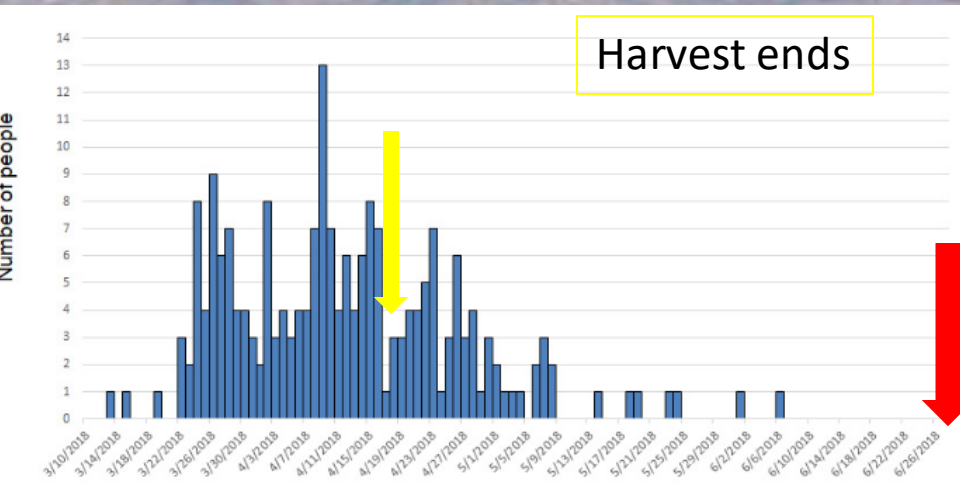
Yuma growing region (Yuma County, AZ and Imperial County, CA)
During the vegetable-growing season
Supplies 90% leafy veggies to US (Nov - Mar)
~1,000 trucks ~ 23 million kg products
EVERY DAY

Trace back revealed no single source

E. coli O157:H7 – Romaine – Multi-state Outbreak Master Traceback Diagram







Lettuce production in the desert
utilize sprinklers during the germination and
stand establishment phase
followed by furrow irrigation.





**WHERE DOES THE WATER
COME FROM?**

Salinas, CA



Yuma,

Loreto, Baja

Imperial Dam - last dam on the Colorado River

Water is diverted in 3 directions:

Gila Valley, All American Canal, and Mexico



Joe Satran/The Huffington Post



Joe Satran/The H

Farmers submit orders for water to their local irrigation district



Water arrives, about three days later





Joe Satran

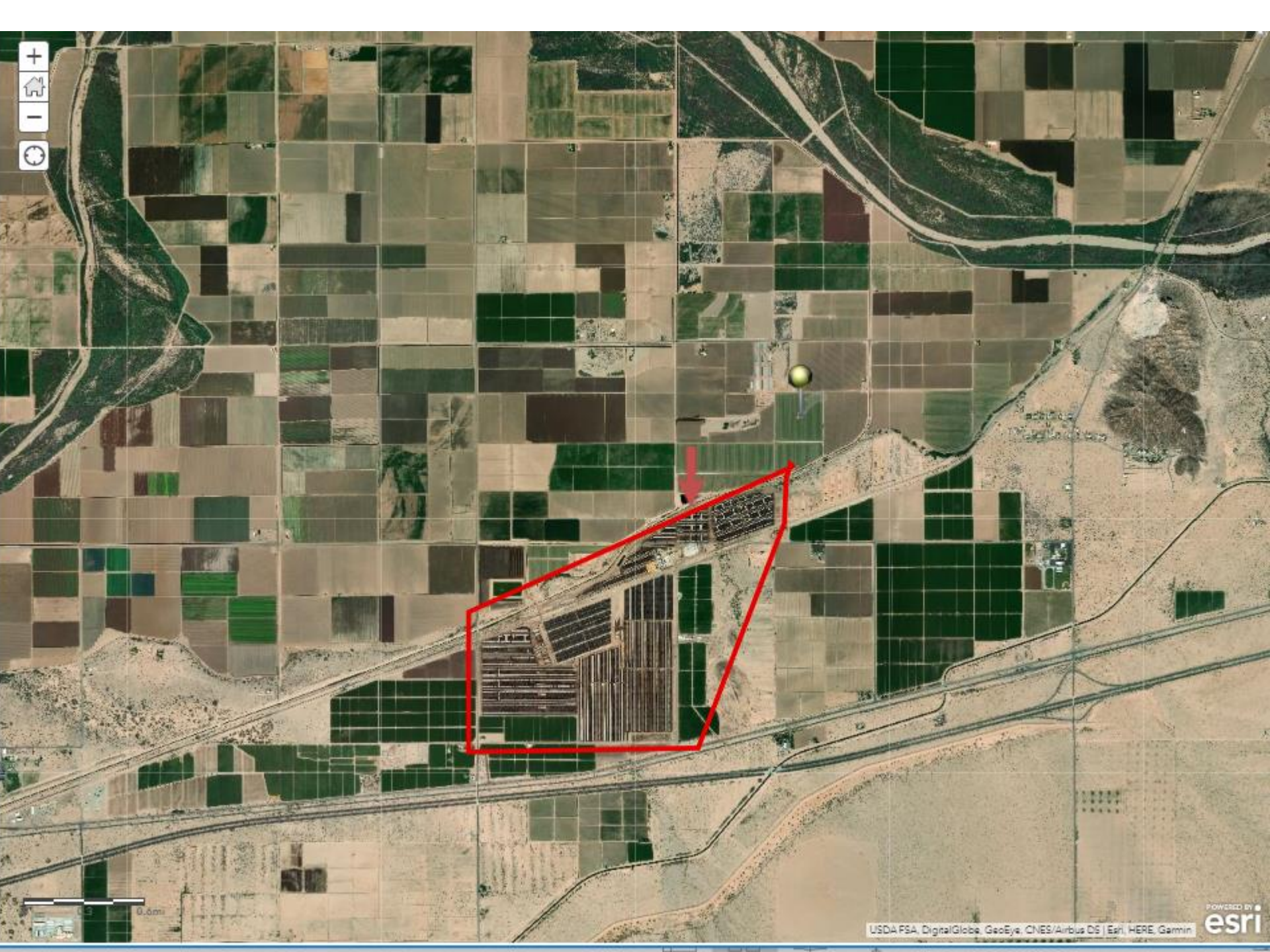


3 samples of irrigation canal water from an irrigation canal in the Welton area of Yuma County contained the outbreak strain



An aerial photograph showing a large-scale agricultural landscape. A prominent irrigation canal, a straight line of water, flows from the top center towards the bottom right. To the left of the canal, the land is divided into a grid of rectangular agricultural fields, some of which are lush green while others are brown. To the right of the canal, the terrain is more arid and less structured. In the bottom foreground, a larger body of water, possibly a reservoir or a slow-moving section of the canal, reflects the bright sun. The overall scene illustrates the infrastructure of large-scale agriculture in an arid region.

How could an irrigation canal get contaminated?



0.6mi



Can hold in excess of 100,000 head of cattle at any one time

100,000 cattle can produce as much waste as ~1.4 million households



An aerial photograph showing a vast agricultural landscape with a patchwork of green and brown fields. In the foreground, there are some industrial or construction structures. In the background, a city is visible, followed by a range of mountains under a clear sky.

Industry stakeholders created: Leafy Greens Food Safety Task Force

- Review regional growing practices



Don't eat any romaine lettuce until further notice



November 20, 2018 - FDA issued public
health advisory



Image by Bettina Elias Siegel

Industry volunteer withdraw produce from market

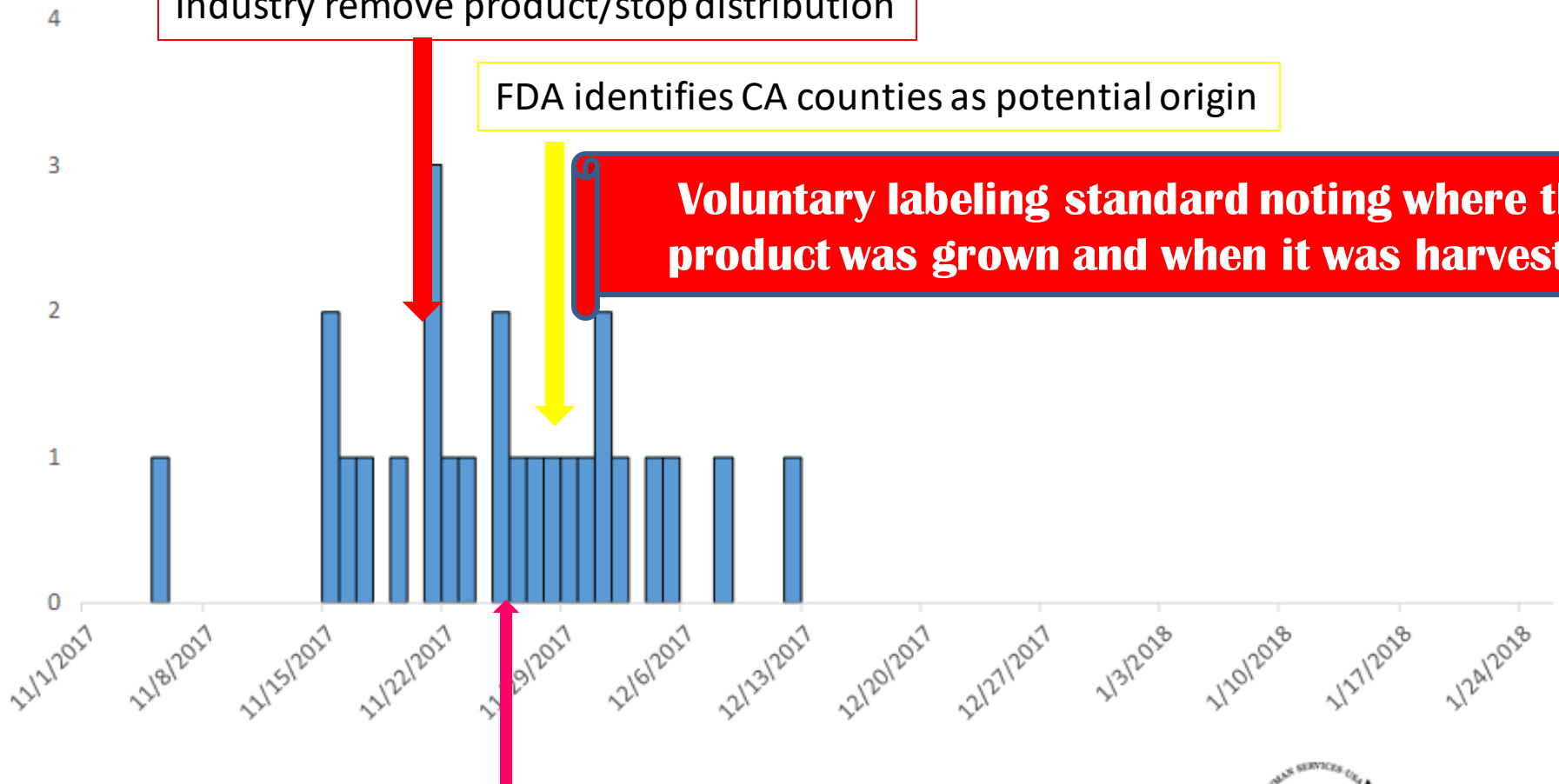
Withhold distribution of romaine lettuce

People infected with outbreak strain by date of illness onset

FDA romaine lettuce recall
Industry remove product/stop distribution

FDA identifies CA counties as potential origin

Voluntary labeling standard noting where the product was grown and when it was harvested



Romaine allowed to return to market



Salinas Valley, CA (central coast)



- Lettuce 5th largest commodity in CA
 - ~\$2 billion in 2017
- Central coast
 - 100,000 acres of lettuce valued at \$1.5 billion

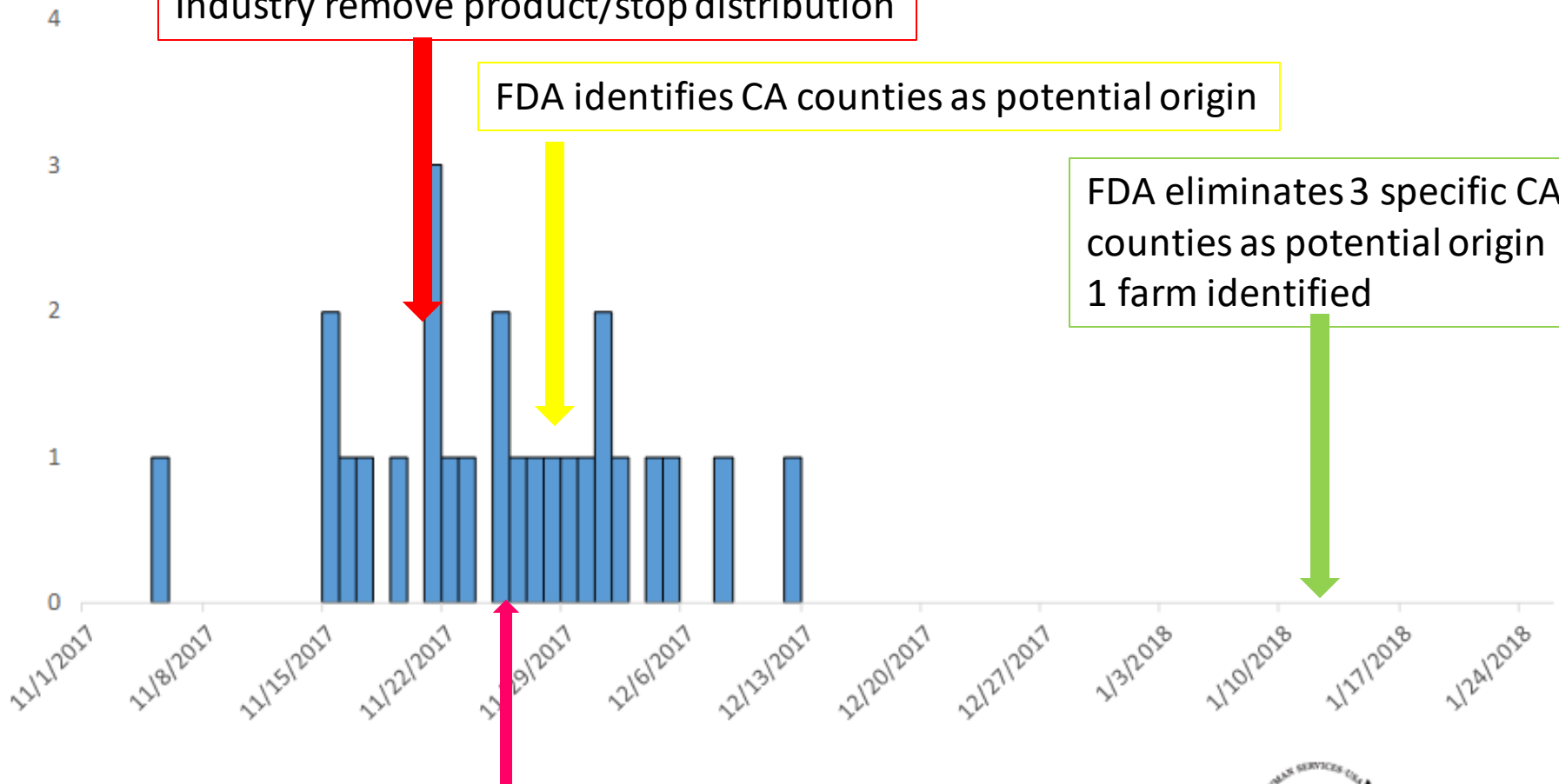


People infected with outbreak strain by date of illness onset

FDA romaine lettuce recall
Industry remove product/stop distribution

FDA identifies CA counties as potential origin

FDA eliminates 3 specific CA counties as potential origin
1 farm identified



Romaine allowed to return to market



Isolated outbreak strain from sediment of holding pond

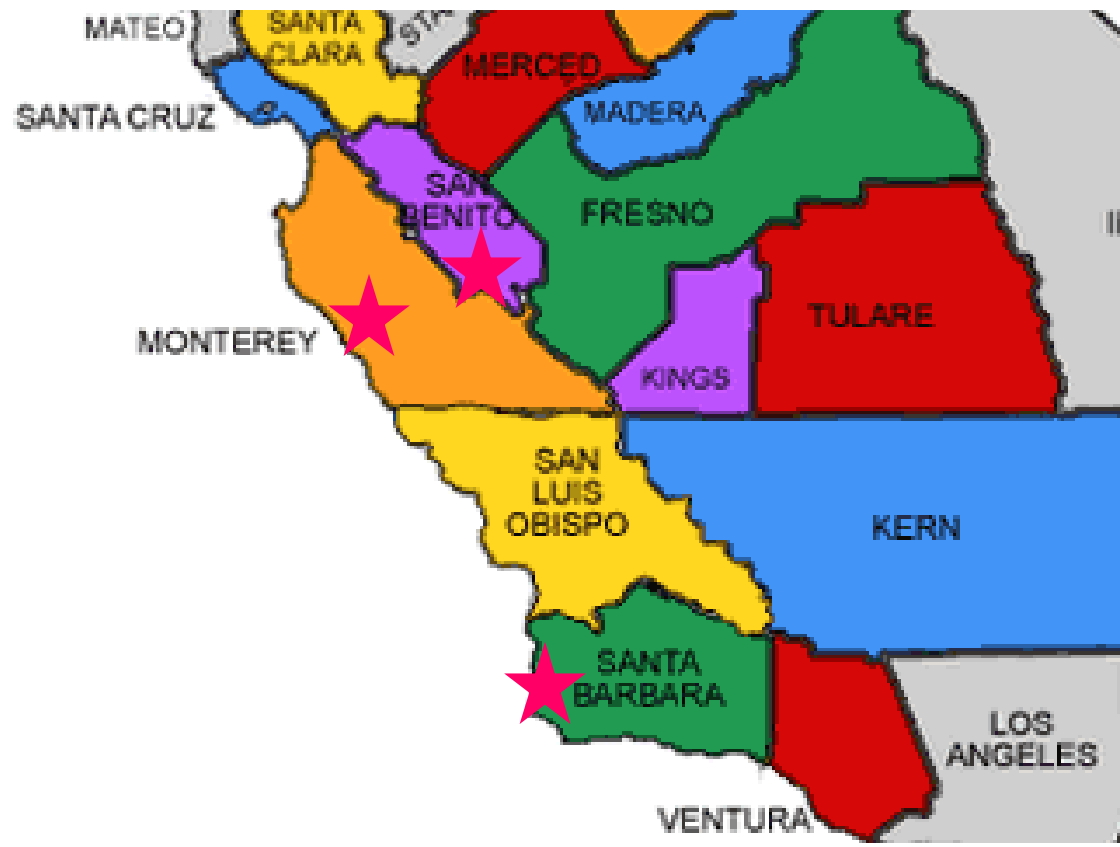


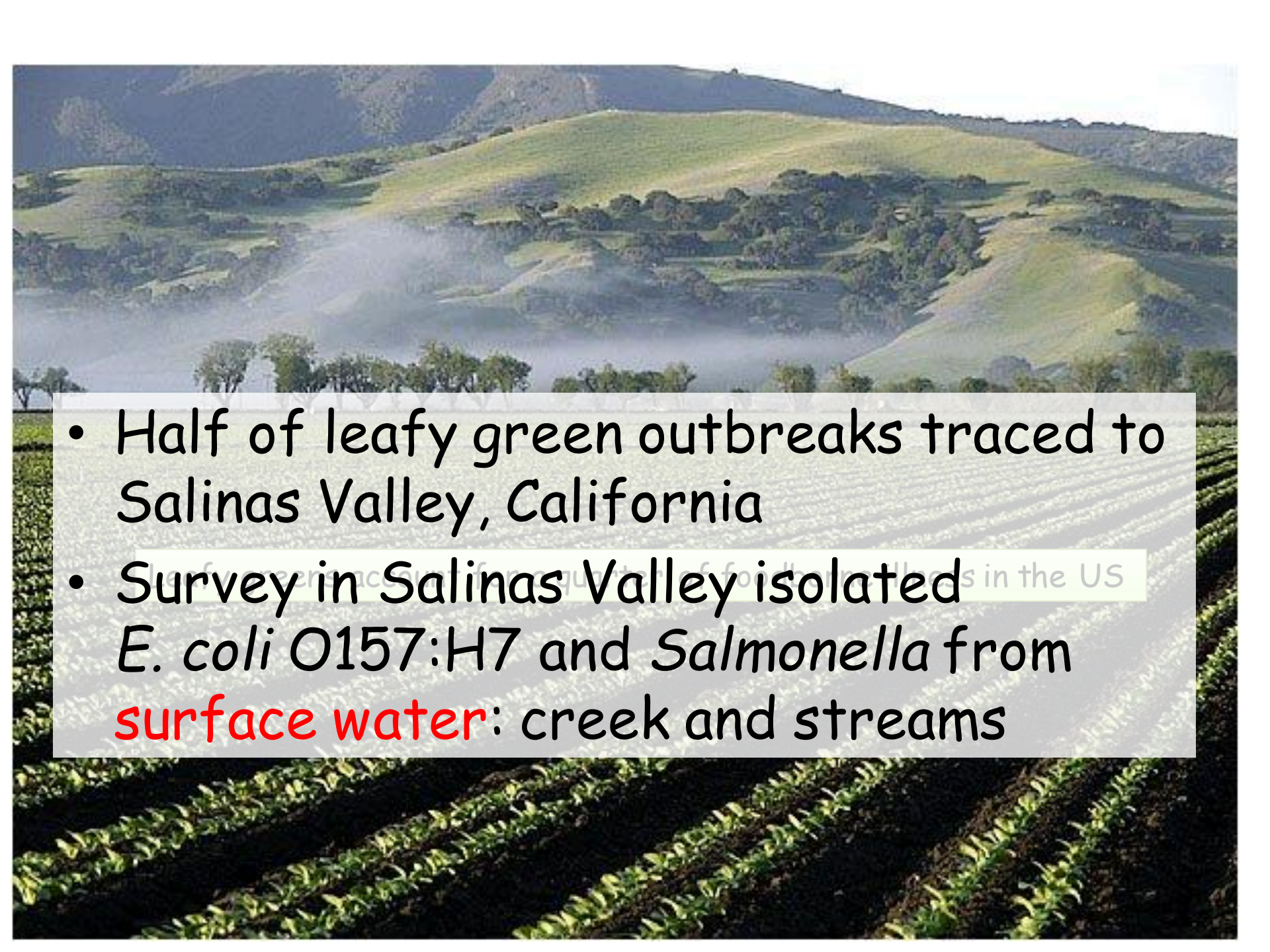


“out of an abundance of caution” recalled red leaf lettuce, green leaf lettuce and cauliflower harvested this year from Nov. 27 - Nov 30



Positive sediment sample from the reservoir doesn't explain how lettuce grown elsewhere was contaminated



- 
- Half of leafy green outbreaks traced to Salinas Valley, California
 - Survey in Salinas Valley isolated *E. coli* O157:H7 and *Salmonella* from **surface water**: creek and streams

Cattle



How do pathogens reach plants?

E. coli O157:H7 more likely where **cattle** were present or following a **rain event**

Leafy greens grow on the Valley floor

Isolated issue?

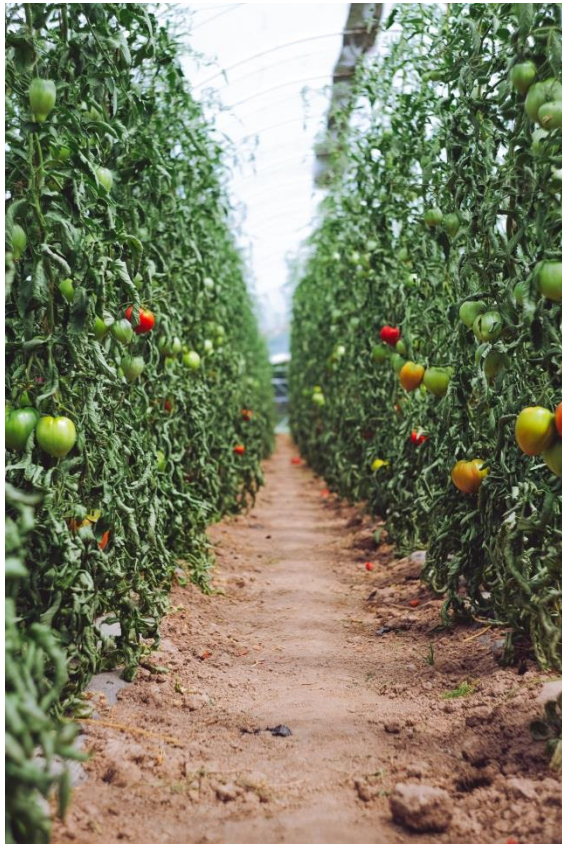


- One strain of *S. enterica* N associated with tomato consumption in 2010
- 2005, SeN outbreak strain near tomato fields; FDA had found SeN in the York River creek in 2009 and 2010
- Sporadic illness continues to occur caused by THIS SeN outbreak strain



Common themes

- Irrigation water
- Animal production near produce production





Questions?