

The potential influence of climate change on produce safety

**Presentation at the Cross-Border Workshop on Adaptation to Climate Change:
Information and Tools for Decision Making**

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**United States Department of Agriculture
Climate Hubs**



The University of Vermont

Produce farms in the Northeastern U.S.



Table 2: Number of farms in 12 Northeastern States growing selected crops, according to the United States Department of Agriculture (USDA) 2012 National Agriculture Census. Northeast states include ME, MA, NH, RI, DE, CT, NY, VT, PA, NJ, MD, and WV.

Crop	Number of farms
Greens (collards, kale, or turnip greens)	1,296
Lettuce	1,572
Melons	6,292
Spinach	475
Tomatoes (field)	44,811

Produce safety

Pathogens of concern

- *Escherichia coli* (*E. coli*)
- *Salmonella enterica*
- *Listeria* (*L. monocytogenes*)

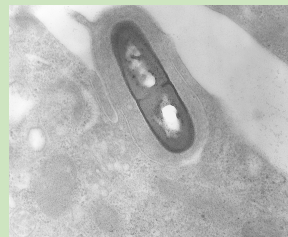
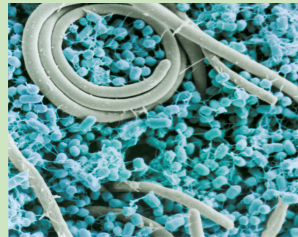


Table 1: Multistate outbreaks associated with leafy greens, melons, and vine fruit

Commodity	Number of multi-state outbreaks (since 2006)	Causal agent (Number of associated outbreaks in parentheses)
Leafy greens (including spinach and lettuce)	7	<i>E. coli</i> (6); <i>Listeria monocytogenes</i> (1)
Cantaloupe	4	<i>Listeria monocytogenes</i> (1); <i>Salmonella</i> (3)
Cucumber	3	<i>Salmonella</i> (3)

Data presented in the Table was retrieved from the CDC, NCEZID, and DFWED (2017).

U.S. regulatory response

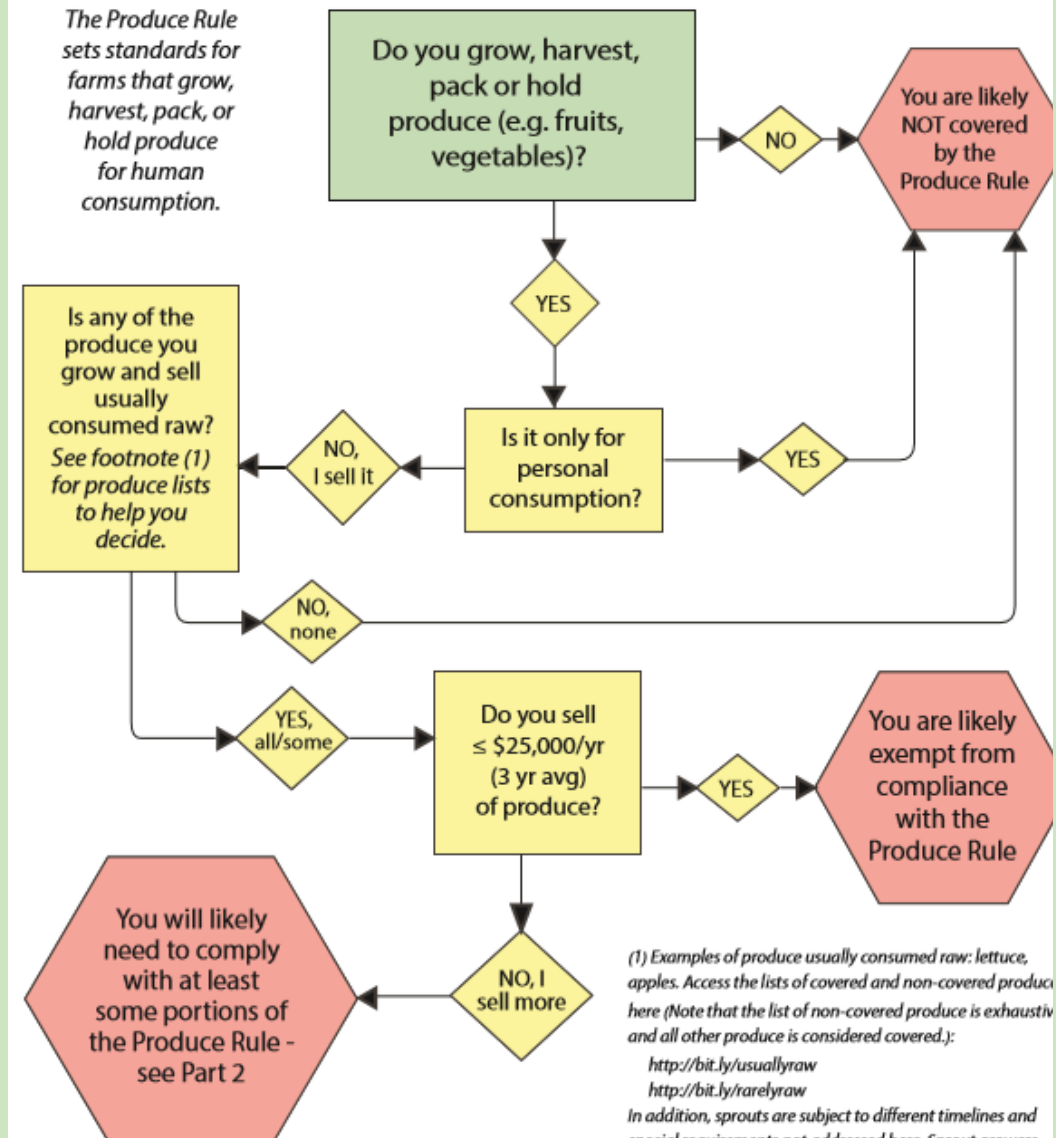
The Food Safety Modernization Act (FSMA)

- **The Produce Safety Rule (PSR)** – final rule issued Nov 27, 2015
- **The Foreign Supplier Verification program (FSVP)** – final rule issued Nov 27, 2015

Flow chart by the National Sustainable Agriculture Coalition:
<https://www.agriculture.ny.gov/FS/general/FSMA-Rule-Flowchart.pdf>

Am I Affected by the FSMA Produce Rule?

The Produce Rule sets standards for farms that grow, harvest, pack, or hold produce for human consumption.



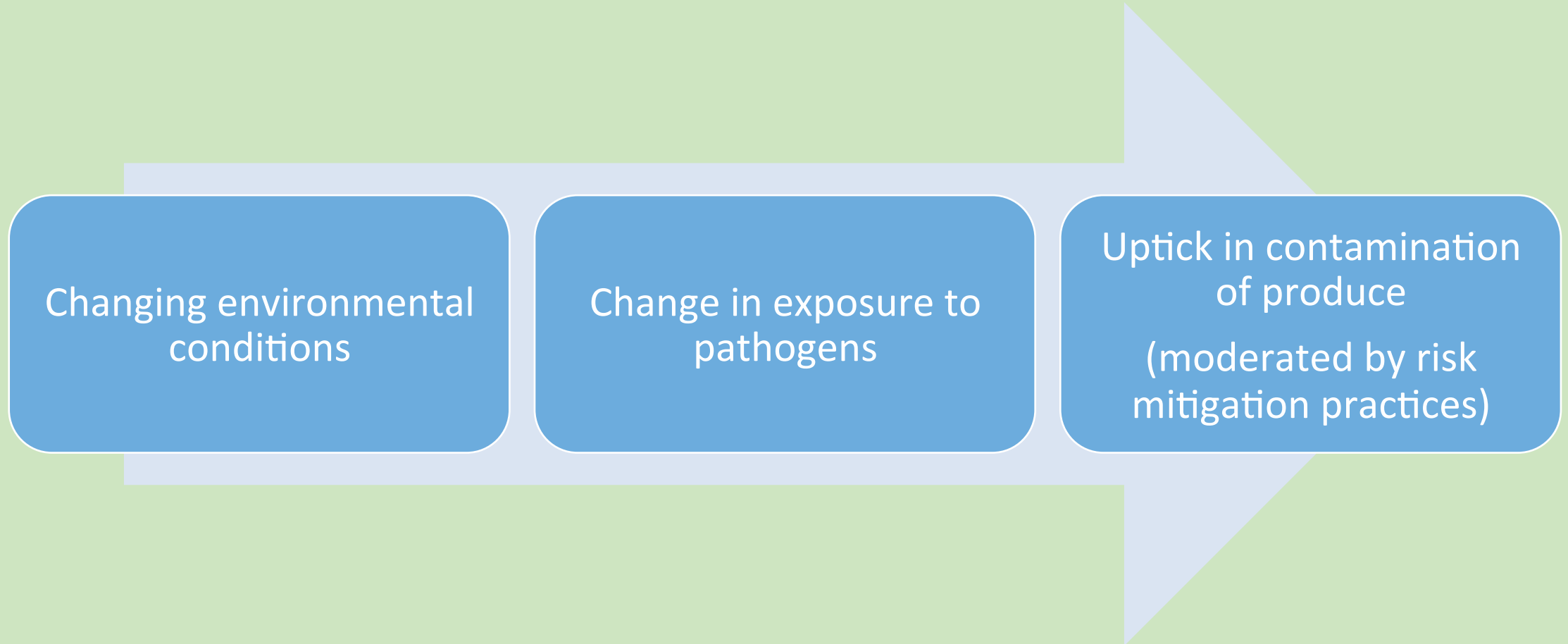
(1) Examples of produce usually consumed raw: lettuce, apples. Access the lists of covered and non-covered produce here (Note that the list of non-covered produce is exhaustive and all other produce is considered covered.):
<http://bit.ly/usuallyraw>
<http://bit.ly/rarelyraw>
In addition, sprouts are subject to different timelines and special requirements not addressed here. Sprout growers should visit the Sprout Safety Alliance for more information http://www.iit.edu/ifsh/sprout_safety

The Produce Safety Rule (PSR)

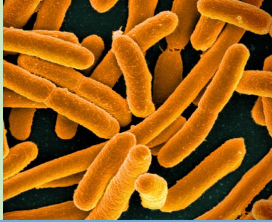
- **Agricultural water** – e. coli thresholds, testing frequency,
- **Biological soil amendments** – wait periods between application of raw manure and harvest, verification of composting processes
- Sprouts
- Domesticated and wild animals
- Worker training, health, and hygiene
- Equipment, tools, and buildings

An FDA overview of the PSR is available at https://www.agriculture.ny.gov/FS/general/FSMA-Produce_at_a_Glance.pdf

What does all this have to do with climate change?

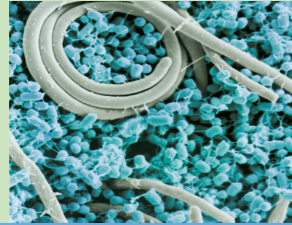


Environmental conditions that allow pathogens to thrive



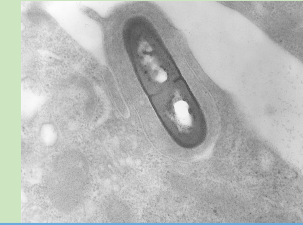
Escherichia coli
(*E. coli*)

- Warm temperatures
- High nutrient availability, low C to N ration of fertilizer
- Low microbial diversity
- Moisture (soil available water storage, slow soil drainage, precipitation)
- Outbreaks peak in summer



Salmonella enterica

- Warm temperatures (incidence increases 5-10% for each one-degree of ambient temperature above 5 degrees C.)
- Moisture (soil available water storage, slow soil drainage, precipitation)
- Outbreaks peak in summer



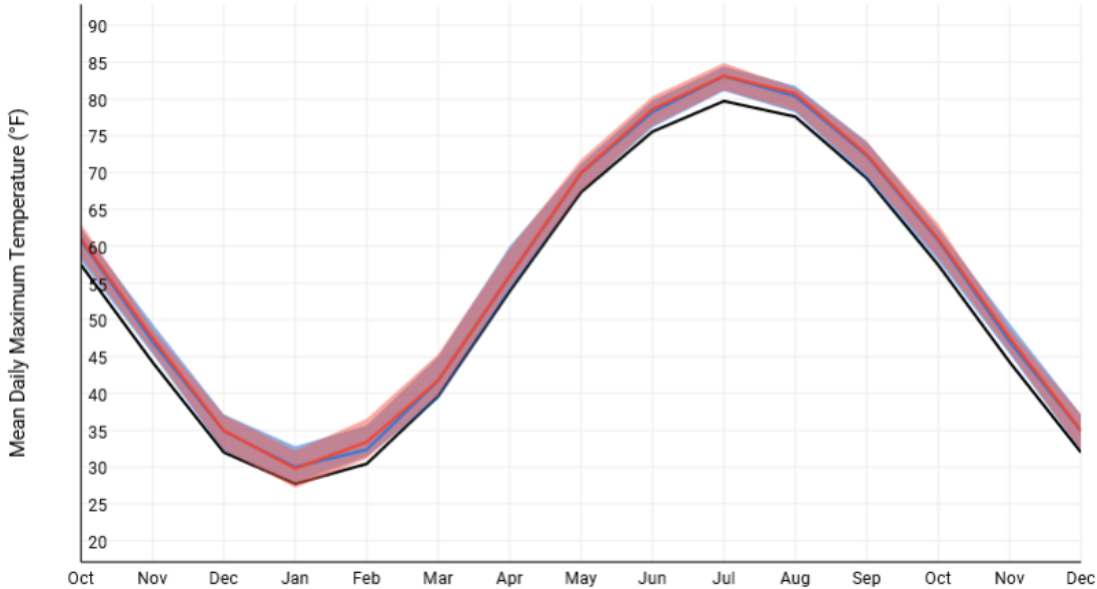
Listeria
(*L. monocytogenes*)

- Survives in cool temperatures, but can survive very hot temperatures as well.
- Moisture (soil available water storage, slow soil drainage, precipitation)
- Outbreaks peak in winter

Figures from the NOAA Climate Resilience Toolkit Climate Explorer: <https://toolkit.climate.gov/climate-explorer2/>

Chart: Addison County
Mean Daily Maximum Temperature

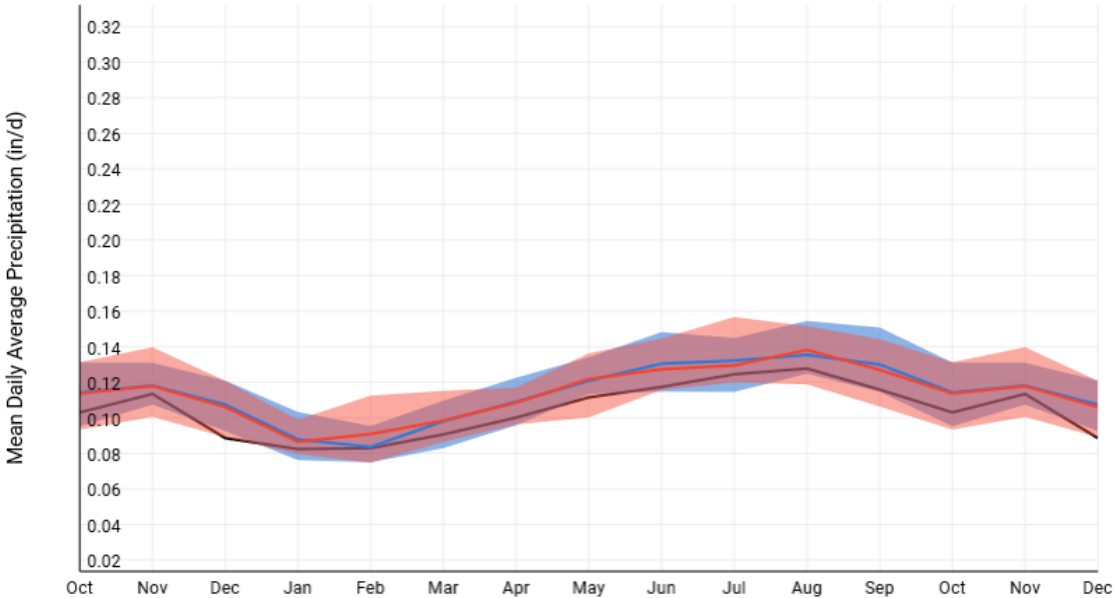
How to read this Image Data



Observations ✓ Lower Emissions ✓ Higher Emissions ✓ Medians ✓

Chart: Addison County
Mean Daily Precipitation

How to read this Image Data



Observations ✓ Lower Emissions ✓ Higher Emissions ✓ Medians ✓

Farmers want to know...

- What do I have to do to comply with FSMA?
- What risks do I actually face NOW?
- What can I do that will lower risk from microbial pathogens on my farm?
- How much is it going to cost?



Community accreditation for produce safety (CAPS)



The evolving research program:

1. Do conditions that mitigate NO₂ also mitigate E. coli populations?
2. Are there regional differences in E. coli survivorship and its relationship to environmental conditions?
3. How do produce farms in the Northeast use water on the farm?
 - What are the sources of that water? Will farms continue to have the access they need in the future?
 - Is the water contaminated and to what degree?

Thank You

Contact with questions of follow-up:

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