

Future of Ag Safety: How AI Will Transform Agriculture



College of Agricultural,
Consumer &
Environmental Sciences
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN



Salah Issa

*Department of Agricultural
and Biological Engineering*

farmdoc

Objectives

Showcase cutting-edge research around autonomous equipment, wearable tech, digital training tools.

How can these futuristic solutions monitor risks, prevent incidents, improve health outcomes.

How can we collaborate to fully realize the safety benefits of new ag technologies.

Background...

Agriculture continues to be one of the deadliest industries in Illinois

Deaths per 100,000 workers

21.3



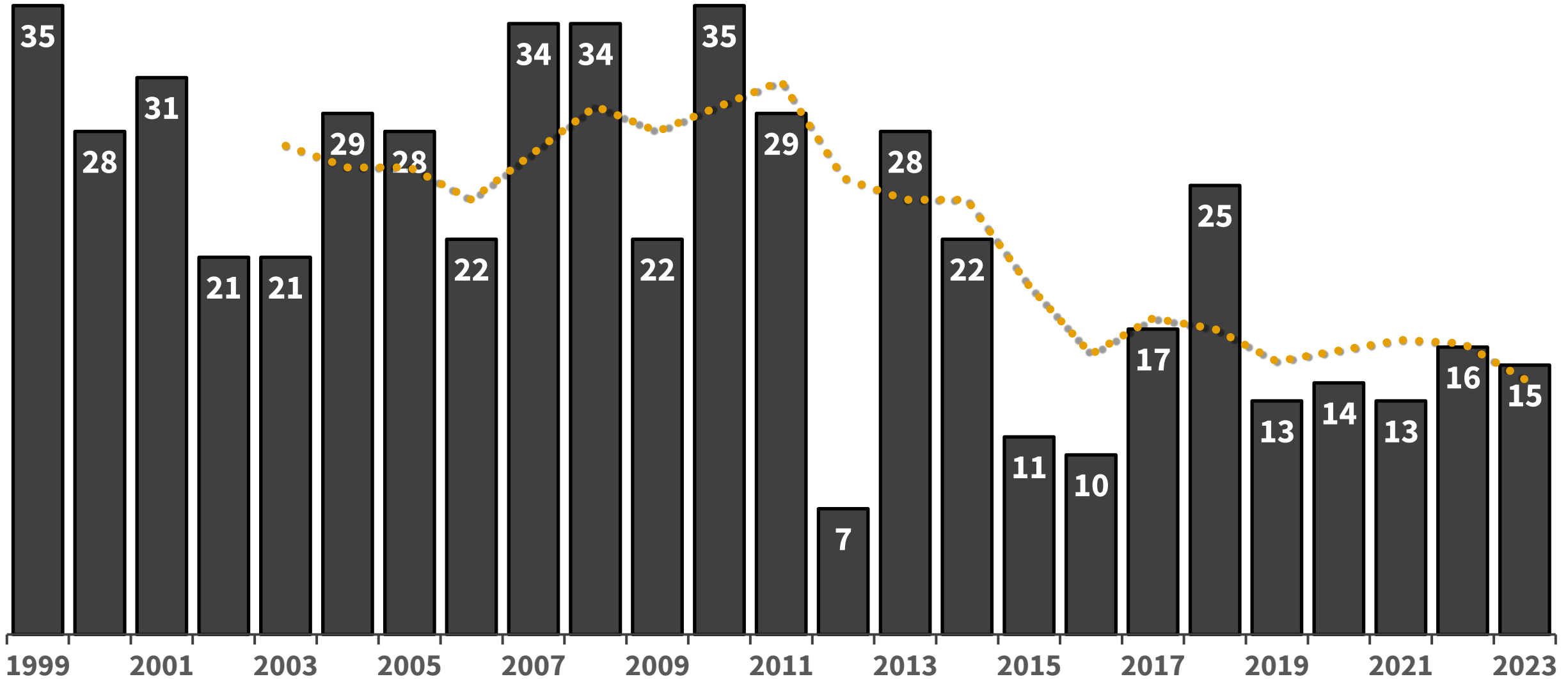
Agriculture

3.0

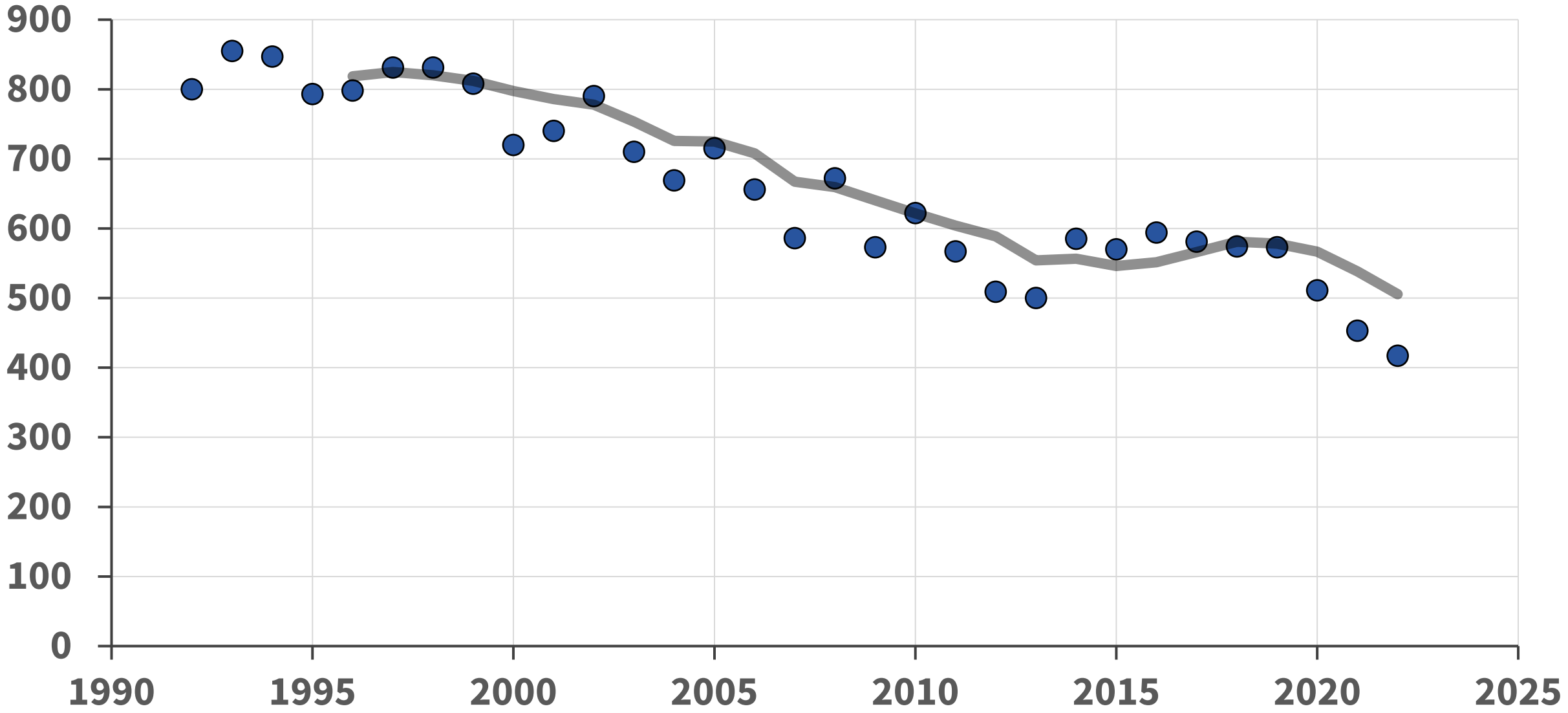


Workers Overall

Illinois Fatal incidents in the last 24 years



US Agricultural Fatal incidents

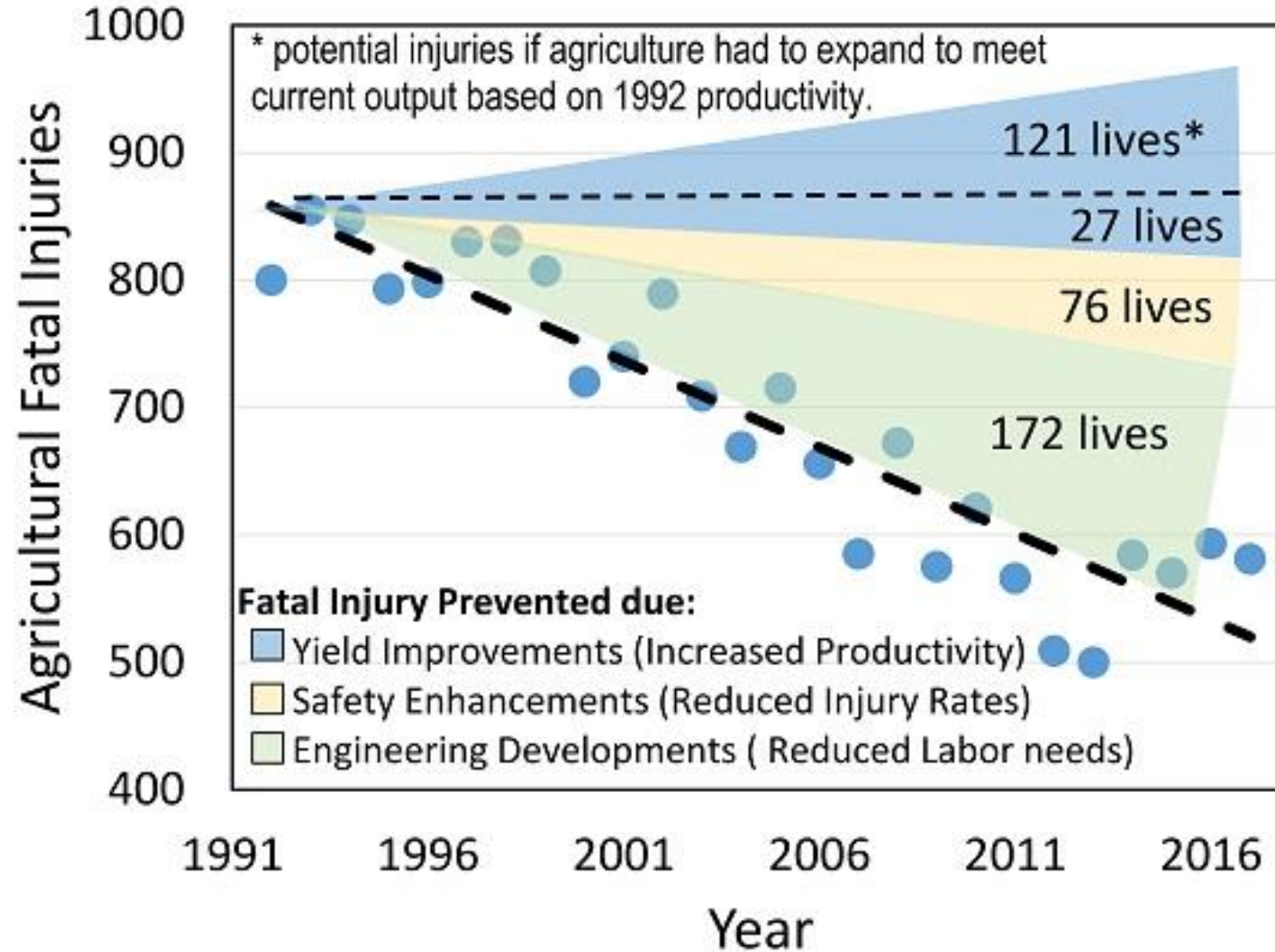


Injuries have declined, but rates haven't

- Number of farmers and farmworkers have also rapidly decreased.
- Number of acres decreased slightly
- Production has continued to increase



Decrease in injuries is due to productivity



Rates are important.

Highlights the pain of the loss



So how will AI transform Ag. Safety ?

- Reduce Workforce
- Reduce Hazards
- Improve Safety Tools/Solution
- Improve Safety Awareness



Reduce Workforce Needs

- **Autonomous Systems will be able to replace labor intensive operations.**
 - Weeding
 - Spraying
 - Harvesting
 - Livestock Operations
- **Reduces total injuries but not necessarily injury rates.**



Reduce Workforce Needs - Examples



Farmwise

Automated mechanical weeder for crops.

1 Operator replaces 34 farmworkers.

Reduce Workforce Needs - Examples

Carbon Robotics – Laser Weeder



Reduce Workforce Needs - Examples

GUSS

- Autonomous sprayers for orchards, vineyards, and high-density orchards
- 3 workers with 8 GUSS sprayers replace 15 workers, 12 tractors + sprayers



Reduce Hazards

Machines can be developed to remove need for labor in Dangerous, Dull or Dirty activities.

- Grain Bin Cleaning/Unloading
- Animal Handling

Reduce injury rates and total injuries.



Reduce Hazards - Example

Grain Weevil

- Designed to enter grain bins.
- Spread fines, break up clumps.
- Reduces chance of individual to enter grain bin.



Safety Tools/Solution

- Tools or systems that enhance the safety of the farmer and/or farmworkers
 - Exoskeletons
 - Wearable Devices
 - Drone systems
- These systems can decrease severity of injury

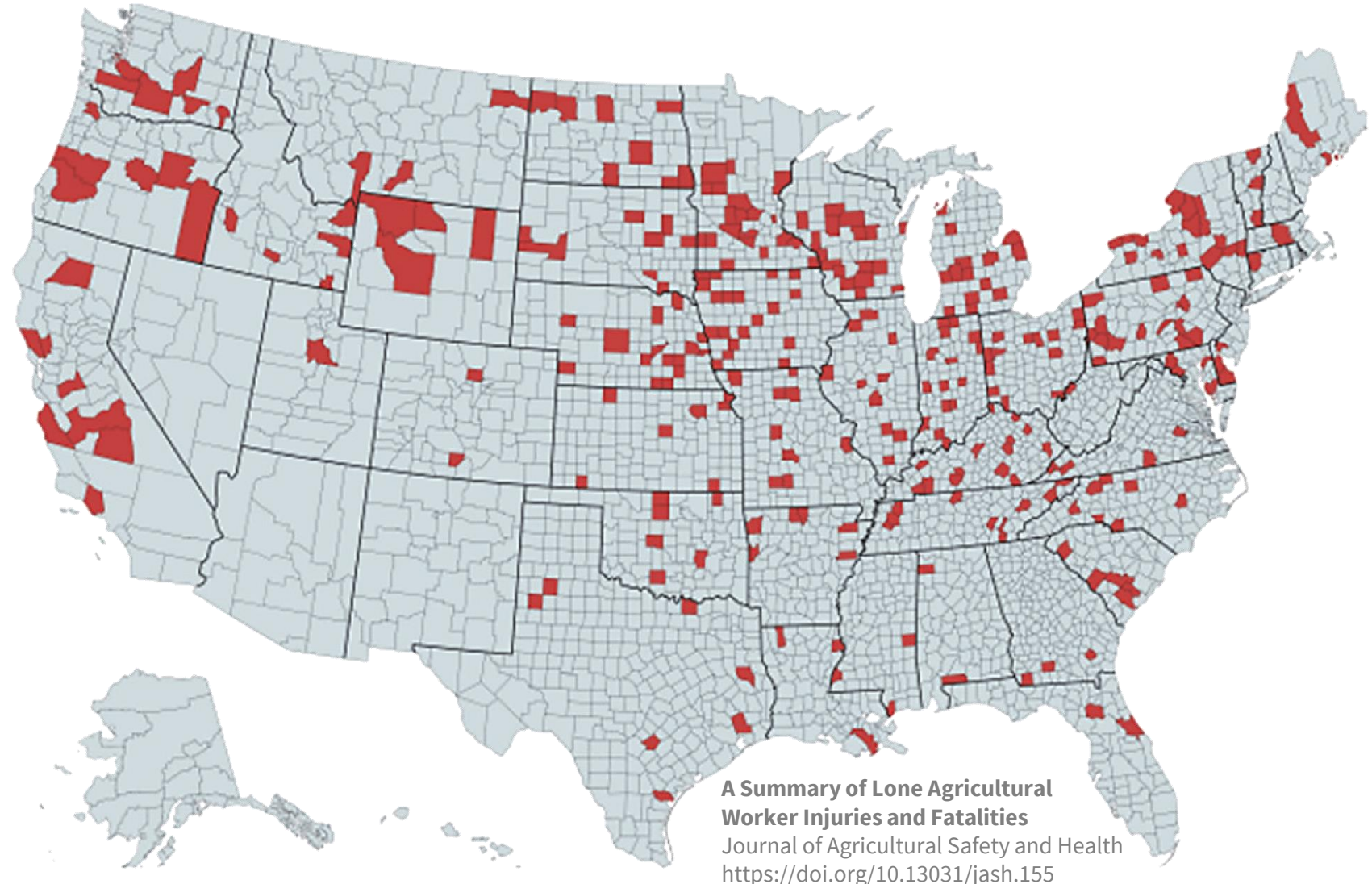


Safety Tools/Solution - Example

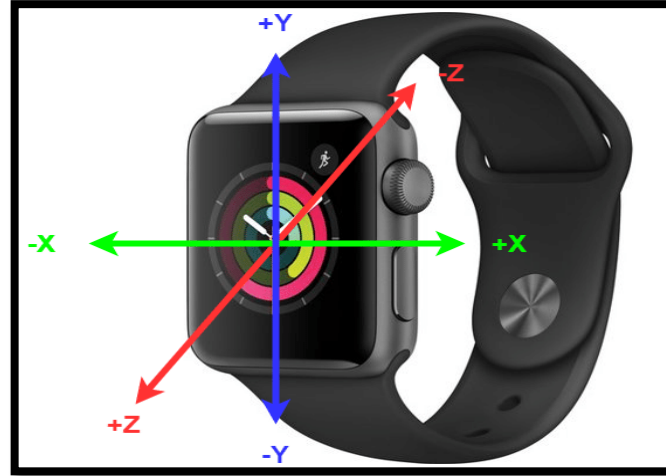
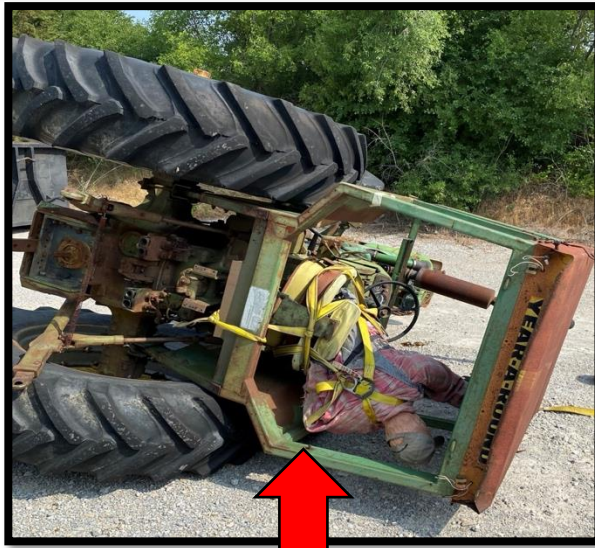
Lone Workers

Aaron Etienne
reviewed almost
2000 cases

368 were lone
worker incidents
(Purdue).



Safety Tools/Solution - Example

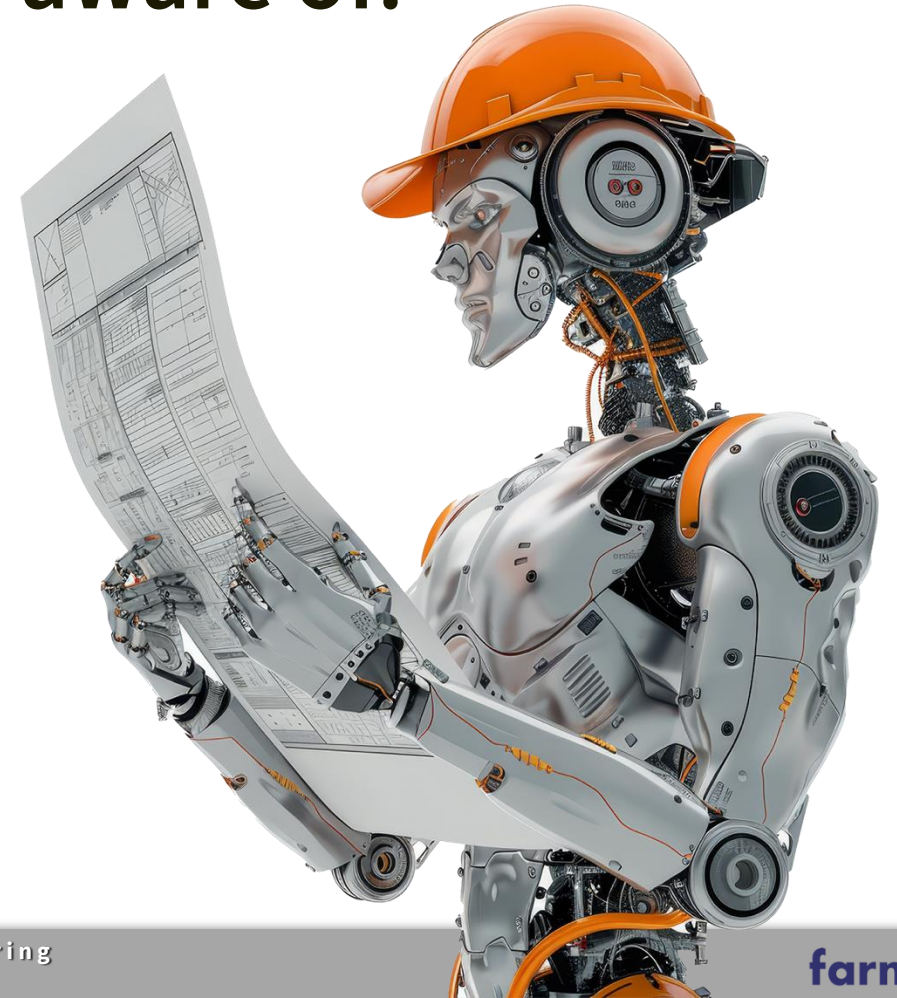


Purdue: Testing the Feasibility of Selected Wearable Devices in Detecting Tractor Rollover Incidents



Improve Safety Awareness

- New AI tools can provide new awareness to safety issues that a farmer/worker might not be aware of.
 - Large language models
 - Multi-modal models
- Reduce injury rates



LLM use case Examples

- Conduct analysis on hazards in the environment or machine
- Process information & Communication
 - Example a machine manual
- Act as a support tool to query standards or other documents.

LLM use case Examples

- Can be a useful tool to promote safety awareness.
- Issues with
 - Bias
 - Hallucinations
 - Accuracy
 - Input data



Areas of Concern

Human-Robot Interactions

- Assumption of Safety
- Are all use cases/misuse considered



Areas of Concern

Introduction of new risks

- Ergonomics

Example harvesting strawberries:
Robotic platform increases
harvesting rate from 77% to 89%

- Cyber security

- Reliability



Areas of Concern

Workforce development/needs

- Preparation for a new generation
- Could this further shrink rural communities ?



What is Next ?

Ensure safety remains a top concern of the industry as we adopt more AI solutions



Safety for Emerging Robotics and Autonomous Agriculture (SAFER AG) Workshop

December 3-4, 2024 | Urbana, IL

<https://go.illinois.edu/SAFERAG>

I | Center for
Digital Agriculture

SAFER AG 2.0

- Bringing together Industry, Academia, Government & Farmers
- Discuss issues/gaps in:
 - Human-Robot Interactions
 - Workforce Development
 - Risk Management
 - Standard Design



<https://go.illinois.edu/SAFERAG>

SAFER AG 2.0

- Two days:
 - Focused on collecting input
- Farmers
\$20 (discounted rate)
- Industry/Academia - \$75



<https://go.illinois.edu/SAFERAG>

I-FARM & SAFER AG Exhibit/Demo

- Dec 4th 9 – Noon @ Stock Pavilion
- See exhibits/demonstration from :
 - I-FARM
 - Center of Autonomy
 - Center for Autonomous Construction & Manufacturing at Scale
 - Private Industry
(Grain Weevil, Birkey's, Industrial Safety Controls)

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