NASA Acres

Down to Earth Information for U.S. Agriculture

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Agriculture is hyperlocal and super global

Satellites offer great tools for making sense of this complex and highly dynamic system and have since the satellite Earth Observing era began in 1972.

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But we still have a lot of acreage to cover

Unlocking the value of satellite data for U.S. agriculture requires:

- Quality
- Clarity
- Integration
- Collaboration

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Down to Earth Information for U.S. Agriculture

Led on behalf of NASA by the University of Maryland
www.nasaacres.org info@nasaacres.org
X @acresprogram

Our Mission:

We bridge the gap from space-to-farm and education-to-impact together with U.S. farmers, ranchers, and other agrifood system decision makers who are addressing the most pressing challenges to sustainable, productive, and resilient agriculture, both today and into the next generation.

Our Vision:

Richer knowledge about past and present agricultural land use, productivity, and sustainability

More tools that use satellite-based Earth observations in the hands of farmers, ranchers, and other agrifood system actors.

A stronger agricultural workforce ready to tackle the challenges of climate change and global hazards to U.S. agriculture and food security.

What NASA Acres Does

1. **Improve methods to measure & map** agriculture.
2. **Increase Knowledge** of the interplay between agronomic management and environmental, productive, and economic outcomes.
3. **Develop & Transition** maps and knowledge into systems and tools for farm to policy decisions.
4. **Build Capacity** in current and future generations to use satellite data for managing agriculture in their own communities.
5. **Guide the Future** of satellite data for agriculture.

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Built on strong foundations:

1. ***Farmer engagement***
2. ***Trust infrastructure***
3. ***Workforce development***

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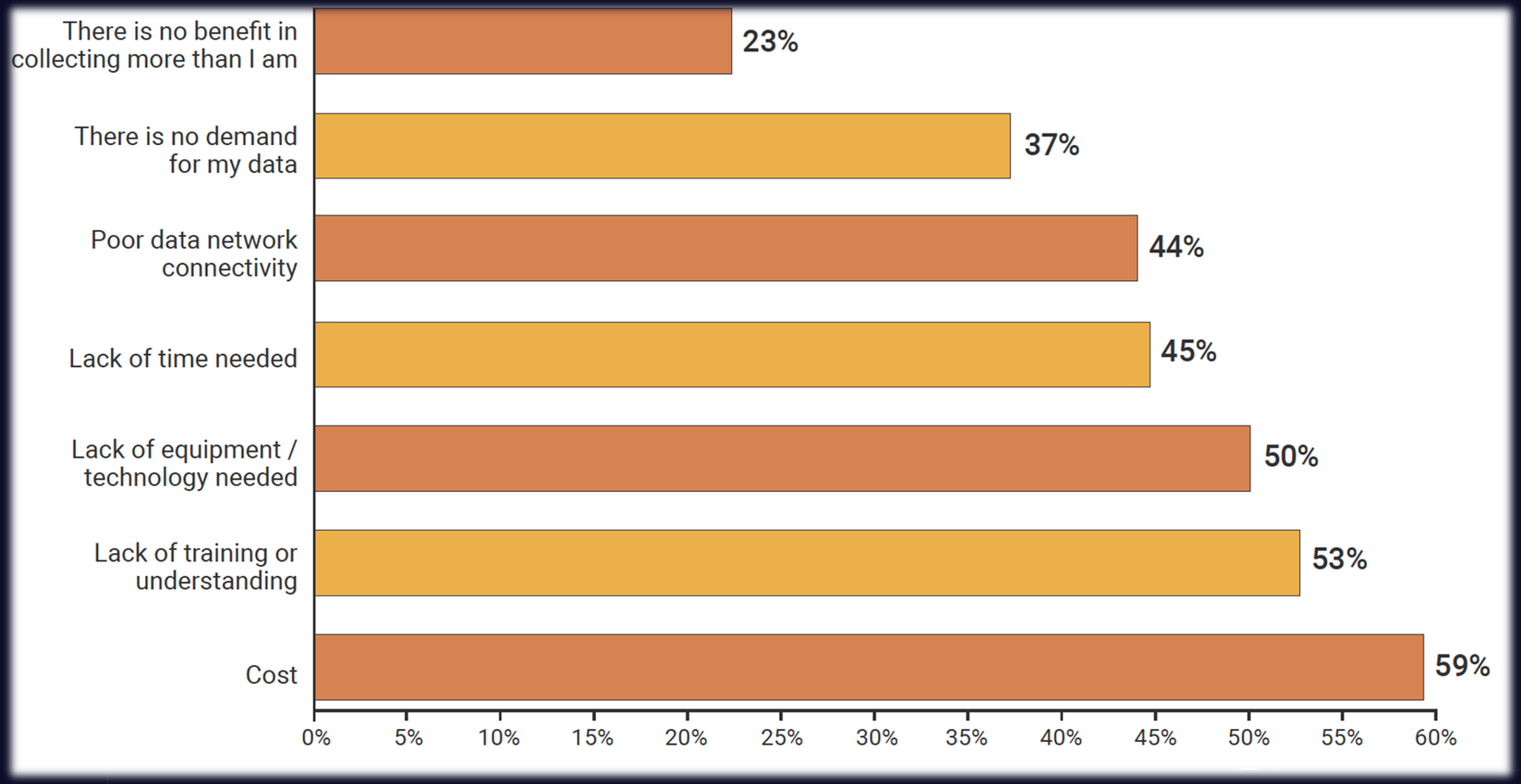
Why satellites?

Historical analysis

Decision support

Reducing data collection burden

Barriers farmers face collecting data



Source: “Farmer Perspectives on Data in 2021”
Farm Journal Trust in Food

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Farmers play an integral role in our efforts

What we do is driven by our collaborators and their needs

How we reach impact is through cultivating relationships

How we approach data is driven by the people who collect and share it

How we assess the value of EO is driven by the value it provides to farmers and to society

How we pave the way for progress

- Understanding facilitators and impediments for digital agriculture adoption
- Building a stronger future workforce that bridges the divide between space and farm

"Every farm, even every acre, is different, just like the people who manage them."
-Lance Lillibridge, Farmer (paraphrase)

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Farmers play an integral role in our efforts

Building a trust infrastructure to unlock the value of EO with farmers

Data Governance

- **Goal: to promote secure and beneficial collaborations to farmers to answer questions they've asked**

13 Core Principles for Data Management

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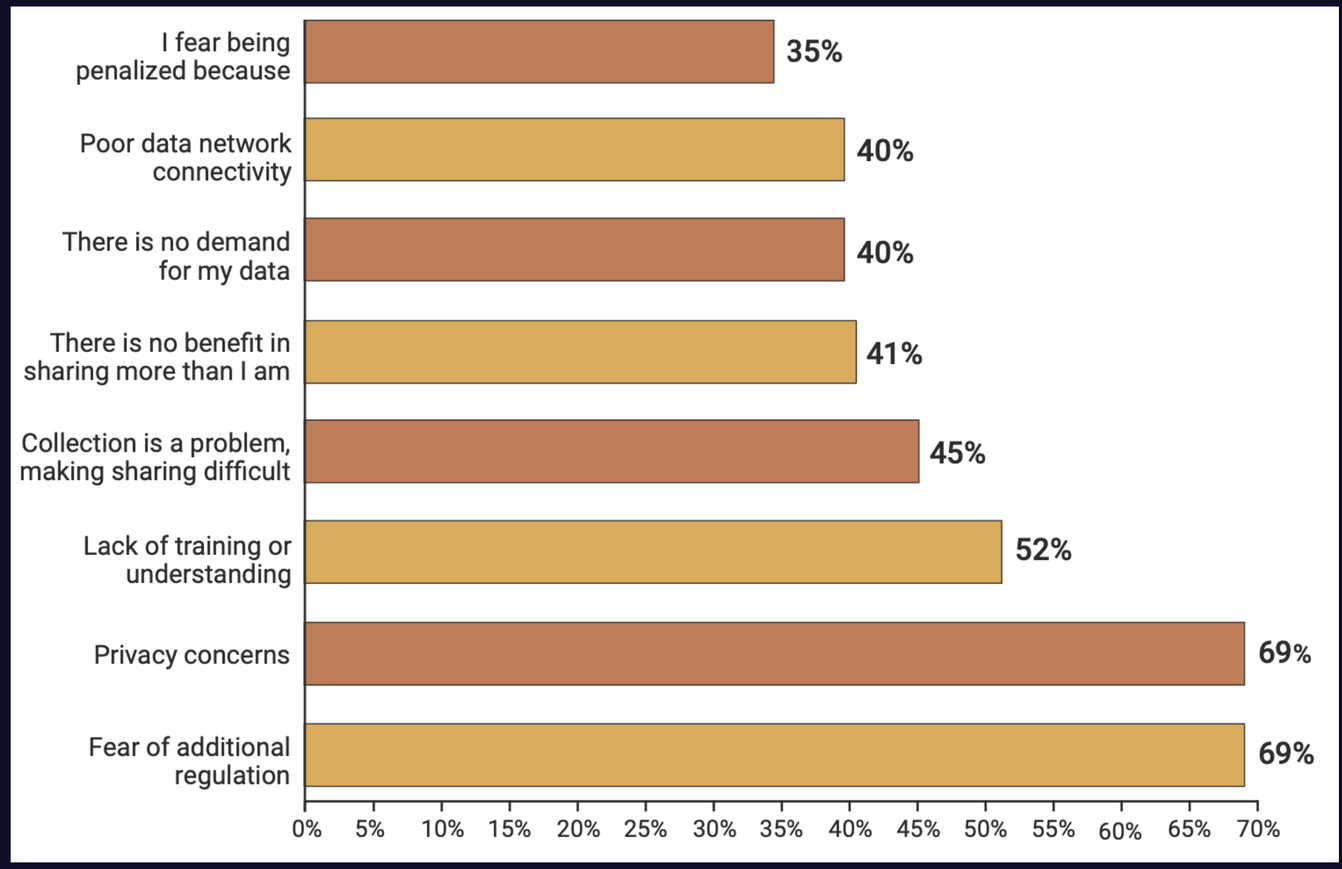
Barriers farmers face sharing data



Source: "Farmer Perspectives on Data in 2021"
Farm Journal Trust in Food

Farmers play an integral role in our efforts

Building a trust infrastructure to unlock the value of EO with farmers

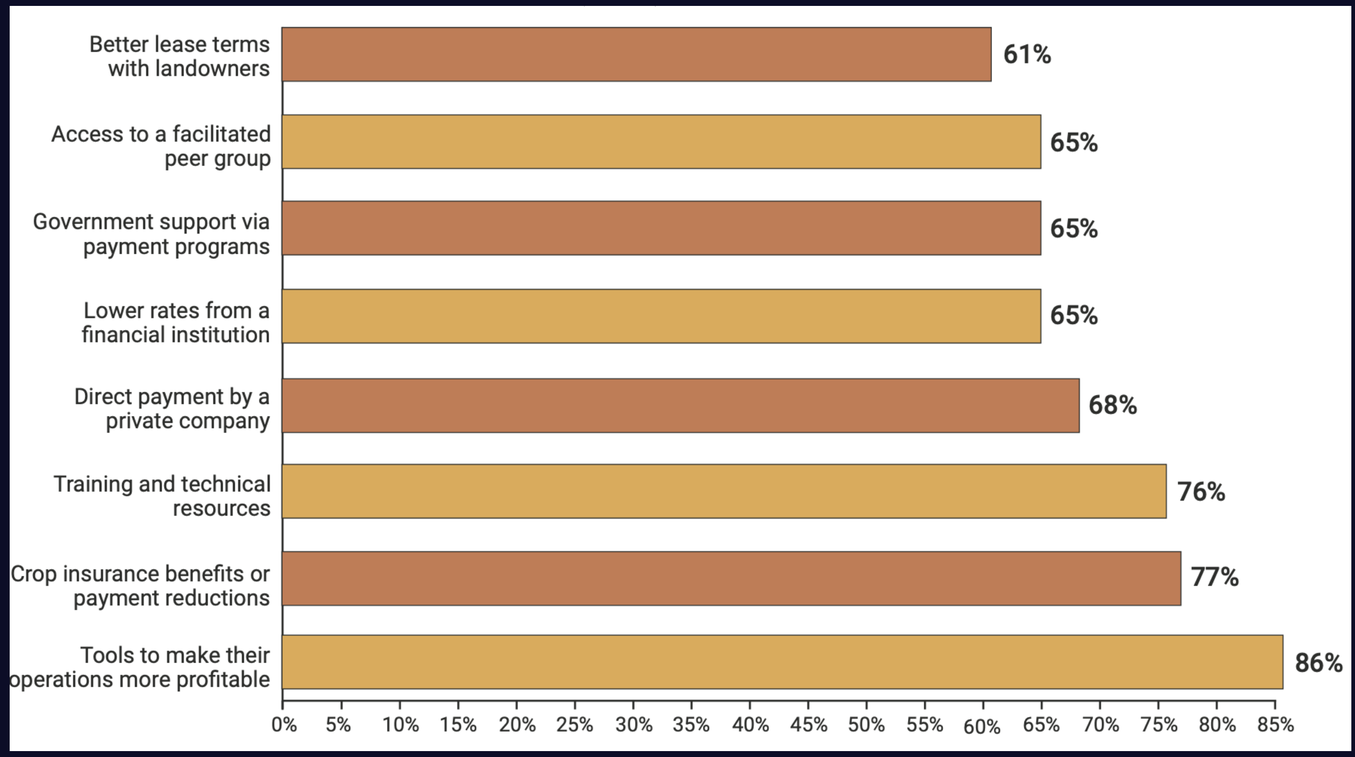
Understanding How to Overcome the Barriers

- Updating survey with Trust in Food, Farm Journal

Addressing Security Concerns

- In Development: “Confidential Clean Rooms” that lock down data & allow for innovation without revealing personally identifiable information or location

Incentives to share data
(now analyzing updated survey results)



Data source: “Farmer Perspectives on Data in 2021”
Farm Journal Trust in Food

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How We Partner

- ▸ **People/orgs fund us**
- ▸ **We fund people/orgs**
- ▸ **We go for new funding together!**
- ▸ **We exchange in kind:** data / effort / expertise, etc.

Our Partners

Sustaining Partner

NASA

Research, Development, and Extension Partners

University of Maryland Department of Geographical Sciences

Arizona State University

Cornell University

University of Illinois Urbana-Champaign

Colorado State University

NC State University

Michigan State University

Mississippi State University

UC Merced

Stanford University

From Prison Cells to PhD

Janzen Ag Law

Collaborating Partners

IL Corn Growers Association

American Farm Bureau Federation

Illinois Farm Bureau. Farm. Family. Food.

esri

NASA Goddard Space Flight Center

NRCS

AXA

ESMC Ecosystem Services Market Consortium

Corteva

University of Hawai'i Maui College

Agriculture Counts

United Way Maui United Way

indigo

John Deere

JW Ranch

Culterra Capital

ASA American Soybean Association

Perennial

Farm Journal

Harvest

efficient vineyard

Unilever

USDA Agricultural Research Service

Brander Winery & Vineyard

MAXAR Technologies

regrow

OpenET

JPL Jet Propulsion Laboratory

E&J Gallo Winery

National Grape Research Alliance

Field to Market

National Association of Conservation Districts

Microsoft

The Nature Conservancy

USGS science for a changing world

Maryland Department of Agriculture

SATELLOGIC

General Mills

Thunder Basin Grasslands Prairie Ecosystem Association

Delaware Association of Conservation Districts

Kansas State University

Habiterre

planet.

Midwest Climate Hub U.S. Department of Agriculture

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Solutions
National Aeronautics and
Space Administration
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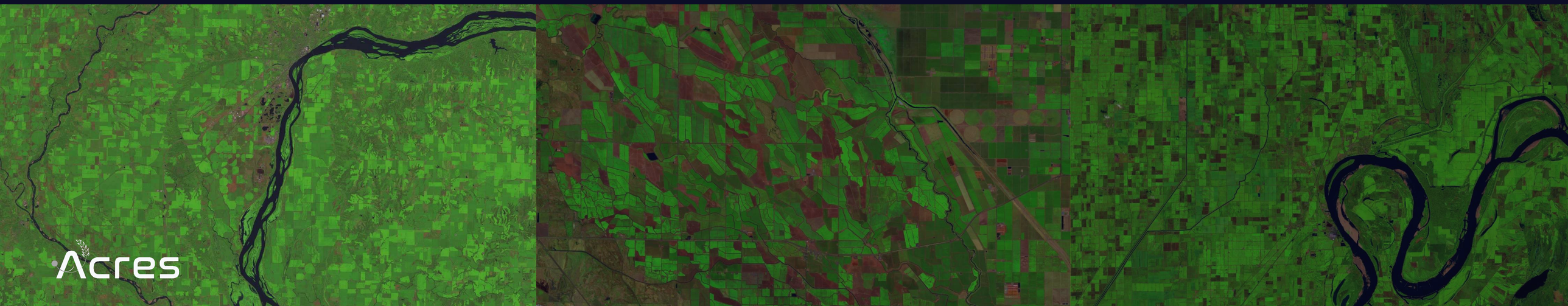
Appendix

What can satellites *(help)* tell us about agriculture?

Essential Agriculture Variables

Measurable “building blocks” to understand state and change in agriculture



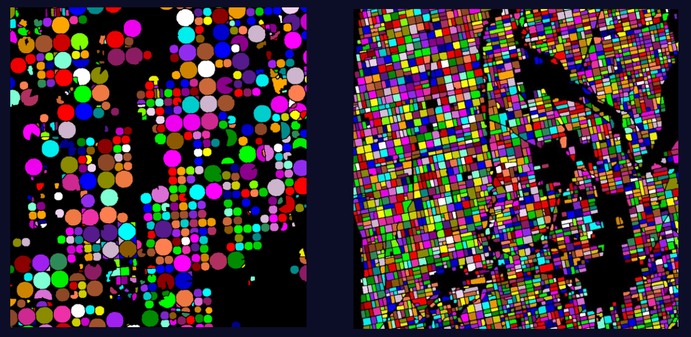
What can satellites *(help)* tell us about agriculture?

Essential Agriculture Variables

Measurable "building blocks" to understand state and change in agriculture

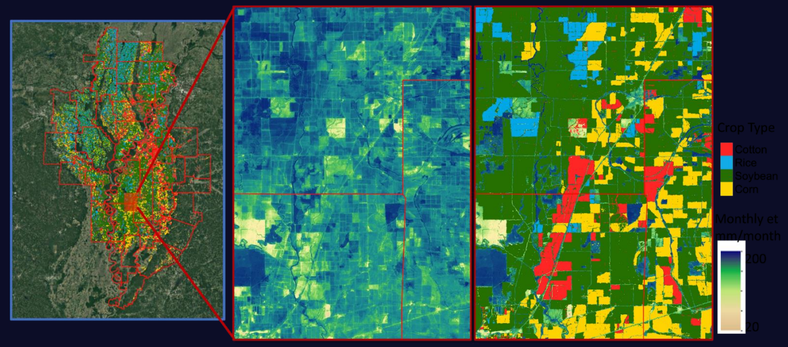
- **What nature is doing** ***(what, when, where)***
  - Temperature, precipitation, flooding, wind speed, extreme weather, drought, water availability, soil moisture, evapotranspiration…
  - Disease early detection
- **What humans are doing** ***(what, when, where)***
  - Cropland and crop type mapping; area estimation
  - Crop & field management; e.g. ~planting & harvest dates, irrigation, cover crop, tillage
  - Rotational grazing
- **What resulted**
  - Canopy nitrogen content and requirements
  - Yield (forecast and final)
  - Cover crop performance (N, C)
  - Forage quality
  - Emissions and sequestration**
  - Water use efficiency
- **What we can expect in the future**
  - Pest & disease risk
  - Within-season field forecast
  - Long-term responses to climate change

Field Boundaries and Sizes



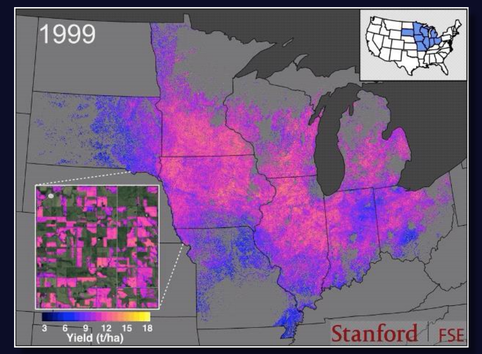
Yan & Roy, Mich State

Evapotranspiration



Y. Yang, Mississippi State;

Field Scale Yield Forecast & Estimation



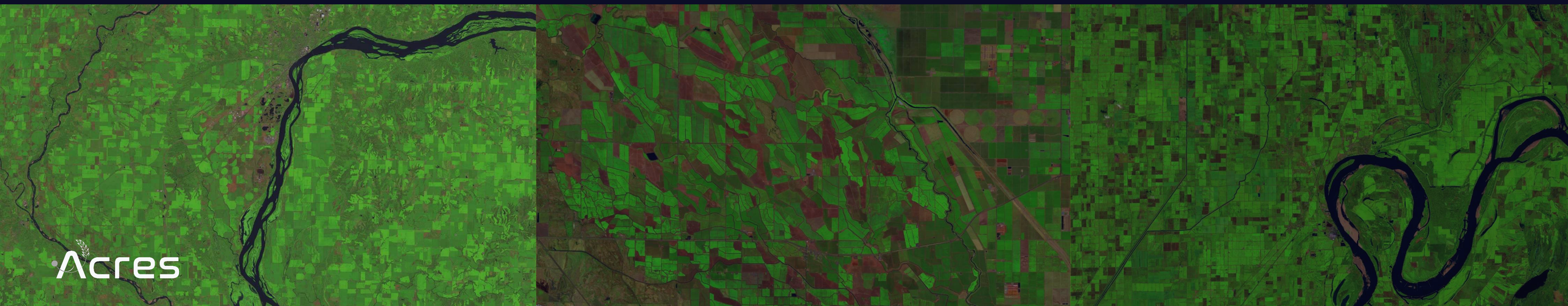
Lobell Lab; Jin et al., 2015, Stanford

What can’t satellites tell us about agriculture?

What do farmers want to know?

What drives their decisions?

Do they use satellite data to make decisions? Why, or why not?

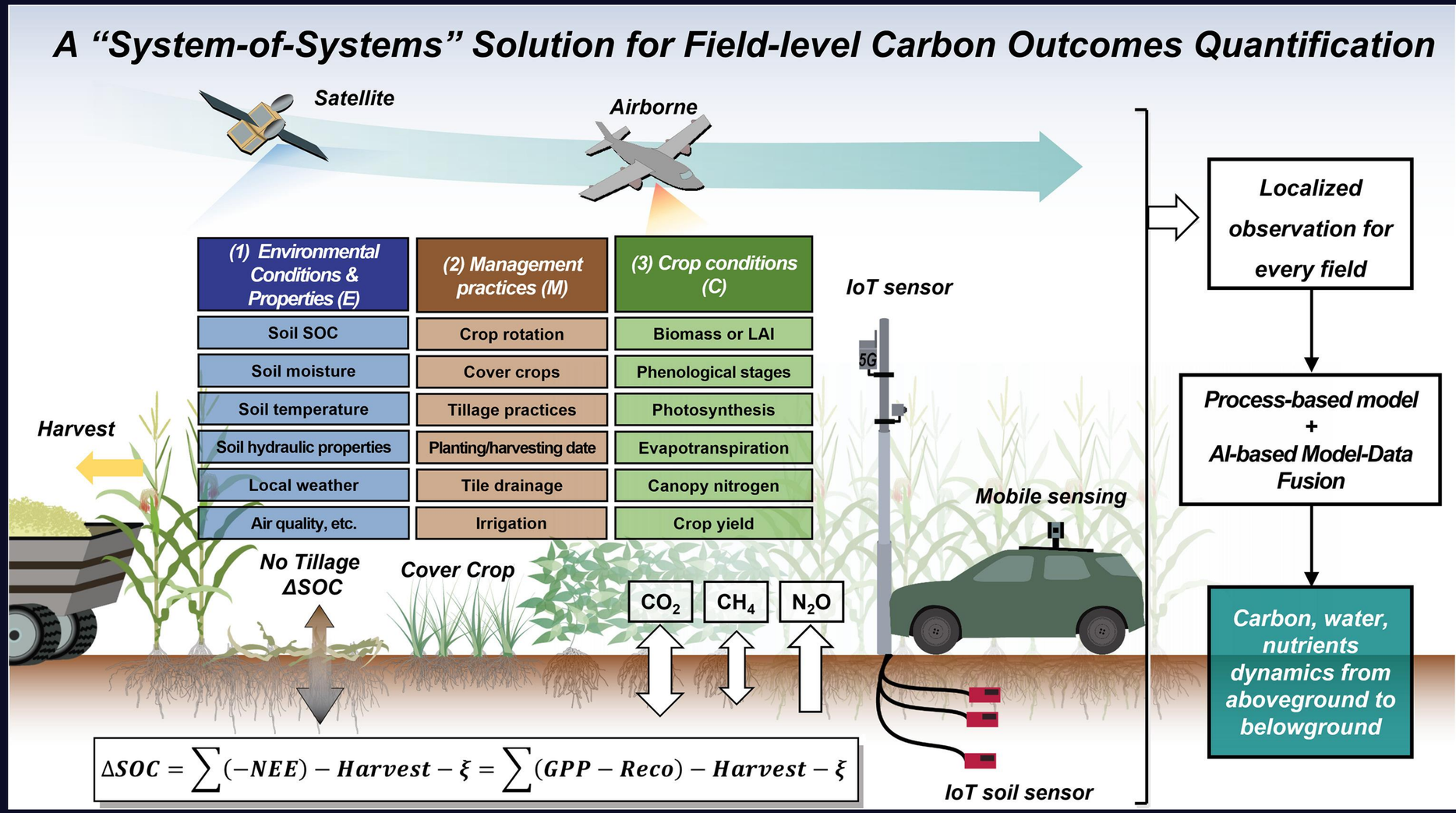


What's ahead for satellite observations of agriculture?

Carbon &
Other Ecosystem
Services

K. Guan et al. 2023
Earth Science Reviews

Satellite data as a a component of an improved measurement system



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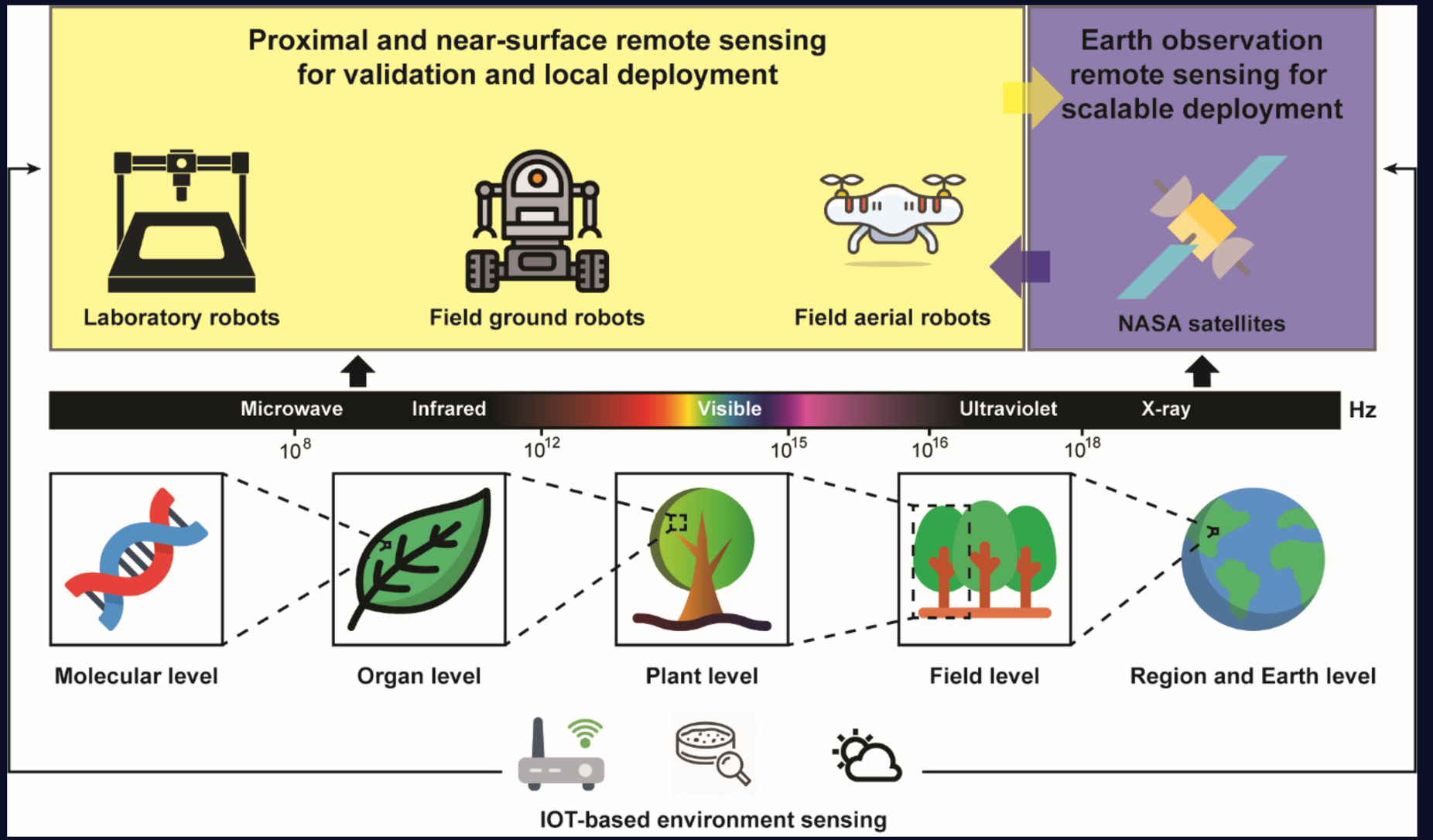
What's ahead for satellite observations of agriculture?

Disease early detection and warning

Satellite data as a a component of an improved measurement system



K. Gold & Y. Jiang
Cornell University

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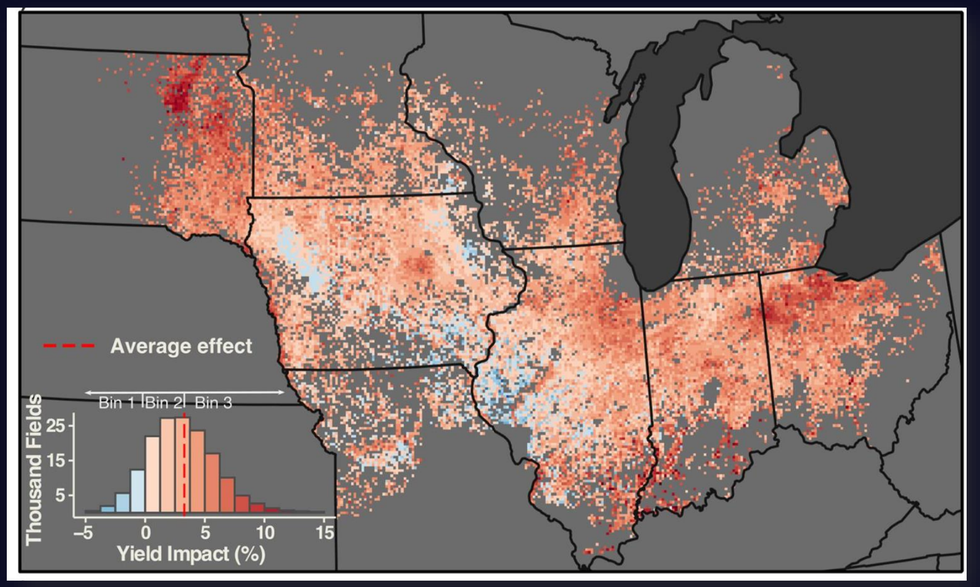
What's ahead for satellite observations of agriculture?

Unpacking Drivers of Yield Variability

Supporting a sustainable, productive, and resilient agriculture system



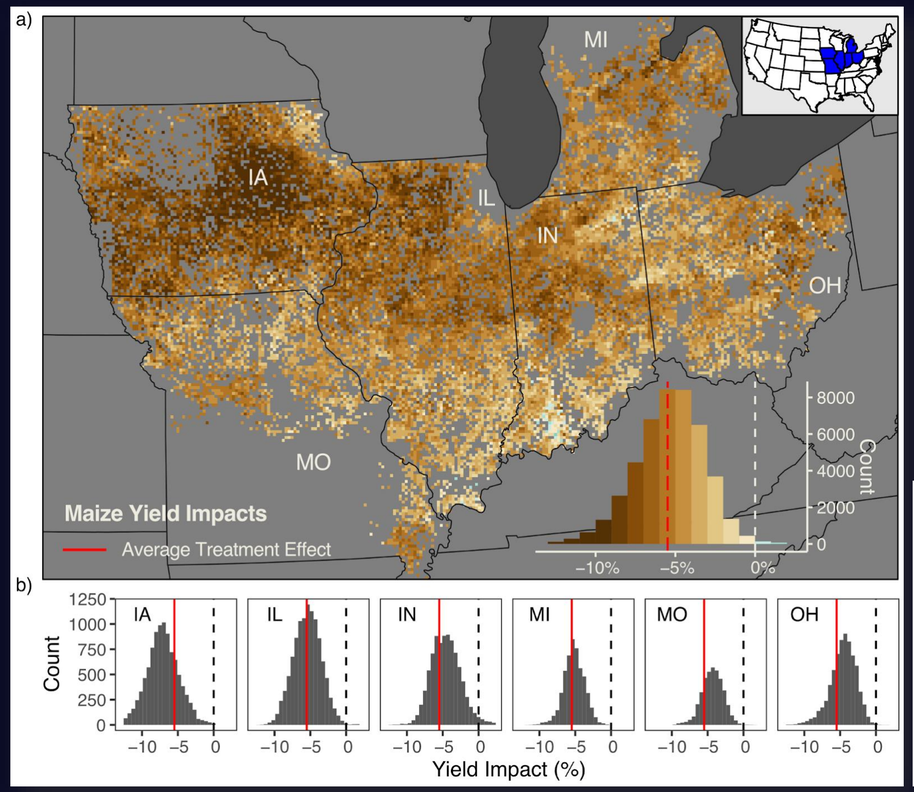
Deines, Lobell, Guan, et al.

(several publications)

Satellites reveal a small positive yield effect from conservation tillage across the US Corn Belt

Jillian M Deines[1], Sherrie Wang[1,2] and David B Lobell[1]

[1] Department of Earth System Science, Center on Food Security and the Environment, Stanford University, United States of America
[2] Institute for Computational and Mathematical Engineering, Stanford University, United States of America



Recent cover crop adoption is associated with small maize and soybean yield losses in the United States

Jillian M. Deines ✉, Kaiyu Guan, Bruno Lopez, Qu Zhou, Cambria S. White, Sheng Wang, David B. Lobell ✉

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