

Farm Robotics: Revolutionizing Agricultural Practices

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Industry partners: EarthSense

Center for Digital Agriculture



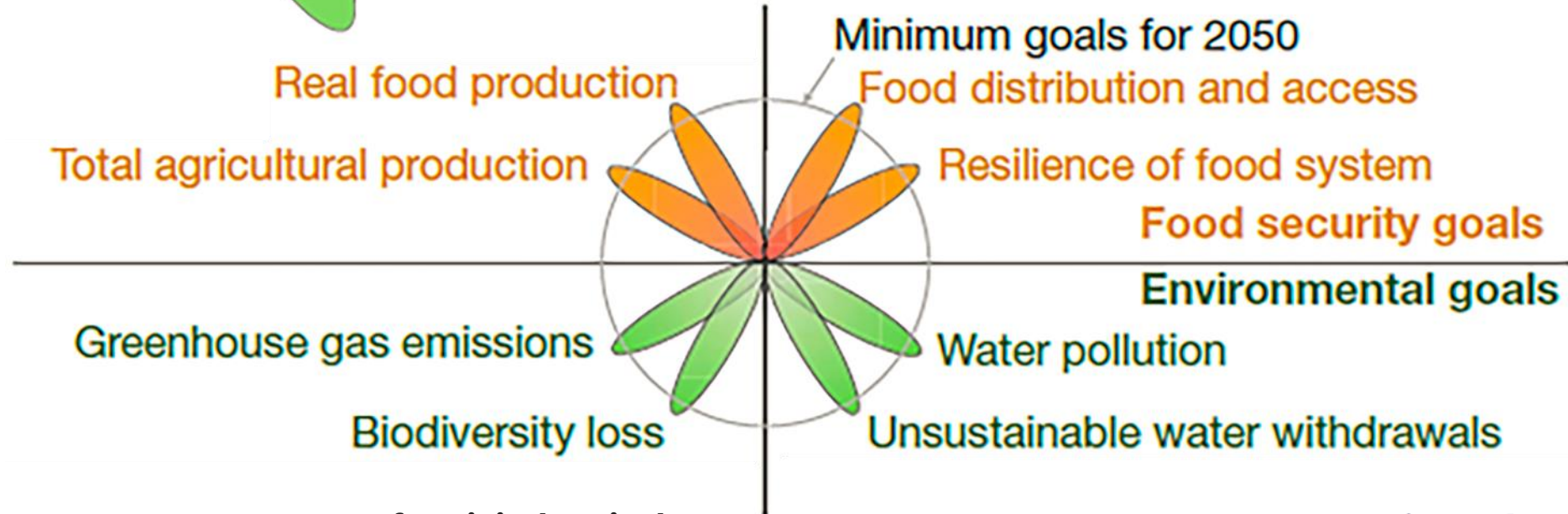
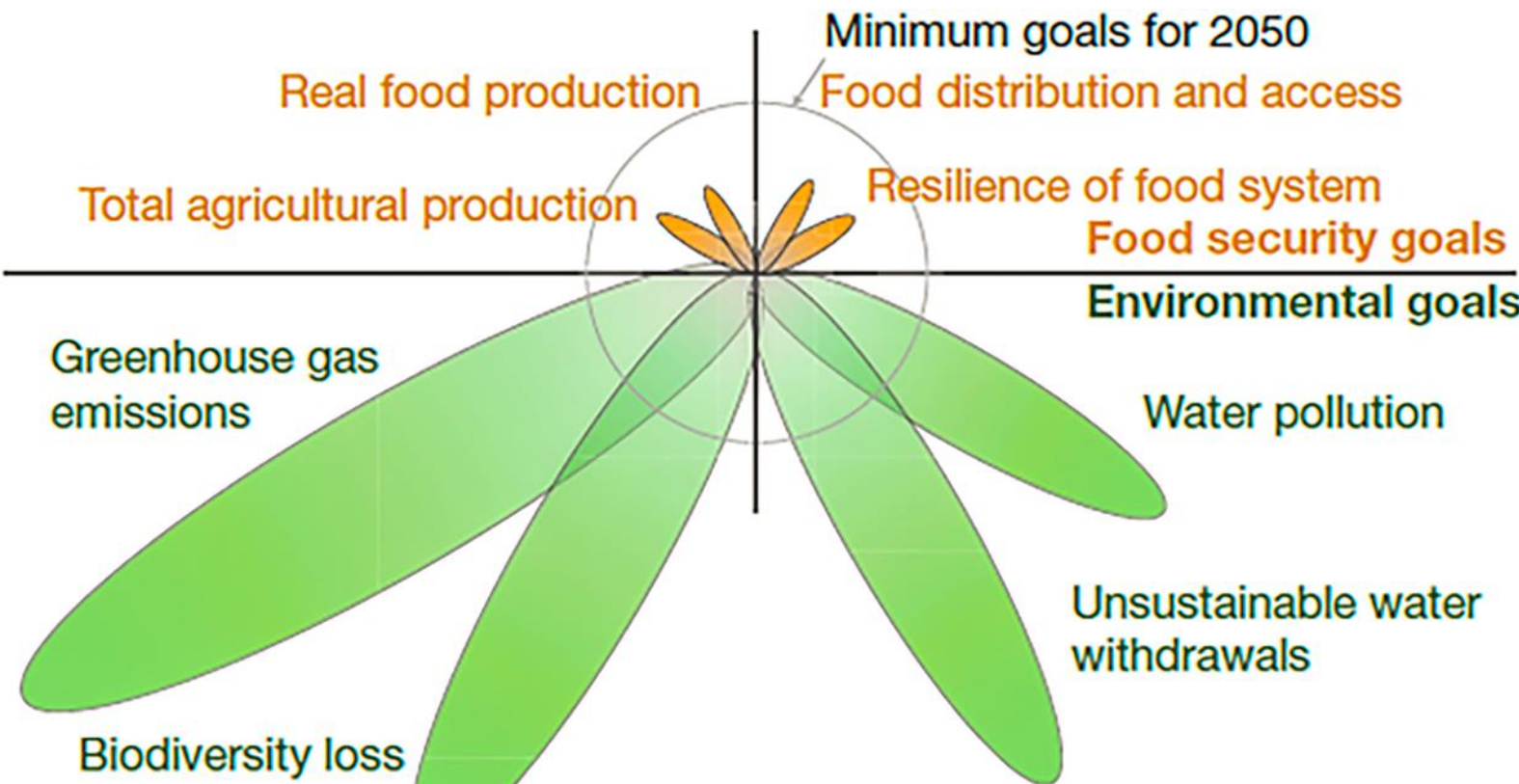
i-FARM



College of Agricultural,
Consumer &
Environmental Sciences

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Foley et al. Solutions
for a Cultivated Planet
2011







Soils are Under Stress



Compaction
Erosion
Nutrient Loss



Center for
Digital Agriculture



Grow

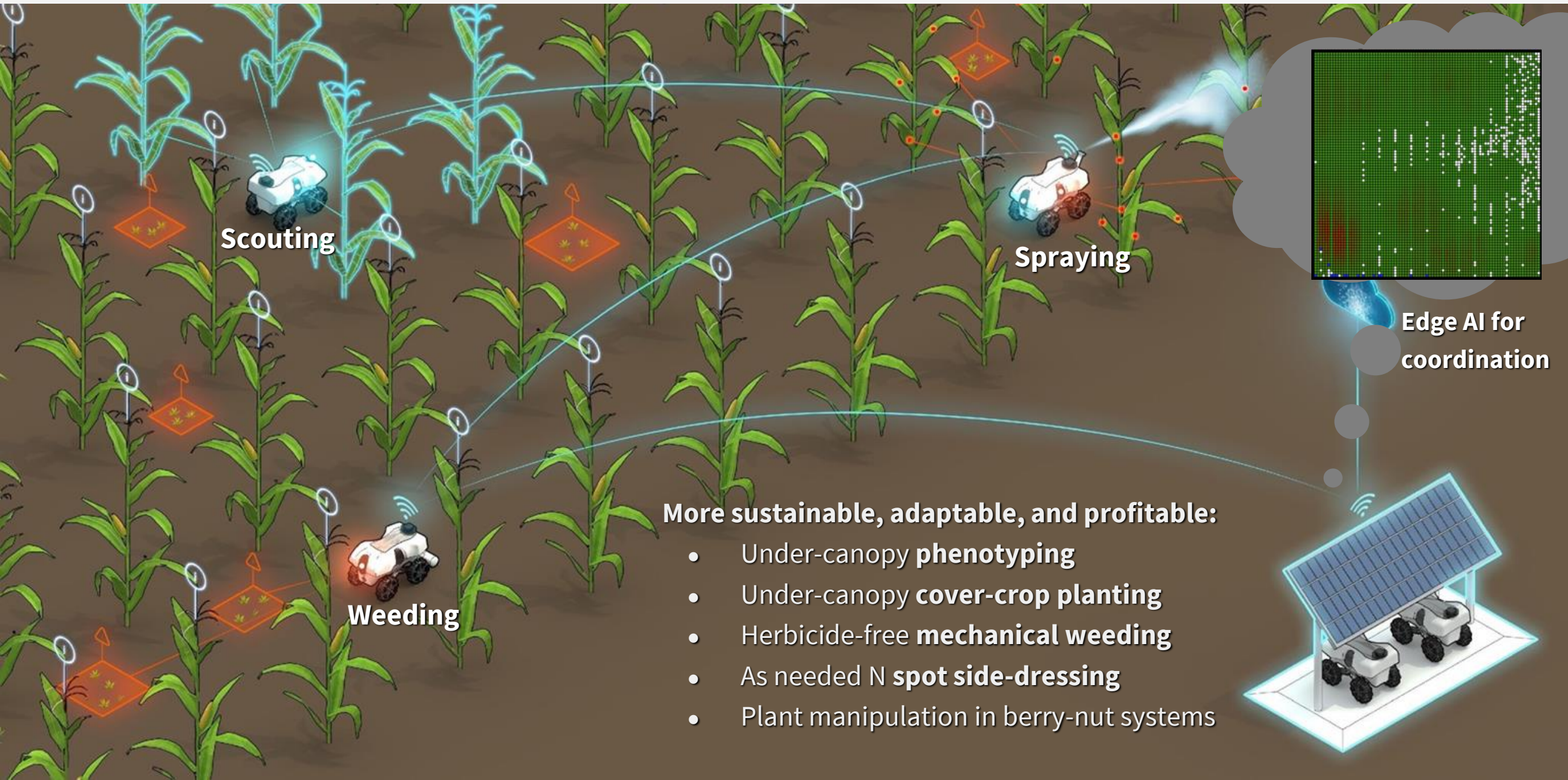


Sustain



Transform

More Sustainability and Resilience with Agbots



Scouting

Spraying

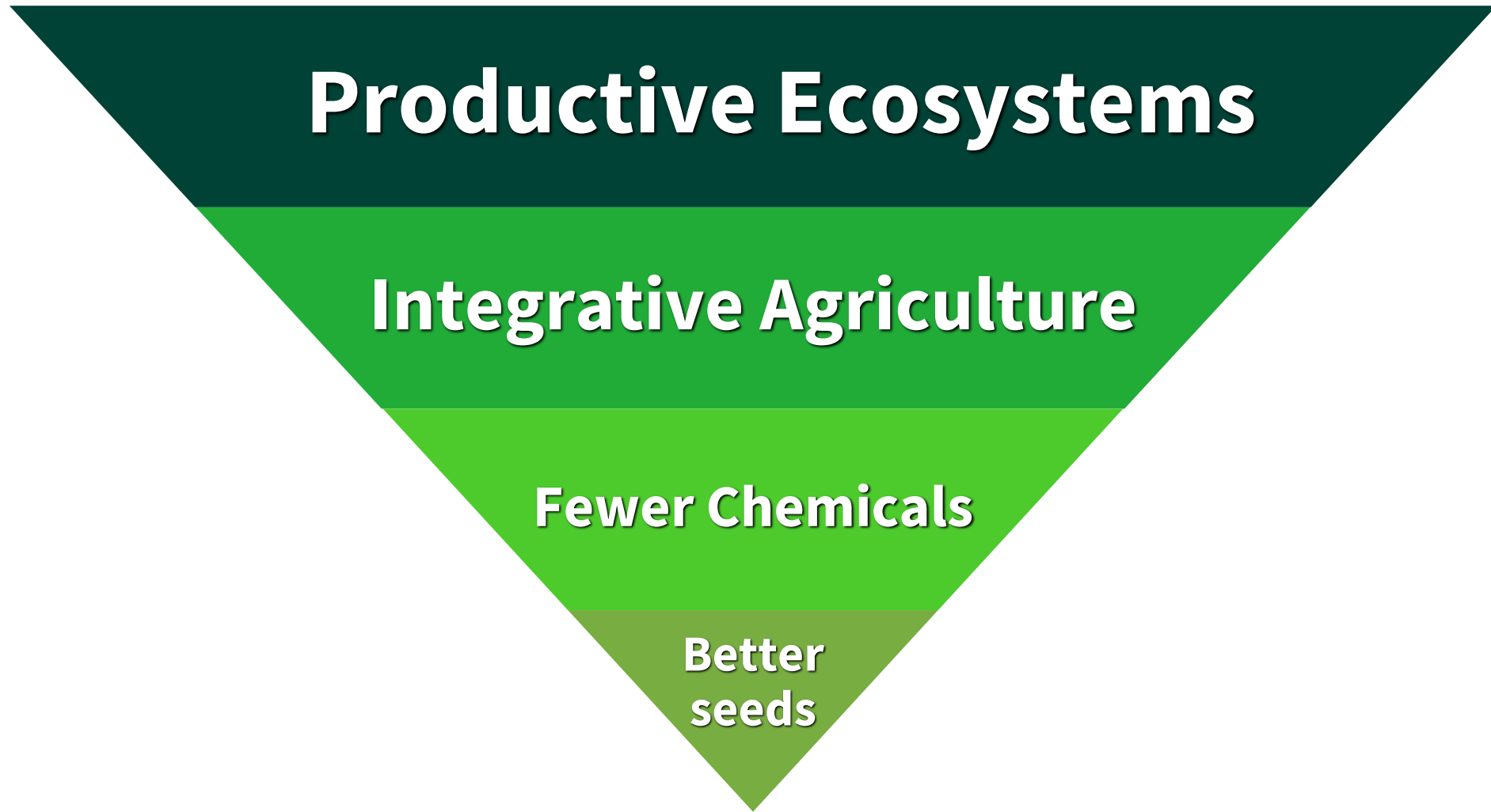
Weeding

Edge AI for
coordination

More sustainable, adaptable, and profitable:

- Under-canopy **phenotyping**
- Under-canopy **cover-crop planting**
- Herbicide-free **mechanical weeding**
- As needed N **spot side-dressing**
- Plant manipulation in berry-nut systems

Path to Sustainable Agriculture



Agricultural robotics has unique challenges



Scales are Vast




**Poor Dataset
Availability**



**Unstructured
Environment**







**95% of US Farmland is
Left Bare 8 Months of the Year!**

This land could be sequestering carbon!

Cover Crops Can Change This



Scalable Carbon Sequestration



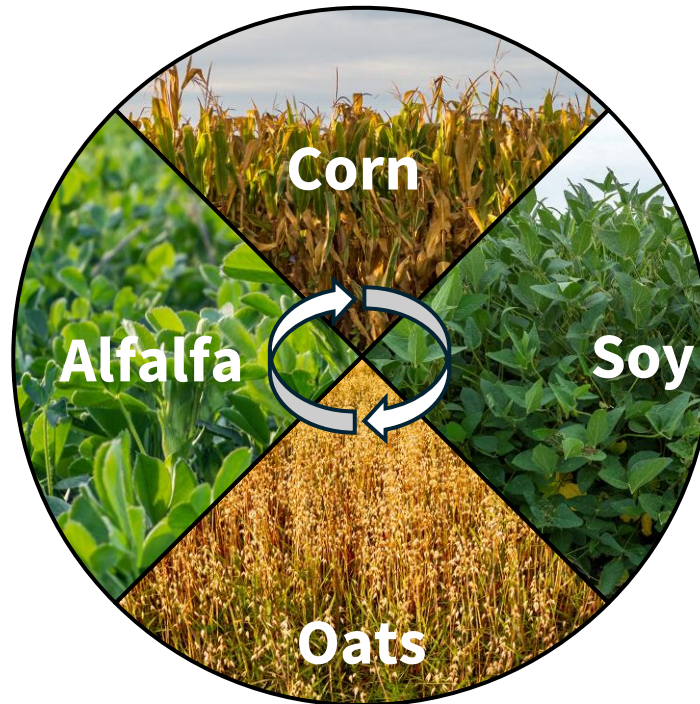
At \$5/Acre Compared to \$15/acre





**Under-canopy cover crop planting robot navigating with
CropFollow++**

Automating existing equipment is not enough



Monocultures

Resource and input hungry

Complex annual rotations

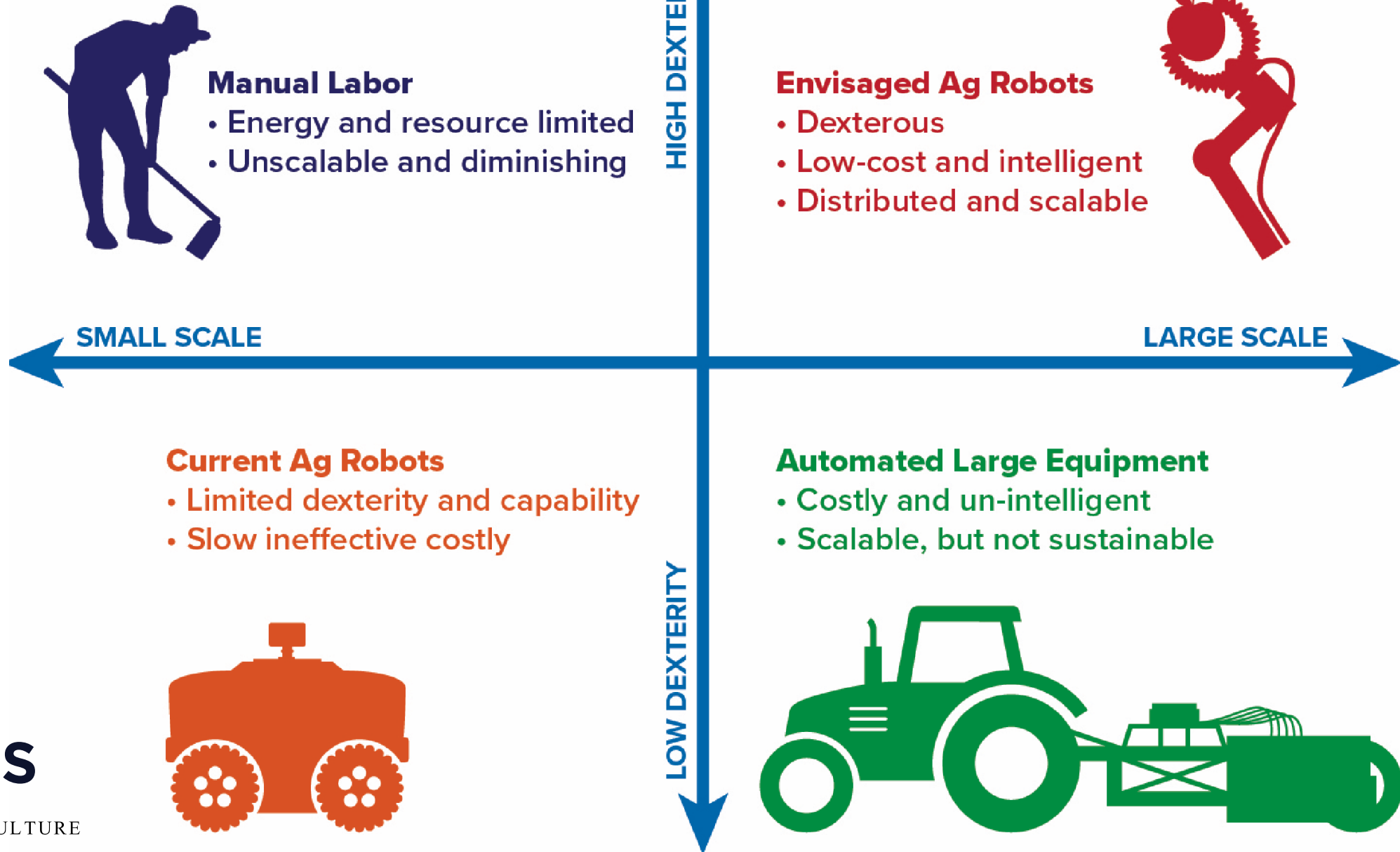
improve sustainability

Perennial polycultures

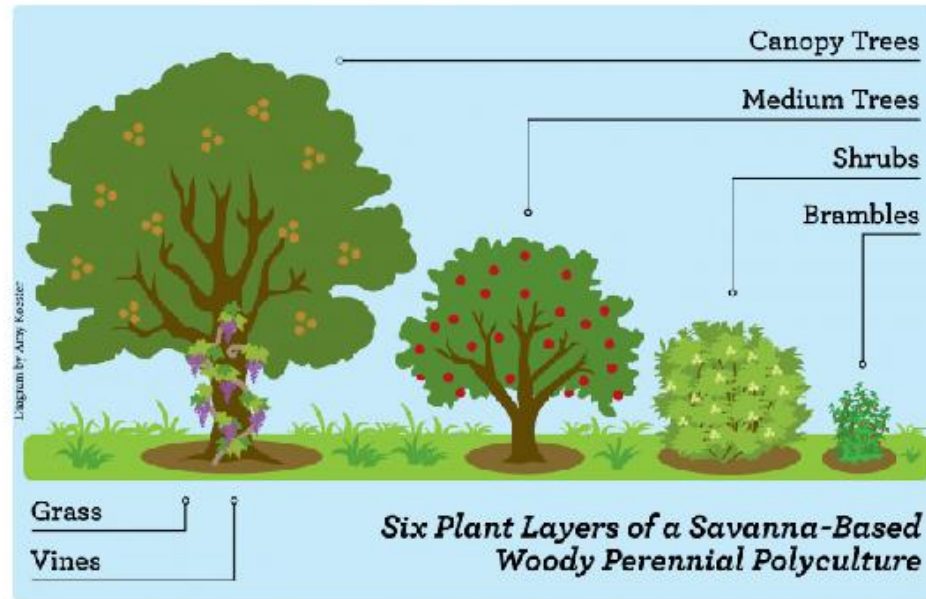
Sustainable by design

**Sustainable ag-systems are more complex, need labor,
current large equipment does not work here**

Envisaged Ag Robots

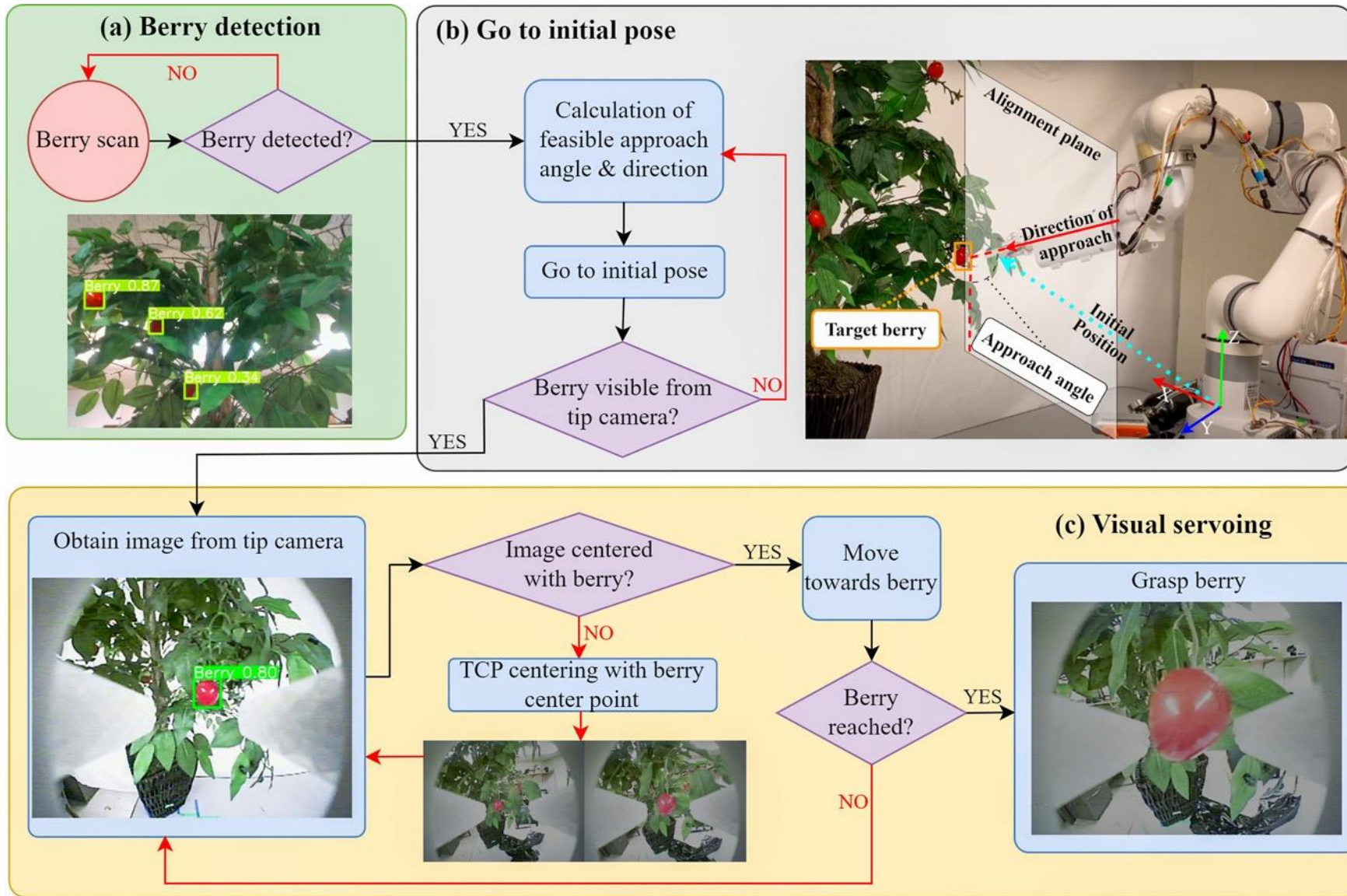


Your farm!



A new class of compact, low-cost, and autonomous equipment will lower barriers to entry to farming!

Berry harvesting with ultra-compact robots



Proposed Approach

- Detect berries from the base RGB-D camera.
- Calculate and actuate to the initial pose for the end effector.
- Center the berry in the image, reach, and grasp the berry using visual servoing



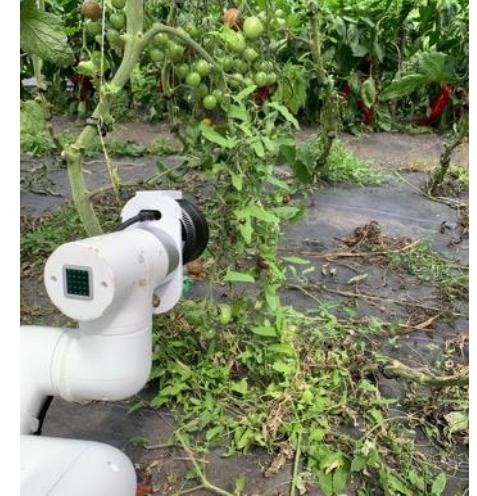
Pest detection and spraying using robots



1. Navigate down the rows autonomously. Simultaneously, camera surveys shrub for zones where bugs thrive: flowers, foliage etc.



2. If bugs are detected, the mobile base stops and the arm visually servos to capture close-up images



3. The tip nozzle sprays chemicals at prescribed targets

Key Results

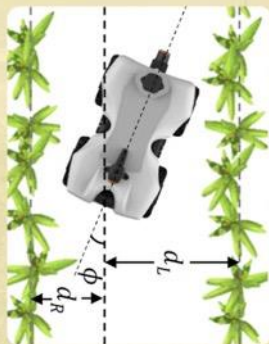




Vision-based perception



Vision-guided Manipulation



Automated navigation

Education
Workforce Training
Curriculum Enrichment



Extension
Profitability & Economic Returns
Adoption by Urban and Minority farmers



Precision Spraying



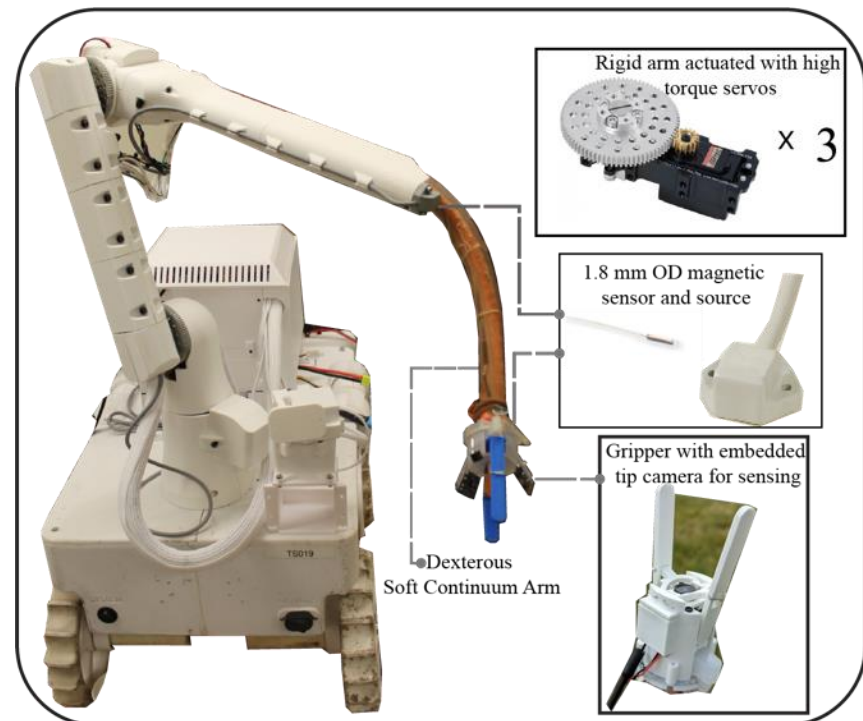
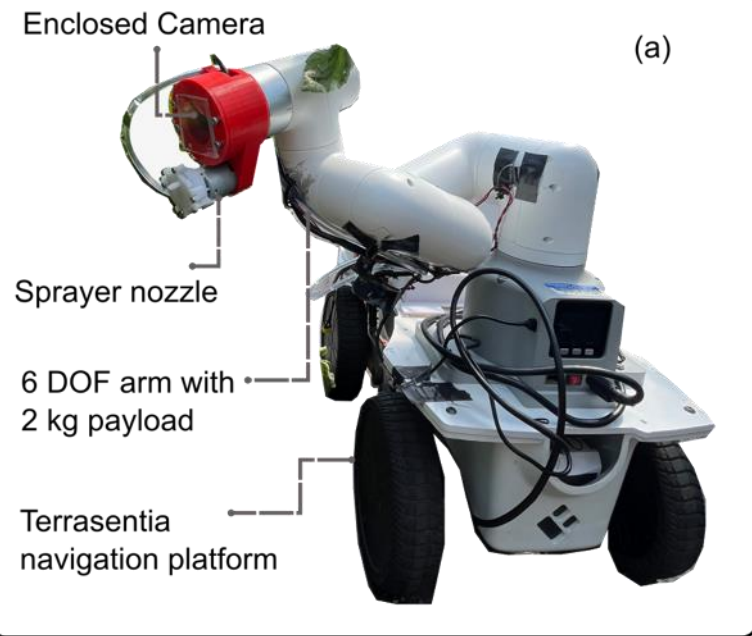
Pest Detection



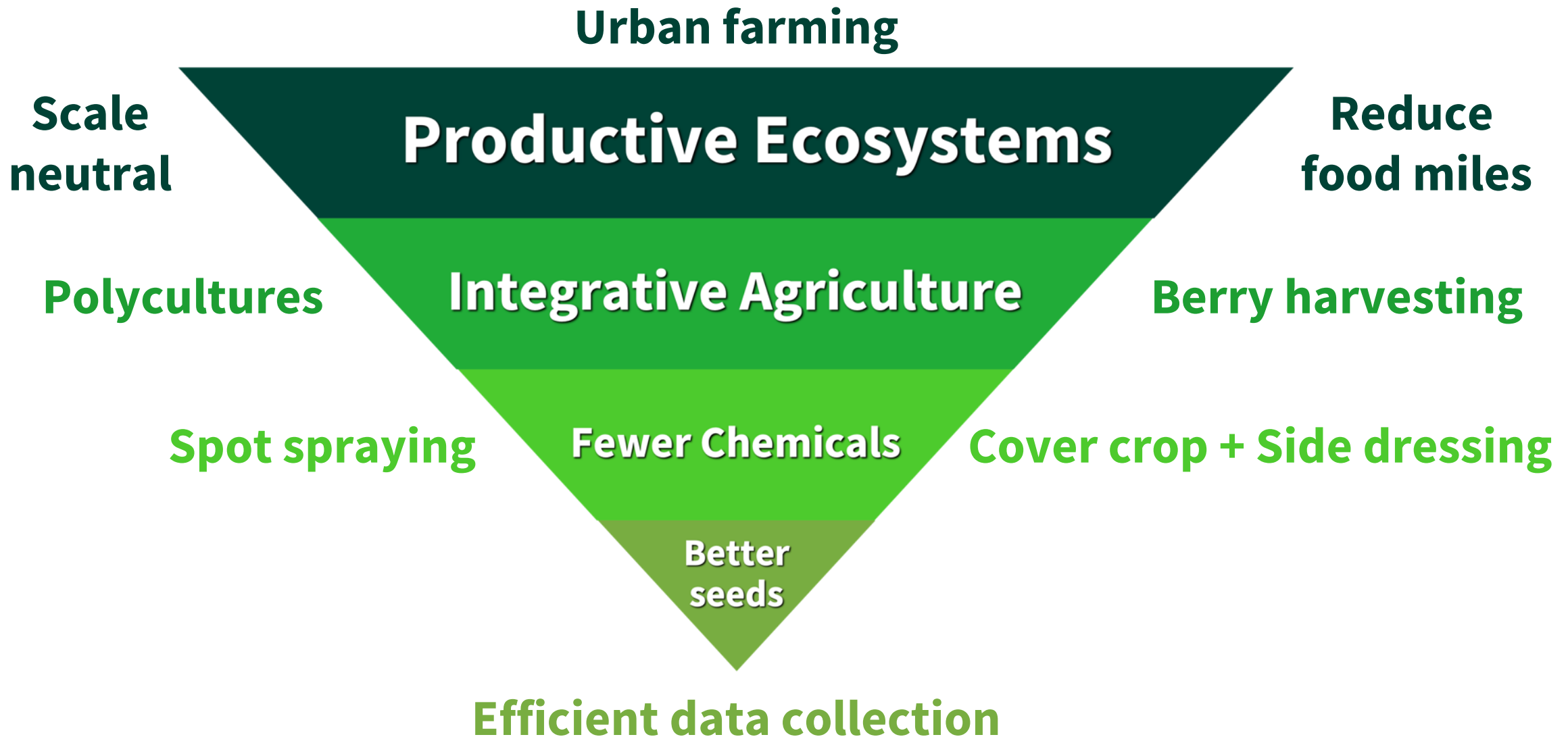
Pruning



Harvesting



Autonomous Robots for Sustainable Agriculture




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I | I-FARM: Farm of the Future

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Welcome to the USDA's only Farm of the Future!

About us

I-FARM stands for "Illinois Farming and Regenerative Management." This University of Illinois-led study — funded for three years and \$3.9M by the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA) — is developing an 80-acre agricultural testbed, where commodity crops, cover crops, and livestock are farmed using synergistic, sustainable practices.

The I-FARM testbed features improved precision farming with remote sensing; new autonomous solutions for cover-crop planting, variable-rate input applications, and mechanical weeding; and artificial intelligence-enabled remote sensing for animal health prediction, nutrient quantification, and soil health.

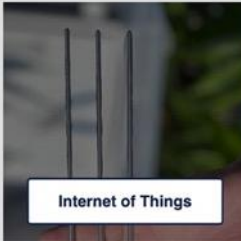


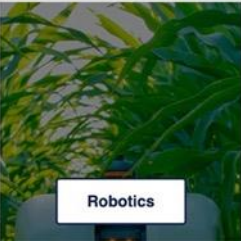
Videos from the field



A full I-FARM video playlist may be found on [YouTube >>>](#)

I-FARM University: Passing on the knowledge!

I-FARM will demonstrate new technologies, data-driven products, and services for farmers and industry, easing adoption and opening new markets.




Subscribing to: **I-FARM Updates**

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Join our mailing list to receive the latest updates on the I-FARM project. This includes research, events and extension programming.

I'm not a robot



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