The Future of Weed Recognition Technology: Open, DIY

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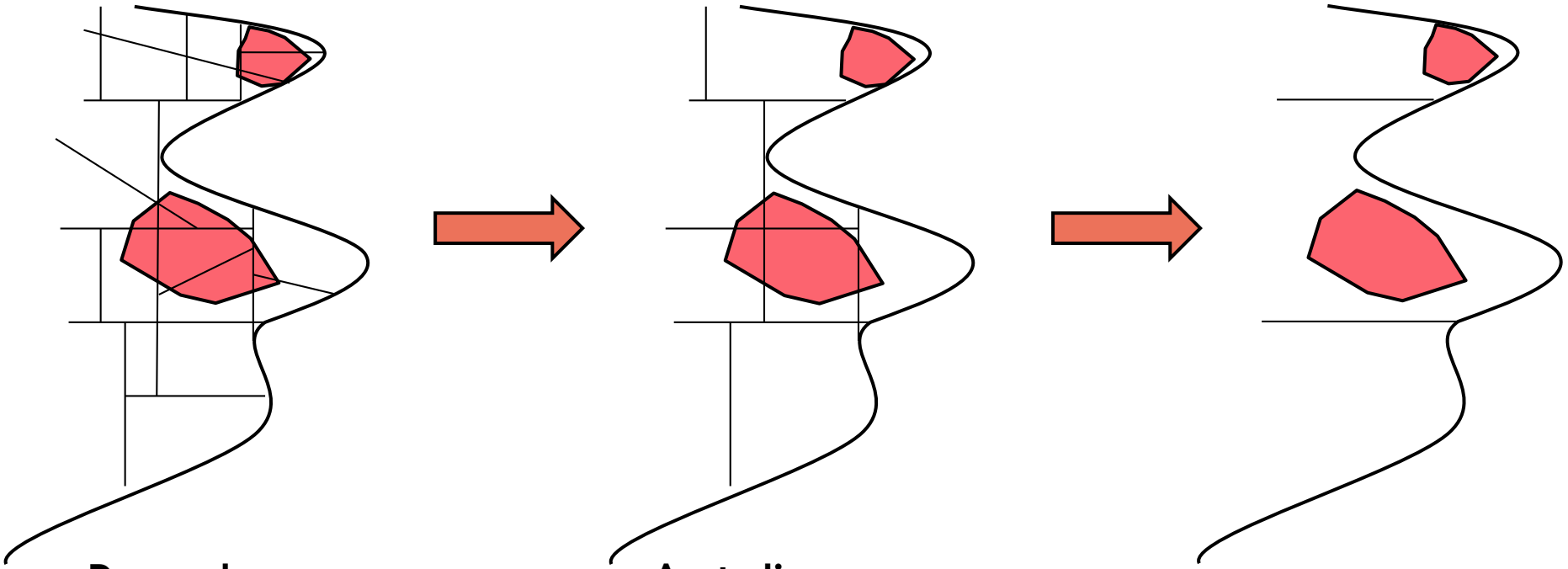
KØBENHAVNS UNIVERSITET

Increasing farm size



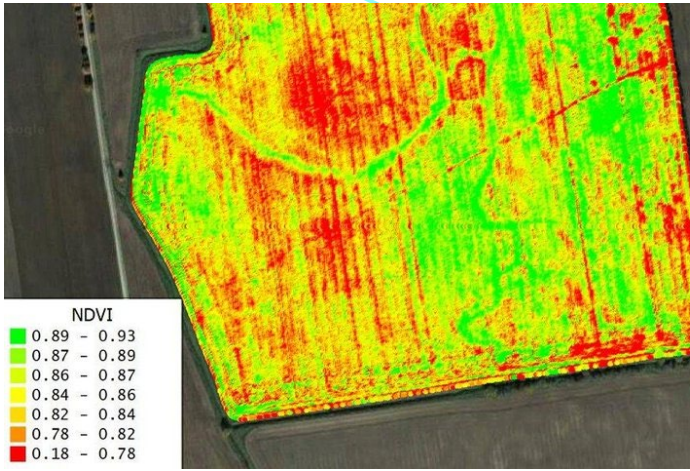
Denmark:
250% increase in 40 years
30ha to 83ha

Australia
~4000ha
Positive correlation – size vs. productivity (Sheng et al. 2019)

AgTech: Bringing back precision?

Technology-driven precision

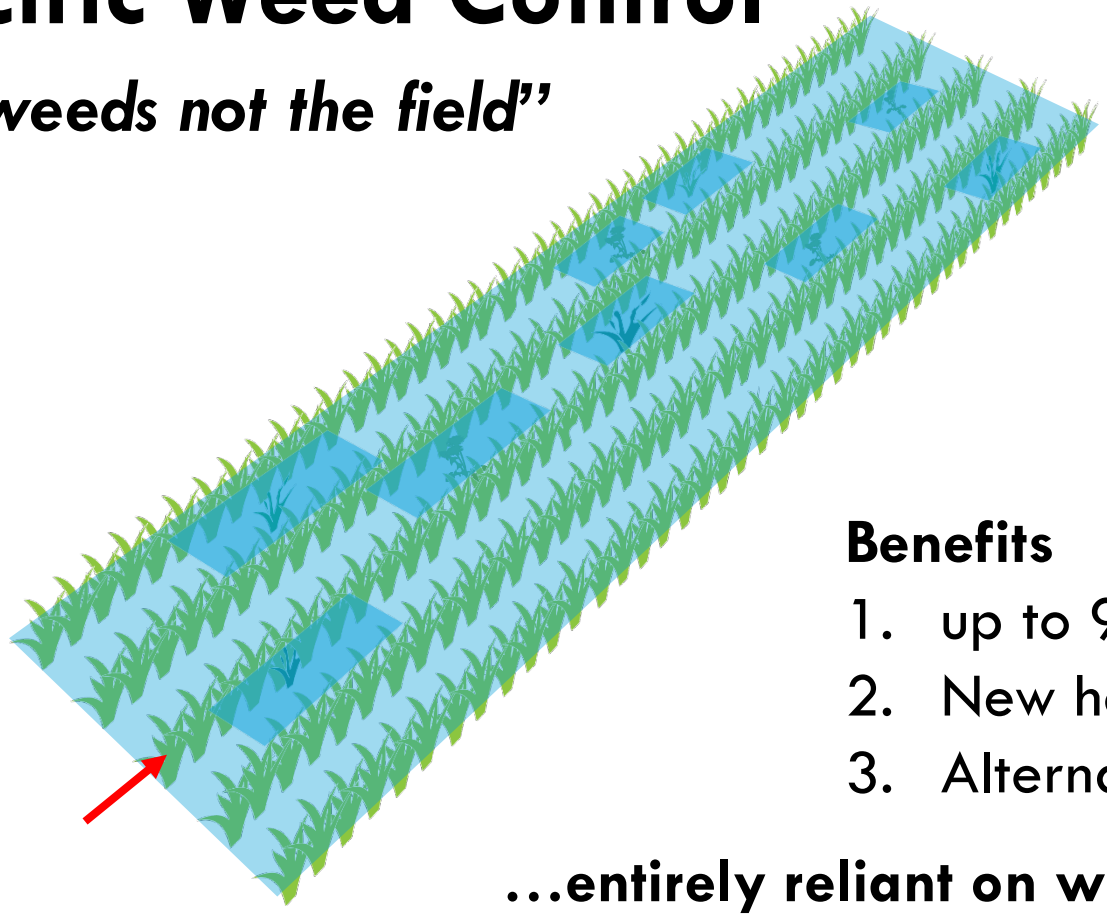
1. Sensing technologies
   - Satellite
   - Drone
   - Camera
   - Scanners
2. Location information
   - GPS guidance
   - Mapping
3. Precision application equipment
   - Seeding, VR fertiliser
   - Targeted spraying
   - Robotics etc.



Source: Shurlaeva et al. 2021

Site-specific Weed Control

"Treat the weeds not the field"



Benefits

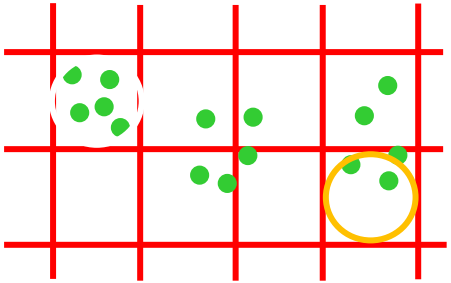
1. up to 90% savings
2. New herbicides
3. Alternative control

…entirely reliant on weed detection

Detection Scale

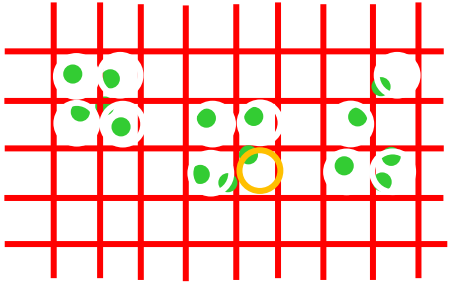
Increasing precision

Target < pixel size



Missed detections

Target > pixel size

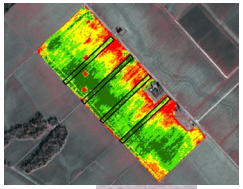


Higher accuracy

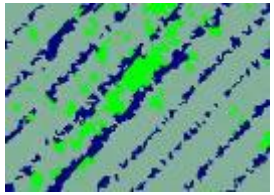
Satellite

Drone

Ground-based



Maps

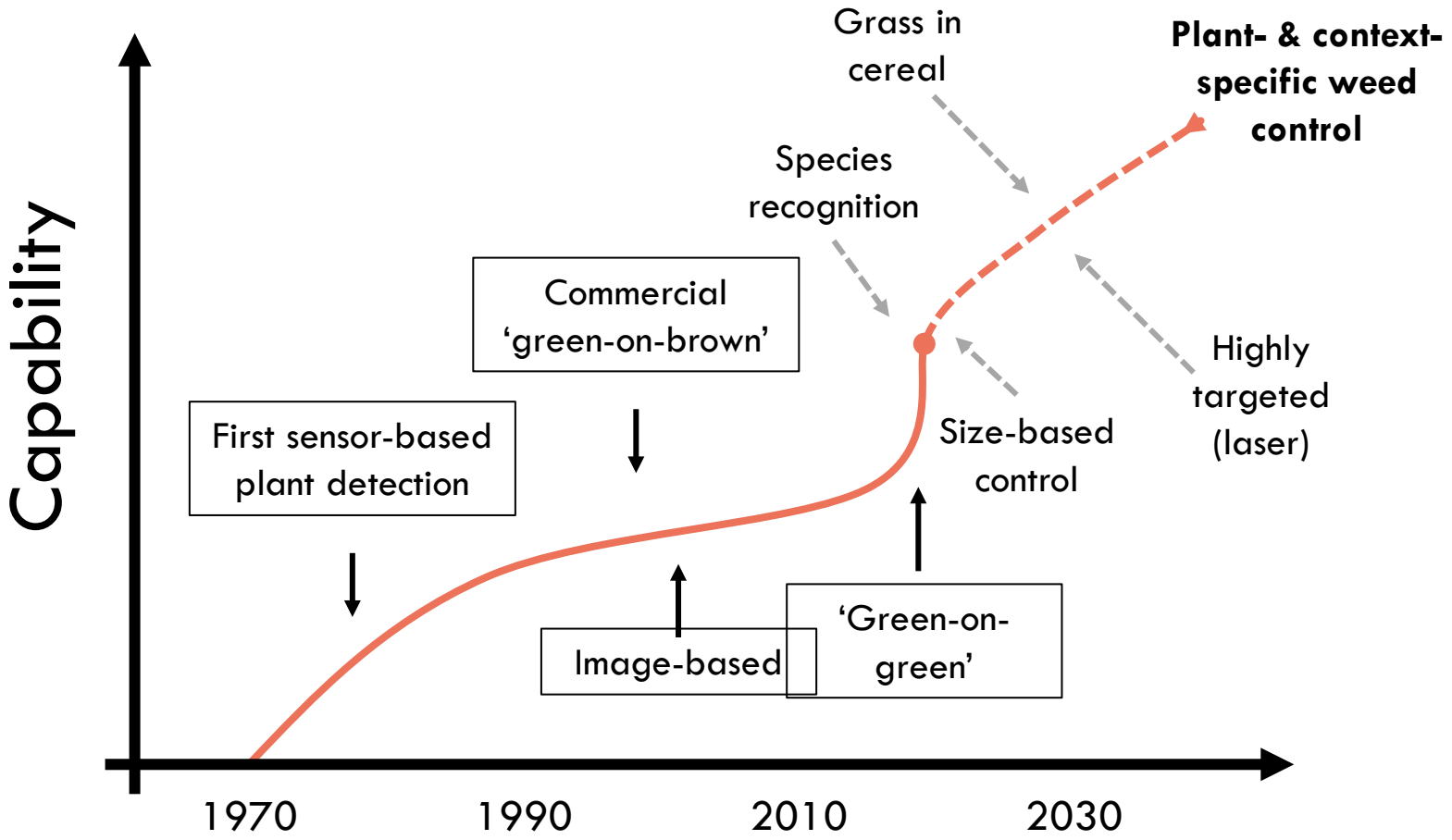


Maps (real-time?)

Real-time

Increasing cost

The SSWC Curve



Use Case: Targeted Tillage

Use Case: Spot Spraying

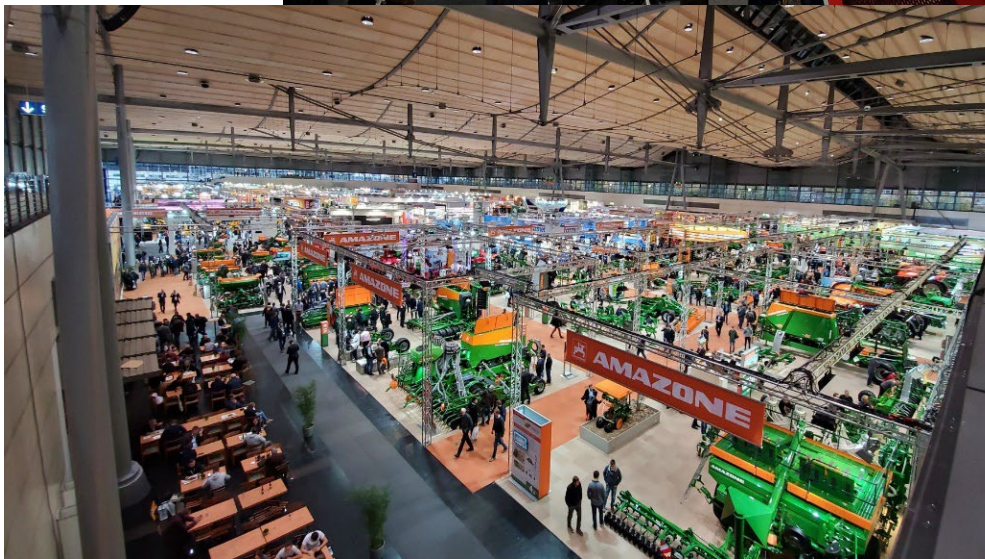
How many spot sprayers?

Agritechnica

1. 256 ha of indoor space
2. 2500 exhibitors, 460k attendees
3. Mind blowing.

Site-specific weed control

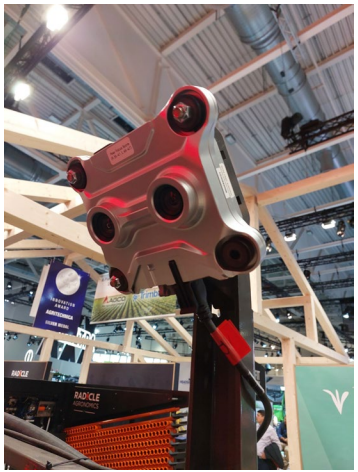
1. 26 different companies
2. 5 in 2019 → over 15 in 2023
3. OEMs partnering with third party providers
4. Not much interest in open-source development



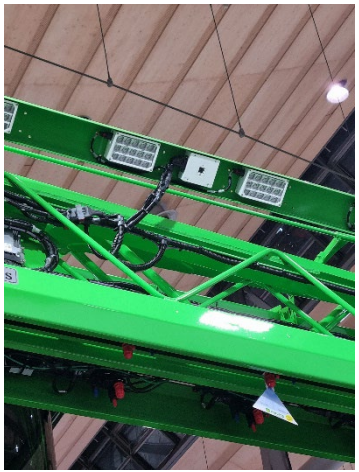
Agritechnica 2023

beeLeap

ExxactRobotics 3S



PrecisionPlanting



One Smart Spray

Bilberry

How did we get here?

Weed detection isn't new.

1. *Not driven by agriculture*
2. *Open-source technology*
3. *Computing power*
4. *Access to open-source data*

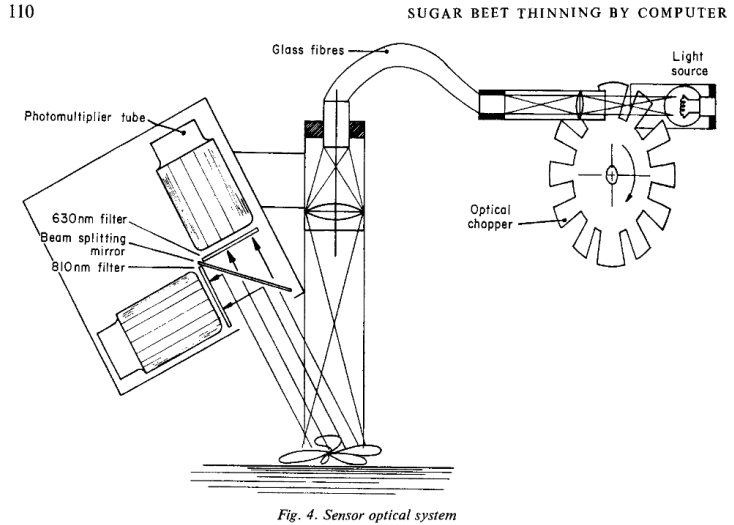


Fig. 4. Sensor optical system

Source: Palmer and Owen, 1971

Attention Is All You Need

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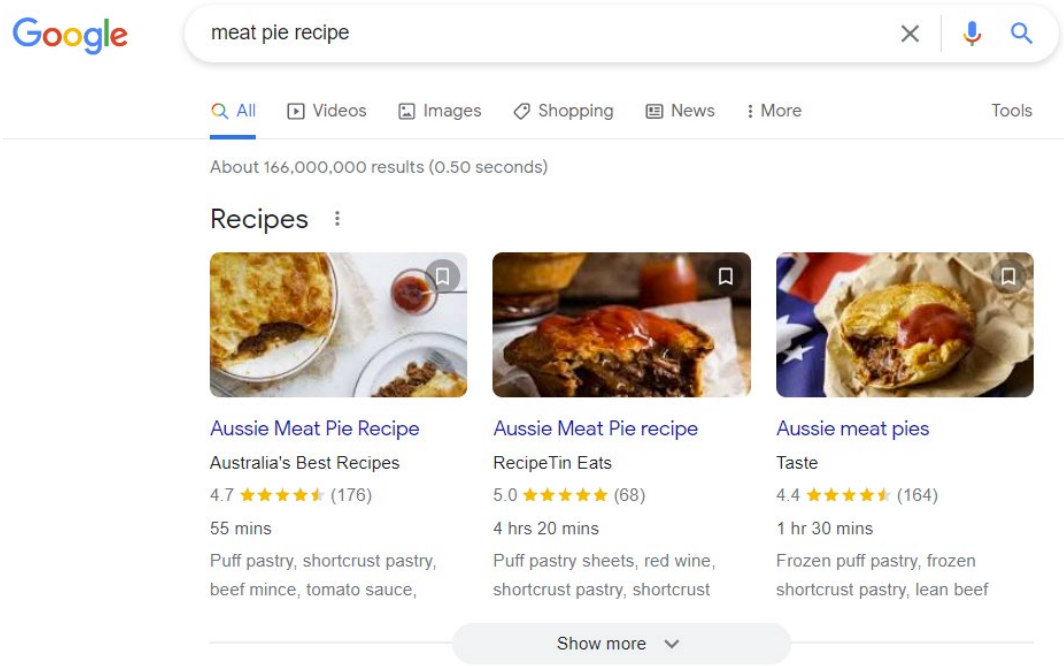
Recipe Books and Pies

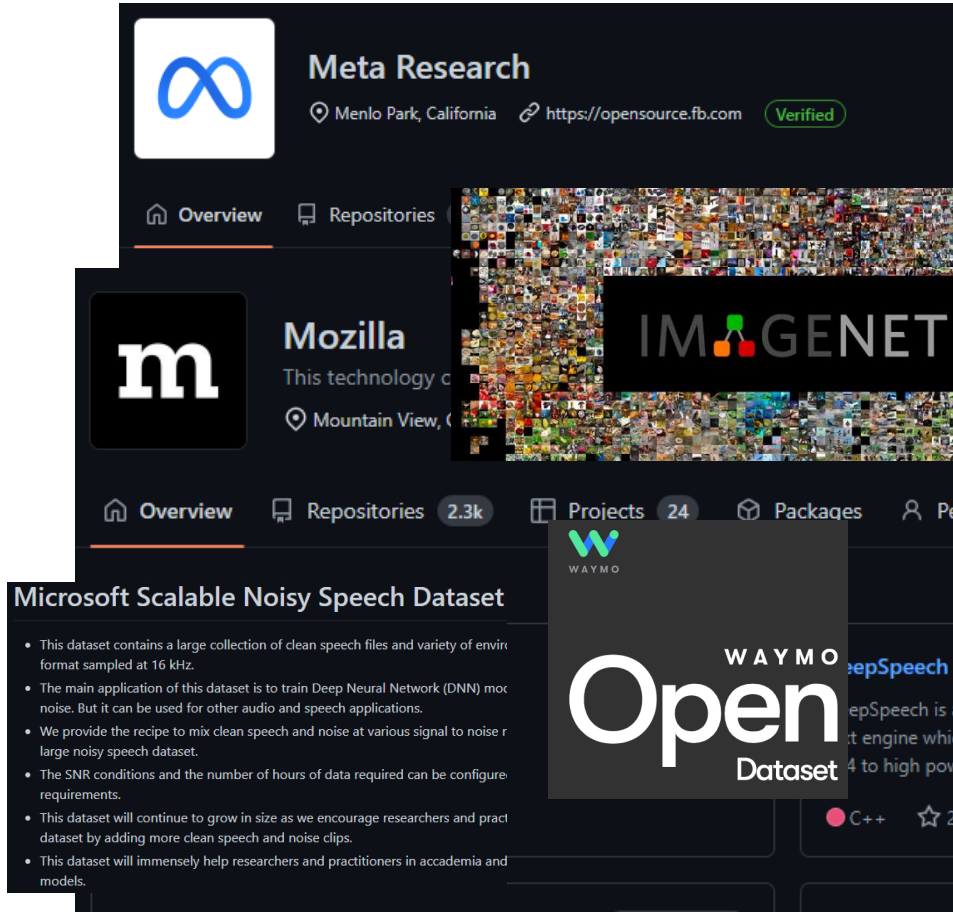


Why did tech become open?

Sharing the tech 'recipe'

- Collaboration – access to talent
- Set industry standards
- Reduced development costs
- Control critical tech
- Indirect benefits
- Lower the barrier to innovation
- User-driven development

Enables open development and use



would tech be as advanced as it is now if it weren't for open source development

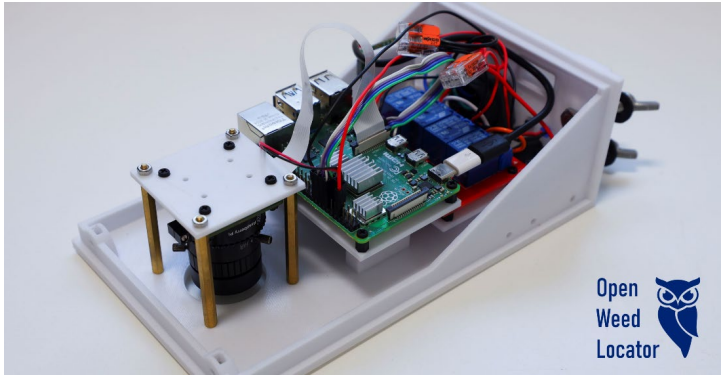
It's unlikely that technology would be as advanced today without open-source development. Open source has played a critical role in accelerating innovation and making advanced technologies accessible to more people. Here are some key reasons why:

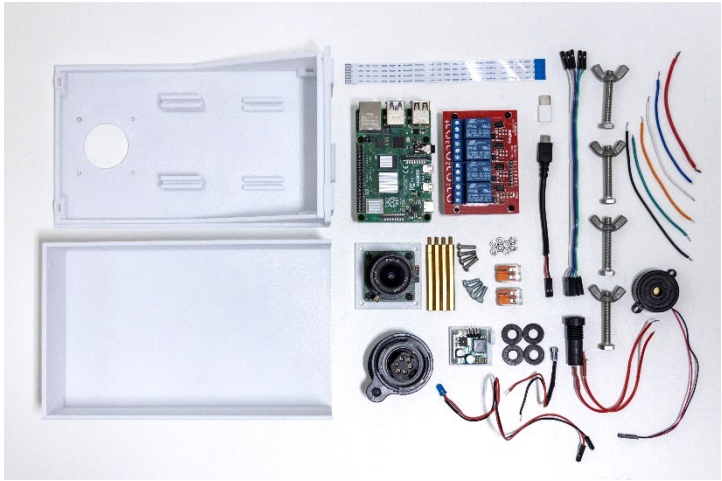
Can agriculture advance faster with open-source tech?

DIY Weed Detector

Aims

- Educational, practical tool
- DIY detection + actuation
- Colour-based/model-based

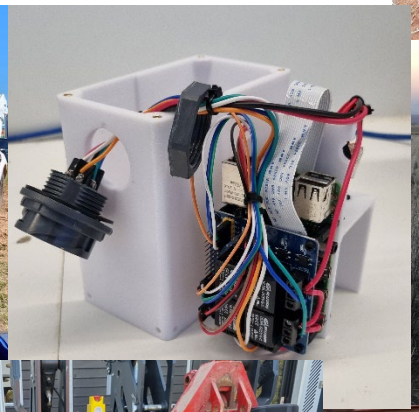


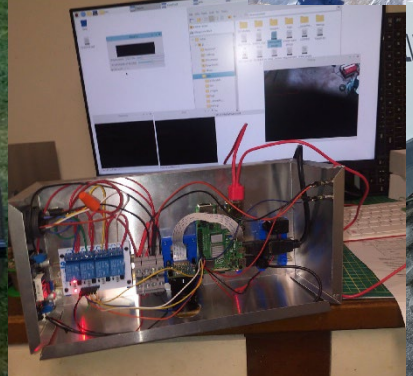


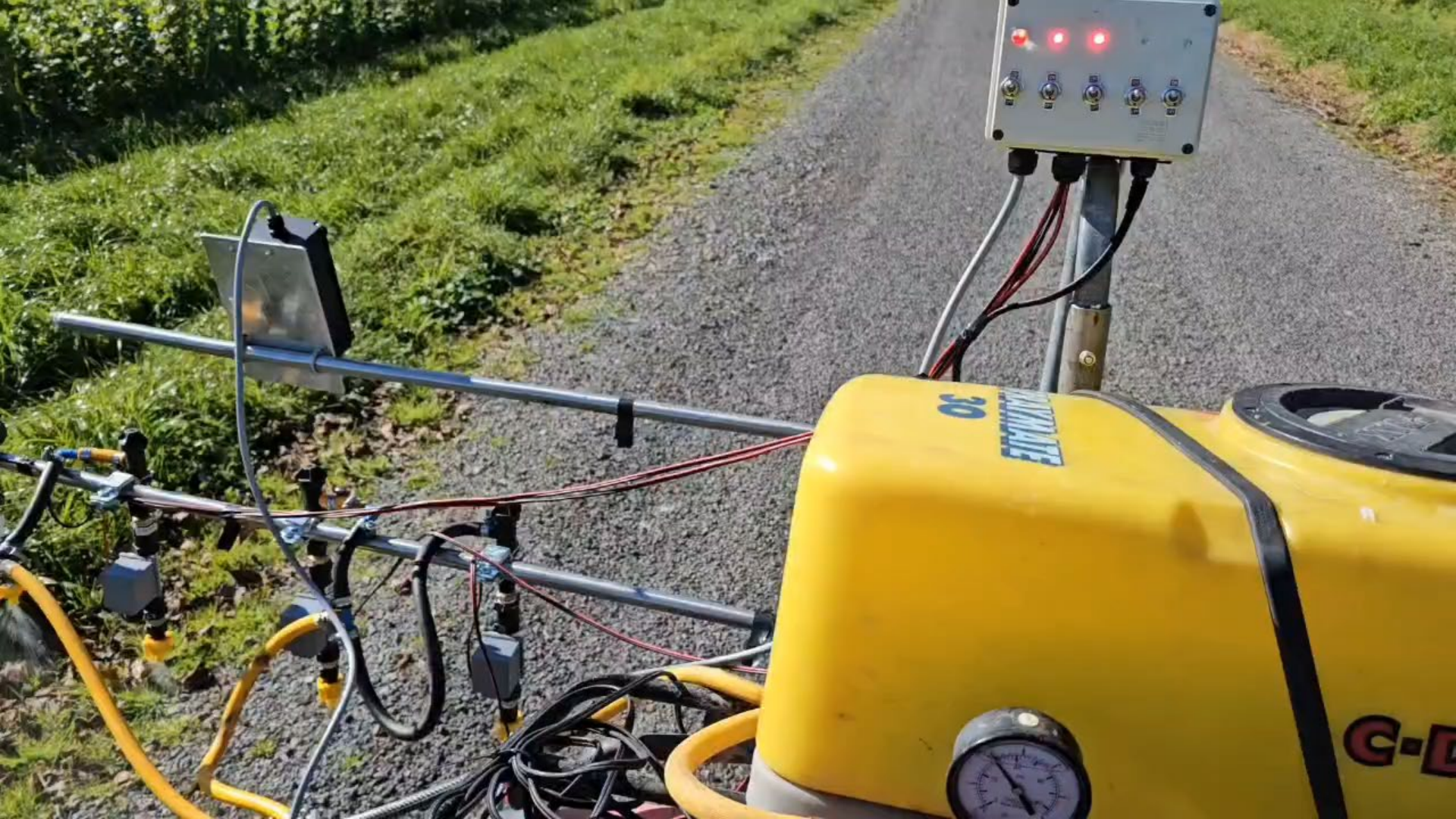
Repository: https://github.com/geezacoleman/OpenWeedLocator

OWL: Community

- Farmer-led innovation
- Aus., Canada, UK, US, France…





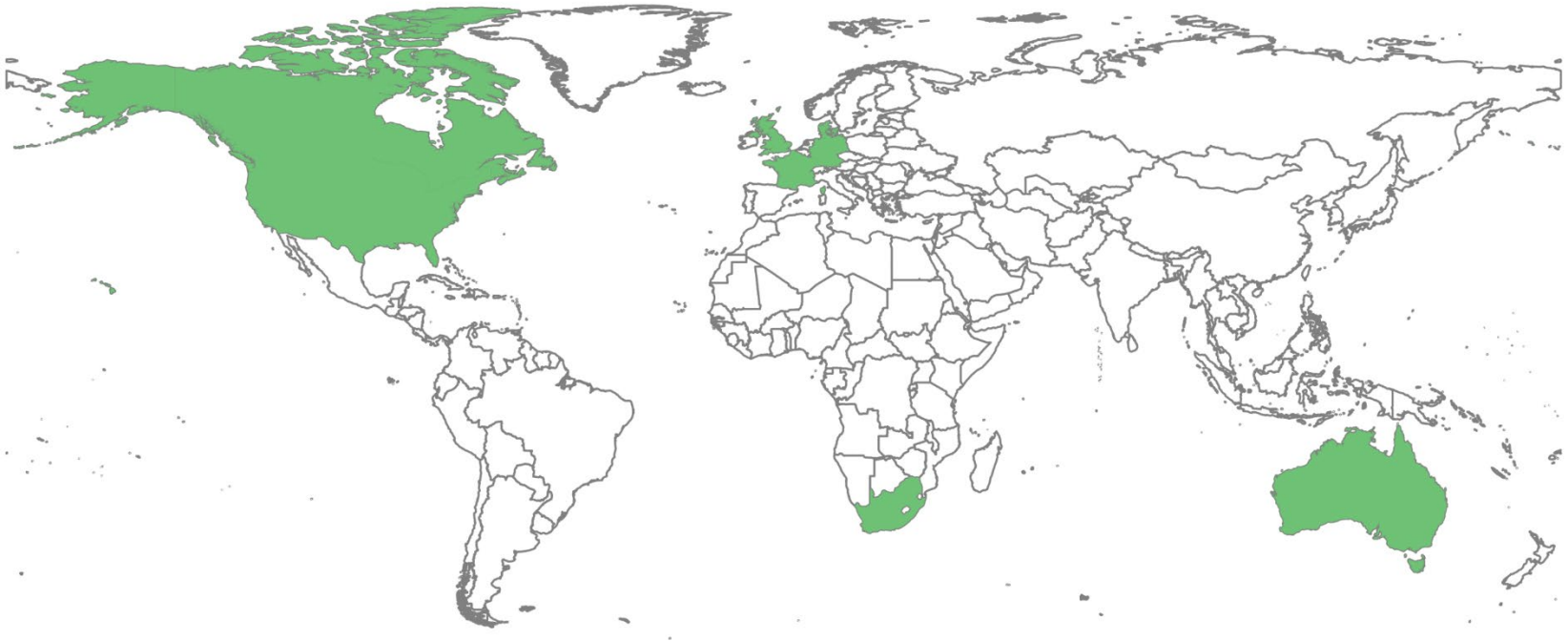

30


ON
OFF
RECORD
SENSITIVITY
OFF
SPOT
STATUS
1
2
3
4


KUBOTA

OWL: Global Community

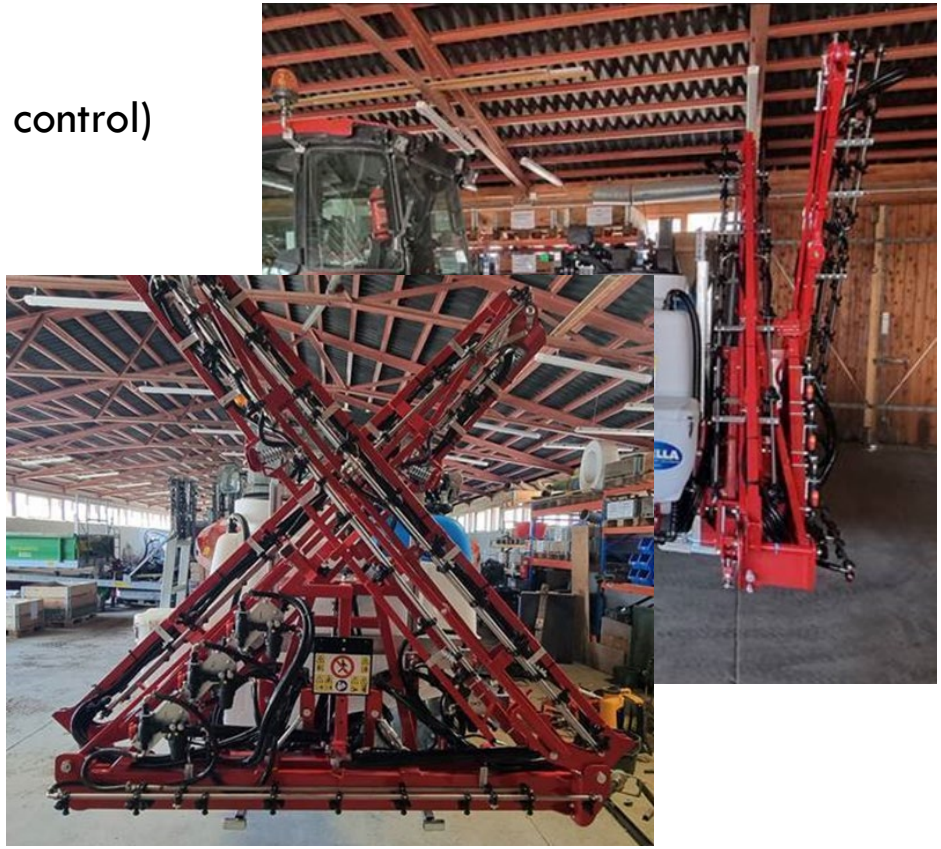
10 countries and counting…



NNF Pioneer Innovator Grant

Aims

1. Improve OWL useability (precision thistle control)
2. Run field trials
3. Workshops, outreach, website



We want to work with you!

Contact me:

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Questions

Open-source images

weed-ai.sydney.edu.au

OWL - DIY weed detector

github.com/geezacoleman/OpenWeedLocator

Contact

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Kieran Shepherd

University of Sydney Research Farm 2021