



Precision Decisions

DRIVING FARMING FORWARDS



Sustainable Intensification?





Global perspective

Threats or Opportunity

- As farmers we are tasked with providing 100% of the worlds food
- In the future we will may be encouraged to also supply 60% of the worlds energy
- 2012 – World population exceeded 7,000,000,000 (Billion)
- 2050 – World population predicted to be 9,000,000,000+ (Billion)
- Change in global diets
- World food production needs to significantly increase to support this growth

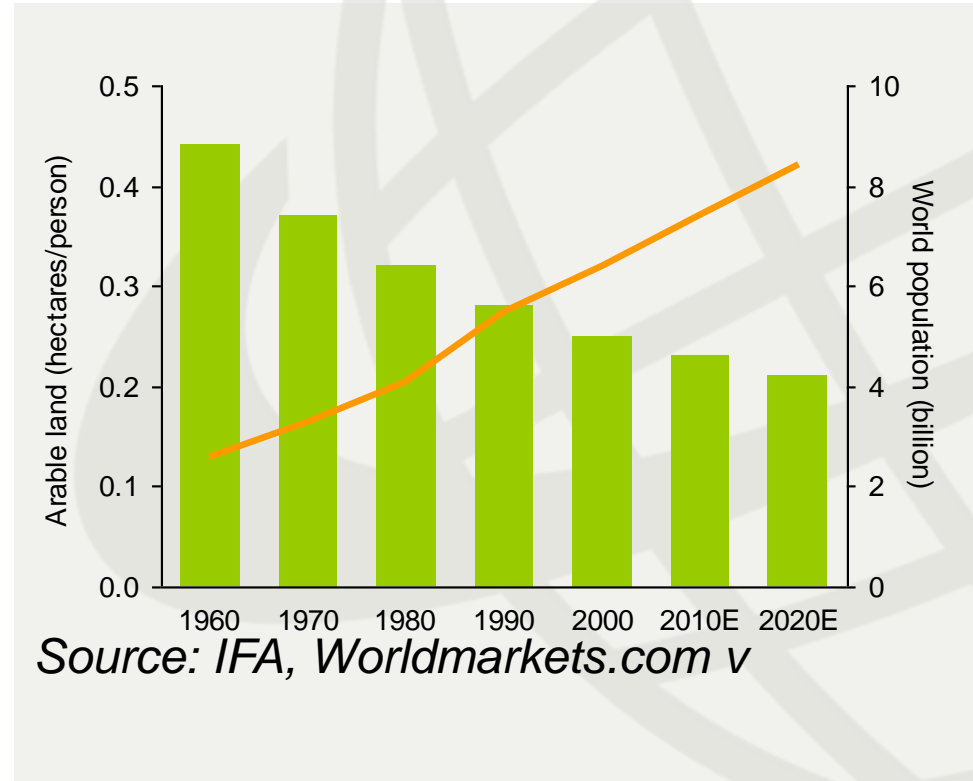


Increasing Population – Limited Recourse

Very limited potential to increase arable land

Improved living standards increase protein consumption per person requiring more grain for animal feed

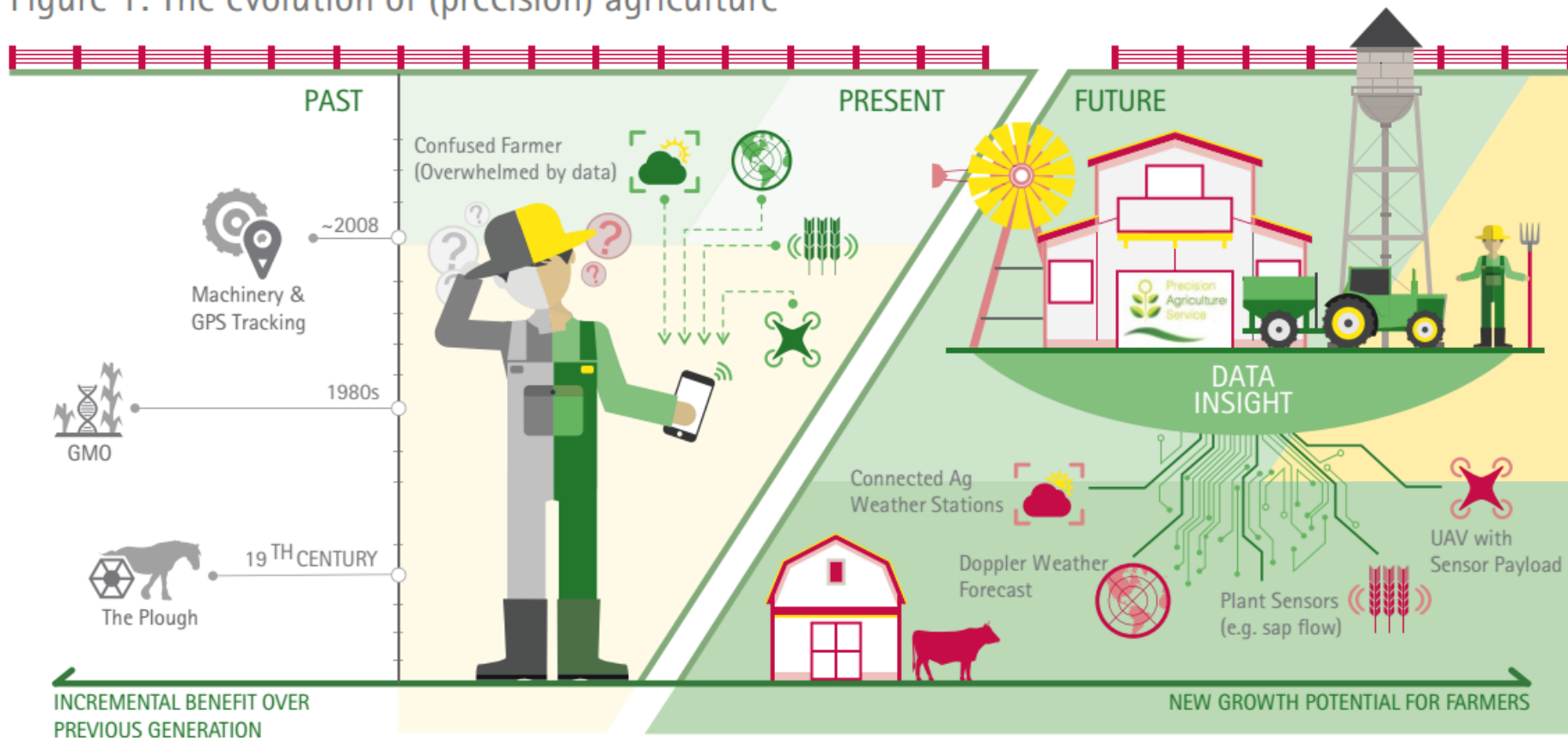
The only solution is to increase agricultural productivity





Evolution of Precision Agriculture

Figure 1: The evolution of (precision) agriculture





What is Sustainable

Job or Food?





Will we reinvent the wheel

Agriculture running on renewables!





How do we fill the Gap





Agricultural Price Challenge

Bigger is better?

UK AGRICULTURAL TRACTOR REGISTRATIONS (> 50 hp)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Units	13068	13566	15540	17104	15013	13347	14094	13951	12498
Annual % Change	-11.4	3.8	14.6	10.1	-12.2	-11.1	5.6	-1.0	-10.4
Total horsepower (000's)	1667	1741	2082	2361	2153	1892	2033	2066	1880
Annual % Change	-12.2	4.4	19.6	13.4	-8.8	-12.1	7.5	1.6	-9.0
Average horsepower	127.6	18% increase in 8 years							150.4
Annual % Change	-1.0	0.6	4.4	3.1	3.9	-1.2	1.8	2.6	1.6



Increasing Scale of Agriculture

More with less - increase productivity and efficiency



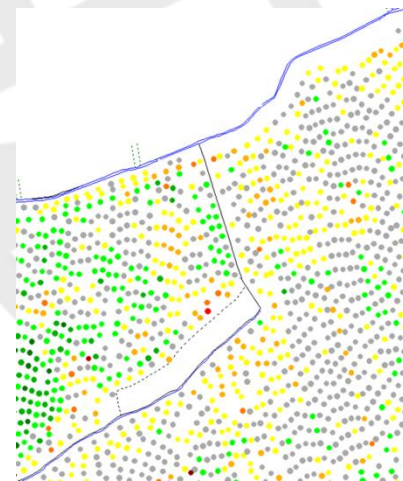
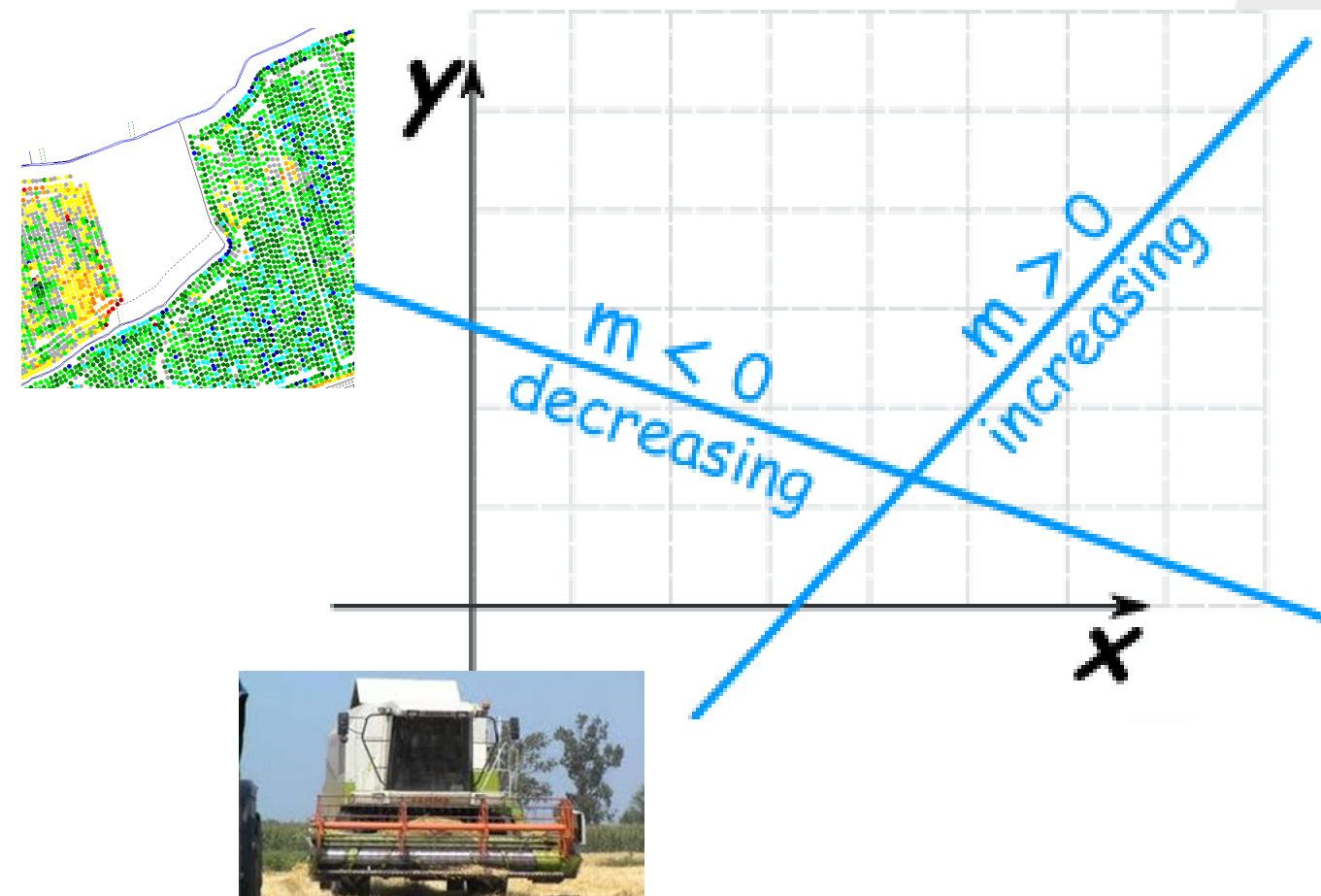


Combine Harvester Scale





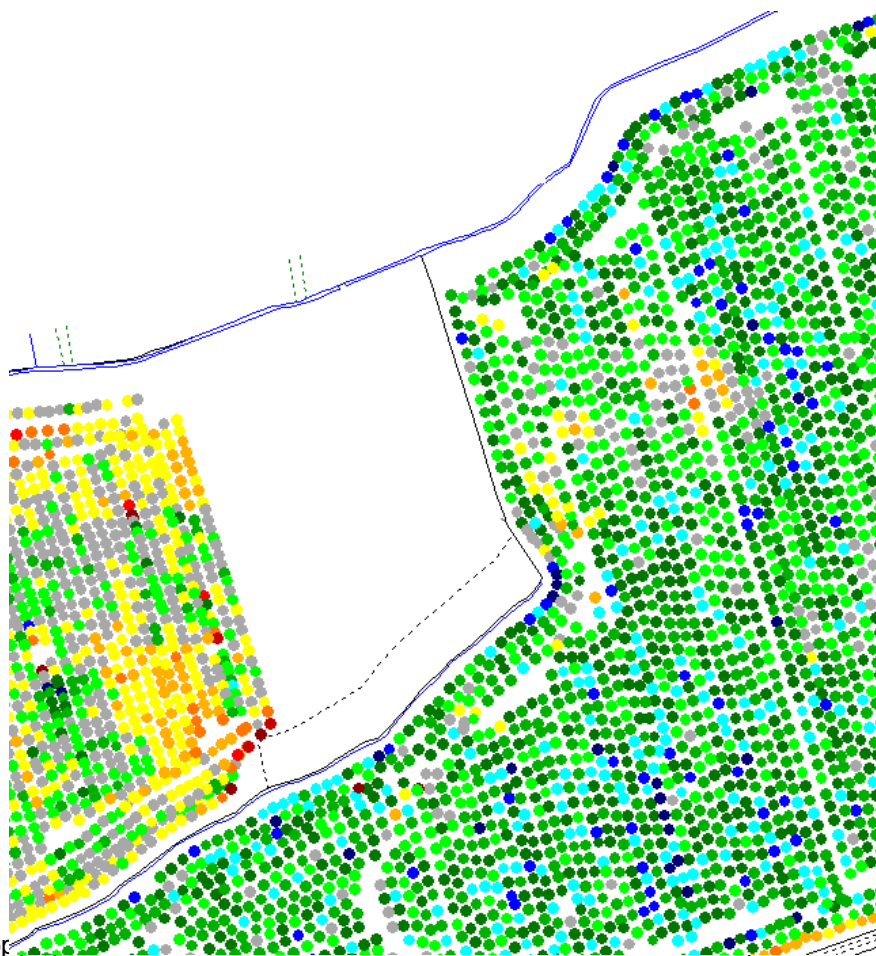
Scale – Output +++++



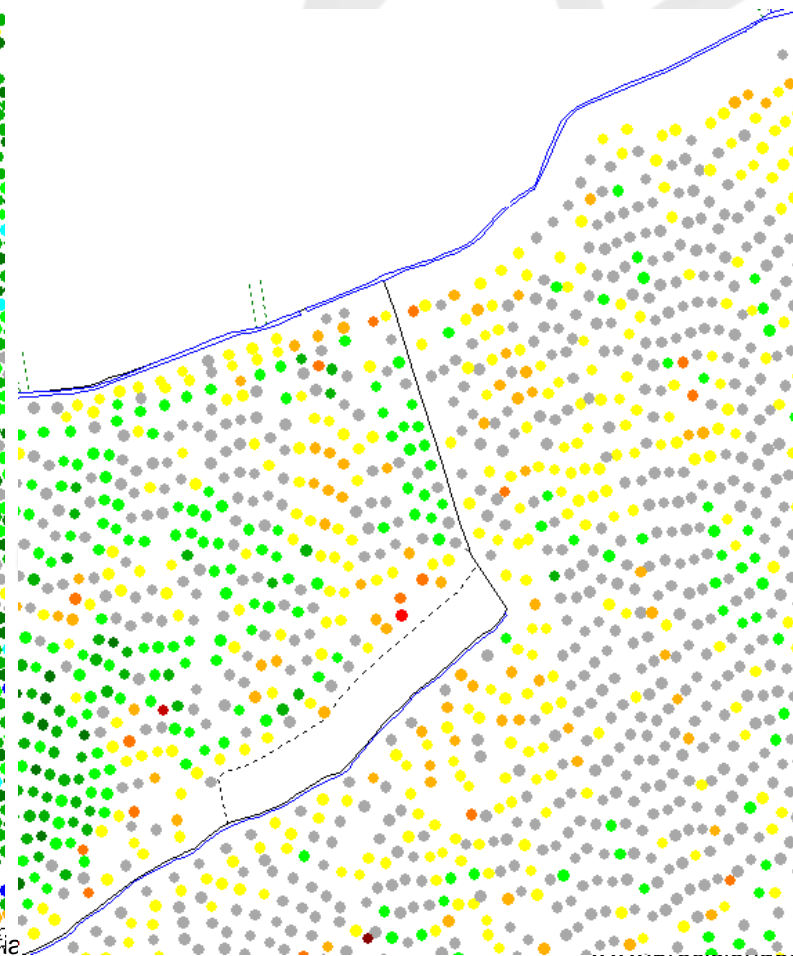


Less data – reducing resolution

Yield Data 2004



Yield Data 2014



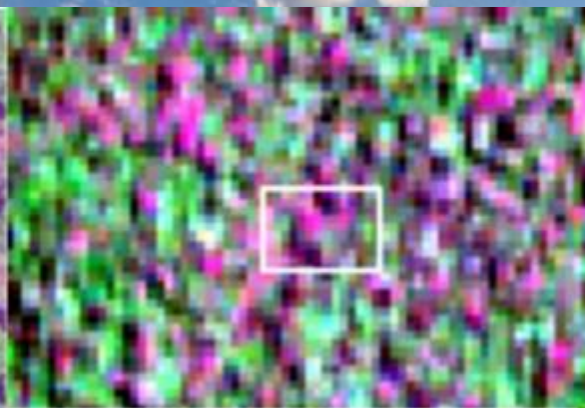


Changes in data size and resolution

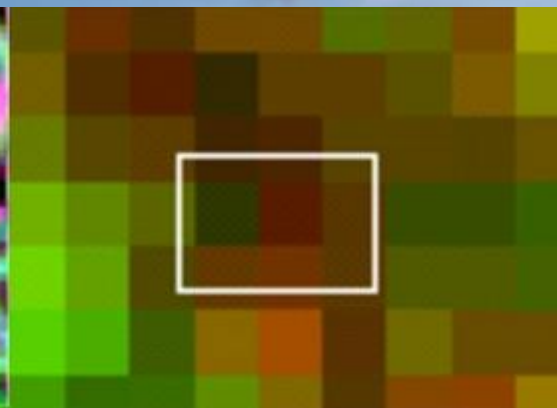
High Resolution
UAV
5 CM Pixel



High Resolution
Satellite
2 M Pixel



Low Resolution
Satellite
20 M Pixel



50 CM
10 TIMES BIGGER
THAN A UAV PIXEL



Management challenges

Conventional or traditional
field management

Field
One rate

Optimised management

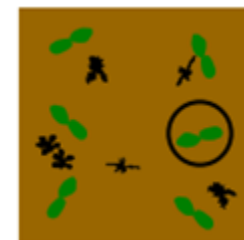
Sub-Field
Variable rate

Single plant management

Single plant
Individual rate

Leaf scale management

Leaf
Leaf rate





Why are animals Different to Plants?





Hands Free Hectare - Pre-Drilling Herbicide Application





**ESTABLISHING
GROWING
HARVESTING
MANAGING**



Precision
Decisions

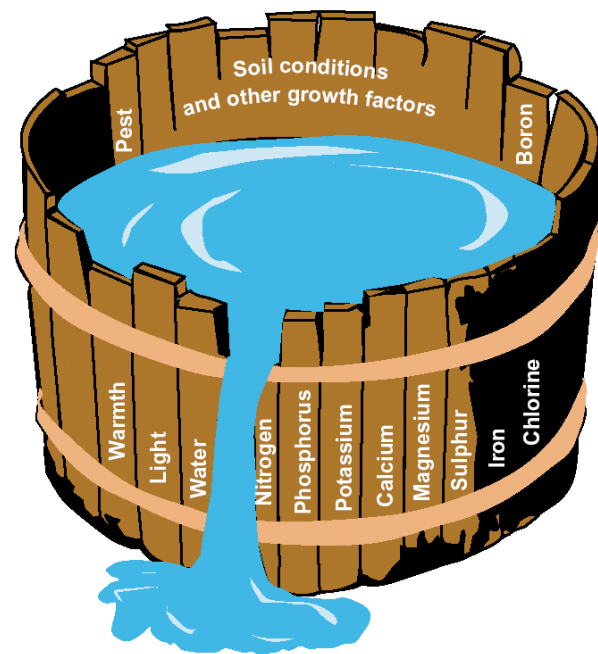
DRIVING FARMING FORWARDS



Limitations cost Money

- **Identify** limiting factors
- Use **Knowledge** to identify Limitations
- **Measure** What works
- **Measure** What does not work

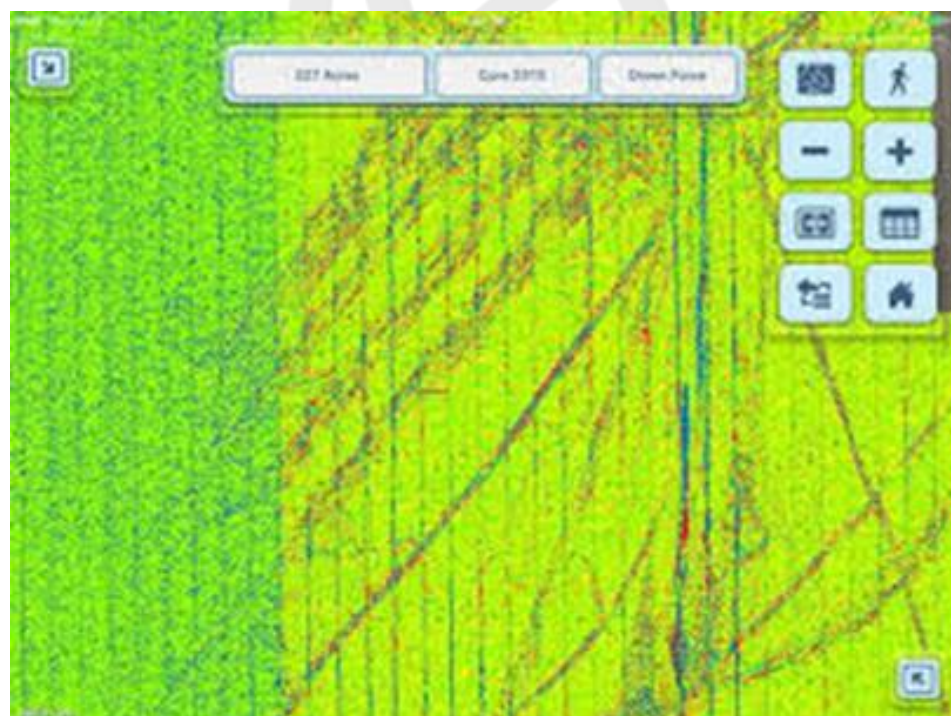
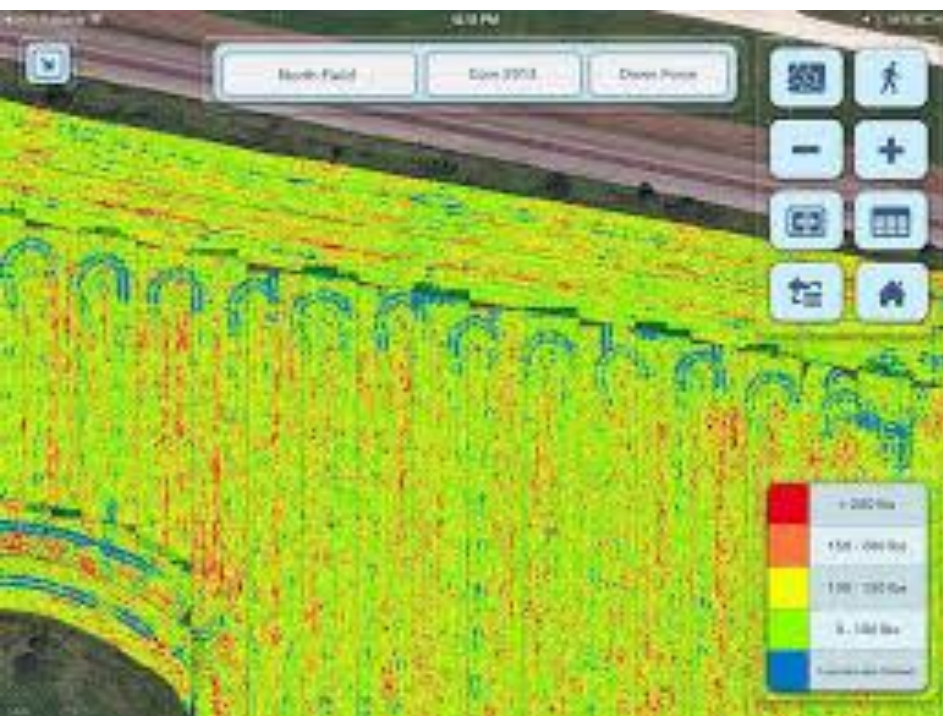
Under performing areas
cost yield and reduce
income





Precision Mapping

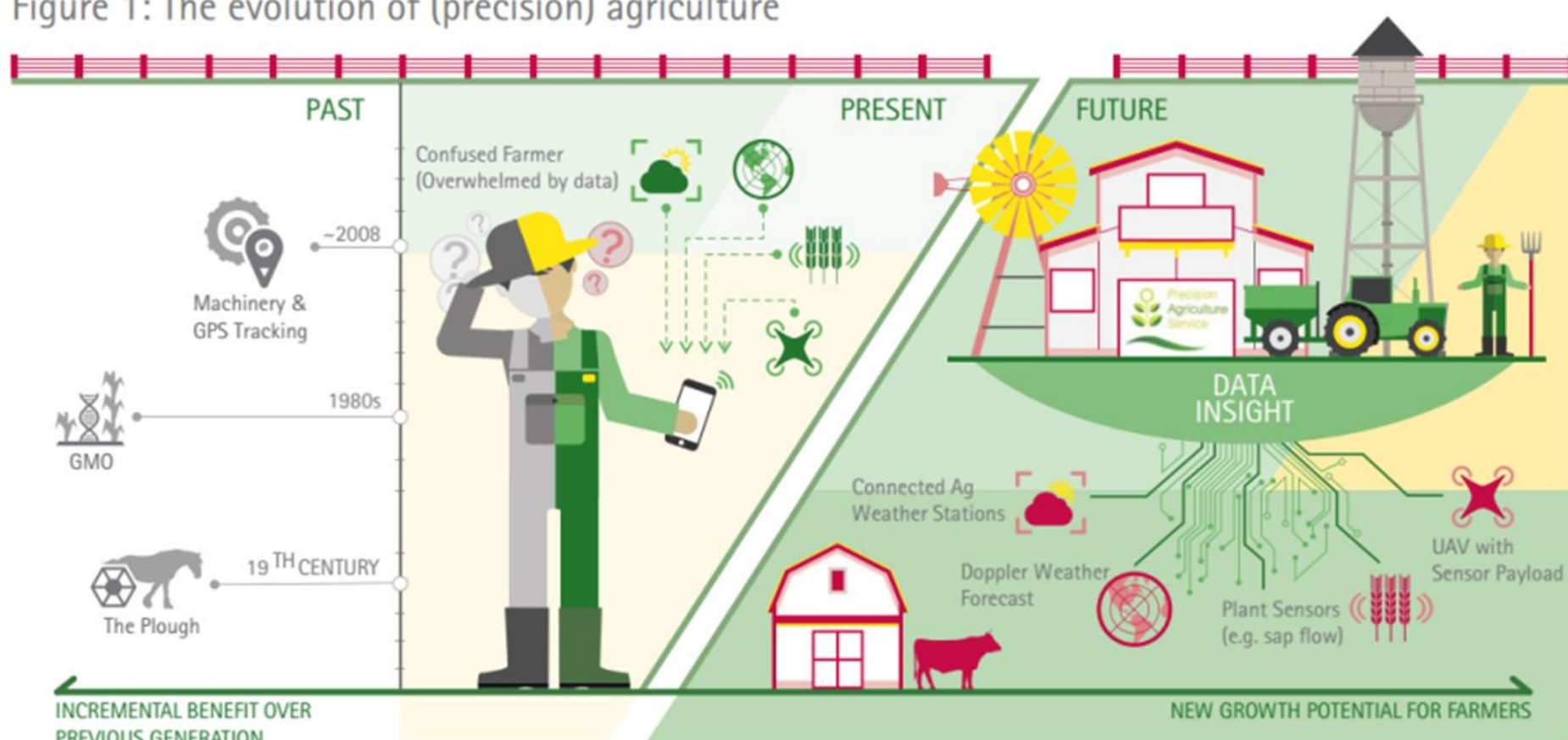
If we can see the problem -





Precision Agriculture

Figure 1: The evolution of (precision) agriculture





HandsFree Hectare

An Innovate UK funded collaborative feasibility study between:



Precision
Decisions



Harper Adams
University



Field Robotics – possible future

Current Ag problems

Limited time windows = ever larger machines

Reduced rural labour = ever larger machines

Compaction limiting yield **cause** large machines

Lack of resolution for PF **cause** large machines

Small robot solution

Reduced compaction = increase yield?

Increased resolution = improved PF = margin gain?

Robots operate in “swarms” = same area covered

Swarm requires management = job retained



Future plant scale
robotic management

40hp scale farming
A first step to field robotics



Precision
Decisions

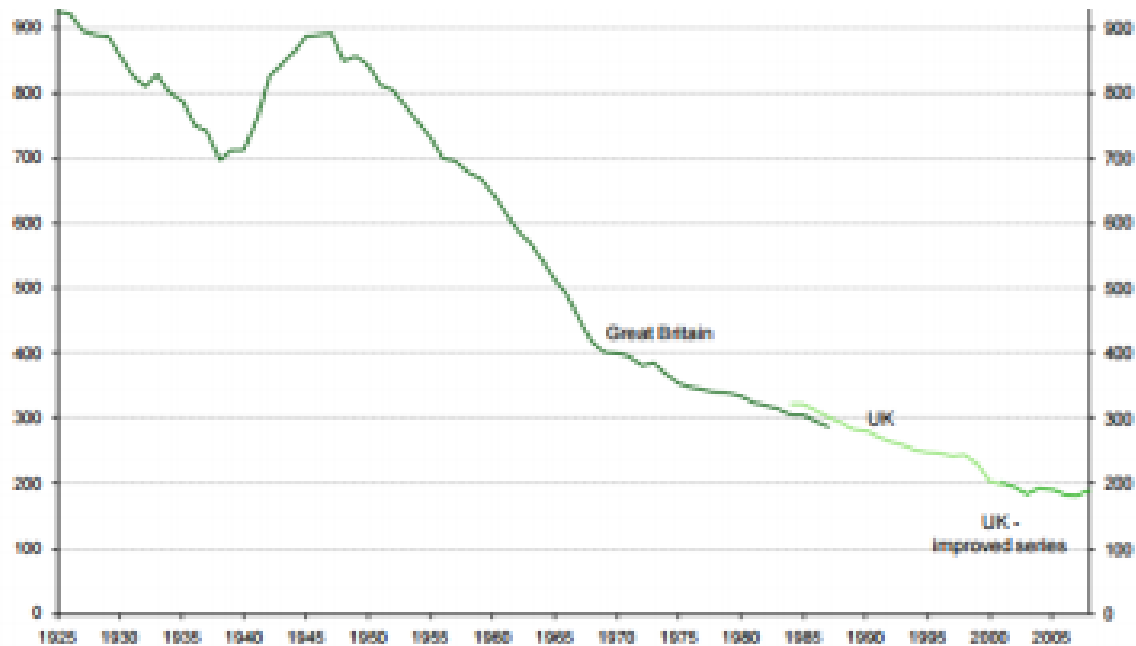


Harper Adams
University



Staff Losses with Robotics?

Figure 3: number of agricultural workers in the UK, 1925-2010 (in thousands)



Source: House of Commons, Briefing paper, Agriculture Historical Statistics, n° 03339, Jan. 2016



Hands Free Hectare – world first

Project outline

“Automated machines growing the first arable crop remotely, without operators in the driving seats or agronomists on the ground”

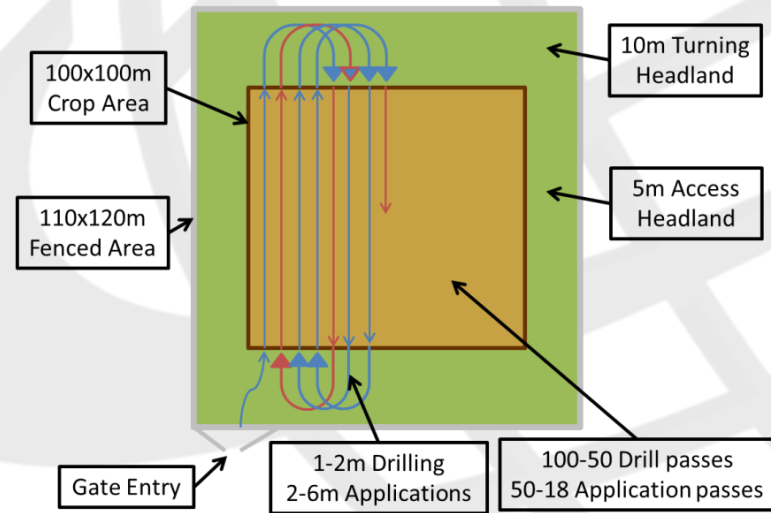
Project objective

1. World first automated field growing cycle: drilling, husbandry/agronomy and harvest
2. Challenge perception of automation capability and inspire through media coverage
3. Utilising machinery and technologies that are available and affordable **not** bespoke and expensive:

Commercial compact Ag machinery

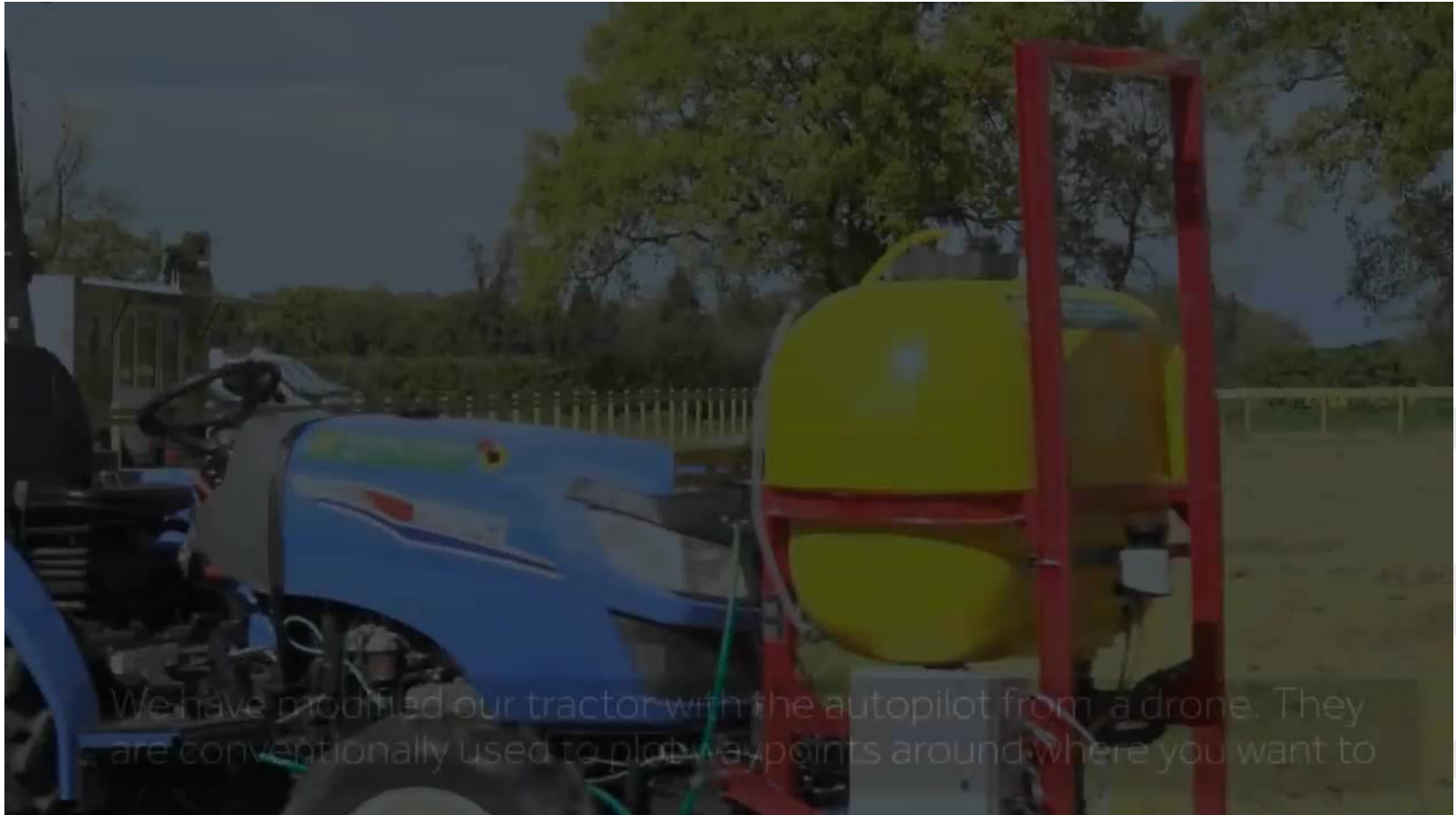
“Open source” automation

4. 1 year project.... One chance!!





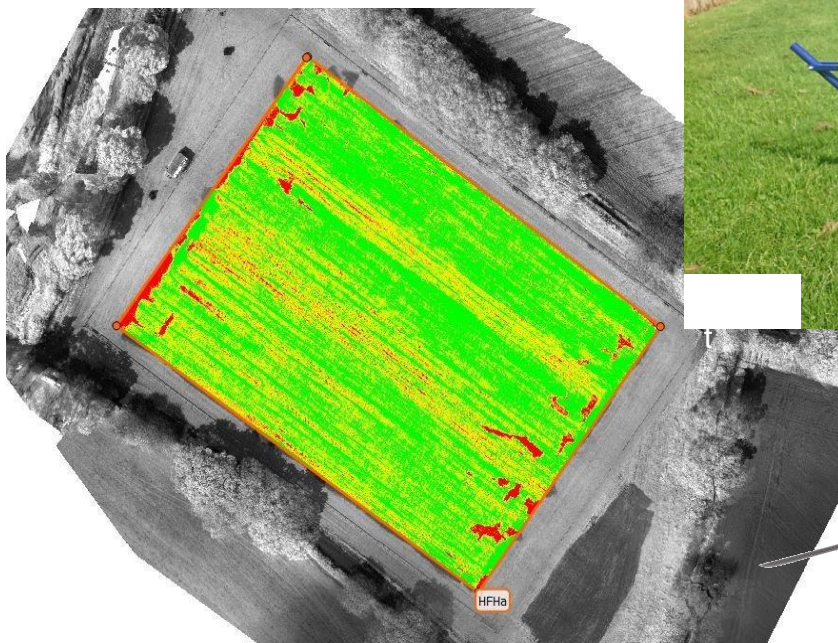
Hands Free Hectare - Drilling Spring Barley with Placed Fertiliser





Hands Free Hectare – progress

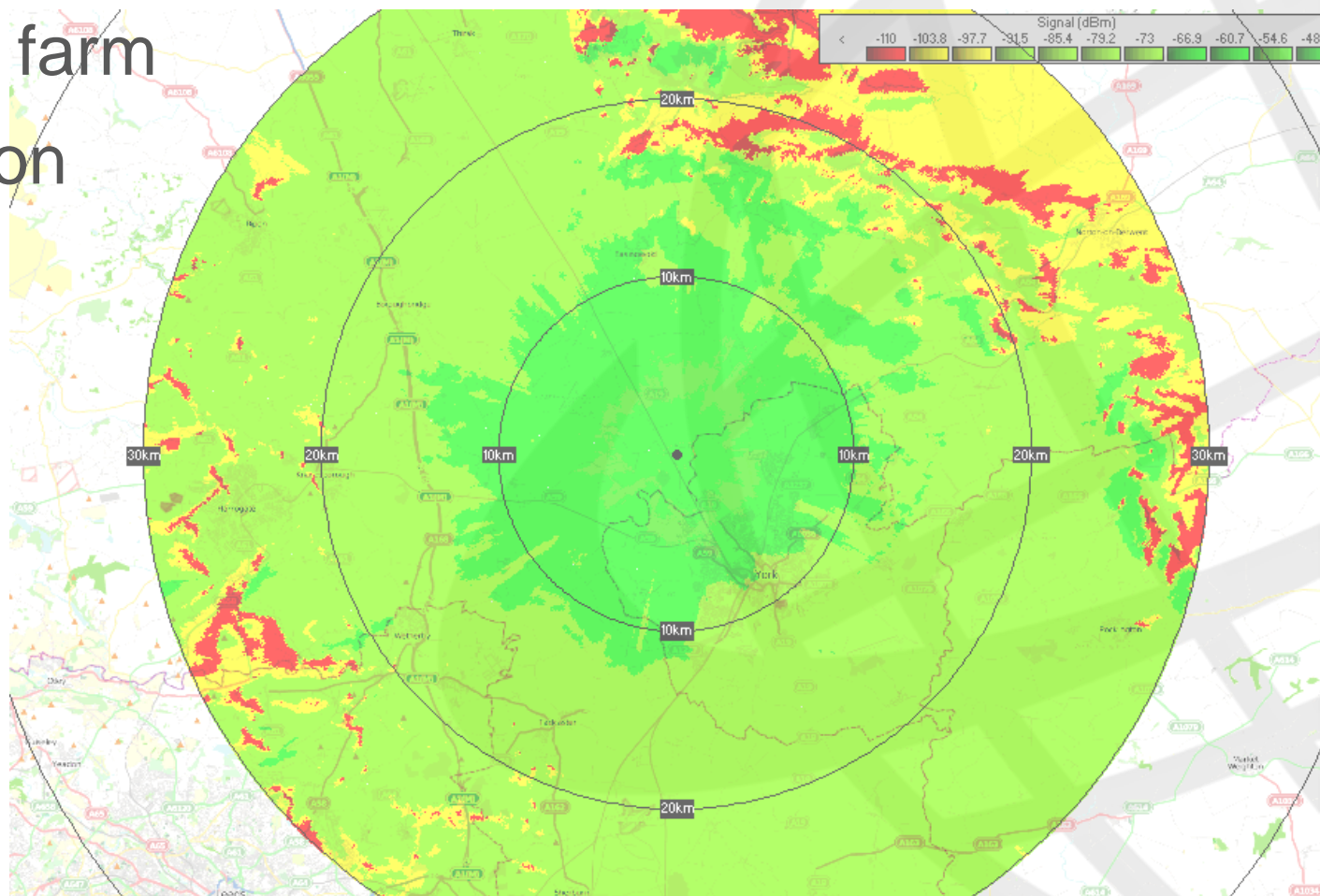
Crop Protection





WiFarm

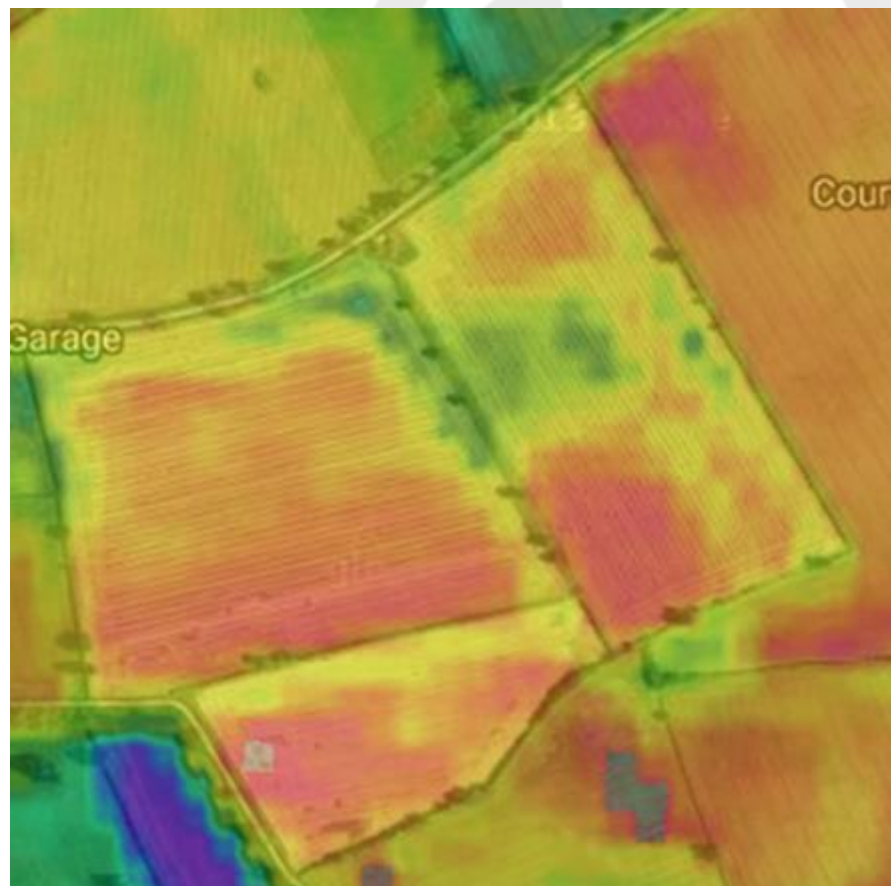
- Open source farm communication network





Field Variability Tool

- Low cost
- Field variability guide
- Build a business case
- Combine with all your data
- Build your own precision strategy
- Linked to your phone





Weather Data

- Individual field scale weather forecasting module
- Better planning of field operations
- Automating field records with live weather links
- Vehicle trackers automating record keeping
- Crop models to inform Risk and Pressure



Hardware sale down with industry sales figures

