Linking Biodiversity & Profitable Farming:

Introducing Hillesden and ASSIST

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Structure

Image credit: Marek Nowakowski

1. Designing & testing habitat for ‘beneficials’
2. Benefits to the farm business: Hillesden
3. Where next? The ASSIST programme

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Image credit: Marek Nowakowski

1) Designing Habitat for ‘Beneficials’

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the buzz project

Creating farmland habitats

- Six commercial farms
- Six new AES prescriptions tested
- Conventional crop control
- 5 years monitoring

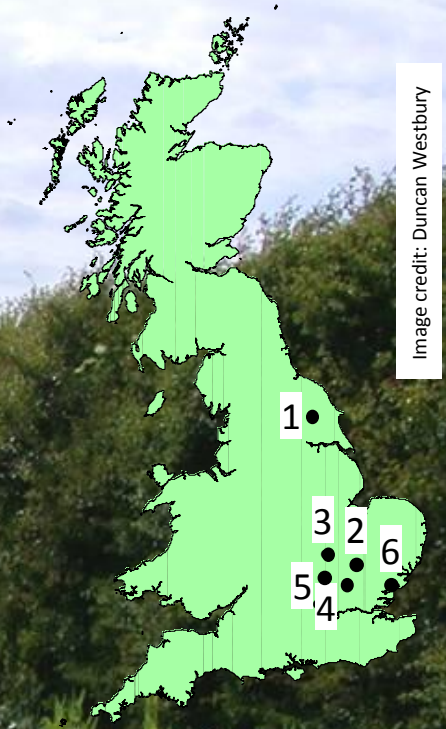

Image credit: Duncan Westbury

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syngenta

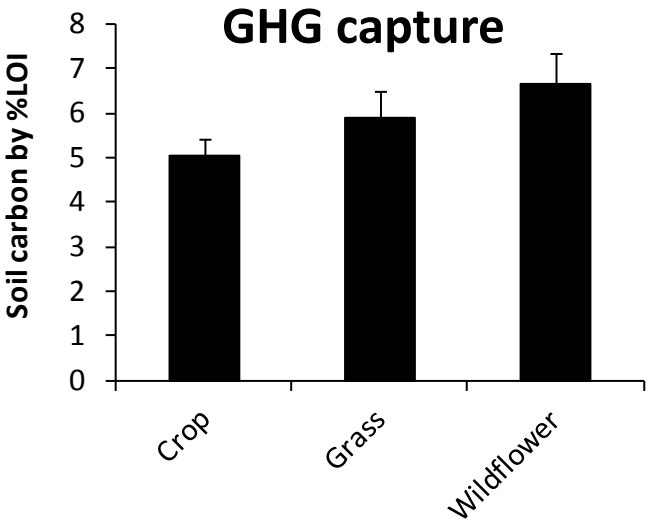
Unilever

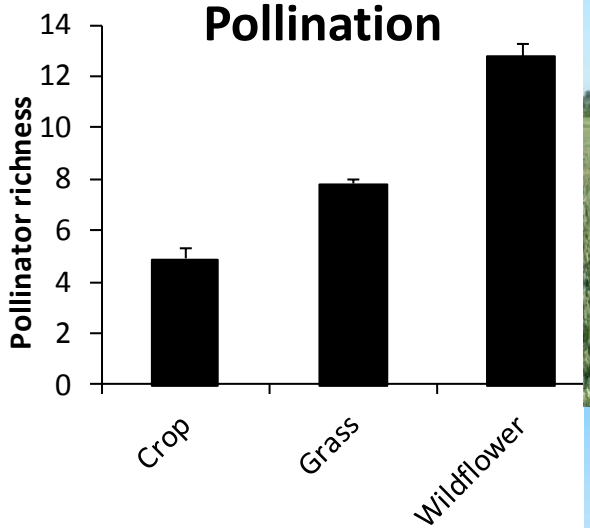
BIRDS EYE

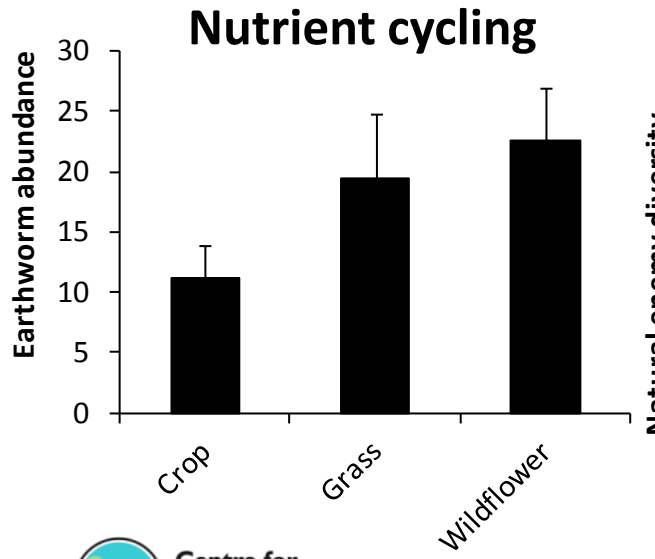
Wildlife Farming Company
- Proven Wildlife Delivery -

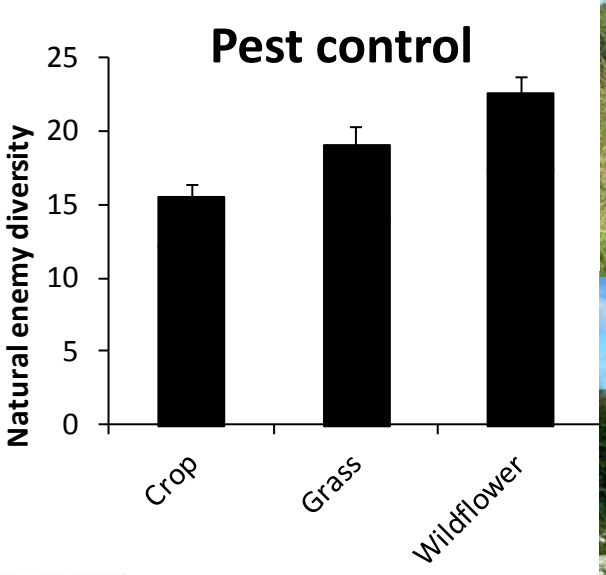
Department for Environment Food & Rural Affairs

Multiple Benefits from Wildflower Margins









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the buzz project

OPERATION Bumblebee

OperationPollinator
Multifunctional Landscapes

Enhancing Natural Pest Control

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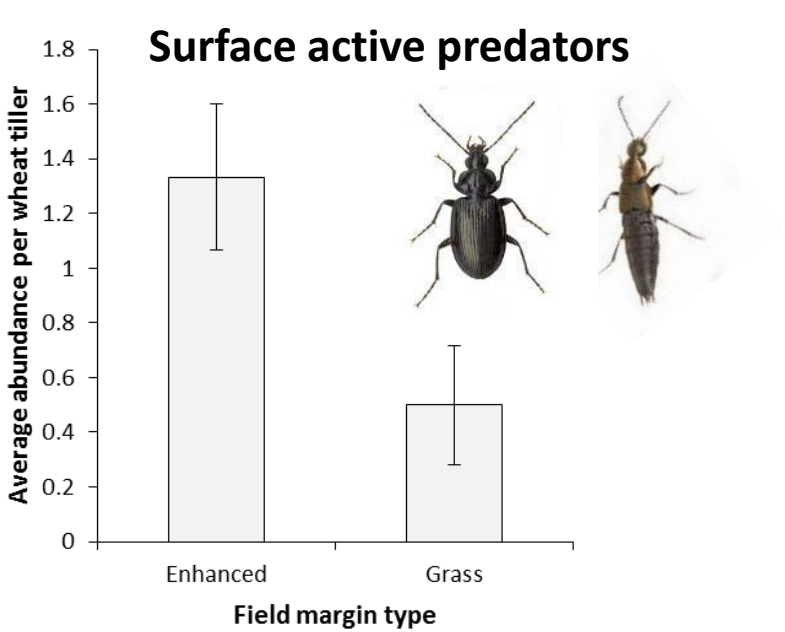
Natural pest control



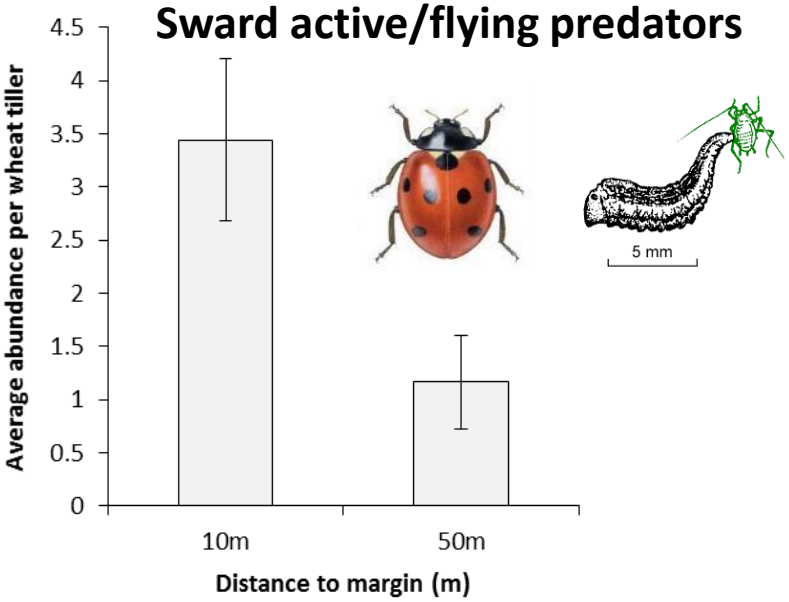
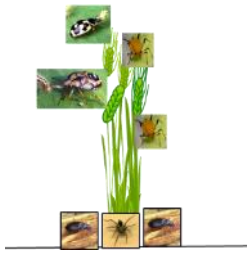


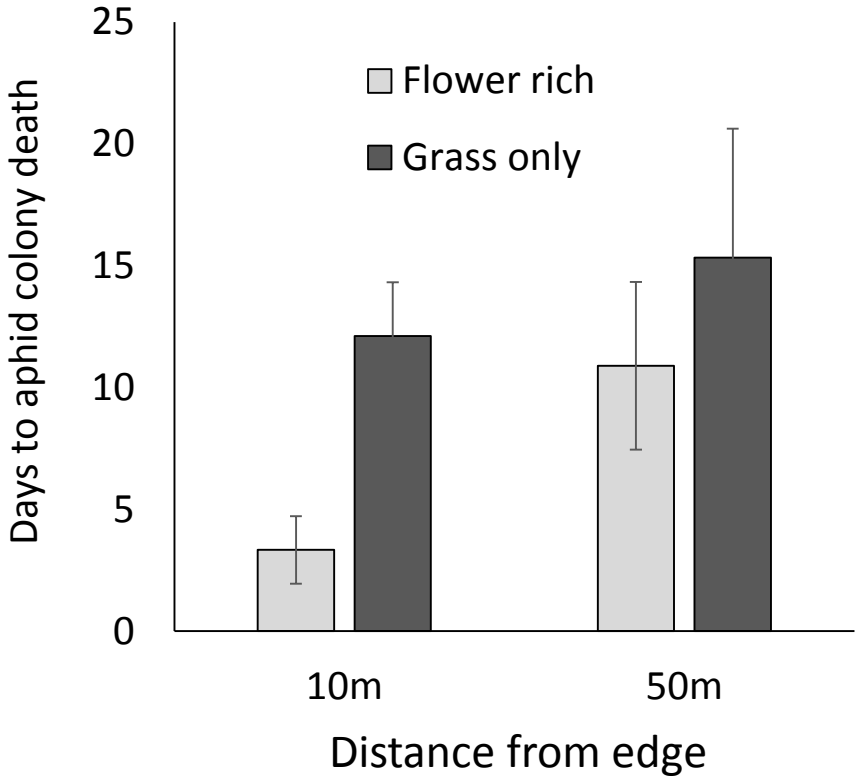
Image credit: Roselle Hyman, CEH

Testing this in the under field conditions

- Natural pest control reduced the survival of aphid colonies
- The best pest control is next to flower rich field margins
- Spill-over into the crop remains a problem



Colony survival when open to all predators



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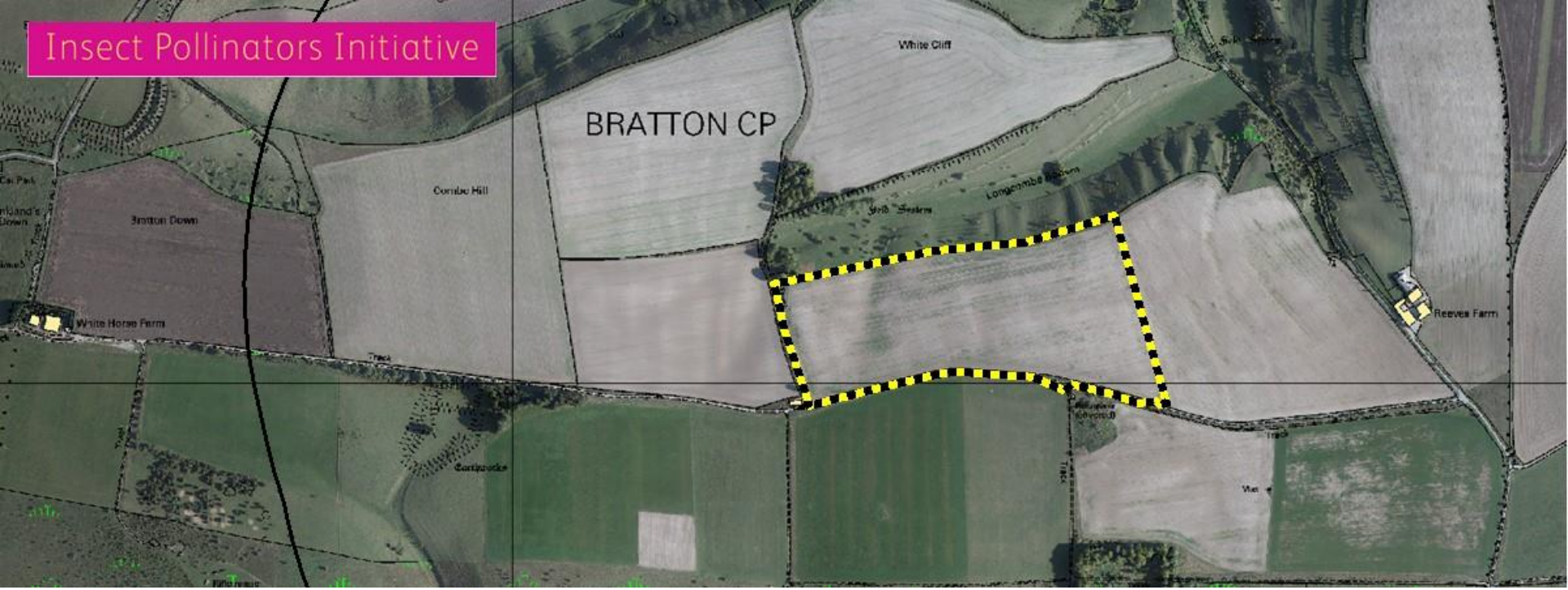

Benefits to Pollinator Populations

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ZSL
LIVING CONSERVATION
ZOOLOGICAL SOCIETY OF LONDON

University of BRISTOL

UEA
University of East Anglia

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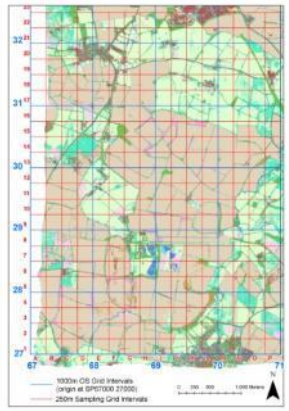
Pollinator methods

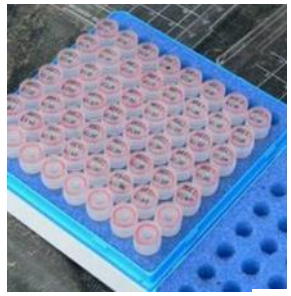
Field surveys

- Sampled DNA from live queens and workers in every habitat patch across the 20km^2 landscape (ca. 3,200 bees)



Molecular genetics

- Genotyped samples then grouped individuals into nests and ‘families’



Landscape modelling

- Relate bumblebee data to detailed maps of the landscape obtained using field surveys and high-resolution aerial remote sensing data

Image credits: Richard Pywell, Lucy Hulmes CEH

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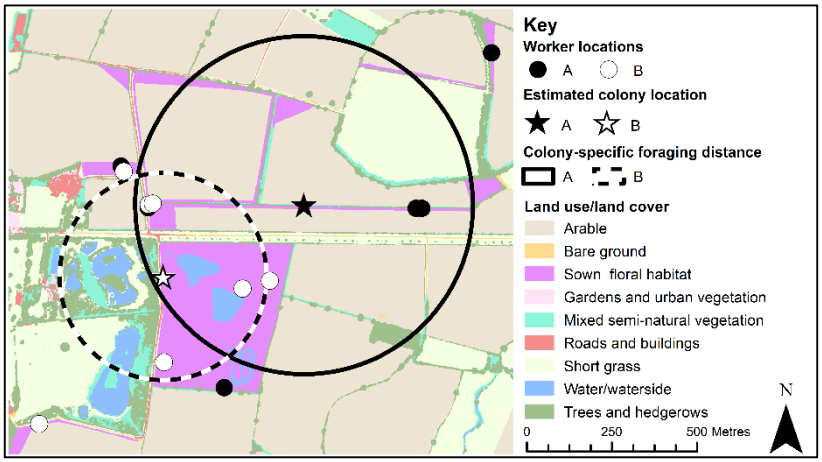
Effects of habitat on bee foraging distance



The more flowers in the landscape, the less distance bumblebees forage for resources

Bombus ruderatus

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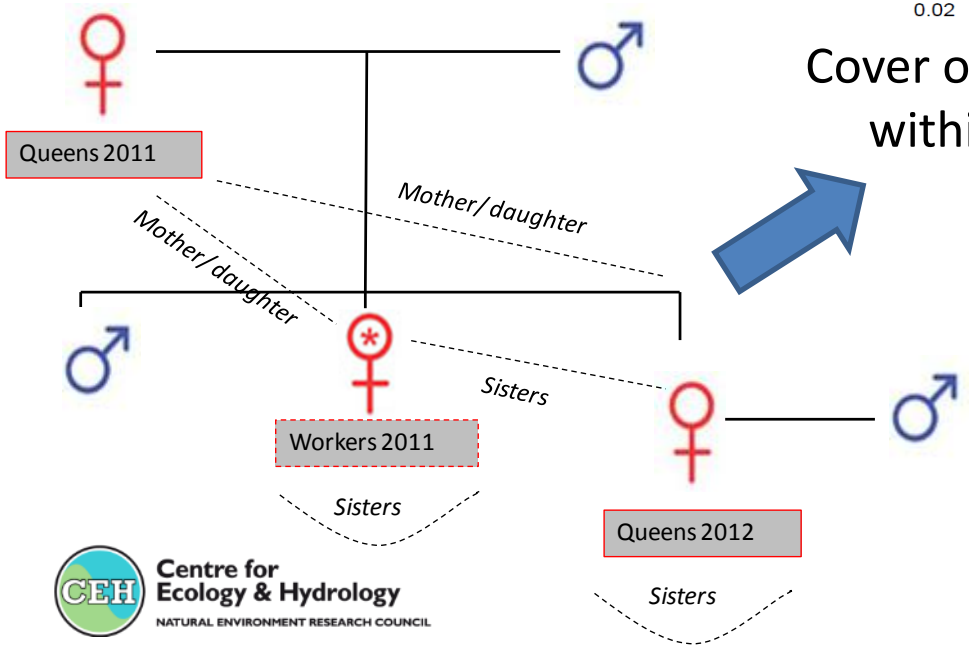
Insect Pollinators Initiative

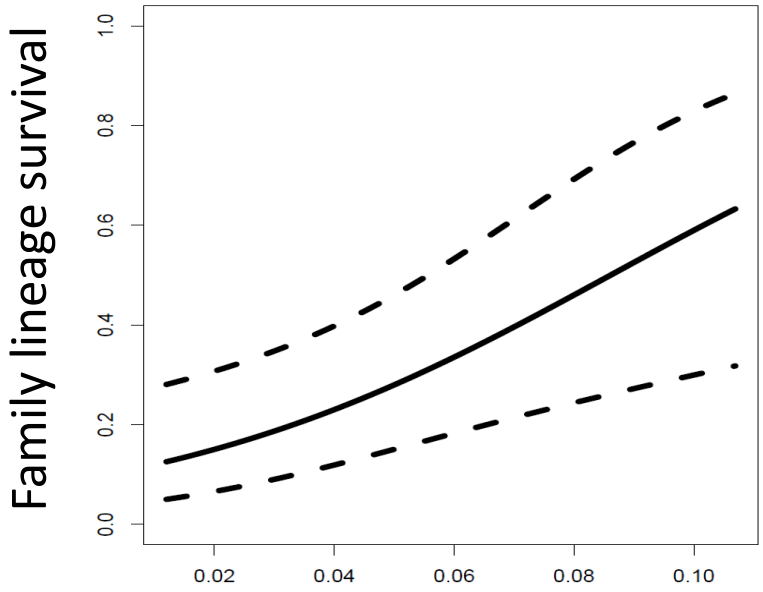
Redhead et al (2016) Ecological Applications

Effects of habitat on between-year survival

First evidence that habitat creation benefits bumblebee populations

"Family lineage survival"





Cover of semi-natural vegetation within 1000m of the colony

n = 456 colonies

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LETTER

nature

Bumblebee family lineage survival is enhanced in high-quality landscapes

Claire Carvell[1], Andrew F. G. Bourke[2], Stephanie Dreier[3,4], Stephen N. Freeman[1], Sarah Hulmes[1], William C. Jordan[3‡], John W. Redhead[1], Seirian Sumner[3,4,5], Jinliang Wang[3] & Matthew S. Heard[1]

Image credit: Marek Nowakowski

2) Benefits to the Farm Business: Hillesden Farm Platform

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Wildlife Farming Company
- Proven Wildlife Delivery -

syngenta

NATURAL ENGLAND

Department for Environment Food & Rural Affairs

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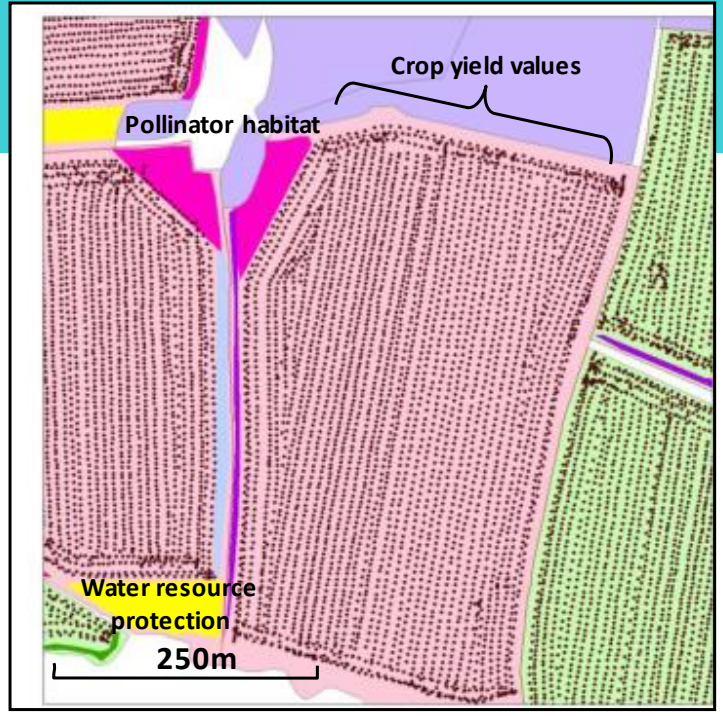
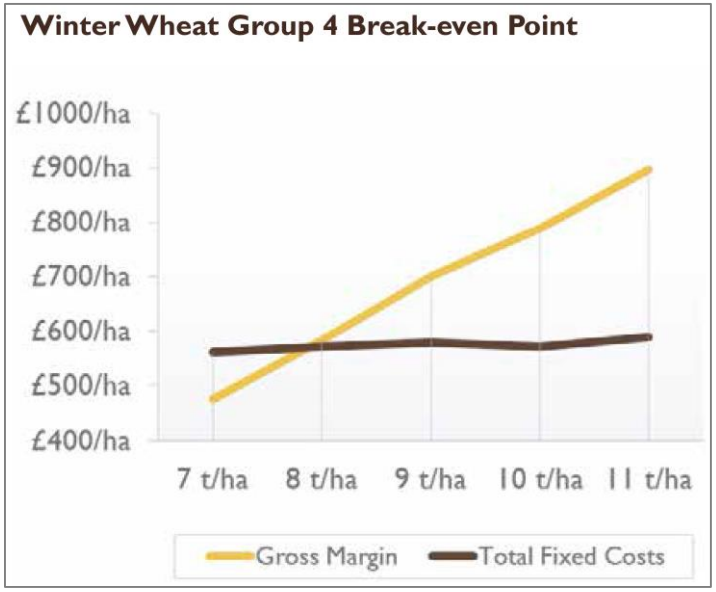
Hillesden Farm Platform

- Commercial 1000ha lowland arable farm
- Heavy soil growing autumn-sown crops (WW / OSR & beans)
- FIFTEEN 50-60ha 'farmlets' = three treatments replicated FIVE times:
  - **Cross Compliance (0% land removed)**
  - **Typical Entry Level AES (3% land removed for two wildlife habitats)**
  - **Entry Level Extra AES (8% land removed for six wildlife habitats)**
- Habitat creation in awkward/low yielding areas (mostly margins/corners)
- Test bed for AES policy





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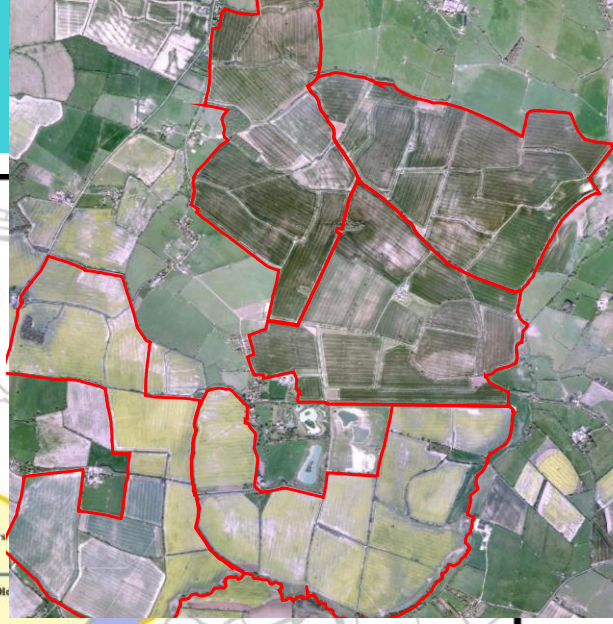
Hillesden



Block 2

Block 1

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- monitored internal hegdes

HillesdenArea

Treatment_type
- Cross compliance
- ELS
- ELS extra

Habitat_type
- Annual cultivation
- Bird EF2
- Flower EF1
- Natural regeneration
- Pollen and nectar
- Skylark scrape
- Tussocky

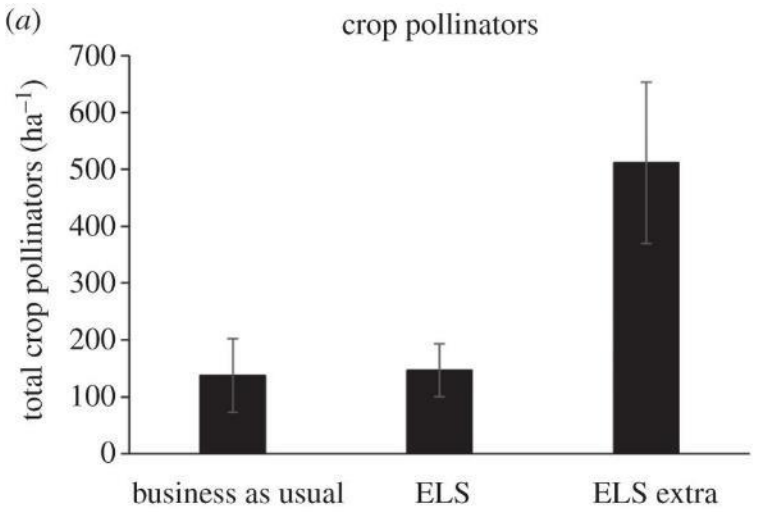
Playing Fields
Morgans
Madkins
Gawcott
Keepers
Poplars
Rogers
Berry Field
Rowley Hill
Rowley Meadow
Chorleys
Bridleway
Mount Pleasant
Shed Field
Barracks
Down way
Thieves Pen
Dry Leys
Groves
Prisnel
Ox Pen
Lampers Den
Lang Ground
Dairy Ground
Sandpit
Rimler North
Rimler South
Fox Clover
Drier Field
Silver Leg
Slade
Horse Paddock
Long Meadow
Ivy Ground
Great Ground West
Great Ground East
Tithe Meadow
Palmers Hill
Top Warren
Lower Warren
Cow House
Sweet Plat
Ram Hill
Ram Hill Meadow
East Field
Dicksons
Richardsons
Ruxby Mead
Snipe Hill
Owl House
Churchill Meadow
Charlies
Blackthorne Lane
Hill Leys
Syd's Piece
Planks

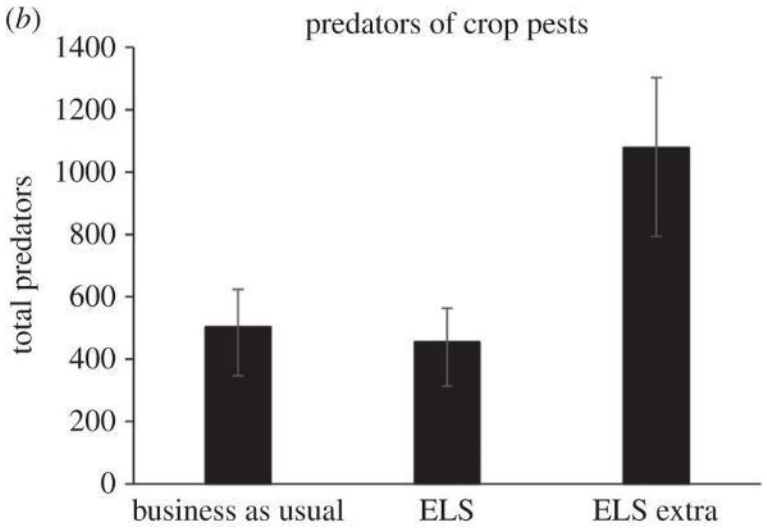
Kilometers
0 0.25 0.5 1

Abundance of ‘Beneficials’

Image credit: Steve Falk

Image credit: Dave Campbell CC BY-NC-ND 2.0





PROCEEDINGS OF THE ROYAL SOCIETY B

CEH Centre for Ecology & Hydrology
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Richard F. Pywell et al. Proc. R. Soc. B 2015;282:20151740

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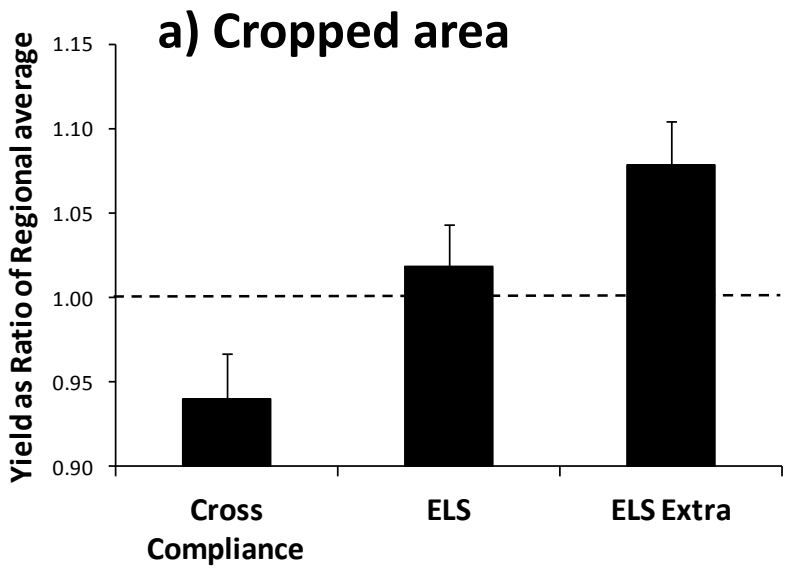
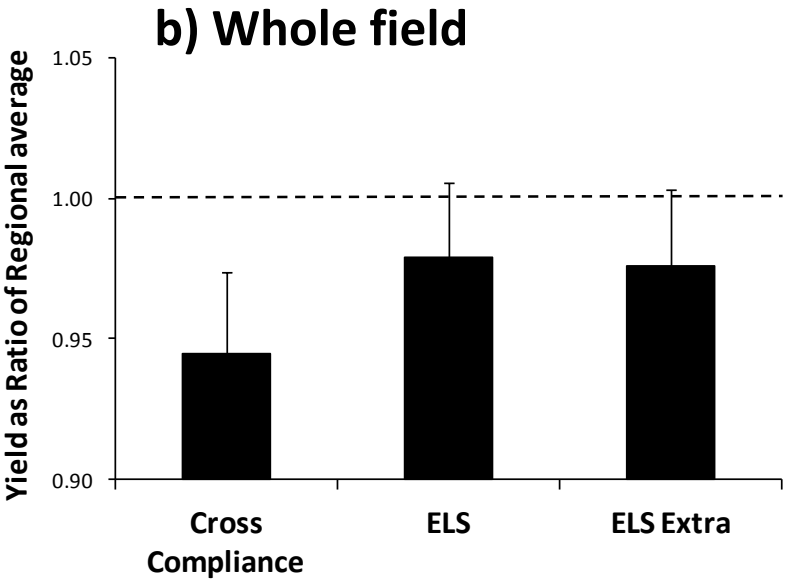
Effects on yield (6yrs): all crops





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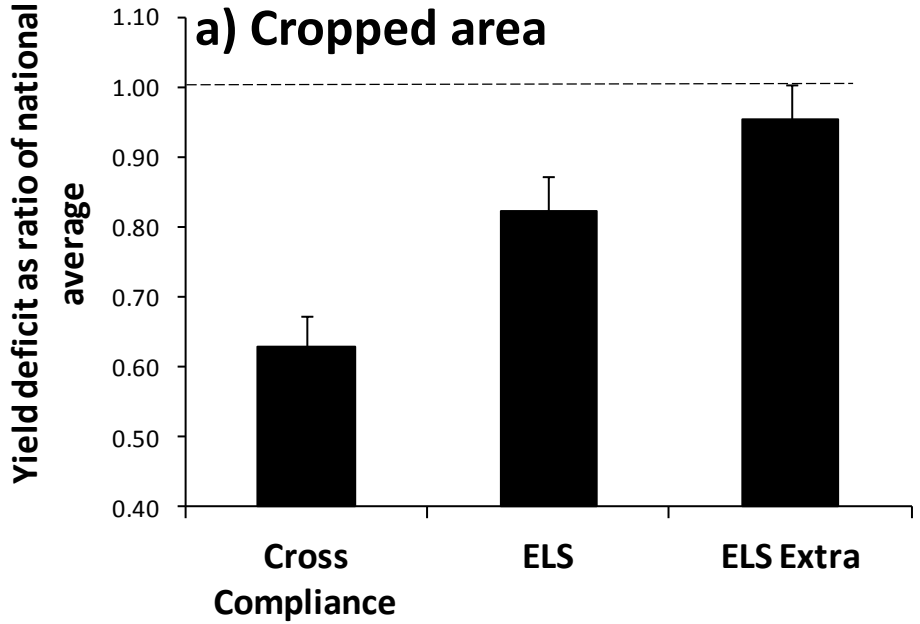
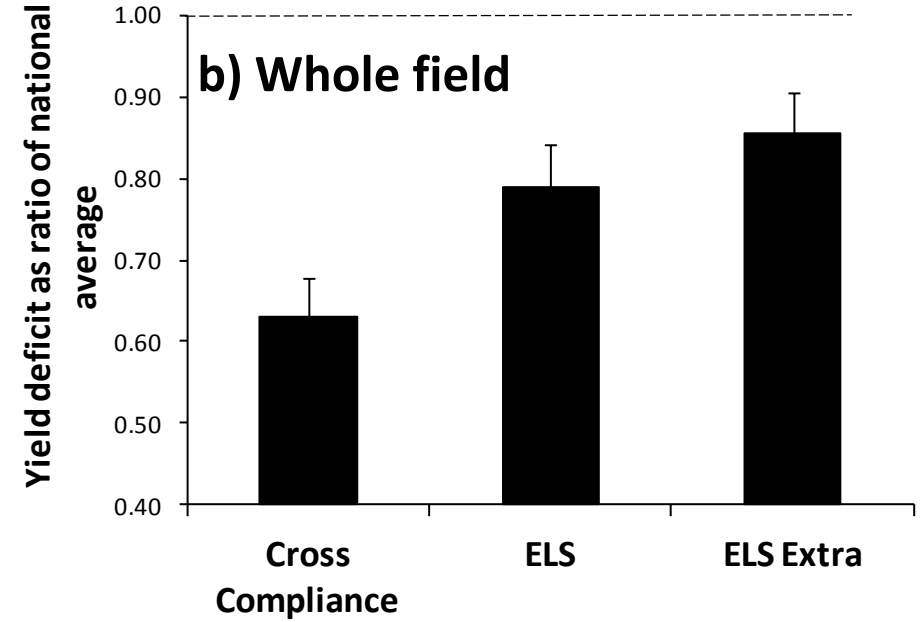
Effects on yield: Beans





Crop yield performance

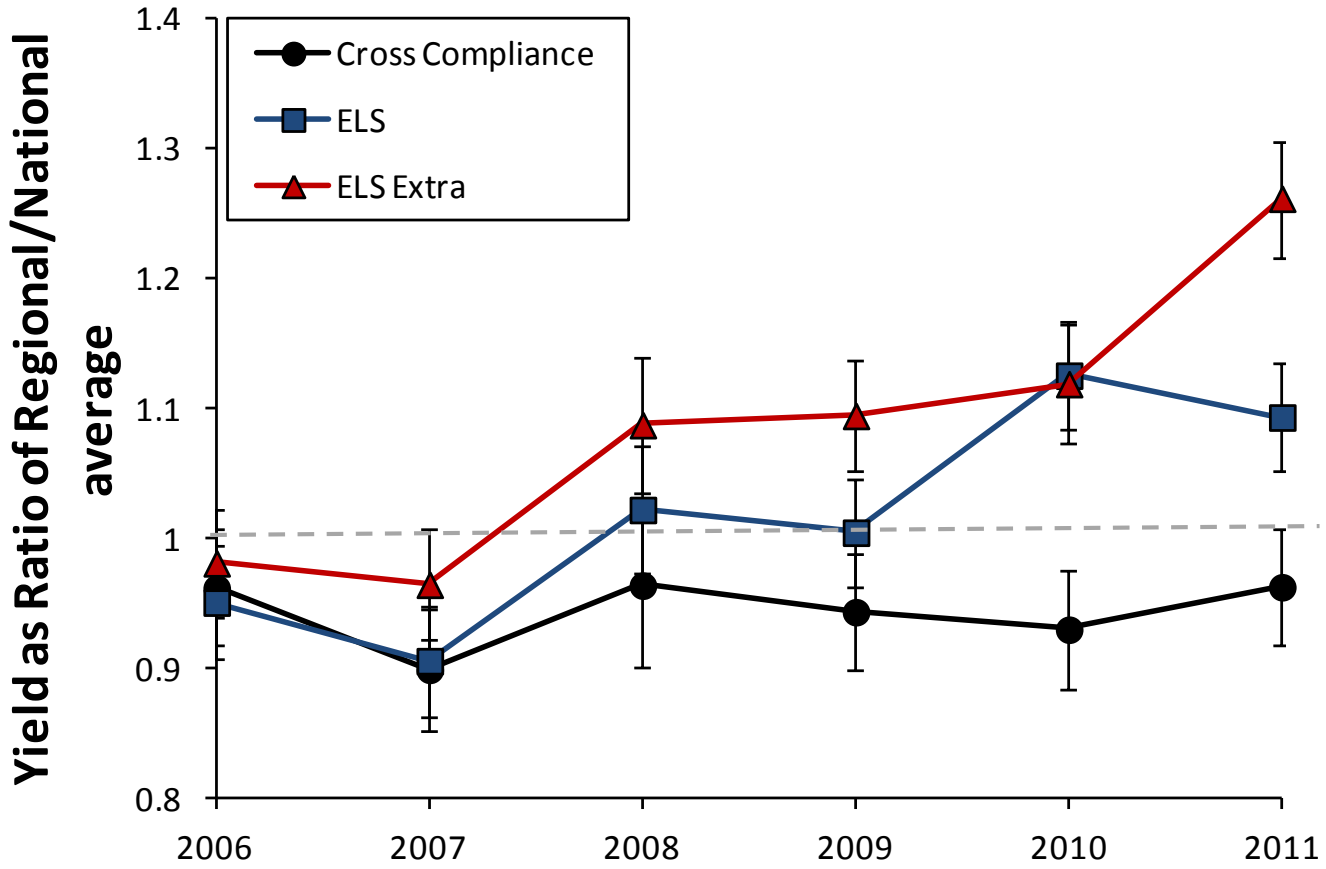


Image credit: Wikipedia Commons

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The Theory: Ecological intensification

'Optimal management of **ecological processes** and **beneficial biodiversity** to improve agricultural productivity, efficiency and resilience to future shocks'

Integrated within precision farming systems

PROCEEDINGS B

rspb.royalsocietypublishing.org

Research

Wildlife-friendly farming increases crop yield: evidence for ecological intensification

Richard F. Pywell[1], Matthew S. Heard[1], Ben A. Woodcock[1], Shelley Hinsley[1], Lucy Ridding[1], Marek Nowakowski[2] and James M. Bullock[1]

Image credit: Richard Pywell, CEH

Image credit: Heather Lowther, CEH

3) What next?

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ROTHAMSTED RESEARCH

British Geological Survey
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funded by BBSRC bioscience for the future NERC SCIENCE OF THE ENVIRONMENT

assist | Achieving Sustainable Agricultural Systems

- 5+ year £11M research programme
- Uniting expertise from NERC and BBSRC institutes, with support from the farming industry
- Develop innovative farming systems to increase efficiency of food production & resilience to future shocks
- Reduce the environmental footprint of agriculture

Image credit: Lucy Hulmes, CEH

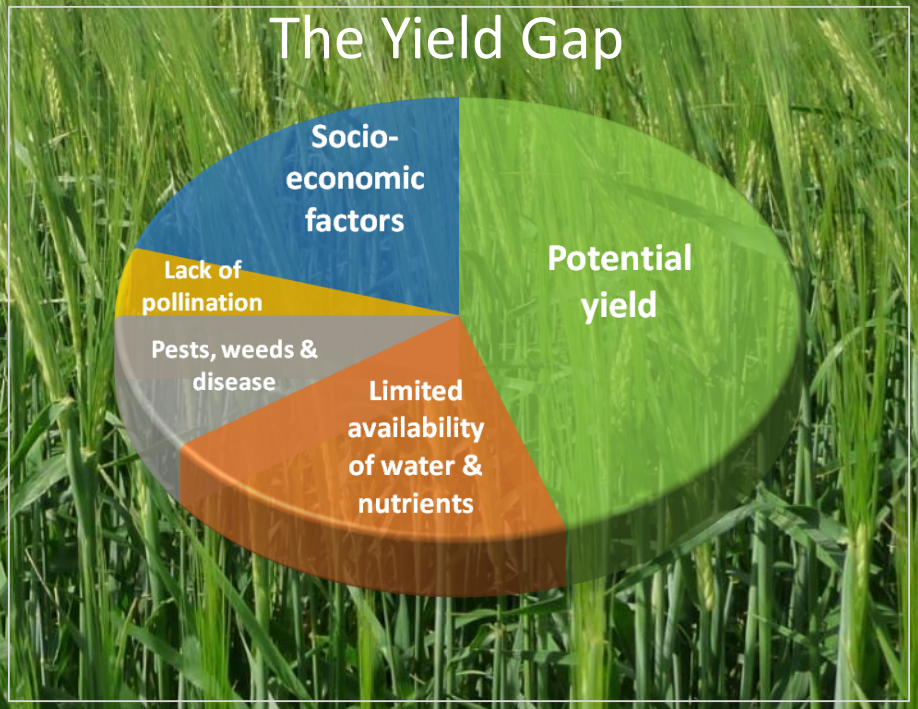
WP1 LIMITATIONS ON CROP PRODUCTIVITY

- Understanding limitations on crop yield
- Overcoming the yield gap
- Influence of bio-physical factors on yield resilience
- Predicting future crop yields

Image credit: Wikipedia Commons

Data collection & analysis
Detailed infield measures
National surveys

- Long-term yield data
- Crop input data
- Soil data



WP2 Environmental impacts of future agriculture

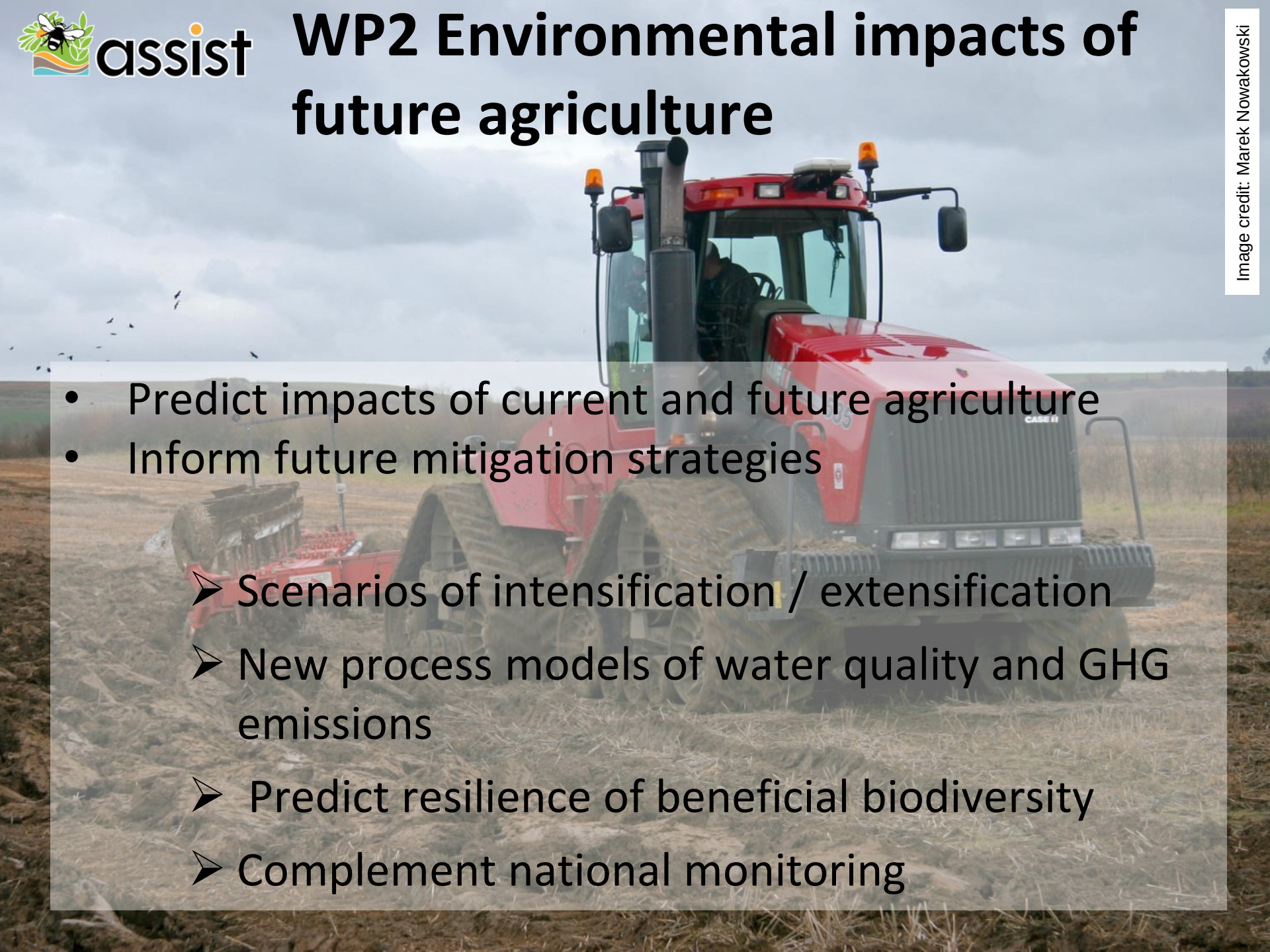


Image credit: Marek Nowakowski

- Predict impacts of current and future agriculture
- Inform future mitigation strategies

  - ➢ Scenarios of intensification / extensification
  - ➢ New process models of water quality and GHG emissions
  - ➢ Predict resilience of beneficial biodiversity
  - ➢ Complement national monitoring

WP3 Sustainable solutions

- Network of 18 commercial study farms
- Real world test of ecological intensification with best agri-tech farming
- Co-designed by industry
- Enhance soil function, pollination & pest control
- Opportunity for technology transfer/ complementary research

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- Bringing the ‘Beneficials’ into the field
- Infield strips of bespoke flower habitat for natural enemies & pollinators

WP4 Synthesis: optimisation of future landscapes

- **Develop modelling framework to optimise farm management for multiple objectives (production, ecosystem services, biodiversity):**
  - Where to intensify/extensify production (WP1),
  - Impacts of changed agricultural management on natural capital and biodiversity (WP2), and
  - Application of intervention measures to mitigate/enhance these effects (WP3)
  - Build resilient future agro-ecosystems

Thank you

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