The potential for UAS in Agricultural, Environmental and Forestry Monitoring

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The Land-use Sector

Agriculture UK

    Gross output £15 billion (1% of UK economy)

    4.3% growth in 2006

    300,000 farmers

Forestry UK

    Gross output £300 million (0.4% of UK economy)

    Employs 29,000 people

Environmental Monitoring UK

    £82 million annual spend on terrestrial & fresh water monitoring

    Environmental consulting worth £1.23 billion

UK Land Area Coverage:

Agriculture	170,776 km²
Forestry	28,252 km²
Environmental monitoring	199,028 km²
TOTAL	**427,056 km²**

The European Picture

Arable and other crops 110 million ha   **Jobs: 9 million**

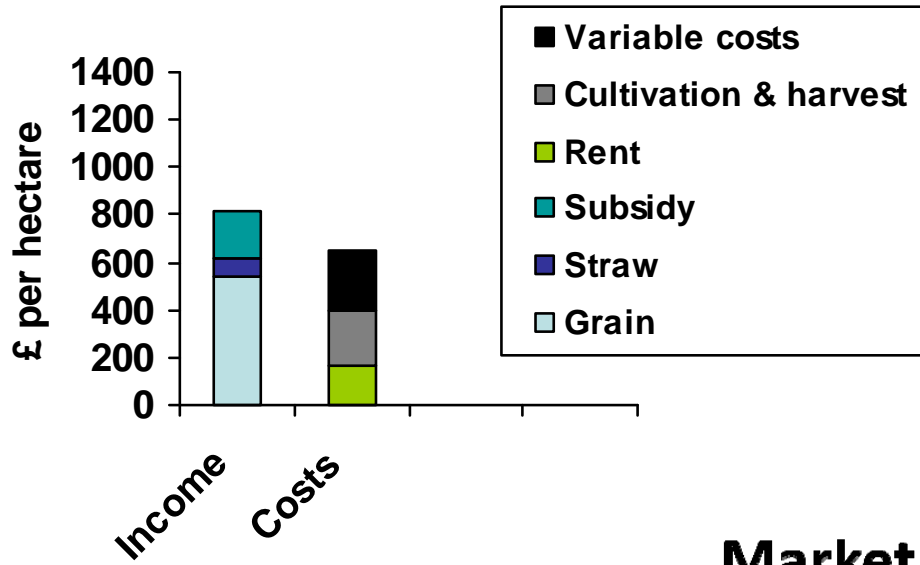**Grassland and Woodland 77 million ha**

Output value €373 billion   **Cost of inputs €23 billion**

Holdings: 7.3 million   **Fertiliser use 18 million kg**
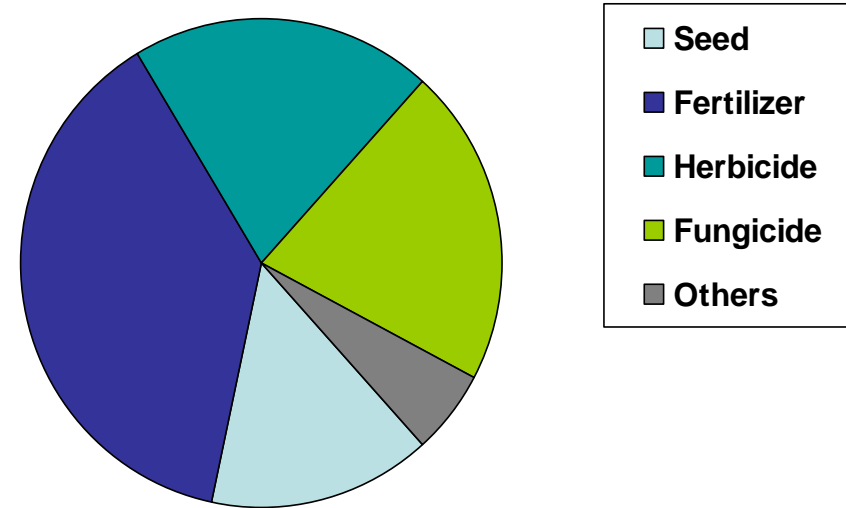
An important and valuable sector –

So why would managers use UAS?
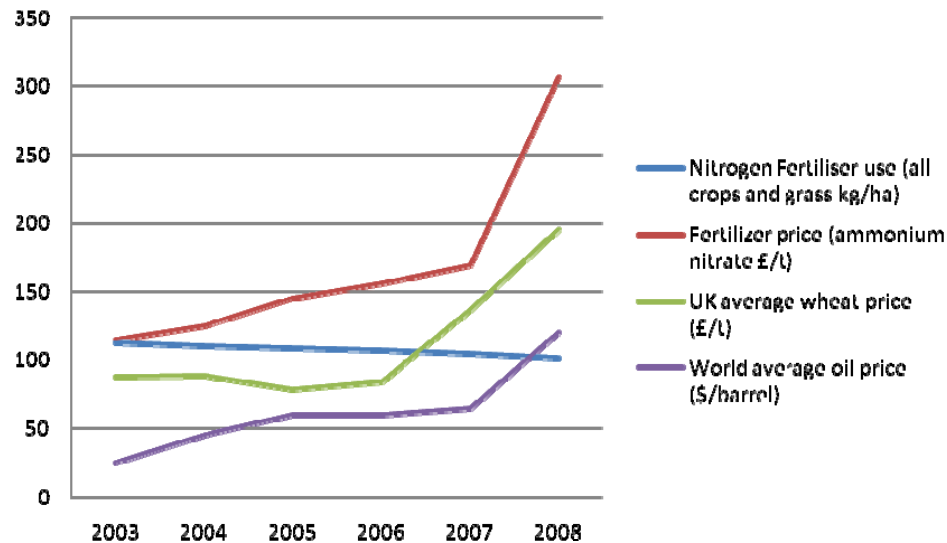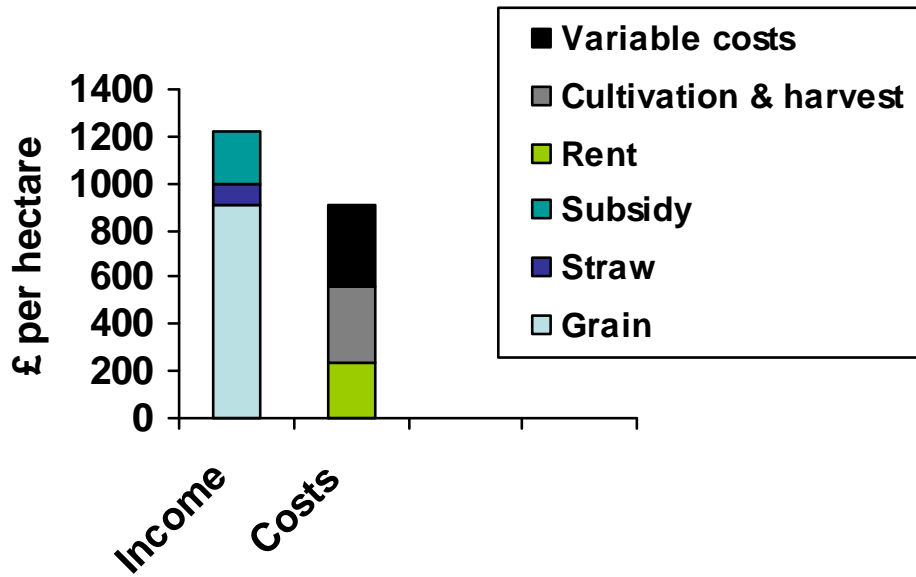
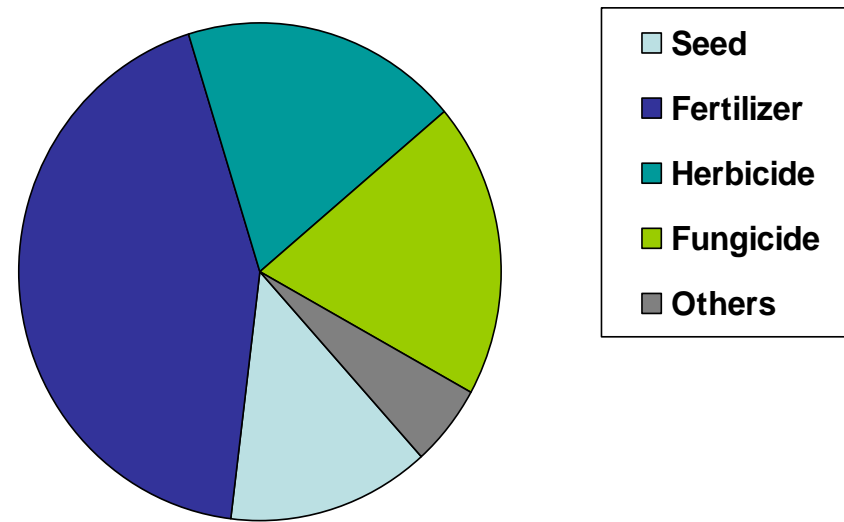# An example of why: Economics of UK Wheat 2007

Economics of UK Wheat 2010

Income and Costs

Split of Variable costs

Too little fertilizer, fungicide and herbicide = reduced yield, less profit

But too much fertilizer, fungicide and herbicide = less profit, but also environmentally bad, don't forget, GEAC*, NVZ§ and bans!

Can we improve the way we assess farm inputs?

This is when we became interested in using aerial *hyperspectral* measurements

*Good agricultural and environmental conditions, §nitrate vulnerable zones
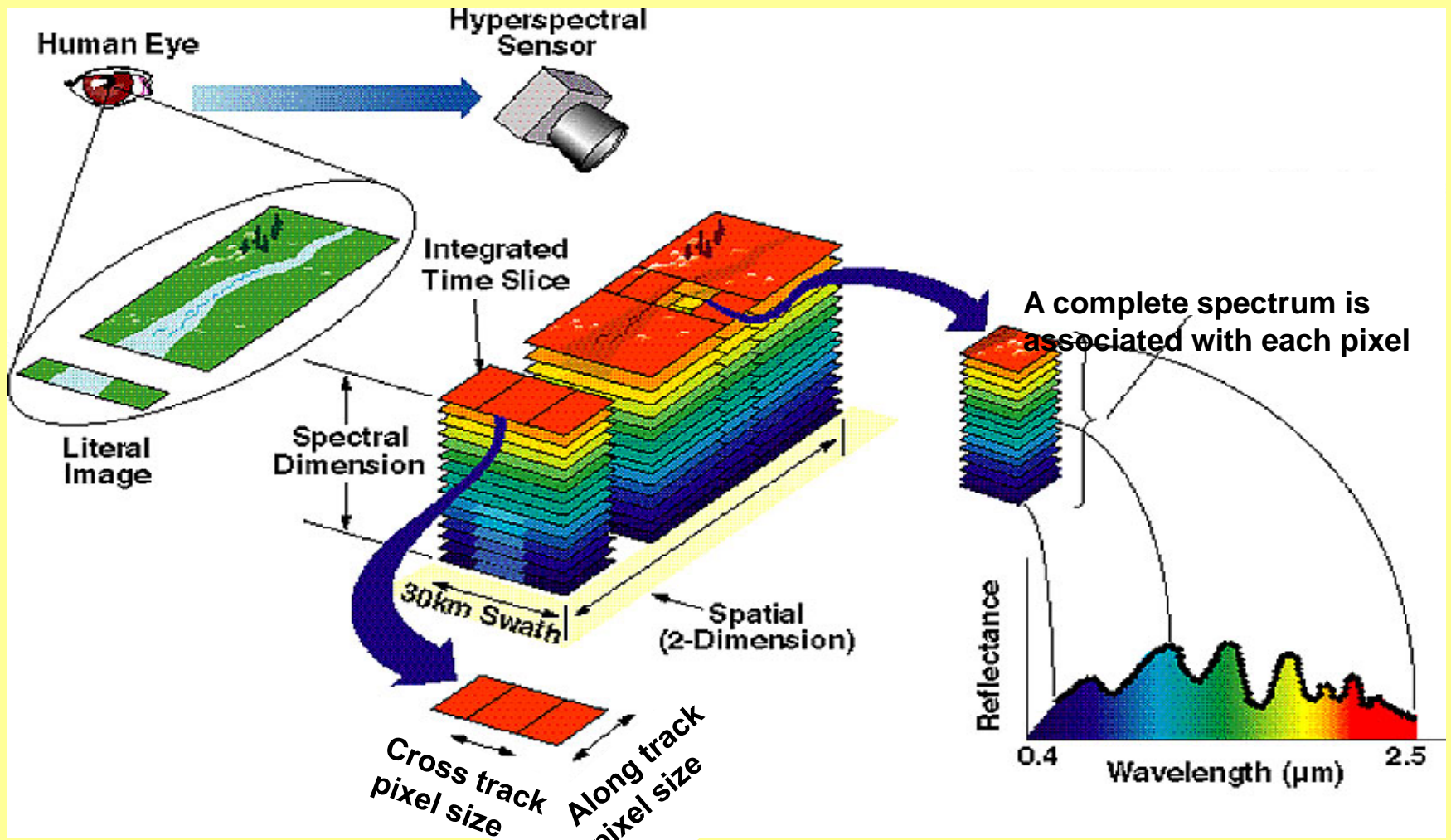
Definition of hyperspectral measurements

Hyperspectral measurements can be used to:

1. Detect disease
2. Distinguish varieties
3. Separate types of grassland
4. Estimate fertiliser requirements
5. Determine herbicide needs
6. Estimate biomass (for grazing or conservation)
7. Determine biodiversity
8. Differentiate tree species
9. Map upland vegetation

And in the live talk examples of all were presented, they can be seen on request.

- **If right sensing can be provided data looks promising**
- **Will it become practical?**

  - **Can we get the data more reliably and cheaply?**

  This is when we became interested in UAS

Comparison of sunshine hours and daylength
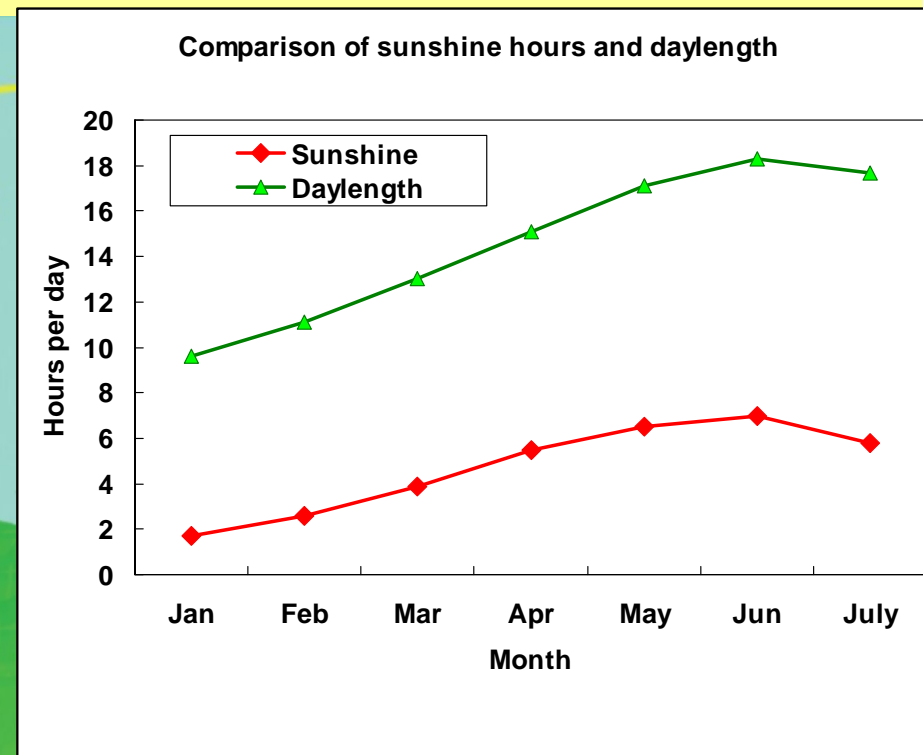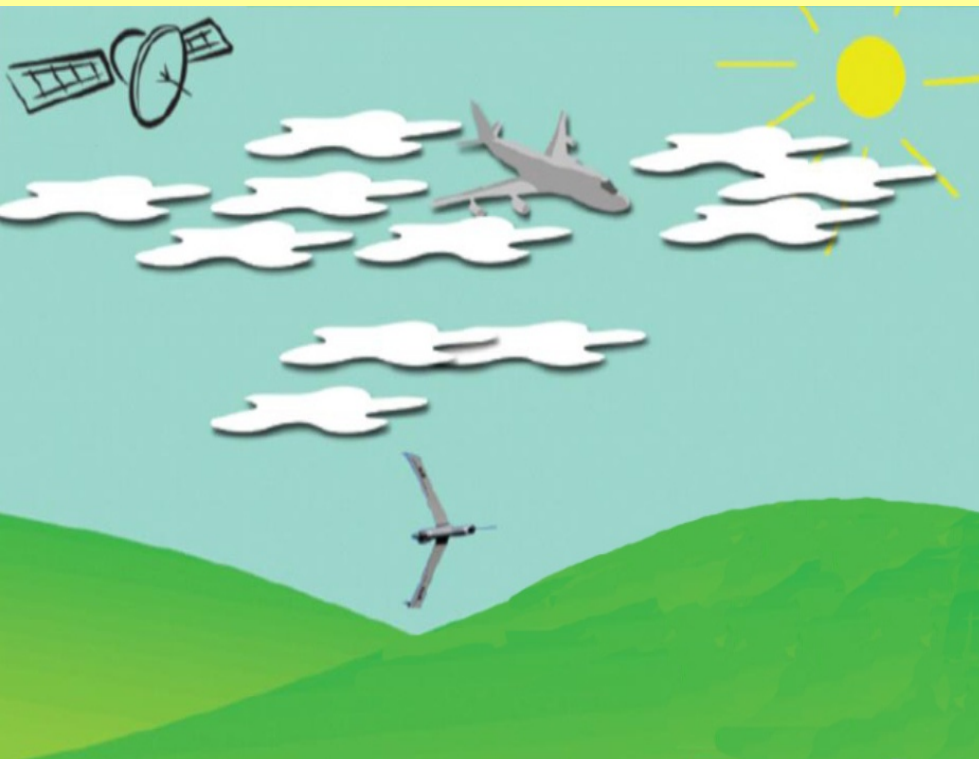
Payloads for UAS in the Land use Sector in priority order

- **NDVI** **(normalised difference vegetation index)**

- **Hyperspectral**

- **LiDAR /Radar**

- **Thermal**

Operational aspects

- **Deployment – beyond line of sight: Often a range of up to 3 km from base would be useful, but not always essential**

- **Extent and range of operation. Ideally ability to cover a 5 km by 5 km area would be useful, ideally from a local launch and recovery with minimal equipment**

- **Altitude. Since the forte of UAV is detailed assessment probably 100 to 200 m altitude would be useful**

- **Real time data: Some information useful but rarely essential**

A practical example – U-MAP project

- No off the shelf solution
- Aerospace partners - QinetiQ
- UAV mapping of NDVI -for crop nitrogen management
- Successful mapping achieved in about 30 minutes per site
- Processing of data was challenging, particularly mosaicing.
- Plan is to develop hyperspectral UAV
- Streamline processing
- And to develop further access to airspace

- **Funding applied for....**

Conclusions: don't forget!

- **Sector requirements quite specific, sensing must be right.**

- **Cost effectiveness vital.**

- **How many end users have you talked to? Unless the outputs are in the form required by the end users they will have little value**

- **In the environmental/agricultural/forestry markets, concentrate on applications where timeliness and detail is valuable.**

- **Premium for light, simply deployed systems.**

- **Can we develop simple airspace access for small UAS over areas of low population density?**

Thank you for listening and to:

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