Global Challenges for Agriculture
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Knowledge Transfer Network
The ‘Perfect Storm’

- Greenhouse gases
- Drug resistance
- Soil degradation
- Population dynamics
- Loss of pollinators
- Climate change

Source: FAO 2008
Projected changes in agricultural production due to climate change - 2080

Source: Cline 2007,
Soil degradation

- Very degraded soil
- Degraded soil
- Stable soil
- Without vegetation
Projected population growth

Human Population Growth

- World Total
- Less Developed Countries
- More Developed Countries

We Are Here

Billions

Year: 1750, 1800, 1850, 1900, 1950, 2000, 2050, 2100
World food production must rise by 50% by 2030 to meet increasing demand and by 75% by 2050 (Source: UN 2008)
World food price index 1990 - 2013

Source: FAO
Pace of Improvement Slowing

UK Yields 1976-2006

- **Oilseed rape**
- **Wheat**
- **Barley**
Has the balance shifted too far?

Technology

‘Agri-empathy’
Are we ignoring the benefits of nature?

- Larger machinery
- Higher chemical inputs
- Exhausted soils
- Loss of biodiversity
- Monocultures

Are we damaging the very fabric of a productive agricultural ecosystem?
Will ‘sensing’ the environment allow more sustainable management?

“Necessity is the mother of invention”
Opportunities for biosensors

— Landscape – vegetation, location of livestock, water quality
— Crops – for stress, phenotyping, nutrient status, health, maturity and quality
— Livestock – health, stress, pregnancy, phenotyping
— Biocontrol – monitoring balance and efficacy
— Soil – ‘health’, microbiota, fertility

Collecting information on which to base decisions
Technologies facilitating and supporting ‘biosensing’

- Sensors/diagnostics
- Chemistry/biochemistry
- Precision engineering
- Big data
- Modelling and forecasting
- Geolocation, communications
- Energy storage, electronics
- Miniaturisation
- ........
After the ‘perfect storm’...
Future priorities

- more output (yield/production)
- from less land
- with less water
- with less energy
- with fewer emissions
- with less waste

To meet the challenge, science is necessary but will not be sufficient.

Capturing the ingenuity of scientists and engineers to develop sensing techniques to support sustainable intensification of agriculture.
Thank you

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