LINKING ENVIRONMENT AND FARMING

The Role of engineering in agricultural water management

Integrating Water and Production

Caroline Drummond LEAF

IAgrE in association with Newcastle University

With sponsorship from MASTENBROEK

Integrating Water and Production

- Big Picture – what drives change
- LEAF in Brief
- Case studies
- Integrated Solutions


We forget that the water cycle & life cycle are one…
Jacques Cousteau

Framing the issue

"Water security":

- ***"...the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies."***

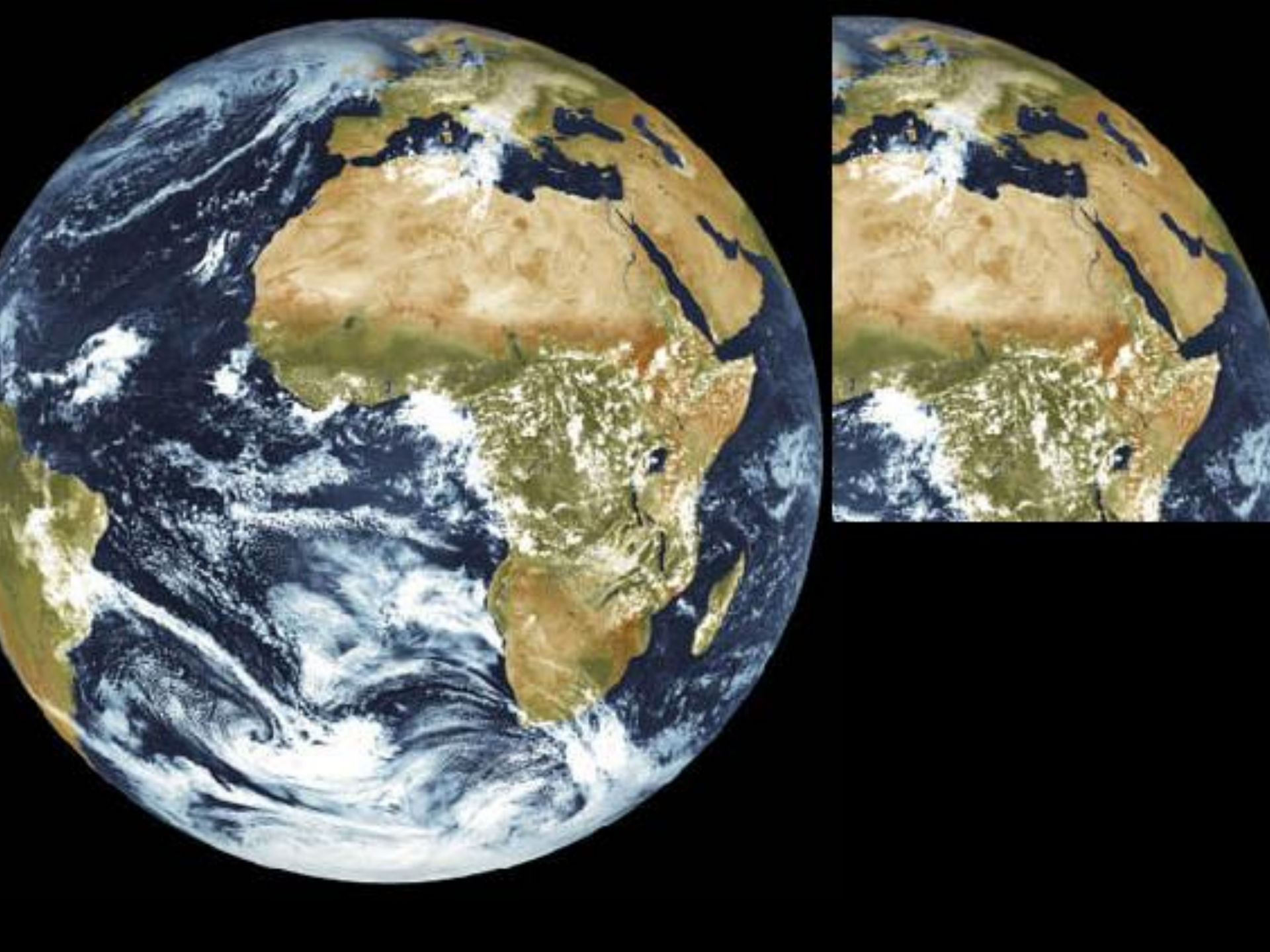
- Not the same as 'food security' and 'energy security',
  - reliable access to sufficient supplies.

- *"water security"* also captures destructive aspects of water
  - floods and droughts as well as quality

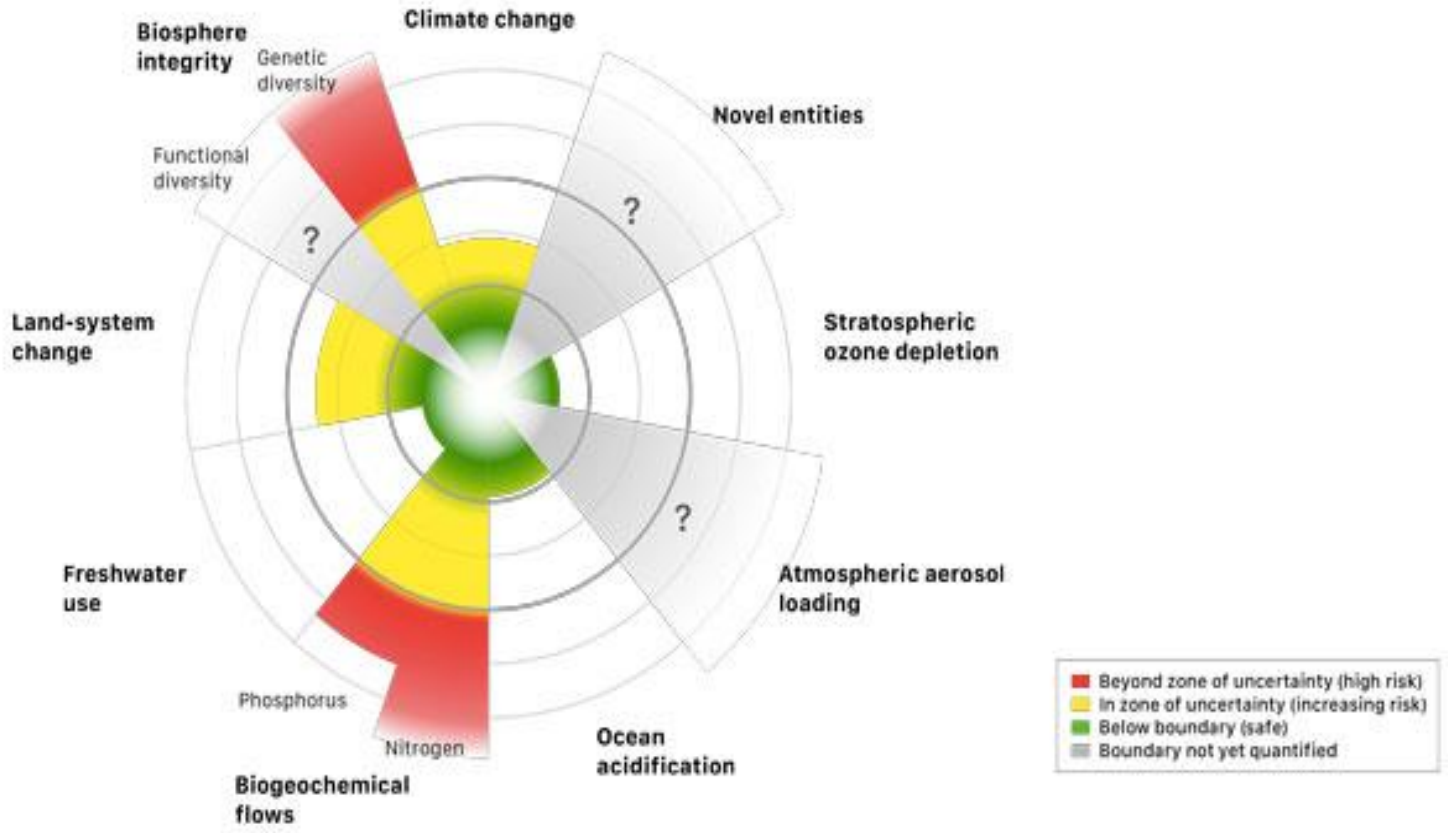
- And broader environmental and biodiversity goals ...


STOP!
the
UST BOWL
NO WATER=
NO JOBS=
HIGHER
FOOD
COST!



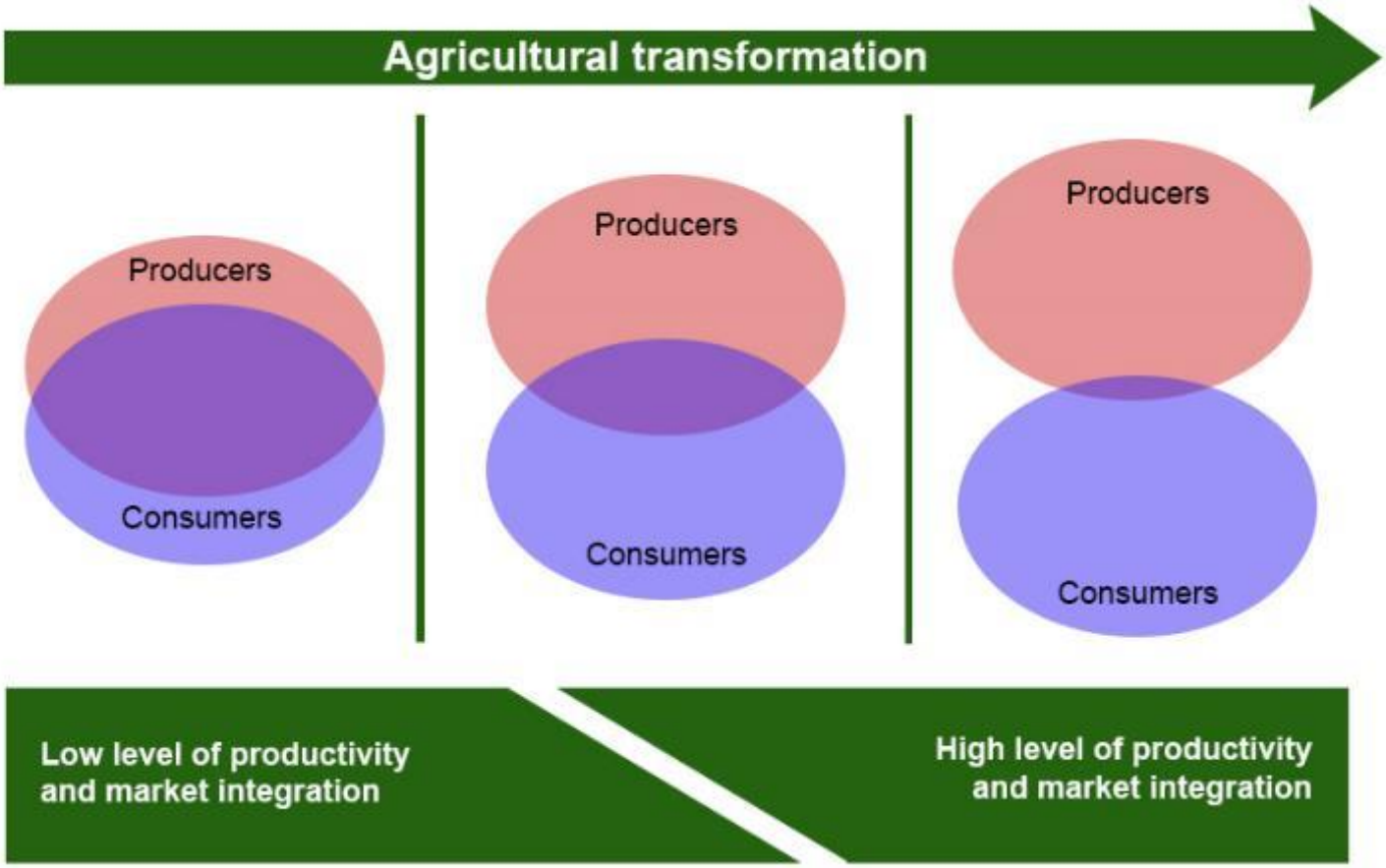


Environmental parameters



Planetary Boundaries Modified from Rockström et al. (2015).

The food system transformation

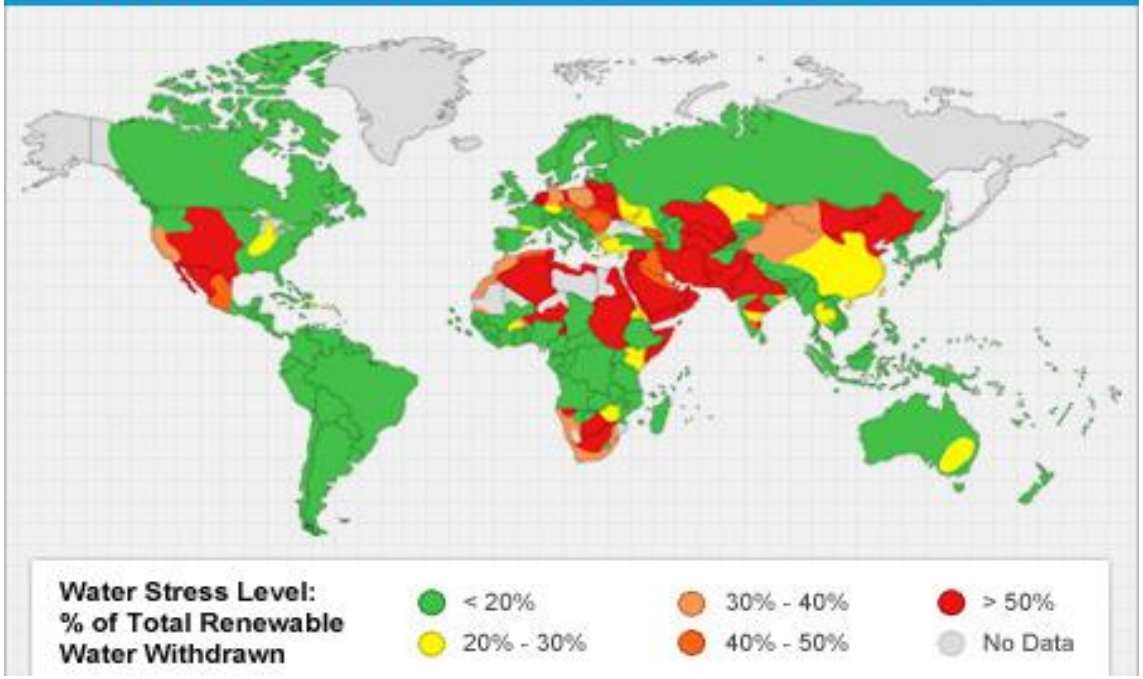


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The challenges of increased urbanisation



Today: A Look at the World's Water Stressed Areas

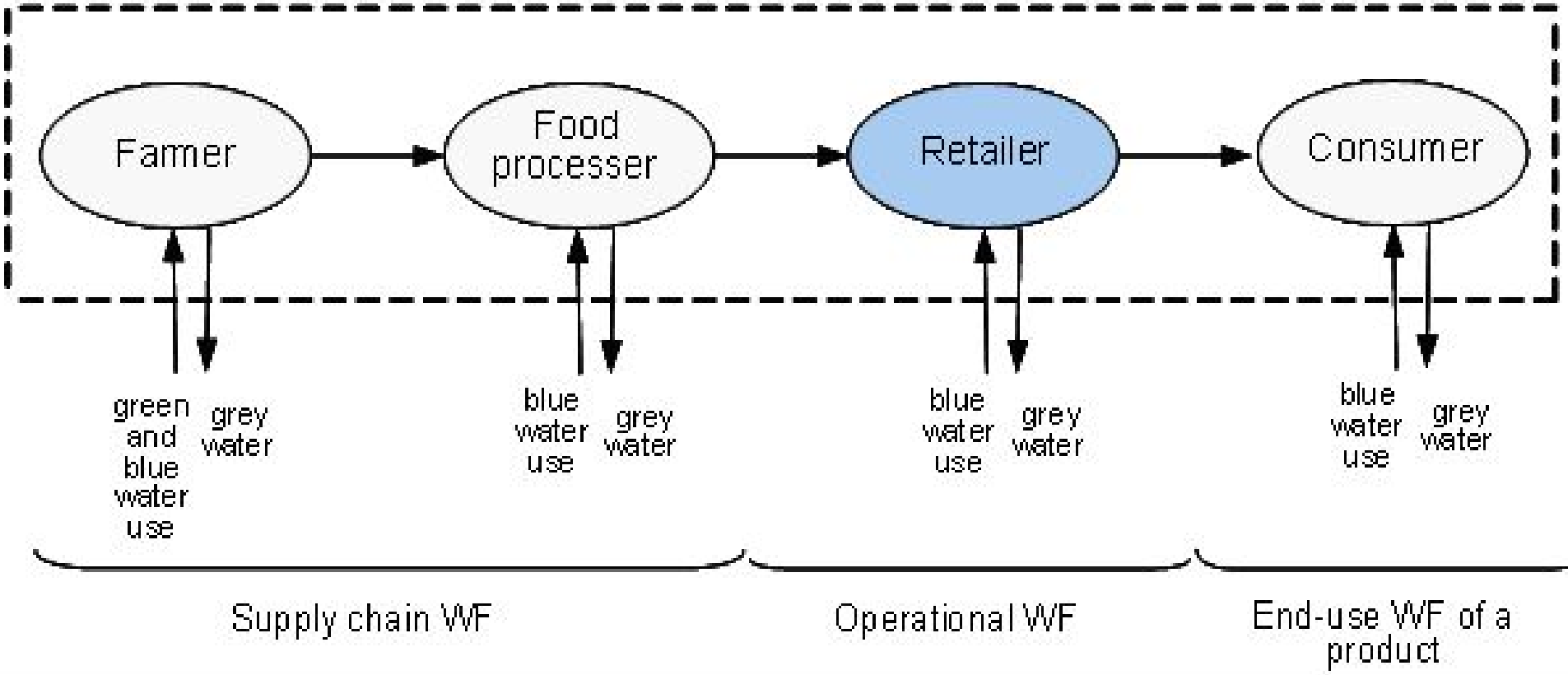


Today, 2.5 billion people, almost 40% of the world's grain production and almost one quarter of the global economy are presently at risk because of non-sustainable water use.

Water Use in our Food

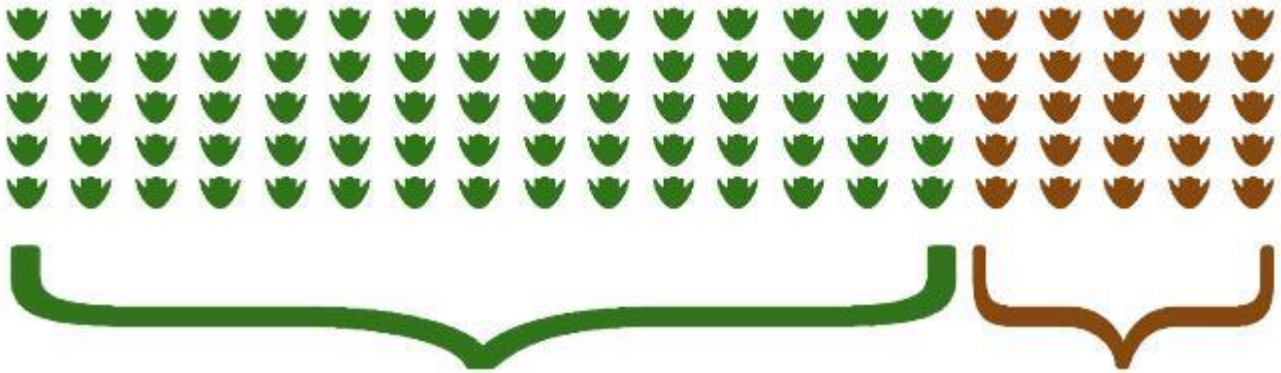


The Water Footprint



Diversity in our diets

Global Food Supply

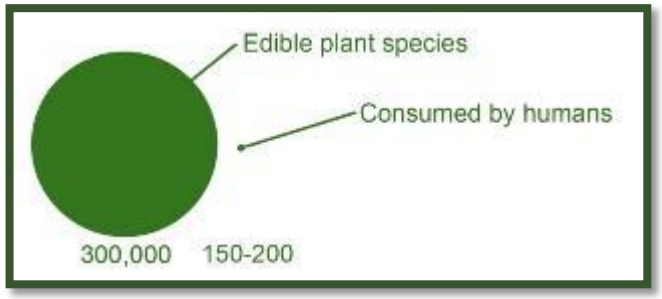


75% Come from only:

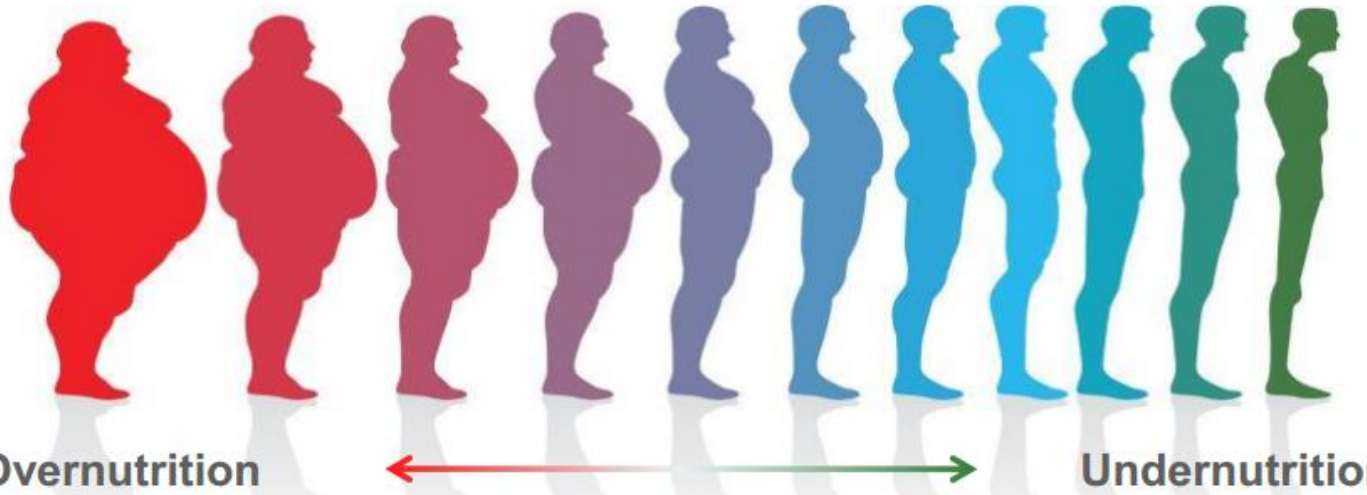
12 plant + **5** animal species

Of which, only **3** make up nearly **60%** of the calories/proteins from plants in the entire human diet.

{Corn + Wheat + Rice}



The Spectrum of Malnutrition in the World Population



Overnutrition ⟷ **Undernutrition**

Nutrient excess

Overweight & obesity

- CVD, diabetes
- Etc.

1.6 billion

1.0 billion

>2.0 billion

Nutrient deficiencies

- Protein energy malnutrition
- Micronutrient malnutrition

Focus on "Big 4": iron, vit A, iodine, zinc

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Headline Target

A 25% reduction in premature mortality related to Non - Communicable Diseases by 2025

World Health Assembly Global Target May 2012

The pizza – the proxy meal



What we do

LEAF's vision…

A world that is farming, eating and living sustainably.

Our mission…

inspiring and enabling sustainable farming that is prosperous, enriches the environment and engages local communities.



IFM delivering sustainable farming



Sustainable farming, delivers a site-specific farming system supporting the integration of the environment, society and farm economic viability over the long term.

LEAF 2012

LEAF's core activities

Facilitating sustainable farming knowledge generation and exchange

Developing market opportunities

Engaging the public in sustainable food and farming

Facilitating knowledge exchange & innovation

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Facilitating sustainable farming knowledge generation and exchange

- 38 LEAF Demonstration Farms
- 8 LEAF Innovation Centres
- LEAF Sustainable Farming Review
- Integrated Farm Management: A Guide
- IFM Bulletin
- LEAF Green Box
- Online information centre
- Monitoring & Evaluation





Developing market opportunities



Developing market opportunities

- The **area of land** around the world, growing LEAF Marque crops increased by 31% overall in 2013 to 247,053 hectares
- **Number of countries** where we have LEAF Marque certified members increased by 14% in 2013 up from 29 to 33
- During 2013, the **number of LEAF Marque certified producers** grew by 6.6%, from 896 to 955
- **Percentage of LEAF Marque UK fruit and vegetable crop area** – up by 22%



Building public understanding and trust





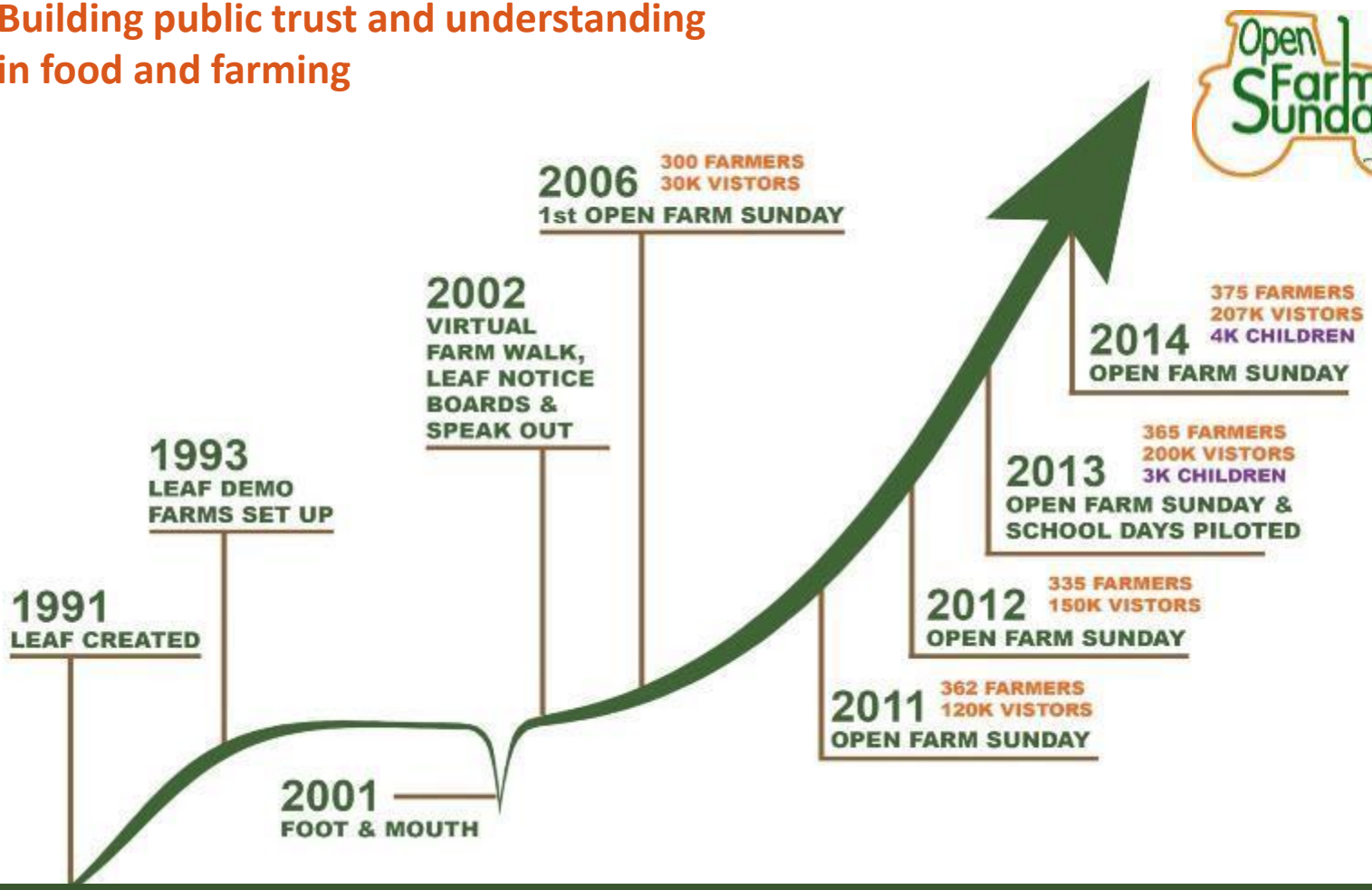
Engaging the public in sustainable food and farming

- **Open Farm Sunday 2014:**
  - 207,000 visitors
  - 375 farms open
  - One in five farms reported over 1,000 visitors
  - 4,000 school children visit a farm on Open Farm School Days
  - Since 2006 1.25 million visitors
- **Let Nature Feed Your Senses**
- **LEAF Virtual Farm Walk**

The evolution of LEAF
1991 and beyond

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Building public trust and understanding in food and farming



IFM delivering sustainable farming

Water Management



Efficient water management is a core component of LEAF's Integrated Farm Management (IFM). Managing water wisely as well as assessing and enhancing the efficiency of on farm water use saves money and helps provide for future needs.

- Water Management Plan
- Water storage and sourcing
- Monitoring
- Drainage from farm building areas
- Soil management
- Plan based action
- Irrigation
- Land drainage and ditches
- Water saving

SIMPLY SUSTAINABLE WATER

Six Simple Steps for managing water quality and use on your land



ASDA LEAF MOLSON Coors









Overall Plan

A competitive business

Resilient supply chains

Supplier collaboration

Resource efficient

Advocacy



Selling quality products

Sustainable agriculture

Meeting customer demands

Healthy sustainable diets

Industry-leading products

ASDA Farming for a better Future

Our water stewardship:

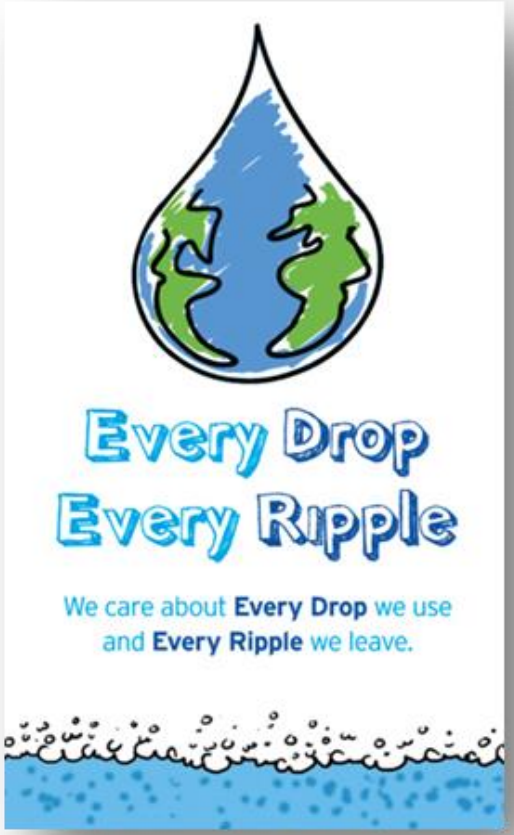
We care about every drop we use and every ripple we leave

OUR DROPS…

•In the UK our brewing operations currently use 4 pints of water to brew 1 pint of beer

•Molson Coors have set an ambitious 2020 target to improve water efficiency by 20% compared to 2011.

•Our UK Alton and Tadcaster breweries already achieved world-class water efficiencies



Simply Sustainable Water in Practice

Six Simple Steps to help improve the performance, health and long term sustainability of your land building up a long term picture of how you manage and protect your water sources as an integral part of your land management.

Six Simple Steps for managing water quality and use on your land

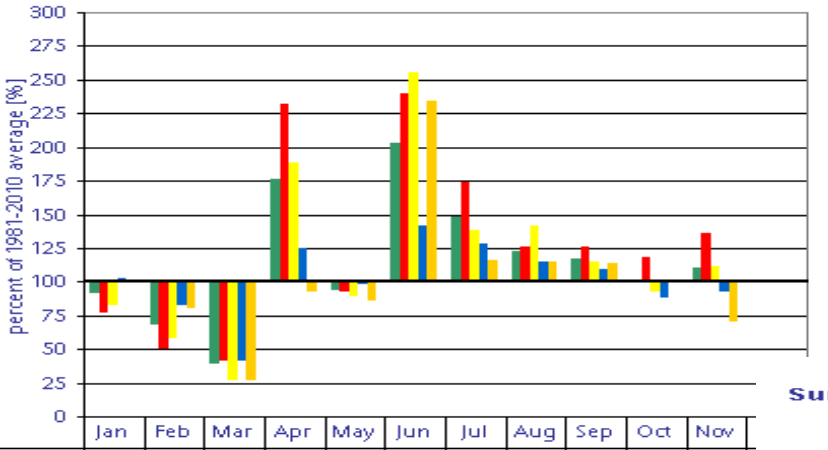
Management
1. Water saving
2. Protecting your water sources

Physical Health
3. Soil management
4. Drainage

Monitoring
5. Tracking your water use
6. Water availability and sunlight hours

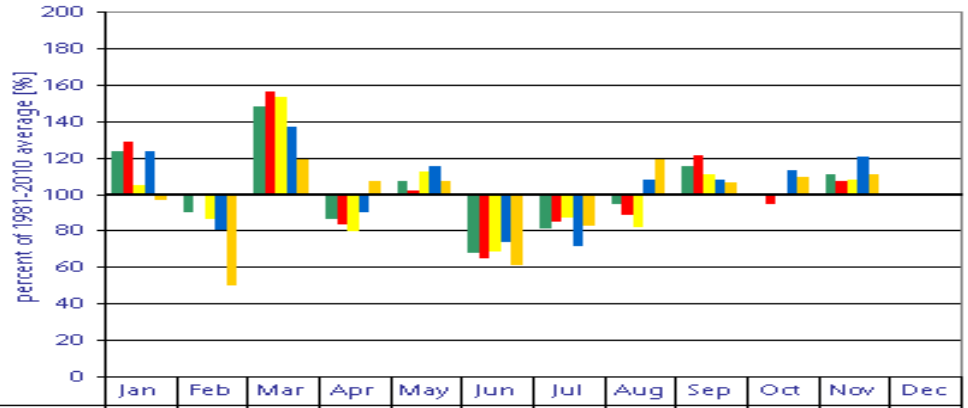
Predicting the unpredictable

Rainfall (1981-2010) anomalies for 2012

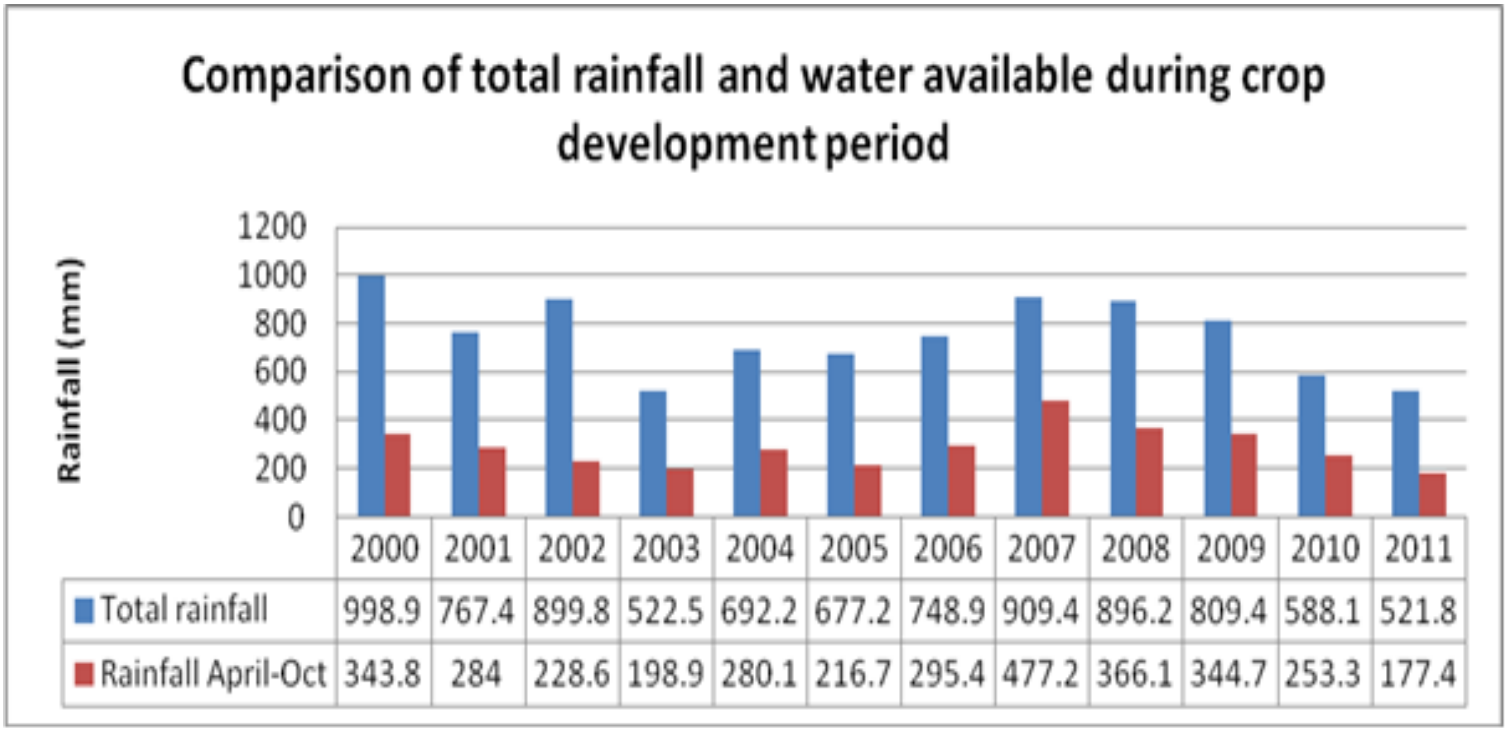


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
UK	91	68	39	176	94	203	148	122	117	101	111
England	77	50	41	232	92	239	174	126	126	118	137
Wales	83	58	27	189	89	256	138	142	114	92	111
Scotland	103	82	41	125	98	142	128	115	109	88	93
N Ireland	99	80	27	93	86	235	116	114	113	99	70

Sunshine (1981-2010) anomalies for 2012



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
UK	124	90	148	86	107	67	81	95	116	100	111	
England	129	99	156	83	102	65	85	89	121	94	107	
Wales	105	86	153	80	112	68	87	82	111	99	108	
Scotland	123	80	137	90	115	74	71	108	108	113	120	
N Ireland	96	50	119	107	107	61	83	119	106	110	111	



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total rainfall	998.9	767.4	899.8	522.5	692.2	677.2	748.9	909.4	896.2	809.4	588.1	521.8
Rainfall April-Oct	343.8	284	228.6	198.9	280.1	216.7	295.4	477.2	366.1	344.7	253.3	177.4

Ross-on-Wye, Herefordshire (Met Office, 2012).

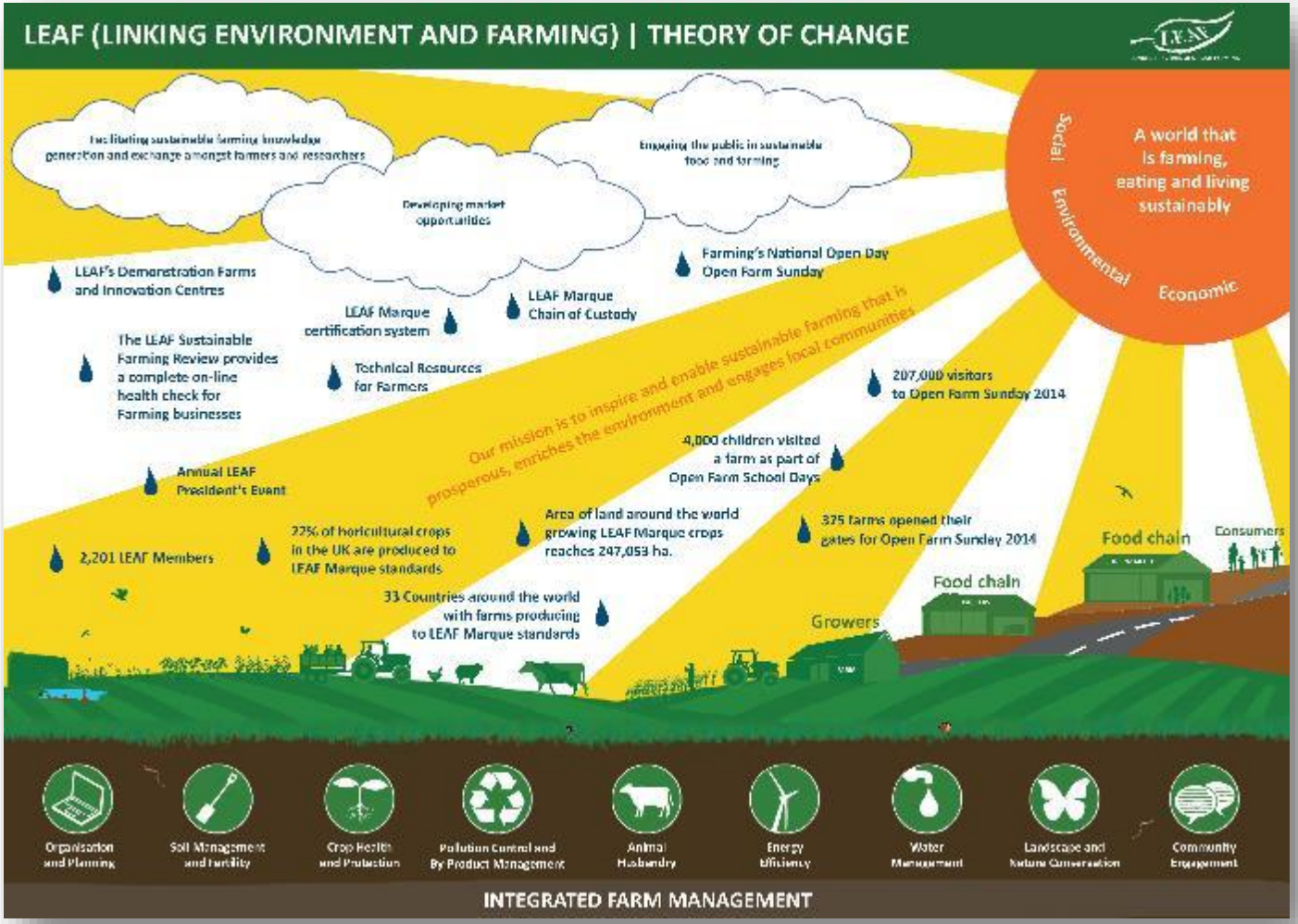
Measuring sustainability



Annual Sustainability Reporting

- Monitor and Evaluate progress in economic, environmental and social performance, such as the LEAF Sustainable Farming Review
- Establish baseline trends against which to monitor future improvements
- Revisit headline indicators to develop sustainable metrics
- Continue to work closely with a range of stakeholders to ensure indicators are scientifically robust, practical, measurable and realistic
- Ensure SMART targets and outcome based – in order to consider impacts and trade-offs
- Annual reporting on regular date and timescale
- ISEAL accreditation

Theory of Change



Water Efficiency



Pressure on Growers

Regulations

Customer Requirements



Weather

Drivers for change

- Business ethos – minimising impact on the environment
- Customer/Assurance requirement to demonstrate that you are managing water effectively
- Cost- reduce water bills
- Cost – reduce waste water disposal bills
- Identify areas of wastage where the business can be more efficient
- Increase production - no water, no product
- Pressure on supply – competing with others for resources that are available
- Correct dilution of crop protection products for maximum effect
- Reduce risk of water pollution and run-off
- Able to recycle suitable water so that it can be re-used

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One Size Doesn't Fit All

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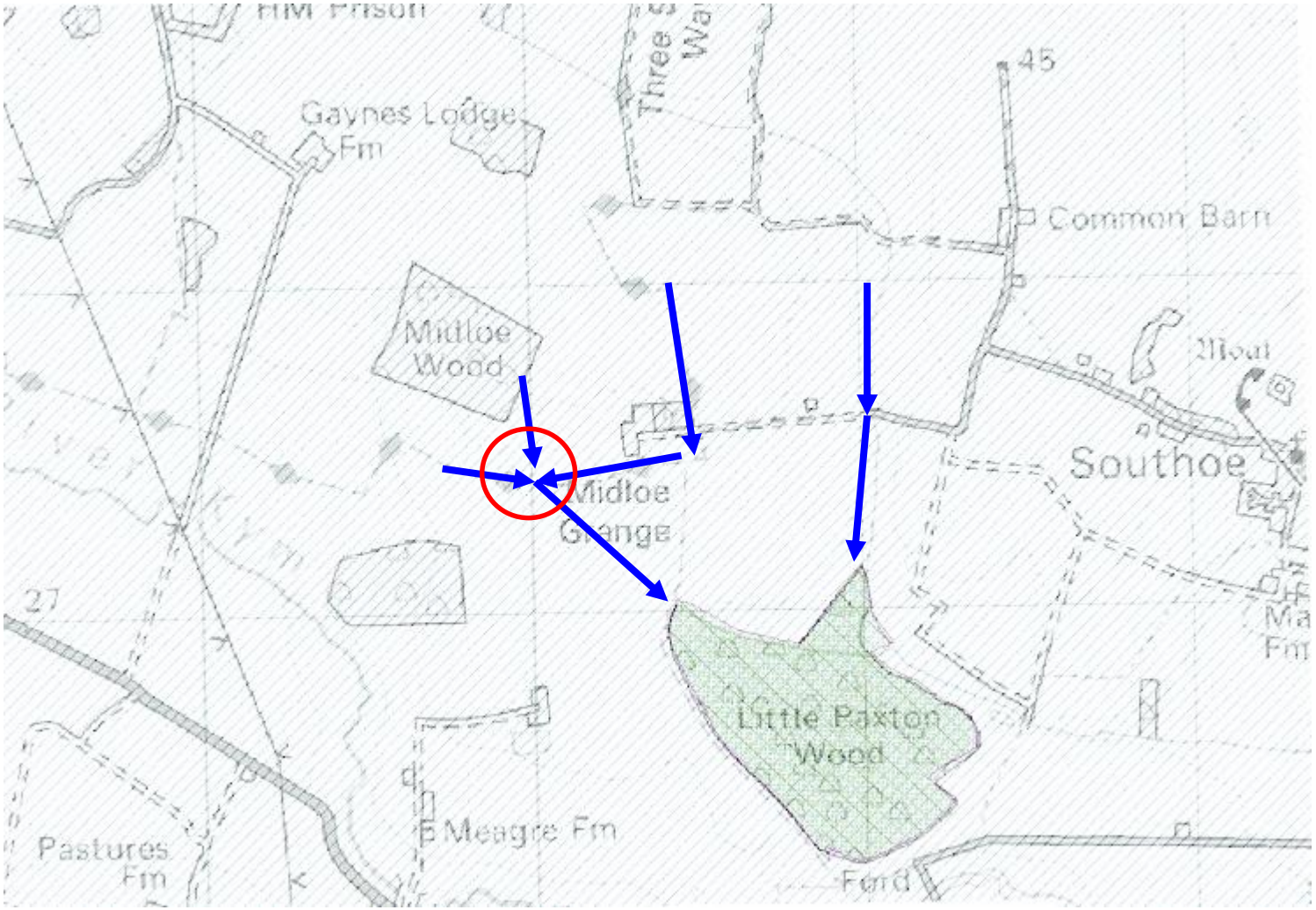




Attention to detail



Drainage Flows



Construction of Field Buffer



Field Buffer In Action



Bunded corner capturing run off before ditch next to low gateway

Willow Barrier and Settlement Pool



Willow Barrier and Settlement Pool Filtering



Irrigation & meeting customers needs

- Elveden is a 22,500 acre estate on the Suffolk-Norfolk border
- The estate has diversified extensively and now comprises:
  - Farming
  - Specialist seasonal vegetables
  - Produce marketing
  - Forestry and hedging
  - Food production
  - Food distribution for local producers
  - Leisure and retail





Irrigation & meeting customers needs

- Elveden's farmland extends to over 10,000 acres
- The main crops are:
  - Onions – 28,000 tonnes
  - Potatoes – 25,000 tonnes
  - Carrots – 20,000 tonnes
  - Parsnips – 10,000 tonnes
  - Cereals; rye, wheat and barley – 10,000 tonnes
- Selling to supermarkets and manufacturers nationwide, for leading product brands, including French fries, potato crisps own brand baby potatoes and rye crisp bread





Irrigation

- **Aim;** To meet plant demands for water and nutrition and optimise the water available to us.
- **Quality;** Skin Finish, Shape, Size, Uniformity, Length, Tuber Count
- **Agronomic;** Aid fertiliser uptake, maximise efficacy of soil applied herbicides, activation of soil stabilisers, aid harvesting and reduce damage at harvest
- **Monitoring;** Maximise point application rates through real time monitoring
- Reduce our Carbon footprint







Irrigation Hardware

Ideally a few of these



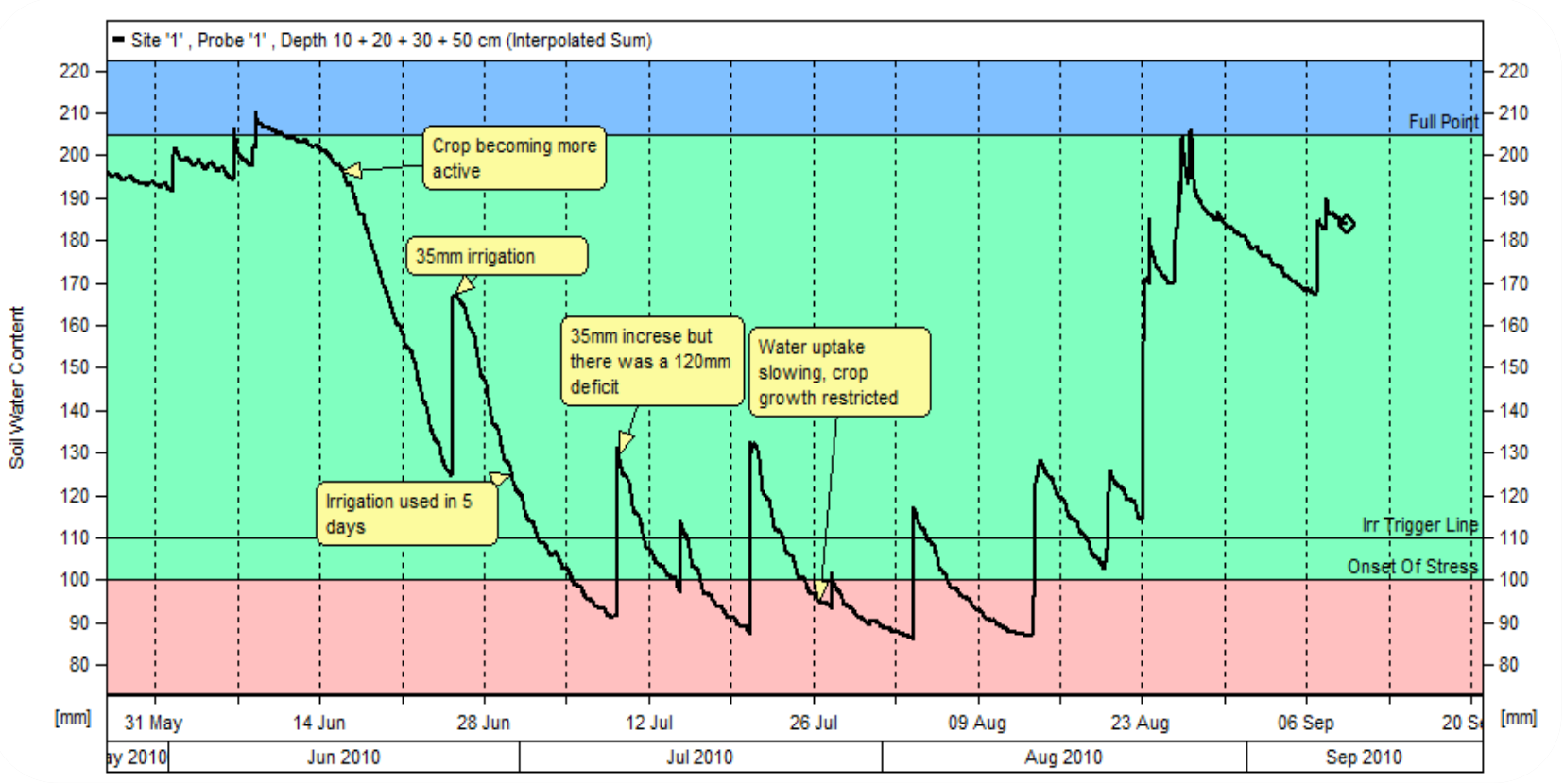
Combined with a few of these



And there is still a place for some of these, although dwindling



Attention to detail



Working with Other Professionals and Enthusiasts

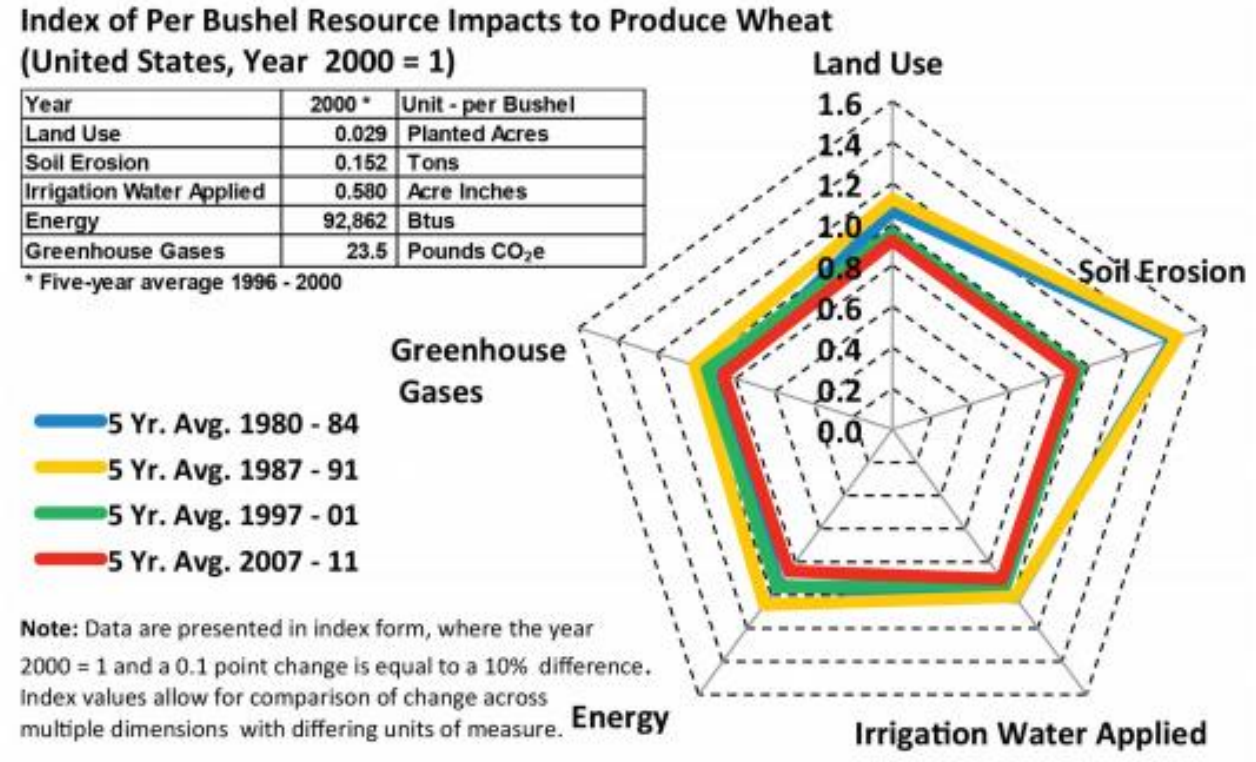


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Integrated Farm Management

Impact trends in U.S. wheat production



Index of Per Bushel Resource Impacts to Produce Wheat, United States, 1980-2011

www.fieldtomarket.org/

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… Working with Nature













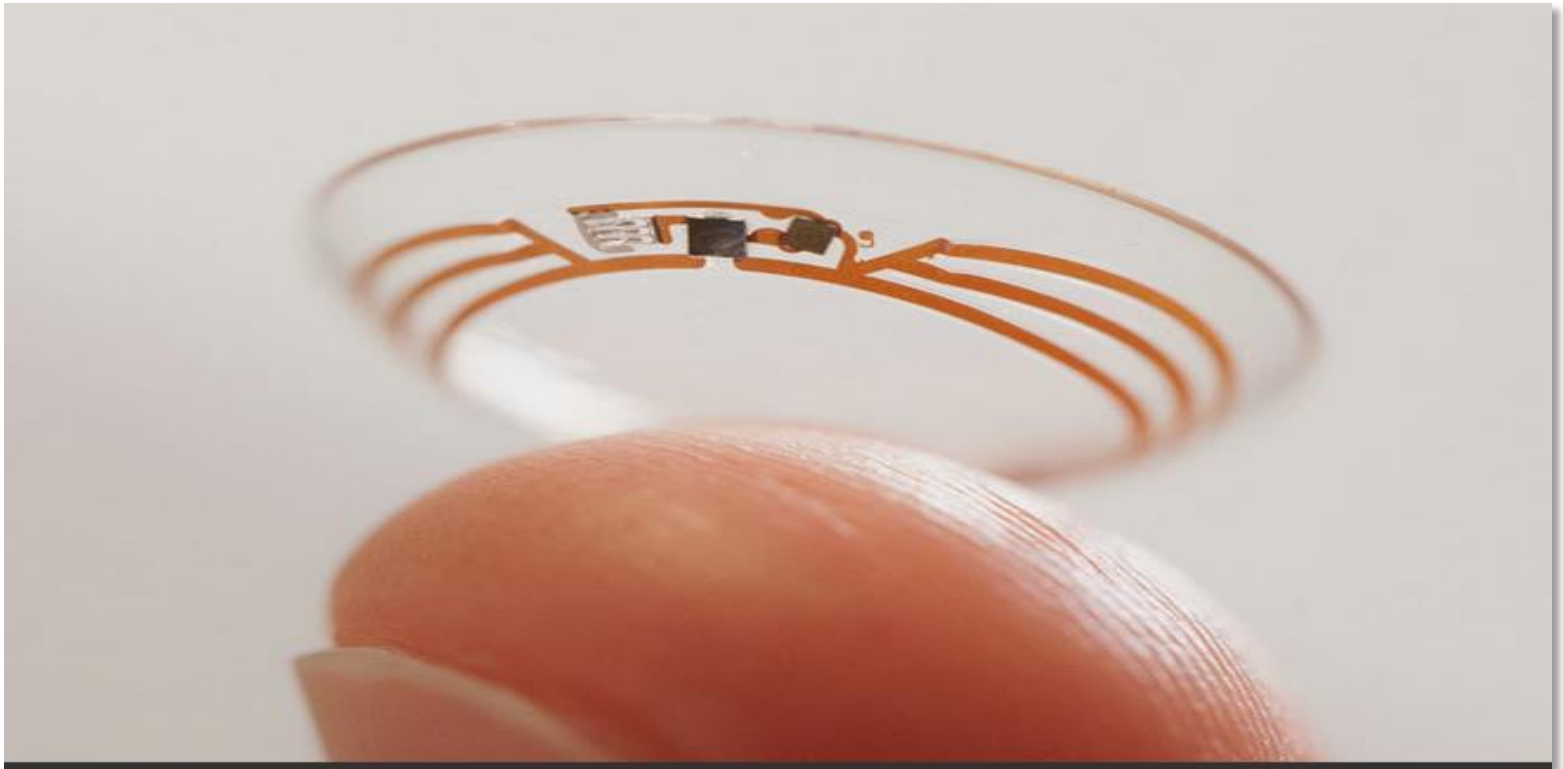
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Personalised health



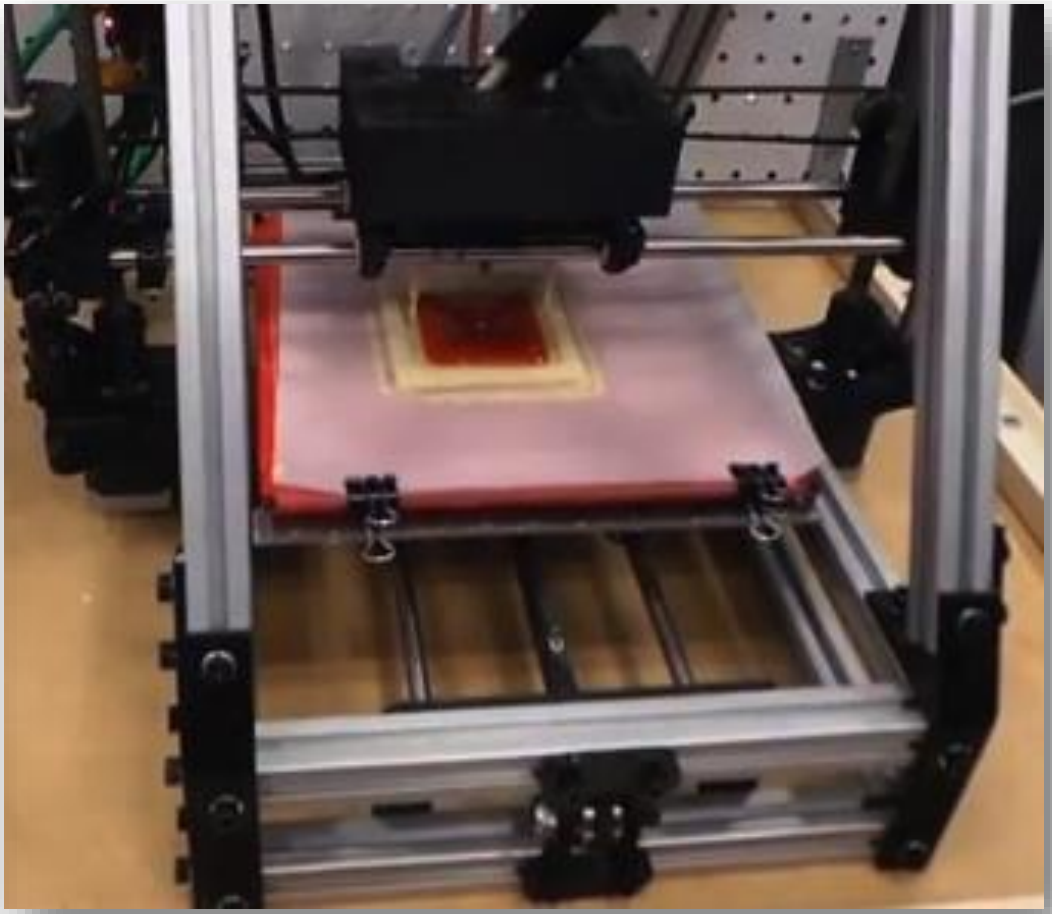
After years of scalding soldering hair-thin wires to miniaturize electronics, Brian Otis, Google X project lead, has burned his fingertips so often that he can no longer feel the tiny chips he made from scratch in Google's Silicon Valley headquarters, a small price to pay for what he says is the smallest wireless glucose sensor that has ever been made.

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The perfect pizza?



	Eat Balanced	Goodfellas	Ristorante	Chicago Town
Calories (Kcal)	172	298	263	303
Fibre (g)	2.5	2.0	1.7	?
Saturated Fat (g)	5.3	12.8	13.6	14

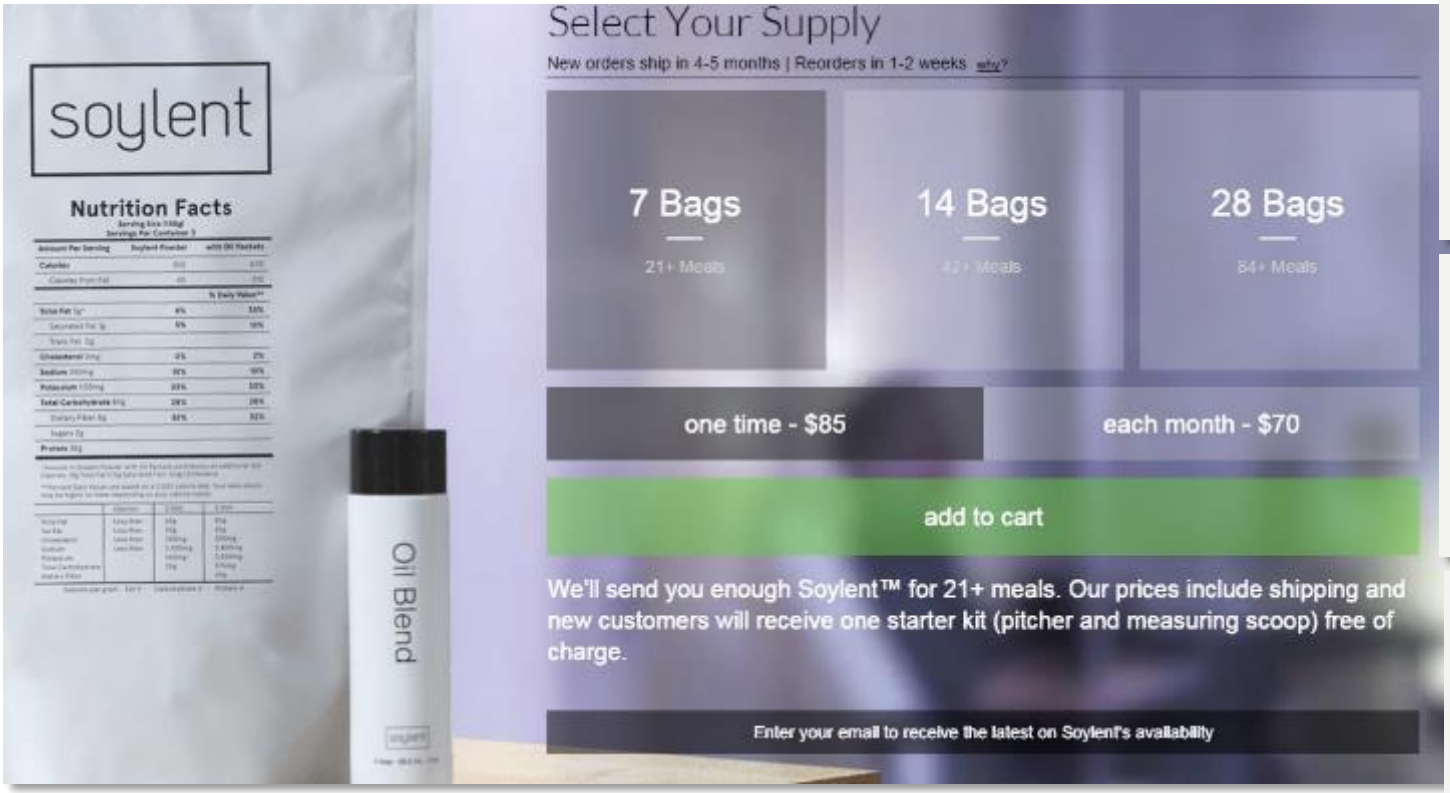


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The restaurant of the future



Be careful what you wish for



Time

Prepare multiple meals in minutes - no need to shop for individual ingredients or plan ahead

Money

Spend less than $10 per day on food, and less than $4 per meal - get more than a day's worth of meals for less than the cost of takeout

Nutrition

Eat balanced and wholesome - get all of the essential nutrients required to fuel the human body

Opportunities

- **Thinking big picture -** *Think big. Start small. Start now.*
- **Delivering resilient farming systems & improved biodiversity & ecosystem services**
- **Improving metrics & impact**



- **Demonstrating the importance of change – public engagement**
- **Stronger partnerships – inside & outside the industry**
- **SMARTER ENGINEERING IS KEY!**

Thank You



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www.leafuk.org