Impact of energy crops at a regional level

Kevin Lindegaard

Impact of Energy Crops Seminar
2nd December 2014

Crops for Energy

Rokwood

Crops for Energy

- EU Framework 7 research project
- 20 partners from 6 countries
- Each cluster includes:
  - SME, a research body and a local authority
- Duration: 36 Months

rokwood

CAPACITIES

- ttz Bremerhaven
- Agraligna
- Institute of Agricultural and Fishery Research and Training
- ASAJA Granada
- BioAzul
- Bio-tricity
- Centre for Sustainable Energy
- Crops for Energy
- Dorset County Council
- Dublin Institute of Technology / Dublin Energy Lab
- EKSPERT-SITR
- European Biomass Association
- Gmina Zaluski
- Granada Energy Agency
- Mazovian Agricultural Advisory Centre
- Regional Planning Authority Altmark
- SalixEnergi Europa
- Scania's Association of Local Authorities
- SP Technical Research Institute of Sweden
- Western Development Commission

Why we need energy crops

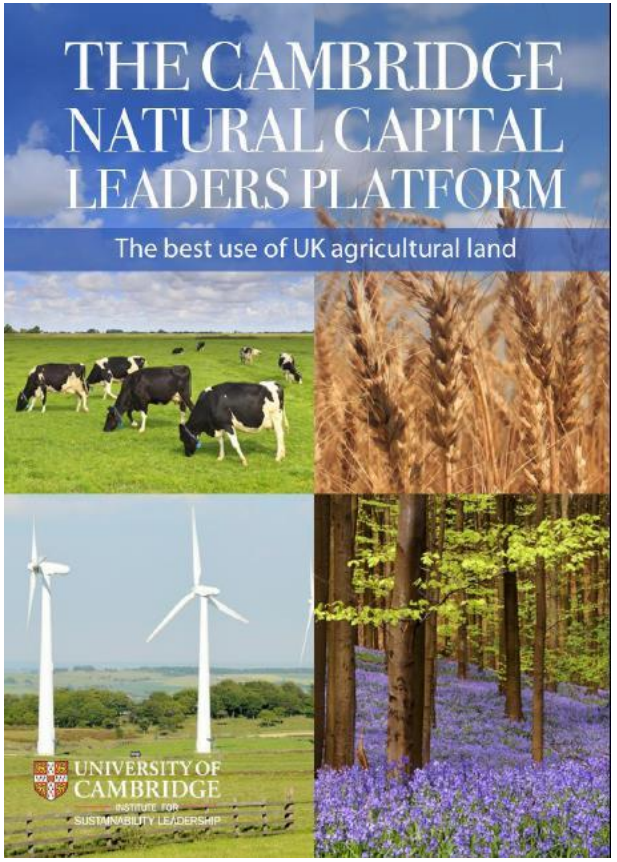
Crops for Energy

- Finite amount of woodfuel
- Not always close to the end user
- Extraction can be expensive
- Transport costs are increasing
- Importing woodfuel is:
  - Less sustainable
  - Revenue benefits are achieved outside of the region
- Energy crops have other benefits

The best use of UK agricultural land

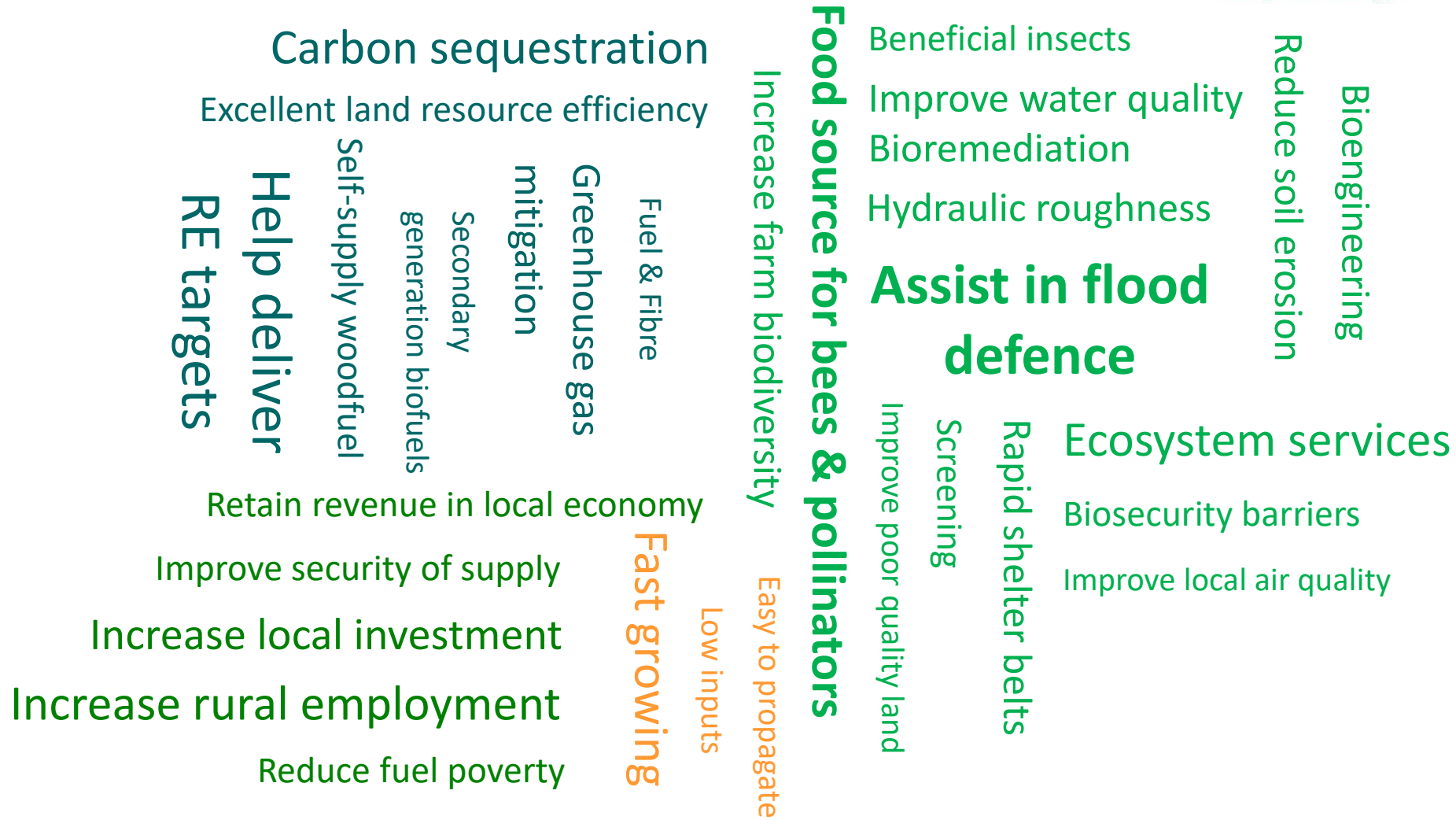
Crops for Energy

"Where land can deliver multiple benefits – such as forestry or perennial crops providing both a source of timber and energy as well as water management, carbon storage and wildlife benefits – all of these should be understood, valued and their multiple delivery actively encouraged and rewarded".



Ref: The Best use of UK Agricultural Land
http://www.cisl.cam.ac.uk/business-platforms/natural-capital-leaders-platform.aspx

SRCs unique set of attributes



Food versus Fuel!

Crops for Energy

- UK – 17 million hectares of farmland

What about:

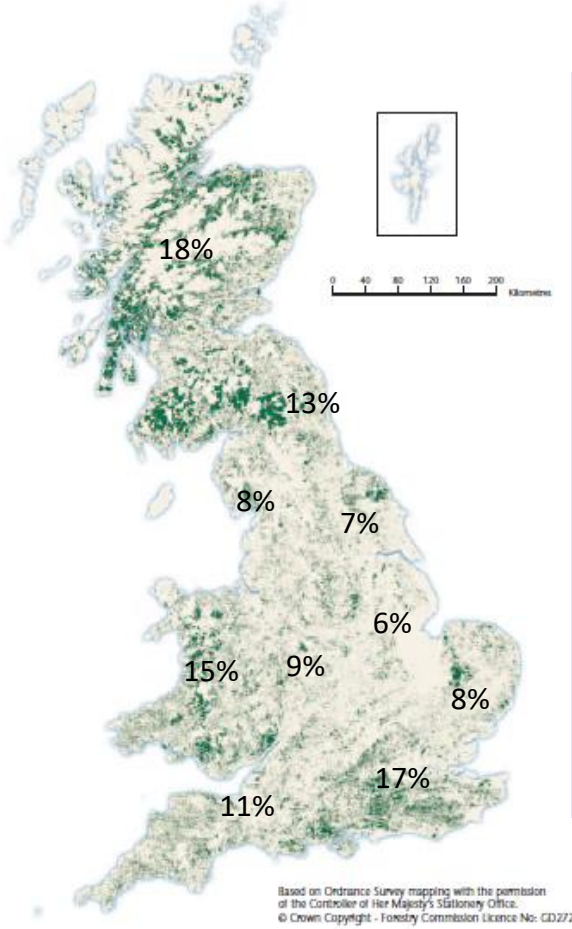
- Food versus horses (0.54-1.08 million hectares)
- Food versus beer and whisky (0.33 million hectares)
- Food versus golf (60,000 hectares)
- Food versus food waste (0.5 million hectares)

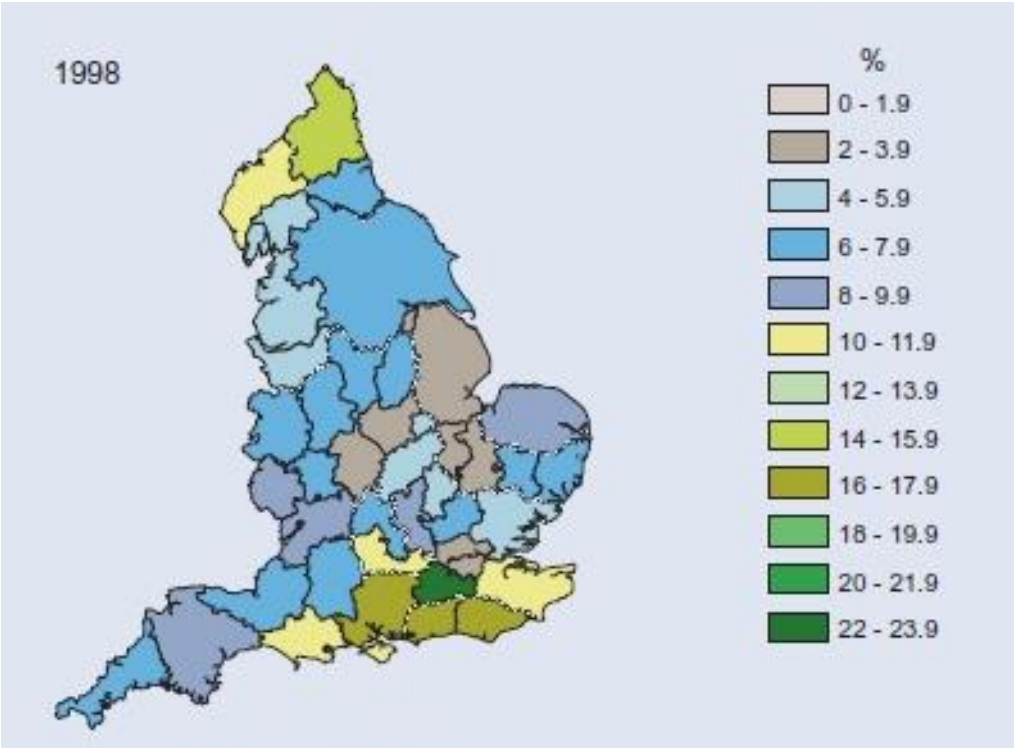
Not all willows are the same

Crops for Energy

Images taken 10th November 2014. Teagasc Research Centre, Carlow, Ireland

Woodland cover



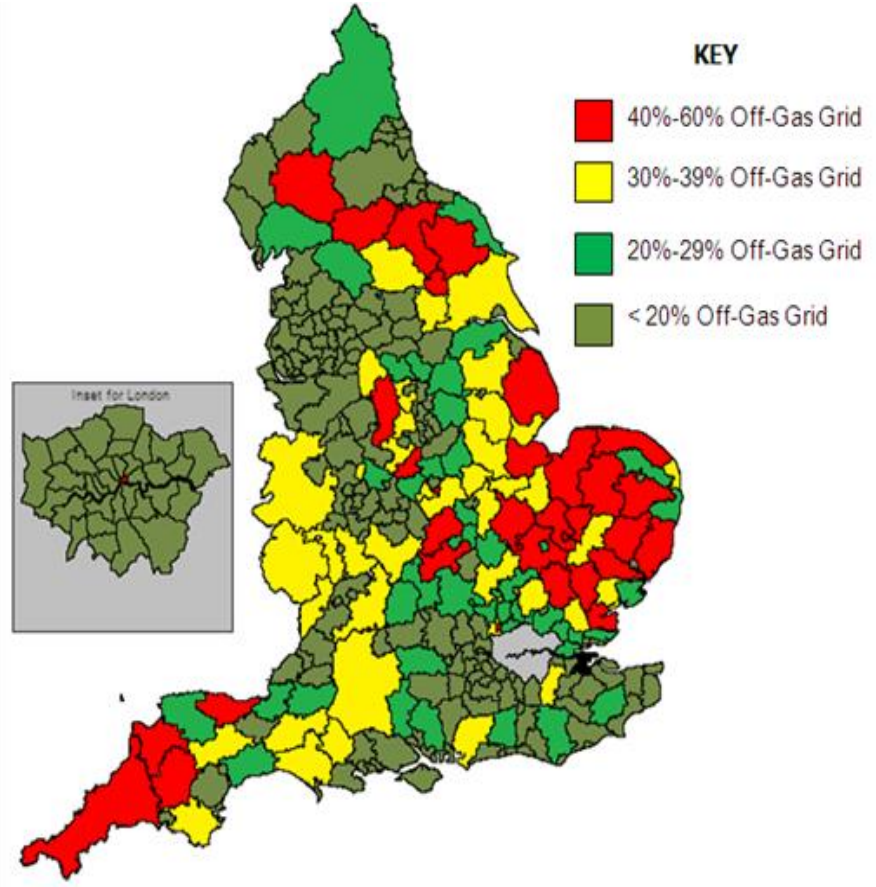


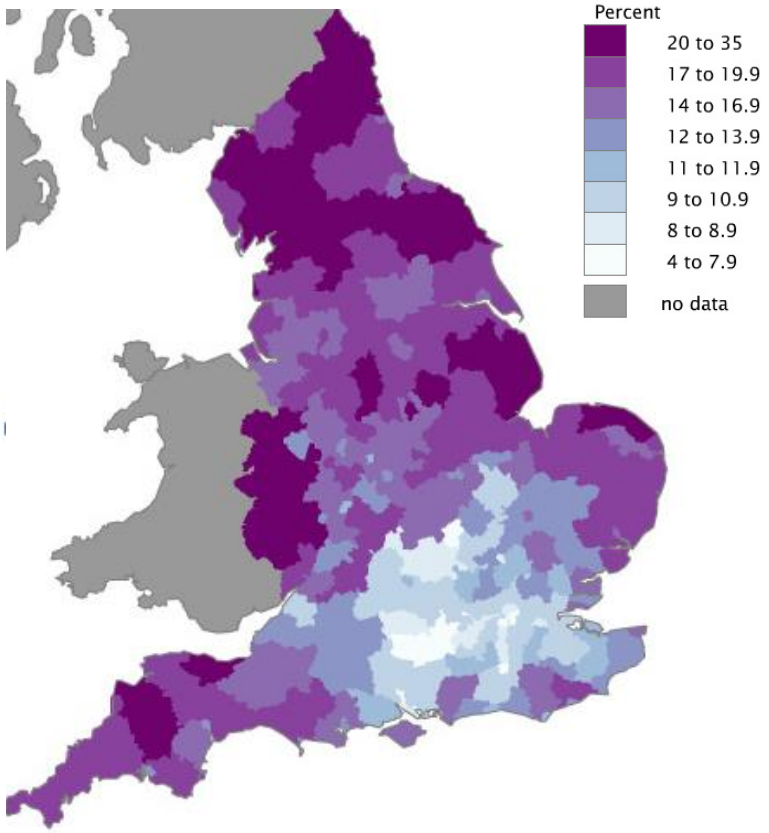
Refs: Forestry Commission. 2011 National Forest Inventory (NFI) woodland map update. http://www.forestry.gov.uk/forestry/INFD-8EYJWF

The National Inventory of Woodland and Trees – England 2001. http://www.forestry.gov.uk/pdf/frnationalinventory0001.pdf/$FILE/frnationalinventory0001.pdf

Off gas areas / Fuel poverty

Crops for Energy





Refs: http://analysis.focalresearch.co.uk/2012/green-agenda/analysis.php?s=which-local-authority-areas-have-the-most-households-off-gas-grid
DECC Households (%) in Fuel Poverty, 2006-11. http://tools.decc.gov.uk/en/content/cms/statistics/local_auth/interactive/fuelpoverty/index.html

Water quality / Flood mitigation

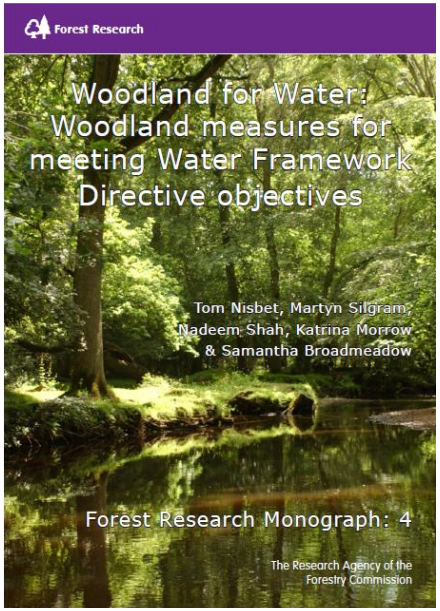
Crops for Energy

- 1/3 of water bodies in the SW ‘good’ status under the Water Framework Directive
- Agriculture - 70% of nitrate pollution in surface water
- 39% of the SW is in an NVZ, affecting 6,806 farms
- Flood defences and coastal erosion in England costs £0.7 billion/yr
- 1/6 houses in England at risk of flooding
- 2/10 local authorities most at risk of flooding are in the SW (North Somerset and Sedgemoor Districts)

Water quality / Flood mitigation

Crops for Energy

- *"Energy woodland crops such as SRC could be a particularly attractive option for **mitigating nitrate leaching in NVZs** by maximising nitrogen uptake and providing a **high yielding crop for farmers**."*
- *"….the rapid growth and multi-stemmed nature of these crops makes them **ideally suited to flood risk management**."*
- *"……energy crops can offer additional advantages for water protection, flood risk management and climate change mitigation by enhancing pollutant uptake and **sediment retention**, more rapid establishment of vegetation roughness (especially for SRC) and **increased carbon sequestration**, as well as a more attractive and faster economic return for landowners."*



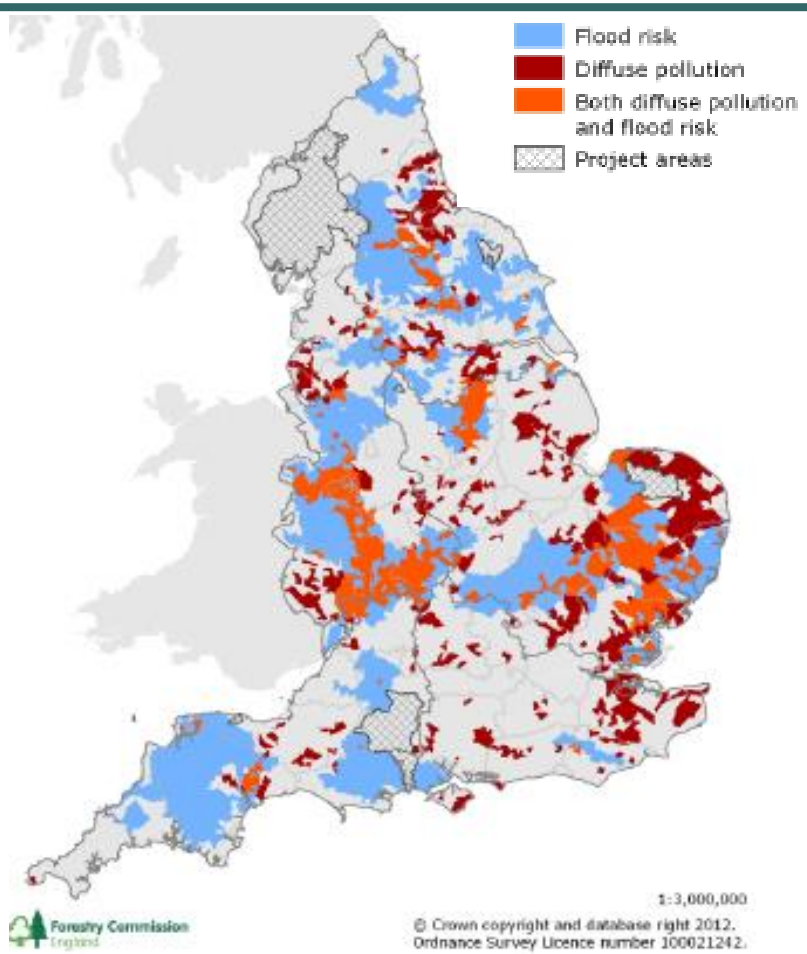
BUT….

"……there is no incentive to plant (energy) crops where they could benefit water most."

Ref: Woodland for Water: Woodland measures for meeting Water Framework Directive objectives. Forest Research July 2011
http://www.forestry.gov.uk/pdf/FRMG004_Woodland4Water.pdf/$FILE/FRMG004_Woodland4Water.pdf

Flood risk / Diffuse pollution

Crops for Energy



Ref: Forestry Commissions Woodland for Water – National EWGS Targeting Map 2012/2013
http://www.forestry.gov.uk/pdf/NationalMapping_report.pdf/$FILE/NationalMapping_report.pdf

Flood mitigation options

Vegetation option	Woodland	SRC	Miscanthus
Time to maturity	> 20 years	4-5 years	4-5 years
Stocking rate (plants per hectare)	Typically 2,250 (up to 10,000)	15,000	13,000
Management	Thinned after 15 years	Cut every 3 years	Cut every year
Hydraulic roughness (Manning's n coefficients)	0.1 when mature	0.1-0.34	0.2
Potential of reducing flood risk in < 10 years	Low	Medium - High	Medium -High
Subsidy payments * (arable land in lowlands)	£2,800 per hectare establishment grant, £2,000/ha for flood defence, £300/ha/yr for 15 years. Total subsidy: £9,300/ha	50% of establishment costs (~ £1,250/ha) Total subsidy: £1,250/ha	50% of establishment costs (~ £1,250/ha) Total subsidy: £1,250/ha

* Under previous Rural Development programme

Biodiversity on farms

Crops for Energy

- Wild bird populations have fallen significantly since 1970.
- 59 species of birds have Biodiversity Action Plans

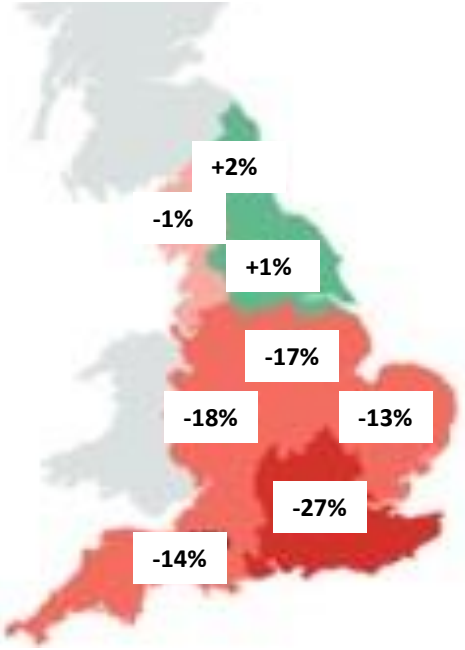
But

- Significantly more birds in SRC compared to the improved grassland and arable controls
- 12 bird species with Biodiversity Actions Plans (BAPs)

Bird populations

Crops for Energy

% Change in farmland bird populations by region 1994-2007



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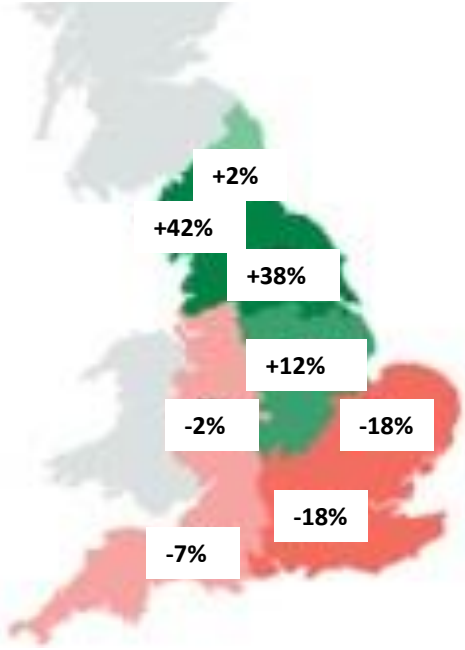
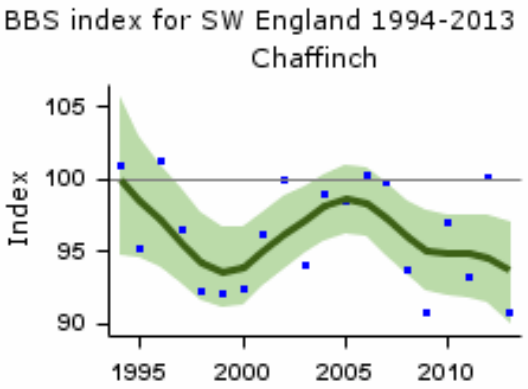
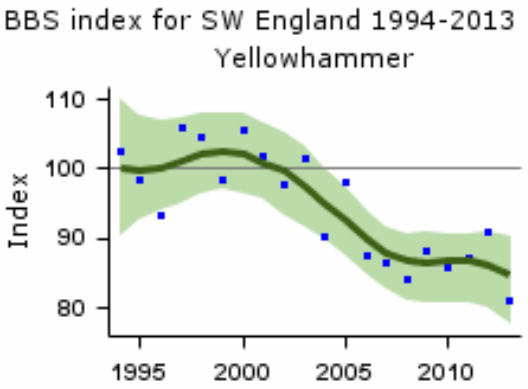


Ref: BTO/JNCC/RSPB Breeding Bird Survey South West England graphs
http://www.bto.org/volunteer-surveys/bbs/latest-results/trend-graphs/south-west-england-graphs

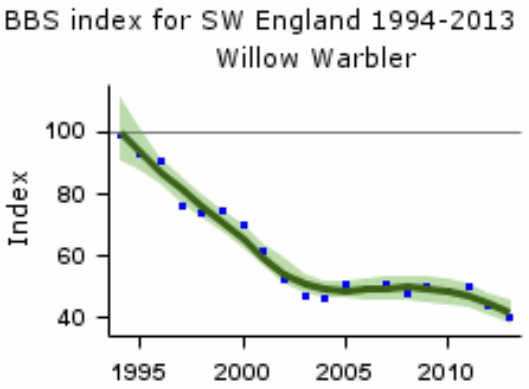
Bird populations



"The most commonly recorded bird in the SRC…"



Red listed / Biodiversity Action Plan
"These important species should benefit substantially from SRC cropping"



Amber listed
"…should also benefit"

Refs: BTO/JNCC/RSPB Breeding Bird Survey South West England graphs
http://www.bto.org/volunteer-surveys/bbs/latest-results/trend-graphs/south-west-england-graphs

Sage et al 2006. IBIS. Birds in willow short-rotation coppice compared to other arable crops in central England and a review of bird census data from energy crops in the UK.
http://onlinelibrary.wiley.com/doi/10.1111/j.1474-919X.2006.00522.x/full

Biodiversity in SRC

Crops for Energy

- Field margins encourage butterfly and other invertebrates
  - 25 species identified in and around SRC plantations
  - 130% increase on land previously used for arable crops

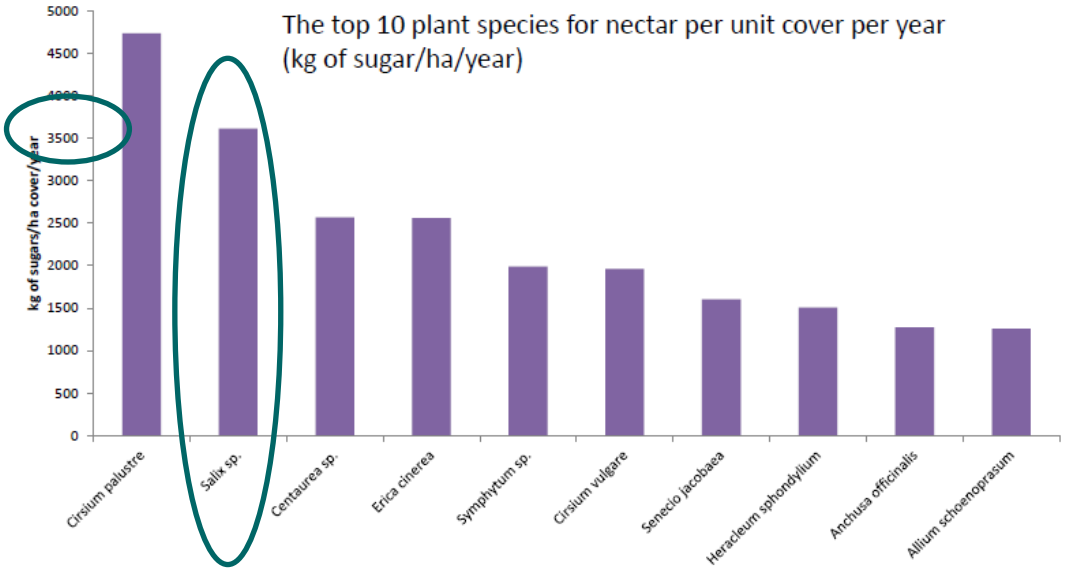
Ecosystem services

- Vegetation 10 x higher in SRC compared to maize
- Predatory arthropods 3 x more in SRC than cereal crops
- Hymenoptera and large hemiptera more abundant in SRC compared to arable and set aside

Pollination services

- 20% of UK cropland is covered by insect pollinated crops
- Value of pollination to UK agriculture = estimated £430 m

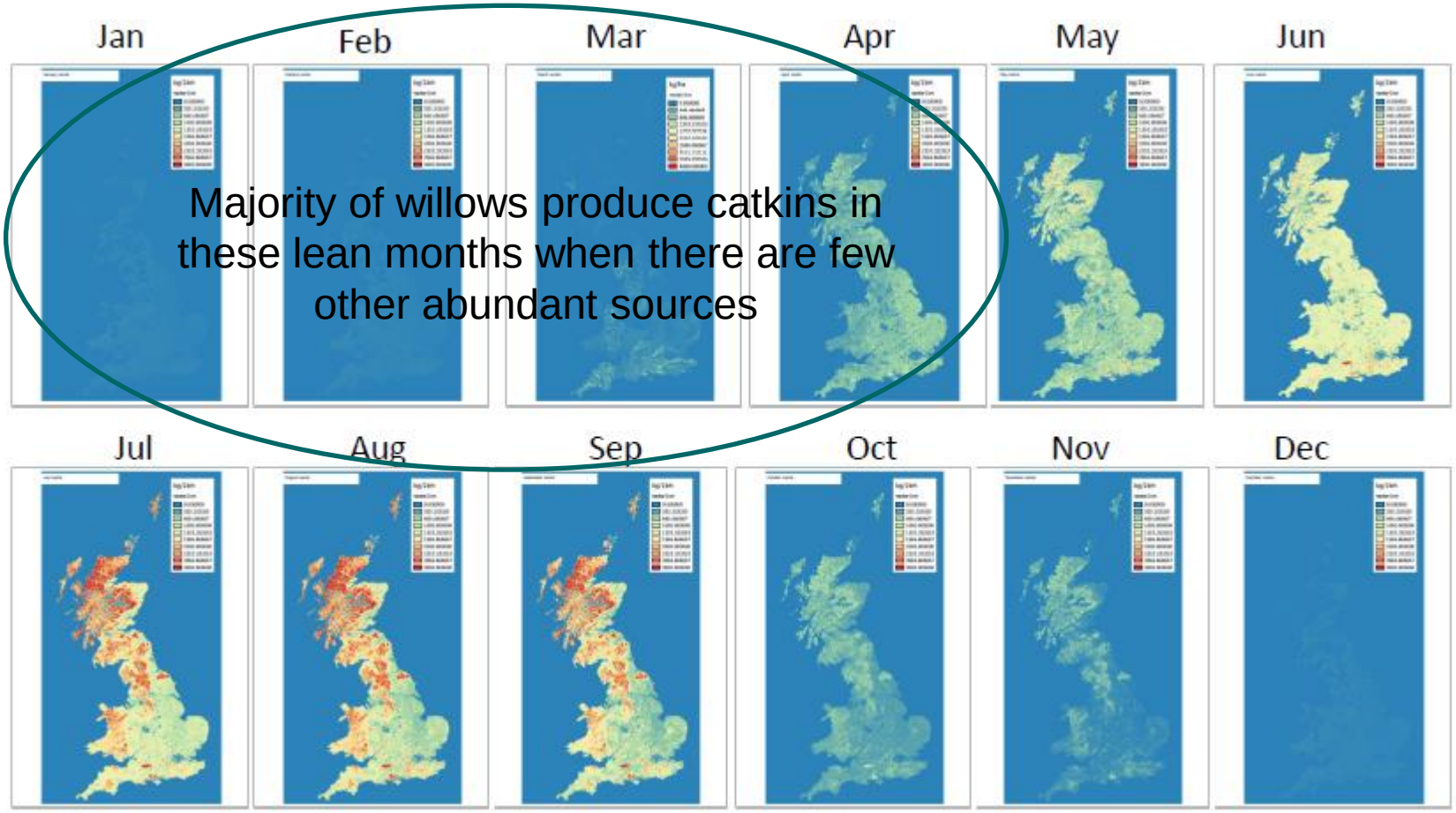
Picture credit: Jason Ingram
http://www.jasoningram.co.uk/



Ref: Quantifying nectar resources from the flower to the national scale. Prof. Jane Memmott, Uni of Bristol . Agriland Project http://www.agriland.leeds.ac.uk/news/documents/4_JaneMemmottnectarresources.pdf

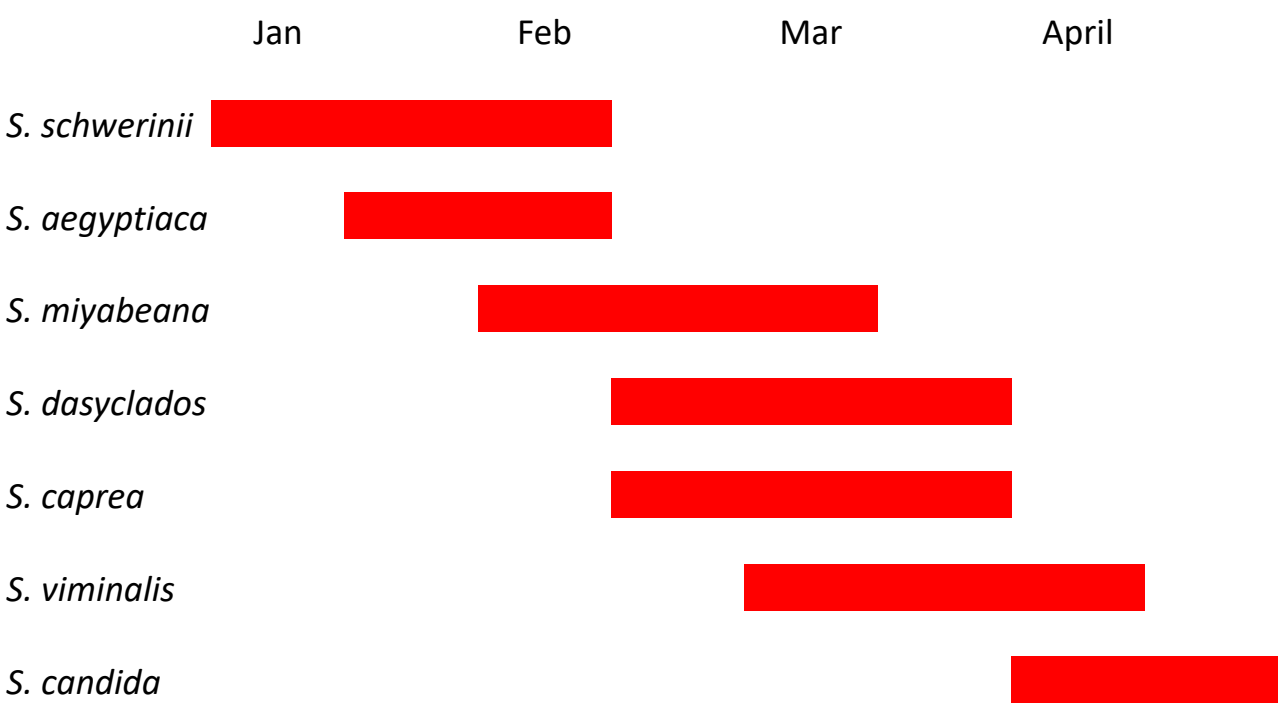
Pollination services

Crops for Energy



Ref: Quantifying nectar resources from the flower to the national scale. Prof. Jane Memmott, Uni of Bristol . Agriland Project http://www.agriland.leeds.ac.uk/news/documents/4_JaneMemmottnectarresources.pdf

Flowering times

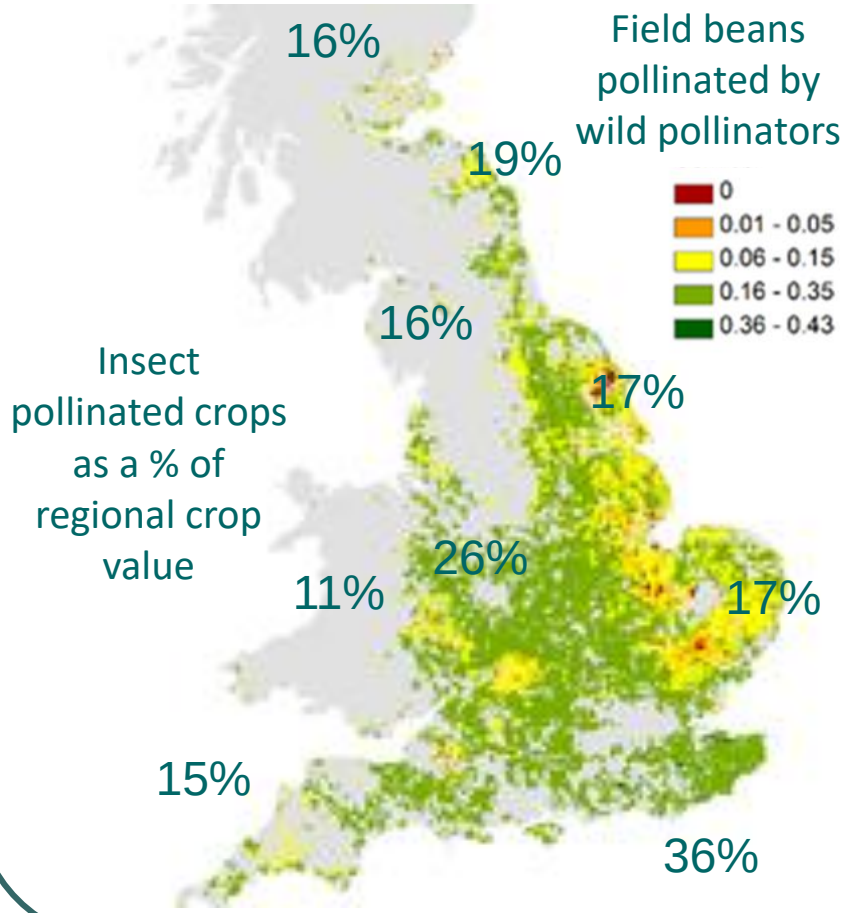


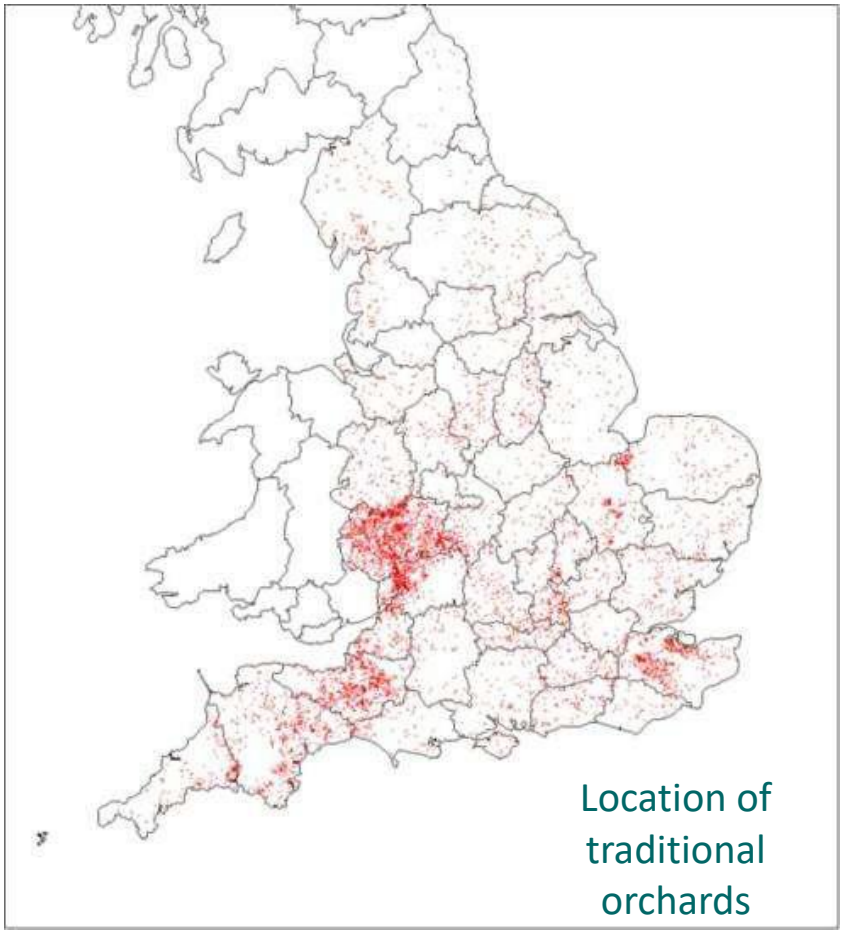
S. dasyclados Loden

(Picture credit: Stig Larsson)

Pollination services

Crops for Energy

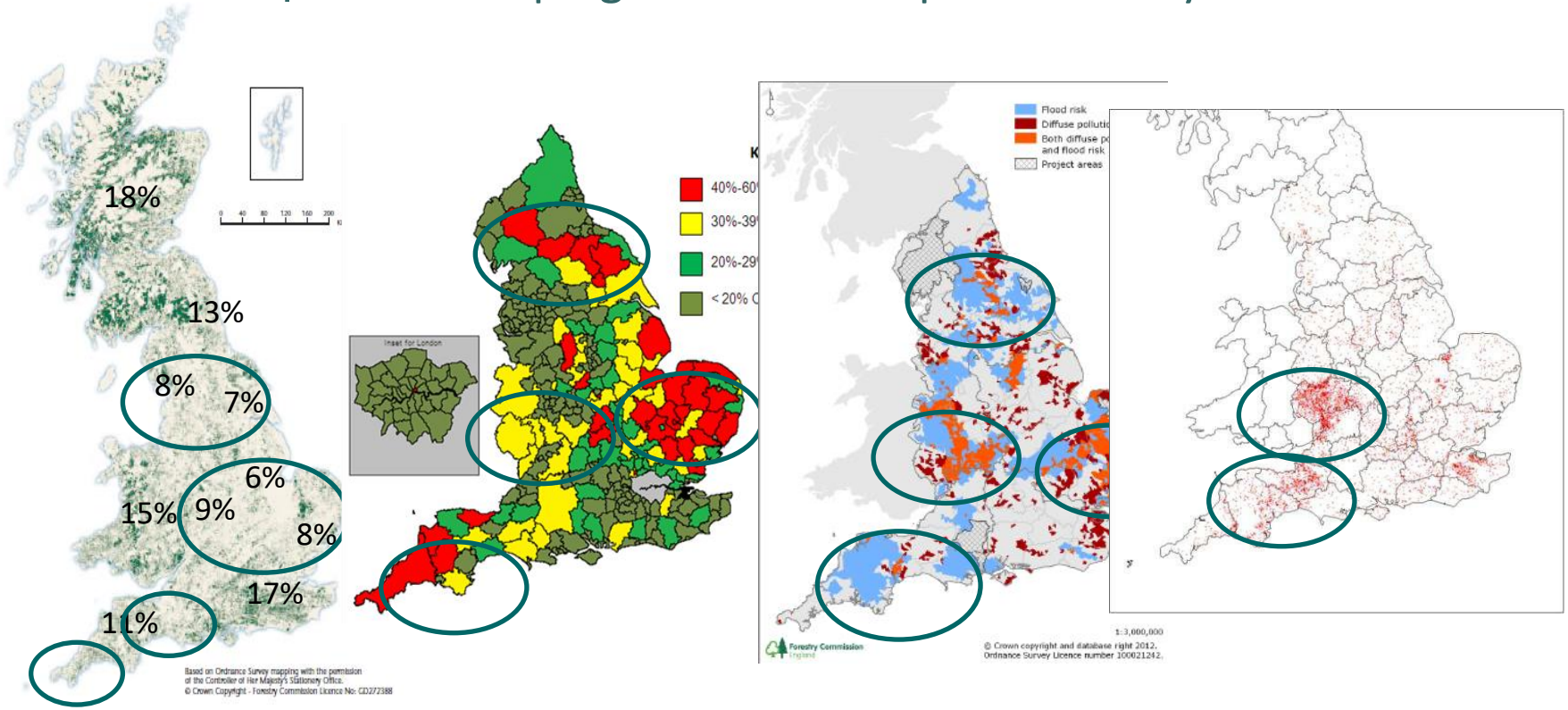




Refs: Polce et al 2013. Species Distribution Models for Crop Pollination: A Modelling Framework Applied to Great Britain.
Breeze et al, 2011. Pollination services in the UK: How important are honeybees?
Traditional orchard project in England. May 2011 http://publications.naturalengland.org.uk/publication/47015

Where should we be planting SRC?

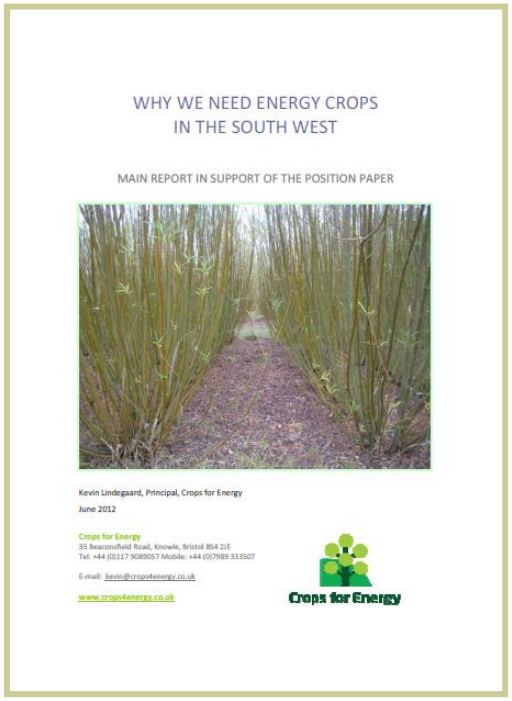
- Where plantations plug a shortfall or provide a key service



Low woodland cover Off gas areas Flooding/Water quality Pollination services

RE targets

- 12% target for renewable heat by 2020
- Predicted heat consumption in the SW is 58.6 TWh
- 12% renewables is 7.03 TWh
- 50% of this demand = 804,532 odt of wood/yr
- Sustainable woodfuel resource in the SW = 685,340 odt/yr



Ref: Why we need energy crops in the SW. Crops for Energy June 2012
http://www.crops4energy.co.uk/why-we-need-energy-crops-sw/

The potential

Crops for Energy

Scenario	Contribution towards the 12%		
	Indigenous woodfuel	Energy crops	Other renewables
1	4.5	0	7.5
2	4.5	1.5	6.0
3	4.5	3.0	4.5
4	2.75	1.5	7.75
5	2.75	3.0	6.25
6	2.75	4.5	4.75

The potential

Crops for Energy

Scenario	Amount of energy crops required			% of SW agricultural land
	TWh/yr	Oven dry tonnes/year	Area (hectares)	
1	0	0	0	0
2	0.88	205,532	21,865	1.2
3	1.76	411,063	43,730	2.3
4	0.88	205,532	21,865	1.2
5	1.76	411,063	43,730	2.3
6	2.64	616,595	65,595	**3.5**

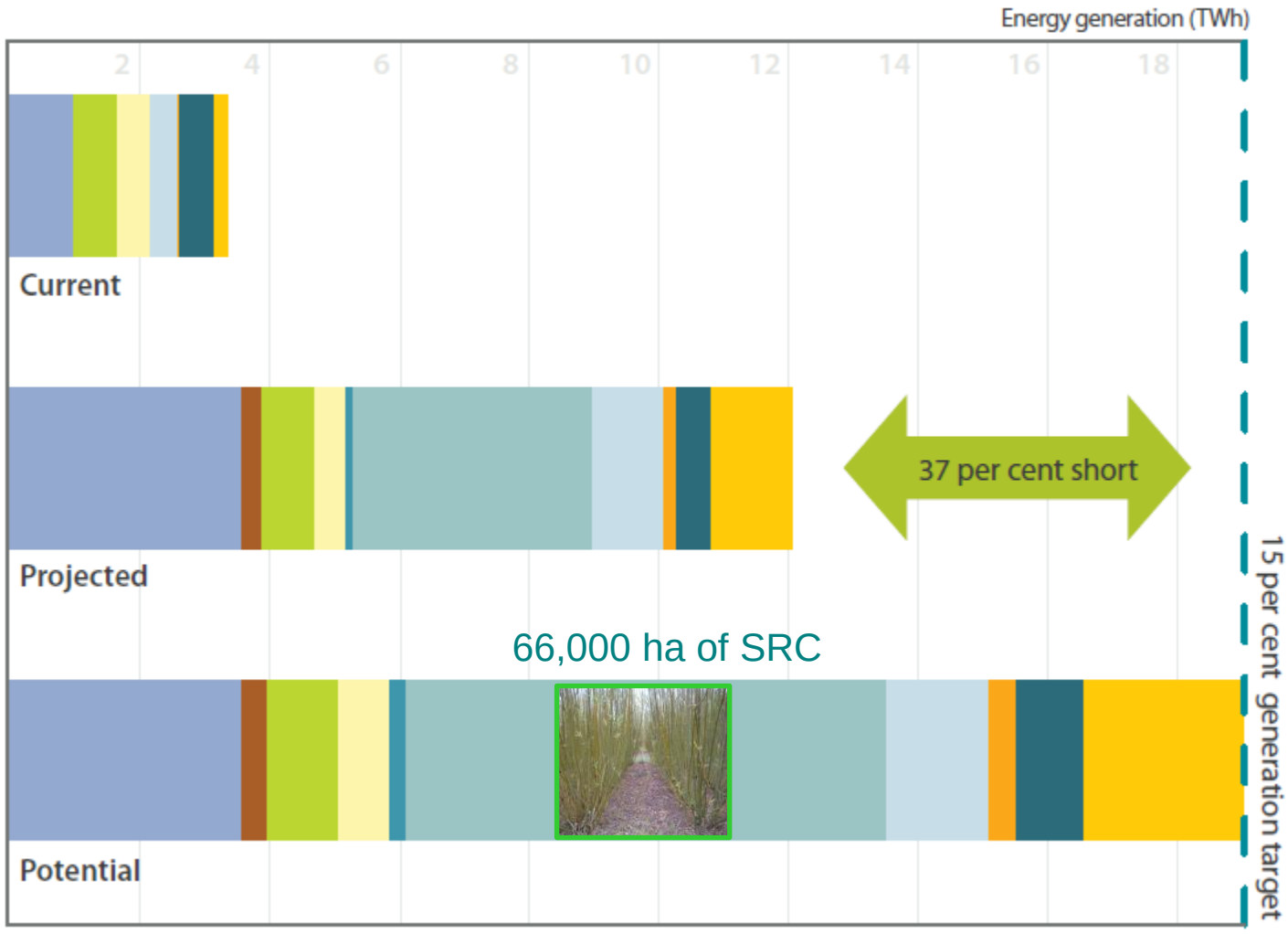
Renewable heat

Crops for Energy

We could produce 37.5% of the renewable heat target from just 3.5% of the agricultural land

Can we meet our targets?

Crops for Energy



Ref: SW Renewable Energy Progress Report 2013 (Regen SW)
http://www.regensw.co.uk/wp-content/uploads/2014/08/2013-Progress-Report-WEB.pdf

Climate change targets

- UK target - 34 % cut in GHG emissions by 2020
- UK agriculture - 8.8% of total GHG emissions in 2009
- SW - 36 million tonnes of GHG emissions in 2009
- Hence, SW agriculture ~ 3.2 million tonnes of GHG emissions

Greenhouse gas reduction

Crops for Energy

- Replacement of more carbon intensive fuels
- Lower transport emissions
- Carbon sequestration benefits
- Growing 65,595 ha of energy crops in the SW
  - Annual saving of 780,946 tonnes CO_2 equivalent
  - 3.5% of agricultural land could offset 25% of the sectors emissions

Greenhouse gas reduction

Crops for Energy

3.5% of agricultural land could offset 25% of the sectors emissions

Post CAP reform reality

- No Energy Crops Scheme
- No SRC in EFAs
- No grants for infrastructure (so far)
- Sidelined by inferior options
- Ignored by Government

Society loses out

Ref: CAP reform consultation: Response from a broad coalition supporting SRC and the energy crops sector. Nov 2013
http://www.crops4energy.co.uk/cap-reform-consultation-response-from-a-broad-coalition-supporting-short-rotation-coppice-and-the-energy-crops-sector/

Law of unintended consequences

Crops for Energy

The result of lobbying against energy crops

You get:

- Energy options you don't like
  - E.g. fracking, nuclear, mega biomass using imports
- Less environmentally friendly crops planted
  - E.g. soya beans, maize
- Slower reaction to climate change
- Reduced biodiversity
- Inferior land resource efficiency

Energy crops and biodiversity

Crops for Energy

	Maintain biodiversity	Increase biodiversity
Replace annual arable crops		✓
Improve water quality	✓	
Reduce GHG emissions	✓	

Let’s work together!

Crops for Energy

Picture credits: Stig Larsson), Rufus Sage, Jan Weger

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