

Les néonicotinoïdes: impacts sur les pollinisateurs et l'environnement

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Types of bee

Honeybees (1)



Bumblebees (~60)



Other bees (~4,000)



Bumblebee declines:

25 UK species, 7 endangered, 3 extinct.

Europe: 13 species extinct in at least one country, 4 species extinct throughout region.

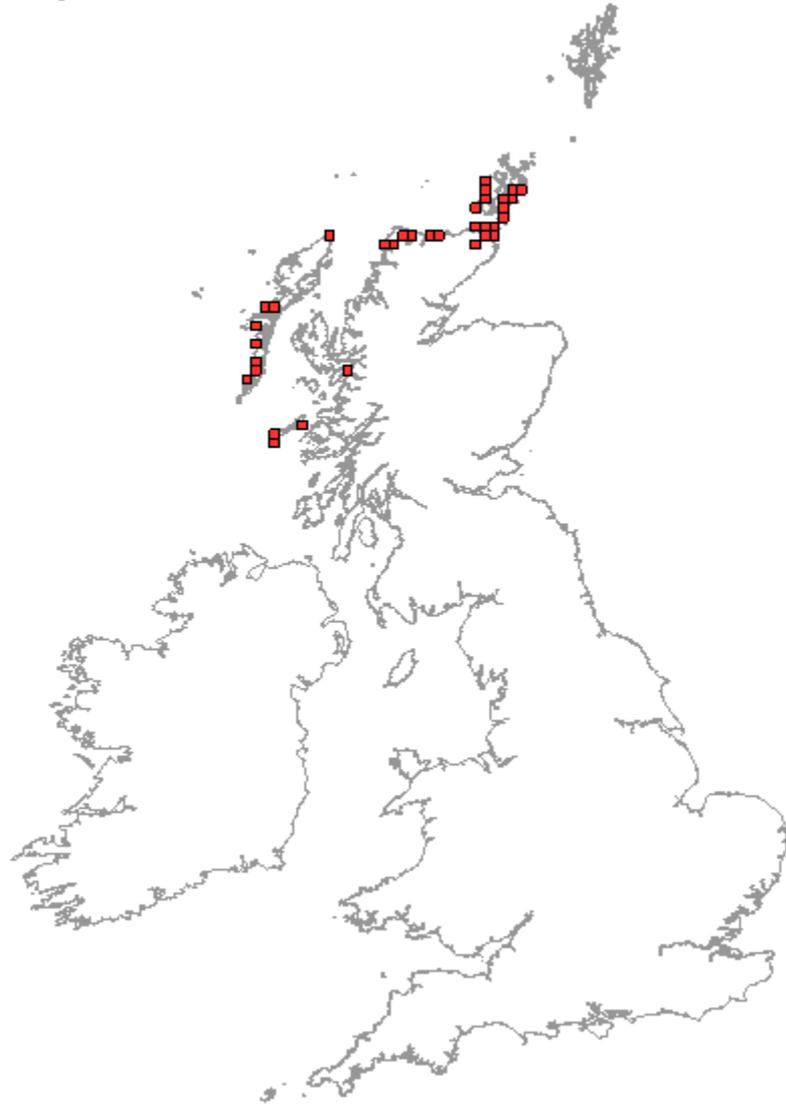
N. America: precipitous declines since 1990s of 5 species, 1 extinction



Great yellow bumblebee



2000-2014



Causes of bee declines?

- ▶ Habitat loss
- ▶ Parasites/disease
- ▶ Pesticides?





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- ▶ Pesticides?



Agrochemical applications on an oilseed rape field in E Sussex

25/08/2012	Insecticide and fungicide	Cruiser	280 g/l thiamethoxam, 8 g/l fludioxonil and 32.3 g/l metalaxyl-M	Seed dressing
28/08/2012	Herbicide	Shadow	Quinmerac, Dimethenamid-p, Metazachlor	Spray
	Herbicide	Dictate	480g/litre bentazone	Spray
	Fungicide	Fiddle	Clomazone	Spray
08/09/2012	Molluscicide	Tds Major	Metaldehyde	Slug pelleter
12/09/2012	Herbicide	Shadow	Quinmerac, Dimethenamid-p, Metazachlor	Spray
10/10/2012	Fungicide	Crawler	Carbetamide	Slug pelleter
05/11/2012	Fungicide	Genie 25	Flusilazole	Spray
	Insecticide	Gandalf	Beta-cyfluthrin	Spray
16/02/2013		Double		
	Fertiliser	Top	Ammonium Sulphate and Ammonium Nitrate	Fertiliser spreader
	Fungicide	Crawler	Carbetamide	Slug pelleter
	Herbicide	Pilot Ultra	Quizalofop-P-ethyl	Spray
10/04/2013	Fertiliser	Nitram	Ammonium nitrate	Fertiliser spreader
22/04/2013	Fertiliser	Nitram	Ammonium nitrate	Fertiliser spreader
17/05/2013	Fungicide	Filan	Boscalid	Spray
	Fungicide	Flanker	Picoxystrobin	Spray
	Insecticide	Alert	Alpha-cypermethrin	Spray
05/06/2013	Fungicide	Propulse	Fluopyram, Prothioconazole	Spray
		Hallmark		
	Insecticide	Zeon	100 g/l lambda-cyhalothrin and 1,2-benzisothiazolin-3-one	Spray
	Insecticide	Gandalf	Beta-cyfluthrin	Spray
	Insecticide	Mavrik	Tau-fluvalinate	Spray

= 22 chemicals + ? adjuvants

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Neonicotinoids

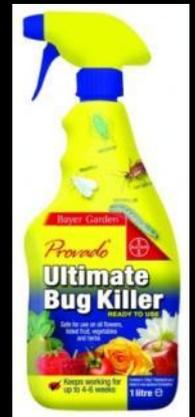
	<u>UK use 2010</u>
Imidacloprid	188,000 Ha
Clothianidin	728,000 Ha
Thiamethoxam	298,000 Ha
Thiacloprid	49,000 Ha
Acetamiprid	7,000 Ha



Mainly used as seed dressing on arable crops.

Also sprayed in horticulture, used as soil drench, granular formulation etc...

Widely sold for garden use e.g. *Ultimate Bug Killer*





FREE SEEDS
for Bees

See inside collar for seeds

Bayer Garden
BAYER

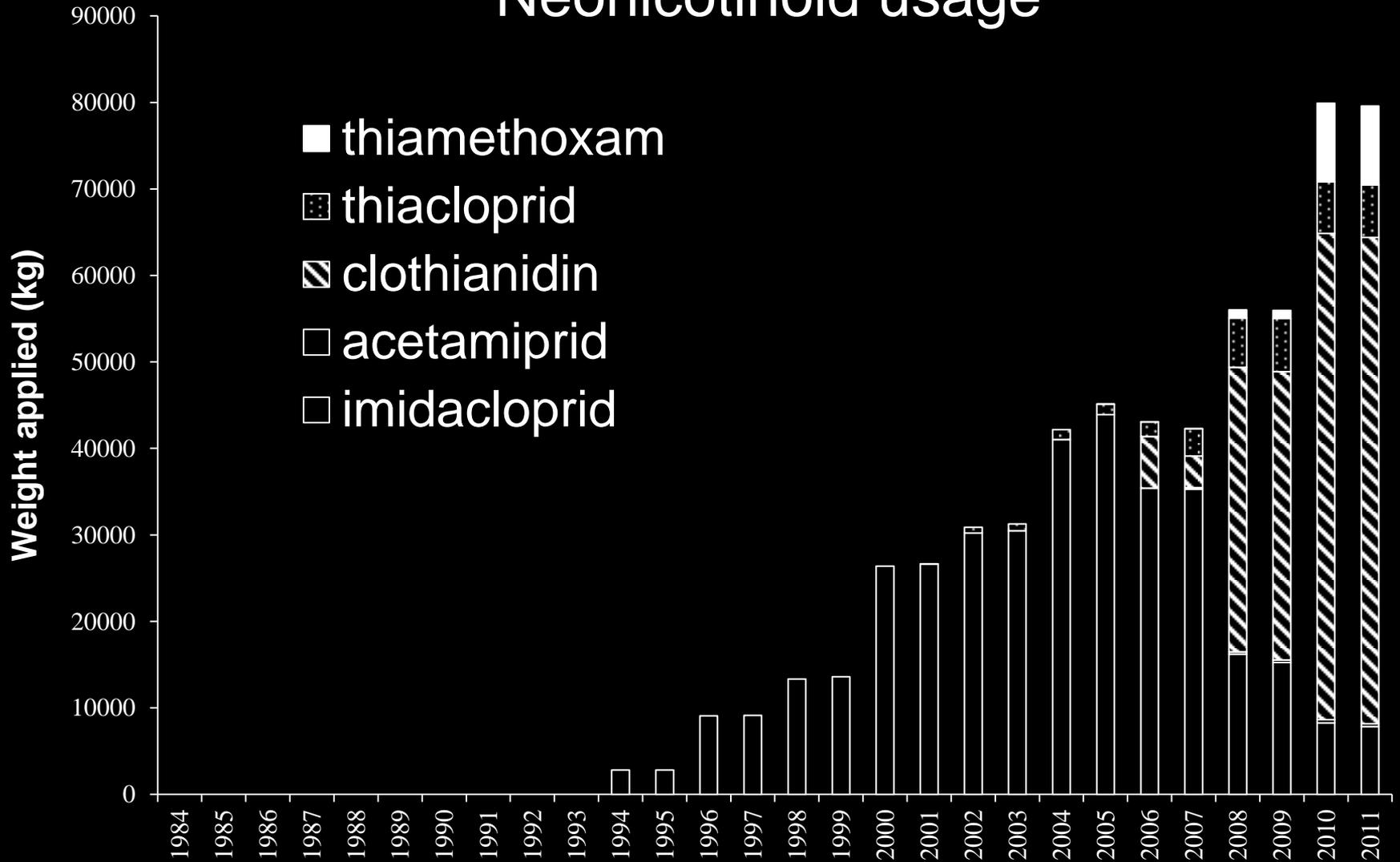
Provado[®]
Ultimate Bug Killer
Ready to Use

1 litre e

Contact and Stomach Action
Works working for up to 4-6 weeks

SEE PREVIOUS SAFETY / READ THE LABEL

Neonicotinoid usage



USA use 2009 = 1,500,000kg

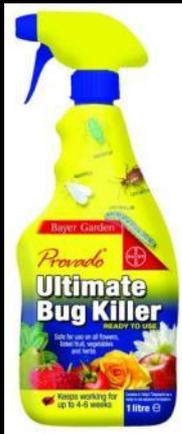
Toxicity

<u>Compound</u>	<u>LD50 in honeybees</u>
Imidacloprid	4 ng/bee (\approx clothianidin \approx thiamethoxam)
Cypermethrin	160 ng/bee
DDT	27,000 ng/bee



Routes of exposure of bees

- Arable crops
e.g. oilseed rape, sunflower, maize
- Horticultural crops
- Field margin flowers
- Gardens and amenity areas



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- Field margin flowers

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Evidence for sublethal effects?

1998-2011: Various lab or cage studies suggest that sublethal exposure of bees impairs learning / food collection / navigation / reduces fecundity.



Whitehorn et al, *Science* 2012



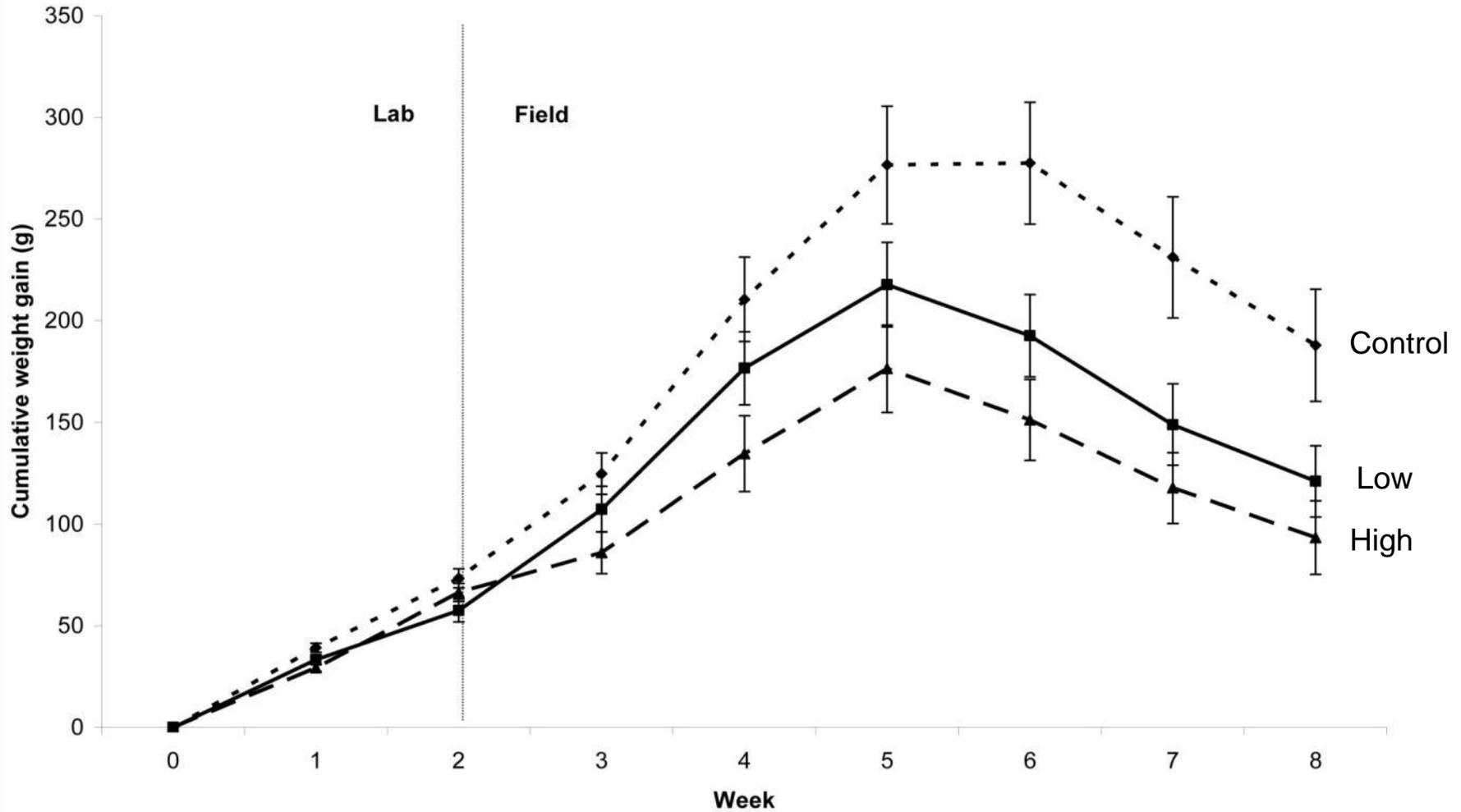
Dosage: Imidacloprid, 0.7ppb in nectar, 6ppb in pollen

Fed bumblebee nests for 2 weeks on:

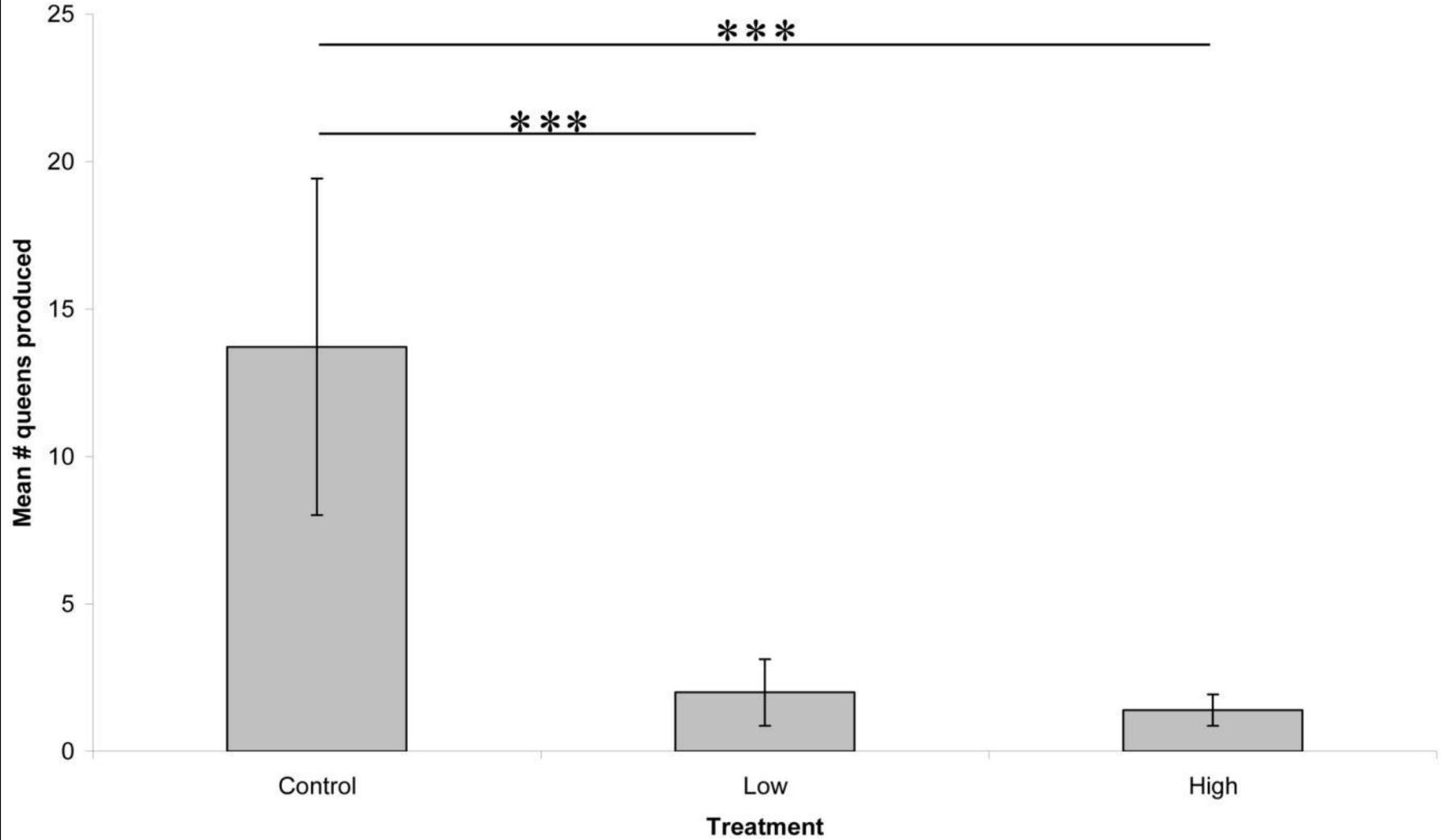
- a) Nectar, pollen (control)
- b) Nectar, pollen + field realistic imidacloprid (low)
- c) Nectar, pollen + 2 x field realistic imidacloprid (high)

After 2 weeks, nests placed in the field.....

Whitehorn et al, *Science* 2012



Whitehorn et al, *Science* 2012



Summary of recent studies:

- Whitehorn et al. 2012: imidacloprid reduces nest growth and queen production
- Fera, unpublished: clothianidin and thiamethoxam reduce colony growth and queen production?
- Henri et al. 2012: thiamethoxam impairs homing in honeybees
- Gill et al. *Nature* 2012: imidacloprid reduces bumblebee survival, egg laying and pollen collection.
- Feltham et al. 2014: imidacloprid reduced pollen collection in bumblebees by 57%
- Ellis et al. in prep: thiacloprid reduces colony recruitment and increases mortality
- Laycock et al. 2012: 1ppb imidacloprid reduces fecundity in bumblebees by 33%

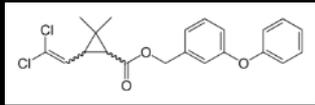
Field

Lab



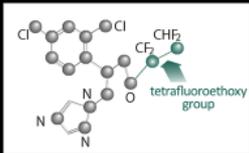


Lack of flowers



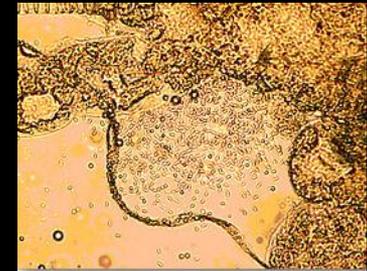
pyrethroids

DMI fungicides



neonics

parasites & diseases

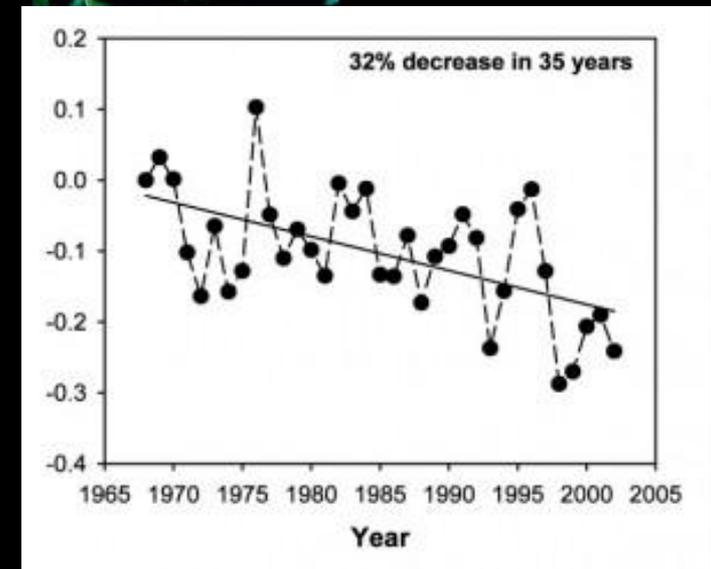
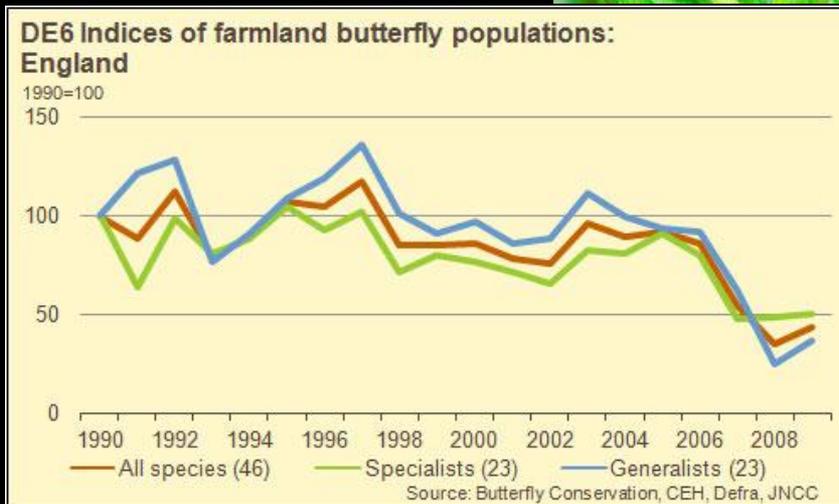
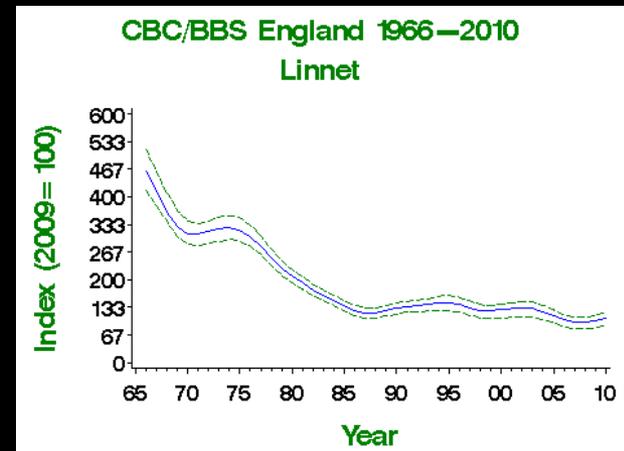


So far, interest has focussed very much on impacts on
bees,

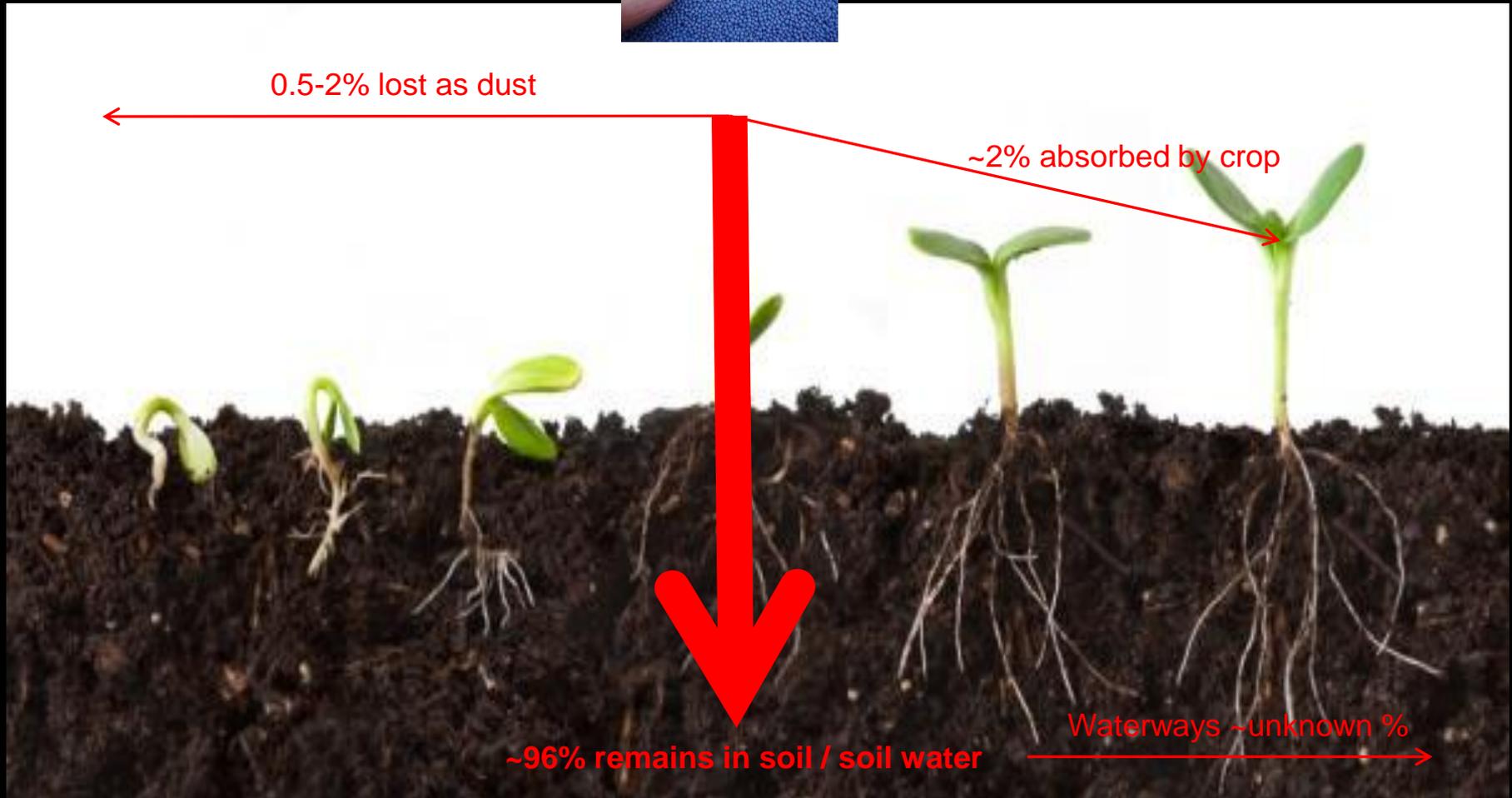
but....

In Europe, most farmland wildlife is in decline:

- Birds
- Butterflies
- Bees
- Moths
- Carabid beetles

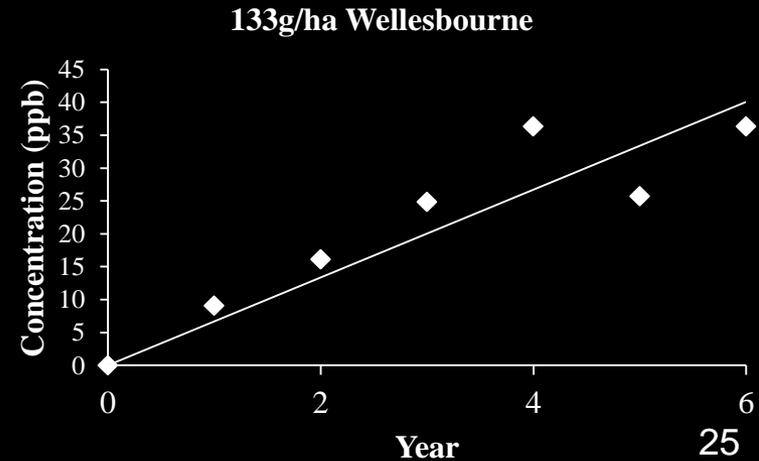
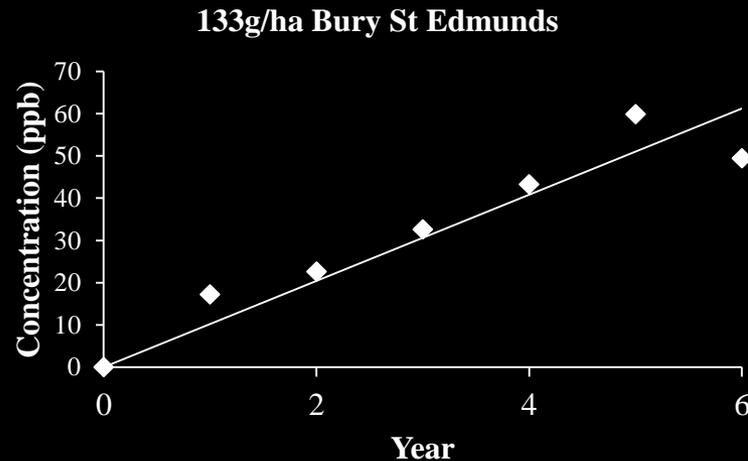
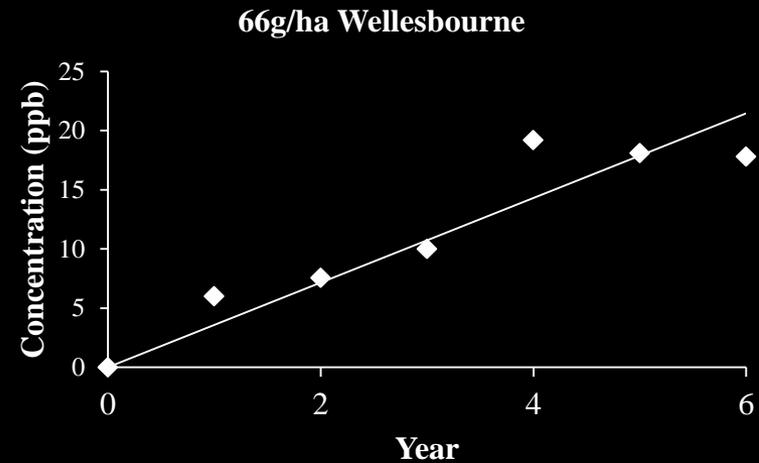
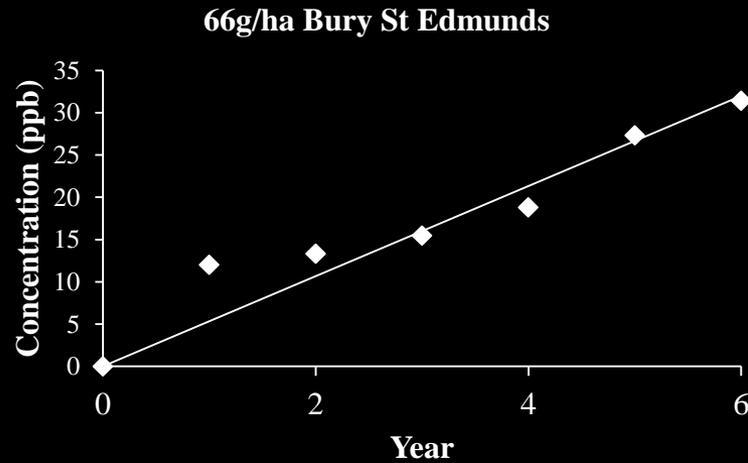


Environmental fate of neonic seed dressings



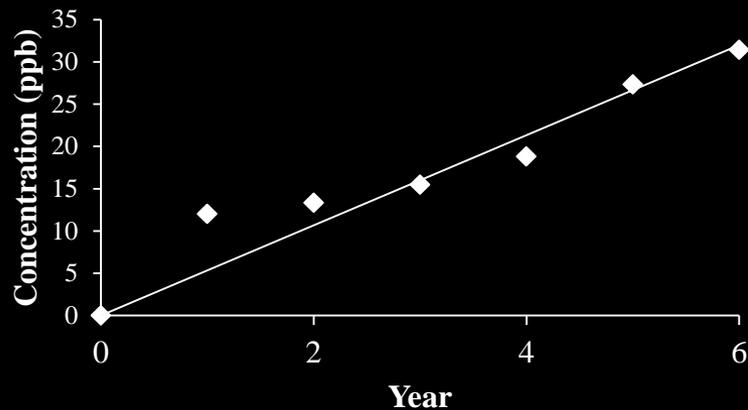
Persistence in soil

Estimates of half lives vary. Most are in the range 200 – 500 days. Some exceed 1,000 days. This would lead us to predict accumulation:

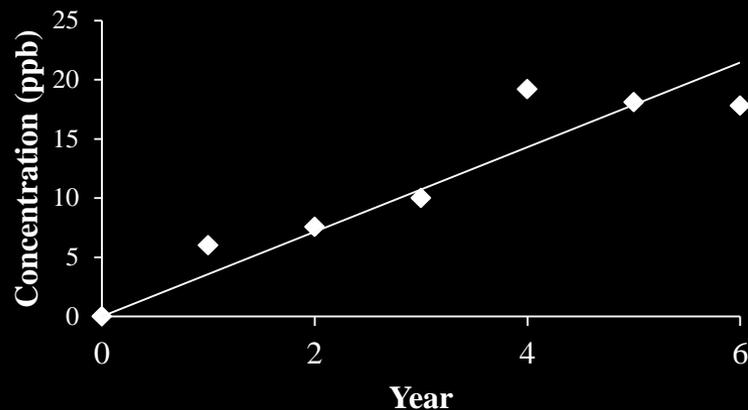


“the compound has no potential for accumulation in soil”

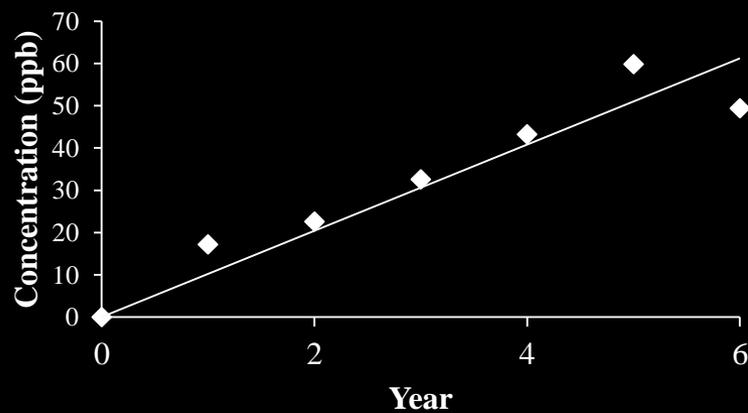
66g/ha Bury St Edmunds



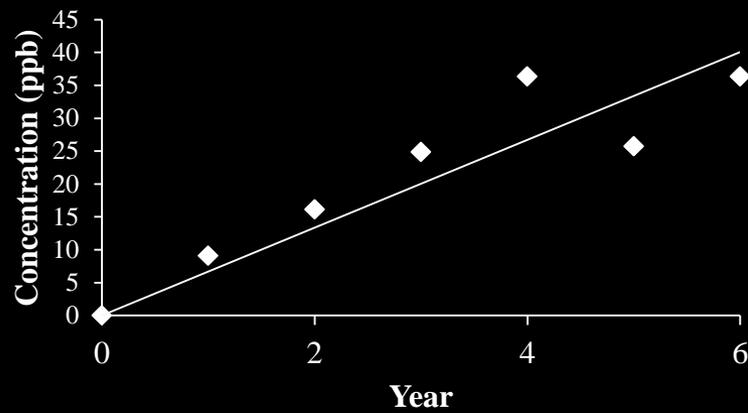
66g/ha Wellesbourne



133g/ha Bury St Edmunds



133g/ha Wellesbourne



Prevalence in waterways?

Numerous recent studies in Europe and N America show neonic levels commonly exceed LC50 for aquatic insects (e.g. brown dun mayfly LC50 = 0.65ppb, concentrations of 1 to 10ppb common in water samples from Netherlands) [Van Dijk et al. 2013 PlosONE]



Persistence in plants

- A single application of imidacloprid to maple trees protected them against insect pests for 4 years

[Note – recent Oregon bee disaster following spray application to ornamental trees]



Prevalence in the environment?

Neonics likely to have accumulated in farmed soils - impacts on soil fauna?

Potential for uptake by field margin and hedgerow plants and hence impacts on herbivores e.g. butterfly caterpillars?

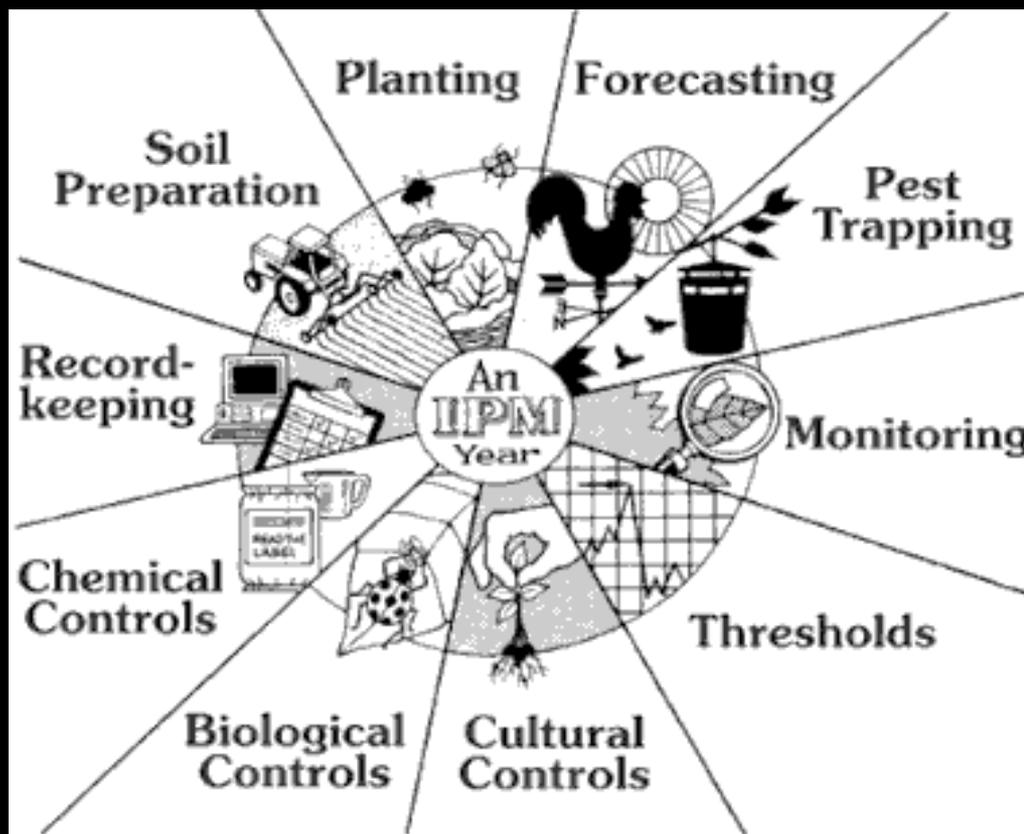
Knock-on effects for predators e.g. birds? [\[forthcoming *Nature* paper?\]](#)

Aquatic fauna?



Few pest management practices seem to be EVIDENCE-BASED

Whatever happened to Integrated Pest Management?



Thank you!



The Sunday Times bestseller



A Sting in the Tale **Dave Goulson**



My Adventures with Bumblebees



VINTAGE