Føre-var men alt for sent?
The EU ban on neonics too little, too late

Prof. Dr. Jeroen P. van der Sluijs

Senter for vitenskapsteori

The RECIPES-Project

The objective

The RECIPES project aims to reconcile innovation and precaution by developing tools and guidelines to ensure the precautionary principle is applied while still encouraging innovation.

The RECIPES project will work closely with different stakeholders through interviews, workshop and webinars.

To this end, RECIPES will

1. Analyse legal and policy initiatives on the precautionary principle at the international, European and national level and describe the emergence of an 'innovation principle'
2. Examine the application of the precautionary principle in eight specific cases
3. Develop scenarios for the future of the precautionary principle taking into account innovation
4. Introduce mechanisms for public involvement in scientific and technological decision-making
5. Create tools and guidelines to the precautionary principle to help policymakers and other stakeholders to assess risks and take into account innovation.

"REconciling sCience, Innovation and Precaution through the Engagement of Stakeholders"

https://recipes-project.eu/

RECIPES
Precaution • Innovation • Science

Case studies

CRISPR gene drives
Rathenau Institute

GMOs
ARC

Financial risks
HU Berlin

Neonicotinoid insecticides
University of Bergen

Nanotechnologies
(OEAW)

Glyphosate
Maastricht

Endocrine disruptors
Maastricht University

Artificial Inteligence
Rathenau Institute

Micro plastic
Maastricht University

RECIPES is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement no. 824665. Views and opinions expressed in this course are purely those of the lecturer and may not in any circumstances be regarded as stating an official position of the European Commission.

Principles in Environmental Policy

- *curative* model
  Polluter Pays Principle
- 'prevention is better than cure' model
  Prevention Principle
- 'better safe than sorry' model
  Precautionary Principle

paradigmatic shift from ***a posteriori*** control (civil liability as a curative tool) to the level of ***a priori*** control (anticipatory measures) of risks

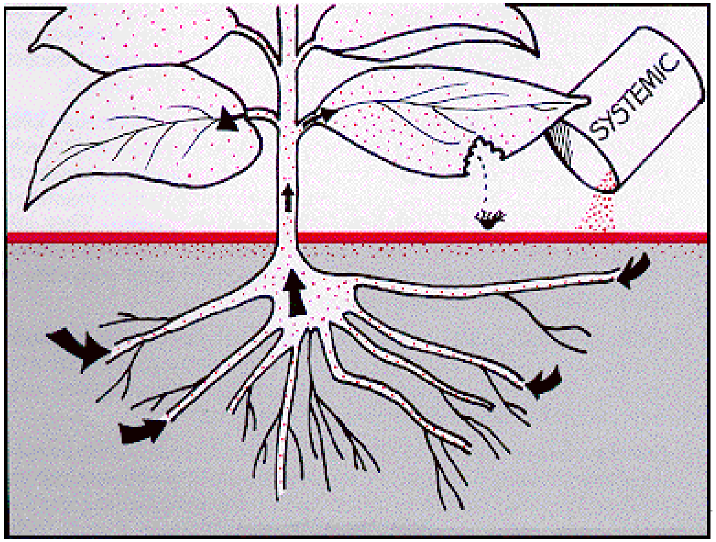
De Sadeleer, 2005 Environmental Principles https://tradevenvironment.eu/index.php/book/environmental-principles-from-political-slogans-to-legal-rules/

Systemic insecticides (neonicotinoids) & bees

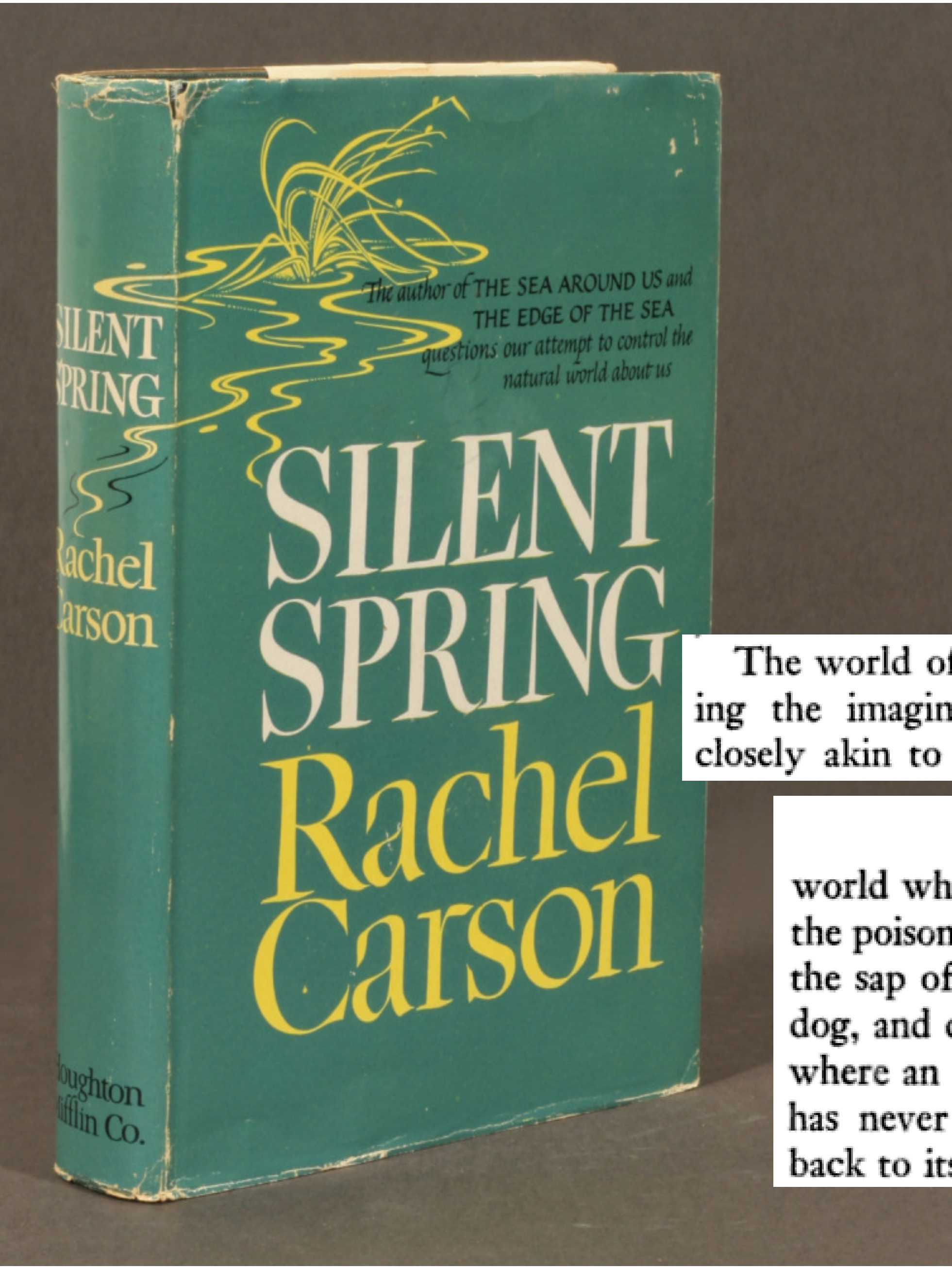
Toxicity of neonicotinoids

Pesticide	®	Use	LD50 (ng/honeybee)	Toxicity index relative to DDT
DDT	Dinocide	insecticide	27000	1
Amitraz	Apivar	insecticide / acaricide	12000	2
Coumaphos	Perizin	insecticide / acaricide	3000	9
Tau-fluvalinate	Apistan	insecticide / acaricide	2000	13.5
Methiocarb	Mesurol	insecticide	230	117
Carbofuran	Curater	insecticide	160	169
λ-cyhalothrin	Karate	insecticide	38	711
Deltamethrine	Decis	insecticide	10	2700
Thiamethoxam	Cruise	insecticide	5	5400
Fipronil	Regent	Insecticide	4.2	6475
Clothianidine	Poncho	Insecticide	4.0	6750
Imidacloprid	Gaucho	Insecticide	3.7	7297

Toxicity of insecticides to honeybees compared to DDT. The final column expresses the toxicity relative to DDT. (Source: Bonmatin, 2009)



Systemic = crop takes it up into its plantsap: chemical makes plant toxic from inside



1962

The world of systemic insecticides is a weird world, surpassing the imaginings of the brothers Grimm — perhaps most closely akin to the cartoon world of Charles Addams. It is a

world where the enchanted forest of the fairy tales has become the poisonous forest in which an insect that chews a leaf or sucks the sap of a plant is doomed. It is a world where a flea bites a dog, and dies because the dog's blood has been made poisonous, where an insect may die from vapors emanating from a plant it has never touched, where a bee may carry poisonous nectar back to its hive and presently produce poisonous honey.

NEONICOTINOIDS

A worldwide survey of neonicotinoids in honey

E. A. D. Mitchell,[1,2]* B. Mulhauser,[2] M. Mulot,[1]† A. Mutabazi,[3]‡ G. Glauser,[3] A. Aebi[1,4]

Growing evidence for global pollinator decline is causing concern for biodiversity conservation and ecosystem services maintenance. Neonicotinoid pesticides have been identified or suspected as a key factor responsible for this decline. We assessed the global exposure of pollinators to neonicotinoids by analyzing 198 honey samples from across the world. We found at least one of five tested compounds (acetamiprid, clothianidin, imidacloprid, thiacloprid, and thiamethoxam) in 75% of all samples, 45% of samples contained two or more of these compounds, and 10% contained four or five. Our results confirm the exposure of bees to neonicotinoids in their food throughout the world. The coexistence of neonicotinoids and other pesticides may increase harm to pollinators. However, the concentrations detected are below the maximum residue level authorized for human consumption (average ± standard error for positive samples: 1.8 ± 0.56 nanograms per gram).

https://science.sciencemag.org/content/358/6359/109/tab-pdf

Timeline neonic case

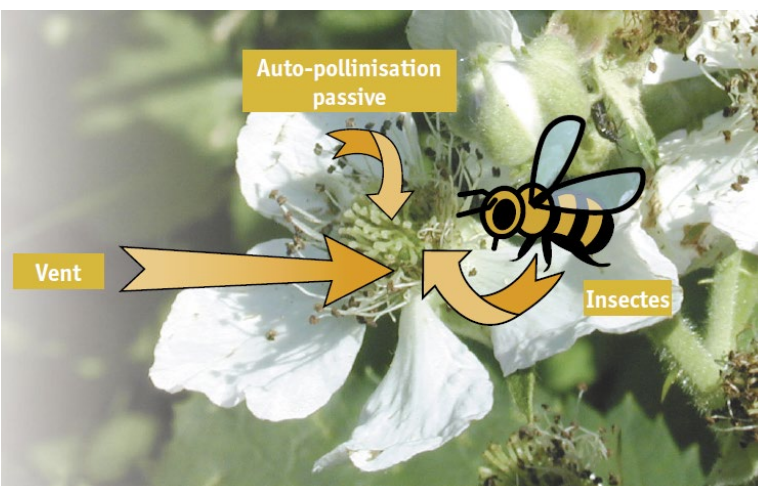
- 1991 Market introduction imidacloprid
- 1994 Early warnings France
- 1999 First ban in France (sunflowers)
- 2002 EFSA established
- 2003 CST report France PEC>>PNEC
  - https://controverses.sciences-po.fr/archive/pesticides/rapportfin.pdf
- 2004 Ban in France (corn)
- 2013 EU ban 3 neonics on crops attractive to bees
- 2018 EU ban on outdoor use in crops
- 2019 EU ban thiacloprid

Items of dispute

Industry & regulatory science	Academic research	
Does not translocate to flowers	Detected in pollen and nectar at ppb level.	Limit of detection
Key risk indicator is Acute Toxicity (+some times 10d chronic)	Sublethal effects are crucial	2003 CST PEC>>PNEC = No Go!
Honeybees	Wild bees	Resilience of honeybee colony >> wild bees
Field tests can overrule lab tests	Field tests used are flawed by design & lack statistical power	Reproducibility
Assess single applications of single substances, assume 1 time exposure	Holistic, all applications together, all neonics together, year round exposure	> 1000 allowed applications of 3 neonics
Allow for recovery of hive after single exposure	Year round exposure makes recovery irrelevant	Recovery
What is field realistic: what industry reports based on models and standard experiments	What we measure in the field.	Invalid assumptions
Emissions based on models with assumptions	Measured levels of pollution proofs models wrong	Invalid assumptions

The importance of pollinators

- 90 major crops (35% world food production volume) depend on pollinators
- Key nutrients: 90-100% from pollinator mediated crops (vit C, antioxidants, lycopene, β-tocopherol, vit A and folic acid)
- 94% of all flowering plants on earth depends on 25000 bee species for reproduction and evolution



Some crops pollinated by bees[3]

Alfalfa
Apple
Almond
Artichoke
Asparagus
Blackberry
Blueberry
Broccoli
Brussels sprouts
Cabbage
Cacao
Cantaloupe
Carrot
Cashew
Cauliflower
Celery
Cherry
Citrus
Dill
Eggplant/Aubergine
Fennel
Garlic
Kale
Kola nut
Leek
Lychee
Macadamia
Mango
Mustard
Nutmeg
Onion
Passion fruit
Peach
Pear
Plum
Pumpkin
Raspberry
Sapote
Squash
Sunflower
Tangerine
Tea
Watermelon

World wide: 25000 bee species; EU 1965
In NL about 350 bee species, 181 of them are on the Red List / at risk of extinction

2013

Parallel Declines in Pollinators and Insect-Pollinated Plants in Britain and the Netherlands

2006

J. C. Biesmeijer,[1*] S. P. M. Roberts,[2] M. Reemer,[3] R. Ohlemüller,[4] M. Edwards,[5] T. Peeters,[3,6] A. P. Schaffers,[7] S. G. Potts,[2] R. Kleukers,[3] C. D. Thomas,[4] J. Settele,[8] W. E. Kunin[1]

Despite widespread concern about declines in pollination services, little is known about the patterns of change in most pollinator assemblages. By studying bee and hoverfly assemblages in Britain and the Netherlands, we found evidence of declines (pre- versus post-1980) in local bee diversity in both countries; however, divergent trends were observed in hoverflies. Depending on the assemblage and location, pollinator declines were most frequent in habitat and flower specialists, in univoltine species, and/or in nonmigrants. In conjunction with this evidence, outcrossing plant species that are reliant on the declining pollinators have themselves declined relative to other plant species. Taken together, these findings strongly suggest a causal connection between local extinctions of functionally linked plant and pollinator species.

PNAS

Patterns of widespread decline in North American bumble bees

Sydney A. Cameron[a,1], Jeffrey D. Lozier[a], James P. Strange[b], Jonathan B. Koch[b,c], Nils Cordes[a,2], Leellen F. Solter[d], and Terry L. Griswold[b]

[a]Department of Entomology and Institute for Genomic Biology, University of Illinois, Urbana, IL 61801; [b]United States Department of Agriculture-Agricultural Research Service Pollinating Insects Research Unit, Utah State University, Logan, UT 84322; [c]Department of Biology, Utah State University, Logan, UT 84321; and [d]Illinois Natural History Survey, Institute of Natural Resource Sustainability, University of Illinois, Champaign, IL 61820

Edited* by Gene E. Robinson, University of Illinois, Urbana, IL, and approved November 24, 2010 (received for review October 3, 2010)

Bumble bees (*Bombus*) are vitally important pollinators of wild study in the United States identified lower genetic diversity and

2011

intensive nationwide surveys of >16,000 specimens. We show that the relative abundances of four species have declined by up to 96% and that their surveyed geographic ranges have contracted by 23–87%, some within the last 20 y. We also show that declining populations have significantly higher infection levels of the microsporidian pathogen *Nosema bombi* and lower genetic diversity compared

2011

PLOS | ONE

RESEARCH ARTICLE

More than 75 percent decline over 27 years in total flying insect biomass in protected areas

Caspar A. Hallmann[1]*, Martin Sorg[2], Eelke Jongejans[1], Henk Siepel[1], Nick Hofland[1], Heinz Schwan[2], Werner Stenmans[2], Andreas Müller[2], Hubert Sumser[2], Thomas Hörren[2], Dave Goulson[3], Hans de Kroon[1]

1 Radboud University, Institute for Water and Wetland Research, Animal Ecology and Physiology & Experimental Plant Ecology, PO Box 9100, 6500 GL Nijmegen, The Netherlands, **2** Entomological Society Krefeld e.V., Entomological Collections Krefeld, Marktstrasse 159, 47798 Krefeld, Germany, **3** University of Sussex, School of Life Sciences, Falmer, Brighton BN1 9QG, United Kingdom

* c.hallmann@science.ru.nl

Citation: Hallmann CA, Sorg M, Jongejans E, Siepel H, Hofland N, Schwan H, et al. (2017) More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PLoS ONE 12 (10): e0185809. https://doi.org/10.1371/journal.pone.0185809

Editor: Eric Gordon Lamb, University of Saskatchewan, CANADA

Received: July 28, 2017

Accepted: September 19, 2017

Published: October 18, 2017

Abstract

Global declines in insects have sparked wide interest among scientists, politicians, and the general public. Loss of insect diversity and abundance is expected to provoke cascading effects on food webs and to jeopardize ecosystem services. Our understanding of the extent and underlying causes of this decline is based on the abundance of single species or taxonomic groups only, rather than changes in insect biomass which is more relevant for ecological functioning. Here, we used a standardized protocol to measure total insect biomass using Malaise traps, deployed over 27 years in 63 nature protection areas in Germany (96 unique location-year combinations) to infer on the status and trend of local entomofauna. Our analysis estimates a seasonal decline of 76%, and mid-summer decline of 82% in flying insect biomass over the 27 years of study. We show that this decline is apparent regardless of habitat type, while changes in weather, land use, and habitat characteristics cannot explain this overall decline. This yet unrecognized loss of insect biomass must be taken into account in evaluating declines in abundance of species depending on insects as a food source, and ecosystem functioning in the European landscape.

http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0185809&type=printable

theguardian

Insects Opinion

Insectageddon: farming is more catastrophic than climate breakdown

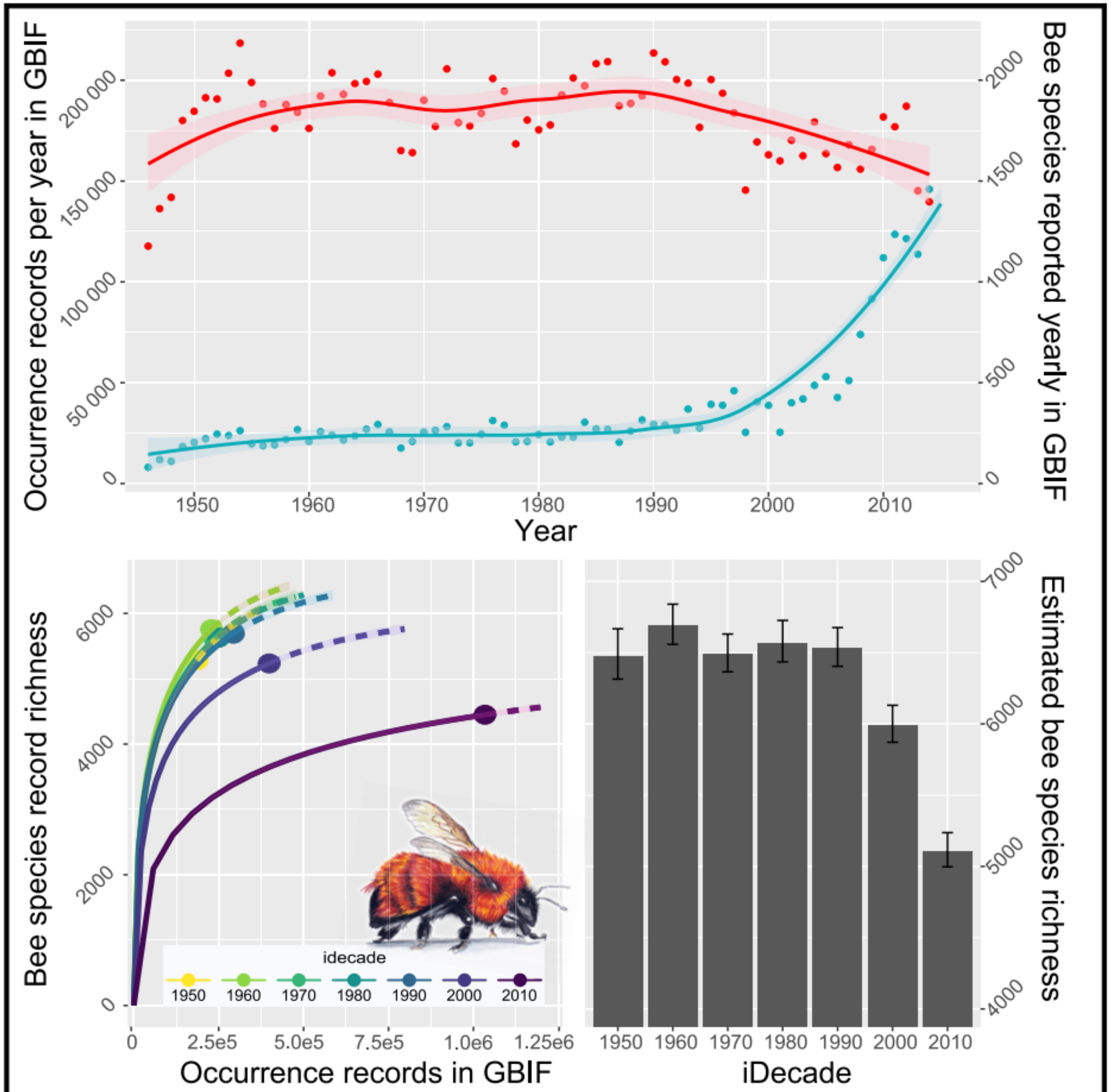
George Monbiot

The shocking collapse of insect populations hints at a global ecological meltdown

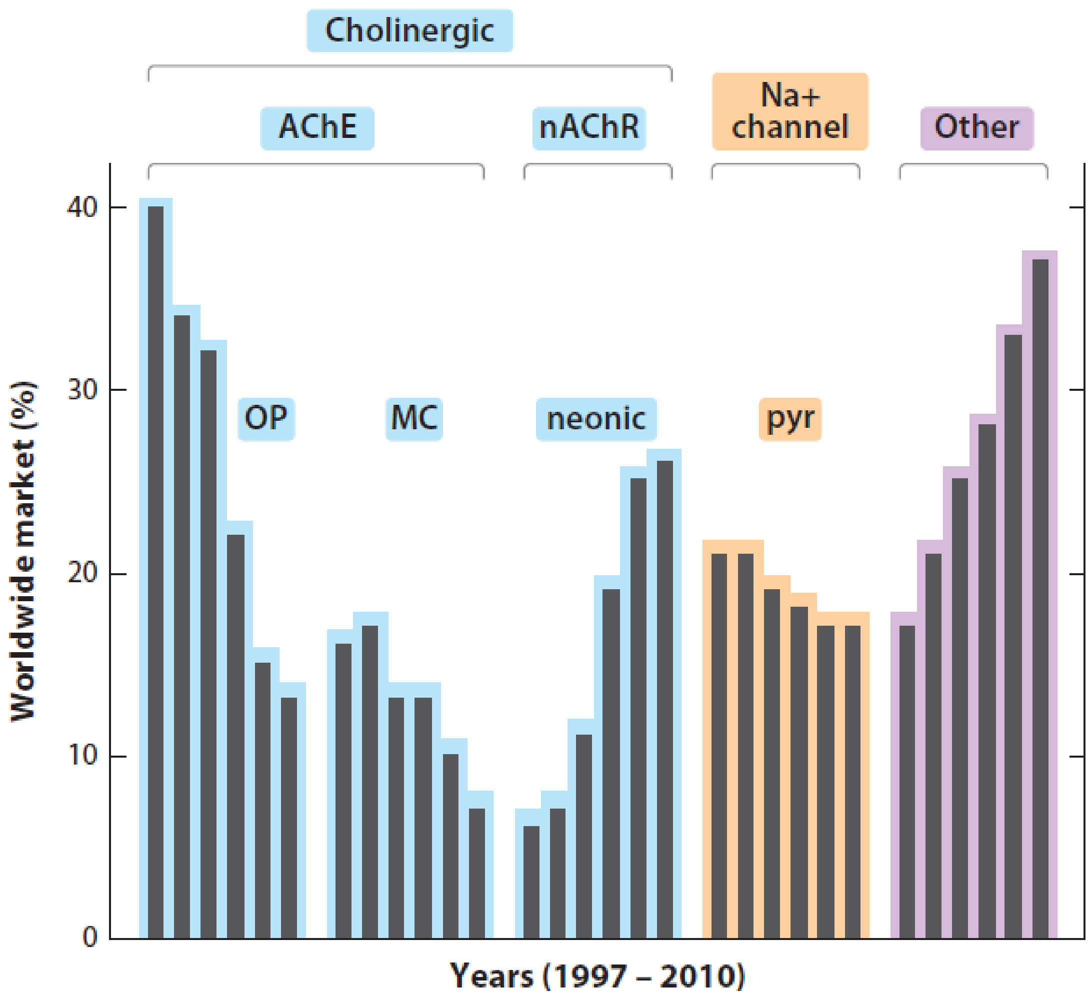
"The impact on wildlife of changes in farming practice (and the expansion of the farmed area) is so rapid and severe that it is hard to get your head round the scale of what is happening. A study published this week in the journal Plos One reveals that flying insects surveyed on nature reserves in Germany have declined by 76% in 27 years. The most likely cause of this Insectageddon is that the land surrounding those reserves has become hostile to them: the volume of pesticides and the destruction of habitat have turned farmland into a wildlife desert."

Number of worldwide recorded bee species is sharply decreasing

Despite increasing number of observations in Global Biodiversity Information Facility,



https://doi.org/10.1016/j.oneear.2020.12.005



Imidacloprid 2010 World production: 20,000 tonnes

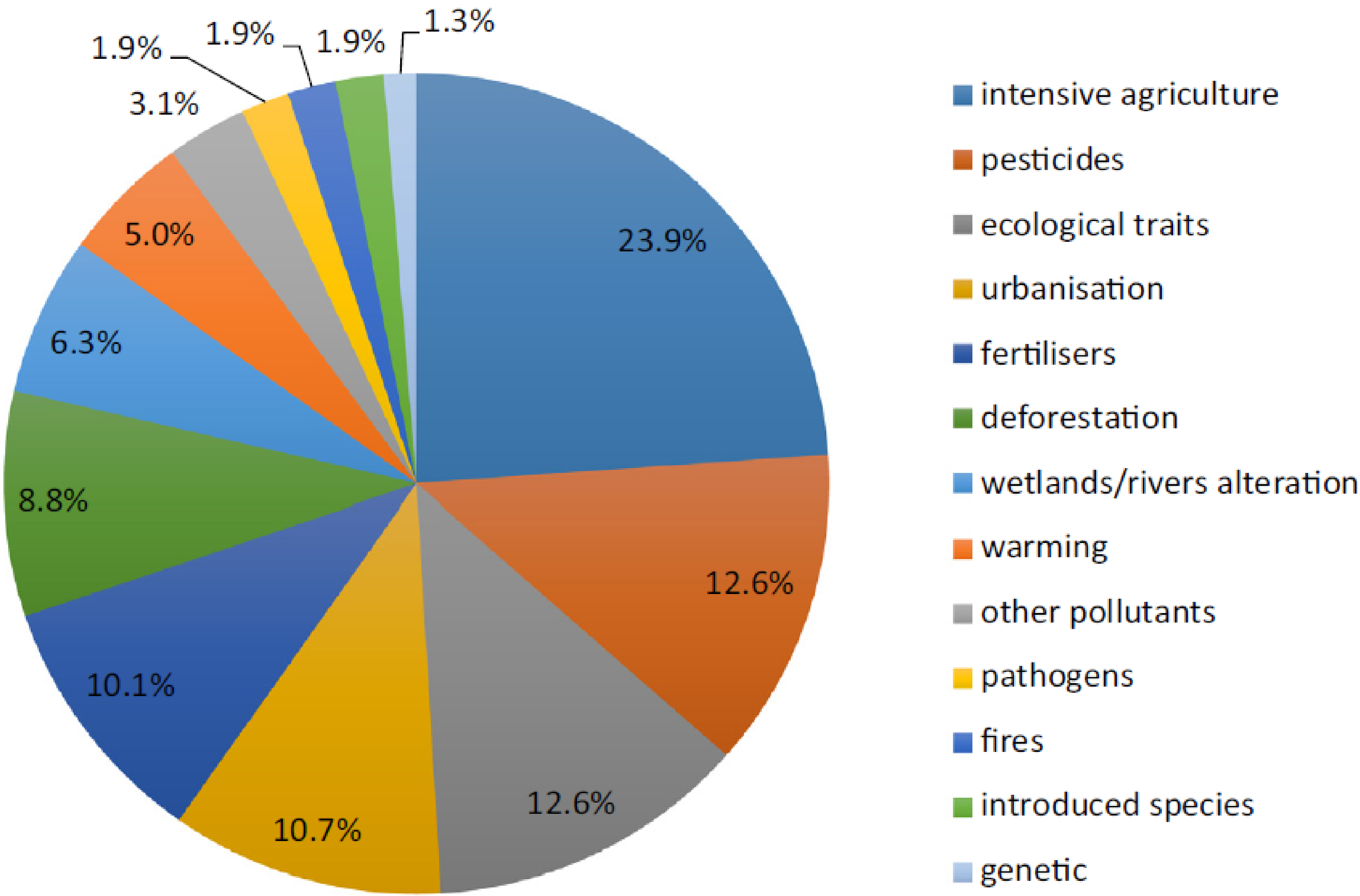
(DDT peak-use 80,000 tonnes in 1959)

Source: Casida and Durkin, 2013 doi: 10.1146/annurev-ento-120811-153645

Figure 4

Changes in use of insecticide classes between 1997 and 2010 showing decreases for organophosphates (OPs), methylcarbamates (MCs), and pyrethroids (pyr) and increases for neonicotinoids (neonic) and other compounds. Abbreviations: AChE, acetylcholinesterase; nAChR, nicotinic acetylcholine receptor. Data shown for the years 1997, 2000, 2002, 2005, 2008, and 2010 from T.C. Sparks (personal communication) are similar to those from his coauthored paper (95).

Scientific uncertainty on what drives insect declines



% of publications [*n*=73] mentioning cause *x* as the main driver

https://doi.org/10.1016/j.biocon.2019.01.020

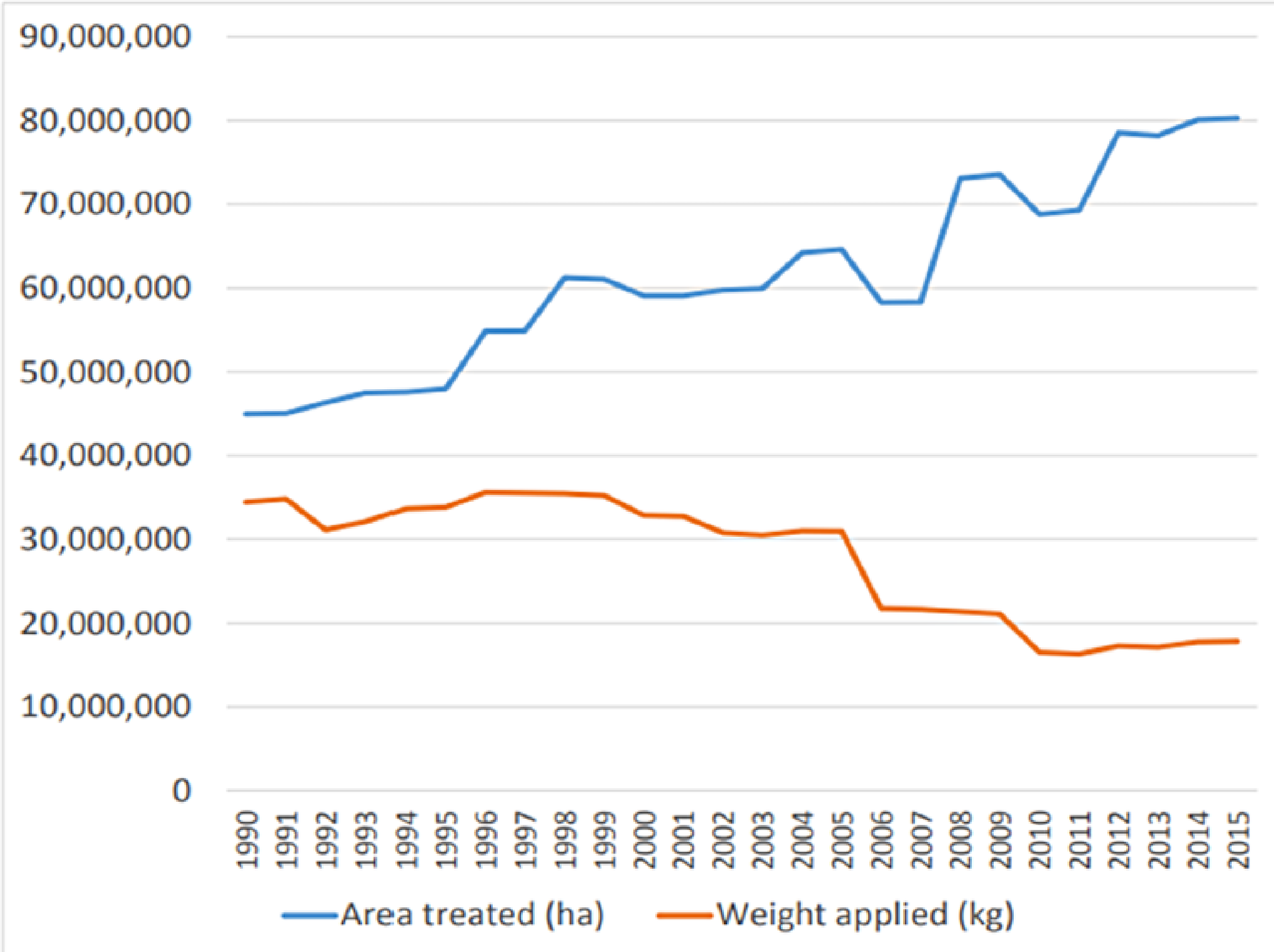
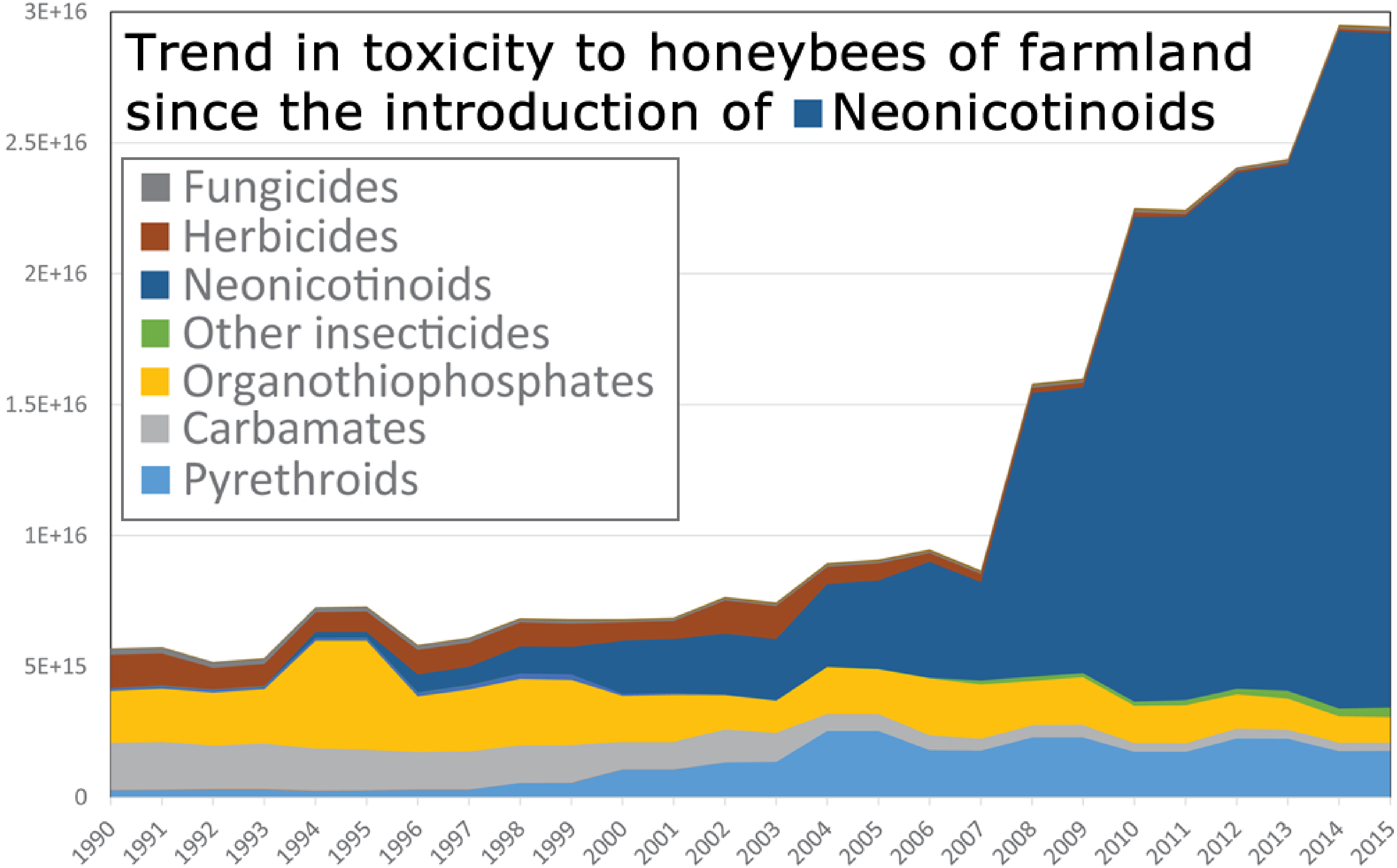


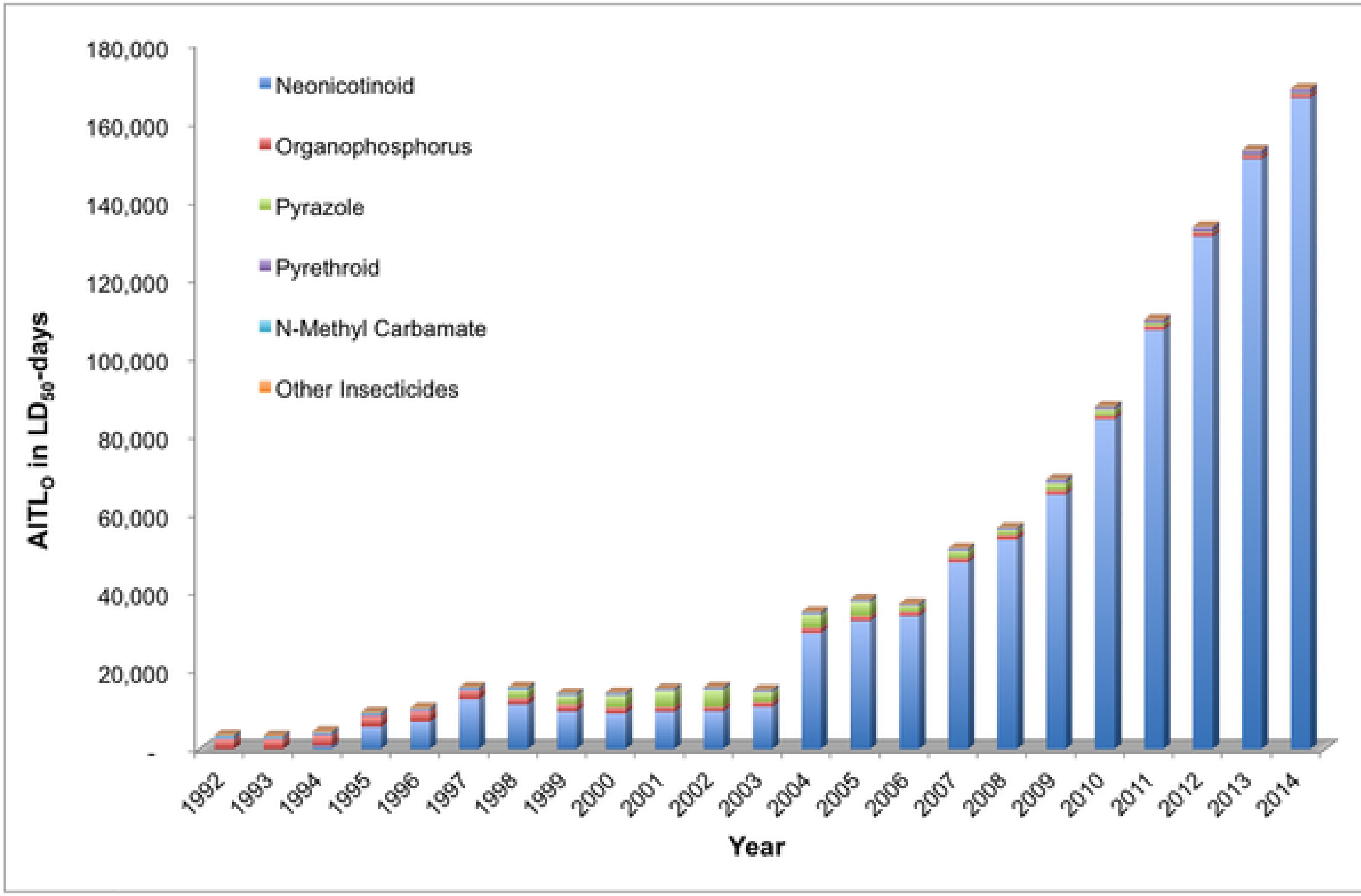
Figure 1 **Area of crop treated (blue line, hectares) and mass of pesticide applied (red line, kilograms) from 1990 to 2015.** The total area of crop remained approximately constant at 4.6 million hectares. In 1990 each hectare of cropped land on average received a total of 7.5 kg of pesticide active ingredient delivered in 9.8 applications. By 2015 each hectare of land received 3.9 kg of pesticide in 17.4 applications.

Full-size DOI: 10.7717/peerj.5255/fig-1



<u>Prophylactic pesticides</u>: # of honeybee lethal doses (LD_{50}) in pesticides applied to UK farmland 1990-2015 DOI: 10.7717/peerj.5255/fig-2

Fig 5. Oral acute insecticide toxicity loading (AITLO) by chemical class, 1992–2014.

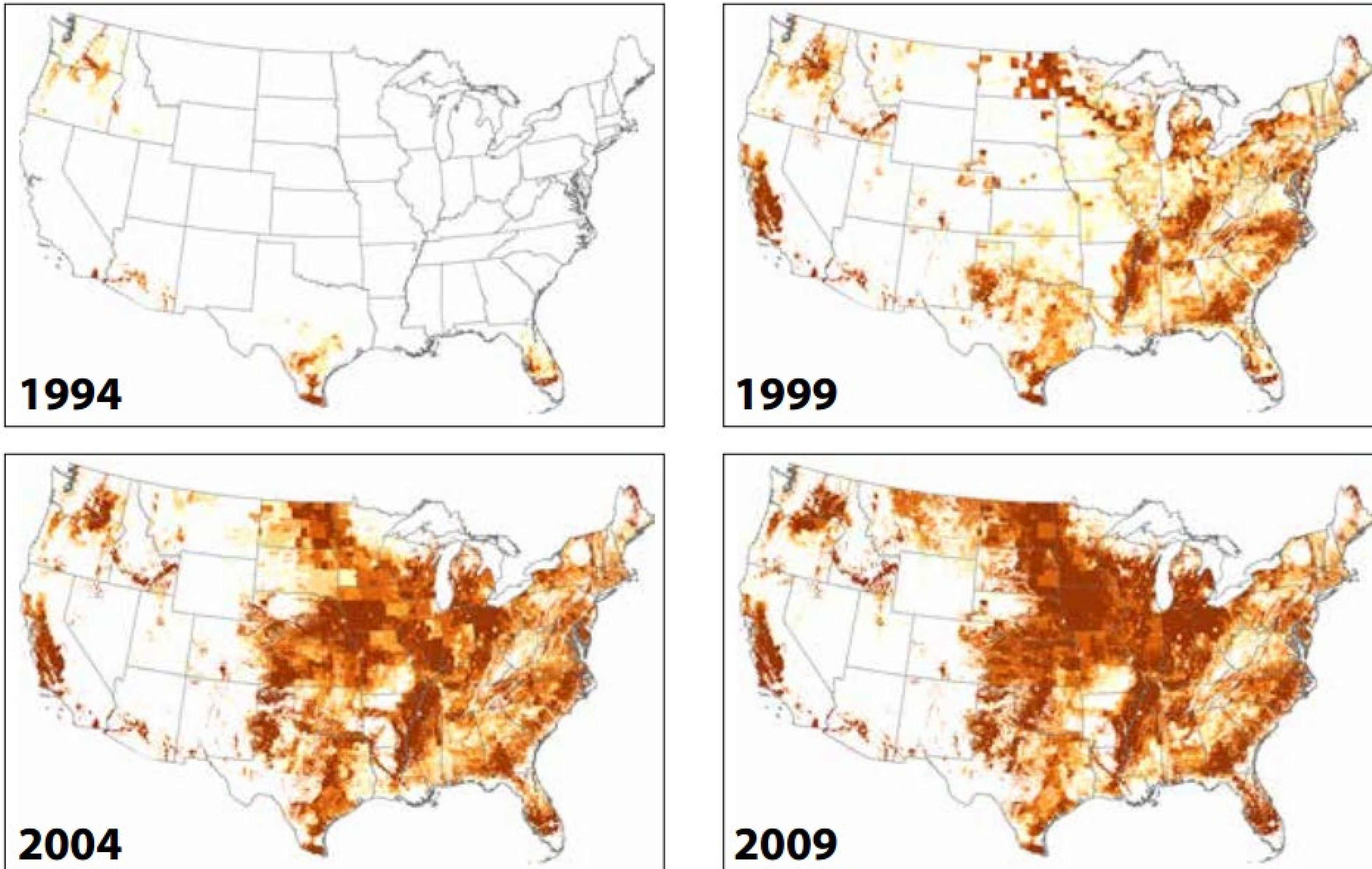


DiBartolomeis M, Kegley S, Mineau P, Radford R, Klein K (2019) An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. PLOS ONE 14(8): e0220029. https://doi.org/10.1371/journal.pone.0220029

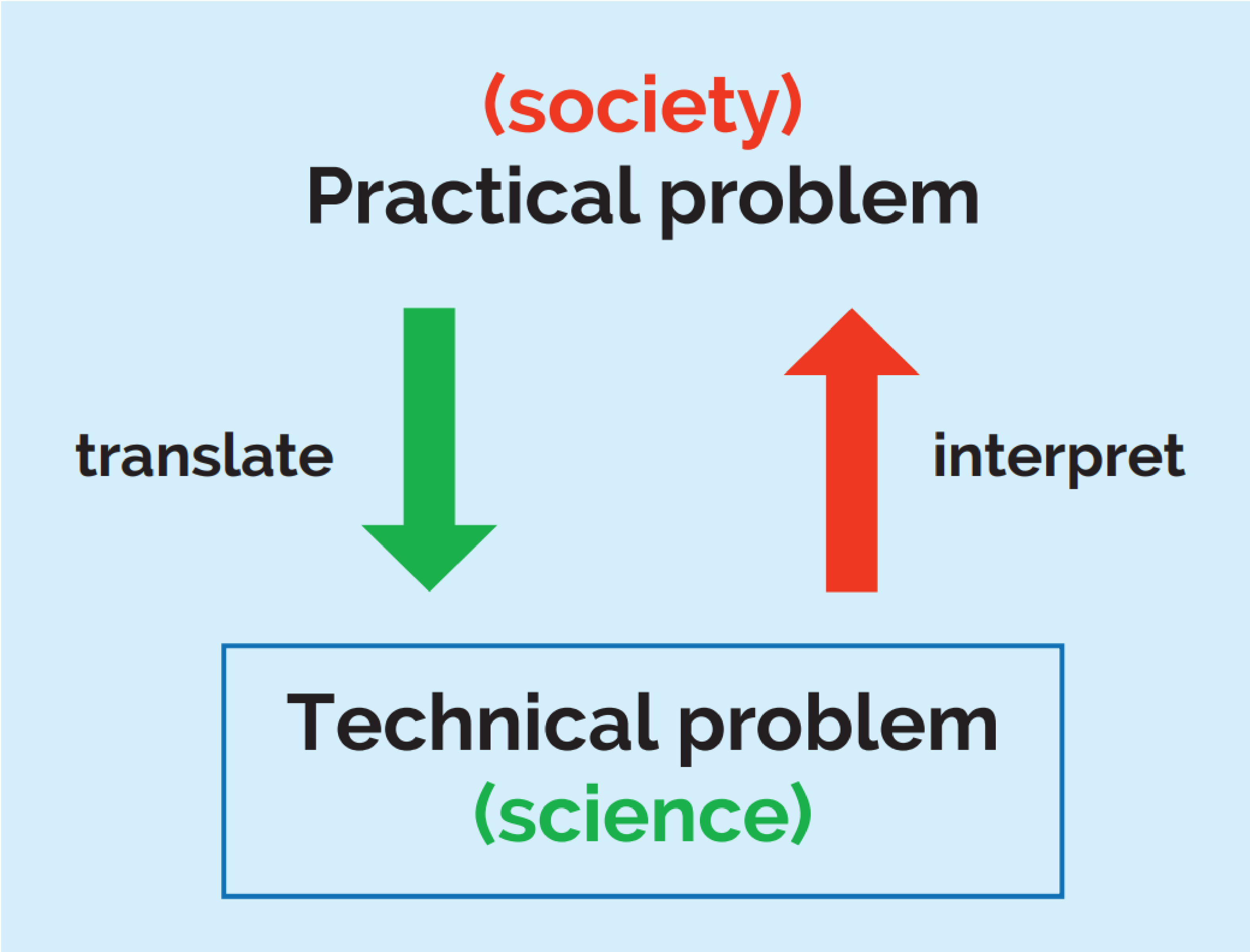
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0220029

PLOS | ONE

Imidacloprid use on farms. Darker color indicates greater quantity used per square mile.



Source: USGS National Water-Quality Assessment Program Pesticide National Synthesis Project, http://water.usgs.gov/nawqa/pnsp/usage/maps/compound_listing.php (accessed 9/16/13).



Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press.

Chronic toxicity imidacloprid for bumblebees

Micro colonies fed with imidacloprid at

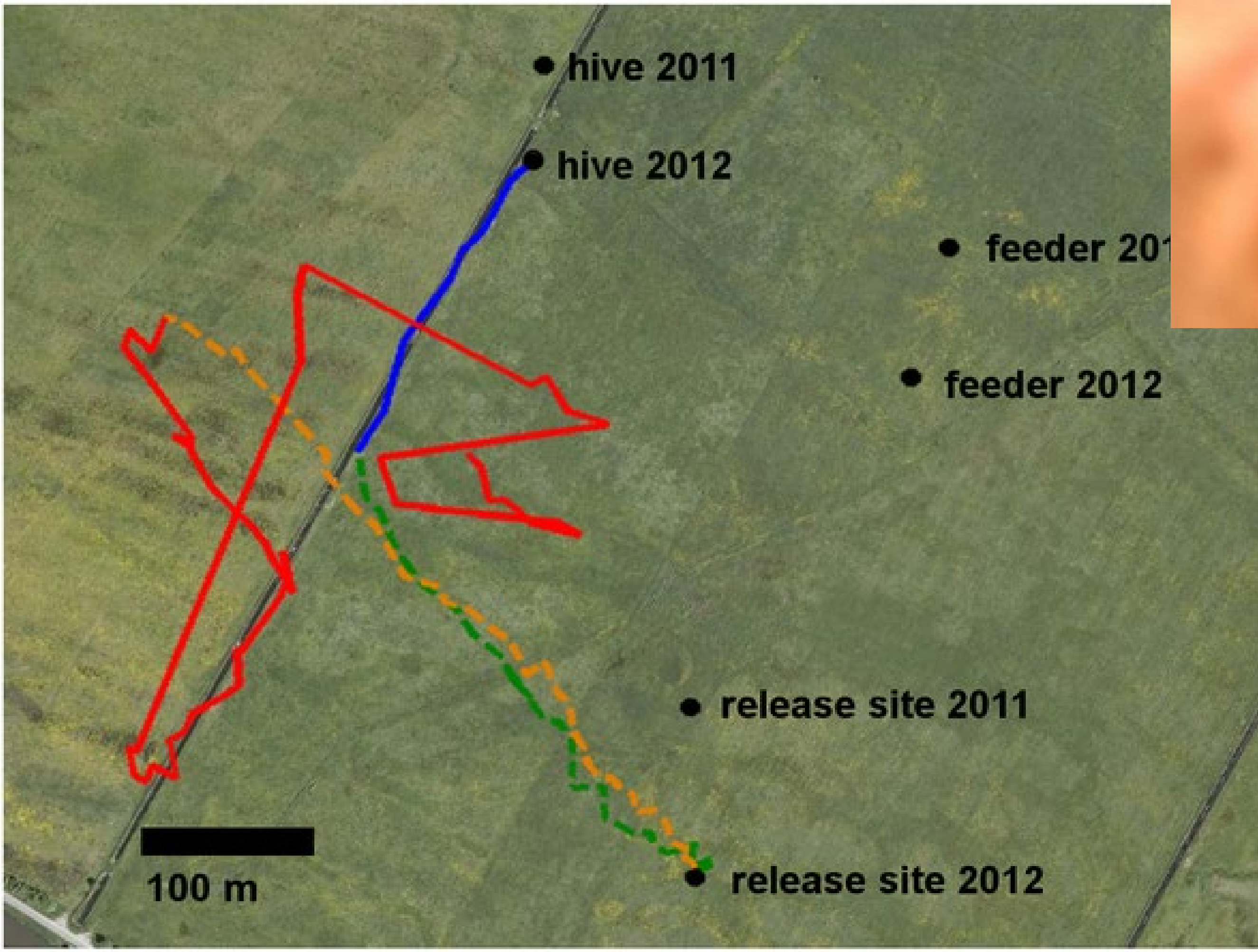
- 200 ppm 100% mortality few hours
- 20 ppm 100% mortality 14 days
- 2 ppm 100% mortality 28 days
- 0.2 ppm 100% mortality 49 days,
- 20 ppb 15% mortality (77 days)
- 10 ppb 0% mortality (77 days)

NOEC reproduction <2.5 ppb

http://dx.doi.org/10.1007/s10646-009-0406-2 Mommaerts e.a. 2010

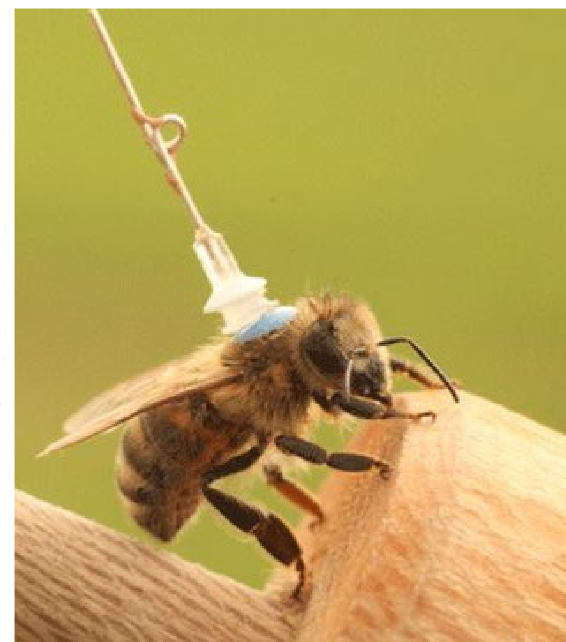
Mismatch with EU regulatory 10 day test!!

Radar-tracking experiment Randolf Menzel:
Bees exposed to neonicotinoids loose orientation



Yellow-Red
Thiacloprid-bees

Green-Blue
Control bees



Fischer J, Müller T, Spatz A-K, Greggers U, et al. (2014) Neonicotinoids Interfere with Specific Components of Navigation in Honeybees. PLoS ONE 9(3): e91364. doi:10.1371/journal.pone.0091364
http://www.plosone.org/article/info:doi/10.1371/journal.pone.0091364

PLOS | ONE

Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production

Penelope R. Whitehorn,[1] Stephanie O'Connor,[1] Felix L. Wackers,[2] Dave Goulson[1*]

[1]School Natural Sciences, University of Stirling, Stirling FK9 4LA, UK. [2]Lancaster University, LEC, Lancaster LA1 4YQ, UK.

*To whom correspondence should be addressed. E-mail: dave.goulson@stir.ac.uk

Growing evidence for declines in bee populations has caused great concern due to the valuable ecosystem services they provide. Neonicotinoid insecticides have been implicated in these declines as they occur at trace levels in the nectar and pollen of crop plants. We exposed colonies of the bumble bee *Bombus terrestris* in the lab to field-realistic levels of the neonicotinoid imidacloprid, then allowed them to develop naturally under field conditions. Treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared to control colonies. Given the scale of use of neonicotinoids, we suggest that they may be having a considerable negative impact on wild bumble bee populations across the developed world.

***Science*, 29 Mar 2012** http://dx.doi.org/10.1126/science.1215025

Wild flowers translocate neonics

Table 6. Pesticide concentrations found in unplanted fields near apiary during planting period in 2011, all concentrations shown are expressed as parts per billion.[1]

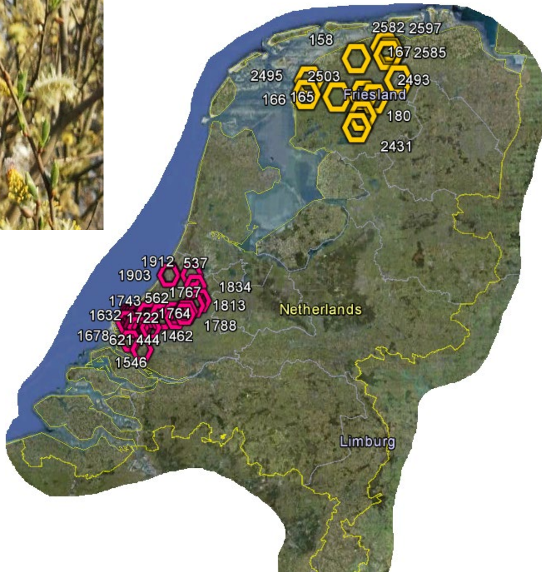
SAMPLE TYPE	Sample wt. (g)	THIAMETHOXAM LOD = 1.0	CLOTHIANIDIN LOD = 1.0	METOLACHLOR LOD = 0.5	ATRAZINE LOD = 0.2	AZOXYSTROBIN LOD = 0.2	COUMAPHOS LOD = 1.0
Soil, unplanted field 1, Soybeans 2010 (2 samples)	5.15, 5.01	ND	6.0±0.3	1014±14	771±170	0.2±0.1	ND
Soil, unplanted field 2, Soybeans 2010 (2 samples)	5.28, 5.43	ND	8.9±0.1	8.3±0.7	160±15	26±17	ND
Dandelions near maize field	2.96	ND	1.4	49	677	ND	ND
Dandelions near maize field	3.81	1.6	5.9	64	1133	ND	ND
Dandelions near maize field	4.51	1.3	3.1	28	522	ND	ND
Dandelions near maize field	4.05	2.9	1.1	60	269	ND	ND
Dandelions near maize field	3.10	1.1	1.6	5.7	125	ND	ND
Dandelions near maize field	3.44	ND	9.4	295	1004	ND	ND
Dandelion, CAES (non-agricultural area)	3.93	ND	ND	ND	0.3	ND	ND

When two aliquots of the same sample were analyzed the results are expressed as ± the standard deviation of the two analyses.
[1]ND = Not detected.
doi:10.1371/journal.pone.0029268.t006

Krupke e.a. 2012. Multiple Routes of Pesticide Exposure for Honey Bees Living Near Agricultural Fields. http://dx.doi.org/10.1371/journal.pone.0029268

Trees translocate neonics from surface water into pollen & nectar

In NL we found imidacloprid and thiacloprid in samples from willow trees (Salix) in polluted areas



Worldwide integrated assessment on systemic pesticides

Global collapse of the entomofauna: exploring the role of systemic insecticides

2014: Eight scientific papers (154 pages)

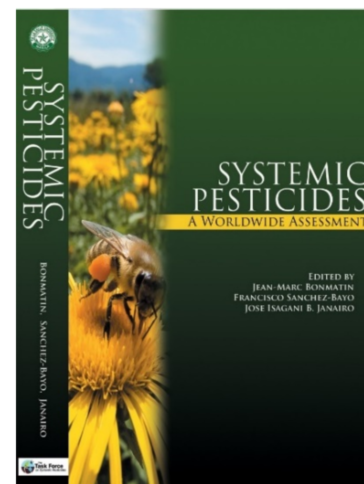
- Five years study
- First meta-analysis on neonicotinoids and fipronil
- 29 scientific authors (no conflict of interest)
- Comprehensive analysis (1121 publications & data from companies)
- Published in *Environmental Science and Pollution Research,* 2015

DOI: 10.1007/s11356-014-3220-1
DOI: 10.1007/s11356-014-3180-5
DOI: 10.1007/s11356-014-3332-7
DOI: 10.1007/s11356-014-3628-7
DOI: 10.1007/s11356-014-3470-y
DOI: 10.1007/s11356-014-3277-x
DOI: 10.1007/s11356-014-3471-x
DOI: 10.1007/s11356-014-3229-5

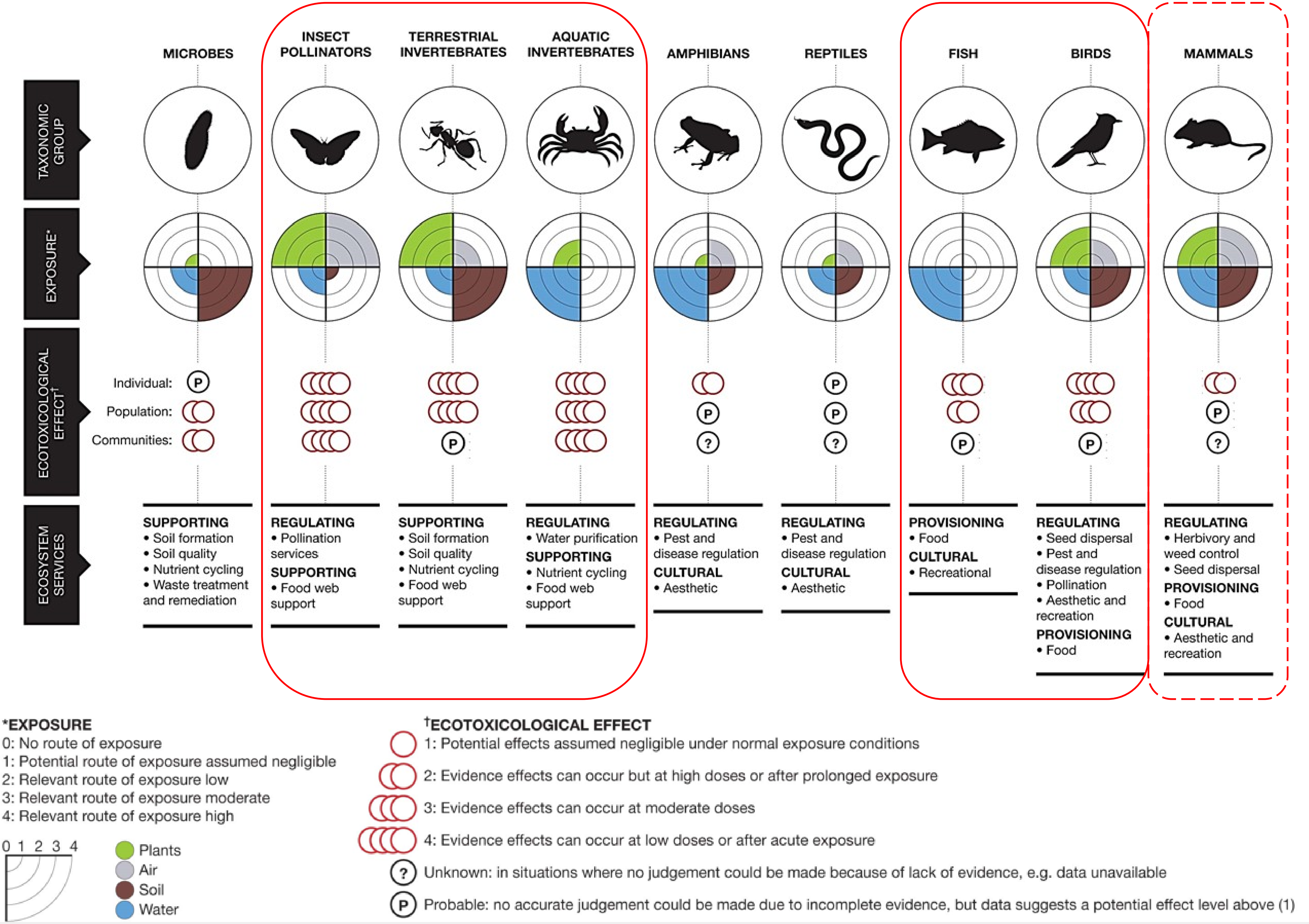
http://www.tfsp.info/assets/WIA_2015.pdf

2017-2018: Three new scientific papers (107 pages)

- Updated meta-analysis on neonicotinoids and fipronil
- 24 scientific authors (no conflict of interest)
- Comprehensive analysis (700 additional publications)
- 3 main chapters:
  - Exposures & Metabolism DOI:10.1007/s11356-017-0394-3
  - Impacts & Ecosystems DOI: 10.1007/s11356-017-0341-3
  - Resistances & Alternatives DOI: 10.1007/s11356-017-1052-5



Slide by: Dr. JM Bonmatin (CNRS) France



Pisa et al. 2017 https://link.springer.com/article/10.1007/s11356-017-0341-3

Loopholes

Neonics continue to pollute our environment:

- **Use as biocide continues**
  - Bayt spray (imidacloprid) to kill flies in cattle breeding (stables, trucks, etc.)
  - Wood conservation (thiacloprid)

- **Use as veterinary medicine continues**
  - On pets and cattle (fleas and flies)

- **Use outside EU on food (for humans and cattle) continues**
  - Neonic residues in food are not fully metabolised, ends up in urine and manure found in effluent of household waste-water treatment plants.

- **Regrettable substitution Neonics:**
  - Thiacloprid (replaced the 3 neonics banned in 2013/2018)
  - Sulfoxaflor [2015] & Flupyradifurone [2015]: same mode of action, *early warnings date from before authorisation decisions*
- **New markets:**
  - Lice treatment in Salmon farming (imidacloprid)

Pet flea treatments poisoning rivers across England, scientists find

17 Nov 2020

Discovery is 'extremely concerning' for water insects, and fish and birds that depend on them

▲ Research found chemical fipronil in 99% samples from 20 rivers in England. Photograph: Danny Lawson/PA

Highly toxic insecticides used on cats and dogs to kill fleas are poisoning rivers across England, a study has revealed. The discovery is "extremely concerning" for water insects, and the fish and birds that depend on them, the scientists said, who expect significant environmental damage is being done.

The research found fipronil in 99% of samples from 20 rivers and the average level of one particularly toxic breakdown product of the pesticide was 38 times above the safety limit. Fipronil and another nerve agent called imidacloprid that was found in the rivers have been banned from use on farms for some years.

One Seresto vet halsbånd contains 4.5 gram imidacloprid

Enough to give 1.2 milliard honeybees (ca. 30 000 hives) a deadly dose (LD50 honeybee = 3.7 ng)

Enough to pollute 640 million litre surface water up to the MTR-norm to protect aquatic insects (MTR = 7 ng/litre)

https://www.theguardian.com/environment/2020/nov/17/pet-flea-treatments-poisoning-rivers-across-england-scientists-find

Sea lice medicine approval ratified in EU law

16-4-2021

Benchmark's CleanTreat water filtration system enables BMK08 to be used without harm to the environment. Photo: Benchmark.

"BMK08 contains the neonicotinoid imidacloprid and has proved to be highly effective in commercial trials in Norway. It is designed to be used with CleanTreat, Benchmark's award-winning filtration system which removes both medicine residues and lice egg strings from wellboat treatment water before it is returned to the sea."

https://www.fishfarmingexpert.com/article/sea-lice-medicine-approval-ratified-in-eu-law/

Current situation in Norway

- In recent years only imidacloprid and thiacloprid were allowed in Norwegian agriculture.

Imidacloprid:

- 2018 EU-ban: outdoor use of imidacloprid no longer allowed in Norway, ony use in permanent greenhouses (veksthus)
- Since november 2020 also banned in greenhouses *“utfasingsperiode” kan selges til og med 1. juni 2021, og videre lagres og brukes til og med 1. juni 2022*
- **Still in use as biocide**: QUICK BAYT, Baythion D Mot Maur, Kvitt N Maurlokkeboks, Maxforce Quantum
- **Veterinary medicine** (Seresto vet halsbånd 4.5 gram imidakloprid)
- New use: **Salmon lice treatment** (BMK08 / Imidacloprid)

Thiacloprid:

- EU ban 2019. *(Utfasingsperiode: tillatt solgt i Norge til og med 3. november 2020, og tillatt brukt i Norge til og med 3. februar 2021.)*
- **Still in use as biocide in timber (wood preservation)**: *Jotun Industry Gunning, Jotun Industry Impregnering*

Challenges

Too little

- How to fix the loopholes?

Too late

- How to reduce delays between early warning and action?
- How to improve the social organisation of expertise to timely inform decisions

Capacity building

- How to build a knowledge network to strengthen the use of the precautionary principle in Norway?