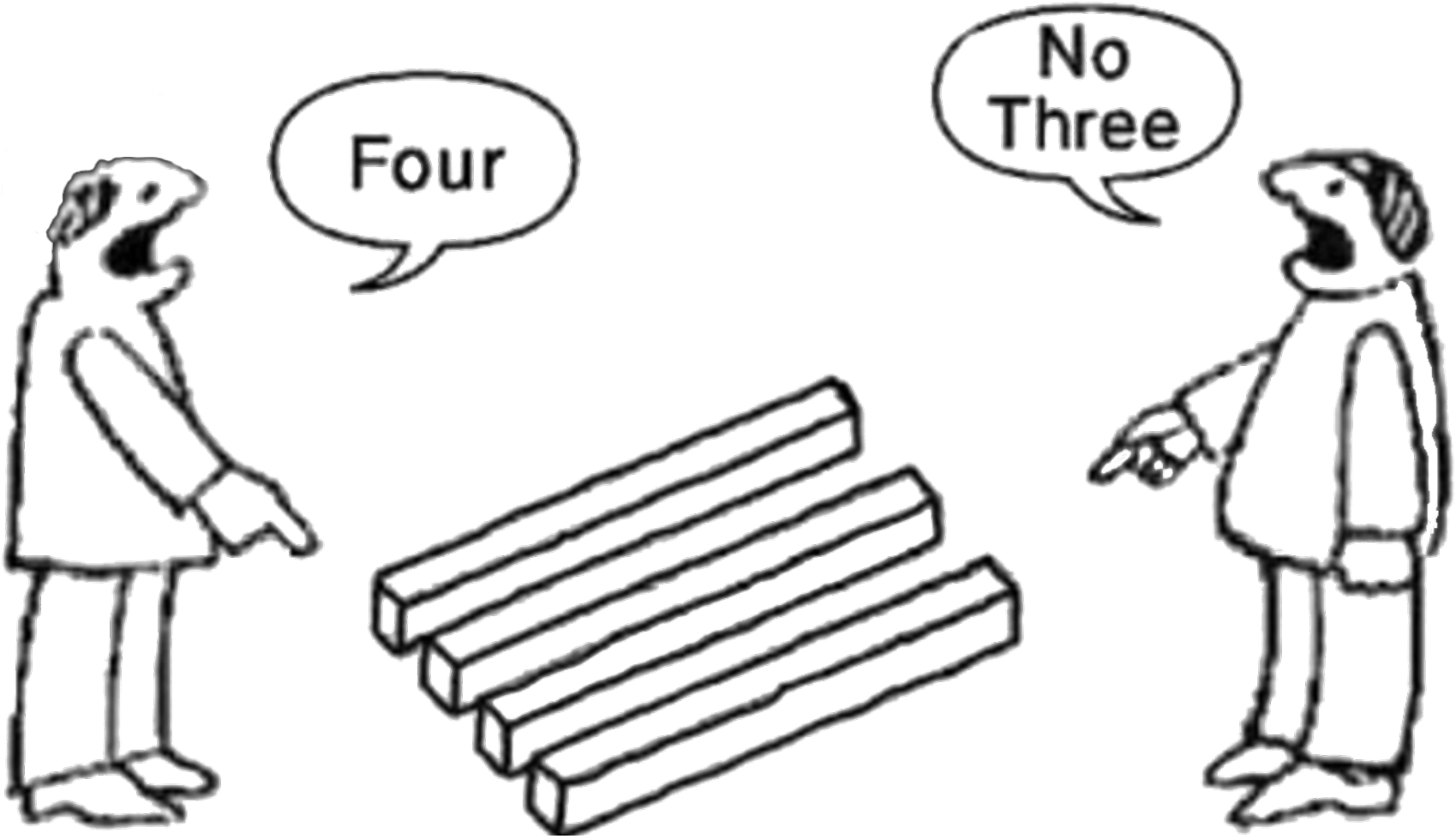
Unraveling controversy on evidence for policy

Jeroen P. van der Sluijs @Jeroen_vdSluijs

Senter for vitenskapsteori


Four
No
Three

INSECTAGEDDON

2011

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 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

2017

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

2018

In NL **181 of 358 bee species** on Red List: **at risk of extinction**

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

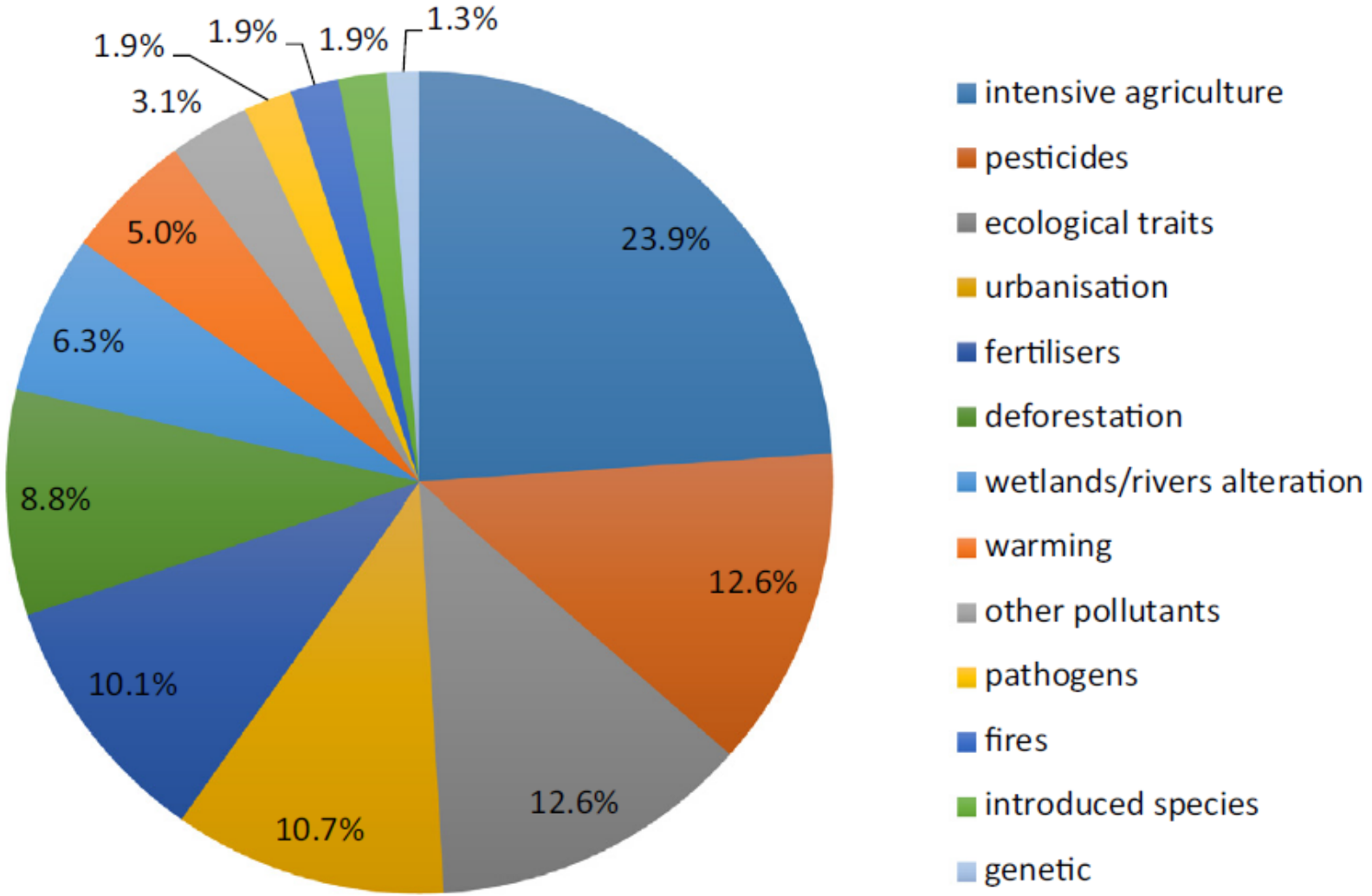
Insects Opinion

Insectageddon: farming is more catastrophic than climate breakdown

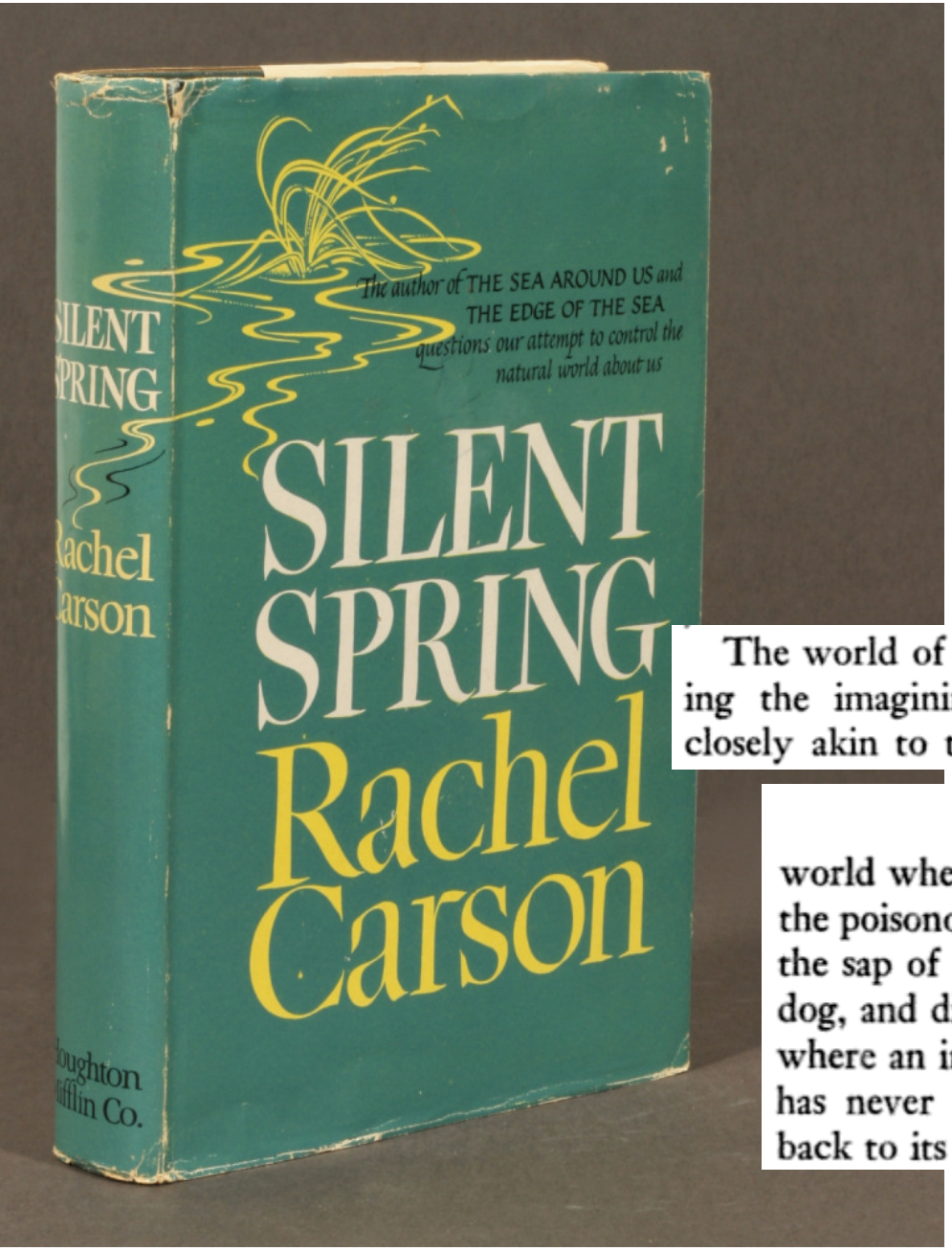
George Monbiot

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."



<u>Scientific dissent</u> on what drives insect declines (% of publications [*n*=73] mentioning cause *x* as the main driver)
DOI: 10.1016/j.biocon.2019.01.020



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

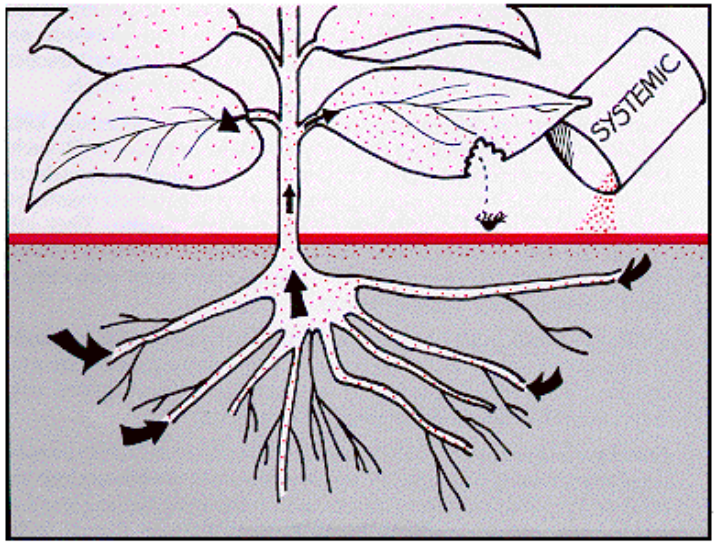
world where the enchanted forest of the fairy tales has become the poisonous forest in which an insect that chews a leaf or sucks the sap of a plant is doomed. It is a world where a flea bites a dog, and dies because the dog's blood has been made poisonous, where an insect may die from vapors emanating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

Systemic insecticides (neonicotinoids) & bees

Toxicity of neonicotinoids

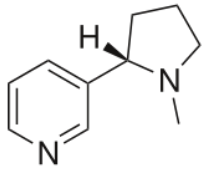
Pesticide	®	Use	LD50 (ng/honeybee)	Toxicity index relative to DDT
DDT	Dinocide	insecticide	27000	1
Amitraz	Apivar	insecticide / acaricide	12000	2
Coumaphos	Perizin	insecticide / acaricide	3000	9
Tau-fluvalinate	Apistan	insecticide / acaricide	2000	13.5
Methiocarb	Mesurol	insecticide	230	117
Carbofuran	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)

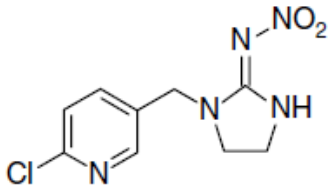


Systemic = crop takes it up into its plantsap: chemical makes plant toxic from inside

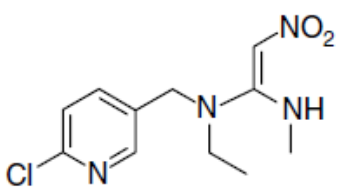
Neonicotinoids



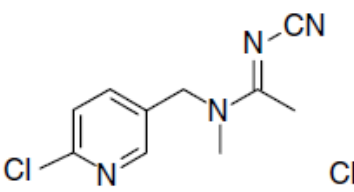
Nicotine



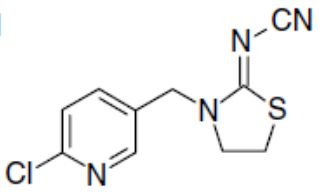
Imidacloprid (1)



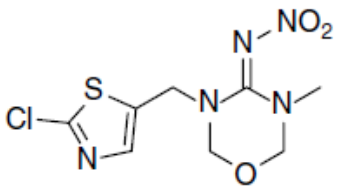
Nitenpyram (2)



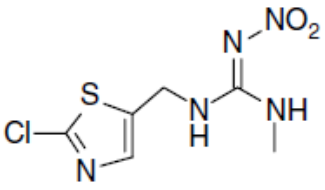
Acetamiprid (3)



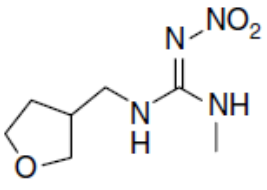
Thiacloprid (4)



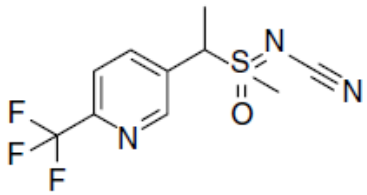
Thiamethoxam (5)



Clothianidin (6)



Dinotefuran (7)



Sulfoxaflor (8)

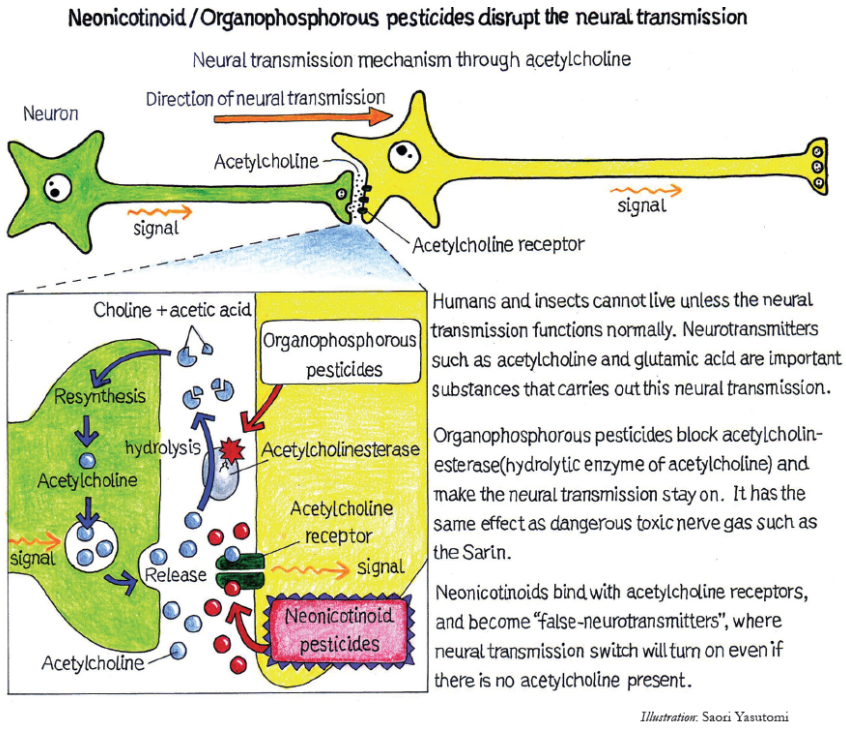
Systemic means:

- **opposite of IPM:**
  pre-emptive strike
  in stead of last resort
- **convenience pesticides**

Imidacloprid + Thiamethoxam + Clothianidin in EU (before ban):

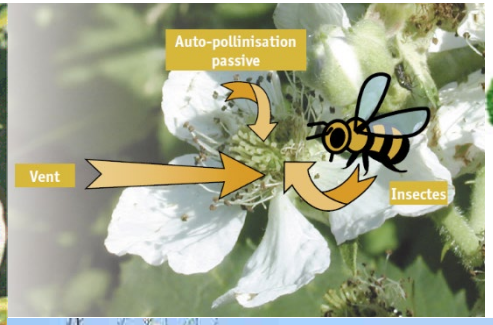
>200 products

>1000 allowed applications



The importance of bees

- 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)
- Value in Europe: 14.2 billion Euro / yr
- 94% of all flowering plants on earth depends on 25000 bee species for reproduction and evolution



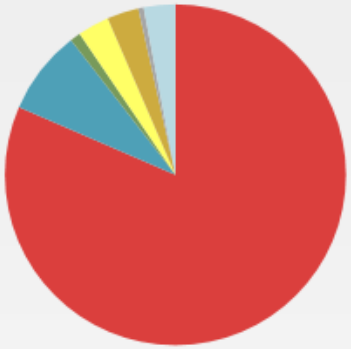
Some crops pollinated by bees[3]

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

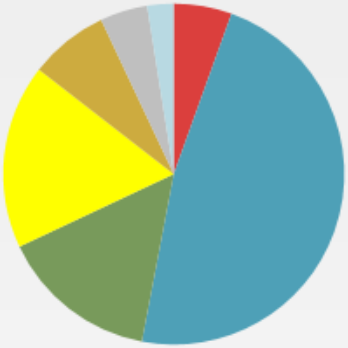

LISTEN TO
THE SCIENCE
BAN
NEONIC

Whose science counts?

Beekeepers

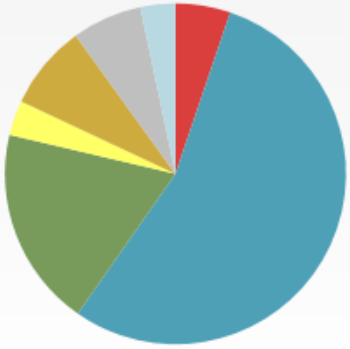


Authorisation board

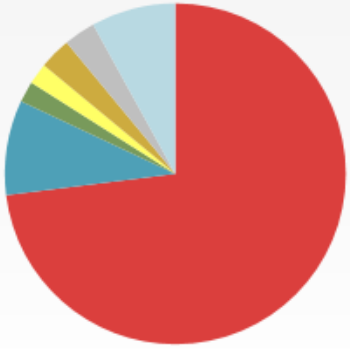


Ministry of Agriculture

Bayer

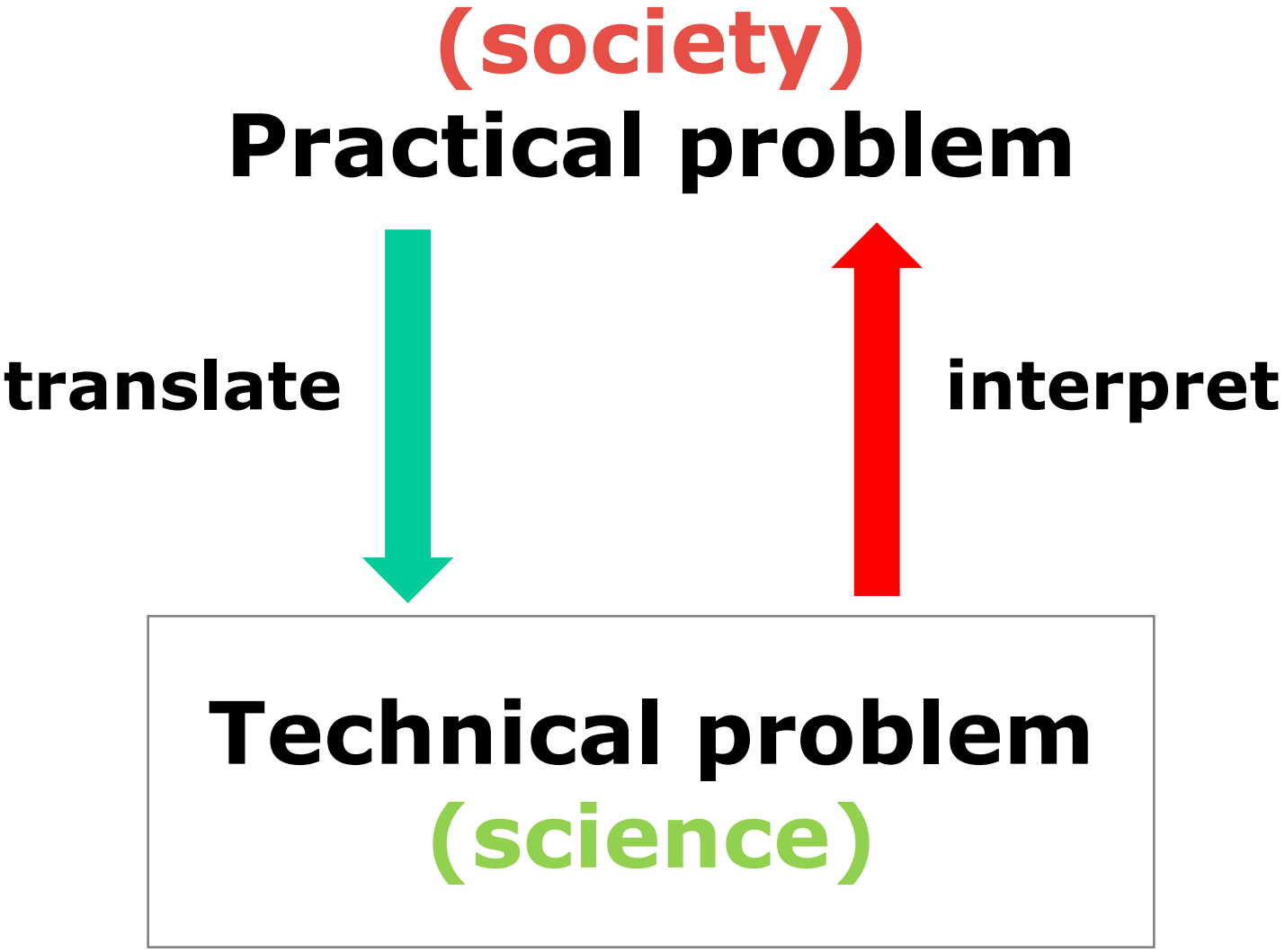


Academic researchers



- Neonic pesticdes
- Diseases
- Pollen
- Sunflower strains
- Climate
- Genetics

(Maxim & Van der Sluijs, 2010)



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

Chronic toxicity imidacloprid for bumblebees

Micro colonies fed with imidacloprid at

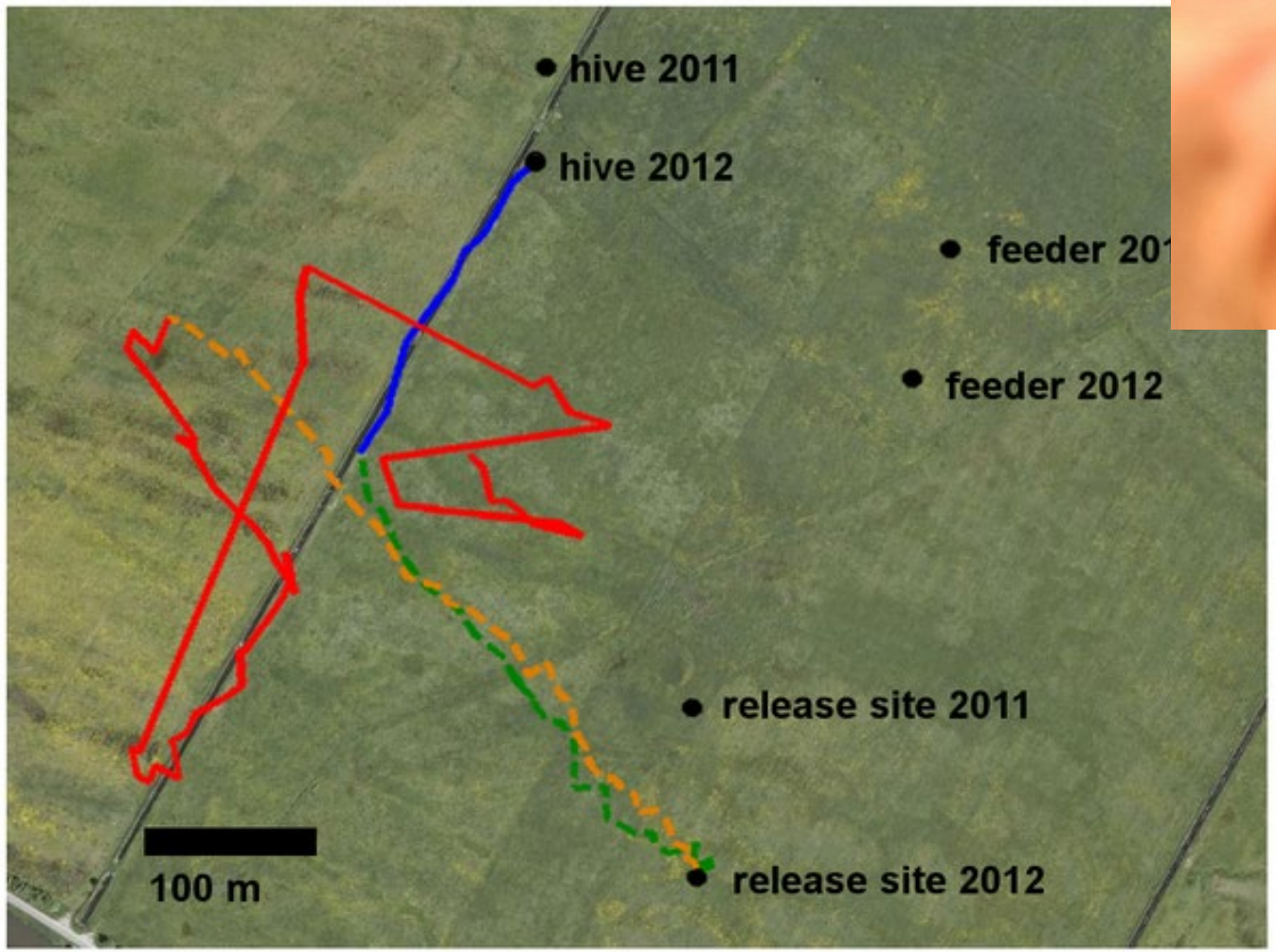
- 200 ppm 100% mortality few hours
- 20 ppm 100% mortality 14 days
- 2 ppm 100% mortality 28 days
- 0.2 ppm 100% mortality 49 days,
- 20 ppb 15% mortality (77 days)
- 10 ppb 0% mortality (77 days)

NOEC reproduction <2.5 ppb

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

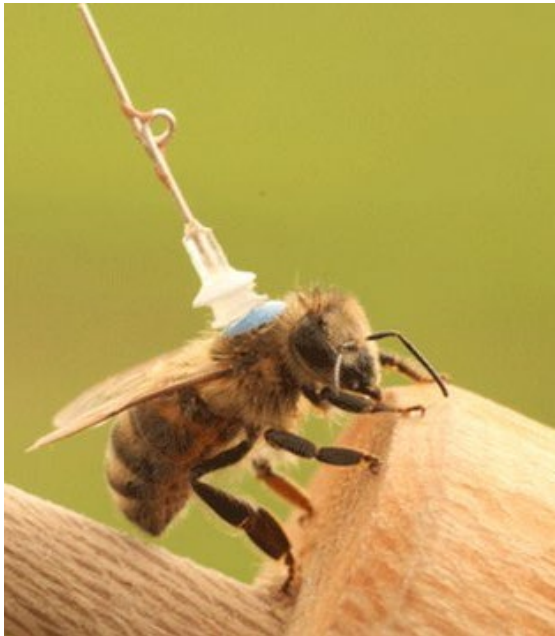
Mismatch with EU regulatory 10 day test!!

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

The pitfall of *lamp-posting* in translating *practical problems* into *technical problems*

Searching where the light shines
may not help to solve the practical problem…

Problems with authorization tests

- In authorization protocols **field studies** (even flawed ones and *n*=1 ones) get **more weight** than lab studies, but from a scientific point of view **lab studies are more reliable**!
- Some field studies have *n*=1
- Until recent: no requirements for **statistical power** of tests used for authorization
- Many **flaws** in experimental set-up of field studies used for authorization
- Many field studies turned out to have a hidden sponsor / **CoI**: Industry lobby
- Example: Cutler and Dupree 2007 study
- **Regulatory risk-tests lag 15yr behind** frontier of science (e.g. 10 day tox-bees)

Superficies (ha)

	39A
Grassland	535.0
Cereals	506.9
Corn	151.1
Rapeseed	102.3
Beet	78.5
Potato	51.7
Cover	38.7
Fabaceae	36.6
Flax	3.3
Miscellaneous	0.4
Vegetables	0.0
Horticulture	0.0
Fruits	0.0

Figure 1.1 *– Example of land use in a circumference of 3 km radius around an apiary (red dot)*

Source: Noa Simon Delso, 2017. Fungicides and bees: a history of the unexpected. PhD thesis. University Louvain la Neuve, Belgium

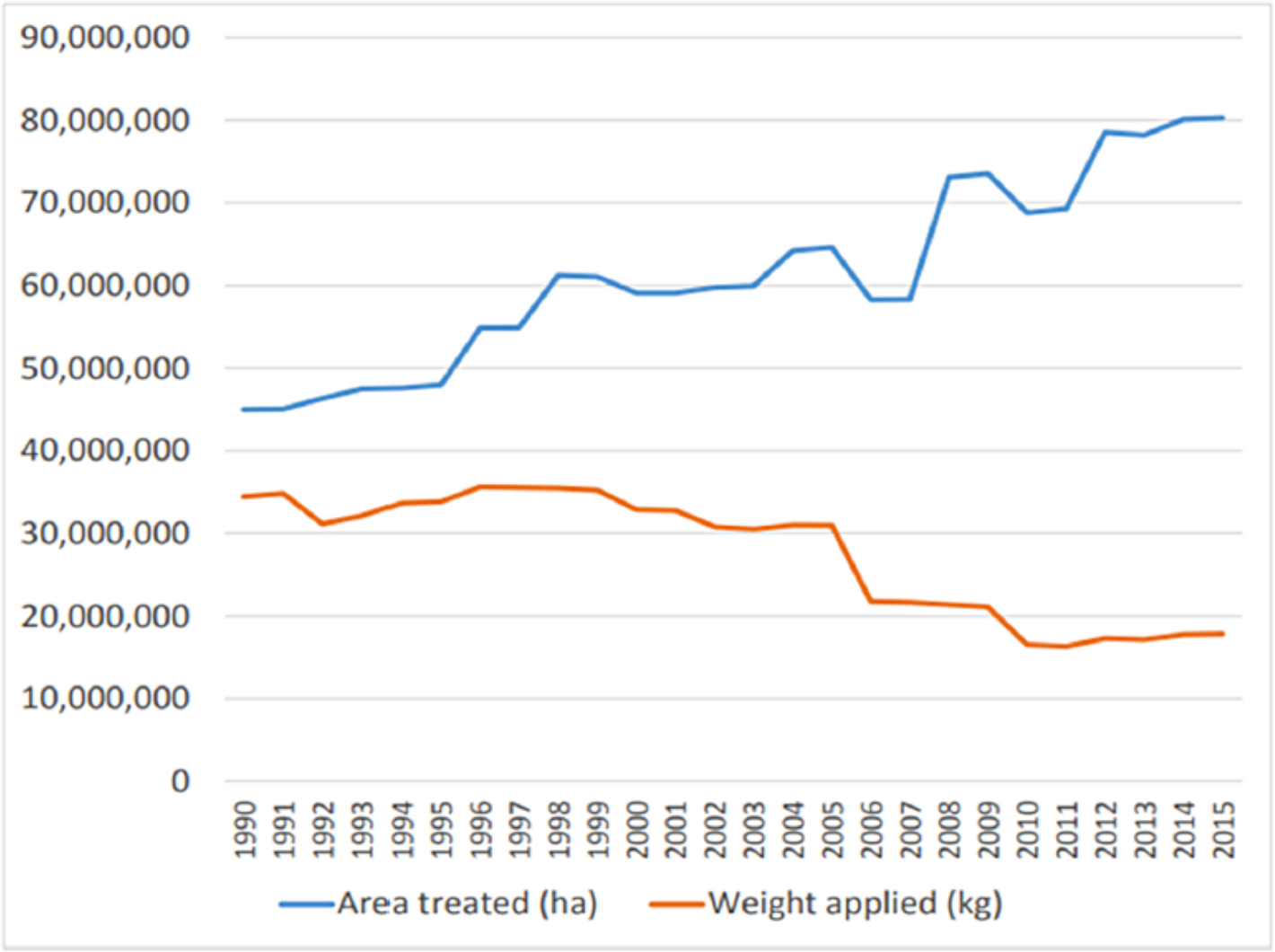
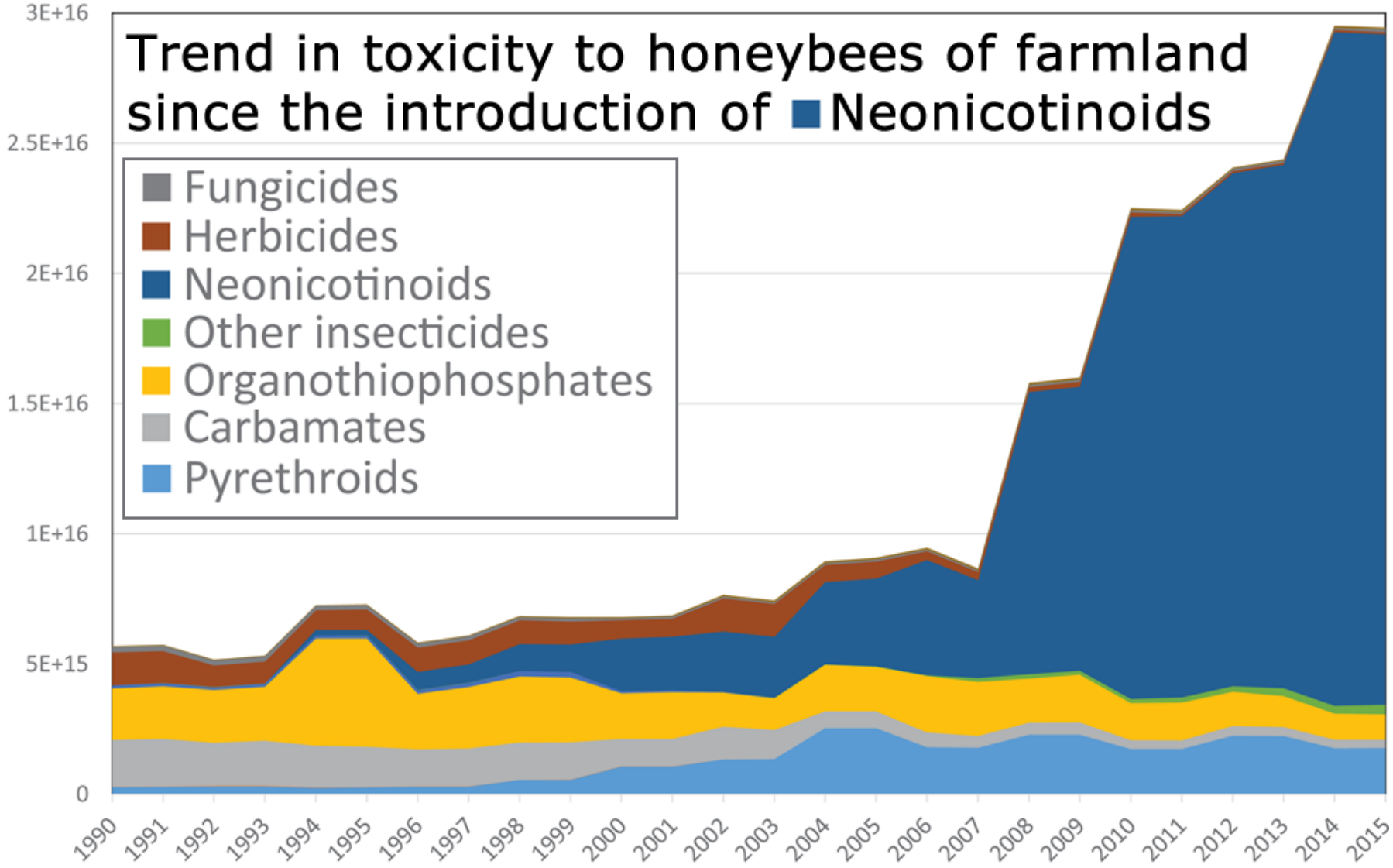


Figure 1 Area of crop treated (blue line, hectares) and mass of pesticide applied (red line, kilograms) from 1990 to 2015. The total area of crop remained approximately constant at 4.6 million hectares. In 1990 each hectare of cropped land on average received a total of 7.5 kg of pesticide active ingredient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

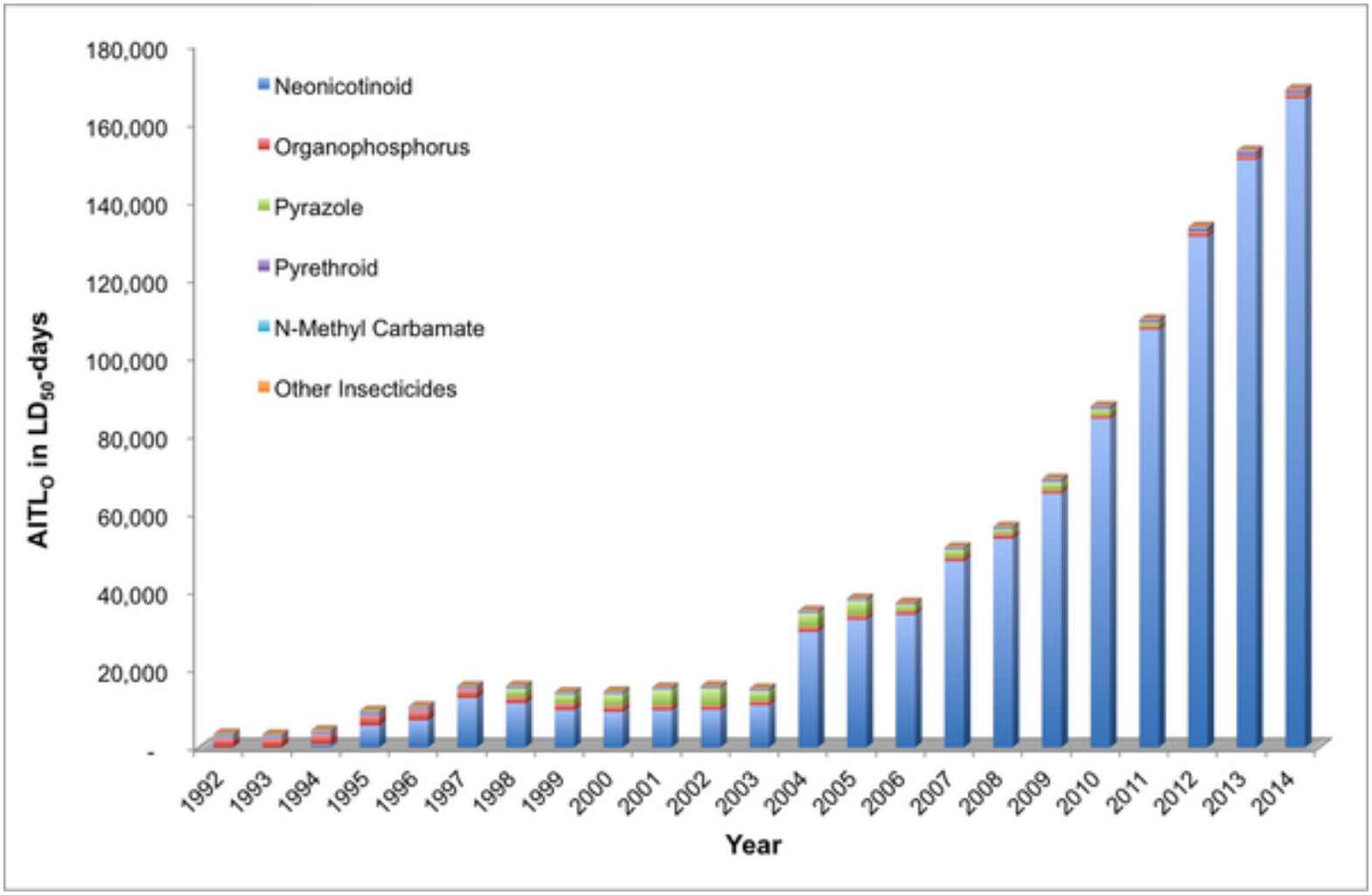
Full-size DOI: 10.7717/peerj.5255/fig-1

https://peerj.com/articles/5255/



<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

Worldwide integrated assessment on systemic pesticides

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

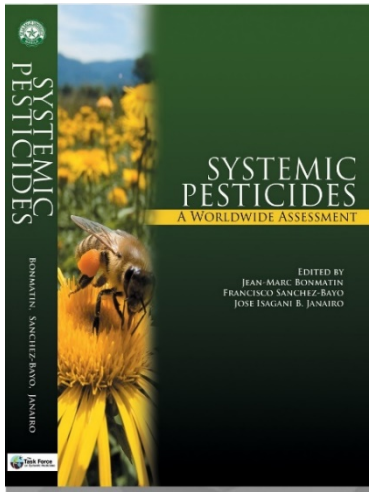
2014: Eight scientific papers (154 pages)

- **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

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**

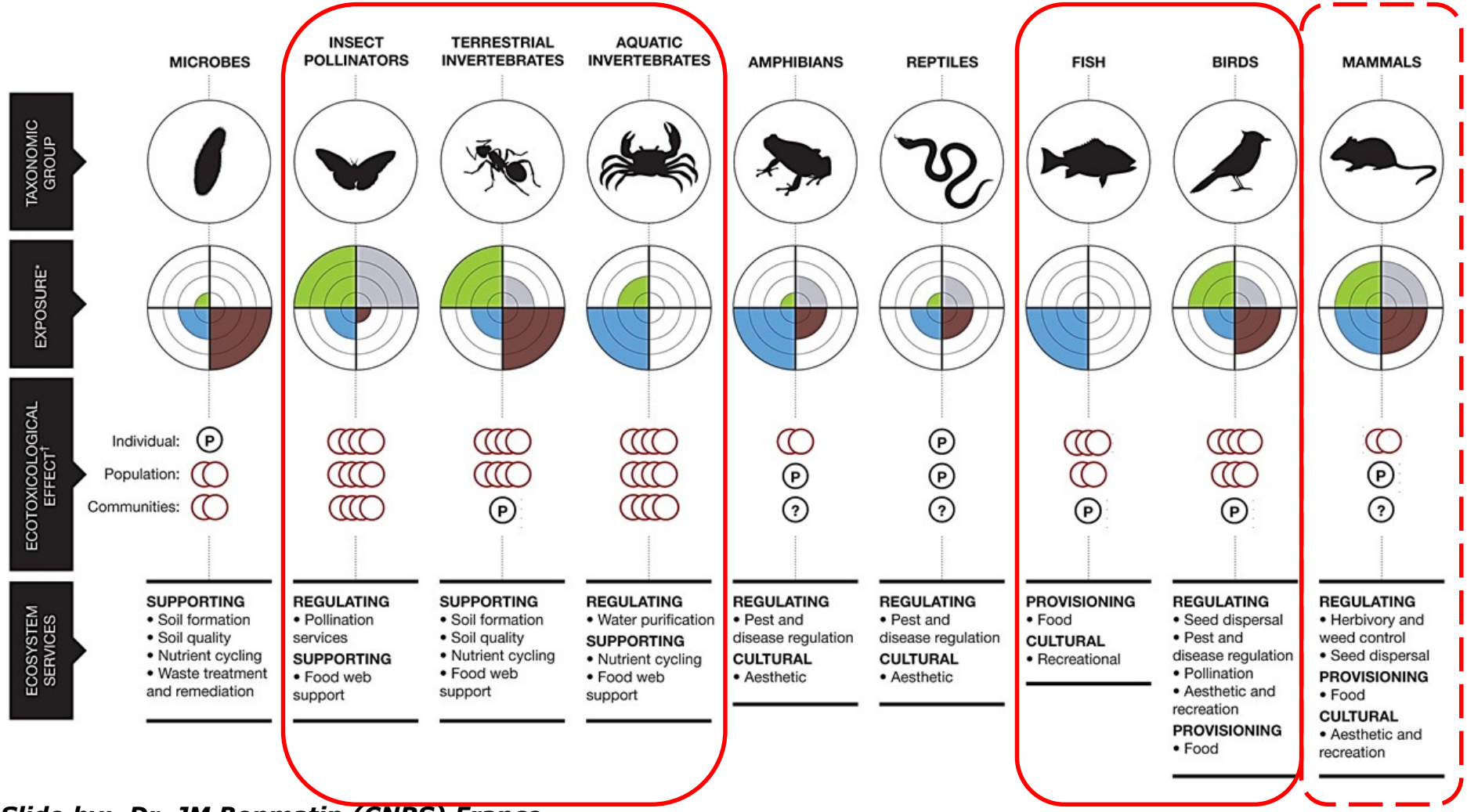


Slide by: Dr. JM Bonmatin (CNRS) France

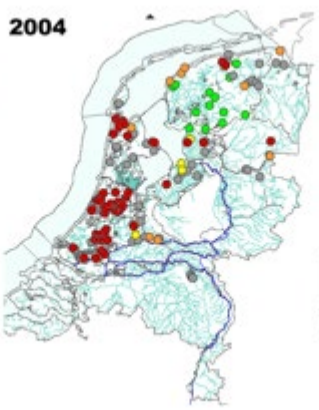
Environ Sci Pollut Res
DOI 10.1007/s11356-017-0341-3

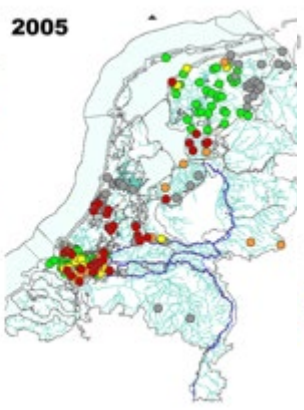
An update of the Worldwide Integrated Assessment (WIA) on systemic insecticides. Part 2: impacts on organisms and ecosystems

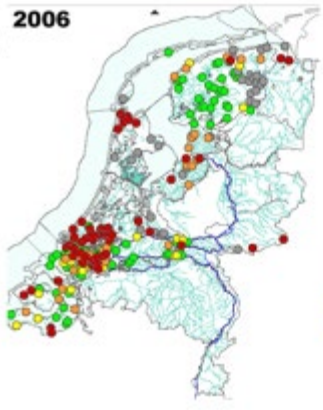
Lennard Pisa[1] · Dave Goulson[2] · En-Cheng Yang[3] · David Gibbons[4] · Francisco Sánchez-Bayo[5] · Edward Mitchell[6] · Alexandre Aebi[6,7] · Jeroen van der Sluijs[8,9,10] · Chris J. K. MacQuarrie[11] · Chiara Giorio[12] · Elizabeth Yim Long[13] · Melanie McField[14] · Maarten Bijleveld van Lexmond[15] · Jean-Marc Bonmatin[16]

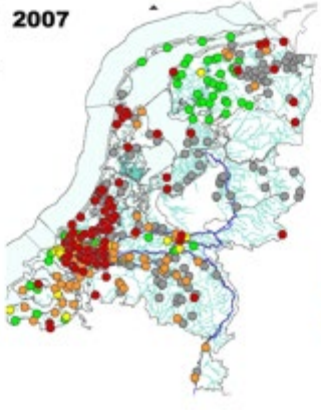


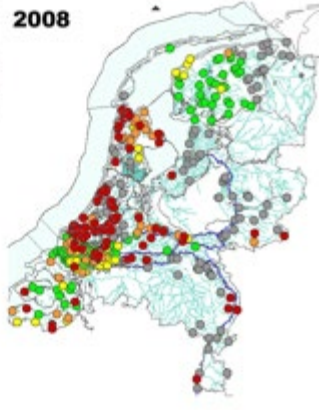
Slide by: Dr. JM Bonmatin (CNRS) France

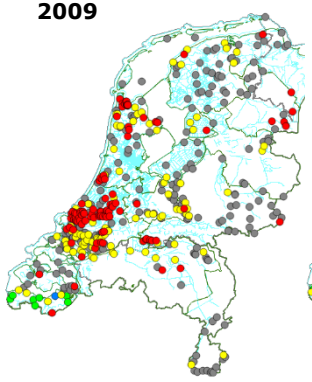


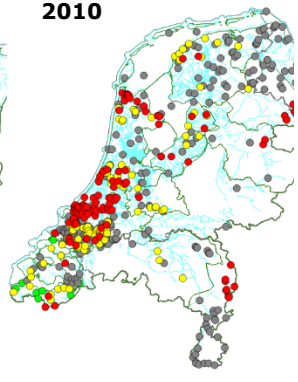


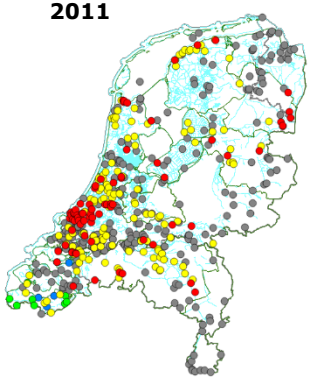


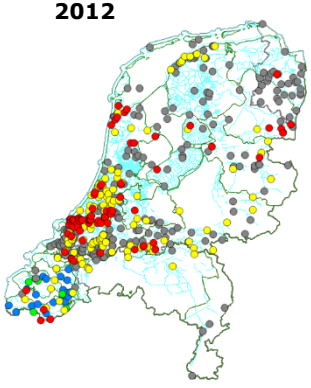


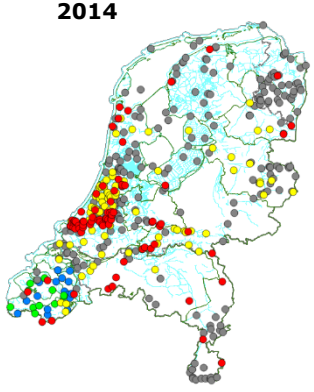








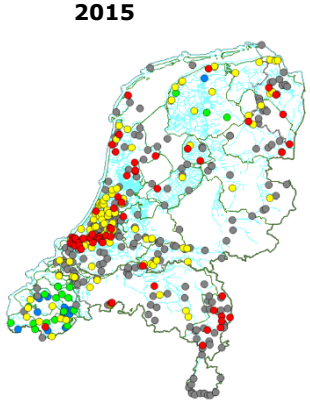


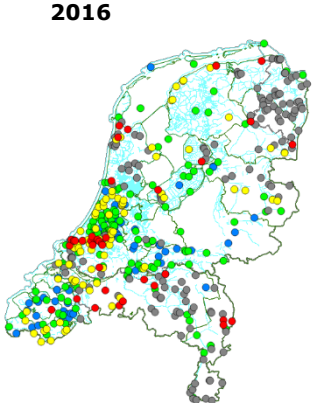


Since 2004, NL surface water is heavily polluted with Imidacloprid

www.bestrijdingsmiddelenatlas.nl

Only 1.6 to 20% of applied neonicotinoid is absorbed by the growing crop (Sur & Stork 2003)
80 to 98.4% leaches to soil & water!



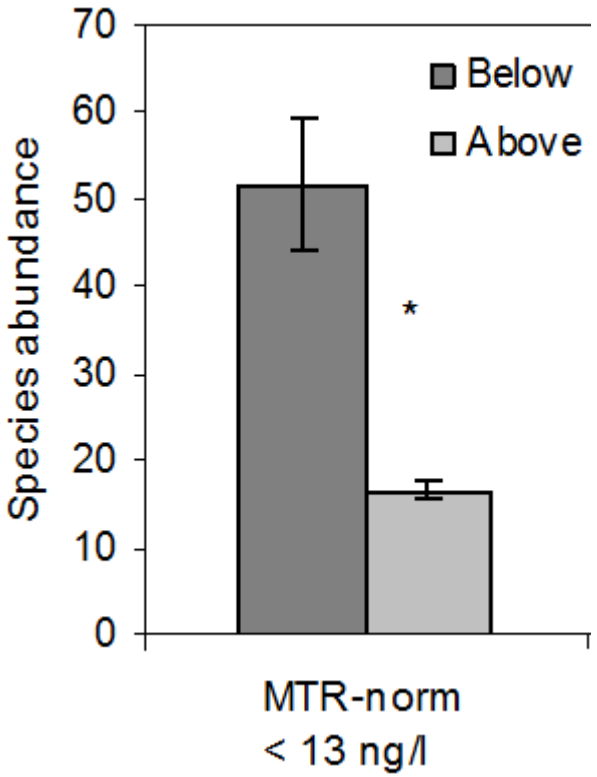


> Target value, <= MTR
< detection limit
> MTR
>2x MTR
>5x MTR

Imidacloprid in Dutch surface water 2003-2008
Exceedances of the Maximum Tolerable Risk standard
MTR = 13 nanogram / liter

Findings on aquatic ecosystems

- 45% of all samples (*n*=9037) on 801 locations: imidacloprid exceeds MTR (>13 ng/l)
- **70%** reduction in macrofauna abundance in polluted water
- Permanent leaching of Imidacloprid year round from fields to surface water
- Meeting MTR requires reduction of use by at least 90%



https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0062374

nature International weekly journal of science

LETTER

doi:10.1038/nature13531

Declines in insectivorous birds are associated with high neonicotinoid concentrations

Caspar A. Hallmann[1,2], Ruud P. B. Foppen[2,3], Chris A. M. van Turnhout[2], Hans de Kroon[1] & Eelke Jongejans[1]

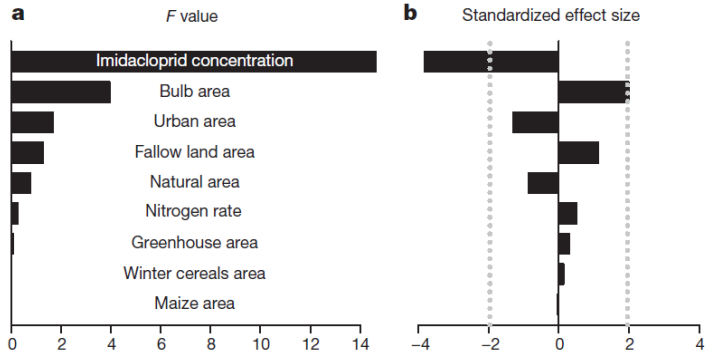
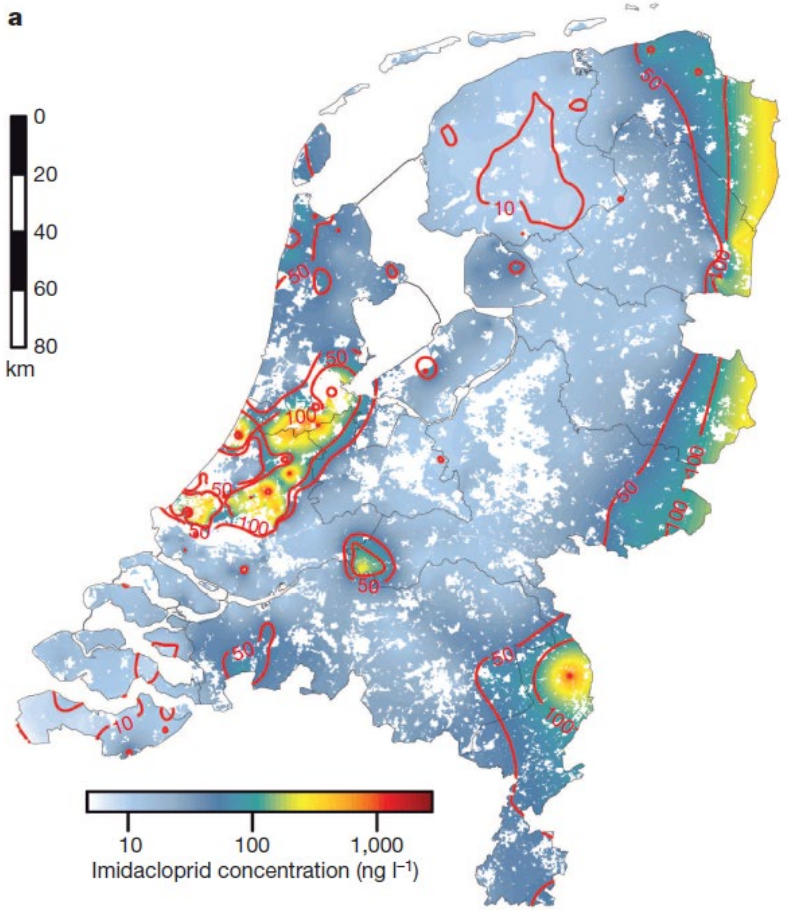
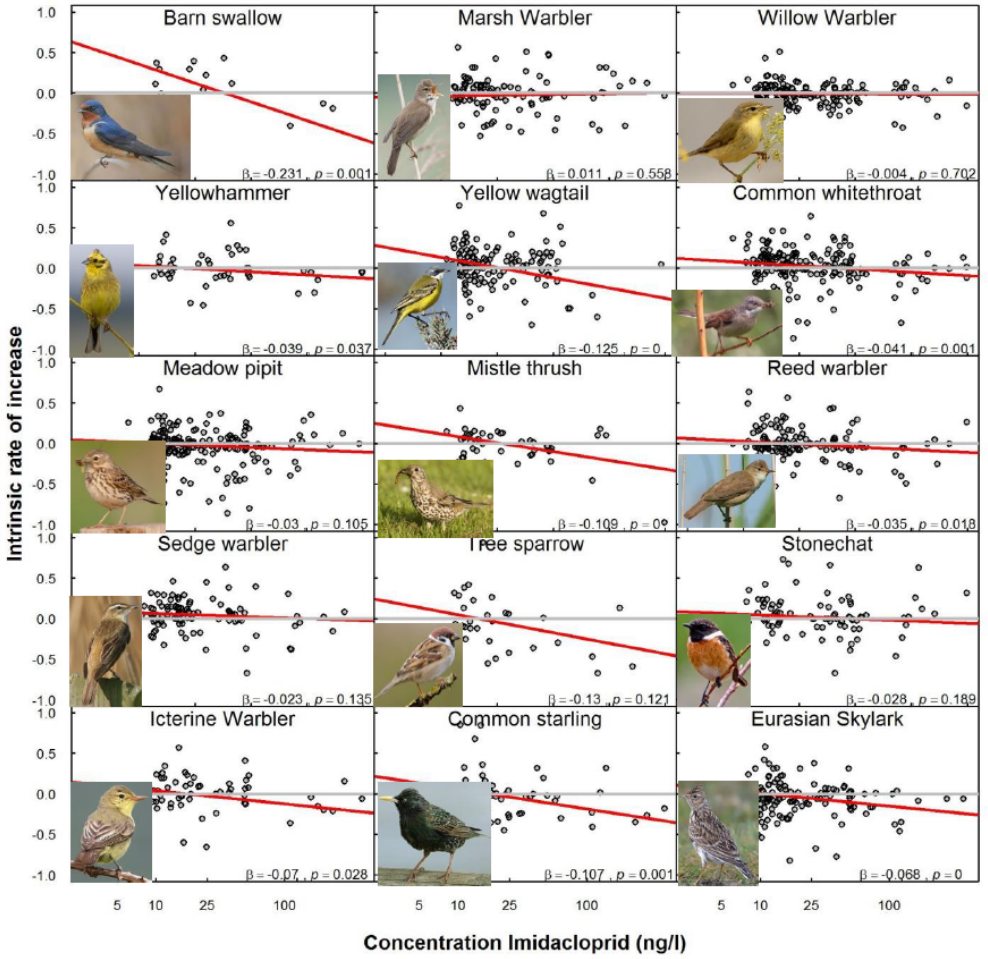


Figure 2 | Comparison of the effect of agricultural land-use changes and the effect of imidacloprid on bird population trends. **a**, The marginal variance





Understanding uncertainty & dissent in risk controversies

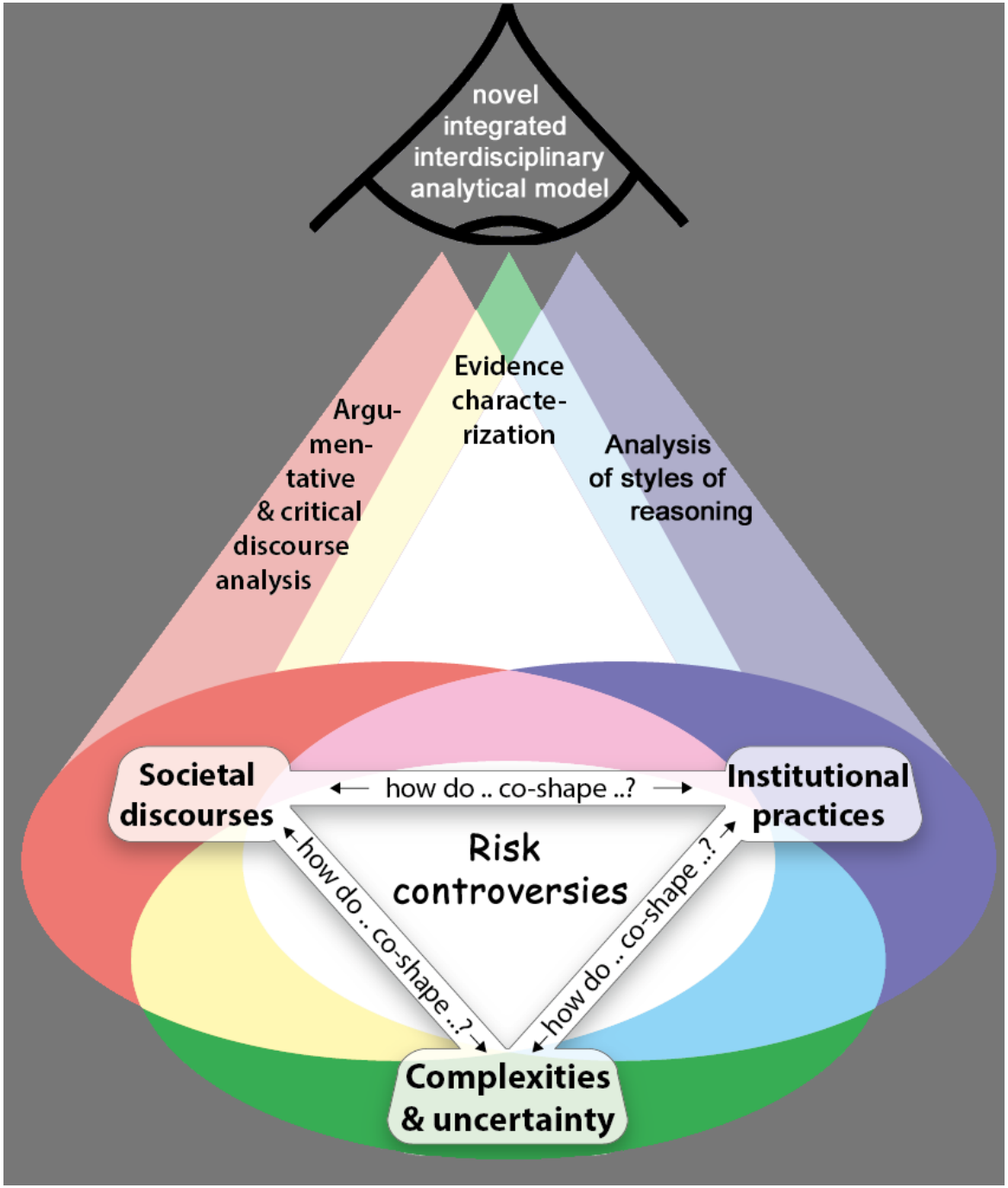
- *How are epistemic, institutional, and societal dimensions of scientific controversies on complex risks interwoven*
- *How can the science-policy interface on such risks be improved to better cope with deep uncertainty and scientific dissent?*

Understanding scientific controversy

- **Find generic patterns** of interwovenness of **scientific**, **societal** & **institutional** dimensions
- Understand why experts disagree and on what
- Clarify what is deeply uncertain and why

To enable & promote:

- More responsible treatment of uncertainty and scientific dissent
- Knowledge utilisation in full awareness of its limitations



New way of looking at scientific controversies

"By shining light on its dynamics from 3 different perspectives (discourse analysis, evidence characterization, analysis iof styles of reasoning) it seeks to reveal how 3 key factors (deep uncertainties; societal discourses; institutional practices) co-shape one another to produce the typical patterns that can be observed in scientific controversies."

Van der Sluijs, 2014

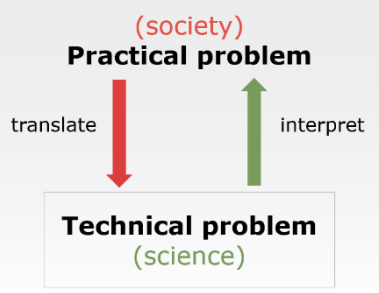
Five ways in which scientific controversies come to an end:

- sound argument closure
- consensus closure
- procedural closure
- natural death closure
- negotiation closure

Beauchamp (1987)

Interpretive space **in scientific assessment results from 3 key sources:**

- **Translational diversity:** The multitude of ways in which risk issues can be translated into technical problems that science can address



- **Argumentative flexibility:** The multitude of tenable styles of scientific reasoning in expert interpretations of evidence
- The existence of **deep uncertainty** (manufactured and actual) in the science.

Trans science (Alvin Weinberg)

- Research Questions that can be phrased scientifically but that in practice cannot be answered by science.

Refs:

- Alvin Weinberg (1972) Science and trans-science, Minerva, 10, 1972, 209-222.
- Alvin Weinberg (1991) Origins of Science and Trans-Science, Citation Classics 34 S18,
- Harvey Brooks (1972) Science and Trans-Science - Letter to the Editor, Minerva

Trans Science – Alvin Weinberg

- "Let us consider the **biological effects of low-level radiation insults to the environment, in particular the genetic effects of low levels of radiation on mice**. Experiments performed at high radiation levels show that the dose required to double the spontaneous mutation rate in mice is 30 roentgens of X-rays. Thus, if the genetic response ,to X-radiation is linear, then a dose of 150 millirems would increase the spontaneous mutation rate in mice by 0.5%. This is a matter of importance to public policy since the various standard-setting bodies had decided that a yearly dose of about 150 millirems (actually 170 millirems) to a suitably chosen segment of the population was acceptable. Now, **to determine at the 95 per cent. confidence leve**l by a direct experiment whether 150 millirems will **increase .the mutation rate by 0.5% requires about 8,000,000,000 mice!** Of course this number falls if one reduces the confidence level; at 60 per cent. confidence level, the number is 195,000,000. Nevertheless, **the number is so staggeringly large that, as a practical matter, the question is unanswerable by direct scientific investigation**."

Alvin Weinberg (1972) Science and trans-science, *Minerva*, 10, 209-222.

"Revolving Doors" … between regulators and Corporations they regulate

"Dr Helen Thompson, a key government scientist whose research was used by ministers to argue against a ban on pesticides thought to harm bees is to join Syngenta, the chemical giant which manufactures one of the insecticides".

Thompson led a field project intended to test the effect of neonicotinoids on bumblebees. However, the study was criticised as flawed after the near ubiquitous use of the insecticides led to the contamination of colonies meant to be pesticide-free controls".

Guardian 26th July 2013.

Slide by Dr. David Gee

Conflicts of interest in regulatory science

Example: ICPBR Bee Brood Working Group (2008)

- Composition: 2 representatives of the industry, 3 of governmental agencies and 1 of a consulting company working for industry; academic scientists and beekeepers absent
- Proposed thresholds for considering a pesticide as being of low risk for the bee brood:
  - 30% loss of bee brood
  - 50% of eggs or other larval stages
- For beekeepers: unacceptable (these values = hives weakened on the long term)

Correspondence

Biodiversity reports need author rules

Two representatives from the agrochemical industry are among 40 authors of a fast-track assessment of pollinators by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES; see go.nature.com/q8lll2). In our view, to support the credibility of assessment results, the IPBES needs a policy requiring authors to declare all funding sources, positions held and other potential conflicts of interest.

It is unclear how the IPBES deals with conflicts of interest. Their second plenary meeting last December postponed a decision on the matter. Authors are nominated by IPBES member states and other stakeholders to "reflect the range of scientific, technical and socio-economic views and expertise; geographical representation … ; the diversity of knowledge systems … ; and gender balance". But the IPBES has no explicit rules for nomination or selection.

IPBES assessments could lead to far-reaching policy interventions, with financial implications for industry sectors (for example, in mining after assessment of land degradation and restoration, or for transport after invasive-species assessment). Given the role of agrochemicals in pollinator decline (J. van der Sluijs *et al. Environ. Sci. Pollut. Res.* http://doi.org/xcx; 2014), it is our view that scientists funded by such corporations should not be lead authors or coordinating lead authors on such assessments.

We also suggest that the IPBES publishes the names of all nominated authors, along with their nominators and justification for their appointment.

Axel Hochkirch *Trier University, Germany.*
Philip J. K. McGowan *Newcastle University, UK.*
Jeroen van der Sluijs *University of Bergen, Norway.*
hochkirch@uni-trier.de

doi:10.1038/516170c

www.tfsp.info

The New York Times | BUSINESS DAY

Scientists Loved and Loathed by an Agrochemical Giant

With corporate funding of research, "there's no scientist who comes out of this unscathed."

By DANNY HAKIM DEC. 31, 2016

EXETER, England — **The bee findings were not what Syngenta expected to hear**.

The pesticide giant had commissioned James Cresswell, an expert in flowers and bees at the University of Exeter in England, to study **why many of the world's bee colonies were dying**. **Companies like Syngenta have long blamed a tiny bug called a varroa mite, rather than their own pesticides, for the bee decline.**

Dr. Cresswell has also been skeptical of concerns raised about those pesticides, and even the extent of bee deaths. But **his initial research in 2012 undercut concerns about varroa mites as well. So the company, based in Switzerland, began pressing him to consider new data and a different approach.**

Looking back at his interactions with the company, Dr. Cresswell said in a recent interview that "**Syngenta clearly has got an agenda.**" In an email, he summed up that agenda: "**It's the varroa, stupid.**"

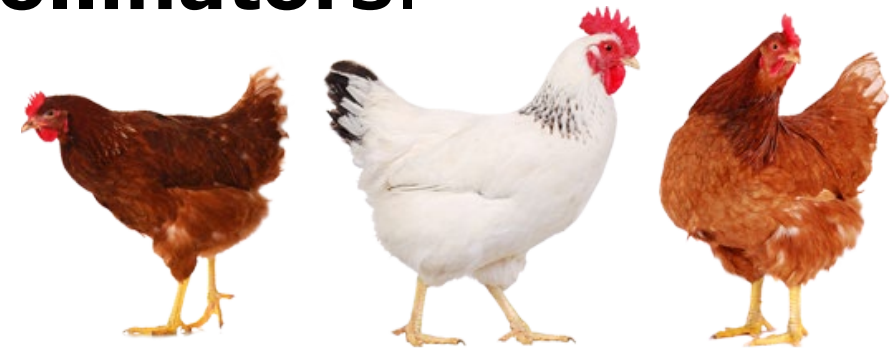
…

For Dr. Cresswell, 54, the foray into corporate-backed research threw him into personal crisis. Some of his colleagues ostracized him. He found his principles tested. **Even his wife and children had their doubts. "They couldn't believe I took the money,**" he said of his family. "They imagined there was going to be an awful lot of pressure and thought I sold out."

https://www.nytimes.com/2016/12/31/business/scientists-loved-and-loathed-by-syngenta-an-agrochemical-giant.html

Honeybee health is wrong frame

Just as the **laying hen** is not a good indicator for the state of **farmland bird populations**, the **honeybee** is not a good measure for bees/**pollinators**.



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

Science for sale

on the interaction between scientific researchers and their clients

Royal Netherlands Academy of Arts and Sciences, 2005

"because of … decreasing public funding of research, universities and research institutes become too dependent on specific external research contracts."

Derailments occur:
"the design of research, the collection and interpretation of data are sometimes adjusted to provide a favourable outcome for the client and the publication of research findings is sometimes prevented, delayed or adapted to the needs of the client. This applies to contract research funded by governments as well as interest groups and industry."

http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20051083.pdf

Volkskrant investigation 2008

Quarter of professors is sponsored

- Amost one fourth of the 5,481 professorial chairs at Dutch Universities is directly or indirectly sponsored by external parties.
- Outlier is Wageningen University, with 36 % sponsored chairs

Source: frontpage “Volkskrant” (Dutch Newspaper) 12 April 2008

CoI : an early definition

"A conflict of interest is a set of circumstances that creates a risk that professional judgement or actions regarding a primary interest will be unduly influenced by ***a secondary interest****"*

Thompson DF (1993) *Understanding financial conflicts of interest*. N Engl J Med 329:573–5761993).

Slide by Dr. David Gee

Conflicts of Interest include:

- Direct: employment, stock ownership, grants, patents.
- Indirect: honoraria, consultancies to sponsoring organizations, mutual fund ownership, paid expert testimony.
- "Conflicts can also exist as a result of personal relationships, academic competition, and intellectual passion. Eg
- A relative who works at the company whose product the researcher is evaluating.
- A self-serving stake in the research results (e.g. potential promotion/career advancement based on outcomes).
- Personal beliefs that are in direct conflict with the topic he/she is researching.

(Elsevier)

Slide by Dr. David Gee

Some of the strategies used

- Selective funding of research adressing favourable questions;
- Keeping important (but unwelcome) aspects ouside the scope of research;
- Making (favourable) assumptions and underpinning these rethorically rather than factual;
- Deliberately faulty experimental design to obtain desired results;
- Intentional misapplication of statistics;
- Hiding unwelcom uncertainties / magnifying welcome uncertainties;
- Improper generalization;
- Removal of unwelcome results, ignoring unwelcome knowledge;
- Prohibition of disclosure of outcomes or prolongued embargo (IPR);
- Tampering of data from literature, observation or experiment;
- Knowingly wrong or biased representation of others' findings;
- Fabrication of data /fraud;
- Drawing of intentionally false concusions / firmer than justified;
- Promote wrong interpretations by the media;
- Disobligue colleagues in order to influence the scientific and societal debate;
- Feigning of expertise (acquisition, media, hearings);
- Spin doctor techniques against unwelcome knowledge;
- Gohst writing;
- Pal review (nepotism);

"Manufacturing Scientific Doubt"

"Doubt is our product since it is the best means of competing with the 'body of fact' that exists in the mind of the general public."

From an executive at Brown & Williamson, Tobacco Company, 1969.

See EEA chapters on Beryllium,tobacco, leaded petrol, climate change etc. And Michaels 2009: Oreskes,2010 on manufacturing doubt.

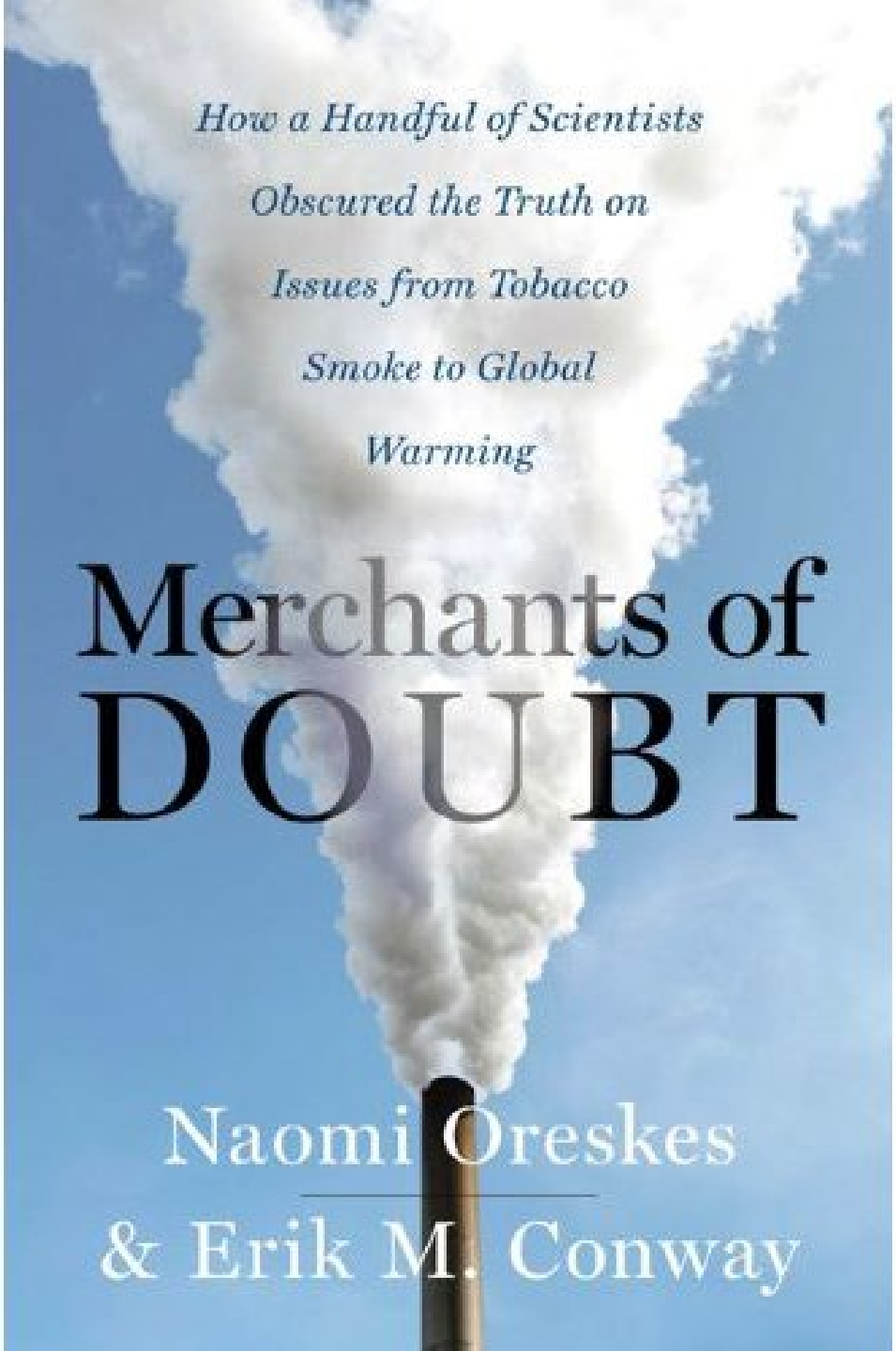
Slide by Dr. David Gee

Tobacco Industry manipulation of Research

- Fund Research supporting Tobacco
- Red herrings: fund research on OTHER causes of lung cancer
- Hide industry role in that research
- Publish only pro Tobacco research
- Suppress “inconvenient truths”
- Criticise such “truths” & attack the messengers
- Change scientific standards
- Disseminate tobacco research to lay press
- Dialogue directly with policymakers, or via “front” organisations

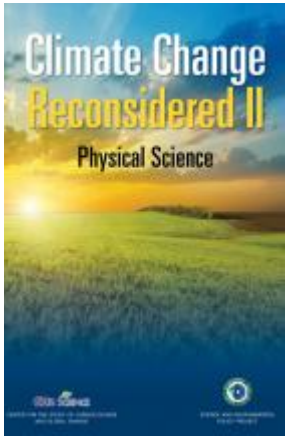
Liz Bero, chapter in “Late Lessons from Early Warnings2, EEA, 2013

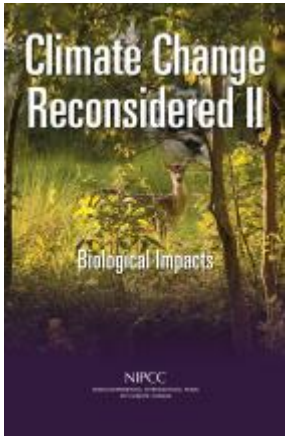
Slide by Dr. David Gee



Nongovernmental International Panel on Climate Change (NIPCC)

The Heartland INSTITUTE



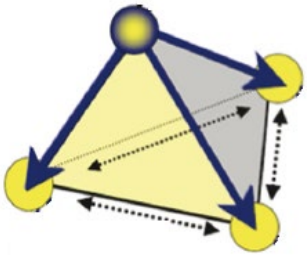


http://heartland.org/

CATO INSTITUTE

"Individual Liberty, Free Markets, and Peace"

http://www.cato.org



Interests

http://books.google.com/books?id=CrtoNFTuPwwC

Science for sale – Bisphenol A

Congress: Science for Sale?

Congress Launches Probe Into Firm's Work on Chemical Used to Make Many Plastic Bottles

*..a confidential Weinberg Group document ...in which the firm suggested to DuPont ... several ways it could **help "shape the debate"** about one of its chemical products. The firm proposed ... "**constructing a study to establish" that DuPont's chemical was safe**, and arranging the publication of papers "dispelling the alleged nexus" between the company's chemical and its alleged harmful effects on humans."*

ABC News 6 Feb 2008

http://abcnews.go.com/Blotter/story?id=4252096&page=1

Exclusive:
'Science for Sale' Probe Deepens

A scientific consulting firm once crowed of its success in delaying the cancellation of a harmful drug by 10 years, congressional investigators say.
Lawmakers have more tough questions for the Weinberg Group, which has been accused of "manufacturing uncertainty" about research to benefit its corporate clients and their products.

ABCNews, March 11, 2008,

http://abcnews.go.com/Blotter/story?id=4428347&age=1

Categories of
Deceitful Tactics and Abuse of the Scientific Process

source: P.H. Gleick, Pacific Institute, 2007

http://www.pacinst.org/publications/testimony/Gleick_Senate_Commerce_2-7-07.pdf

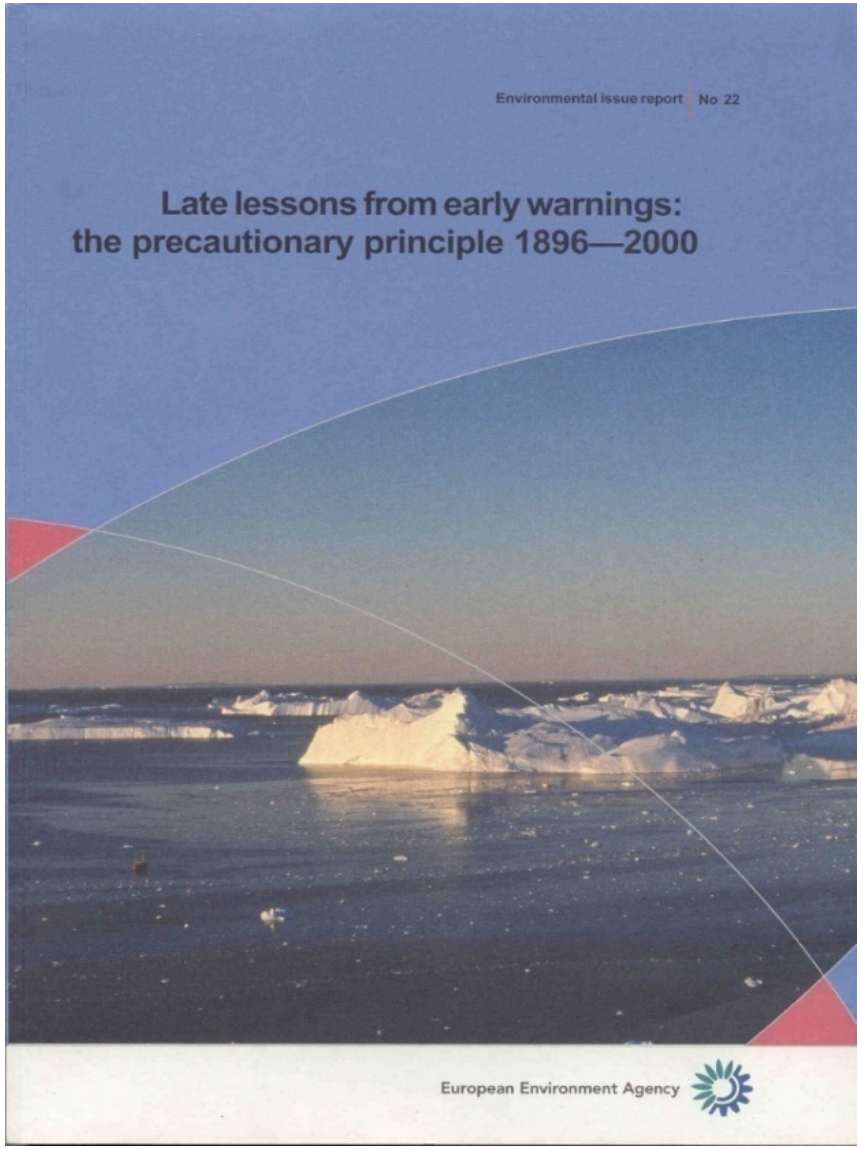
- Appeal to Emotion (appeal to ridicule, fear etc)
- Personal ("Ad Hominem") Attacks
- Mischaracterizations of an Argument
- Inappropriate Generalization
- Misuse of Facts (inadequate sample)
- Misuse of Uncertainty
- False Authority
- Hidden Value Judgments (ideologies)
- Scientific Misconduct (fabrication etc.)
- Science Policy Misconduct (Packing Advisory Boards, selective funding)

Counterweight

- Codes of conduct *(=if power balance remains unchanged this is "end of pipe!")*
- Multi-disciplinary broad expert panels
- Include minority views in scientific advice (Health Council)
- Organise systematic scrutiny and critical reflection (KQA)
- Investigative journalism
- Extended Peer Review: Blogosphere
- Contra-expertise / Science shops
- Community Based Auditing
- Crowd financing of contra-research
- Critical Discourse Analysis
- Audits

Revision of research funding required:
More independent funding, increase academic freedom!

2001



2013

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0001:FIN:EN:PDF

https://www.eea.europa.eu/publications/late-lessons-2

34 case studies in the "Late Lessons" reports...

'Environmental chemicals'

- Beryllium
- PCBs
- CFCs
- TBT antifoulants
- Mercury
- Environmental Tobacco
- Perchlorethylene
- Booster biocides
- DBCP
- DDT
- Vinyl chloride
- Bisphenol A

Ecosystems

- Ecosystems resilience
- Great Lakes pollution
- Fish stock collapse
- Acid rain
- Bee decline, France
- Invasive alien species
- Floods
- Climate change

Transport fuel additives

- Benzene
- MBTE
- Lead

'Micro technologies'

- Nano
- GMOs & Agro-ecology

Animal feed additives

- BSE, 'mad cow disease'
- Beef hormones
- Antibiotics

- Asbestos

Pharmaceuticals

- Contraceptive pill
- DES

Radiations

- X-rays
- Mobile phones
- Nuclear accidents

Slide by Dr. David Gee

European Environment Agency

Types of Biases:

"Reasoning often starts with established conclusions and works back to find "facts".

Its not lack of knowledge or understanding-but "motivational reasoning" …. which confirms your own bias and writing off inconvenient truths"

From evidence based policymaking to policy based evidence making..

"Seeing Reason: human brains skew facts", D jones , New Scientist, Dec 3rd 2016

Slide by Dr. David Gee

Some Biases in Research & Risk Assessment

- **Methodological biases towards false negatives**

- **Intellectual bias *ie commitment to a paradigm; authored previous evaluation/RA***

- **Reporting biases**

- **Funding bias: See the Vatican and its seeking of scientists who would contradict Galileo. See histories of Asbestos, Lead, some Pharma, Tobacco, BPA, & Mobile phones..where source of funding strongly predicts nature of the results**

See chapters on Precautionary Science & on Precaution, "Late Lessons from Early Warnings," 2013

Slide by Dr. David Gee

Direction and magnitude of biases?

What is the main direction of error in epidemiological and experimental studies ,and their interpretation……?

Slide by Dr. David Gee

Methodological Biases: Environmental Health Sciences and Their Main Directions of Error

SCIENTIFIC STUDIES	SOME METHODOLOGICAL FEATURES	MAIN[1] DIRECTIONS OF ERROR:
Experimental	•High doses	**False positive**
Studies	•Short (in biological terms) range of doses	False negative
(Animal)	•Low genetic variability	False negative
	•Few exposures to mixtures	False negative
	•Few Foetal-lifetime exposures	False negative
	•High fertility strains	False negative (Developmental/reproductive endpoints)

[1] Some features can go either way (e.g.inapproriate controls) but most of the features mainly err in the direction shown in the table

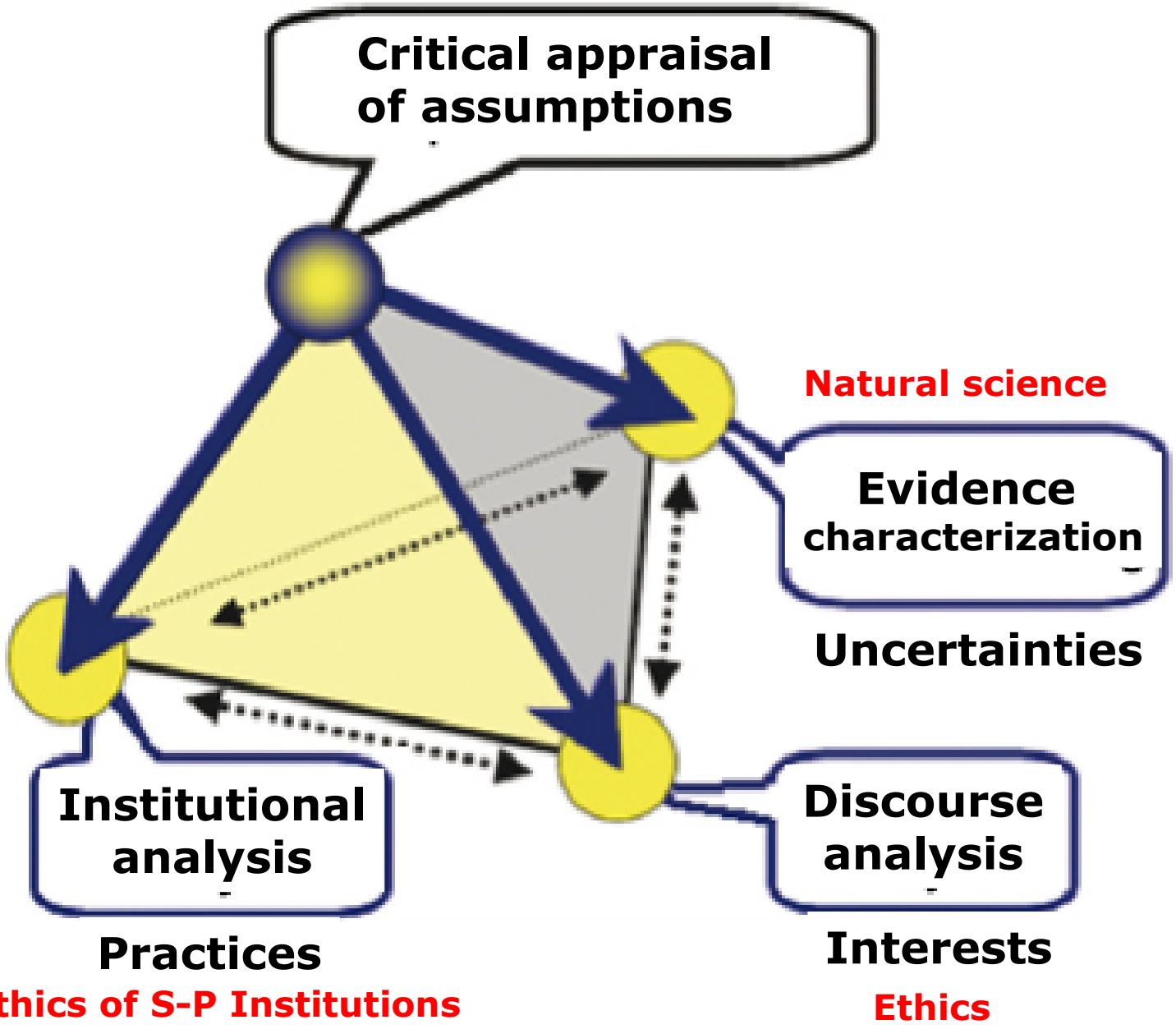
(Gee, Bailar, Grandjean,2004, Gee 2008, Grandjean,2013, Gee,2014)

Slide by Dr. David Gee

Observational	•Confounders	**False positive/negative**
Studies	•Inappropriate controls	**False positive/negative**
(Wildlife &	•Non-differential exposure misclassification	False negative
	•Insensitive outcome measures	False negative
Humans)	•Inadequate follow-up	False negative
	•Lost cases	False negative
	•Simple models that do not reflect complexity	False negative
	•Multi-causality	False negative
Both	•Publication bias towards positives	**False positive**
	•Reporting bias	False negative
Experimental And	•Scientific cultural pressure to avoid false positives	False negative
Observational Studies	•Low statistical power (e.g. From small studies)	False negative
	•5 % probability level to minimise chances of false positives	False negative
	•Funding bias	False negative

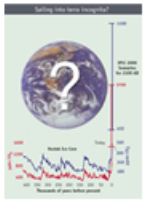
Slide by Dr. David Gee

Knowledge Quality Assessment (KQA)



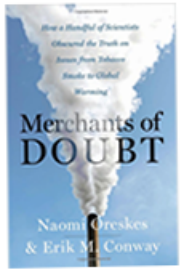
(Van der Sluijs, 2013)

Analytical framework to assess the interactions between epistemic, institutional and societal dimensions of risk controversies



Evidence characterization & Knowledge Quality Assessment

Deep scientific uncertainty & complexity



Scientific Knowledge

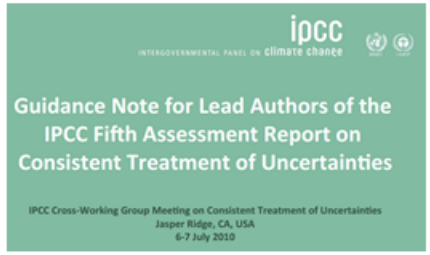
How do scientific complexity & deep uncertainty shape the societal discourse

how does the societal discourse shape scientific complexity & deep uncertainty

Substantial assumptions

how do scientific complexity & deep uncertainty shape the institutional practices

how do the institutional practices shape scientific complexity & deep uncertainty



Critical appraisal of assumptions

IPBES responds on conflicts of interest

Societal assumptions

Regulatory assumptions

Argumentative & critical discourse analysis

Interests

Societal discourse

Regulatory Risk Assessments

Institutional practices (of regulatory risk appraisal)

Institutional analysis of Science Policy Interface

how does the societal discourse shape institutional practices

how do the institutional practices shape the societal discourse

ipcc ICES CIEM efsa

ipbes