



**Pesticide  
Action  
Network**  
Europe

Pesticide  
Environmental Risk  
Assessment:  
Environment  
unprotected?

Angeliki Lyssimachou, PhD  
Environmental Scientist/Toxicologist  
ERA of Pesticides; EFSA, 15-16 November 2016

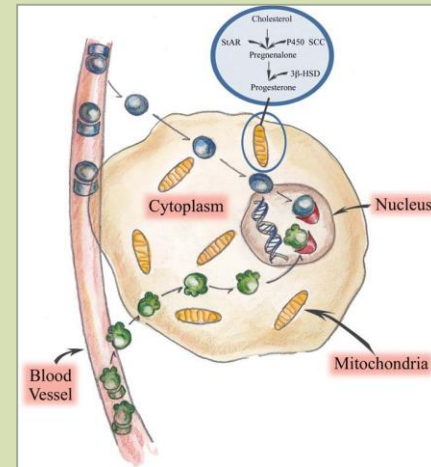
# Pesticides



Deliberately made to be toxic to living organisms

- Cellular sites in target species similar to other organisms

Pesticides are toxic to non-target species



Species population

Impact ecosystems

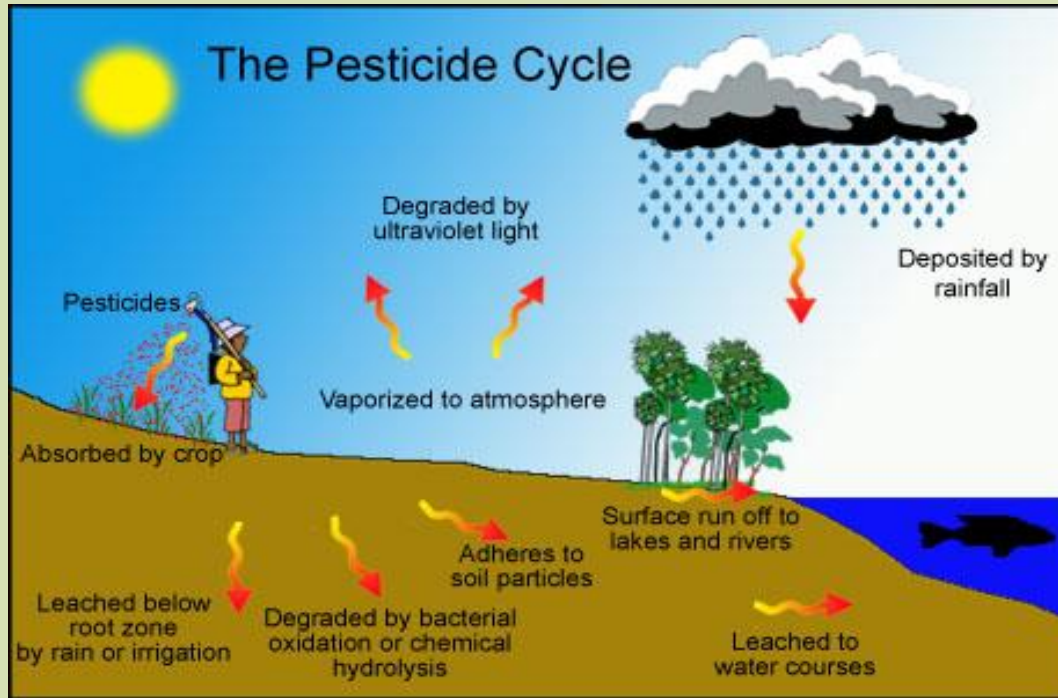
biodiversity

Low water solubility + Repeated use →

Contamination of ecosystems



## Pesticides, not just for crops



- Only a tiny fraction reaches the target pest

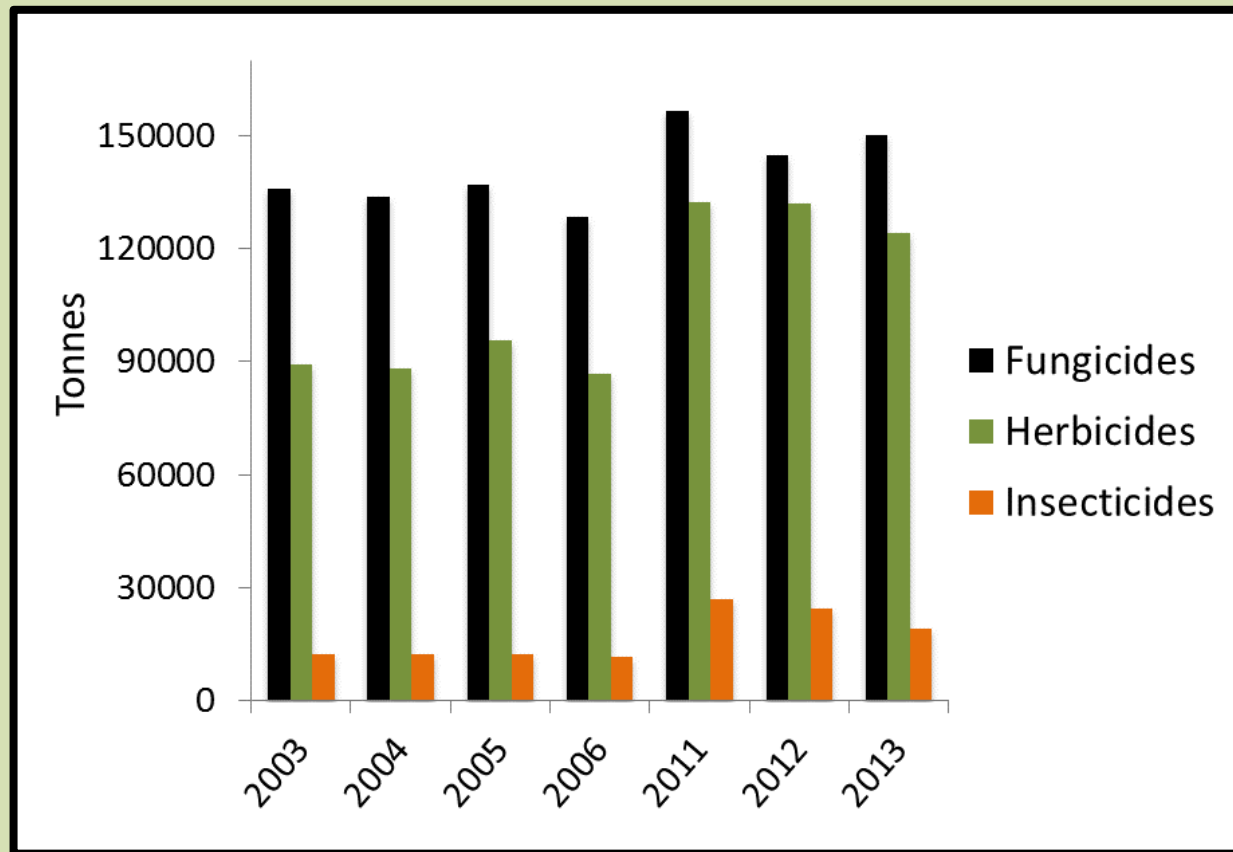
- Detected in: biota (flora and fauna), air, soil, sediments, rivers & streams, even in humans.
- About 38% of EU's total land area is treated with pesticides



## Pesticide sales in EU

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EU: 300,000,000 kg/year – world's highest consumer



# Anthropogenic pressures



## Pesticides not the only ones



- Population expansion
- Consumption of resources
  - Marine
  - Freshwater
  - Terrestrial
- Habitat and biodiversity loss (extinction)
- Ecosystem services loss
- Invasive species



- Land exploitation
- Deforestation
- Degradation of land and habitat loss
- Livestock production
- Intensive agricultural production



- Industrialization
- Urbanization
- Freshwater exploitation
- Pollution
  - Freshwater
  - Marine
  - Air
  - Land
- Ecosystem degradation

# Anthropogenic pressures



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- Land exploitation
- Deforestation

**Pesticides are intentionally released to open fields**

- Loss
- Livestock production
- Intensive agricultural production



- Industrialization
- Urbanization

- Air and water pollution
- Pollution
  - Freshwater
  - Marine
  - Air
  - Land
- Ecosystem degradation



## Legal requirements - pesticides

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PPPR (EC) 1107/2009:

Rec 8:

*“The purpose of this Regulation is to ensure **a high level of protection** of both human and animal health and the environment.... **The precautionary principle should be applied.**”*

Art 2(b,e): *“Residues/products shall not have **any unacceptable effect on the environment.**”* (non-target species, biodiversity and ecosystems)

Annex II 3.8.: no unacceptable effects on bees, no endocrine disruptors

But are these objectives fulfilled?



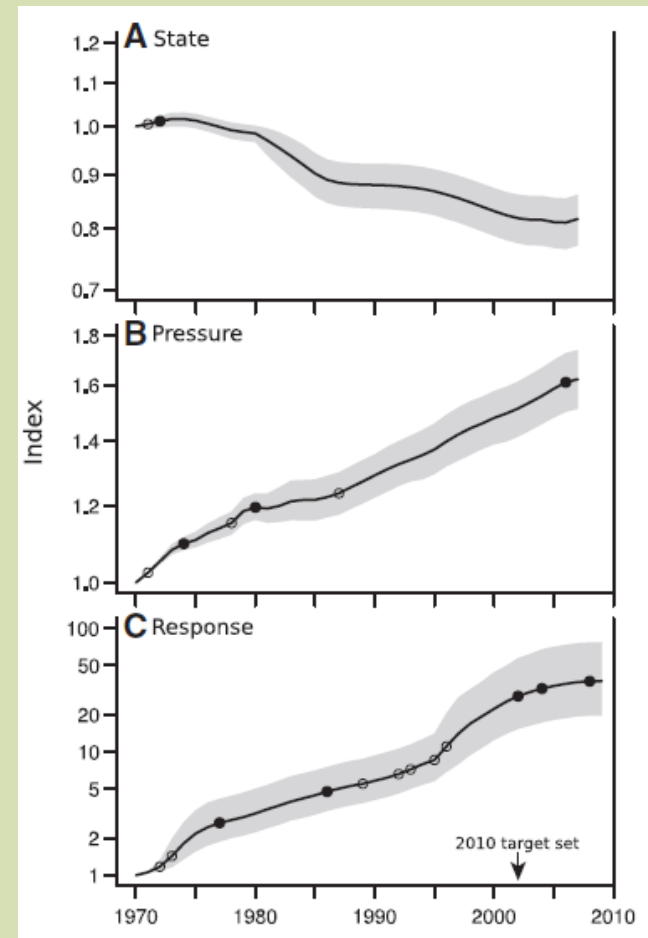
# Accelerating global biodiversity loss

2002 Convention on Biological Diversity: reduction targets by 2010

Study period :1970s-2010

## Indicators

- Declines in population trends
- Increasing pressures
- Policy and management responses are increasing but are not effective



Butchart SHM, Walpole M, Collen B, van Strien A, Scharlemann JPW et al (2010). Global biodiversity: Indicators of recent decline. *Science*, **328**: 1164-1168

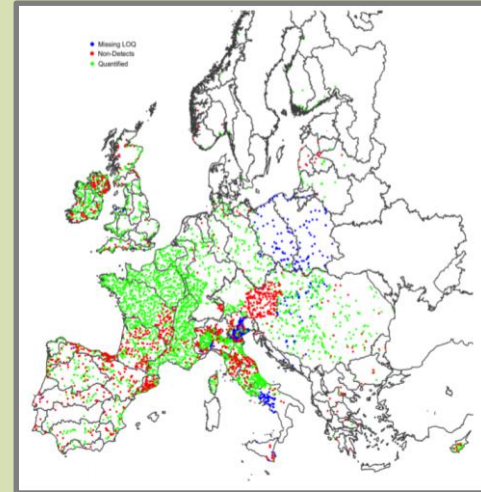




# EU freshwater ecosystems unprotected

## Study - Outline

- 2006-2010 EEA data
- 4000 EU sites; 91 EU rivers
- 223 Organic pollutants
- Fish, invertebrates, algae



### C<sub>max</sub> Vs **Acute Risk** Threshold

- LC50/10

### C<sub>mean</sub> Vs **Chronic Risk** Threshold

- LC50/ 100,1000,50

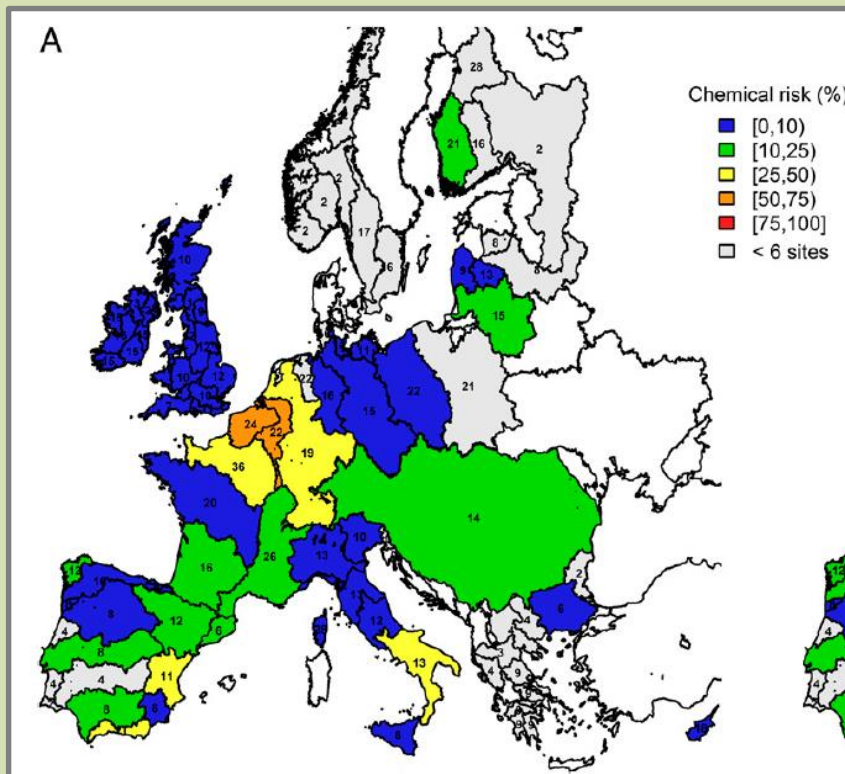
Malaj E, von der Ohe PC, Grote M, Kuhne R et al. (2014). Organic chemicals jeopardize the health of freshwater ecosystems on the continental scale. *PNAS* **111**: 9549-9554



# EU freshwater ecosystems unprotected

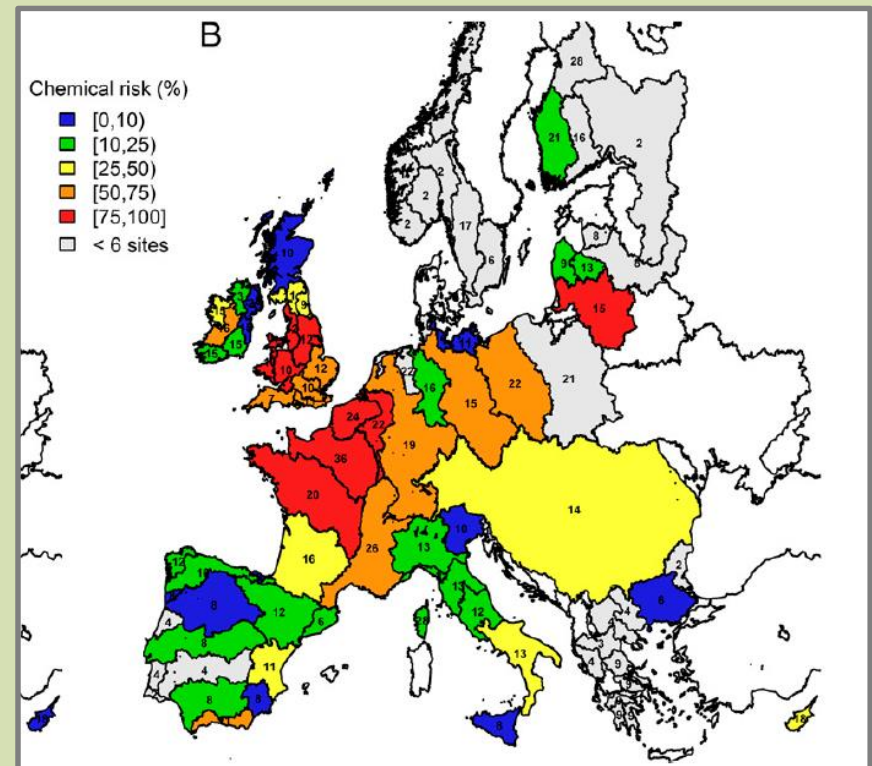
## Acute Toxicity

■ Acute Risk at 14% sites



## Chronic Toxicity

■ Chronic Risk 42% sites

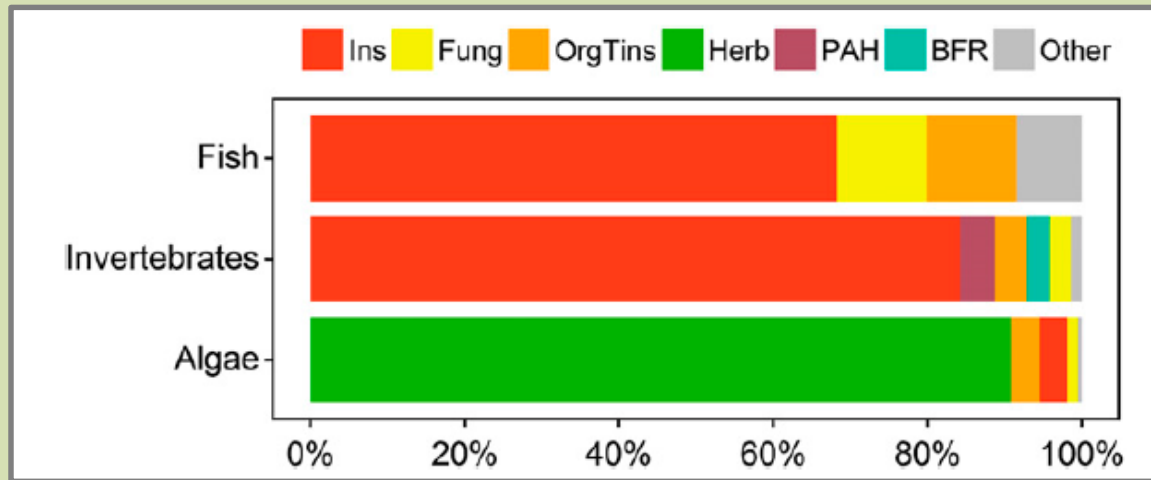


Malaj E, von der Ohe PC, Grote M, Kuhne R et al. (2014). Organic chemicals jeopardize the health of freshwater ecosystems on the continental scale. *PNAS* **111**: 9549-9554



# Pesticides- the underlying cause

## Pesticides - Contribution



■ Fish: 81% insecticides

■ Invertebrates: 87% insecticides

■ Algae: 96% herbicides

■ Chemical risk

■ ↑ Agricultural land

■ ↓ Natural vegetation

Malaj E, von der Ohe PC, Grote M, Kuhne R et al. (2014). Organic chemicals jeopardize the health of freshwater ecosystems on the continental scale. *PNAS* **111**: 9549-9554

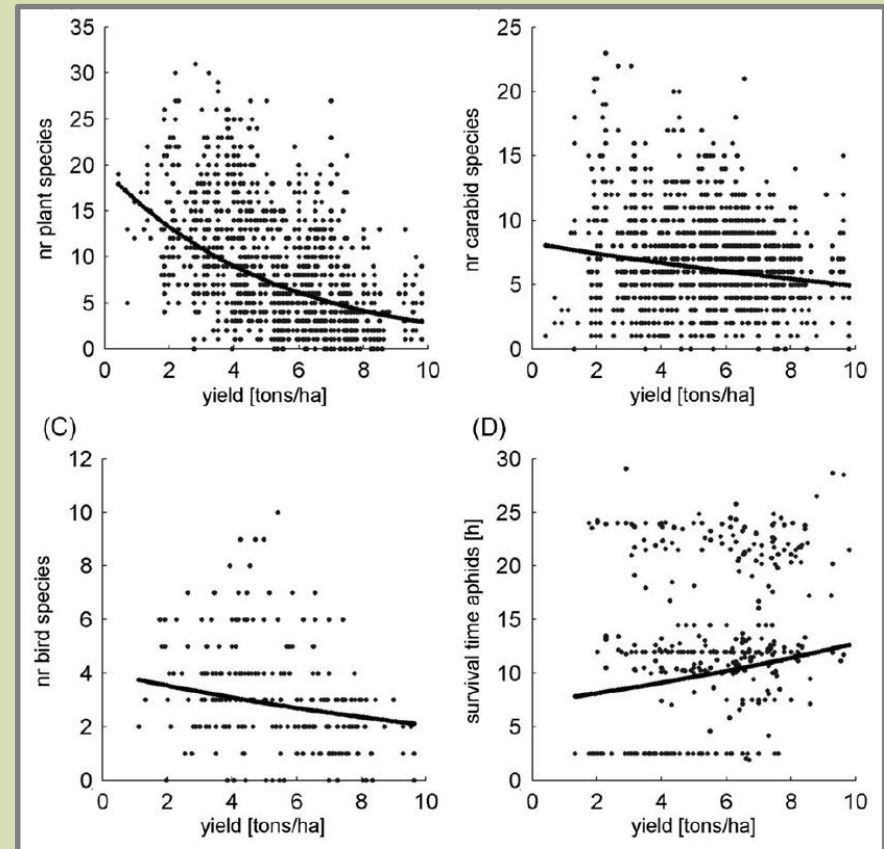


# Pesticide effects on biodiversity

## Study

- 8 EU countries, 9 sites:
  - 30 x 30 up to 50 x 50 km<sup>2</sup>
  - 30 arable farms/site (cereals)
- Indicators:
  - Wild plants, carabids & birds
  - Biological control (aphids survival)
  - Farmers' practises, landscape

## Cereal yield



Geiger F, Bengtsson J, Berendse F, Weisser WW, Emmerson M, et al. (2010). Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. *Basic and Applied Ecology* **11**: 97-105



# Pesticide effects on biodiversity

## Results

	Explanatory variable	Standardized effect	<i>p</i> -value
Wild plants	<i>Mean field size</i>	-0.094	0.014
	% of land under AES	0.149	<0.001
	Frequency of herbicide application	-0.1061	0.003
	Frequency of insecticide application	-0.105	0.013
	Applied amounts of a.i. of fungicides	-0.262	<0.001
Carabids	% of land under AES	0.062	0.012
	Applied amounts of a.i. of insecticides	-0.061	0.001
Birds	Frequency of fungicide application	-0.127	0.017
Biological control	% of land under AES	-0.144	0.002
	Applied amounts of a.i. of insecticides	0.114	0.001

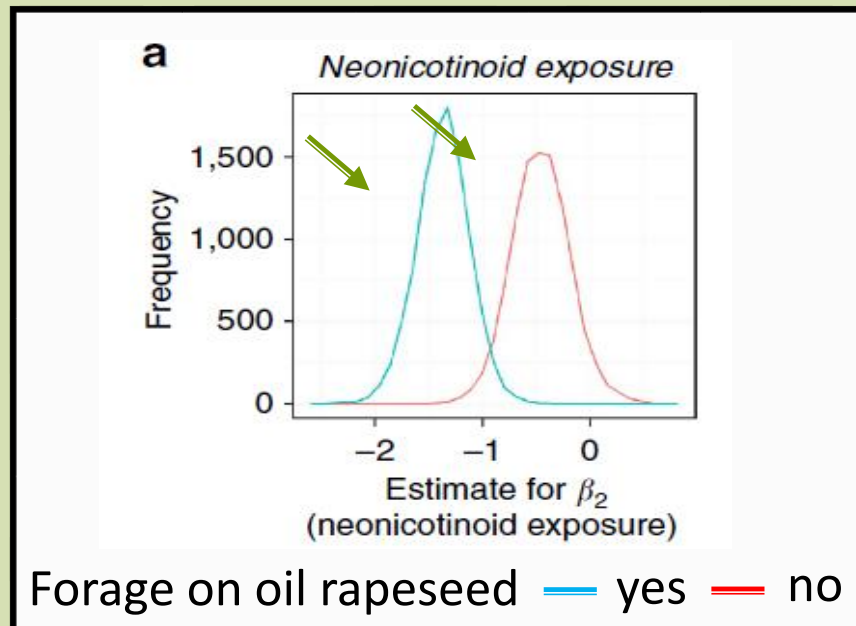
Geiger F, Bengtsson J, Berendse F, Weisser WW, Emmerson M, et al. (2010). Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. *Basic and Applied Ecology* **11**: 97-105



# Impact of neonicotinoids on wild bees

## Study

- 62 wild bee species in UK
- Oilseed rape treated crops
- Data from 1994-2011:
  - 31,818 surveys
  - 4,056 Km<sup>2</sup>



- Other pollinators affected:
  - Butterflies
  - Bumble bees

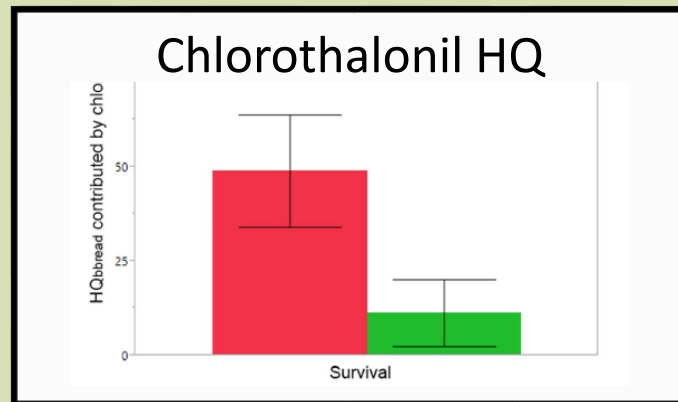
Woodcock BA, Isaac NJB, Bullock JM, Roy DB et al. (2016). Impact of neonicotinoid use on long-term population changes in wild bees in England. *Nature Communications* 7:12459



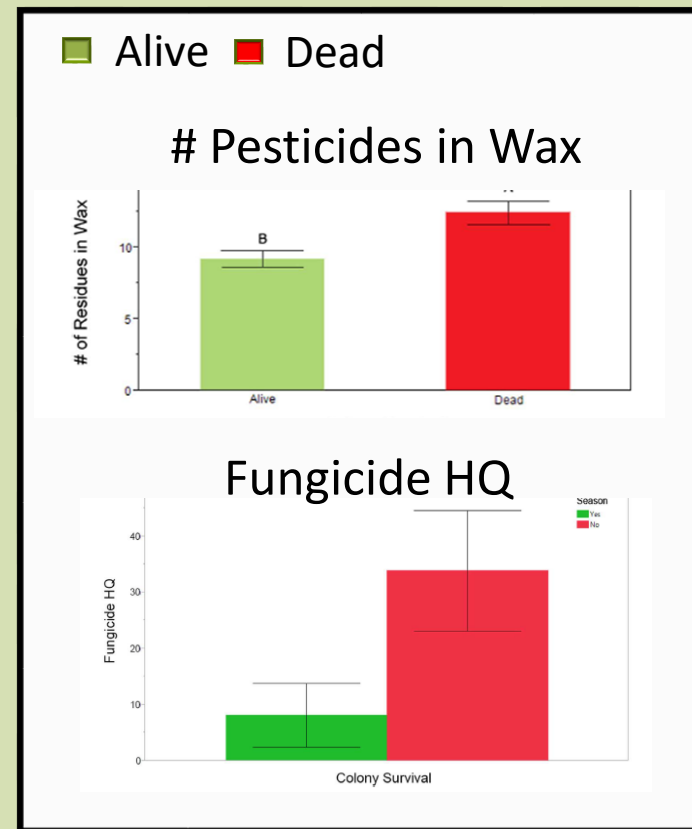
# Bees unprotected from herbicides

## Study

- Pesticides in bee matrices:
  - Bees (13)
  - Beebread (61)
  - Wax (71)
- Hazard Quotient
- Colony Survival



## Bee mortality



Traynor KS, Pettis JS, Tarpy DR, Mullin CA, Frazier JL et al. In-hive pesticide exposome: assessing risks to migratory honey bees from in-hive pesticide contamination in the Eastern United States. *Scientific Reports*, 6:33207





# ERA - Underestimation of harm? Insecticides

## Insecticides

Regulatory Acceptable  
Concentration (RAC) sw/sed

**Vs**

Measured Insecticide  
Concentrations (MICs) n=23

44.7% MICs > RACs

55% of sites (n=1566)

- Limited monitoring data
- > Environmental Quality Standards (WFD)
- 90% with mixtures

**Insecticide are the main drivers of biodiversity loss**

Stehle S, Schulz R (2015). Pesticide Authorization in the EU – environment unprotected? *Environ Sci Pollut Res* **22**: 19632-19647





## ERA – Underestimation of harm?

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### Fungicides

- Predicted Environmental Concentrations (PECs) *FOCUS scenarios*
- Measured Fungicide Concentration (MFC) sw/sed
- Are PECs worst case scenarios? *No, its an underestimation*

	Seawater	Sediment
Step 3	<b>15%</b> PEC <sub>sw</sub> < MFC <sub>sw</sub>	<b>67%</b> PEC <sub>sed</sub> < MFC <sub>sed</sub>
Step 4	<b>28%</b> PEC <sub>sw</sub> < MFC <sub>sw</sub>	<b>76%</b> PEC <sub>sed</sub> < MFC <sub>sed</sub>

**Herbicide permitted levels unsafe**

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Knäbel A, Meyer K, Rapp J, Schulz R, (2014). Fungicide field concentrations exceed FOCUS surface water predictions: Urgent need of model improvement. Environ Sci Technol, **48**, 455-463.

# Environment Unprotected - Recapitulate

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- Pressures are increasing steadily
- Biodiversity loss and ecosystem degradation is increasing
- Real-time monitoring is missing
- Scenarios fail to predict worst-case and the environment remains unprotected
- Long term, chronic effects of ERA are underestimated



## Final remarks

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- Urgent need to reduce pesticide environmental exposure
- Europe has to adopt non toxic alternatives for agriculture
- Environmental Risk Assessment must have a truly conservative, ecological-based approach
- Abandon the concept that ecosystems always recover
- EU models should consider low dose, long term effects. Reproduction impairment, endocrine disruption and chronic effects on species should be identified
- EU should ban completely the use of dangerous and already banned pesticides (MS derogations) and prohibit exports



*Thank you!*