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# Pesticides and their effect on terrestrial biodiversity



Pesticide  
Action  
Network  
Europe

15th May 2019, Brussels



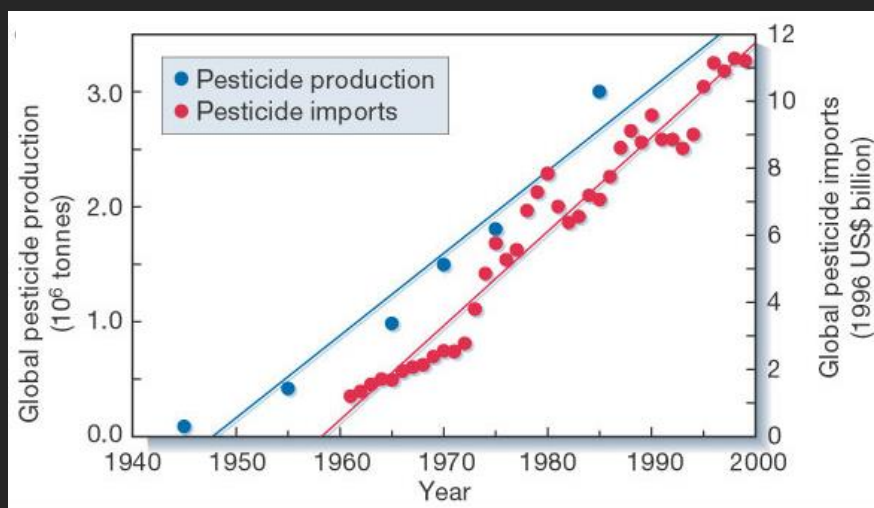
175 million hectares are used by agriculture  
= 40 % of the EU-28 land area (2013).

Two thirds of the agricultural land is used for the  
cultivation of crops >25% of the EU-28 area.

## PESTICIDES IN THE EU

- Approx. 380.000 t active ingredients / year.
- On average > 3 kg of a.i. / ha / year.
- Ca. 500 molecules registered in > 1000 (?) products.
- Pesticides influence fundamental biological processes such as nerve conduction, photosynthesis, respiration, protein synthesis, ....

## DEVELOPMENT OF PESTICIDE USE

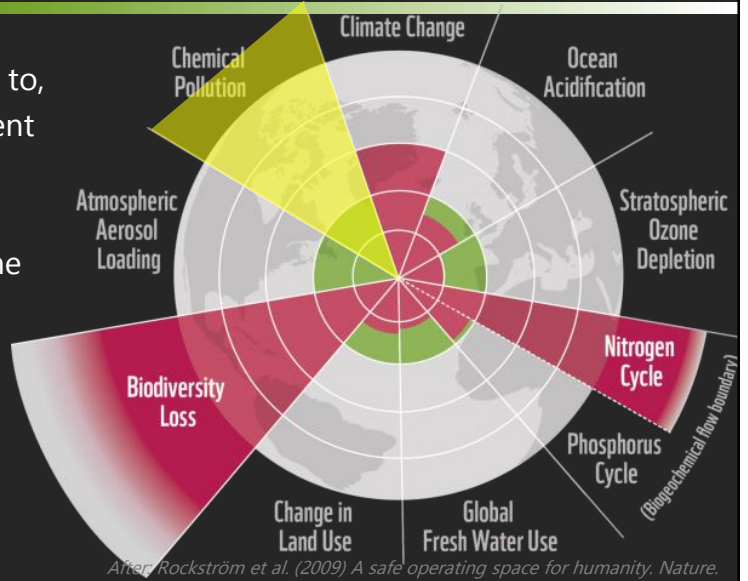


Tilman et al. (2002). *Agricultural sustainability and intensive production practices*. *Nature*.

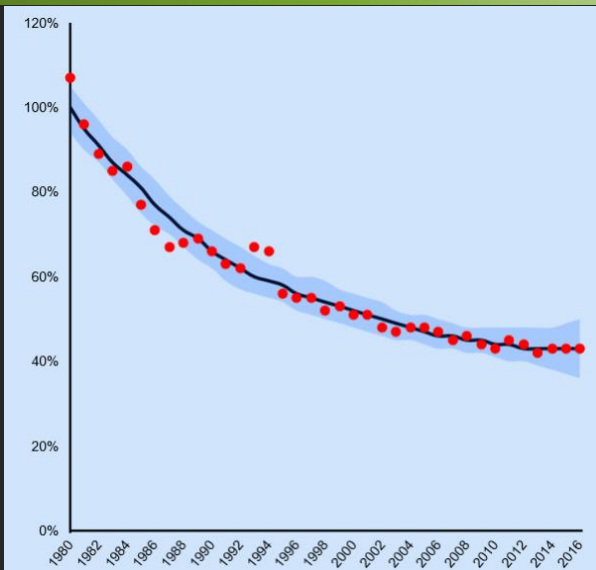
# PLANETARY BOUNDARIES

For example amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disruptors, heavy metal and nuclear waste in the global environment, or the effects on ecosystem and functioning of Earth system thereof.

Status: To be determined



# FARMLAND BIRDS IN EUROPE

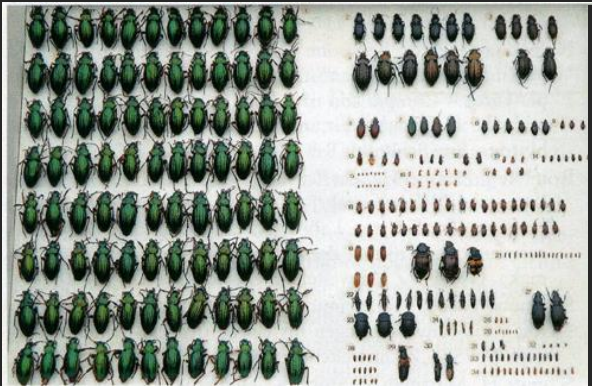


Population trend:

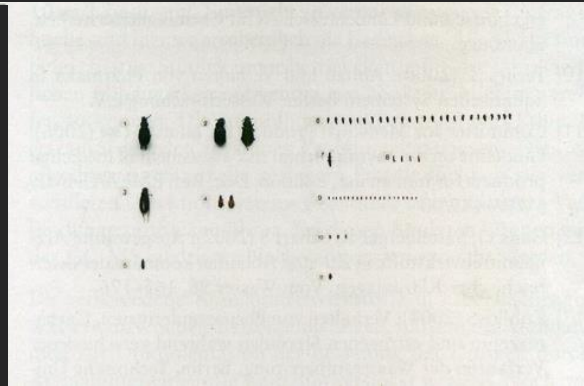
- Decline: 24
- Increase: 7
- Stable: 5
- no trend: 3

European Bird Census Council (EBCC) 1980-2016 (ebbc 2016).

# INSECTS



July 1951



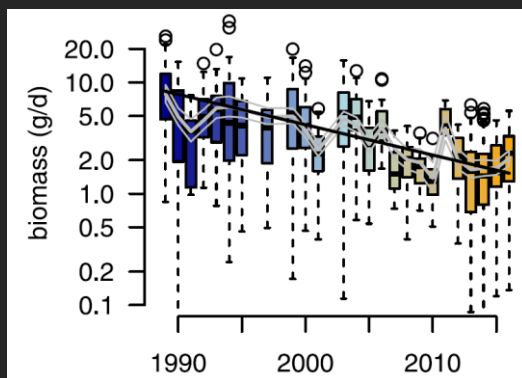
July 1981

Beetle community trapped in winter wheat close to Kiel (N-Germany). Typical species numbers and abundances of a pitfall trap left open for four weeks.

*Heydemann & Meyer (1983) Auswirkungen der Intensivkultur auf die Fauna in den Agrarbiotopen. Landespflege und Landwirtschaft*

# INSECT BIOMASS DECLINE

Up to 82 % reduction of flying insect biomass in 27 years in conservation areas in the agricultural landscape of Germany (1989-2016).



*"In light of previously suggested driving mechanisms, our analysis renders two of the prime suspects, i.e. landscape and climate change, as unlikely explanatory factors for this major decline in aerial insect biomass in the investigated protected areas."*

*Hallmann et al. (2017). More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PLoS one.*

## BIODIVERSITY DECLINE

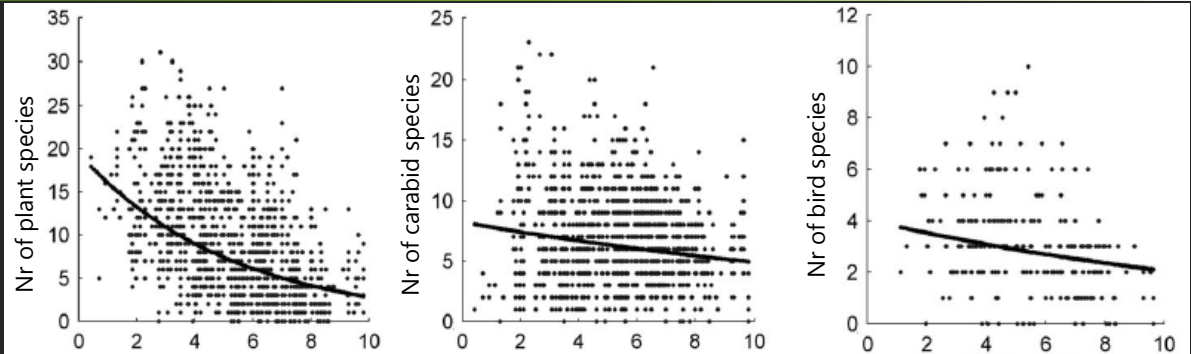
- Climate change
- Invasive species
- Habitat reduction and fragmentation
- Agricultural intensification (reduction of crop rotation and fallows, increase in fertiliser application, autumn sowing, ...)
- Pesticides

## MULTIPLE CAUSES

- European study (9 countries), 30 farms / country.
- Recording of biodiversity in wheat fields.
- 13 parameters of intensification measured: Field size, % of arable crops in landscape, amount of fertiliser, crop rotation, ploughing, ... & number and amount of pesticide applications.

*Geiger et al. (2010). Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. Basic and Applied Ecology.*

# PESTICIDES



Yield in t / ha as a measure for intensification

Number of applications and amount of pesticides were the only significant negative response variables for all groups.

# PESTICIDE EXPOSURE





## APPLICATION SEQUENCES

Number of pesticides used per season (treatment index)  
in Germany (2014):

Wheat: **4**   Potato: **13**   Vineyards: **20**   Fruit orchards: **34**

*(PAPA-Datenbank, JKI 2018)*

# PESTICIDES IN AGRICULTURAL SOIL

Soil analysis in Czech Republic:

- 53 pesticides and 15 metabolites in wheat fields in November.
- 50% of soil samples with > 5 pesticides.

EU registration of pesticides with long half-lives in soil (examples):

- Fluopyram Fungicide (Bayer) 309 days
- Chlorantraniliprol Insecticide (DowDupont) 597 days
- Flutriafol Fungicide (BASF) 1358 days

*Hvězdová et al. (2018). Currently and recently used pesticides in Central European arable soils. Science of the Total Environment.*

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**"pseudo-persistent"  
or  
"continuously present"**





## OFF FIELD

- Entry of pesticides in field margins, hedges, meadows, fallows and flower strips ....

Drift and over-spray

*Hahn, Lenhardt & Brühl (2014) Characterization of field margins in intensified agro-ecosystems – why narrow margins should matter in terrestrial pesticide risk assessment and management. Integrated Environmental Assessment and Management.*

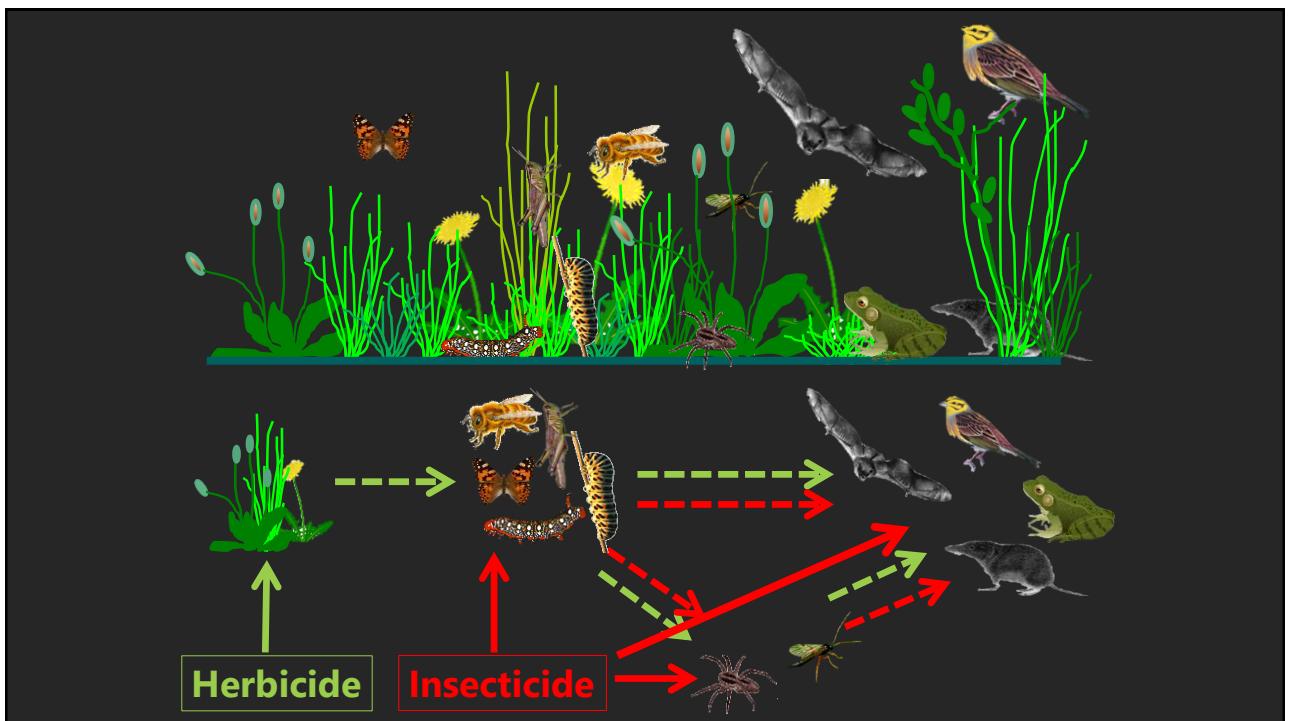
## PESTICIDE RESIDUES

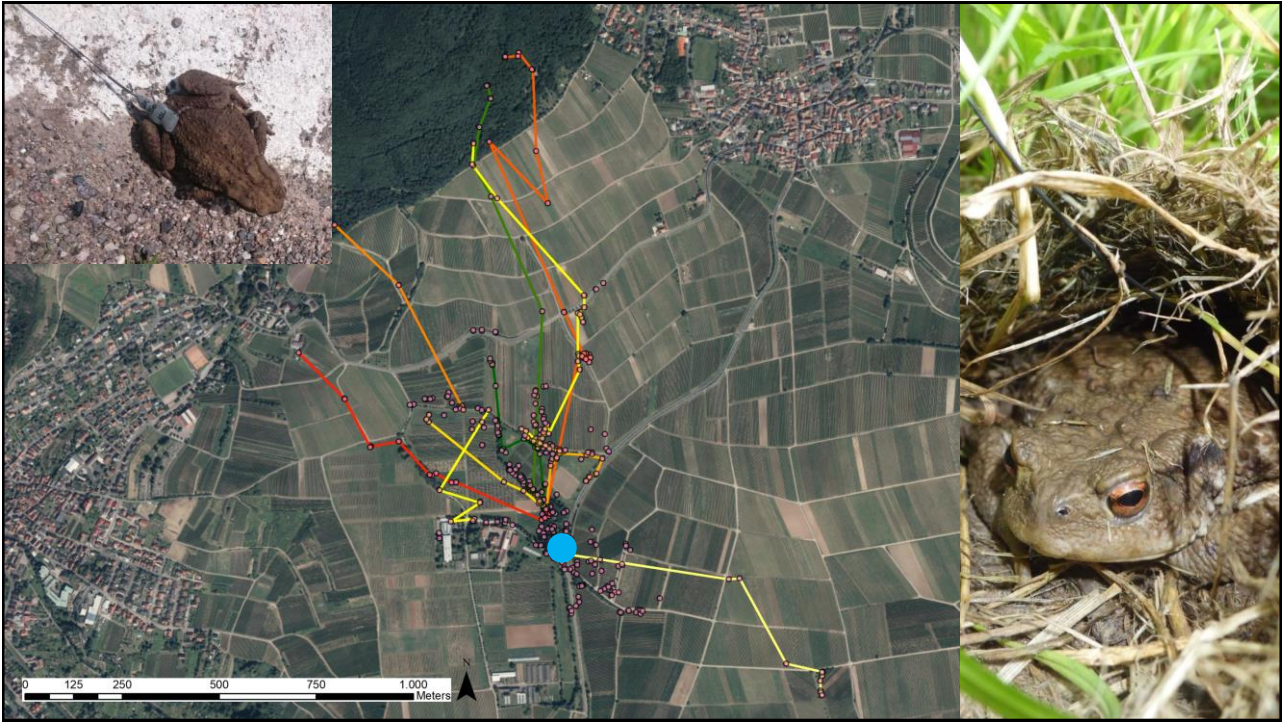
- Residues in flowering plants in field margins reveal similar levels as crop plants (oil-seed rape).

*Botías et al. (2015). Neonicotinoid residues in wildflowers, a potential route of chronic exposure for bees. Environmental Science & Technology.*

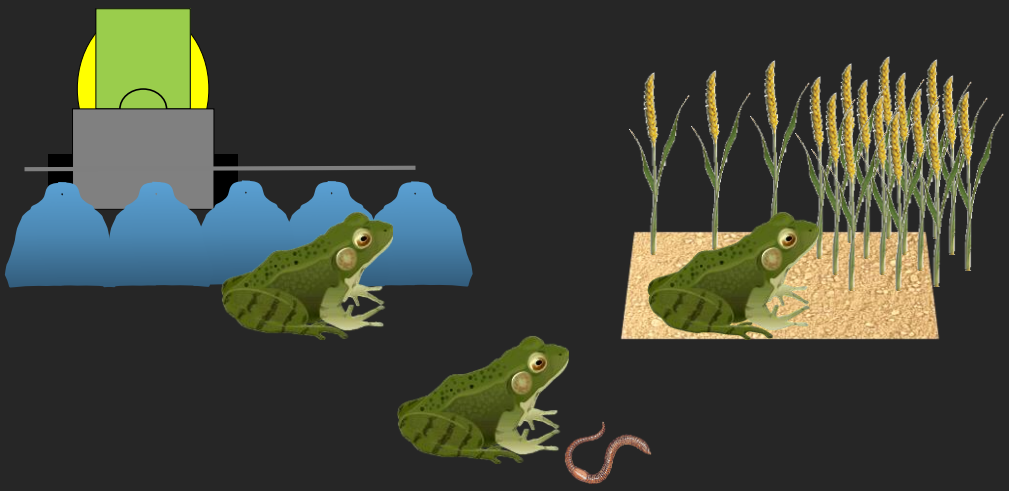
- Residue levels are high enough to result in acute mortality in insects.

*Botías et al. (2016). Contamination of wild plants near neonicotinoid seed-treated crops, and implications for non-target insects. Science of the Total Environment.*



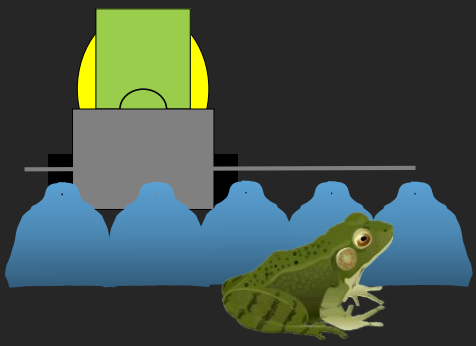


# TERRESTRIAL PESTICIDE EXPOSURE



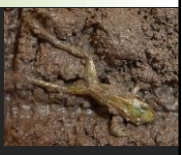
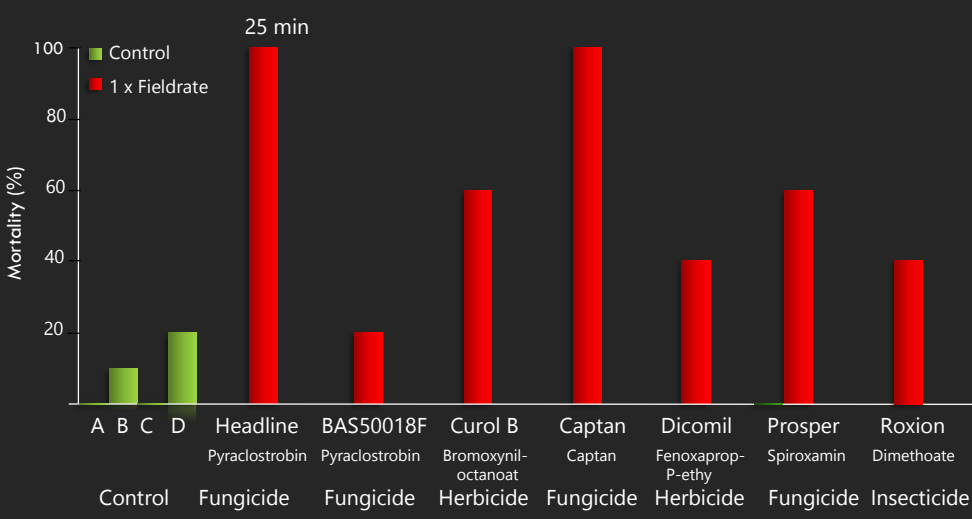
*Brühl, Pieper & Weber (2011) Amphibians at risk? - Susceptibility of terrestrial amphibian life stages to pesticides. Environmental Toxicology and Chemistry.*

# TERRESTRIAL PESTICIDE EXPOSURE



direct, acute effect

# OVERSPRAY MORTALITY



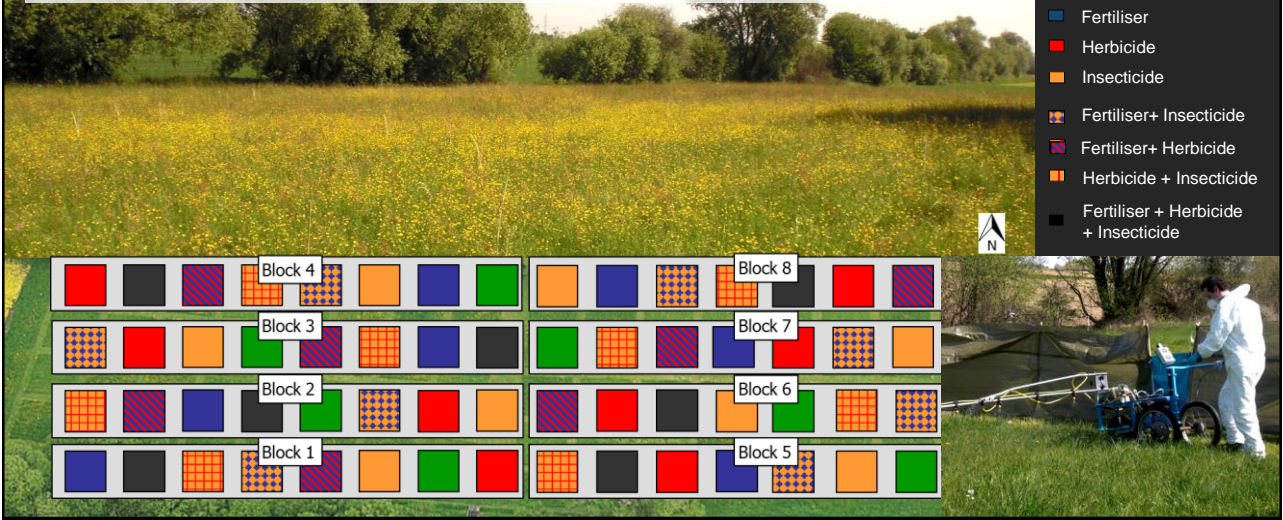
Brühl et al. (2013) Terrestrial pesticide exposure of amphibians: An underestimated cause of global decline? Scientific Reports, 3: 1135.

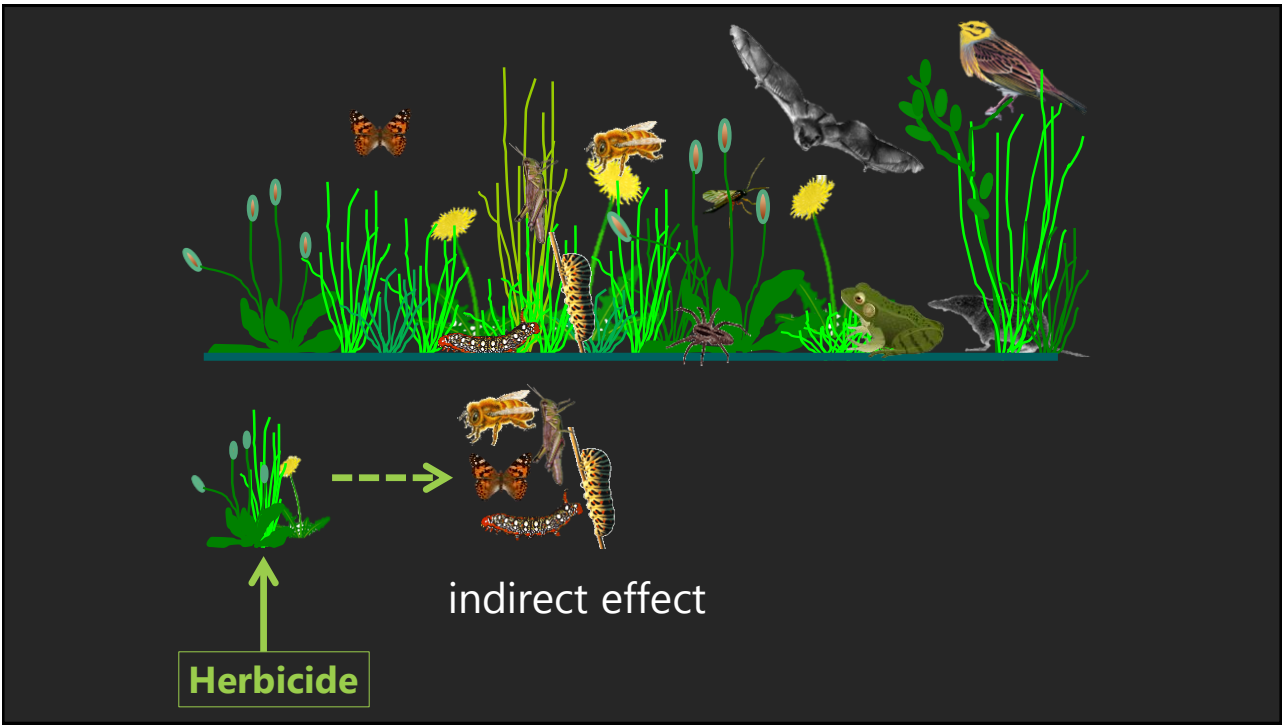
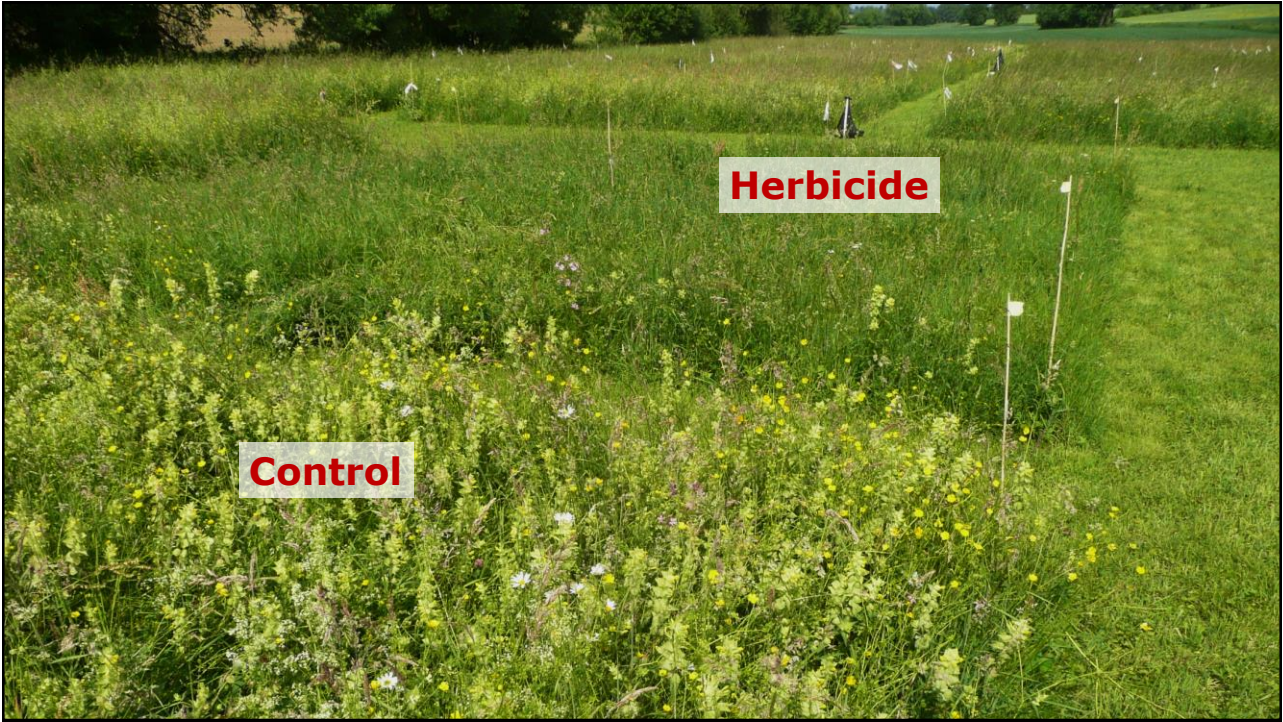


# PLANT COMMUNITIES

Schmitz, Hahn & Brühl (2014). Agrochemicals in field margins – An experimental field study to assess the impacts of pesticides and fertilizers on a natural plant community. *Agriculture, Ecosystems & Environment*.

- Control
- Fertiliser
- Herbicide
- Insecticide
- Fertiliser+ Insecticide
- Fertiliser+ Herbicide
- Herbicide + Insecticide
- Fertiliser + Herbicide + Insecticide







## BUTTERCUP FLOWERS

- Reduced food availability for flower visiting insects.
- 117 flower visiting insect species were recorded in flowers of *R. acris*.
- Including specialists like the buttercup scissor-bee *Chelostoma florissomnis*.

Weiner, Werner, Linsenmair & Blüthgen (2011) Land use intensity in grasslands: Changes in biodiversity, species composition and specialisation in flower visitor networks. *Basic and Applied Ecology*.

# ENVIRONMENTAL RISK OF PESTICIDES

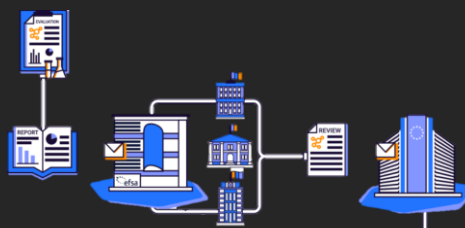


## APPROVAL & AUTHORISATION

EU pesticide laws are the strictest in the world.

An active substance is only approved by the European Commission after a rigorous and lengthy (> 3 years) science-based assessment to ensure its use is safe. For this purpose, a complete dossier of studies must be submitted addressing the comprehensive data requirements which are set at EU level by specific regulations.

## How Europe ensures pesticides are safe



# ENVIRONMENTAL RISK OF PESTICIDES


- Active molecules and products are evaluated. They are applied in sequences and mixtures.
- Only direct effects are included in the assessment. Indirect effects distort food webs.
- In-field environmental effects are not assessed. This concerns more than 25 % of the terrestrial land area of the EU-28.



# ENVIRONMENTAL RISK OF PESTICIDES

- Active molecules and products are evaluated when they are applied in sequences and mixtures.
- Only direct effects are evaluated. Indirect effects are not assessed. This is a major gap in the assessment of the terrestrial land area of

**Pesticide use is not correctly evaluated and therefore not safe for the environment.**



**Thank you !**

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