

# Long-term monitoring of pesticides in air and atmospheric deposition in Sweden

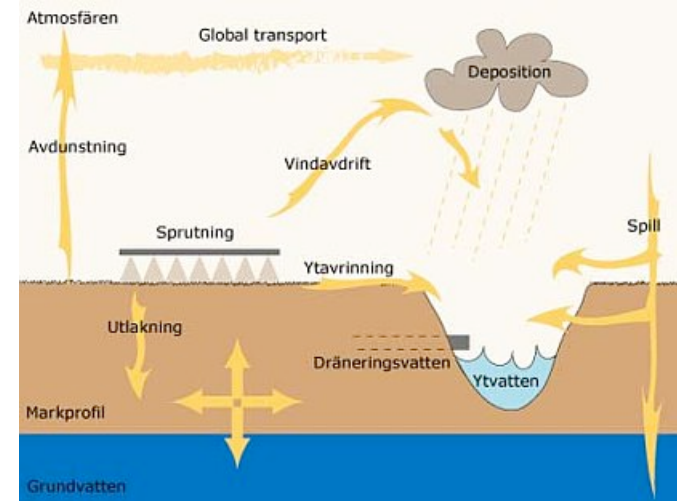
Jenny Kreuger, Elin Paulsson, Ove Jonsson & Therese Nanos

Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden

*Pesticide Behaviour in Soils, Water and Air  
York, UK 30 August – 1 September 2017*

# Background

- Long-term monitoring of environmental fate of pesticides in Sweden since 2002
  - Main focus on surface water and groundwater
  - To a lesser extent, also monitoring of pesticides in atmospheric deposition and in air



# Sampling sites



- Sampling sites located jointly with other international/national atmospheric monitoring programs (e.g. EMEP)
- Located in rural background areas, surrounded by forests, >1 km from treated fields

# Methods - rain

- Event related sampling using a bulk sampler (a stainless steel funnel, area 0.5 m<sup>2</sup>, above a fridge)
- Ca 12-15 samples/season
- Ca 130 pesticides analysed today
- Start in 2002 at Vavihill and in 2009 at Aspvreten
- Main growing season
  - From 2009 April-October
  - Previously May-June + October





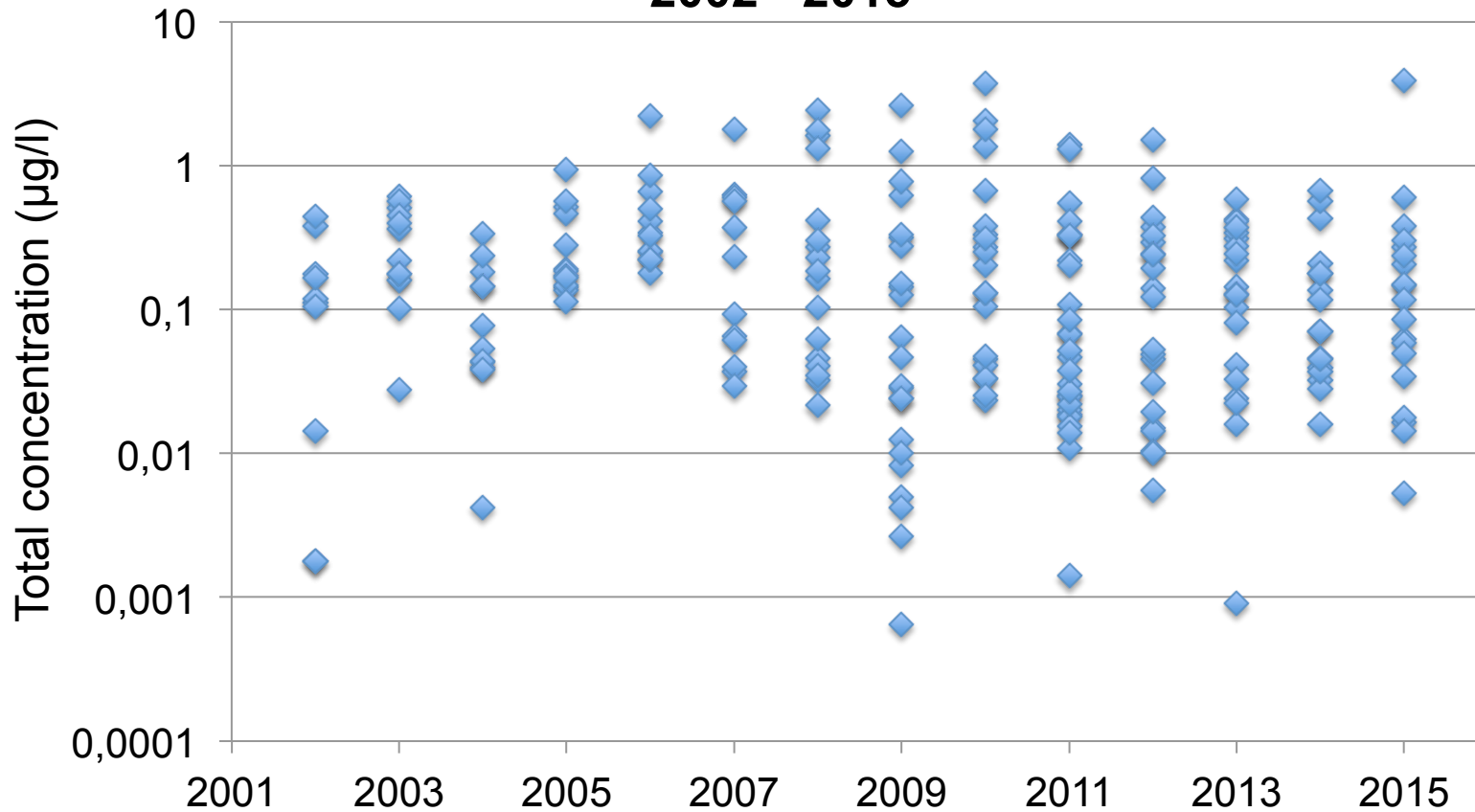
## Methods - air

Air samples collected

- At fixed intervals using a high-volume pump (ca 550 m<sup>3</sup>/day)
- Using pre-cleaned cartridges with quartz fiber filter and PUF/XAD/PUF
- Sampling intervals 5-7 days
- Ca 10 samples/season
- Ca 60 pesticides analysed
- Started in 2009 at Vavihill

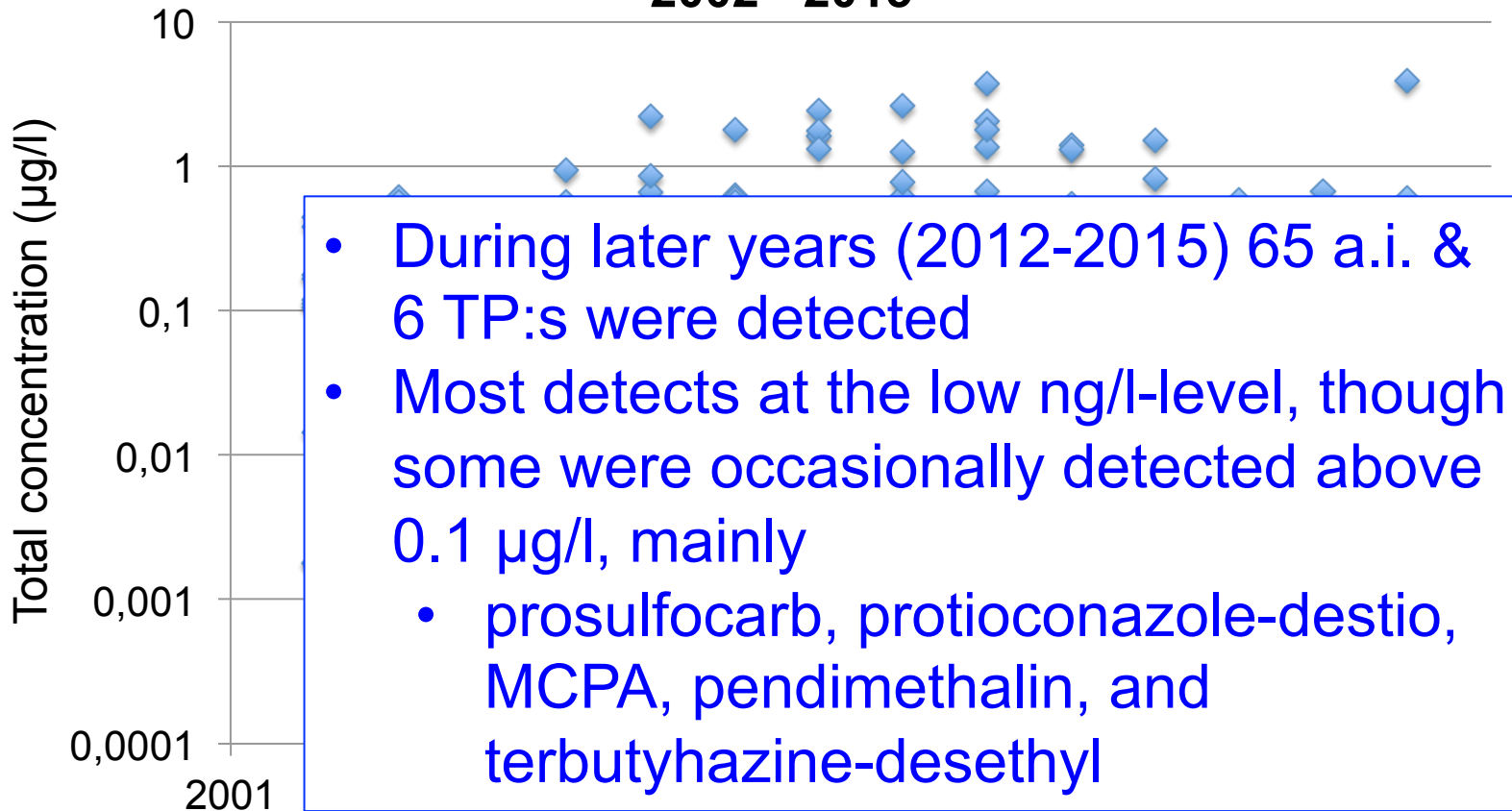


## Vavihill (south) - Total concentration per sample 2002 - 2015



*Max total concentration 3.9 µg/l in a sample from October 2015,  
with prosulfocarb constituting the major part (3.8 µg/l)*

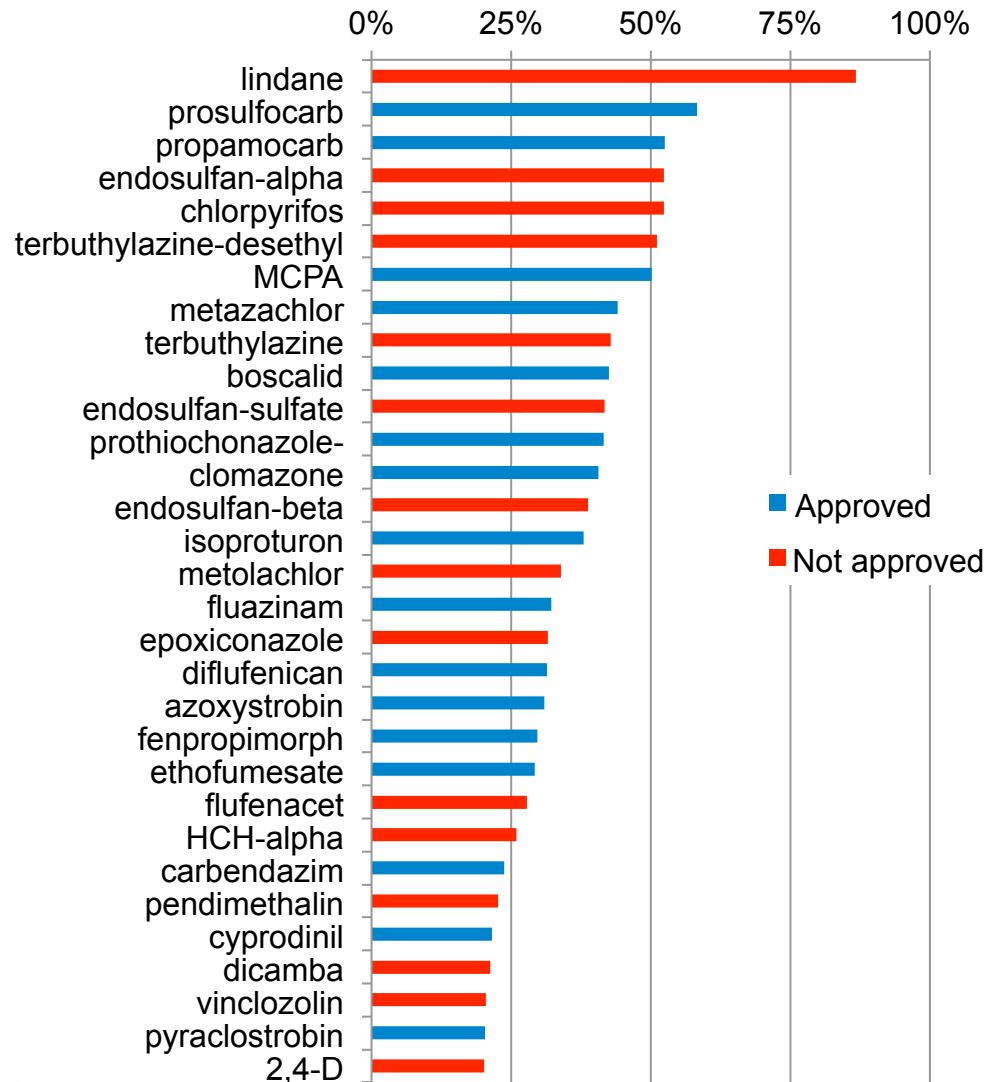
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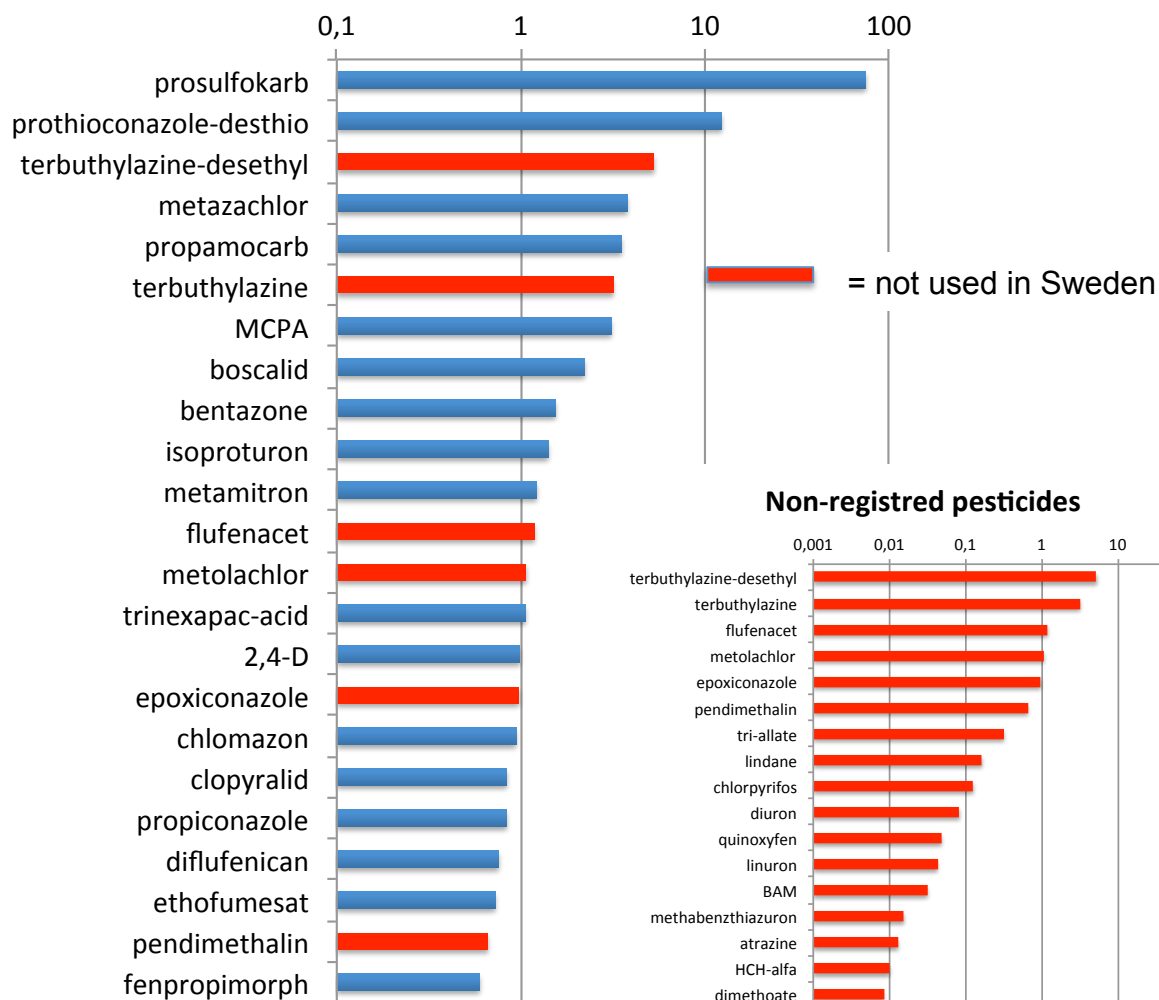
## Detection frequency in rainwater at Vavihill (south) during recent years 2012-2015

Of those pesticides detected in  $\geq 20\%$  of the samples – ca 50% were not used in Sweden during the investigation period (lindane, endosulfan, chlorpyrifos, terbuthylazine, metolachlor, epoxiconazole, flufenacet, dicamba, vinclozolin)

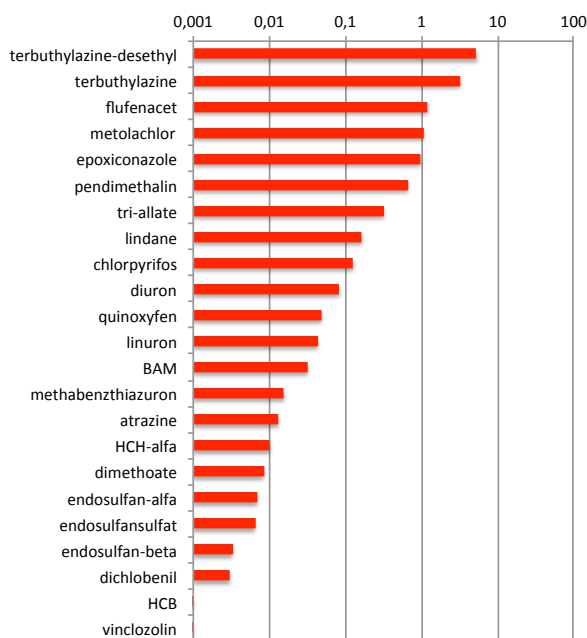




## Average deposition 2012-2015 ( $\mu\text{g}/\text{m}^2 \cdot \text{year}$ )



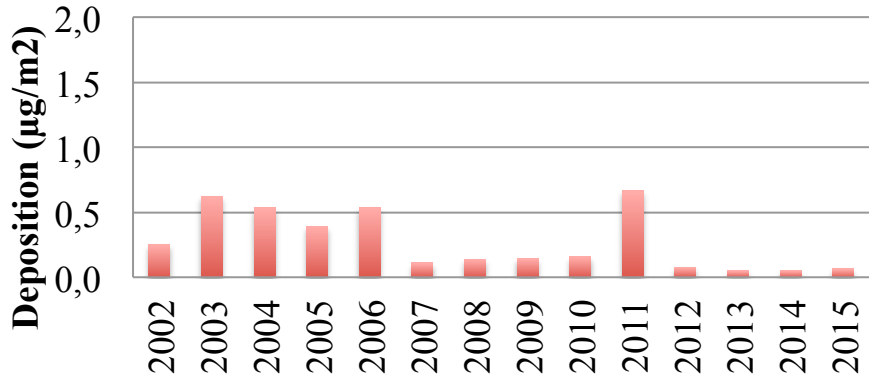
### Non-registered pesticides



Atmospheric deposition at Vavihill in southern Sweden 2012-2015 (April-October)

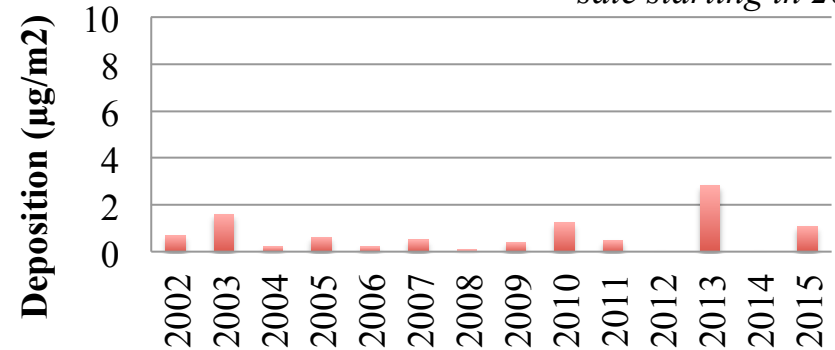
- Herbicides dominate, followed by fungicides
- Also pesticides not registered for use in Sweden (red bars) contribute to the total load

### lindane

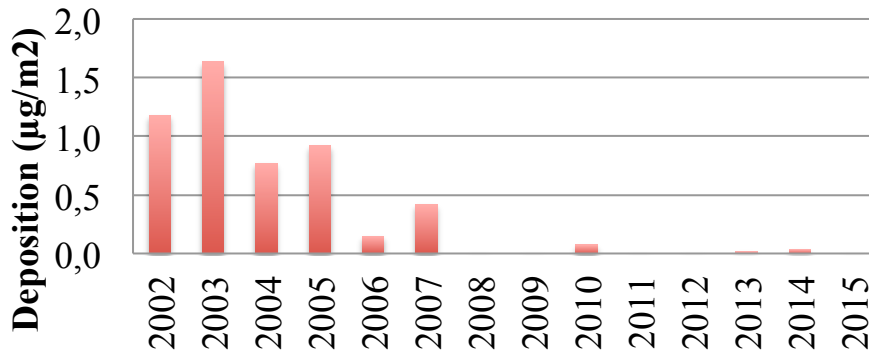


### 2,4-D

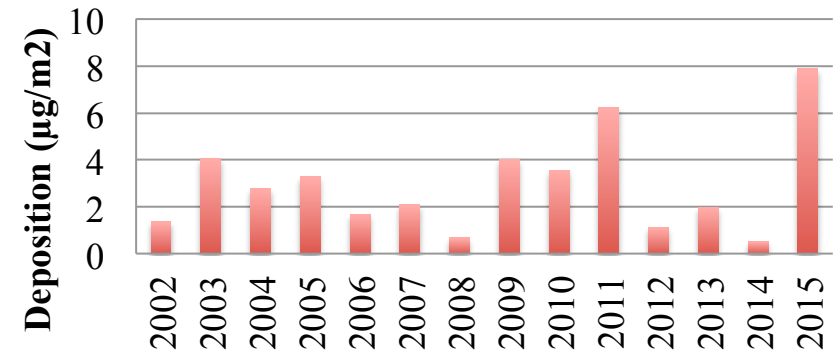
*Now registered, with sale starting in 2015*



### atrazine

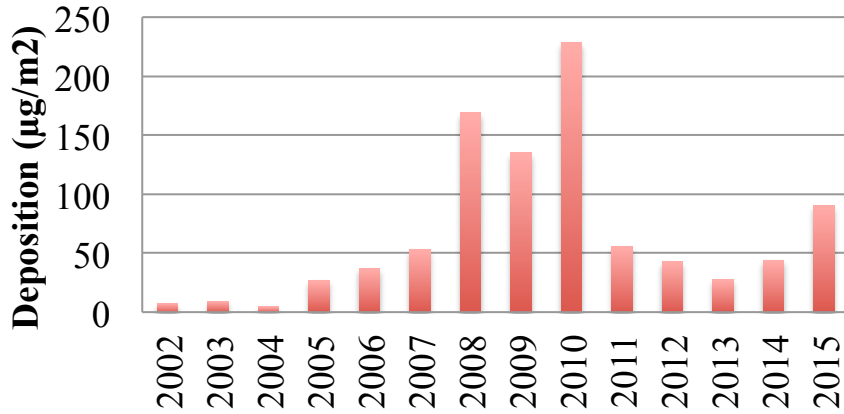


### terbuthylazine

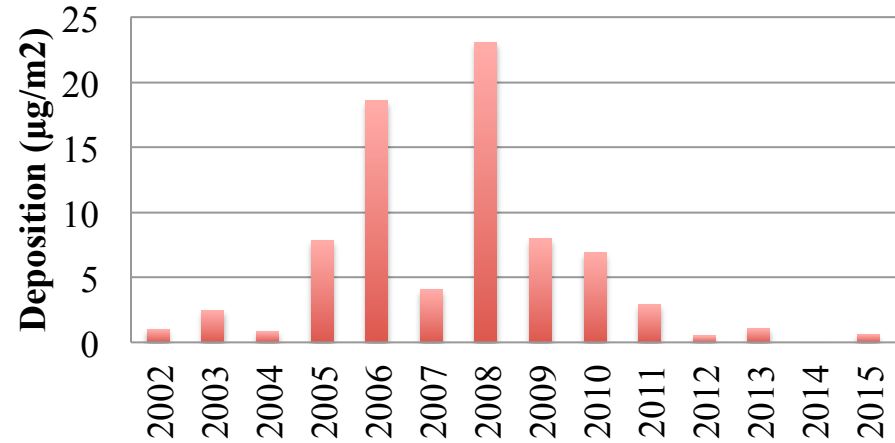


Yearly  $\Sigma$  3-month deposition ( $\mu\text{g}/\text{m}^2$ ) 2002-2015 for pesticides not used in Sweden  
Banned within the EU (left) and approved within EU (right)

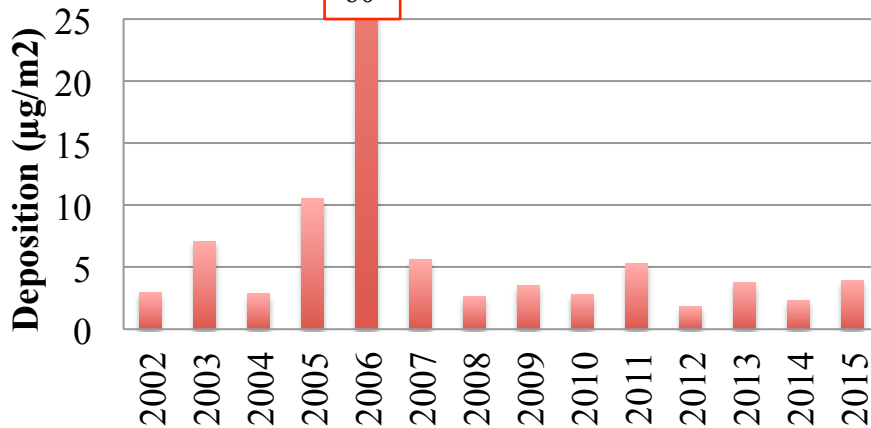
### prosulfocarb



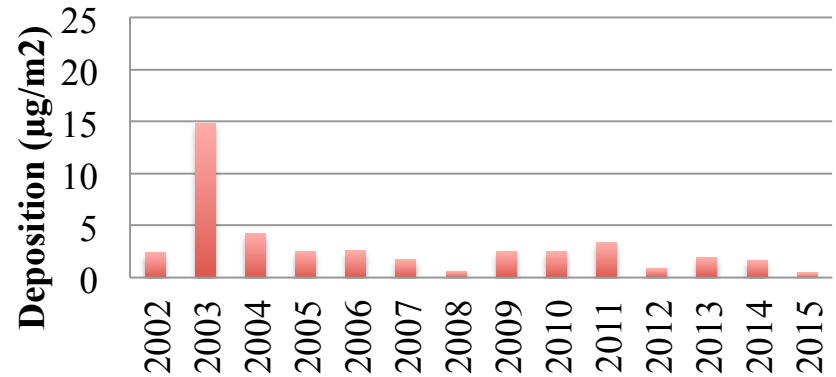
### pendimethalin (banned 2008)



### MCPA



### isoproturon (banned 2012)

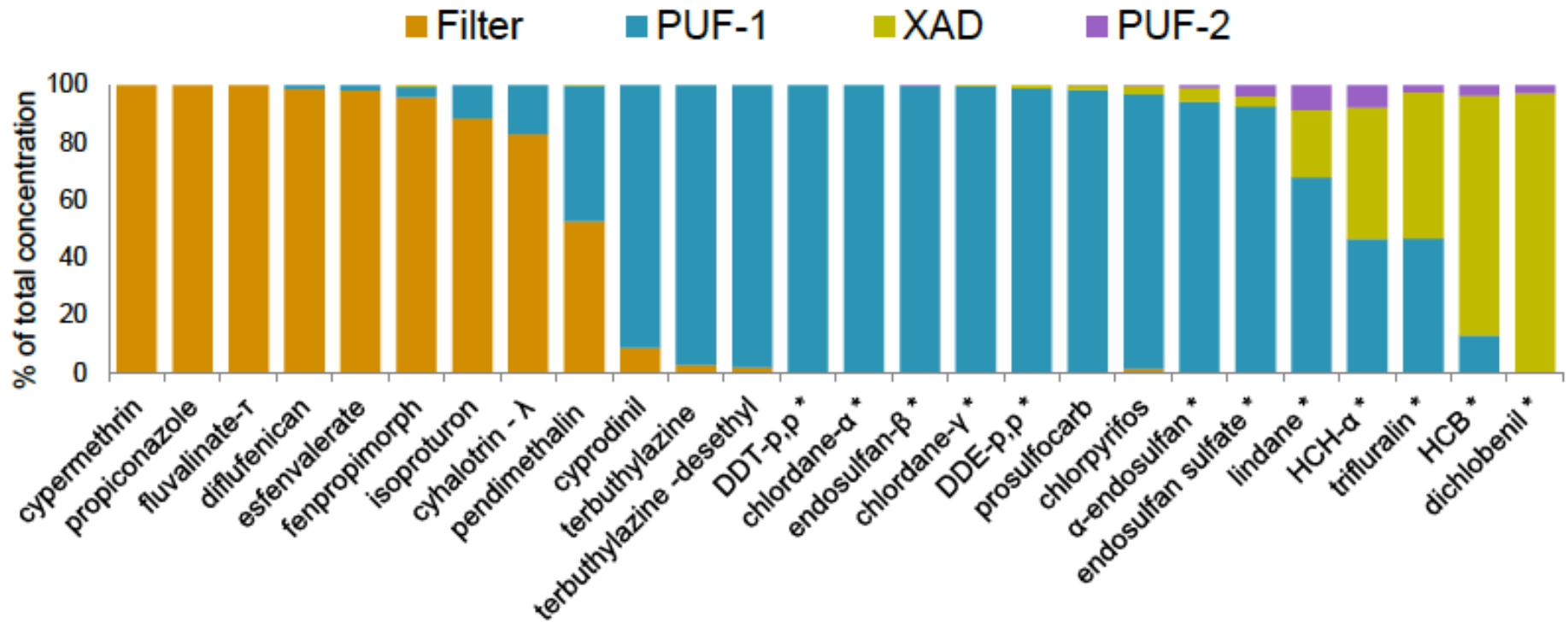


Yearly  $\Sigma$  3-month deposition ( $\mu\text{g}/\text{m}^2$ ) 2002-2015

Pesticides used in Sweden (left) and for pesticides banned during the period (right)

# Air samples - distribution between filter, PUF and XAD

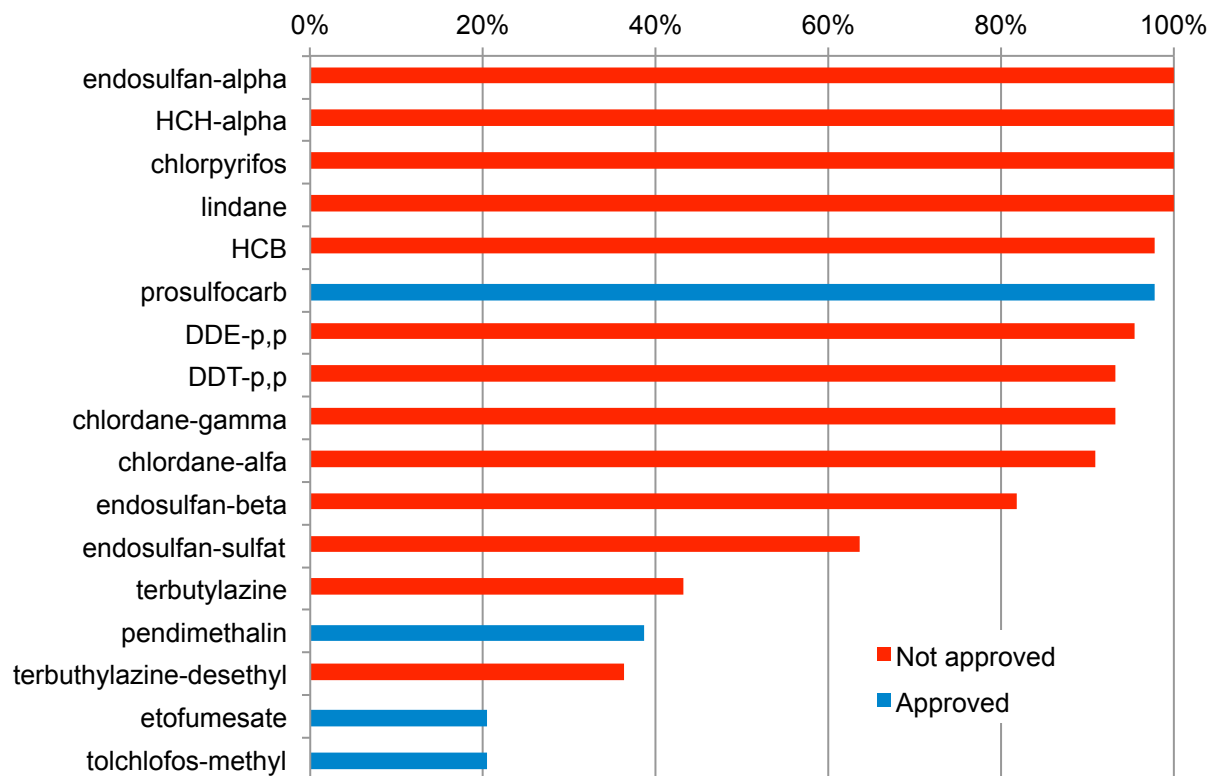
for 26 pesticides detected in >20% of the air samples (n = 34)



- PUF breakthrough (> 30%) for dichlobenil, HCH-a, HCB and trifluralin.
- However, only 4% of total pesticide concentration found in XAD and PUF-2

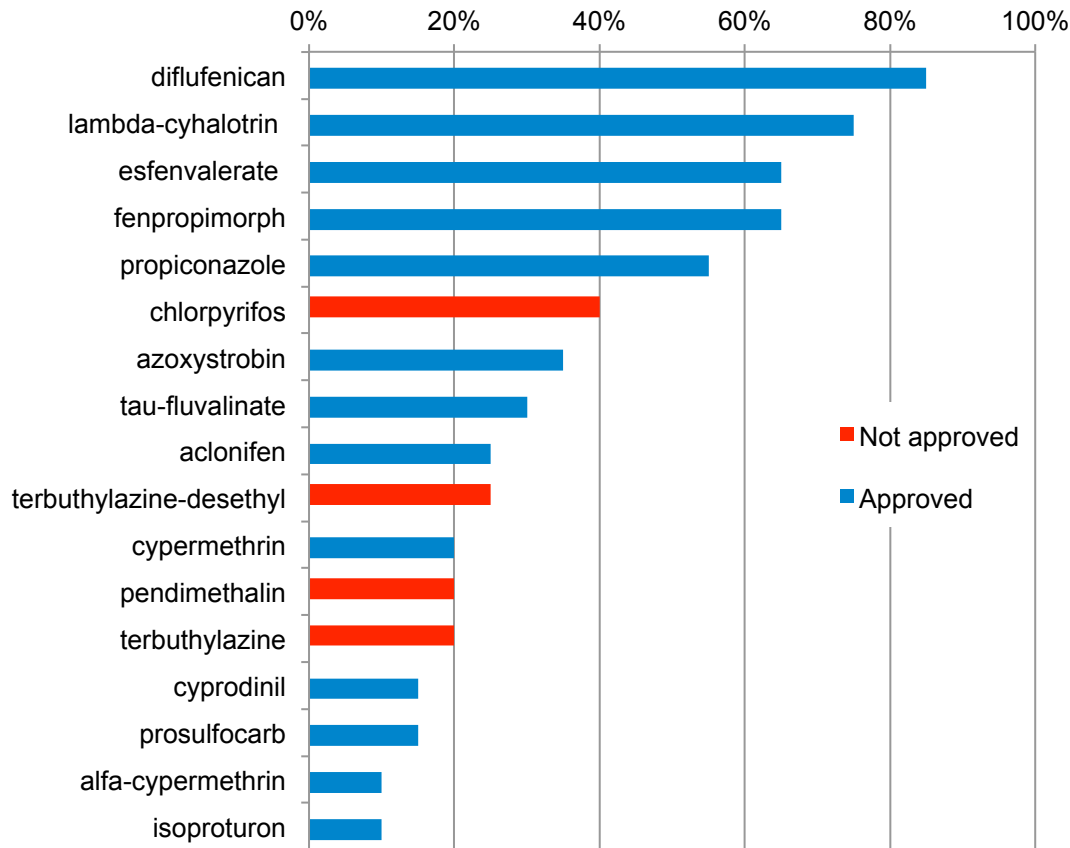
\* Substances not approved for use within EU at the time of sampling

# Detection frequency in air (adsorbent, PUF-1) 2012-2015



- A total of 31 a.i. and 5 TP:s
- Majority of pesticides detected in the gas phase are not approved for use within Sweden, many not even within the EU
- Most concentrations at low levels ( $< 0.1 \mu\text{g}/\text{m}^3$  air), mainly prosulfocarb detected above this level (max.  $30 \mu\text{g}/\text{m}^3$  air)

# Detection frequency in air (filter) 2012-2015



- Majority of pesticides detected in the particulate phase are approved for use within Sweden
- Most concentrations at low levels ( $< 0.1 \mu\text{g}/\text{m}^3$  air), mainly fenpropimorph detected above this level (max.  $0.8 \mu\text{g}/\text{m}^3$  air)

# Conclusions

- Currently used pesticides are regularly detected at ng/l-levels in rainwater, with occasional µg/l-level findings
- A larger number of pesticide detected during spring/early summer, however higher concentrations were detected during fall (mainly prosulfocarb)
- Deposited amount corresponds to ca 0.1-0.0001% of the applied dose in the field
- A significant contribution to atmospheric deposition in southern Sweden from pesticides not used within Sweden, i.e. a transboundary atmospheric transport of pesticides

# Thank you! Questions?

Acknowledgement:

- The national pesticide monitoring programme is funded by the Swedish Environmental Protection Agency
- Information about the pesticide monitoring program at
  - [Department of Aquatic Sciences and Assessment](#) or
  - [Centre for Chemical Pesticides](#)

