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

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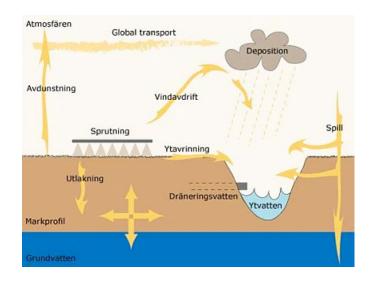




### **Background**

- 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 m², 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









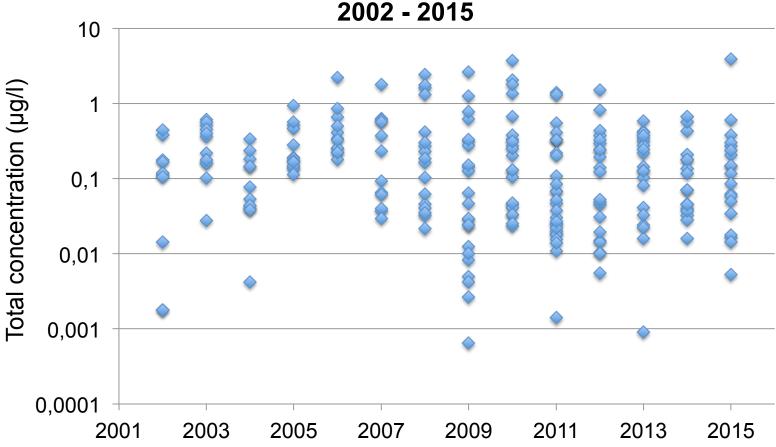
### **Methods - air**

### Air samples collected

- At fixed intervals using a highvolume pump (ca 550 m³/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



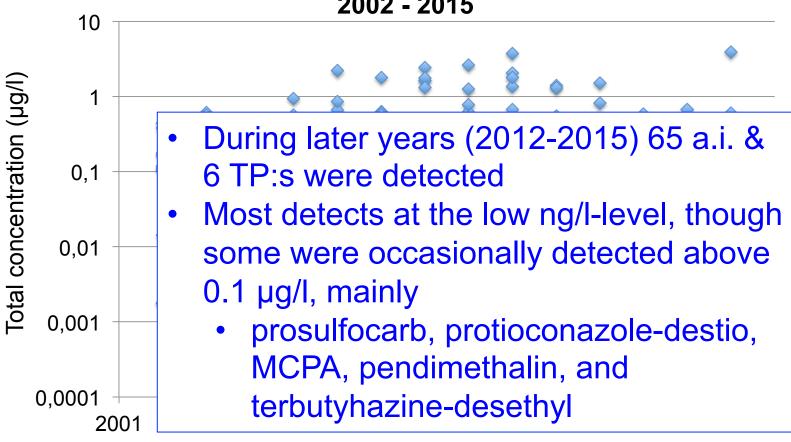
## Vavihill (south) - Total concentration per sample 2002 - 2015



Max total concentration 3.9  $\mu$ g/l in a sample from October 2015, with prosulfocarb constituting the major part (3.8  $\mu$ g/l)

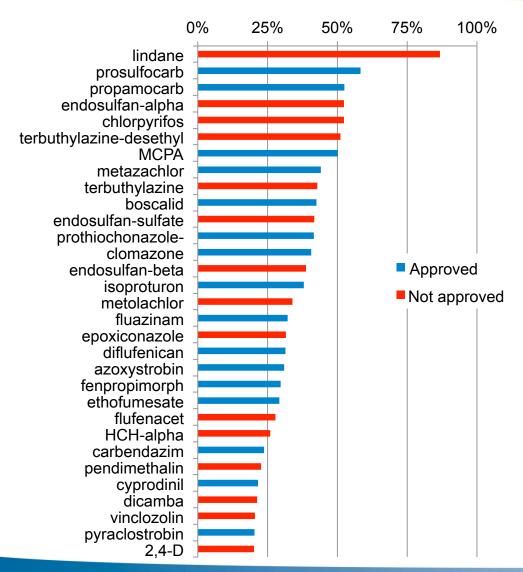


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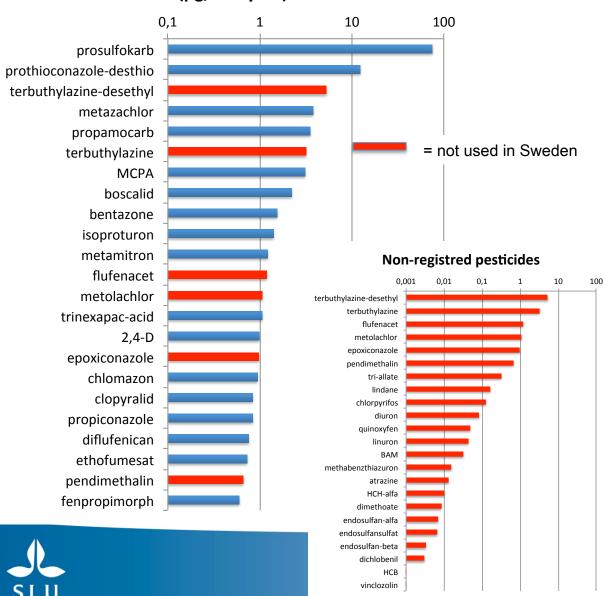


# Detection frequency in rainwater at Vavihill (south) during recent years 2012-2015

Of those pesticides detected in ≥ 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 (µg/m2\*year)

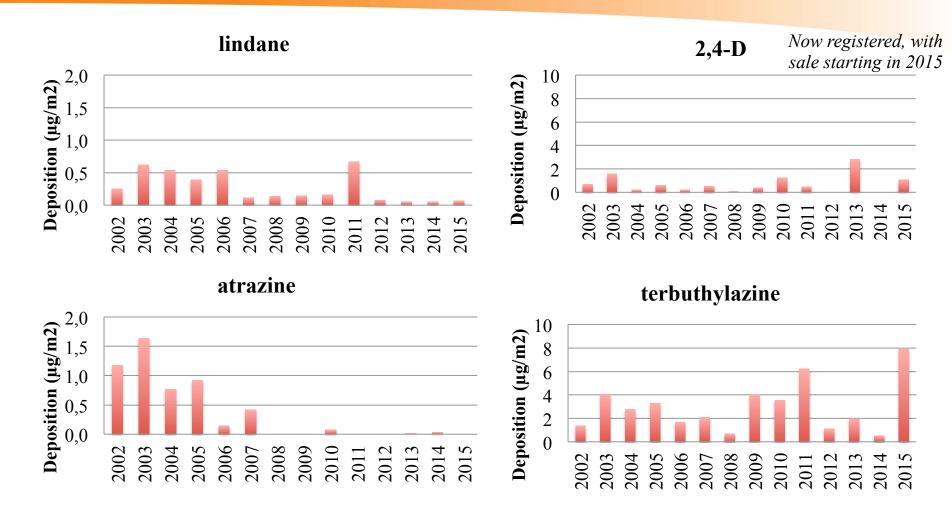


**Atmospheric** deposition at Vavihill in southern Sweden 2012-2015 (April-October)

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

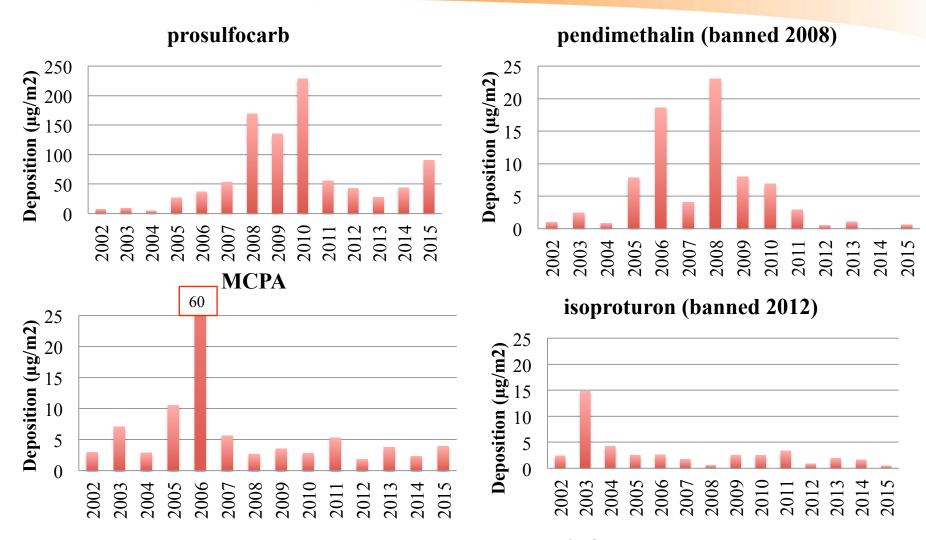


Center for Chemical Pesticides



Yearly  $\Sigma$  3-month deposition (µg/m²) 2002-2015 for pesticides <u>not used</u> in Sweden Banned within the EU (left) and approved within EU (right)



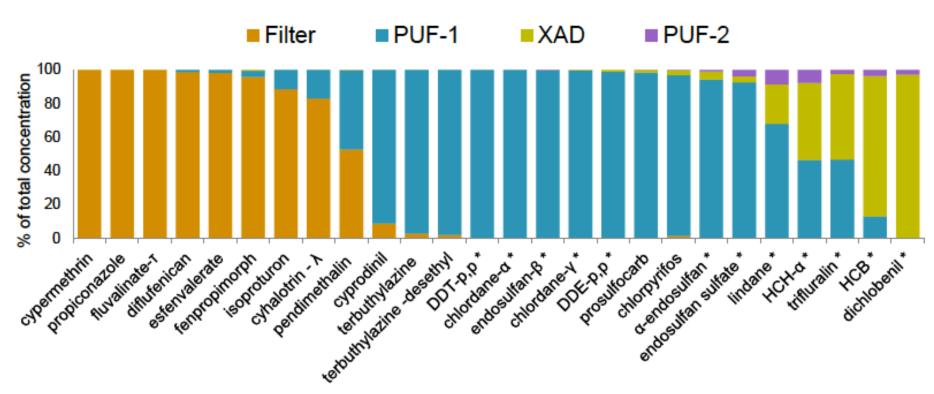


Yearly  $\sum$  3-month deposition (µg/m²) 2002-2015 Pesticides used in Sweden (left) and for pesticides banned during the period (right)



### Air samples - distribution between filter, PUF and XAD

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



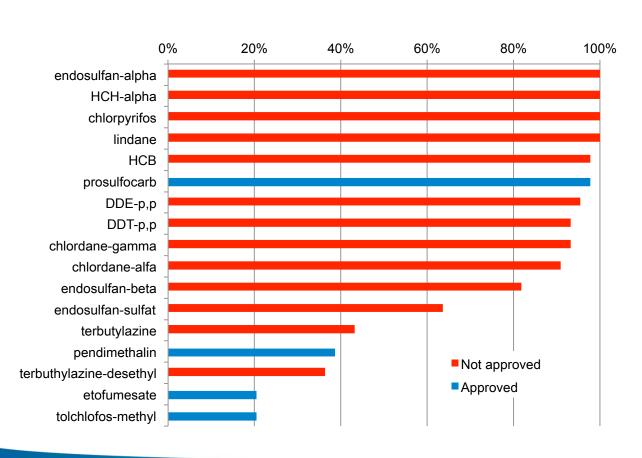
- PUF breakthrough (> 30%) for dichlobenil, HCH-a, HCB and trifluralin.
- However, only 4% of total pesticide concentration found in XAD and PUF-2



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



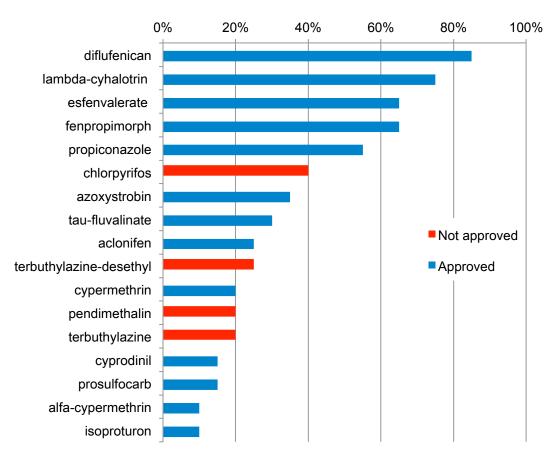
# Detection frequency in air (adsorbent, PUF-1) 2012-2015



- 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 μg/m³ air), mainly prosulfocarb detected above this level (max. 30 μg/m³ 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 µg/m³ air), mainly fenpropimorph detected above this level (max. 0.8 µg/m³ air)



### **Conclusions**

- Currently used pesticides are regularly detected at ng/l-levels in rainwater, with occasional  $\mu$ g/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



