

Pesticides in Finnish groundwater

Results from the monitoring of diffuse loads from agriculture to groundwater

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Monitoring of pesticides – MaaMet -project

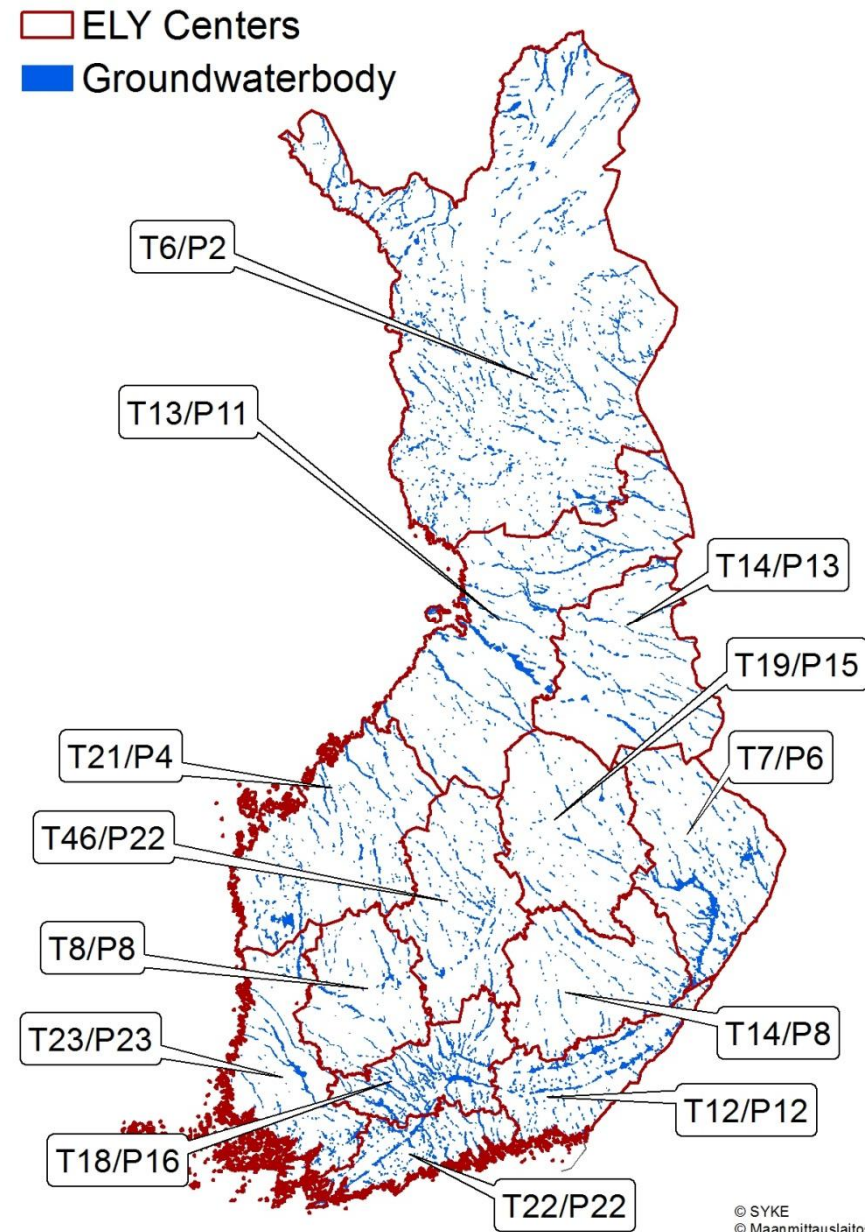
- The monitoring started in 2007 and is funded by the Ministry of Agriculture and Forestry
- Groundwater monitoring is one out of 7 subprojects
- Groundwater monitoring consists of nutrient and pesticide monitoring
- Monitoring is used for the purposes of Water Framework Directive (WFD)
- First couple of years it was mainly screening
- Only a few sites have uninterrupted time series (max 7 years)

Monitoring of pesticides – MaaMet - project

- The Centers for Economic Development, Transport and the Environment (ELY centers) have independently picked the sites
- That naturally leads to differences in national scale
- The monitoring is done mostly from existing wells
- Monitoring sites are mostly fields but also nursery gardens
 - Only a few sites have been specially selected for monitoring effects from forestry
- Updated guidance is given to unify the monitoring
 - For pesticides we have recommended a 3 year rotation unless there is need for more dense monitoring (e.g. WFD risk areas)
 - Emphasizing more on monitoring the farming of open land vegetables (carrots, gabbage, etc.), strawberries, apples, peas...

Scale of monitoring

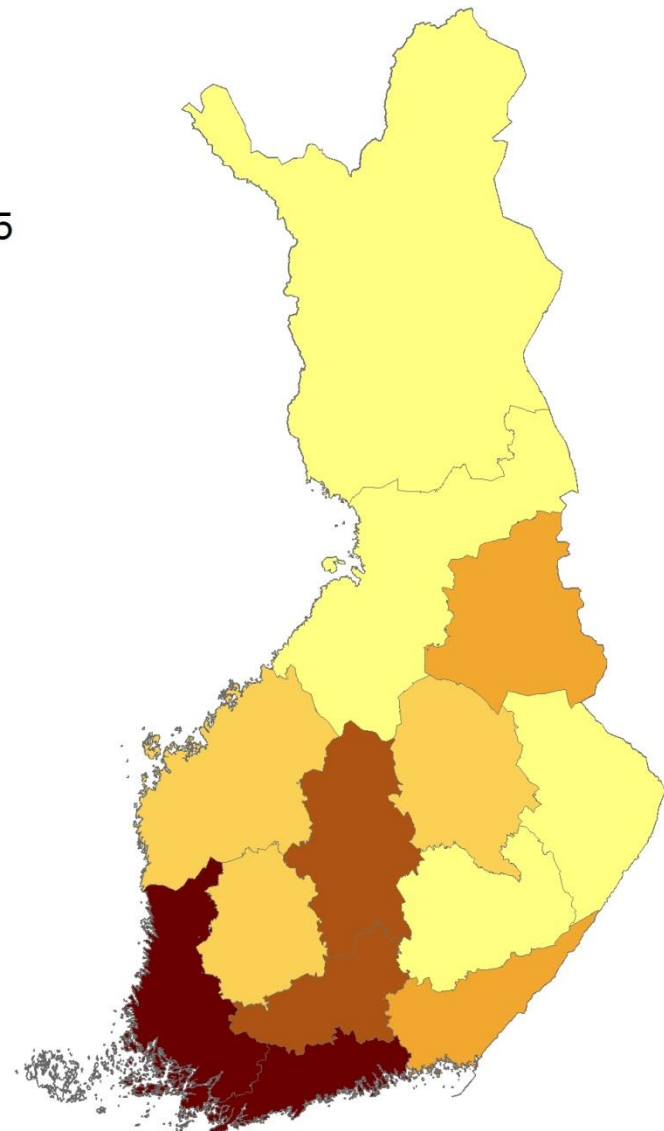
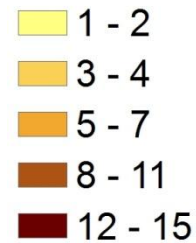
- Total of 223 groundwaterbodies (GWB) have been monitored
- Pesticides have been monitored in 162 GWB's
- Longterm pesticide monitoring in approximately 50 GWB
- Sampling usually between June-December
- 170-211 pesticides and their metabolites have been analyzed



Results (2007-2015) – National scale

- Pesticides were found in 50 % of all GWBs where they were analyzed
- Pesticides are mostly found in the GWBs in south and southwest
 - Partly because those areas have the most monitoring
 - Some areas have very little pesticide analysis
 - Lapland has had monitoring since 2014

Number of GWBs with pesticides



Most detected pesticides

- During the monitoring period (2007-2015), 50 different pesticides and their metabolites have been detected
- The most common ones are the metabolites of dichlobenil, atrazine, simazine and terbuthylazine
- Dichlobenil was removed from the market in Finland in 2009, terbuthylazine and simazine in 2004 and atrazine in 1992
- DEET is also detected in many GWBs, even though it is not used as a pesticide
- Total sum of individual pesticide concentration has exceeded the QS (0,5 µg/l) in 15 GWBs

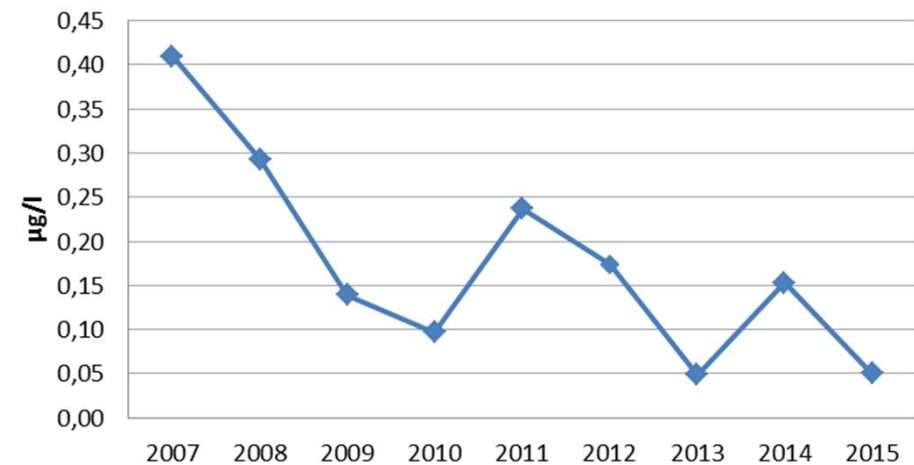
Top 25 pesticides

Pesticide	GWBs	<LOD	>LOD <QS (0,1 µg/l)	> QS (0,1 µg/l)
2,6-dichlorobenzamide	33	11	9	13
Desisopropylatrazine	30	7	21	2
Deisopropyldeethylatrazine	29	11	13	5
Desethylatrazine	27	17	8	2
Atrazine	24	8	9	7
Simazine	24	14	7	3
DEET	23	11	8	4
Desethylterbuthylazine	20	7	10	3
Terbuthylazine	15	2	8	5
Hexazinone	12	4	4	4
Bromacil	7	6	1	0
Mecoprop + Mecoprop-P	7	2	4	1
Metamitron-desamino	7	7	0	0
Bentazone	6	3	3	0
3-methyl-4-chlorophenol	5	2	3	0
Dichlorprop + Dichlorprop-P	4	1	3	0
Metribuzin-desamino-diketo	4	1	3	0
Pentachlorobenzene	4	1	3	0
2,4-Dichlorophenol	3	1	2	0
AMPA	3	1	2	0
Clopyralid	3	1	1	1
MCPA	3	1	2	0
Propiconazole	3	1	1	1
Dichlobenil	2	1	1	0
Glyphosate	2	1	0	1

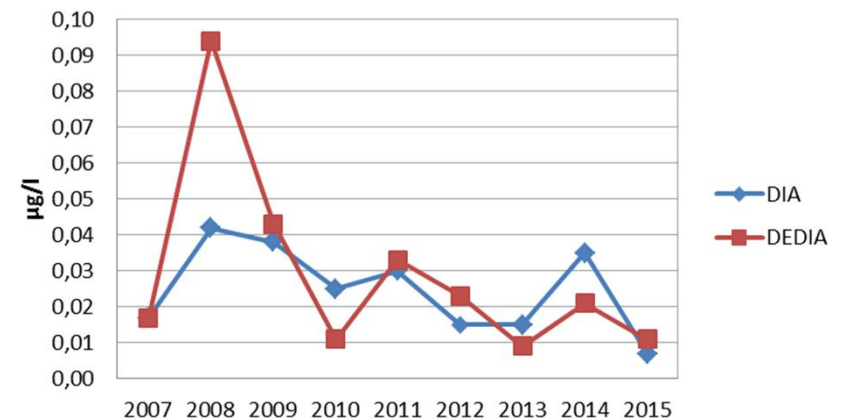
Preliminary results of most detected pesticides

- Looking at the annual mean concentrations from the long term monitoring sites (data from at least 5 year period), BAM (2,6-dichlorobenzamide), DIA (Desisopropylatrazine) and DEDIA (Deisopropyldeethylatrazine) seem to show a downward trend
- More data is needed to get reliable statistics because most sites have gaps and less results from the early years
- Max values during the monitoring:
 - BAM 1,2 $\mu\text{g/l}$ (2012)
 - DIA 0,18 $\mu\text{g/l}$ (2014)
 - DEDIA 0,74 $\mu\text{g/l}$ (2008)

BAM (12 sites)



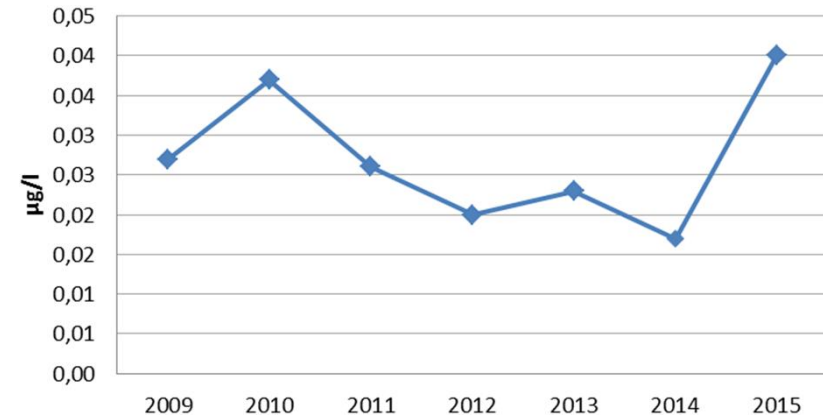
DIA, DEDIA (11 sites)



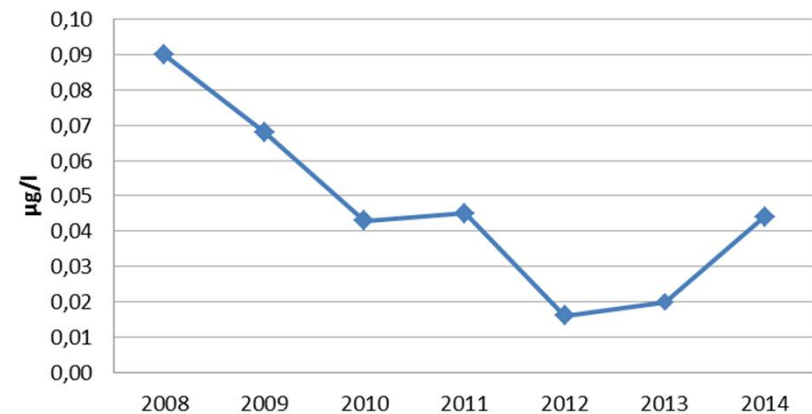
Preliminary results of most detected pesticides

- For atrazine it is very hard to see any long time trends, because we have lesser sites of long term detection and shorter time series
- Notable is that there are still individual high concentrations from recent years: overall max 0,54 $\mu\text{g/l}$ (2014)
- For simazine there are even less sites of long term detection
- In ~60 % of GWBs where simazine was detected, the concentration was < LOD
- Max value of simazine is 0,45 $\mu\text{g/l}$ (2008)

Atrazine (7 sites)



Simazine (5 sites)



Future actions in the monitoring

Report of the results by the end of the year

- We will be looking at the landcover and crop data of certain hot spot areas more closely
- More statistical analysis

Monitoring

- Emphasizing more on monitoring the farming of open land vegetables and special plants since their need of pesticides has usually been quite high
- More analysis of glyphosate and AMPA since 2015
 - Higher costs partly reason for the lack of previous analysis

Thank you!

