

# Investigative groundwater monitoring of plant protection products active substances in Lithuania

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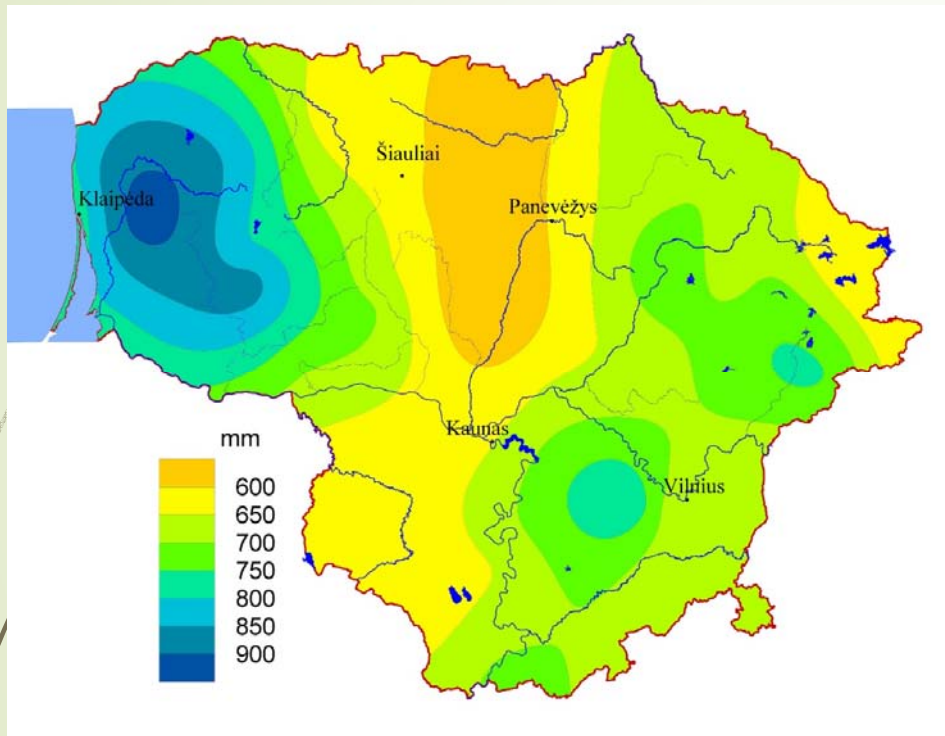




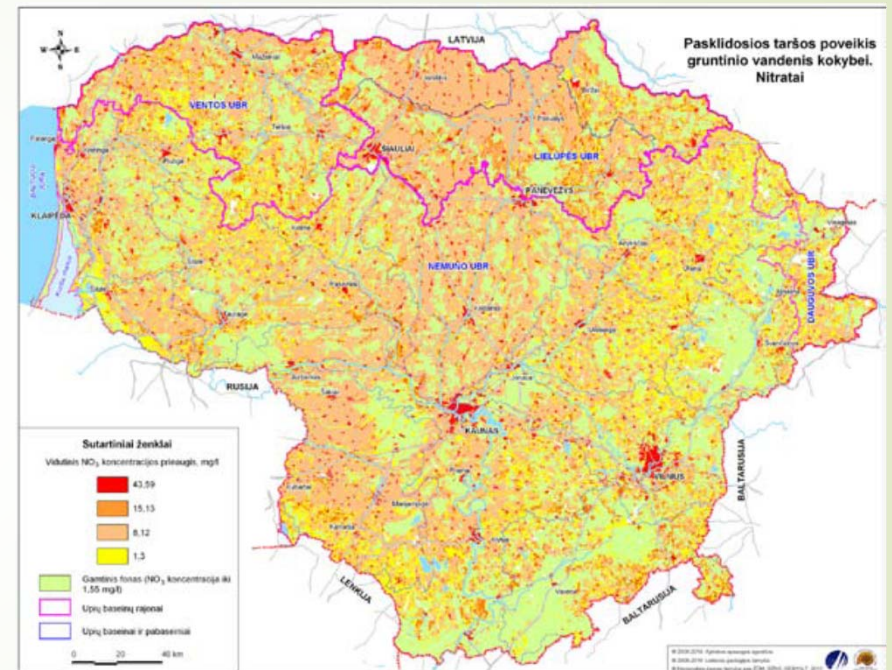
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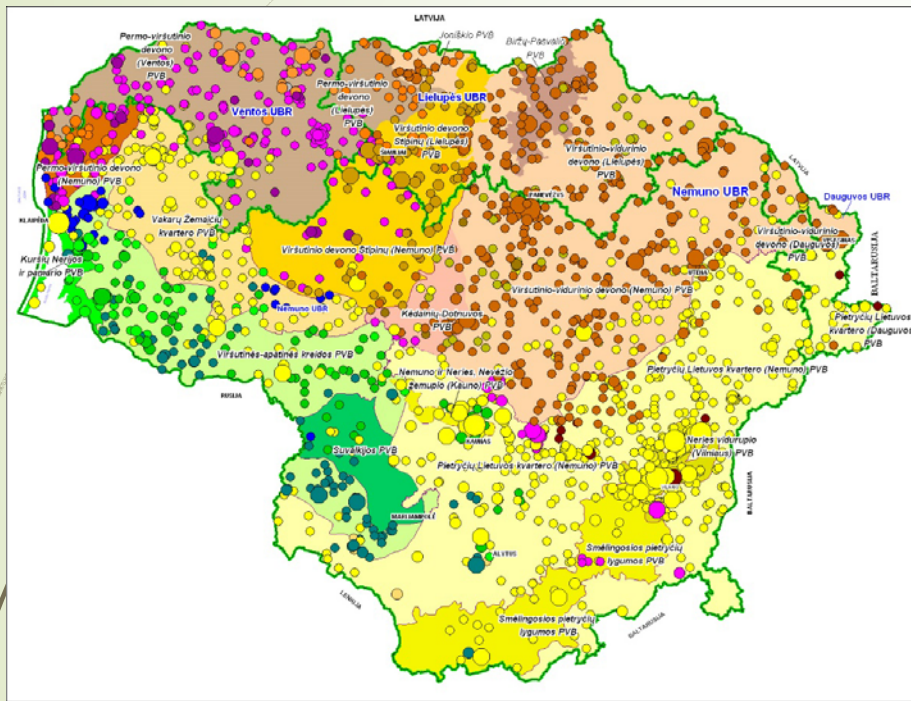
# Background



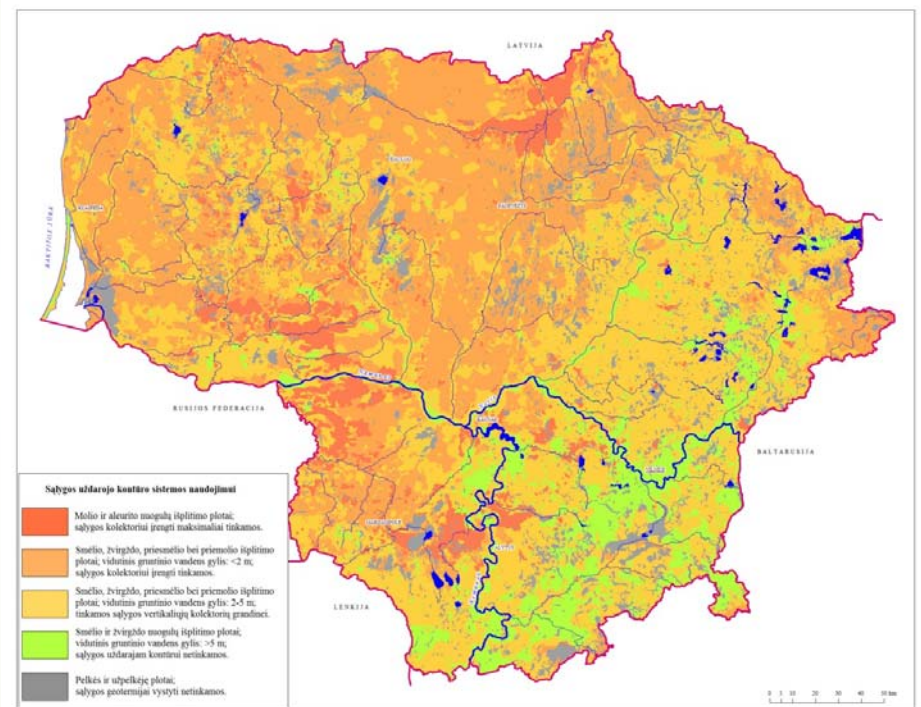
Climate – humid, continental  
Mean annual amount of precipitation in Lithuania (1981–2010)



Land use:  
*Arable land - 33.48%; 70% artificially drained*  
*Forests – 33.3%*



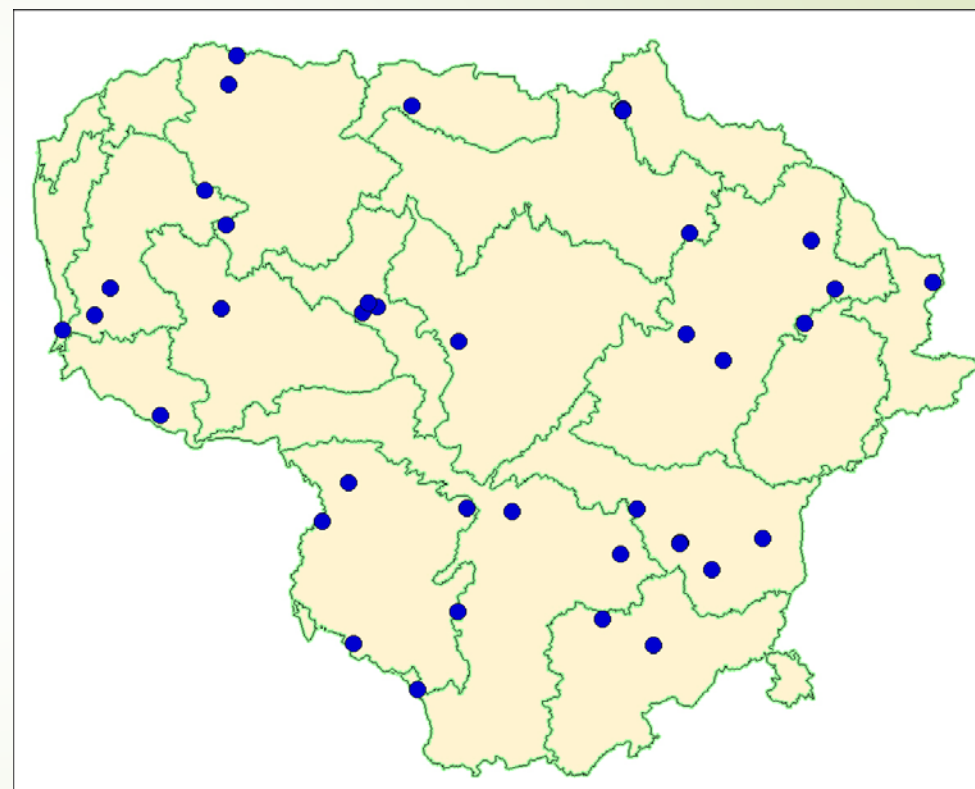
Aquifers used for public water supply



Shallow (unconfined) groundwater

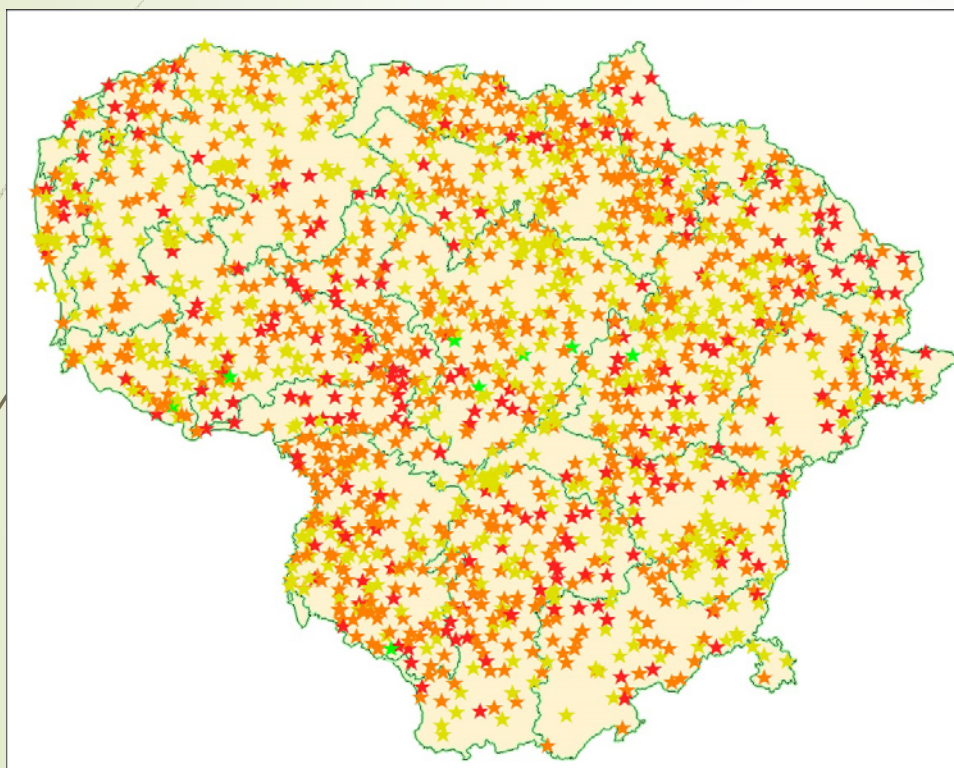
# Monitoring of pesticides in groundwater

Analitė	Tyrimo		Leidžiama iki (HN 24:2003)	Matavimo vnt.
	metodo žymuo	rezultatas ± U		
1	2	3	4	5
<i>Chlororganiniai pesticidai</i>	<i>LST EN ISO 6468:2000</i>			<i>µg/l</i>
2,4' - DDD	<i>LST EN ISO 6468:2000</i>	$a < 0,005$	0,10	<i>µg/l</i>
2,4' - DDE	<i>LST EN ISO 6468:2000</i>	$a < 0,006$	0,10	<i>µg/l</i>
4,4' - DDD	<i>LST EN ISO 6468:2000</i>	$a < 0,004$	0,10	<i>µg/l</i>
4,4' - DDE	<i>LST EN ISO 6468:2000</i>	$a < 0,005$	0,10	<i>µg/l</i>
4,4' - DDT	<i>LST EN ISO 6468:2000</i>	$a < 0,007$	0,10	<i>µg/l</i>
Aldrinas	<i>LST EN ISO 6468:2000</i>	$a < 0,004$	0,030	<i>µg/l</i>
Dieldrinas	<i>LST EN ISO 6468:2000</i>	$a < 0,010$	0,030	<i>µg/l</i>
Endrinas	<i>LST EN ISO 6468:2000</i>	$a < 0,004$	0,10	<i>µg/l</i>
Heksachlorbenzenas	<i>LST EN ISO 6468:2000</i>	$a < 0,010$	0,10	<i>µg/l</i>
Heptachloras	<i>LST EN ISO 6468:2000</i>	$a < 0,008$	0,030	<i>µg/l</i>
Heptachlor-ekso-epoksidas	<i>LST EN ISO 6468:2000</i>	$a < 0,007$	0,030	<i>µg/l</i>
Heptachlor-endo-epoksidas	<i>LST EN ISO 6468:2000</i>	$a < 0,005$	0,030	<i>µg/l</i>
Lindanas (gama – HCH)	<i>LST EN ISO 6468:2000</i>	$a < 0,009$	0,10	<i>µg/l</i>
Metoksichloras	<i>LST EN ISO 6468:2000</i>	$a < 0,012$	0,10	<i>µg/l</i>
Pentachlorbenzenas	<i>LST EN ISO 6468:2000</i>	$a < 0,005$	0,10	<i>µg/l</i>
alfa-Heksachlorcikloheksanas (alfa – HCH)	<i>LST EN ISO 6468:2000</i>	$a < 0,007$	0,10	<i>µg/l</i>
beta-Heksachlorcikloheksanas (beta – HCH)	<i>LST EN ISO 6468:2000</i>	$a < 0,008$	0,10	<i>µg/l</i>
delta-Heksachlorcikloheksanas (delta – HCH)	<i>LST EN ISO 6468:2000</i>	$a < 0,006$	0,10	<i>µg/l</i>
<i>Fosforo organiniai pesticidai</i>	<i>LST EN 12918:2000</i>			<i>µg/l</i>
Diazinonas	<i>LST EN 12918:2000</i>	$a < 0,024$		<i>µg/l</i>
Fenitroionas	<i>LST EN 12918:2000</i>	$a < 0,017$		<i>µg/l</i>
Malationas	<i>LST EN 12918:2000</i>	$a < 0,014$		<i>µg/l</i>
<i>Organiniai azoto ir fosforo junginiai</i>	<i>LST EN 12918:2000</i>			<i>µg/l</i>
Metil-parationas	<i>LST EN 12918:2000</i>	$a < 0,022$		<i>µg/l</i>
Etil-parationas	<i>LST EN 12918:2000</i>	$a < 0,012$		<i>µg/l</i>



► National groundwater monitoring: 50 observation wells, located in arable land

## Investigations and monitoring of contaminated sites




Registered - 1379 pesticide storages;

During 2002-2005 most of pesticides were removed;

Investigations of soil and groundwater carried out in 99;

Remediation actions in 20;

Groundwater monitoring – 3 sites.



# Groundwater monitoring of pesticides in well-fields

- ▶ Aprobation of groundwater resources - analysis of pesticides required for groundwater of wellfields, exposed to potential risk (pesticides storage areas or arable land in protection zone of wellfield)
- ▶ Groundwater monitoring in well-fields  $>100 \text{ m}^3/\text{d}$ , pesticides required in case of risk ~

20. Pesticides

20.1. Aldrin

20.2. Dieldrin

20.3. Heptachlor

20.4. Heptachlor- epokside

20.5. Other pesticides

20.6. Sum of pesticides

# Investigative monitoring of PPP

## ► Target substances

### ► PPP containing Metribuzine (1);

Date of registration - 2010

Potatoes cultivation

1 apl./year 1,0-1,5 l/ha

### ► PPP containing Metazachlor (12)

Date of registration - 2000 - 2015

Rape cultivation

1apl./3years (groundwater), 10 m protection zone for surface waters and dimetachlor

### ► PPP containing Dimetachlor (2)

Date of registration - 2002 - 2008

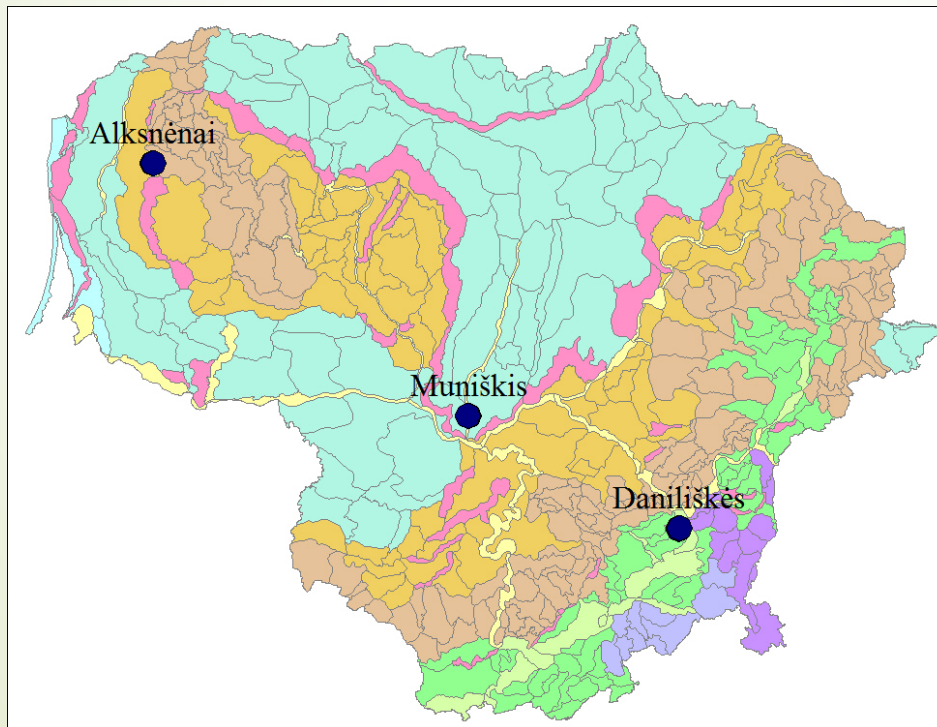
Rape cultivation

1apl./3years (groundwater), 10 m protection zone for surface waters and dimetachlor

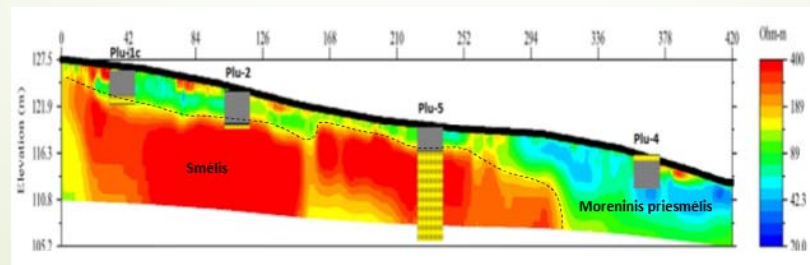
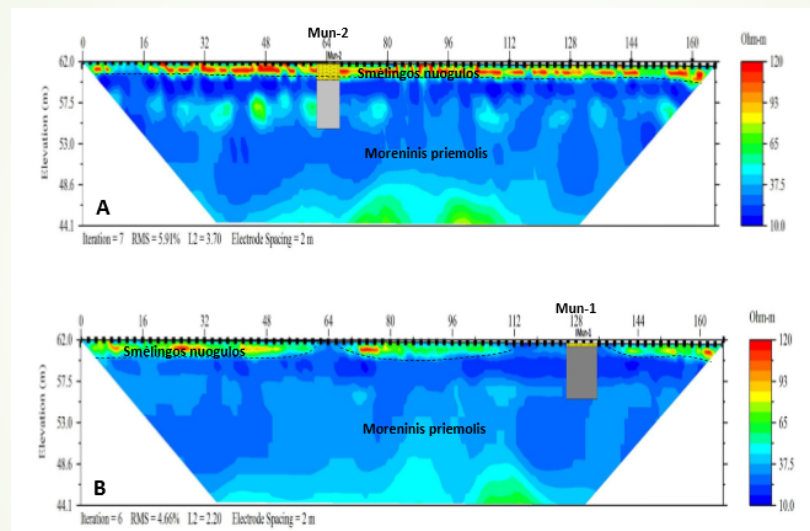


# Site selection

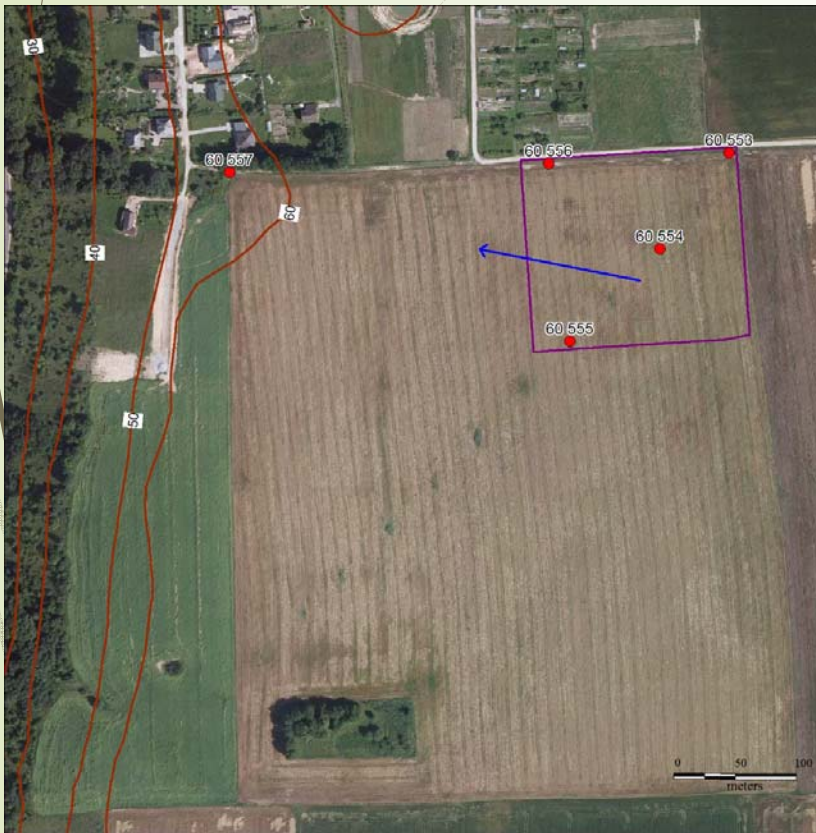
- Site selection - 3 investigative fields, which are owned by the State Plant Service and are used for plant varieties investigation;



# Investigations of geological-hydrogeological conditions of sites



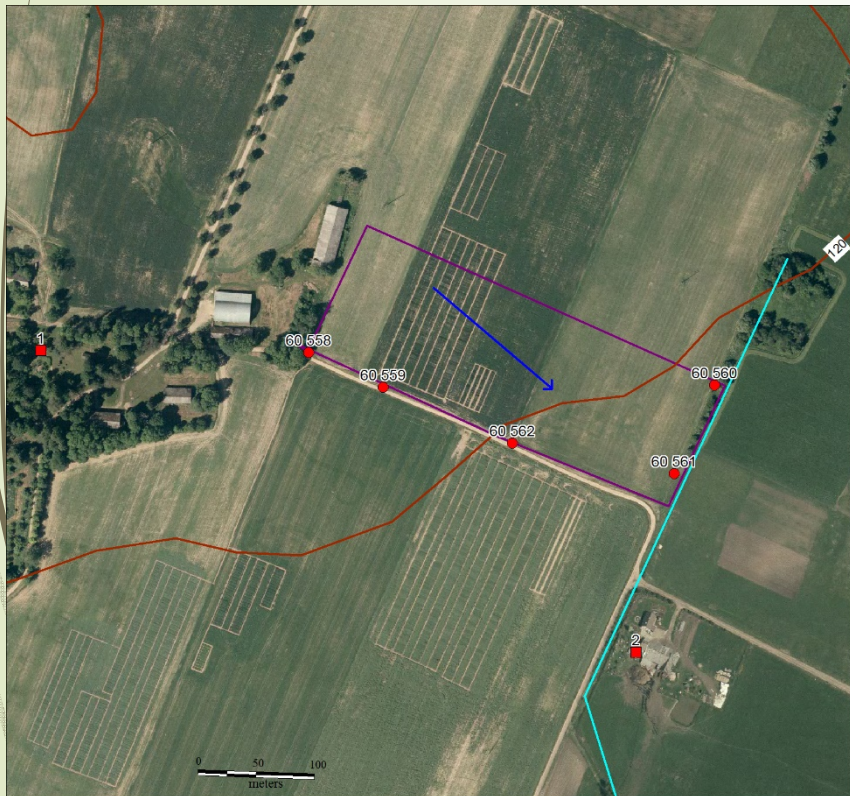
# Muniškis, field of rape, PPP containing metazachlor and dimetachlor



- Morainic plain, the upper part consists of till deposits.
- Shallow groundwater occurs in sandy lenses at a depth of 4.0–5.7 m.
- The groundwater flow is regulated by the Nevėžis River which is located ~500 westward of the field.
- Fertilizers affect the groundwater chemical composition - the concentration of the total dissolved solids is 1050–1400 mg/l, sulphates 130–425 mg/l, and phosphates 2.4-3.55 mg/l.

well	date	metazaklor	metazaklor ESA (BH 479-8)	metazaklor OA (BH 479-4)	metazaklor-1-karbonsyra (BH 479-12)	dimetaklor	dimetaklor ESA	dimetaklor OA	dimetaklor CGA 369873
(53)Mun-1	2015.12.09	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
(53)Mun-1	2016.06.12	<0.050	<b>0,29</b>	<b>0,29</b>	<b>0,13</b>	<0.050	<0.050	<0.050	<b>0,26</b>
(54)Mun-2	2015.12.09	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
(54)Mun-2	2016.06.12	<0.050	<b>0,097</b>	<b>0,054</b>	<b>0,069</b>	<0.050	<0.050	<0.050	<0.050
(55)Mun-3	2015.12.09	<0.050	<b>0,12</b>	<0.050	<0.050	<0.050	<0.050	<0.050	<b>0,16</b>
(55)Mun-3	2016.06.12	<0.050	<b>3,9</b>	<0.050	<0.050	<0.050	<0.050	<0.050	<b>4,8</b>
(56)Mun-4	2016.06.12	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
(57)Mun-5	2015.12.09	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
(57)Mun-5	2016.06.12	<0.050	<b>0,1</b>	<0.050	<b>0,079</b>	<0.050	<0.050	<0.050	<b>0,13</b>

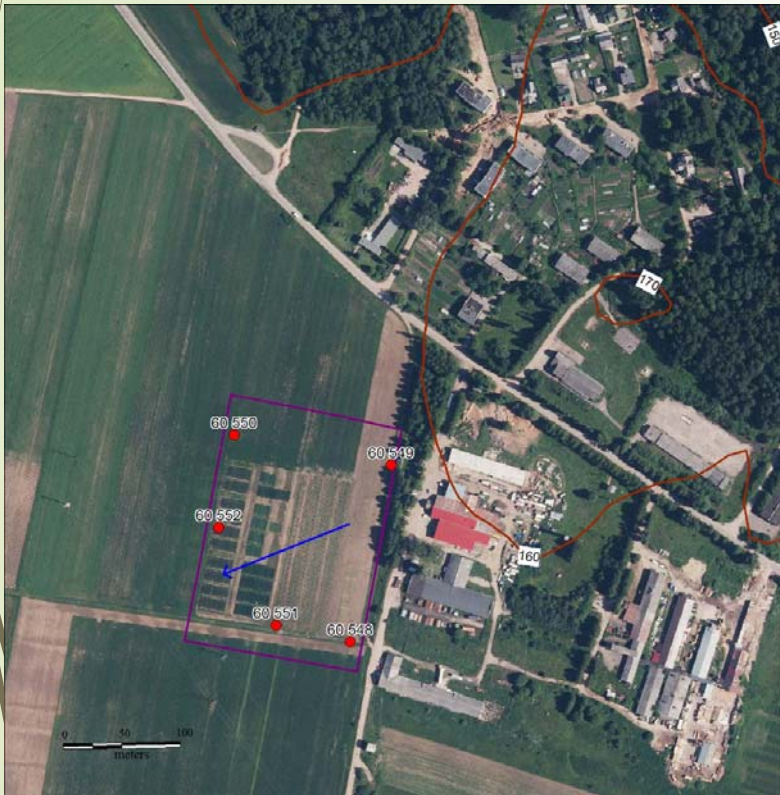
# Alksnėnai, field of rape, PPP containing metazachlor and dimetachlor



- Slope of a morainic upland, drops downward for 10 m in a 330 m long segment.
- Sandy till up to a depth of 1.8-4.7 m. It becomes saturated with water during snowmelt or intensive rainfalls.
- Up to the investigated depth of 13.54 m - sand layers.
- The groundwater is found at a depth of in 9.9–10.8 m.
- The hydrochemical composition of the groundwater does not indicate high impact from agricultural activities, NO<sub>3</sub> - 23.6 mg/l just in 1 well.

Well	date	metazaklor	metazaklor ESA (BH 479-8)	metazaklor OA (BH 479-4)	metazaklor or-1-karbonsyr a (BH 479-12)	dimetaklor or	dimetaklor or ESA	dimetaklor or OA	dimetaklor or CGA 369873
Plu-1s	2015.12.09	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Plu-1s	2016.06.12	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Plu-2s	2015.12.09	<0.050	2,2	0,066	0,051	<0.050	<0.050	<0.050	0,41
Plu-2s	2016.06.12	<0.050	0,49	0,11	<0.050	<0.050	<0.050	<0.050	0,14
(60)Plu-3	2015.12.09	<0.050	1,2	<0.050	<0.050	<0.050	<0.050	<0.050	0,22
(60)Plu-3	2016.06.12	<0.050	2,1	0,12	<0.050	<0.050	<0.050	<0.050	0,47
(61)Plu-4	2015.12.09	<0.050	2	0,084	<0.050	<0.050	<0.050	<0.050	<0.050
(61)Plu-4	2016.06.12	<0.050	7,4	4,2	<0.050	<0.050	<0.050	<0.050	0,18
(62)Plu-5	2015.12.09	<0.050	3,7	0,36	<0.050	<0.050	<0.050	<0.050	0,43
(62)Plu-5	2016.06.12	<0.050	3,3	0,48	<0.050	<0.050	<0.050	<0.050	0,39

## Daniliškės, field of potatoes, PPP containing metribuzin



- Outwash plain
- The upper part of geological cross-section consists of layers of equigranular sand mixed with interlayers of silt.
- Shallow groundwater occurs at a depth of 6.9–9.3 m.
- Agricultural contamination could be traced by increased concentration of nitrates consisting 61-72 mg/l.
- No PPP active substances were found in the soil or groundwater samples

well	date	metribuzin
Dan-1	2015.12.10	<0.050
Dan-1	2016.06.12	<0.050
Dan-2	2015.12.10	<0.050
Dan-2	2016.06.12	<0.050
Dan-3	2015.12.10	<0.050
Dan-3	2016.06.12	<0.050
Dan-4	2015.12.10	<0.050
Dan-4	2016.06.12	<0.050
Dan-5	2015.12.10	<0.050
Dan-5	2016.06.12	<0.050



# Conclusions

- ▶ The metabolites of active substances of PPP used in rape cultivation could get into groundwater
- ▶ The investigative monitoring program is set for five years and is expected to allow qualifying the results and giving some recommendations for use of specific plant protection products in the future...
- ▶ New field of investigations –
  - Costly,
  - High precision in every step;
  - Colaboration and communication.