Urban pesticide best management practices: results of Phyt’Eaux Cités, a program to reduce river contamination (2007-2010, France)

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Runoff principal way of pesticides transfer to surface water in urban areas

Gerecke et al., 2002

Impervious surfaces – irregular land cover – multiple uses and users
SEDIF: A public DRINKING WATER SERVICE for the GREATER METROPOLITAIN PARIS AREA

- Delivery territory: 144 Municipalities
- 4 Million people supplied
- 900,000 m³ water per day
- Essentially surface water 95%

More than 13,600 pesticide analyses per year
More than 130 molecules

Problems with water treatment related to pesticide detection
Idea developed in 2006

PROJECT LEADER

USES AUDIT

Phyt'Eaux Cités

WATER QUALITY

SCIENTIFICAL RESEARCH
Sampleing

- 1st sampling first week of the month
  - 189 molecules (2007)
  - 212 molecules (2008-2009-2010)

- 2nd sampling third week of the month
  - 42 substances (principal urban contaminants)

Audit of public users and inquiry on total applied quantities
Audit Results

✓ After one year 53% applications less as compared to 2007. A good percentage of local authorities had also started other type of treatments.

✓ After three years, 50 municipalities participated at least to one theoretical training (49 to the practical one)

✓ After four years, 28 cities started a sustainable planning and 2 cities stopped treatments

✓ At the end of 2010, 414 technical service agents trained (97% considered those trainings useful)
Audit Results

- Between 2007 and 2009, 56 municipalities have signed the Phyt’Eaux Cités charter

  - Reduction of 68% of active substance quantities (2267 kg in 2007 as compared to 728 kg in 2009)

- 12% of the inquired cities stopped some treatments (ex. cemeteries) and 44 cities stopped sport field treatments

- 77% of the local authorities respect of environmental - health European and national policies (better use)

Clover of engagement

Hamelet et al., 2009
189 substances (171 active substances and 18 metabolites, filtered water).

At the outlet of the Orge Basin, 33 substances (29 active substances and 4 metabolites) were quantified at least one time and 6 displayed 100% frequencies (glyphosate and its metabolite, diuron and its metabolite, amitrole and atrazine)
✓ Pesticide application months: maximal risk of transfert
✓ Fortnight sampling: established sampling date, random hydrology
✓ 10 rainfall events: maximal concentrations
Inter annual variations

Botta et al., 2011, Chemosphere, submitted
Annual Glyphosate load in kg for 2007

Blanchoud et al., 2011, Piren Seine
### Results

Blanchoud et al., 2011, GFP Conference

**Flux annulé (en kg) et volume d'eau (Mm3)**

- **Diuron**: -90%
- ** Glyphosate**: -80%
- **Amitrole**: -66%
- **AMPA**: -48%
- **Water Volume**

Piacenza · 30th August – 1st September 2011
## Load decrease

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall days</td>
<td>176</td>
<td>182</td>
<td>149</td>
<td>162</td>
</tr>
<tr>
<td>Water Volume at Athis Mons (Mm³)</td>
<td>111</td>
<td>111</td>
<td>98</td>
<td>119</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximal periods</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
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<tbody>
<tr>
<td>Rainfall days</td>
<td>76</td>
<td>67</td>
<td>52</td>
<td>53</td>
</tr>
<tr>
<td>Water Volume at Athis Mons (Mm³)</td>
<td>48</td>
<td>41</td>
<td>35</td>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Substances</th>
<th>Decrease 2008 – 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diuron</td>
<td>93 %</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>50 %</td>
</tr>
<tr>
<td>Aminotriazole</td>
<td>44 %</td>
</tr>
<tr>
<td>AMPA</td>
<td>20 %</td>
</tr>
</tbody>
</table>
Uncertainties summary

• Uncertainty on pesticide analysis
  • Between 10% and 30%

• Uncertainty on load calculation when detection frequency is very low
  • Different quantification limits
  • Maximal load values: LQ / 2
  • Minimum load values: 0

• Discharge uncertainty
  • Daily mean discharge

• Uncertainty on method, rainfall - dry periods
  • Considering suspended matter or discharge?

Blanchoud et al., 2011
Piren Seine
Chlortoluron and isoproturon essentially applied in winter (high discharge – low temperature)

AMPA metabolite of glyphosate upstream, at Athis-Mons partly originated from detergent degradation

Mecoprop has urban origine in Athis-Mons whereas it as agricultural origins in Sermaise

Study at the Orge watershed scale : URBAN origin of Orge River contamination
### Export modeling

**Documented Urban Input**
- Municipalities
- Railways
- Airport
- Roads
- Householders

**Scenario 1** *Phyt’Eaux Cités*
- No impact of householder applications
- Glyphosate: 11%
- Diuron: 16%
- Amitrole: 15%

**Scenario 2** *Blanchoud, 2004*
- Estimation Householders (13 g.hab.year⁻¹)
- Glyphosate: 2.3%
- Diuron: 3.5%
- Amitrole: 3.4%

**Scenario 3** *Boulet, 2006*
- Estimation Householders (86% of total urban application)
- Glyphosate: 1.4%
- Diuron: 2.1%
- Amitrole: 2%

**RISK PREVENTION - RISK MITIGATION SESSION**

*Piacenza • 30th August – 1st September 2011*

*Botta et al., 2009 PhD Manuscript*
Conclusions

Phyt’Eaux Cités → 2007-2010

• The impact of pesticide used in urban settlements on surface water quality was confirmed.

• Use of pesticides by municipalities generally decreased from 2007 to the end of 2010.

• In some cities, chemical treatments were also replaced by other type of weed-control (thermal, mechanical, etc...).

• Using different load calculation methods, a sensible decrease of pesticide load in river was registered from 2008 and 2010.
“Phyt’Eaux Cités was a new approach to reduce the contamination of surface water by pesticides.

The programme suggested to city staff specific pest management strategies and general alternative controls.

The more knowledge and mobilization of the local authorities could reduce urban pesticides transfer.

Project Phyt’Eaux Cités 2 → 2012-2016
Acknowledgements

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