Focus on Phosphorus

- a pilot project where farmers, agricultural advisers, researchers and authorities co-operate in

Identifying P loss risk and appropriate mitigation measures at farm level

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Swedish Board of Agriculture
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The farmers in the pilot catchments

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Outline

• The pilot project
• Pilot catchments
• Risk identification and suggestions on mitigation measures
• Effect on water quality of mitigation efforts so far
• Experiences from the project
The pilot project 'Focus on Phosphorus'

Aim:

Using the experience and knowledge from farmers, agricultural advisers, researchers and authorities in order to …

• find effective strategies to reduce P losses from agricultural land to waters

• test and implement both established and new mitigation measures

Project areas should be small agricultural catchments where monitoring data is already available

The project started in 2007 with the Swedish Board of Agriculture as project leader
### Pilot catchments

**Catchment**

<table>
<thead>
<tr>
<th></th>
<th>N33</th>
<th>E23</th>
<th>U8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay (%)</td>
<td>25</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Arable land (%)</td>
<td>87</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Water discharge (mm)</td>
<td>300</td>
<td>180</td>
<td>250</td>
</tr>
<tr>
<td>P (mg/L)</td>
<td>0.18</td>
<td>0.23</td>
<td>0.29</td>
</tr>
<tr>
<td>P loss (kg/ha)</td>
<td>0.54</td>
<td>0.43</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Coloured areas refers to agricultural production areas.
Agricultural management 2006-2010

2006-2009

- Reduced application of P in commercial fertilizer in E23
- The area of buffer strips decreased in all catchments due to changes in subsidies

2010

- Re-establishment of buffer strips in U8
- Structure liming in U8 (90%) and E23 (10%), partly financed by authorities
- Reduced soil tillage in U8 and E23
Self-evaluation of P loss risks at the farm

Questionnaire matrix

Questionnaire matrix covering recent knowledge on
- risk sources for P losses to waters and
- corresponding possible mitigation measures

Questions in three categories:

1. Cropping systems including soil tillage and fertilization
2. In-field characteristics including soil properties and function of drainage systems
3. Character of open ditches and water courses
Self-evaluation of P loss risks at the farm

**Background information**

**Modeled maps covering potential risk areas for**

- Ponded water
- Surface runoff
- Soil erosion

**Maps on soil test results**

- P-AL
- pH
- Clay content

**Information on crop management**

**Information on water quality in sub-catchments (optional)**

The erosion map was developed by using high-resolution elevation data and a distributed model (USPED)

F. Djodjic, 2013
# Identification of risk factors

<table>
<thead>
<tr>
<th>Catchment</th>
<th>N33</th>
<th>E23</th>
<th>U8</th>
</tr>
</thead>
</table>

**In cropping systems**
- Ploughing close to ditches
- Ploughing in late autumn
- High P application rates
- Application of manure in late autumn
- Crop rotations

**In the field**
- High P content in the topsoil
- Soil compaction
- Ponding water
- Surface runoff
- Erosion

**In open ditches and water courses**
- Flooding
- Erosion in stream banks
- Erosion in stream bottom
- Grazing in the gully
- Removal of vegetation and sediments

<table>
<thead>
<tr>
<th>Risk level</th>
<th>N33</th>
<th>E23</th>
<th>U8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In cropping systems</td>
<td>Catchment</td>
<td>In open ditches and water courses</td>
<td>Catchment</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------</td>
<td>-----------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Buffer strips and vegetation filters</td>
<td>Possible</td>
<td>Liming above drainpipes</td>
<td>Possible</td>
</tr>
<tr>
<td>Application of manure in spring</td>
<td>Possible</td>
<td>Liming in connection pipes</td>
<td>Possible</td>
</tr>
<tr>
<td>Fertilization according to soil test results</td>
<td>Possible</td>
<td>Fence for avoiding grazing</td>
<td>Possible</td>
</tr>
<tr>
<td>Subsequent crop the same year</td>
<td>Urgent</td>
<td>Reduce slopes in the gully</td>
<td>Urgent</td>
</tr>
<tr>
<td>In the field</td>
<td></td>
<td>Two step flooding ditches</td>
<td></td>
</tr>
<tr>
<td>Reduced soil tillage</td>
<td></td>
<td>Sedimentation pond</td>
<td></td>
</tr>
<tr>
<td>Sowing without soil tillage</td>
<td></td>
<td>Trees and bushes close to the water course</td>
<td>Possible</td>
</tr>
<tr>
<td>Contour ploughing</td>
<td></td>
<td>Protection from erosion in stream angles</td>
<td>Possible</td>
</tr>
<tr>
<td>Ploughing of subsoil</td>
<td></td>
<td>Convert open ditches to culverts</td>
<td></td>
</tr>
<tr>
<td>Structure liming</td>
<td></td>
<td>Wet land, flooding areas</td>
<td></td>
</tr>
<tr>
<td>Restoration of drainage systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larger paddocks for horses and cattle</td>
<td></td>
<td></td>
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</tbody>
</table>

Not actual
Possible
Urgent
Effect of measures on P concentrations at catchment stream outlet

Catchment U8

Catchment N33

Catchment E23

Photo: Anuschka Heeb
Experiences from the project and suggestions for the future

• A questionnaire matrix together with a high-resolution erosion map can be a practical tool for farmers to identify risk areas and appropriate mitigation measures at the farm, preferably together with an adviser.

• To have the farmers’ own knowledge and experience as the driving force in finding the risk sources and adequate measures is probably a most effective approach in reducing P losses.

• Measures have to be valuable for the farmer - targeted subsidies may here be useful.

• Considering pilot projects in the future, the ideal is if only one measure is implemented upstream each measuring point - otherwise the effect of each measure is hard to determine with just monitoring at catchment outlet.