Challenges for water suppliers and government regarding impact of agricultural land use

Report from Lower Saxony, Germany

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Drinking water since 1948
Investments 2012 15 Mio. €

Waste water treatment seit 1999
Investments 2012 14 Mio. €

Clients ca. 1,1 Mio.

Staff 653

Further tasks: Urban Drainage (City of Oldenburg), Public Information, European Project Cooperation
Protection of the resource „groundwater“ by geology

Oldenburg
Bremen

Groundwater main source for drinking water
- deep aquifers covered by clay and loam
- clay layers broken with geological features
- vulnerable sandy aquifers

Protection of the resource "groundwater" by geology
Protection of the resource „groundwater“

- EU-Water Framework Directive
- EU-Nitrat Directive
- Drinking water regulation (D)

- Fertilizer decree
  (Federal law: Düngeverordnung)
- Protection decree for water protection areas
  (released by the communities)
- Cooperation with farmers „voluntary agreements“
  (based on the water abstraction charge in Lower Saxony)
- Investments by regional public water supplier

Groundwater protection

2014, May 19th  Governing WEF-Nexus  6
Groundwater protection programme by the regional water supplier OOWV

**Groundwater protection**

- Deepening of the wells
- Afforestation
- Cooperation with farmers
- Organic farming

**Public information and relation**

2014, May 19th

Governing WEF-Nexus
Groundwater protection (OOWV) Organic farming

- Less nitrogen
- No pesticides
Nitrate (mg/l) in drinking water wells (Waterworks Holdorf)

14 shallow production wells  7 shallow + 7 deep production wells

Groundwater protection by deepening the wells

Drinking water limit

Nitrat [mg/l] im Rohwasser

Nitrate (mg/l) in drinking water wells (Waterworks Holdorf)
Development of nitrate concentration in groundwater (water winning area - waterworks Holdorf)
Groundwater quality in water winning areas

**Waterworks Großenkneten:**

Intensive agricultural land use - average nitrate content in 16 observation wells

Shallow groundwater, 5 m below groundwater surface
Goundwater quality in water winning areas

Waterworks Thülsfelde:

Intensive agricultural land use - Average nitrate content in 11 observation wells

Shallow groundwater 5 m below groundwater surface

Drinking water limit: 50 mg/l
Groundwater quality in Lower Saxony

In Lower Saxony drinking water comes mainly from groundwater.

Evaluation of the groundwater quality regarding EU-WFD:

50 mg/l Nitrat limit regarding drinking water is exceeded in 60% of the groundwater bodies in Lower Saxony.
A new actor has come on the scene - biomass digesters
Development of biogas in Lower Saxony

Quelle: MJ Niedersachsen, ML Niedersachsen, Landesamt für Statistik, Darstellung OOWV
Changes in land use due to biogas (Germany)

Change of arable land use due to new sector „biogas“, Here: maize in 1.000 ha (Germany)

Source: Deutsche Maiskommitee
Globalization of food production

Annually ca. 2.4 Mio. t fodder imported to Germany
↓  (Soja, wheat, barley, maize, sunflower-, palmkernelextraction, a.s.o.)

- 2.6 Mio.
- 10.8 Mio.
- 103 Mio.

• 1.457 Biogasplants in Lower Saxony

38.7 Mio. t liquid manure
8.1 Mio. t solid manure
9.9 Mio. t manure from biogasplants (calculated input of maize)

Source: LWK- Nährstoffbericht, 2013
Additional side effect: Ploughing of grassland (Lower Saxony)

- Increasing numbers of bioenergy plants in Lower Saxony
- Loss of grassland in Lower Saxony (in WWA: 34,000 ha seit 1990)
- Increasing ha of maize (in WWA: 20,000 ha von 2005 bis 2010)
- Increasing animal density (counties of Cloppenburg and Vechta > 4 Livestockunits/ha)

Source: NLWKN - 2013
Consequence of biogas-production in water protection area

N (kg/ha) annually leached by Maize in Water protection area of Thülsfelde

<table>
<thead>
<tr>
<th>Year</th>
<th>Leached (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-2004</td>
<td>80,000</td>
</tr>
<tr>
<td>2005-2011</td>
<td>140,000</td>
</tr>
</tbody>
</table>
Challenges for Lower Saxony to reach the aims of the EU-WFD

• Rising amounts of organic manure
  – animal husbandry ongoing growing sector
  – bioenergy plants

• Further aspects
  – ploughing of grassland (nitrogen and carbon release)
  – Higher percentages of maize on arable land due to demand of bioenergy plants
  – Rising values for residual nitrogen in autumn in soil, leached out towards groundwater
### Challenges regarding ecosystem levels

<table>
<thead>
<tr>
<th>Levels within the ecosystem</th>
<th>Evaluation parameters</th>
<th>Existing legal targets</th>
<th>Values in WPA Grossenkneten</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landuse</strong></td>
<td><strong>Landuse:</strong> for example % fallow plots, % maize, % forest</td>
<td>no</td>
<td>&gt; 31% of maize</td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td>kg Nmin/ ha (soil sample 0-90 cm) in autumn to evaluate the efficiency of the applied measures</td>
<td>no</td>
<td>&gt; 90 kg N/ha</td>
</tr>
<tr>
<td><strong>Percolating water</strong></td>
<td>Nitrate concentration under agricultural landuse</td>
<td>no</td>
<td>&gt; 133 mg/l NO₃</td>
</tr>
<tr>
<td>(unsaturated zone)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shallow Groundwater</strong></td>
<td>Nitrate concentration in observation wells (mg Nitrat/l, ug Pestizide/l, ug Metabolite of Pestizide/l)</td>
<td>&lt; 50 mg Nitrate/l (EU - WFD)*</td>
<td>&gt; 50 mg/l Nitrate</td>
</tr>
<tr>
<td><strong>Deep Groundwater,</strong></td>
<td>Nitrate concentration in production wells (mg Nitrat/l, ug Pesticide/l, ug Metabolite of Pesticide/l)</td>
<td>&lt; 50 mg Nitrate/l (Drinking water act)</td>
<td>6 mg/l Nitrate</td>
</tr>
<tr>
<td>Location of the wells</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"Missing links": Existing legal framework for agricultural production is either not defining targets ↑, or not appropriate to respond to the pressure already there
Making groundwater protection suitable for future

→ Urgent need for an effective amendment of the German Fertilizer law in 2014/15:
  – Inclusion of biogas slurry (N coming from plants) into the 170 kg N/ha limit for N from organic manure
  – Obligation towards planning manuring
  – Less reductions by considering the effectiveness of N in organic fertilizers
  – Improved methods to calculate the nutrient balance on farm level
  – Effective systems to calculate and control the needed export of manure from farm
  – Longer closing time for spraying slurry
  – Effective controlling system and sanctions
  – Cheap and easy parameters for monitoring schemes
Monitoring success

Results in residual nitrogen (kg N/ha/ 90 cm soil) in autumn on plots owned by OOWV 241 samples from arable land with contract to the farmer (2013)

kg autumn $N_{min}$/ha => potential pollution with nitrate /l in percolating water

$Autumn \ N_{min}\ (kg \ N/ha) * 443 * \text{exchange frequency (1)} = \ mg \ Nitrat/l$

Percolating rate (here: 350 mm)
Less precaution due to changing priorities

Precaution regarding vital services: ↓

Quality of service of general interest: ↓ Need to adjust instruments to secure high standards

Natural resources: Keen competition regarding exploitation
Strong drivers anticipating groundwater protection

EU targets / „Kyoto“: “CO₂-Reduction“ → National Action plan 2020 (D)

- 13,2% of transport energy from energy crops
- 30% of electricity from renewable energy
- 14% of heating energy from renewable energy

+ shortage of fuel/gasoline + rising prices at food/land markets
+ market for new technologies + rising demand on water rights

Support of environmental schemes

Support of renewable energy

2014, May 19th
In the last 25 years our customers had to pay approximately 100 Million € for groundwater protection measures!

And still the nitrate concentration has an upward trend in our water protection areas!!

Now we demand a sharper administrative law!!!
Vielen Dank für Ihre Aufmerksamkeit.