

CASEE-Conference

"The EU Strategy for the Danube region – with specific emphasis on
Land and Water Management and the Environment"

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Scientific Base for Determination of Nitrate Vulnerable Zones in Croatia

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Starting point

- Land use map
- Groundwater vulnerability map,
- Data base from ground and surface water monitoring program – to present the density of monitoring points.

Starting point

- Consumption of mineral nitrogen
- - according to FAO database
- - agricultural land :
 - according to the FAOSTAT database
 - CORINE Land Cover (CLC) database.

QUESTION 1

- How agriculture influence water contamination with nitrogen?

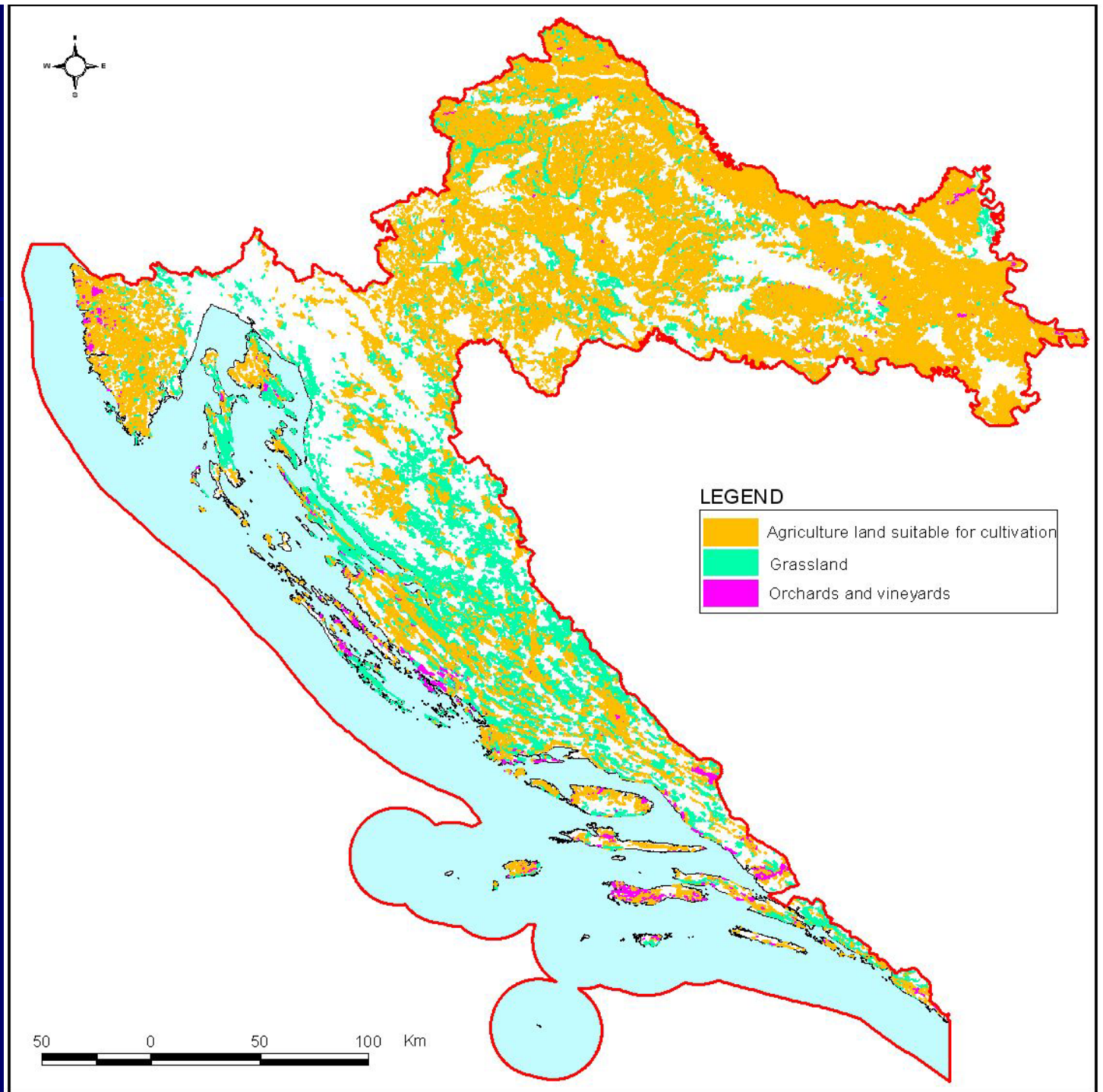
QUESTION 2

- Which kind of data and research programs do we need for the estimation of agricultural influence on water contamination with nitrogen?

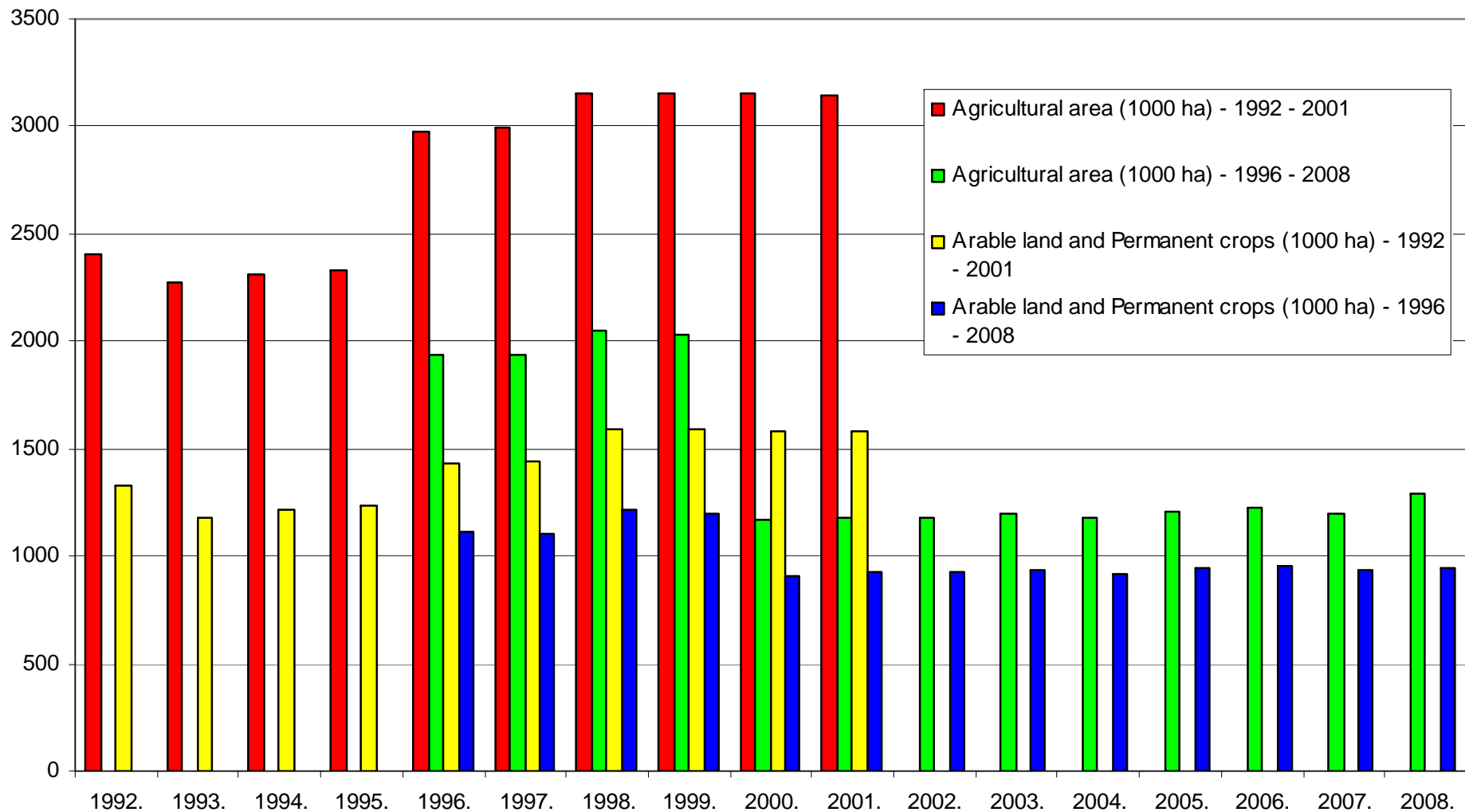
QUESTION 3

- What can we do in order to decrease agricultural influence on water contamination with nitrogen?

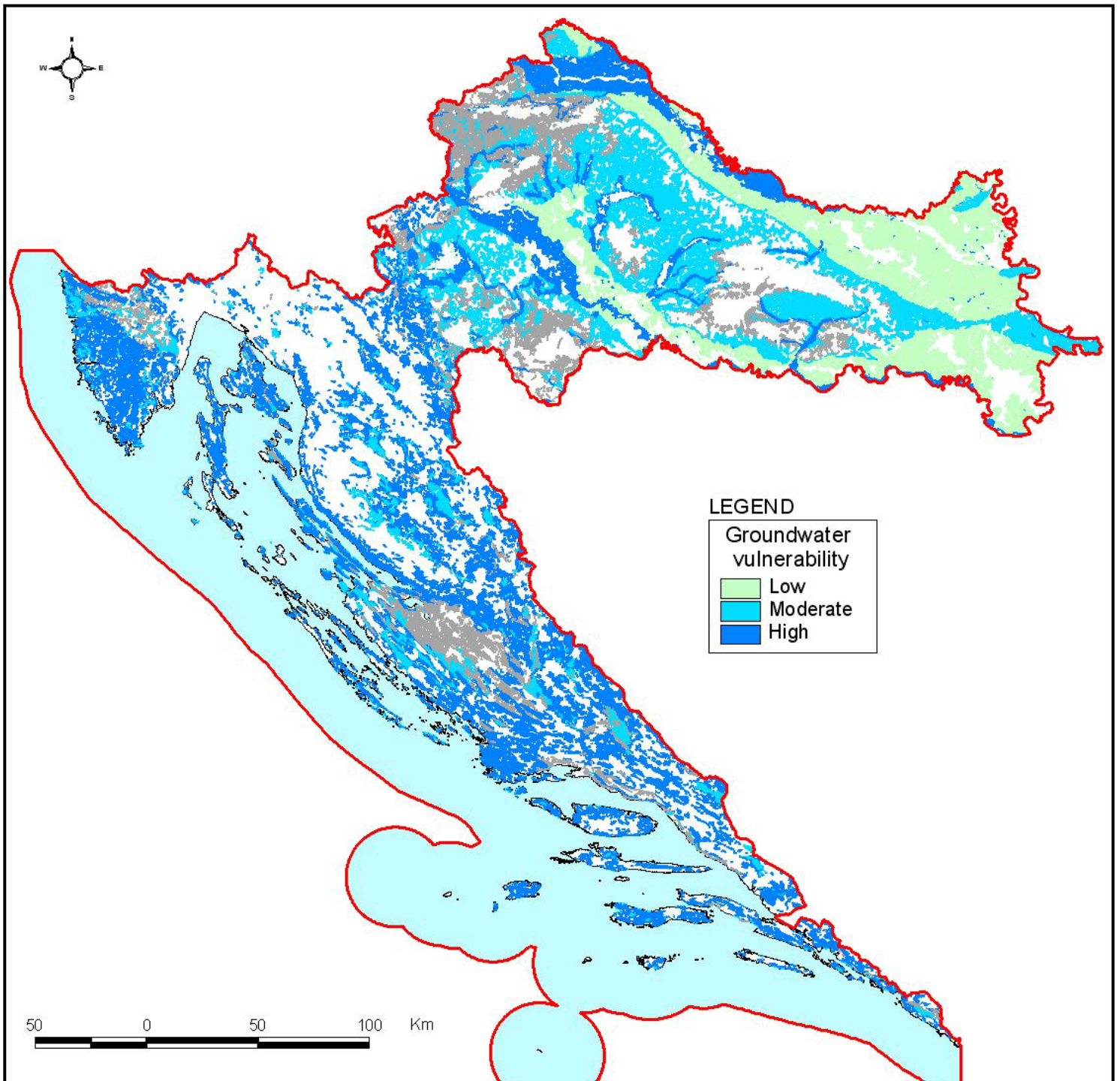
Land use map



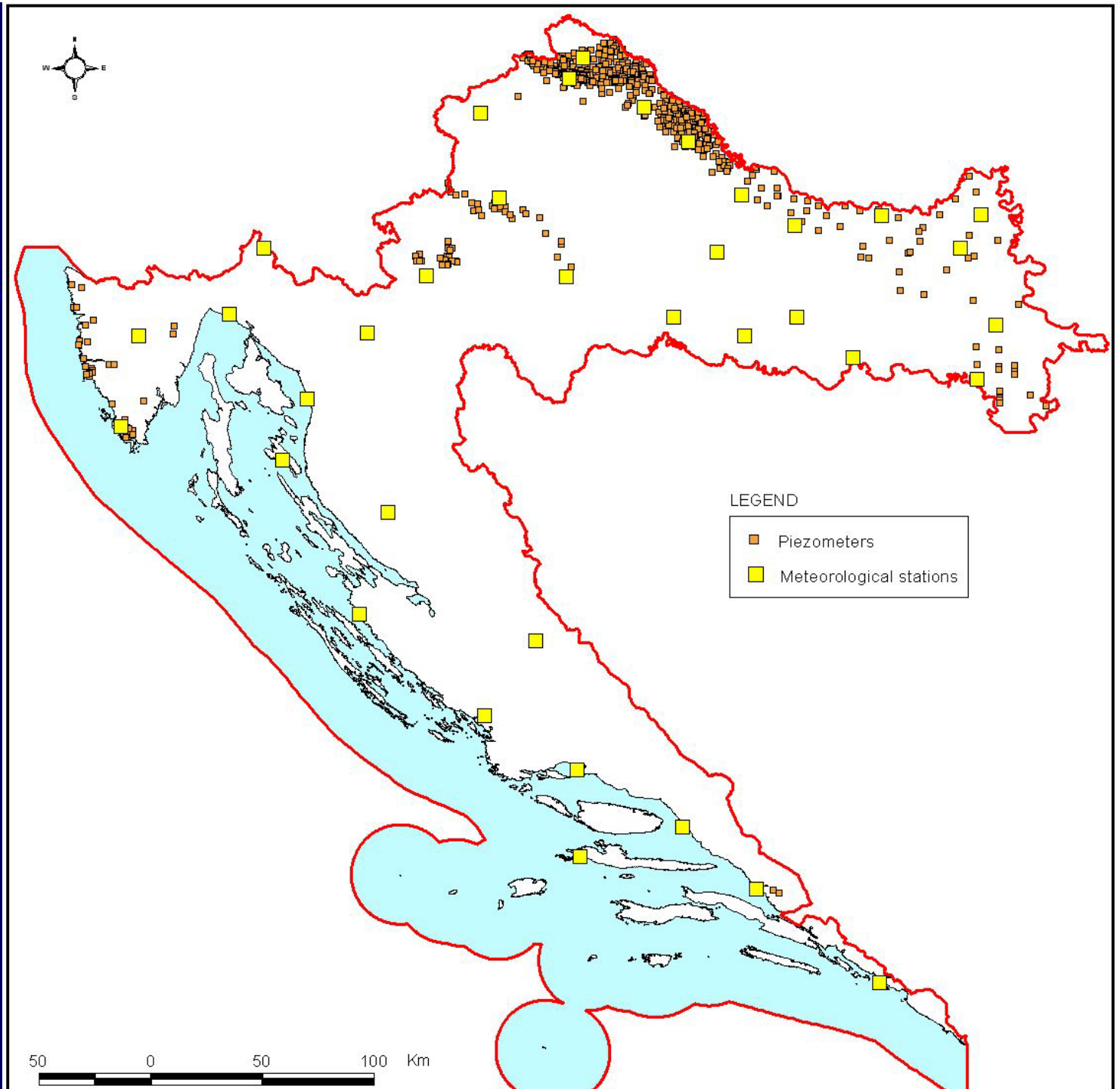
Agricultural area, Arable land and Permanent crops, Croatia, 1992-2008



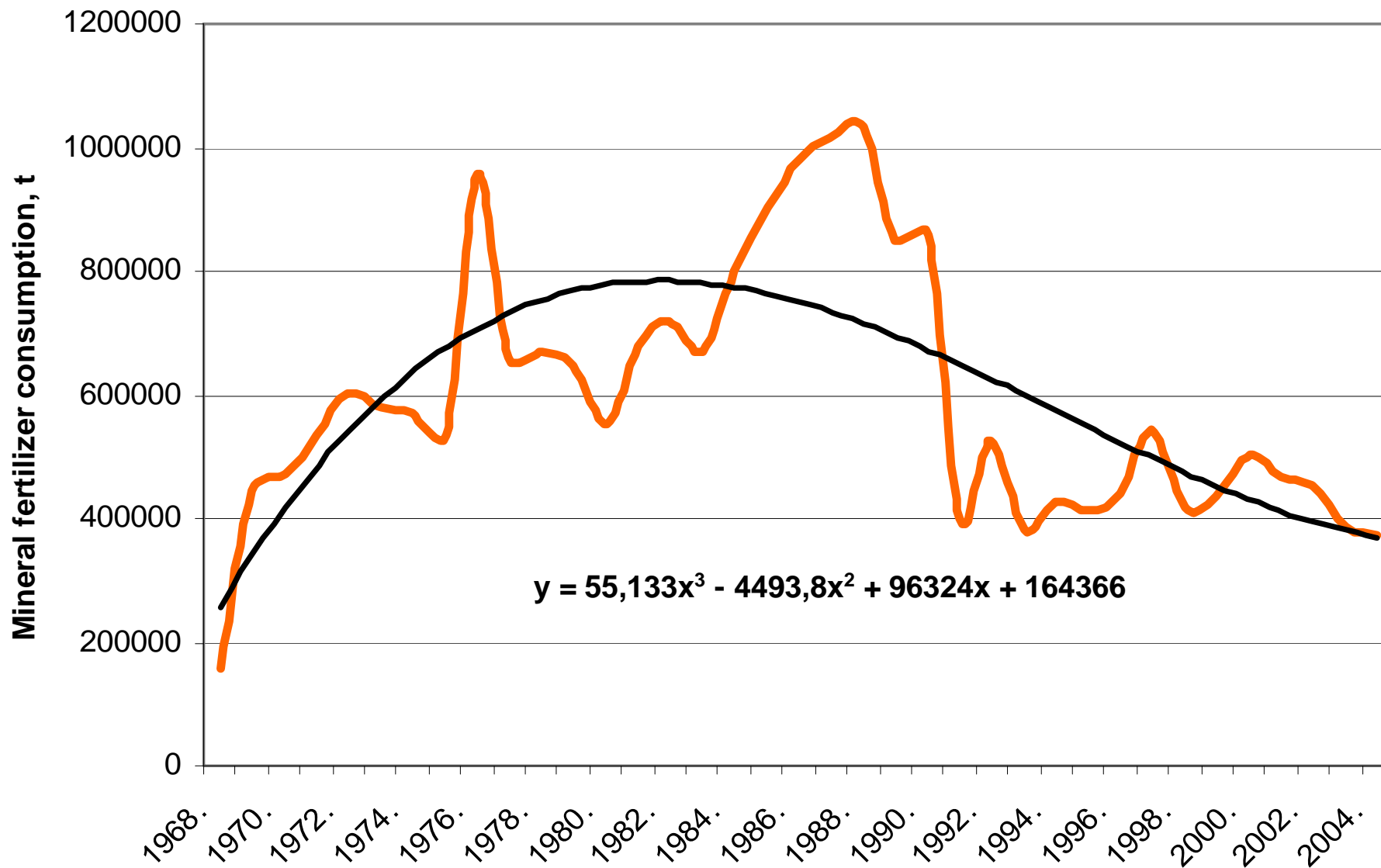
Groundwater vulnerability map



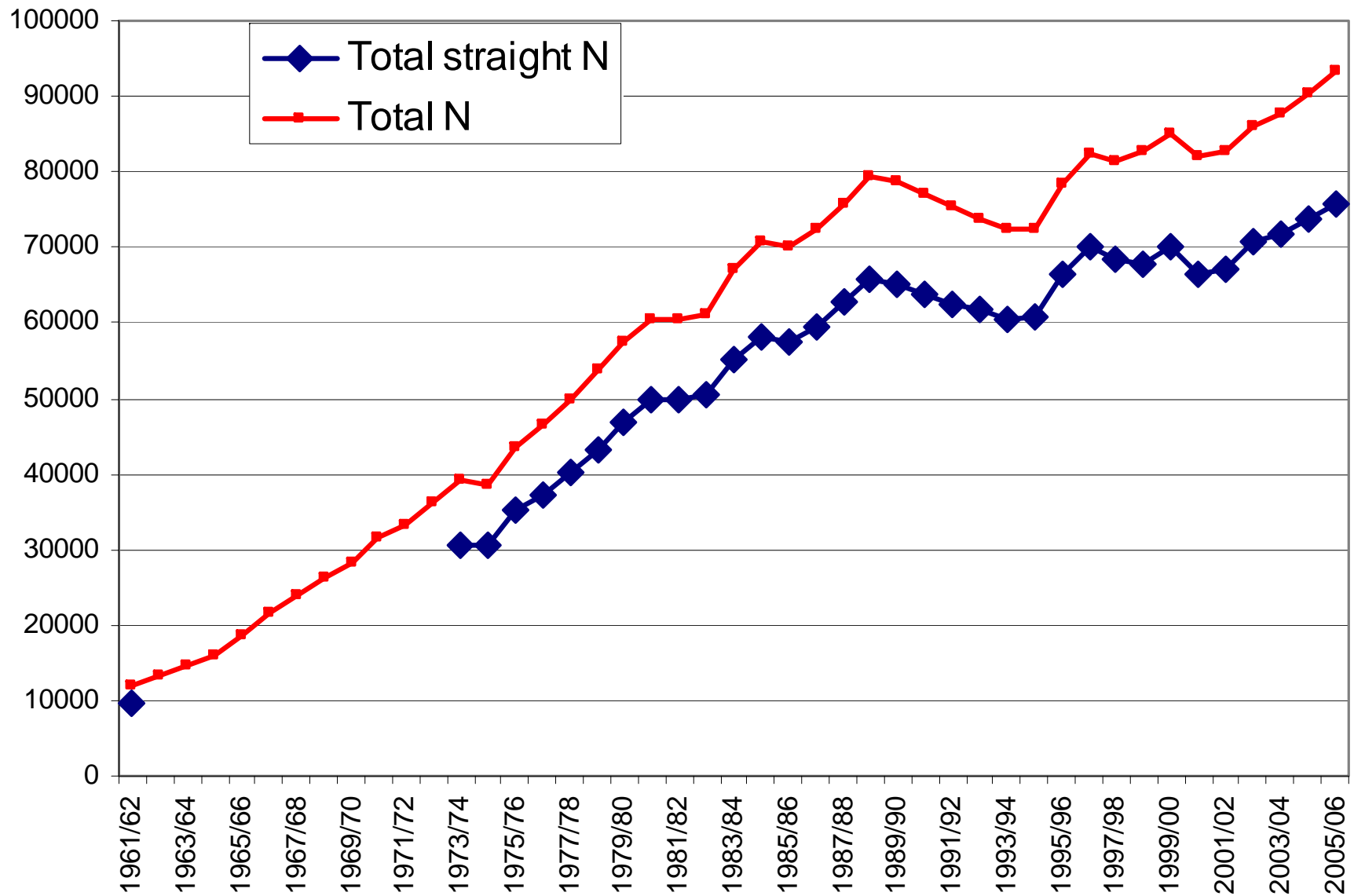
Map of piezometers and meteorological stations



Fertilizer use in Croatia,

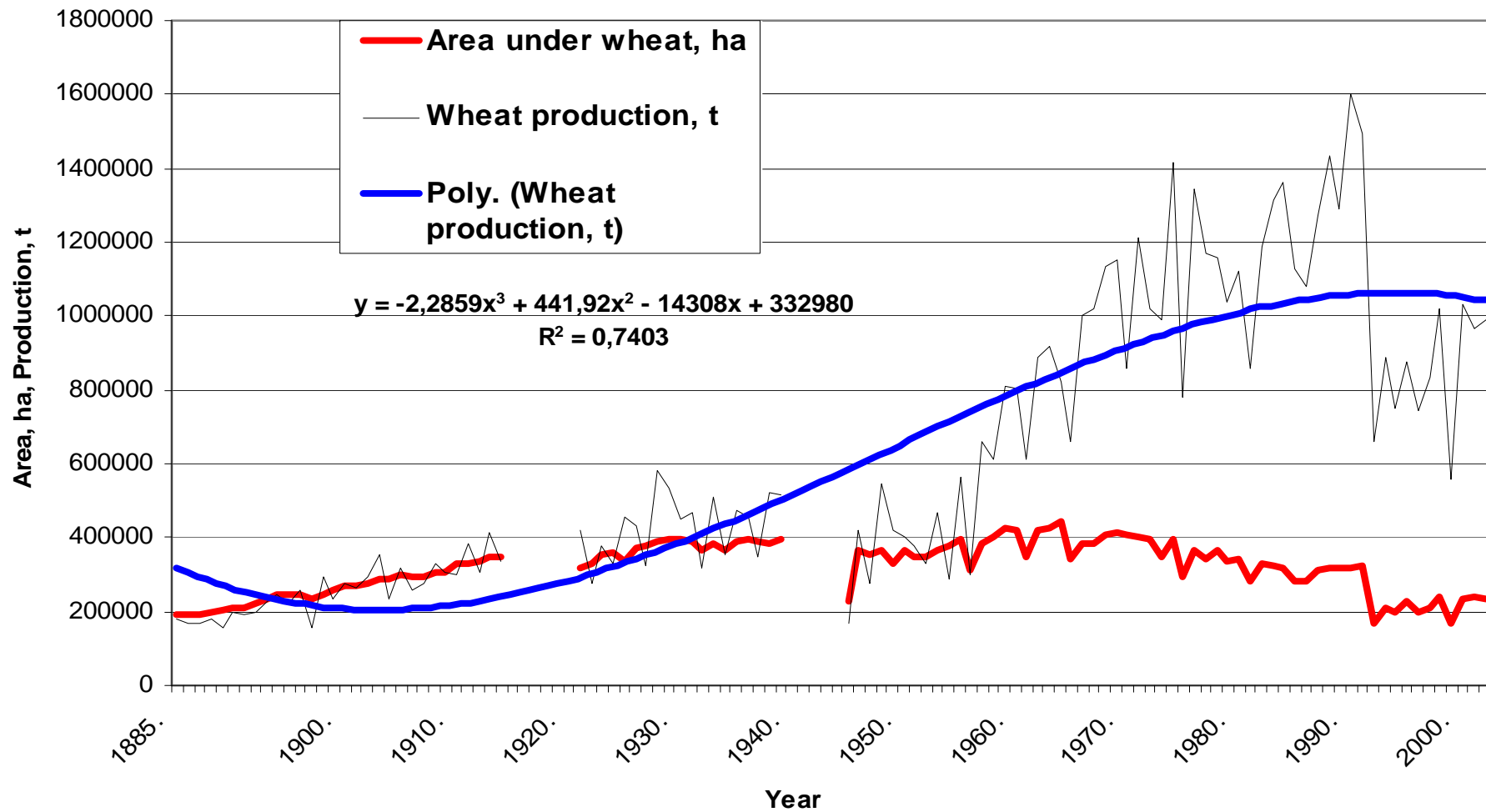


World mineral N consumption



Wheat production in Croatia

Area under wheat and yields of wheat, Croatia, 1885-2002.



| Water indicator | Agricultural activity | Collection place |
|--|--|--|
| Use of plant nutrient (N+P) | The use of agricultural land, Consumption of mineral fertilizers, Content of N and P in mineral fertilizers, Organic fertilizers Application per hectare, quantity, time and method of application | Recorded at farms, counties, basins |
| Concentration of N and P in rivers | Assessment of agricultural ratio as a source of dispersed pollution | By the monitoring plan |
| Nitrogen load | The use of agricultural land, Consumption of mineral fertilizers, Content of N in mineral fertilizers, Production and application of organic fertilizers by livestock type and manure management, Content of N in organic fertilizers. Application per hectare, quantity, time and method of application. Crop yield, N balance, | Calculation model using the specific data from perennial field research and relevant base data |
| Phosphorus load | The use of agricultural land, Consumption of mineral fertilizers, Content of P in mineral fertilizers, Production and application of organic fertilizers by livestock type and manure management, Content of P in organic fertilizers. | Calculation model using the specific data from perennial field research and relevant base data |
| Concentration of nitrate in ground water | Assessment of agricultural ratio as a source of diffuse pollution | By the monitoring plan, especially for vulnerable areas |

According to BEHRENDT et al.

- <http://cat.inist.fr/?aModele=afficheN&cpsidt=17369330>
- A change of the total emissions from 393 kt a⁻¹ N in the 1950s to a maximum of 923 kt a⁻¹ N in the mid 1980s and a recent value of about 756 kt a⁻¹ N were estimated for the total Danube Basin.

According to BEHRENDT et al.

- It can be concluded that the present load of dissolved inorganic nitrogen (DIN) and total nitrogen (TN) of the Danube into the Black Sea is about 1.9 times higher than in the 1950s.
- The maximum DIN load (1980) was 2.2 times higher than in the 1950s.

Contribution of Agriculture?

- Do we have enough information?
- Do we have specific research programs?

- **Nitrogen application – good, bad and necessary**

Conclusions

- According to FAO the consumption of nitrogen from mineral fertilizers in Croatia from 1992 to 2001 ranged from 30 to 56 kg N ha⁻¹ to agricultural land or from 60 to 105 kg N ha⁻¹ to arable land
- From 1996 to 2008 ranged from 46 to 133 kg N ha⁻¹ to agricultural land or from 78 to 181 kg N ha⁻¹ to arable land.

Conclusions

- Apart from quantity of applied nitrogen fertilizers on agricultural farms in Croatia more attention should be dedicated to the **application techniques and their timing as well as the relevant education of farmers** referring to the use of most efficiently nitrogen fertilization.

Conclusions

- According to available data and presented maps, extra efforts should be undertaken to objectively define the causes and sources of pollution of surface and ground water before final determination of vulnerable areas in Croatia.

THANK YOU FOR THE ATTENTION!