Module 17

Mapping the Village/ Visualisation of Analyses Results

Summary

A village map with the location of the water sources (wells or springs) and their related nitrate concentrations gives an indication of the “hot spots” of polluted water sources, and also the areas with little or no nitrate pollution. A similar map can be produced with the locations of pollution sources of. Long-term monitoring of the nitrate concentrations in different local water sources gives insight into the level of water pollution during the different seasons.
Forms for recording the monitoring results, examples of village maps with locations of the monitored wells or distribution system and graphics of long-term nitrate monitoring results are found in this module:

17a Form for collecting monitoring results of water sources in and around the village
17b Form for reporting results of the long-term (seasonal) monitoring of 2 water sources
17c Example of mapping a village in Uzbekistan
17d Example of mapping a village in Georgia
17e Example of mapping water sources in a village and the related nitrate concentrations in Belarus
17f Example of visualisation of the seasonal fluctuation of nitrate concentration in 5 different wells in Ukraine
17g Example of visualisation of the seasonal fluctuation of nitrate concentration in 5 different wells and 2 different regions in Romania

Objectives

The pupils make the water supply system and water sources visible in a village map and the long-term nitrate monitoring results of selected wells are processed in a graphic. By this activity a better understanding of the sensibility of the groundwater pollution and its causes will be reached. The maps and graphics contribute to the identification of strategies for providing safe water to the citizens.

Key words and terms

Mapping, visualisation, monitoring

Preparation/material

Materials	Preparation
Maps of the village	Cooperation with mayor or water supplier
Paper/poster, coloured pens	
Nitrate quick tests and forms for recording the results	2 or 3 weekly monitoring results of some selected local water sources. Form 17a and b
Precipitation meter	Report of the level of precipitation

Mapping the village/ visualisation of analyses results

Introduction

For the implementation of a Water Safety Plan, a lot of data is produced and collected. One way to get a better overview of the collected data about water sources and their locations, or about the area with potential contaminants, is by making the data visible in maps and/or graphics. An advantage of producing maps and graphics (visualisation) is that the results are easier accessible and understandable to a broader public.

1. Mapping the village and its water sources/ distribution network

Use an existing map of the village if possible. If the village is served with a centralised piped water system, you could ask the mayor or the water supplier for a village map showing the distribution pipes, water reservoirs, abstraction points and the houses connected to the network. If no map is available, you can draw one yourself (see example 17c). First draw a draft to find out what has to be included, how big the scale will be and what size the map will be drawn.

Each child will then draw a more detailed map of his home's surroundings. This works like a zoom into the bigger map. Use the water supply (the well, where the drinking water is taken from) as the centre of the map and include the near surroundings.

Place the maps together to get a bigger picture of the village. If there are still unmapped parts of the settlement, the basic elements should be added. Drafts are sufficient here. If the individual maps overlap, compare the results. The more accurate version will be placed on top.

The following basic elements should be found:

- Distinctive landmarks and institutions such as schools, churches, town hall, dispensary
- Heights (hills, valleys etc.)
- Rivers, waterways etc.
- Streets
- Houses
- North/South/East/West
- Scale

Then include the following elements:

- Water supply: wells, public tabs, water points, springs etc.
- Land use, such as grazing land, landfill (dump), industry or small businesses (garages, fuel stations, workshops etc.)
- (Pit/school) latrines, disposal of wastewater
- Pig/cow stables

After testing the nitrate concentration of the different water sources, think about using colours to mark the quality of each water supply (see also module 7 and 16). Different symbols can be used to distinguish the various types of water supplies. Insert the nitrate monitoring results into the related water sources. Relevant information such as the supply relevant parameter involving turbidity can also be inserted into the map. In addition, the possible identified sources of water pollution could be included in the same map.

For a village served with one water supply network, the map can clarify which houses are connected to the supply, the location of the water abstraction and the catchment area with the different protection zones.
In the map, the land-use or human activities within the catchment zones could be distinguished and critical circumstances could be identified (see also module 1, 2 and 10).

2. Visualisation of the fluctuation of nitrate results

Water sources are influenced by environmental events and circumstances, as well as by human activities, including management of animal and human excreta manure or gardening. Therefore, many water sources do not have stable quality and parameters, such as microorganism or nitrates, can fluctuate more or less throughout the year.

To understand the sensitivity of water sources to man-made (anthropogenic) contaminants, it is very useful to select some water sources in different locations within or around the village and monitor the nitrate concentration of the sources on a regular basis (Form 17b can be used for recording the results). If possible, monitor the sources during one year every 2 or 3 weeks (long-term or seasonal monitoring).

To investigate the influence of precipitation on the nitrate concentration in the water source, the weather events should be recorded. A precipitation measure beaker in a yard could be used for this task, or it could be recorded by simple observation.

The monitoring results can be collected in a form and finally processed/visualised in graphics (see example in Module 17). Pupils can make the graphics by hand or with a computer programme. The recorded levels of precipitation and the long-term nitrate monitoring results should be processed in a graphic, and the two recording's data should parallel by having the same time frame.

In the graphic, it is extremely important to mention: the used units, the related parameter, date of sampling, type of water source or sample, etc., and to give a clear subtitle of the visualised results of the investigation.

Finally an outsider should be able to understand the presented data.

3. Sharing information

It is recommended to prepare a poster of the maps and graphics, and hang this in a classroom, a school corridor or in another public place, where the results of the findings are open to the pupils and a broader public.
Also, discuss the results with the water authorities and other stakeholders.

Please be aware, a low nitrate concentration in the water source is no guarantee for safe drinking water!!!

4. Exercises and questions

- Compare the environments of polluted and clean water supplies.
- Have you identified any risks to the water supply?
- Identify why is one less protected source more influenced by a nitrate contamination than the other source?
- Identify possible sources of pollution.
- Identify the depth of groundwater sources/wells.
- Is there a relation between the depth of the groundwater layer and the nitrate concentration?
- Is there a relation between the location of the water sources and the nitrate concentration?
- Are there any visible patterns in the dispersion of the water quality?
- What can be done to protect the water from contamination? Collect all ideas. Often the unconventional suggestions lead to innovative solutions.
- Is the water catchment of the centralised water supply area well protected against any contamination?

WSP related activities

- The results of the maps and the graphics should be discussed with all stakeholders.
- What and where are the sources of pollution?
- Do all villagers have access to safe water?
- Develop strategies for a better water protection.
- Develop strategies for improved access to safe water for all villagers.

5. Text sources and further reading

WaterAid learning for advocacy and good practice, (2007). Water and sanitation mapping: a synthesis of findings, WaterAid. Available from http://www.odi.org.uk/resources/docs/3838.pdf

17a. Form for collecting monitoring results of water sources in and around the village

Selected results, for example the nitrate results and the location of the related water sources could be inserted and made visible in a village map.

Date of sampling	Type of water source (*central piped water, well, spring or river, etc.*)	Location of sampling	Depth of well/ ground water	Nitrat mg/l	Turbi-dity	Odour	Colour	pH	Remarks

17b. Form for reporting results of the long-term (seasonal) monitoring of 2 water sources

For the seasonal monitoring of the nitrate concentration fluctuation and visual quality /suspended solids, some (4 or 5) selected water sources are tested every 2 or 3 weeks during the year, if possible. Parallel to the monitoring, the level of precipitation is measured with a precipitation measure beaker or observed and recorded. If the precipitation is not measured, codes for the level of precipitation should be used; e.g. -, +, ++, +++

Finally, the nitrate results and the related level of precipitation and date of sampling should be transferred into a graphic (see example of form 17e).

Project school: **Village:**

	Source									Source								
Name/address of water source																		
Type of water source (river, well, spring or piped water)																		
Depth of groundwater																		
State of well /remarks																		
Date of monitoring																		
Nitrate mg/l																		
pH																		
Suspended solids																		
Colour																		
Precipitation during 14 days																		

Continuation:

Date of monitoring																		
Nitrate mg/l																		
pH																		
Suspended solids?																		
Colour																		
Precipitation during 14 days																		

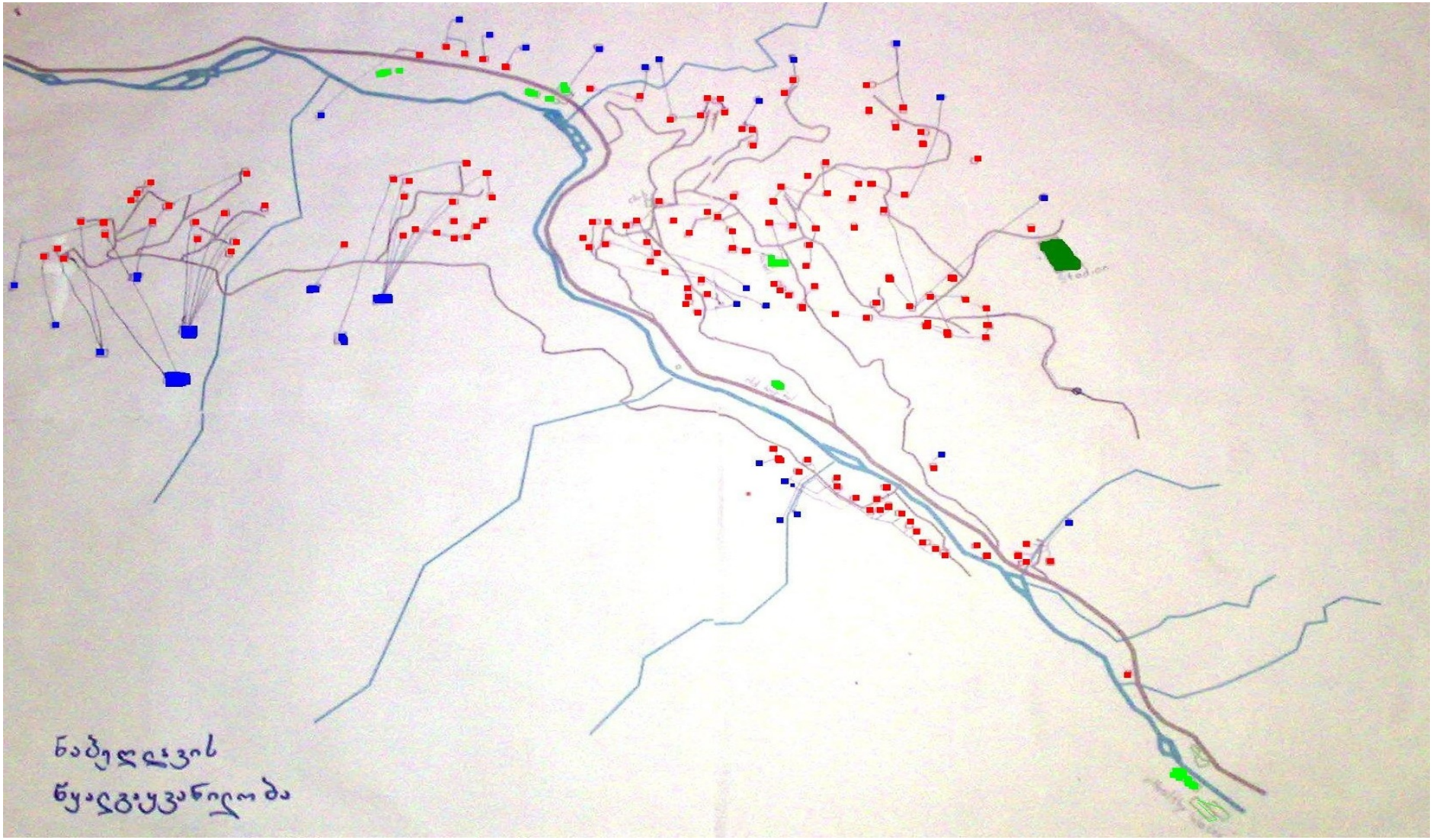
17c. Example of mapping a village in Uzbekistan

A village map with the locations of the water sources increases the understanding of the local water system. The water network and house-connections should also be included.

Source. WECF/Mehriban (2007) TMF Project

17d. Example of mapping a village in Georgia

A locally designed map of the village Nabeghlavi, Georgia, with the locations of the water sources, connected and not-connected houses and the local spaces.
Colour: Red house; Blue water sources, green public spaces



Source: WECF/ Momavlis Gzebi (2011)

17e. Example of mapping water sources in a village and the related nitrate concentrations, Belarus

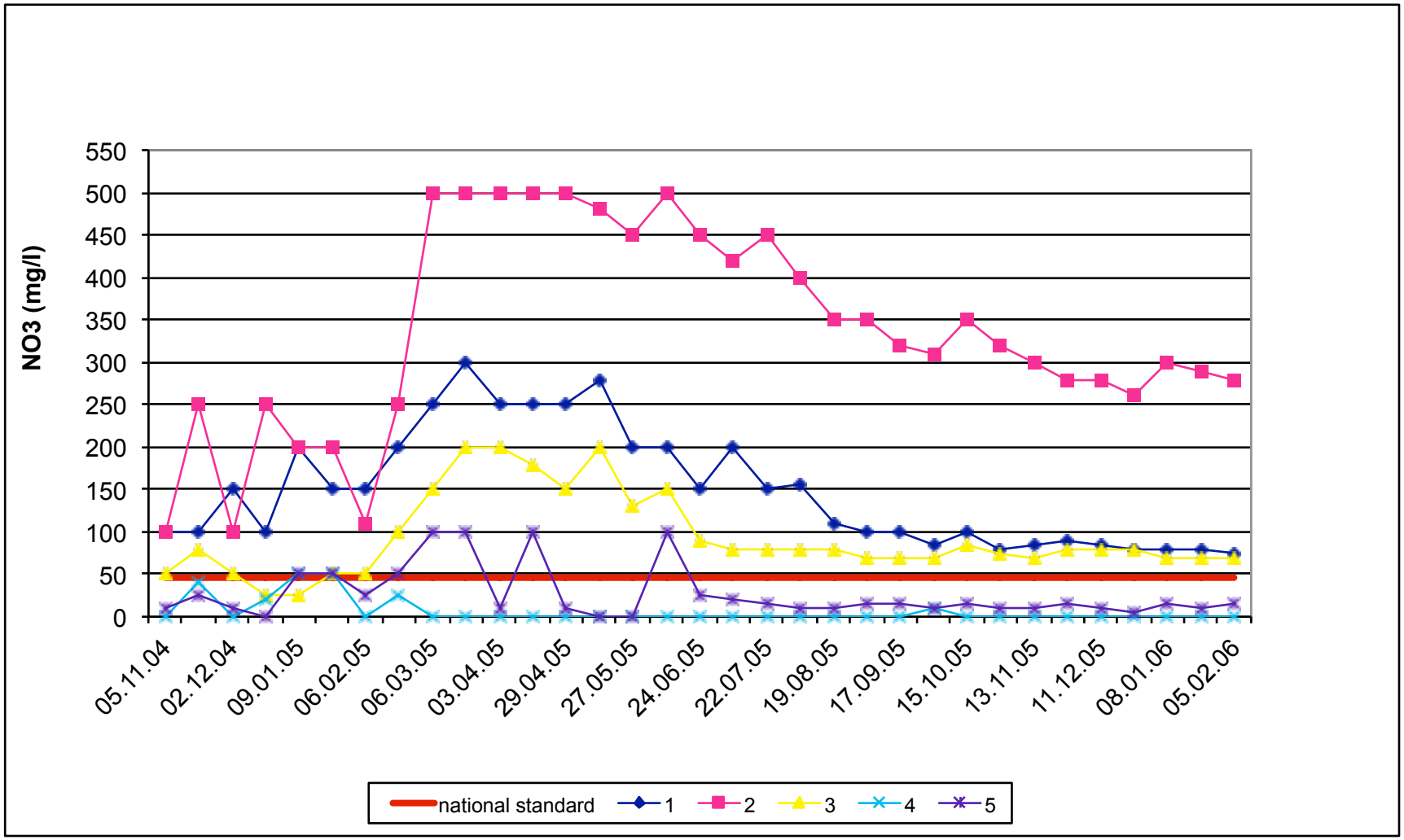
A village map with the location of the water sources (wells or springs) and their related nitrate concentrations gives an indication of the “hot spots” of polluted water sources, but also the areas with less or without nitrate pollution of the water. The range of the nitrate concentration should be made visible with different colours.
A similar map can be produced with the locations of pollution sources. Such maps are useful for identifying strategies and for providing safe water to the citizens. Questions such as “why are some well waters polluted and not others; what are possible sources of pollution; which well waters could be recommended for consumer use”, should be answered.

Map of the Smilovichy Village, Belarus, with drinking water wells and the related nitrate concentration. Produced by students of the local secondary school. The set maximal value for nitrate in drinking water in Belarus is 45mg/l. The nitrate quick tests give an impression of the level of nitrate pollution, but do not demonstrate the exact concentration.

Source WECF/Ecoproject, 2008, MATRA Project

17f. Example of visualisation of the seasonal fluctuation of nitrate concentration in 5 different wells, Ukraine

Nitrate concentrations in groundwater can more or less fluctuate during the year and season. The fluctuations depend on i.e. human activities, the type of soil layers and amount of precipitation, the velocity and the depth of the groundwater. Long-term monitoring of the precipitation level and the nitrate concentration of some identified water sources, connection between the environments, human activities and the sensibility of the groundwater pollution can be made. Answers to questions suchas “why are some wells severe polluted, why is the nitrate concentration increasing in springtime” should be found



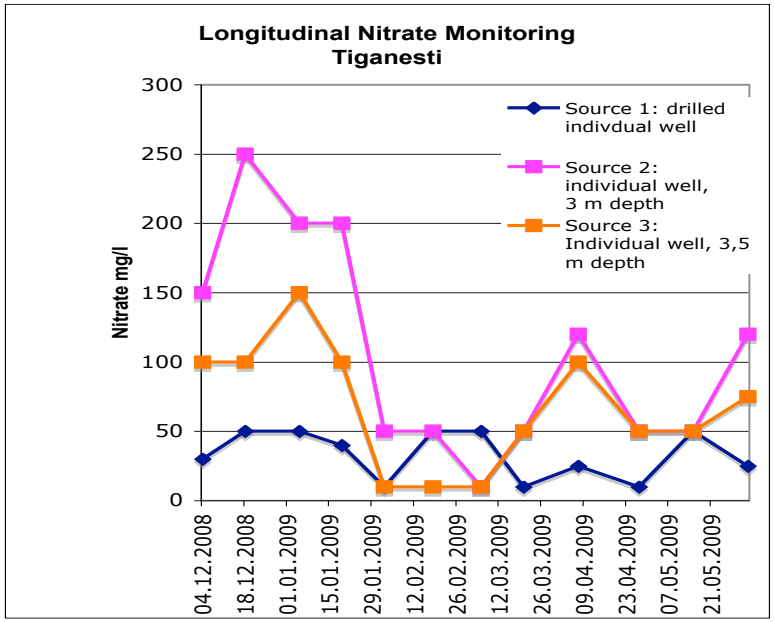
Seasonal nitrate monitoring results of 5 different wells in the village Bobryk, Ukraine, carried out by the local school.
Source: WECF/Mama-86, MATRA project 2004-2006

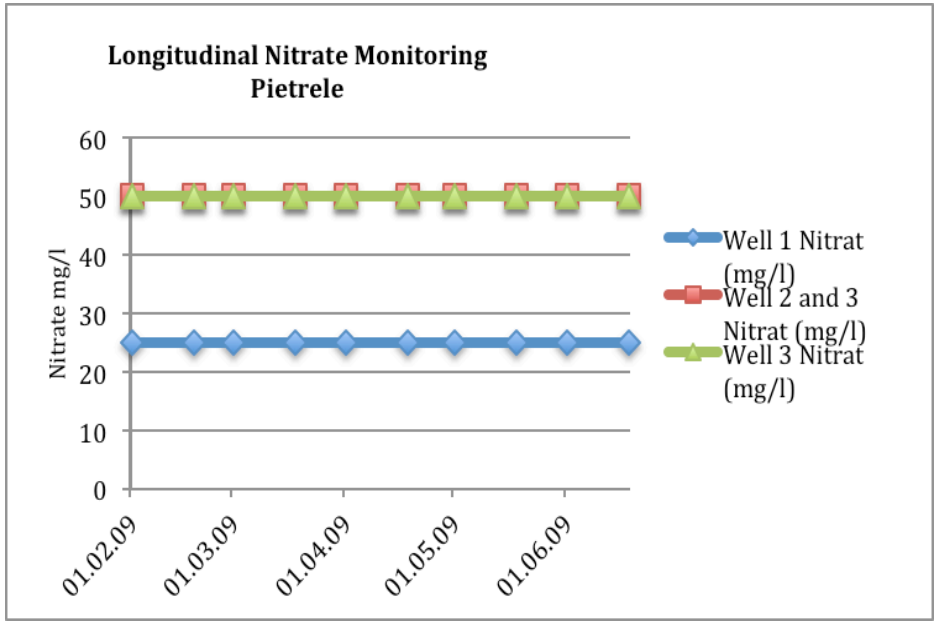
17g. Examples of visualisation of the seasonal fluctuation of nitrate concentration in 6 different wells and 2 different regions, Romania

Nitrate concentrations in groundwater can more or less fluctuate during the year and season. The fluctuations depend on i.e. human activities, the type of soil layers and amount of precipitation, the velocity and the depth of the groundwater. Long-term monitoring of the level of precipitation and the nitrate concentration of some identified water sources, connection between the environments, human activities and the sensibility of the groundwater for pollution can be made. Answers on questions such as "why are some wells severely polluted, why is the nitrate concentration increasing in springtime" should be found.

The graph on the right shows the monitoring results of 3 wells from a groundwater layer of 60 m depth in Pietrele. They don´t show any fluctuation in the nitrate concentration, indicating that the aquifer is well protected for now. However, a nitrate concentration of 50 mg/l indicates that the aquifer is influenced by man-made pollution.

The water samples in Tiganesti (at the left), from a groundwater layer of 8m depth, partly show an enormous nitrate decrease in the months of December and January. This is the season when the pigs, mostly located in the backyards of the households, are slaughtered. The graphic also shows that the groundwater is very sensitive to the infiltration of contaminants.





Seasonal nitrate monitoring results of different wells in the villages Tiganesti (county Teleorman) and Pietrele (county Giurgiu), Romania, carried out by the local schools.
Source: WECF/EuroTeleorman, Fondation Ensemble project, 2009