STATUS, TRENDS AND IMPACTS

From the inputs by countries in the CACENA region on the transboundary aquifers, one can recognize differences in the significance that countries dedicate to the groundwater resources. For instance, mountain countries such as Kyrgyzstan and Tajikistan have expressed less interest on the groundwaters, due to fact that both surface and groundwater resources are available. In general, most human activities provide some pressures on groundwater systems, and have the potential to affect both water quantity and quality. However, as it was found, the lack of effective, sustainable and comprehensive groundwater monitoring programmes identified in most countries of the CACENA region creates obstacles to the current and prospective evaluation of the groundwater quality and quantity in the aquifers used.

GROUNDWATER QUANTITY

As stated above, groundwater abstraction for water supply and irrigation in the region was identified as the main use of groundwater. The questions on water quantity impacts were oriented to two areas:

- Identify impacts on groundwater level;
- Identify both type and scale of problems associated with groundwater abstraction from the aquifer.

Concerning the trends on the groundwater level, no information was provided by countries. In spite of the fact that most of the participating countries have already

established groundwater quantity monitoring network, it might be an indicator that groundwater level is not an issue in the region.

From the inputs received, it can be deduced that mostly local impacts on quantity status of groundwater were observed. However, some countries also recorded widespread impacts (reduction of borehole yields, spring flow, polluted water drawn into aquifers) characterized as moderate (Turkmenistan, Uzbekistan) and severe (Kazakhstan, Uzbekistan, Turkmenistan). The main types of quantity impact caused by over-exploitation of groundwater resources occur as reduction of borehole yields, base flow and spring flow (aquifers No. 3, 8, 12, 13, 14, 15, 16, 17 and 18), polluted water being drawn into an aquifer (1, 2, 3, 9 and 12) degradation of ecosystems (3 and 9), and salt water upcoming (9 and 12). Information on groundwater quantity problems is summarized in the table below.

Groundwater quantity problems				
Problem	Increasing scale of problem →			
	1. Local and moderate	2. Local but severe	3. Widespread but moderate	4. Widespread and severe
Increased pumping lifts or costs		12	12	
Reduction of borehole yields	3, 13, 17, 18		12	8
Reduced base flow and spring flow	14, 15, 16			3, 12
Degradation of ecosystems	3, 9,			
Sea water intrusion				
Salt water upcoming	9	12		
Polluted water drawn into aquifer	1, 3, 9,		2, 12	
Land subsidence				
Decline of piezometric level				8

GROUNDWATER QUALITY

In general, countries have reported problems with groundwater quality. The assessment of the groundwater quality impact has shown occurrences of seven groups of pollutants: salinization, nitrogen substances, pesticides, heavy metals, pathogens, organic compounds, and hydrocarbons. There are four aquifers (aquifers No. 5, 6, 7 and 8) without any indication of groundwater quality impacts. In seven aquifers (1, 2, 3, 4, 12, 13 and 17), at least one kind of pollution was recorded as caused by human activities. In 3 cases, the natural origin of salinization was indicated (9, 10 and 12).

As the most frequent source of pollution, agriculture was recognized influencing five aquifers by nitrogen substances, pesticides and hydrocarbons (aquifers No. 1, 2, 12, 13 and 17). The level of agricultural pollution was recorded from “moderate” to “serious”. This is in direct connection with the current situation in the agriculture practices of the CACENA region, where where old-fashioned technologies and methods for farming are applied.

Industry is the main pollution source causing groundwater contamination by heavy metals, industrial organic compounds and hydrocarbons. Heavy metals originate also from ore mining (aquifers No. 1, 2 and 12). The level of impact on water quality by these pollutants varies between “slight” to “serious”.

There were identified other contaminants influencing four aquifers (aquifers No. 1, 2, 3 and 14): radioactive elements coming from disposal of waste products of extracting enterprises and sulphates and hardness. Groundwater quality problems in CACENA region are summarized in the following table.

Groundwater quality problems			
Problem	Nature of problem		Typical range of concentration
	Natural origins	From which human activities	
Salinization	9, 10 and 12	Irrigation: 4 and 17	1.00 – 3.00 g/l
Nitrogen species		Agriculture: 2, 12, 13 and 17	Values are not available
Pesticides		Agriculture: 1, 2 and 12	Values are not available
Heavy metals		Industry: 1 Ore mining: 2 and 12	Values are not available
Pathogens		Sewer leakage: 12	Values are not available
Industrial organic compounds		Industry: 12	Values are not available
Hydrocarbons		Agriculture: 1 and 2 Industry: 3 and 12	0.2 – 0.0015 mg/l
Radioactive elements		Disposal of waste products of extracting enterprises: 1 and 2	Values are not available
Sulphates and hardness		3 and 14	Values are not available

Concerning the situation on transboundary effects, the countries have reported different impact on groundwater quantity and quality. From the preliminary evaluation it may be concluded, that there are very few evidences of the decline of groundwater level caused by human activities in neighbouring countries. Only in two cases transboundary quantity impacts were observed (aquifers No. 1 and 8), while others were recorded without any evidence of water quantity transboundary effects. There was not any correlation found between types of aquifers and water-quantity impacts.

From the point of view of quality, the situation seems to be more serious. Most countries have indicated significant impact on groundwater quality caused by human activities in the neighbouring countries. There was no evidence of the geographical distribution in the aquifers. It may be remarked, that this evaluation can be understood as a very rough and preliminary estimation, because transboundary impact assessment can be influenced by many factors (mainly data availability) and probably does not reflect the real situation in the region.