could be considered as subject to human influence. These are assessed from indicator species associated with concentrations which are above a given value. Three of these techniques were employed: (a) the determination of arsenic concentration and time series of the water; (b) the comprehensive network of observation wells managed by ARPA - Regional Agency for Environmental Protection; and (c) the groundwater quality data obtained from the National Institute of Health. The groundwater data includes the location of the aquifers, the geology, the geology and the hydrogeology. The groundwater data includes the location of the aquifers, the geology, and the hydrogeology. The groundwater aquifer is located within the Felisina-Marina region (Italy) in compliance with the EU WFD and Lgs. 30/2009. The authors note that arsenic concentrations in the time series of water samples show a statistically significant increase. The arsenic concentrations are analyzed using ICP-MS (inductively coupled plasma mass spectrometry) and ICP-AES. The arsenic concentrations in the water samples are presented in Table 1. The arsenic concentrations are highest in the percolated water from the Catena and Lungara aquifers, with levels of 1-2 mg/L. The authors also note that the arsenic concentrations in the water samples are higher than the WHO standard of 0.1 mg/L. Therefore, a correct management of water resources in the plain area assumes a correct comprehension of the recharge processes, in particular the relationship between the recharge processes and the aquifer properties. The results obtained by the hydrogeological balance sheet indicate that the contribution to recharge of alluvial plain area arising from mountain rock masses is consistent, approximately about 6.5 m³/s, corresponding to 5% of total rainfall. Considering that the amount of water pumped from the alluvial aquifer of the Adda-Oglio plain is about 5.78 m³/s, the recharge coming from mountain aquifer is quite significant. At regional scale, the contribution to recharge of mountain aquifer rock is more consistent (about 48.5 m³/s), corresponding to the 15% of rainfall and to the 14% of the groundwater flow. This result confirms that at the regional scale, the recharge is important to maintain and preserve the plain aquifer. The hydrogeological balance presented in this study can be the most important step to implement numerical simulation of the water exchanges between the plain and the mountain areas, in order to obtain quantitative information about the flow of water and groundwater aquifers. Another possible improvement is to use these models as provisional tools. Furthermore, in order to understand the availability of water resource related to climate change scenarios, neural networks architectures have been built and trained. They are capable to relate the rainfall data (inputs to the mountain system) to outputs, separating them in springs flows (for mountain zone) and water table levels (for the plain area). Operating in this direction, it has been possible to evaluate the effects of climate change on water availability both in mountain and in plain area.

A7-12 Orate, Rotiroti, Marco
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GROUNDWATER QUALITY CHARACTERIZATION OF CREMONA AREA (NORTHERN ITALY) AFFECTED BY AS, FE AND NN CONCENTRATIONS. THE ANALYSIS AND AQUIFER TEXTURE MODELING
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Key words: aquifer texture; Manganese; Groundwater contamination; Aquifer texturing modeling

This study was developed within the framework of a scientific collaboration between the University of Bicocca and the University of Trento. The main aim is to identify the quality of the groundwater hosted by the major alluvial aquifer of the Oglio river, and the effects of contamination. The study area is situated near the confluence between the Adda and Oglio rivers. It covers a 50 km² area around the urban territory of Cremona, and extends to a depth of around 200-250 m, corresponding to a Aquifer Group A (Regione Lombardia & ENI, 2002), which hosts in this area both the flow and confined aquifers. The aquifer texture model includes the (a) collection of historical data-related wells and logs, (b) storage of collected data in specific databases, (c) construction of a 3-D model of the aquifer structure, (d) design and construction of a field survey of water chemistry, and (e) analysis of the hydraulic properties of the system. (f) spatial and time analysis of water quality data considering the hydrogeological and the infiltrative structure of the aquifer, (g) elaboration of a genetic hydrogeological conceptual model, incorporating some hypotheses about the mechanism and the origin of the contamination. The 3-D hydrogeologic model simulates the textural distribution of the aquifer deposits. It was built by means of kriging interpolation of the percentages of fine (clays, silts, peats), medium (sands) and coarse (gravels, pebbles, deposits) derived from the numerical coding of well data logs. The resulting model underlines the abundance of fine deposits and puts in evidence the significant presence of peat lenses. The hydrogeological measurements, executed in July 2010, indicate that the groundwater is characterized mainly by a calcium-bicarbonate facies, with high pH values, increasing with the depth of sampling, ranging from 7.0 to 7.5 in the shallow aquifer and from 7.5 to 8.5 in the deeper aquifers. The groundwater flow is only in the saline aquifer while in the confined aquifers it has negative values (-100 to -200 mV). Conductivity ranges from 300 to 1000 IS and it increases with the depth of sampling. These values indicate a medium to high level of water mineralization. With respect to the most important chemical parameters, bicarbonate ranks among the most important elements, and they increase with depth. The highest bicarbonate values could be generated by the equilibration of the CO₂-derived from the degradation of the organic matter of the aquifer. Nitrates and sulfates increases with the depth of sampling, with higher concentrations of the former than the latter. Ammonia has been detected with low concentrations in the shallow aquifer and generally with high values (1-5 mg/L) in the underlying aquifers. Iron and manganese has been measured at high levels: they range respectively from 100 to 6000 mg/L and from 10 to 1200 mg/L. Generally the higher levels have been found in the surficial aquifers. It is possible to identify a decrease of concentration with depth, probably connected to the pH increase.

A7-14 Orate, Cornamai, Enrico
AQUIFER VULNERABILITY: AN ANALYTICAL PERSPECTIVE
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Key words: aquifer vulnerability; impact; transport equations
Theoretically it should be possible to predict the impact of a polluting event on an aquifer from the knowledge of the pollutant (i.e. chemicals involved, volumes released etc.); the most common vulnerability assessment methods, however, does not allow such a prediction to be made. Starting from the evaluation of two different hydrogeological models of transport equations it will be discussed under what conditions and to what extent it is possible at all to predict the pollution impact and what is the class of reference vulnerability measures may be constructed.

A7-15 Orate, Torrese, Patrizio
GEOPHYSICAL AND HYDRODYNAMIC SURVEYS WITHIN THE STUDY OF THE SALTWATER UPRISING OCCURRING IN THE OLTREPO PAVESE PLAIN (CENTRAL ITALY) TORRESE Patrizio; PILLA Giorgia; BERSON Marica
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Key terms: saltwater uprising; Voghera Fault; geophysical survey; VLF-EM; electrotopography
The alluvial aquifer of the Oltrepò Pavese plain sector (Po Valley, Northern Italy) is characterized by the presence of the Voghera Fault (Messinian) that up-rise from the tertiary marine bedrock and mix with the shallow groundwater. This phenomenon is defined as the "Voghera Fault" and it is called a "tectonic dislocation" which the groundwater flows are mainly distributed in the alluvial aquifer. The geochemical anomalies of groundwater is mainly due to the "Voghera Fault" tectonic dislocation and the groundwater flows are mainly distributed in the alluvial aquifer. The groundwater flows are mainly distributed in the alluvial aquifer. The alluvial aquifer is made up of a series of geological layers, including clay, sand, and gravel, that are separated by lenses of silt and clay. The clay layers serve to reduce the hydraulic conductivity of the aquifer, which in turn affects the movement of groundwater. The alluvial aquifer is the main source of water for the surrounding area, and its quality is critical for human health and ecosystem services.

A7-13 Orate, Cremenesi, Daniele
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INTERACTIONS BETWEEN ROCK MOUNTAIN AND ALLUVIAL PLAIN AQUIFERS IN THE SERIO RIVER BASIN (BERGAMO - ITALY)
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Key terms: Hydrogeological balance; recharge; Serio River
The Serio River Lombardy is one of the major river systems of the Po Plain and is characterized by a large number of springs, both on surface and underground. However, urban growth, industrial and agricultural activities have caused a significant decrease of water resources, both in terms of quality and quantity, especially in the alluvial aquifer. Therefore a correct management of water resources in the plain area assumes a correct comprehension of the recharge processes, in particular the relationship with mountain aquifers. The results obtained by the hydrogeological balance sheet indicate that the contribution to recharge of alluvial plain area arising from mountain rock masses is consistent, approximately about 6.5 m³/s, corresponding to 5% of total rainfall. Considering that the amount of water pumped from the alluvial aquifer of the Adda-Oglio plain is about 5.78 m³/s, the recharge coming from mountain aquifer is quite significant.