

## **Steering Mechanisms for Sustainable Land Use and Protection of Groundwater Resources**

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Water resources are easy to affect, because they are vulnerable to land use as there is an interaction between both. Any form of excessive withdrawal or infiltration of pollutants can disturb their sensitive balance. To develop conceptions for sustainable water management, it is important to know all influencing parameters, which lead to direct consequences or interact in a secondary way. Arid and semiarid regions are increasingly faced by water shortages and degradation of water quality. Depletion of surface and groundwater resources is the result of growing water demand and sometimes ineffective water use of domestic, industrial and agricultural sectors.

Risk management is done considering all processes from the release of contaminants at the surface along the pathway within the unsaturated zone to the groundwater resource. The main focus is generally on groundwater vulnerability to contamination, which is the evaluation of the unsaturated zone with respect to their protective function to groundwater, and the potential threat (hazard). The evaluation of the potential risks of land use for groundwater resources is usually implemented using geographic information systems producing maps with the relevant information.

Especially the conversion of native grasslands and forests to agriculture and urbanization are anthropogenic effects in changing land use, which have a great impact on groundwater resources. With regard to land use, agricultural practices are often the most significant sources of health-related groundwater pollution. Nitrate contamination can be found in many parts of the world mainly due to the large land area used for agriculture and the use of different forms of fertilizers to increase production yield. A wide range of pesticides can also be transported with the percolation water and contaminate the groundwater. In order to avert the resulting danger to human and the environment the impact of land use on groundwater resources is one focus to identify potential contamination risks and to ensure a sustainable and integrated groundwater management.

One of the important modules of an information system is the evaluation of the impact of land use on groundwater vulnerability to contamination. Vulnerability assessment and the quantification of the pollutant impact into the water resources using newly developed methods can be implemented together to produce quantified vulnerability maps as basis for water management concept with a decision support.