

Towards Joint Management of Transboundary Aquifer Systems: Methodological Guide

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ABSTRACT

Aquifer systems, which represent an important part and sometimes the only source of a country's available water resources, are unequally known.

Much more frequently than transboundary rivers, transboundary aquifers are shared between various countries which generally use them independently, partially for drinking water supply and for industrial uses, but mainly for irrigated agriculture. This leads more and more to cases of overexploitation and pollution which create tensions at all levels, with a risk of crises and conflicts between countries sharing the same aquifer.

For all these reasons, it is today important to improve knowledge and promote a reasonable and sustainable integrated management of transboundary aquifer systems.

To reach this objective, the present document firstly recalls the main challenges of transboundary aquifers, their specificities, and the need for integrated water resources management (IWRM) (Chapter I). It then describes the different tools available to improve knowledge and the development of this precious resource: technical, legal, institutional and economic, but also educational and co-operation instruments (Chapter II). Finally, it proposes a progressive and multiform approach for joint, equitable and sustainable transboundary aquifer management and it describes the mechanisms required to create the proper institutional structure for the management of shared ground (and possibly surface) water resources.

Key words: challenges, tools, joint management methodology,

1. WHY THIS METHODOLOGICAL APPROACH?

Currently more than half of the world population and a great number of socio-economic activities, particularly agriculture, depend on groundwater, which is now under increasing pressures. In fact, groundwater is more and more seen as a heritage to preserve, both for our present needs and for the future generations. This strategic resource should be given special attention and sustainable management, as sound as possible, in order to make the necessary economic and societal changes, while maintaining or improving at the same time the living conditions of the users.

This is especially necessary when the aquifer systems are transboundary, i.e. crossed by political boundaries, and therefore shared between two or more sovereign States. This issue, dealt with inappropriately or partially, may lead to a loss of opportunity in terms of human and economic developments, to a degradation of the living conditions in the areas concerned, and can generate tensions and even open conflicts.

To date, many efforts have focused on the management of transboundary surface waters. However, still little action on transboundary aquifer systems has been made, except for a restricted number of projects involving some shared aquifer systems, and only taking into account some aspects of the issue.

Yet, to date, over 270 transboundary aquifer systems have already been identified worldwide by the ISARM (Internationally Shared Aquifer Resources Management) programme of UNESCO. These aquifer systems are, quantitatively and qualitatively, very affected by the development of human activities, mainly agriculture, and by increasing urbanisation. Moreover, in many arid and semi-arid regions, groundwater resources are not or little renewed. Their sound use is even more crucial and climate change may worsen the situation in the decades to come.

To avoid irreversible degradation of these shared aquifer systems, not penalise future generations and prevent possible conflicts between States on the use of these critical resources, it is essential to establish a dialogue and constructive collaboration among the stakeholders. This involves the definition of common objectives and adapted strategies as well as the design and implementation of some mechanisms for transboundary management. Good knowledge of the characteristics and operation of aquifer systems is a prerequisite without which no informed decision can be made.

In order to contribute to the establishment of appropriate management of shared groundwater, the French Development Agency has launched a study carried out by a partnership between BRGM, UNESCO, the International Office for Water and the Water Academy, which led to the development of a methodological guide for the joint management of transboundary aquifers. The goal is to help the political and administrative authorities concerned to gradually implement collaborative, balanced and sustainable management of their groundwater and shared aquifer systems.

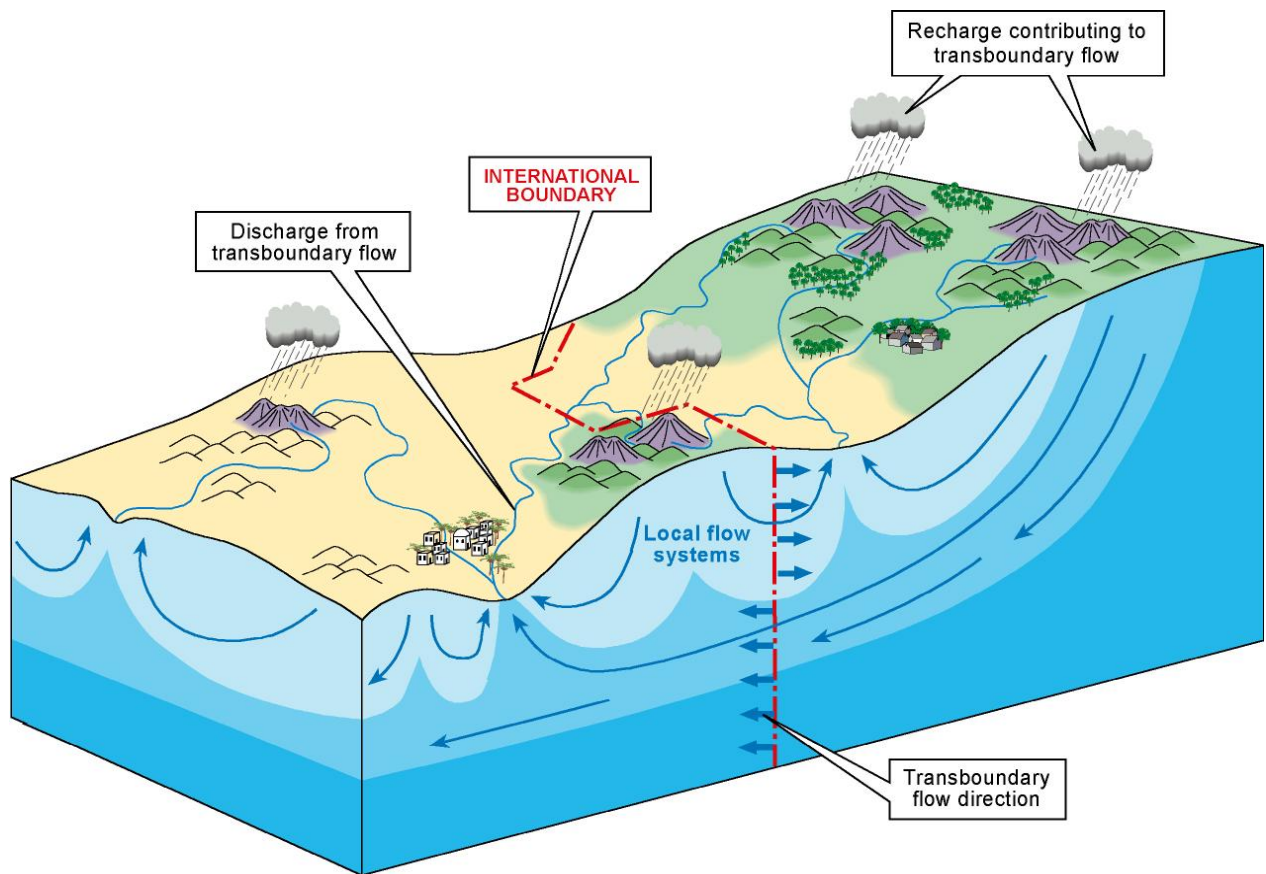
2. CHALLENGES AND SPECIFICITIES OF INTEGRATED MANAGEMENT OF TRANSBOUNDARY AQUIFER SYSTEMS

Groundwaters play a major role in the socio-economic development of our societies. More than half the global human population relies on groundwater, for various economic activities and for drinking purposes. Furthermore, groundwaters contribute to maintaining ecosystems and feed numerous humid zones which are the habitat of a rich biodiversity. Today groundwaters are under more and more pressure due to increased pumping, urban development and socio-economic development, and climate change. They are also under severe threat and often affected by pollution due to human activities.

Aquifer systems whether transboundary or not, are still unequally known on the scientific and technical level. Their characteristics, their functioning, their capacities and their limits are often ignored. Aquifers have a more complex functioning than surface waters: in aquifers water flows in a three dimensional space. Human activities can have a very negative impact on aquifers, and due to their inertia (often ignored) such an impact is visible only some years later. These characteristics are still not well considered by water managers.

Aquifers are also of two categories: renewable and not. Different management considerations are affected to each category.

Transboundary aquifers are not different from any other aquifer system. The difference is that they span the territory of two or more States. The political boundaries add more constraints to the knowledge and the management of this shared resource.



(Source: UNESCO, ISARM 2001)

3. RECOMMENDED TOOLS AND APPROACH

3.1. Available tools

To establish effective and sustainable water resources management, the practice around the world shows that it is necessary to implement a package of complementary and consistent means for action in accordance with the concepts of Sustainable Development and Integrated Water Resources Management, namely:

- scientific, technical and technological means, to improve knowledge of transboundary groundwater and aquifer systems regarding its geological structure, its three dimensional physical limits, its recharge and discharge zones, its vulnerability
- organisational and institutional means to effectively implement Integrated Water Resources Management (IWRM) with the involvement of stakeholders
- legal and administrative means to ensure the framework and the necessary regulatory functions of water resources in a harmonious manner on both sides of the borders. While international law for groundwater is still at a premature stage, the UN General Assembly adopted in December 2008 a Resolution on the law of transboundary aquifers, offering guidelines for States for their agreements on transboundary aquifers.

- economic, financial and fiscal resources, to mobilise the necessary capital and encourage the achievement of common objectives, such as fixing water tariffs, applying the polluter pays principle and mobilising cooperation funds;
- means for training and professional development to improve the skills of political decision makers, managers and technical and administrative staffs. Multi-disciplinary training courses on transboundary aquifers at the intention of water managers and decision makers are under development
- means for participation and co-operation, to exchange information in a transparent manner and to develop long-term co-operation, such as the establishment of cooperation mechanisms, or joint commissions, as it is widely spread for transboundary surface water bodies, and benefiting from the exchange of experience within specific networks, and from the catalytic role of international and regional organisations.

None of these six categories of means is, in itself, sufficient. Their combination enables progress and the achievement of satisfactory and sustainable results.

These tools must be gradually implemented at the same time and at the different levels necessary for shared aquifer systems: local, national, transboundary and international, while working according to the natural geographical units, the hydrogeological basins.

3.2. Proposed methodological approach and mechanisms for a concerted management of transboundary aquifers

Joint management of transboundary aquifer systems is an extremely complex and very sensitive issue. Therefore, the recommended approach and proposed mechanisms for joint management of transboundary aquifer systems are pragmatic, multifaceted and progressive.

Joint, equitable and sustainable management of transboundary aquifer systems requires not only technical skills and financial resources, a clear legal and technical organisations but also a political involvement from the countries concerned. The commitment of all concerned parties (non-governmental stakeholders, international organisations, etc.) is also necessary for the implementation of the management methods. Indeed, the actions to be carried out, using the available tools presented above, should be conducted both at the national, local and transboundary levels and in some cases or for some aspects, at the international level.

The recommended methodological approach proposes actions that can be consistently, successively or, if possible, simultaneously carried out:

1. At the local and national level:

- Clarification of roles and responsibilities of institutions with the elaboration of a legal framework for groundwater management, and the definition of the roles and responsibilities of the national institutions involved in groundwater management.
- Improving the knowledge of the transboundary aquifer systems: Data is collected at the national level. However, in the case of transboundary aquifers the exchange of data among the riparian countries is a first step, in the cooperation, allowing the apprehension of the system as a whole, and not limited to part of it.
- Information and involvement of the various stakeholders and users, as well as the local authorities

2. At the transboundary level

- Preliminary technical contacts: these contacts, which could be facilitated by international organisations, appear as important first steps, identifying the needs and issues at stake, and preparing for the official meetings
- Holding official meetings with the participation of high level representatives from the riparian States, representatives from regional or international UN organisations, development agencies and banks
- Collecting, organising and sharing data in a harmonised framework
- Establishing common tools for management, such as conceptual and mathematical models including the various aspects: physical, environmental and socioeconomical

4. CONCLUSION

The equitable share of benefit deriving from the use of transboundary aquifers is a goal to be achieved, taking into consideration the importance of this resource and the issues at stake. After the first step raising awareness and improving the scientific knowledge, the second step is for the concerned steps to establish relations at the technical and diplomatic levels. International organisations can facilitate and assist such actions. Existing commissions and organisations for the management of transboundary surface water bodies have here a role to play by extending their scope of action to aquifer systems in their territory of competence. Pilot projects can already develop the tools and the know-how presented in the guide book, and create lessons learnt to be exchanged in other basins.

BIBLIOGRAPHY

- Margat J., Les eaux souterraines dans le monde, BRGM éditions, 2008 ©UNESCO/BRGM 2008
- Pennequin D. Fonctionnement des hydrosystèmes, Annales des Entretiens de l'Environnement, APESA, Pau 2002
- Pennequin D. and S. Foster. Groundwater quality monitoring: the overriding importance of hydrogeologic typology (and need for 4D Thinking), the Water Framework Directive: ecological and chemical status monitoring, John Wiley and Sons, ed., Chapter. 5.1, 2008.
- Puri S., Appelgren B., Arnold G., Aureli A., Burchi S., Burke J., Margat J., Pallas P. Internationally Shared (Transboundary) Aquifer Resources Management, Their Significance and Sustainable Management. A framework Document, IHP-VI, Paris, France, November 2001.
<http://unesdoc.unesco.org/images/0012/001243/124386e.pdf>
- Puri S. & Aureli A. (ed), Atlas of Transboundary aquifers, Global maps, regional cooperation and local inventories, UNEESCO-IHP, 2009
<http://www.isarm.net/publications/323>
- Stephan R.M, La coopération transfrontalière sur les eaux souterraines : un processus en évolution, Dynamiques Internationales, N°2, January 2010 <http://www.dynamiques-internationales.com/publications/numero-2-janvier-2010/>
- Bouzit M, Ansik E., 2008, Socio-economic analysis integrating soil-water system modelling for the Kempen region – heavy metal pollution in groundwater, Aquaterra, BRGM
- Pennequin D. and Machard de Gramont H., Application of the WFD concept at the frontiers of Europe for transboundary resources management; illusion or reality?, International symposium - Aquifer Systems Management - 30 May-1st June 2006, Dijon, France